Woodstock Main WWTF Upgrade

Preliminary Engineering Report Amendment
Final Submittal

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Table of Contents

1. BACKGROUND

The Woodstock Main Wastewater Treatment Facility (WWTF) is a 0.45 million gallon per day (MGD) facility consisting of screening, grit removal, influent pumping, a 5-celled aeration basin, secondary clarification, chlorine disinfection, and de-chlorination. The solids handling facility on-site consists of two aerated holding tanks, where wasted solids are stored prior to being dewatered and disposed of by an external contract dewatering company.

A preliminary engineering report (PER) was prepared by Hoyle Tanner, dated May 3, 2023. The preliminary engineering report analyzed historical operating data, assessed the existing conditions of each unit process, evaluated alternatives for each unit process, and provided a recommendation for a proposed upgrade project.

New, emerging technologies since the 2023 PER document was prepared have been expanding the options for equipment and process selection. This Preliminary Engineering Report Amendment serves to evaluate different biological process alternatives. The evaluation will provide the Town of Woodstock with a comprehensive alternatives analysis intended to determine a biological process that is both economical and meets the needs of the facility. This document also serves to evaluate different dewatering technology alternatives to provide the Town of Woodstock with options to pursue on-site dewatering in the future.

2. EXISTING FACILITIES

2.1 Existing Discharge Permit

The Woodstock Main WWTF is permitted under Discharge Permit No. 3-1228, effective date October 1, 2019, to discharge treated effluent from outfall S/N 001 to the Ottauquechee River. The discharge permit flow and effluent quality requirements are summarized in Table 2-1 on the following page.

Table 2-1 Woodstock Main WWTF Current NPDES Discharge Permit

Effluent Parameter	Annual Limit	Monthly Average	Weekly Average	Daily Maximum	Instantaneous Maximum
Flow (annual average)	0.450 MGD	--	--	--	--
BOD_5	--	30 mg/l 113 lbs	45 mg/l 248 lbs	50 mg/l --	--
TSS	--	30 mg/l 113 lbs	45 mg/l 248 lbs	50 mg/l --	--
Total Phosphorus	-	-	--	Monitor Only	-
Total Nitrogen	-	-	-	Monitor Only	-
Total Kjeldahl Nitrogen (TKN)	-	-	-	Monitor Only	-
Nitrate/Nitrite Nitrogen (NOx)	-	-	-	Monitor Only	-
Settleable Solids	--	--	--	--	1.0 mg/l
Total Residual Chlorine	--	--	-	--	0.1 mg/l
E. Coli Bacteria	--	--	--		77 col/100 ml
pH	--	Between 6.5 and 8.5 Standard Units			--

In April 2020, Hoyle Tanner prepared a letter report recommending adjustments to the South Woodstock WWTF and Woodstock Main WWTF estimated total nitrogen (TN) allocations. Currently the Woodstock Main WWTF has an estimated annual average TN allocation of 55 lbs/day. Based on review of the historical operating data for the Main WWTF, it was recommended to transfer 3 lbs/day TN from the Main WWTF to the South Woodstock WWTF. Therefore, the estimated allocation for the Main WWTF would be reduced to an annual average of 52 lbs/day TN.

2.2 Original Design Criteria

Table 2-2 summarizes the original WWTF design criteria and current existing flows and loadings.

Table 2-2 Existing Influent Design Criteria

Parameter	Original Design Criteria[1] (1983)	Current Conditions[2] (2023 PER)	Current Conditions[3]
Average Daily Flow	0.450 MGD	0.224 MGD	0.231 MGD
Peak Hourly Flow	0.750 MGD	> 0.750 MGD	1.90 MGD
Biochemical Oxygen Demand	117 mg/L 439 lbs/day	289 mg/L 540 lbs/day	305 mg/L 588 lbs/day
Total Suspended Solids	101 mg/L 379 lbs/day	213 mg/L 384 lbs/day	232 mg/L 447 lbs/day

Notes:

1. Source: Operations and Maintenance Manual, 1983.
2. Based on Daily Monitoring Report data from January 2016 to September 2021, as presented in the Preliminary Engineering Report, dated May 3, 2023.
3. Based on Daily Monitoring Report data from January 2020 to December 2024.

2.3 Historical Operating Data

The original Preliminary Engineering Report dated May 3, 2023, and hereafter referred to as the *2023 Preliminary Engineering Report*, analyzed data from January 2016 through September 2021. In an effort to reflect more current influent flow and load conditions to the Woodstock Main WWTF, data from January 2020 through December 2024 was analyzed and presented in this report.

2.3.1. Flow

Average monthly effluent flow from January 2020 through December 2024 is presented in Figure 2-1. Over this period of time, the average monthly effluent flow was 0.231 MGD, which is 51% of the design average monthly flow and permitted average annual flow of 0.450 MGD. A maximum monthly average influent flow during this period of 0.471 MGD was experienced in July 2023, which exceeds the design average monthly flow and permitted average annual flow of 0.450 MGD.

NPDES Permit 3-1228 includes a requirement that if the effluent discharged for a period of 90 consecutive days exceeds 80% of the permitted flow limitation, the facility shall submit projected loadings and a program to maintain satisfactory treatment levels. The Woodstock Main WWTF is currently operating at approximately half of their permitted flow and is not at risk of exceeding 80% of their permitted flow limit for a period of 90 consecutive days. During the time period, the average monthly flow exceeded the 80% permitted flow threshold for the months of August 2023, December 2023, March 2024, and April 2024.

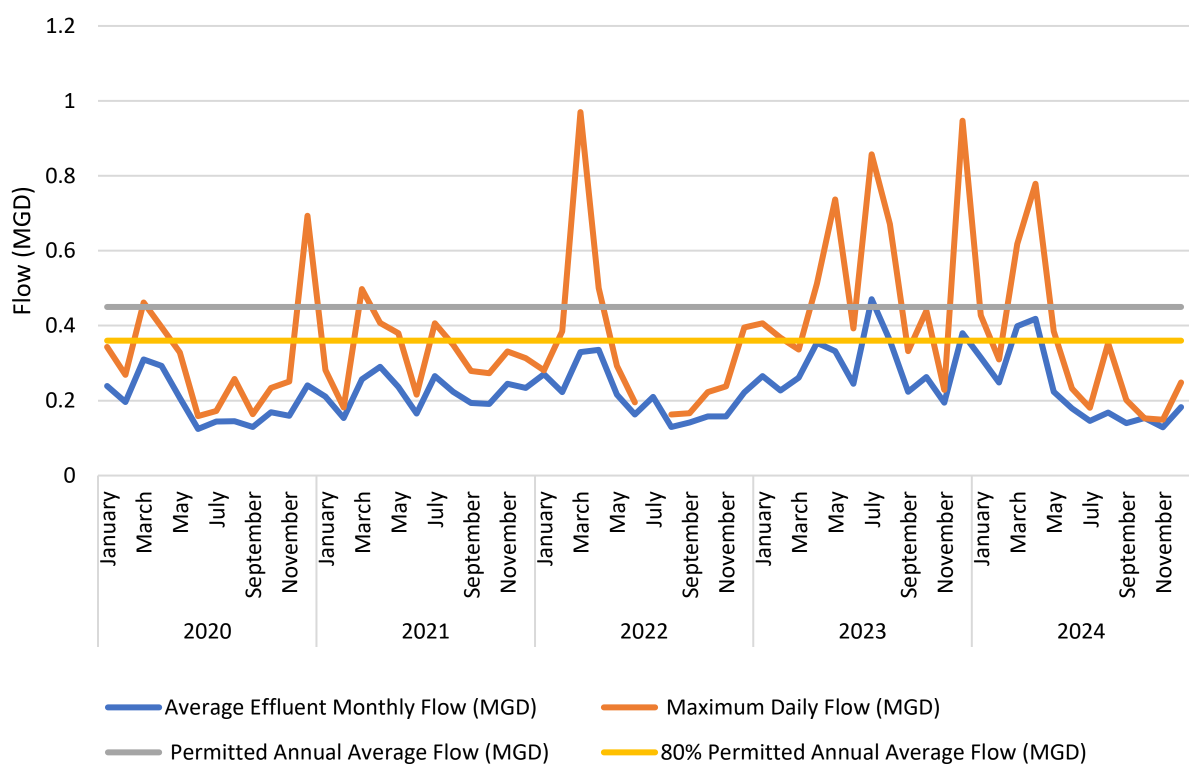

Figure 2-1 Effluent Flow

The peak day flow from January 2020 to December 2024 was 0.97 MGD in March 2022. This flow value exceeds the historical peak day flow of 0.846 MGD identified in the *2023 Preliminary Engineering Report* based on data from January 2016 through September 2021. Two outliers were removed from the historical dataset, specifically 2.248 MGD experienced on January 3, 2022, and 1.25 MGD experienced on July 14, 2022. Communication with the operator revealed that this data was input incorrectly.

2.3.2. Biochemical Oxygen Demand (BOD)

Influent BOD

Average influent BOD concentrations from January 2020 to December 2024 ranged from 87 to 790 mg/L, with an average concentration of 305 mg/L, as presented in Figure 2-2. The design BOD concentration defined in the *2023 Preliminary Engineering Report* based on data from January 2016 to September 2021 was 289 mg/L. A 5.5% increase in average influent BOD is observed between the data evaluated in the *2023 Preliminary Engineering Report* and the data evaluated in this amendment document. The average monthly influent BOD load from January 2020 to December 2024 was 569 lbs/day BOD. This is a 12.5% increase in average monthly influent BOD load of 506 lbs/day BOD from January 2016 to September 2021.

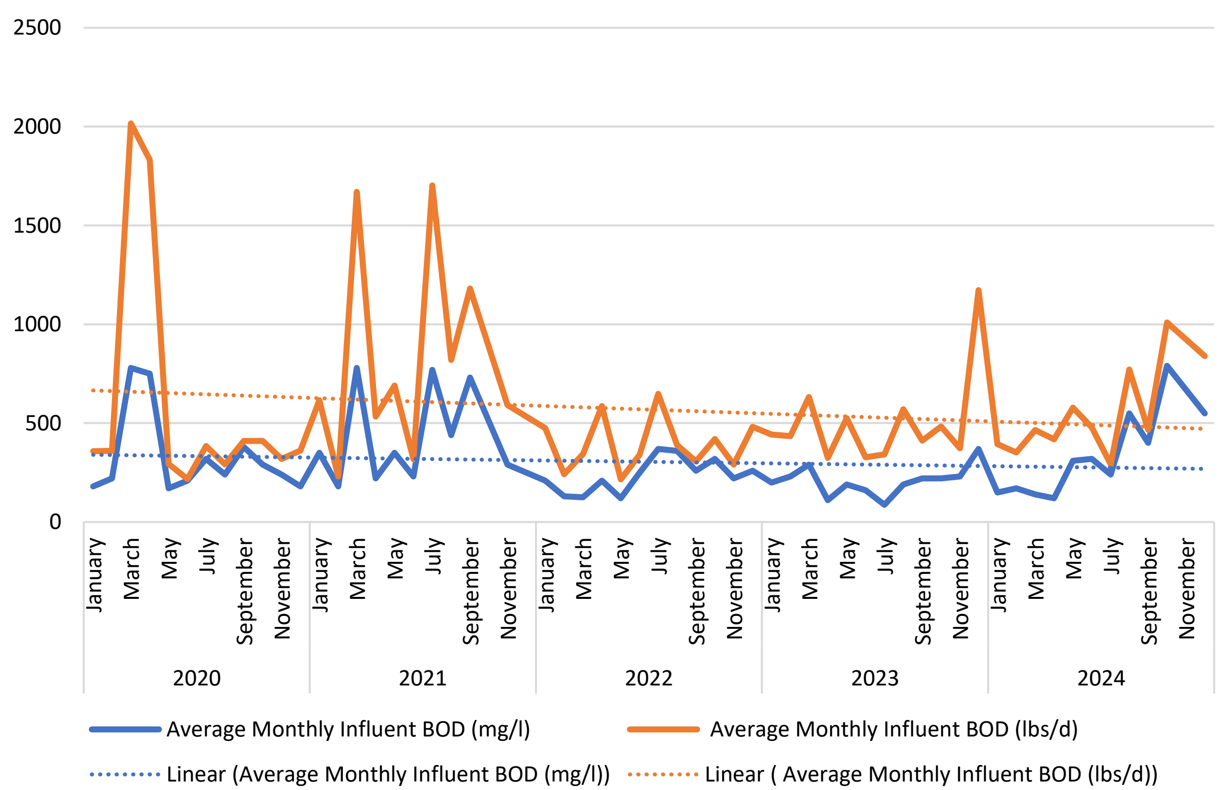

Figure 2-2 Influent BOD

Effluent BOD

Historical effluent BOD data is presented in Figure 2-3. Effluent BOD concentration ranged from 2.5 to 11 mg/L with an average of 4.4 mg/L, well below the effluent monthly average permit limit concentration of 30 mg/L. Average effluent BOD loading during this time period was 8.2 lbs/day, well below the effluent monthly average permit limit load of 113 lbs/day. The Woodstock Main WWTF continues to perform well and removes between 93-99+% of BOD, with an average removal of 98%.

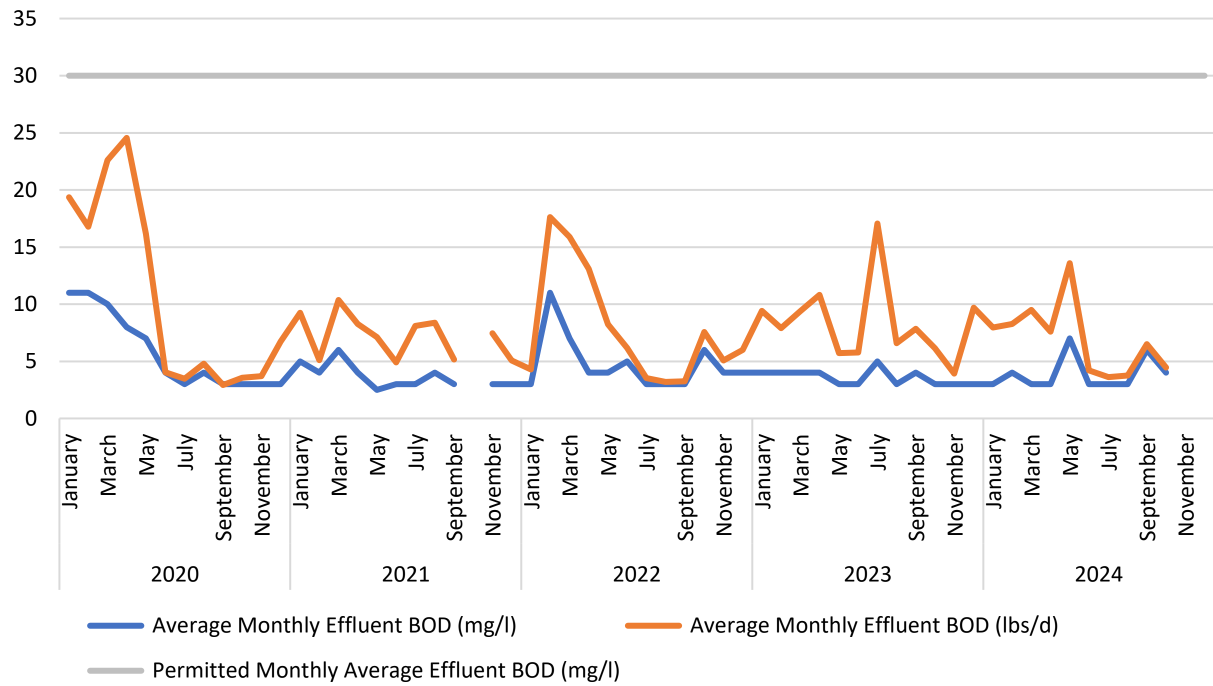

Figure 2-3 Effluent BOD

2.3.3. Total Suspended Solids (TSS)

Influent TSS

Historical influent TSS data is presented in Figure 2-4 on the following page. The average influent TSS concentration from January 2020 to December 2024 was 232 mg/L, equivalent to a 9% increase from the proposed design and historical average influent TSS concentration of 213 mg/L determined in the *2023 Preliminary Engineering Report*.

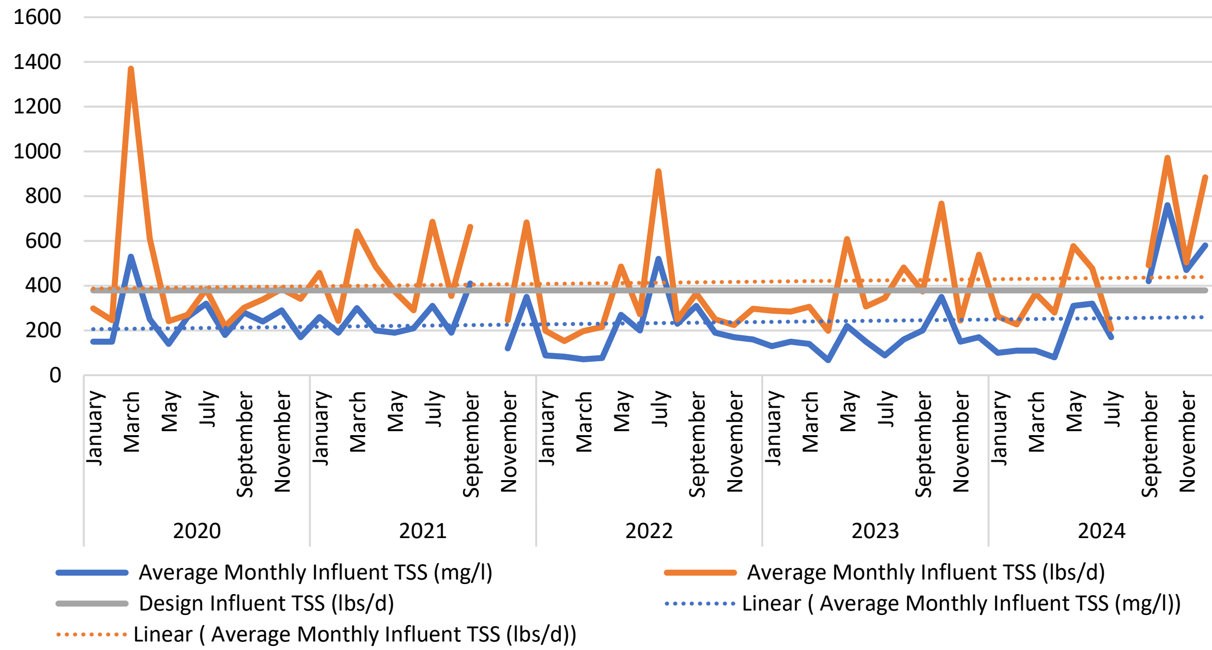

Figure 2-4 Influent TSS

Effluent TSS

The average annual influent TSS load from January 2020 to December 2024 was 413 lbs/day TSS. In comparison to the 374 lbs/day average from 2016 to 2021 determined in the *2023 Preliminary Engineering Report*, loading increased by 10%. Similar to past findings, the influent TSS concentrations and loads have been increasing over time. With this being said, the Woodstock Main WWTF removes between 94-99+% of TSS, with an average percent TSS removal of 99%, as seen in Figure 2-5.

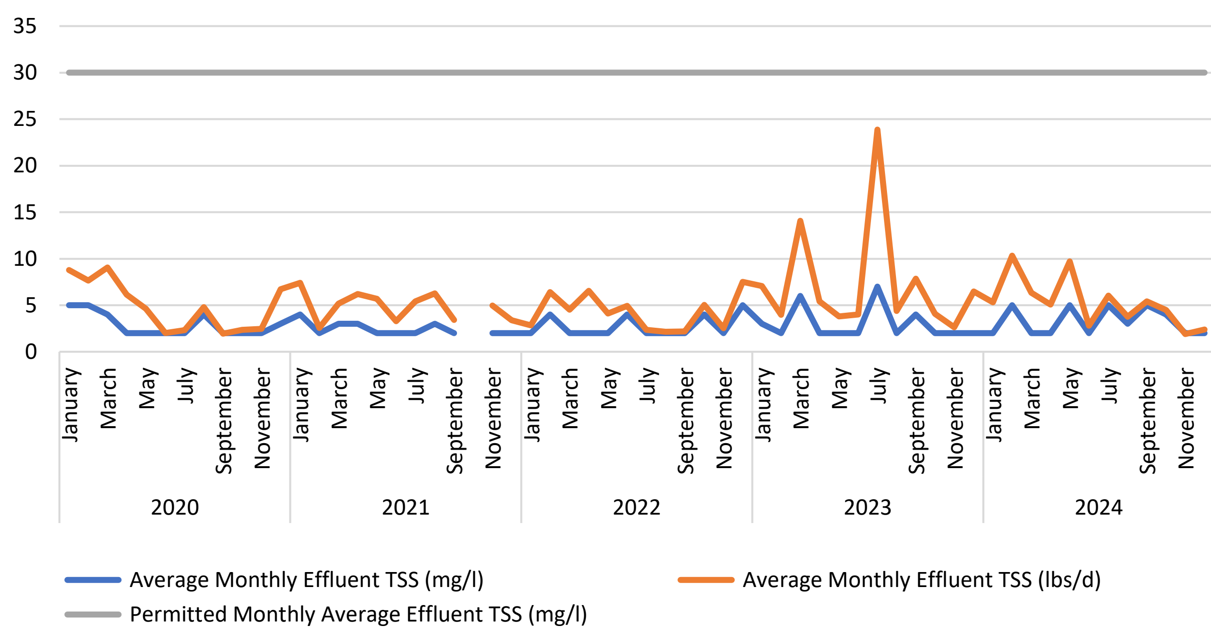

Figure 2-5 Effluent TSS

2.3.4. Total Nitrogen (TN)

Influent TN

As seen in Figure 2-6 , influent TN concentrations ranged from 15 mg/L to 130 mg/L, with an average of 45 mg/L from January 2020 to December 2024. Historical influent TN trends have been volatile, with especially great variability experienced from 2020 through 2021. Sources of nitrogen can include the supernatant when the center sludge digester is siphoned off and the centrate from dewatering, both of which are returned back to the Headworks. The increased spikes in influent TN were compared to existing data around sludge digester decant and dewatering centrate. While some high TN concentrations are correlated to sludge digester decant, specifically the 130 mg/L TN concentration in March 2020, not all high TN concentrations can be tied to side stream returns.

The *2023 Preliminary Engineering Report* defined a design influent TN concentration of 48 mg/L, based on historical operating data from January 2016 through September 2021. Due to the historical variability in influent TN concentrations, as well as limited data around side streams such as decant being returned to the process, the proposed design criteria, outlined in Table 3-1 on the following page, maintains the design influent TN concentration of 48 mg/L rather than using the 45 mg/L average influent TN from January 2020 through December 2024.

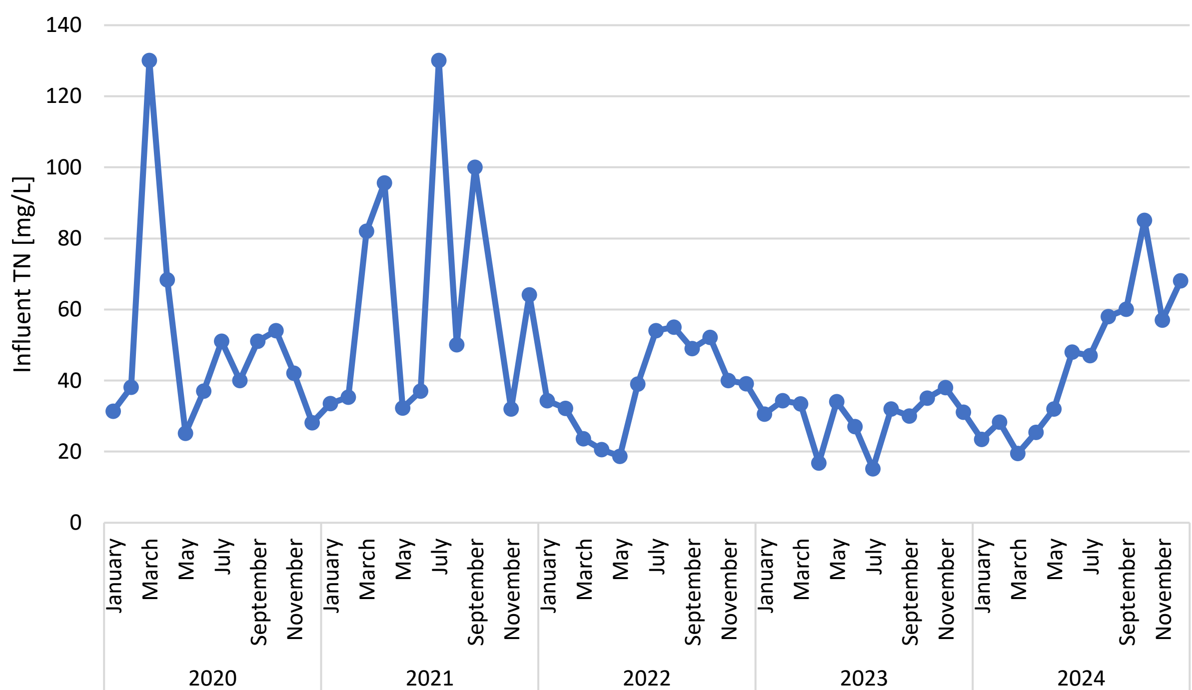

Figure 2-6 Influent TN

Effluent TN

From January 2020 to December 2024, the average monthly effluent TN load was 21.7 lbs/day, which is 42% of the estimated average annual TN allocation of 52 lbs/d. The effluent total Kjeldahl nitrogen (TKN) ranged from 0.01 mg/L to 14 mg/L. Effluent TN concentrations ranged from 4.8 mg/L to 30 mg/L. A significant reduction in effluent TN concentration as compared to influent TN concentration indicates that the Woodstock Main WWTF is able to partially denitrify.

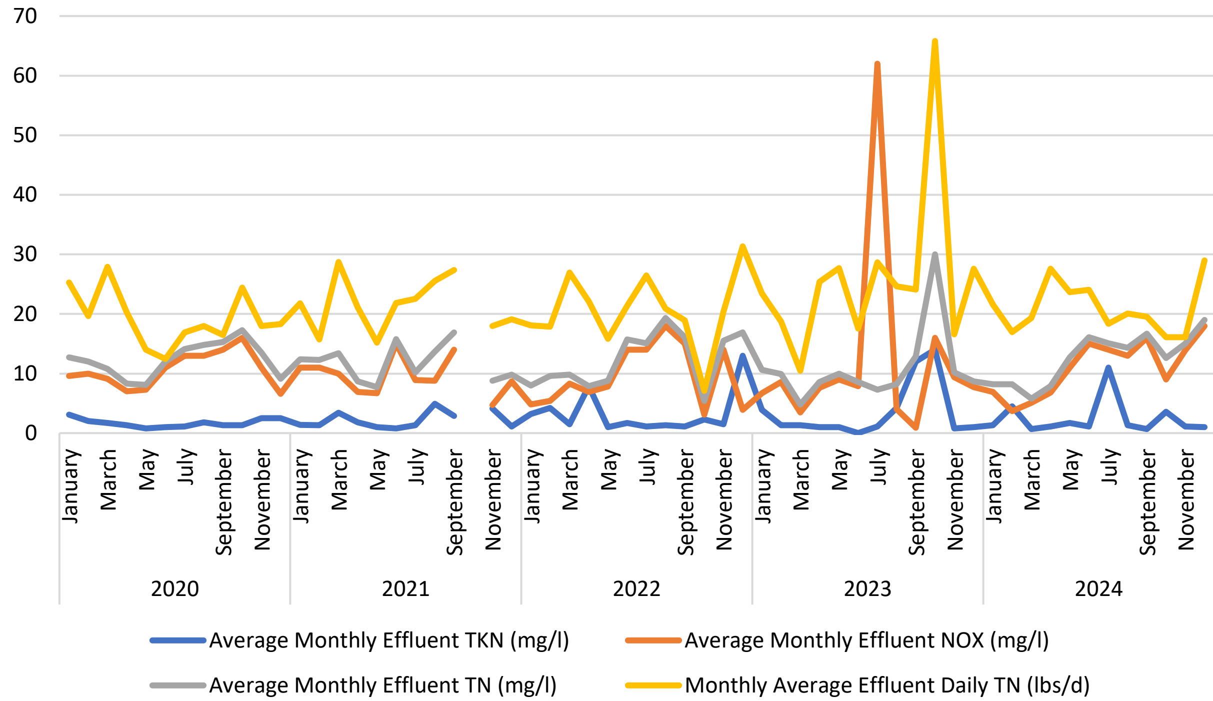

Figure 2-7 Effluent Nitrogen Data

2.3.5. E. Coli

The Main WWTF had one exceedance of the permitted instantaneous maximum e. Coli limit of 77 counts per 100 ml in July 2023, as seen in Figure 2-8 on the following page. The exceedance of 170 counts per 100 ml occurred on July 25, 2023. Upon receiving the E. Coli result, operators found that a chlorine pump needed to be changed out. After changing out the chlorine pump, the E. Coli count was 1 per 100 ml the following day, indicating the lapse in sufficient disinfection was likely a result of the pump malfunction. From January 2020 to December 2024, the maximum effluent E. Coli ranged from 1 to 170 counts per 100 ml, with an average count of 7 per 100 ml.

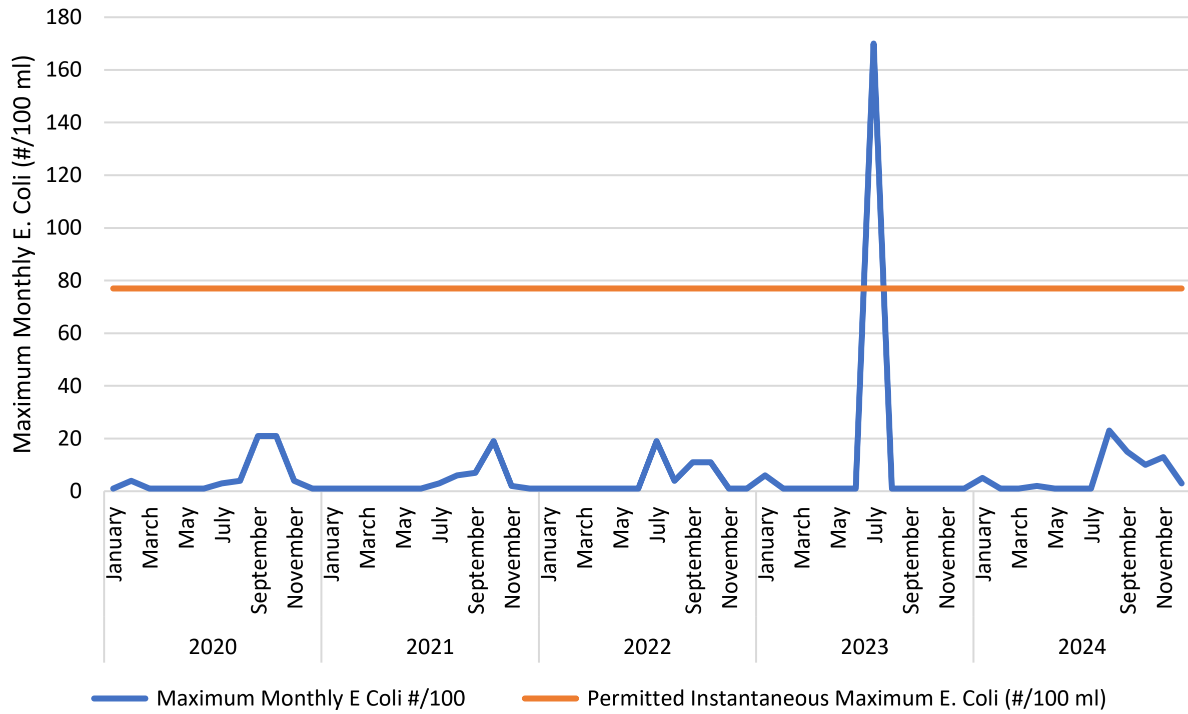

Figure 2-8 Effluent E. Coli

3. ALTERNATIVES EVALUATION

3.1 Design Criteria

3.1.1. Influent

Table 3-1 on the following page presents the 1983 original influent design criteria, proposed influent design criteria in the *2023 Preliminary Engineering Report*, current influent conditions based on data from 2020-2024, and the updated proposed influent design criteria for the liquid treatment processes at the Woodstock Main WWTF. Analysis of historical operating data is discussed in Section 2.3. The design peak hourly flow has been increased from the proposed peak hourly flow in the *2023 Preliminary Engineering Report* to reflect a new defined peaking factor of 4.2 based on historical flow data from 2020-2024 analyzed in Section 2.3.1.

Table 3-1 Influent Design Criteria

Parameter	1983 Original Design[1]	Proposed Design Criteria (from 2023 PER)[2]	Current Conditions[3]	Updated Proposed Design Criteria[4]
Average Daily Flow (ADF)	0.45 MGD	0.45 MGD	0.23 MGD	0.45 MGD
Peak Hourly Flow (PHF)	0.75 MGD	1.71 MGD	0.97 MGD	1.90 MGD
Biochemical Oxygen Demand (BOD)	117 mg/L 439 lb/day	289 mg/L 1,085 lb/day	305 mg/L 588 lb/day	305 mg/L 1,145 lb/day
Total Suspended Solids (TSS)	101 mg/L 379 lb/day	213 mg/L 799 lb/day	232 mg/L 447 lb/day	232 mg/L 871 lb/day
Total Nitrogen (TN)	--- ---	48 mg/L 180 lb/day	45 mg/L 87 lb/day	48 mg/L 180 lb/day
Temperature (min/avg/max)	7.7/14.8/23.4 Deg. C	7.7/14.8/23.4 Deg. C	7.7/15.0/23.4 Deg. C	7.7/15.0/23.4 Deg. C

Notes:

1. Source: Operations and Maintenance Manual, 1983.
2. Source: Preliminary Engineering Report, 5/3/2023. Peak Hourly Flow is based on a historical peaking factor of 3.8 from January 2016 to September 2021. Historical BOD, TSS, and TN concentrations are back calculated using historical average flows and loads.
3. Based on Daily Monitoring Reports from January 2020 to December 2024.
4. Peak Hourly Flow is based on a historical peaking factor of 4.2 from January 2020 to December 2024 (PF = PDF/ADF = 0.97/0.23). Design loads are calculated based on current concentrations and design flows.

As discussed in Section 2, influent concentrations have increased slightly in the 2020-2024 data compared to the January 2016 through September 2021 data analyzed in the *2023 Preliminary Engineering Report* for all constituents except for total nitrogen (TN). The historical TN concentration decreased from 48 mg/L to 45 mg/L; however, the updated design TN concentration is proposed to remain at 48 mg/L to be most conservative.

3.1.2. Effluent

Effluent design criteria for the Woodstock Main WWTF are based on the existing NPDES permit and are provided in Table 3-2 on the following page. The existing NPDES permit expired on September 30, 2024. A new permit has not been issued. It is anticipated that the majority of the effluent limitations will remain the same in the next permit round, with the exception of Total Phosphorus. It is anticipated the Woodstock Main WWTF will receive a new Total Phosphorus (TP) effluent limit of 0.8 mg/L.

Table 3-2 Effluent Design Criteria

Parameter	Original Design Criteria	Proposed Design Criteria
Flow (Annual Average)	0.450 MGD	0.450 MGD
BOD (Monthly Average)	30 mg/L	30 mg/L
TSS (Monthly Average)	30 mg/L	30 mg/L
Total Phosphorus (Daily Maximum)	Monitor Only	0.8 mg/L 3 lb/day
Total Nitrogen (Annual Average)	Monitor Only	13.9 mg/L 52 lb/day
Total Kjeldahl Nitrogen (TKN) (Daily Maximum)	Monitor Only	Monitor Only
Nitrate/Nitrite Nitrogen (NOx) (Daily Maximum)	Monitor Only	Monitor Only
Settleable Solids (Instantaneous Maximum)	1.0 mL/L	1.0 mL/L
Total Residual Chlorine (Instantaneous Maximum)	0.1 mg/L	0.1 mg/L
E. Coli (Instantaneous Maximum)	77 CFU/100 mL	77 CFU/100 mL
pH	6.5-8.5 S.U.	6.5-8.5 S.U.

As discussed in the *2023 Preliminary Engineering Report*, VTDEC provided guidance on January 31, 2023 stating, “Upon direct discharge’s review of effluent and upstream phosphorus data from the facility, there appears to be reasonable potential for the effluent to contribute to a violation of Phosphorus Vermont Water Quality Standards in the receiving water. When the permit is renewed, this means the facility will likely be assigned a phosphorus limit.” Based on discussions with VTDEC, the following was assumed:

- The future limit will not require tertiary treatment of the secondary effluent.
- Chemical addition of a metal salt for precipitation of ortho-phosphate would be adequate for meeting the potential future effluent total phosphorus limit.
- The design should allow for future addition of tertiary treatment in the hydraulic profile, if possible.

3.2 Biological Process

The biological process at the Woodstock Main WWTF consists of package treatment tankage within a 68-ft diameter circular reinforced concrete tank. The two-train tank is divided into five (5) cells per train, provided with the ability to step feed. Assessment of the existing biological process revealed that the existing tanks are in poor condition with visible concrete deterioration, corroded grating, and a failing steel beam used to support the center wall. It is recommended to replace the existing biological process in its entirety with a new biological process and aeration equipment. As part of this PER Amendment, three (3) biological treatment process alternatives were identified and further developed to replace the existing biological process:

1. Anaerobic/Anoxic/Oxic (A^2O)
2. Aerobic Granular Sludge (AGS)
3. Sequencing Batch Reactor (SBR)

3.2.1. Biological Process Alternative #1: Anaerobic/Anoxic/Oxic (A^2O)

Biological Process Alternative #1 is an Anaerobic/Anoxic/Oxic (A^2O) process. The A^2O process is a conventional sludge system designed to ensure adequate BOD removal, nitrification, and provide conditions that support biological ortho-phosphate uptake.

Anaerobic Selector

The first reactor in the A^2O process is a multi-stage anaerobic selector where return activated sludge (RAS) and municipal influent is staggered. RAS is introduced to the first stage of the anaerobic selector. Nitrate and dissolved oxygen can be present in the RAS, which can prevent true anaerobic conditions and when introduced with municipal influent, can consume soluble BOD and volatile fatty acids present in the municipal influent that are required for biological phosphorus removal. Staggering the introduction of RAS and municipal influent allows for denitrification of the RAS prior to being introduced to the municipal influent, allowing for true anaerobic conditions and cultivation of polyphosphate accumulating organisms (PAOs). This multi-stage configuration is known as the Block and Hong process modification.

Anoxic Zones

Following the anaerobic selector, wastewater is directed to anoxic reactors. Nitrified mixed liquor, referred to as internal mixed liquor recycle (IMLR), is returned from the end of the aerobic zones to the beginning of the anoxic zones for denitrification. Anoxic zones promote denitrification (the conversion of nitrate/nitrite to nitrogen gas). Denitrification requires low dissolved oxygen concentrations, the presence of an electron acceptor which is supplied in the form of nitrate from the IMLR flow, and the presence of an electron donor which can be supplied in the form of influent soluble BOD, by endogenous respiration, or an external carbon source.

Oxic Zones

Following denitrification in the anoxic zones, flow will enter oxic (aerobic) zones for BOD removal and nitrification. Aeration equipment will be controlled to maintain a dissolved oxygen (DO) setpoint in the oxic zones. Dissolved oxygen probes will continually monitor DO levels within the reactors to a PLC based control panel that controls the blower speed and valve position of the electrically actuated modulating airflow valves.

Mixing

Compressed gas mixing will be provided in the anaerobic and anoxic zones. Compressed gas mixing provides bursts of compressed air which are fired through nozzles located near the tank floor. These bursts of compressed air provide uniform mixing of the tank contents through rapid upward velocity without transferring oxygen to the tank contents. The compressed gas mixing in the anaerobic zone can be programmed for intermittent mixing to create ideal conditions for enhanced biological phosphorus removal (EBPR), essentially achieving the conditions of a fermenter. This promotes the production of volatile fatty acids (VFAs), which are used by PAOs to achieve EBPR. New compressors and a receiving tank for the compressed gas mixing system will be housed in a new Process Building. Compressed gas mixing systems have zero in-tank maintenance with no mechanical or electrical components.

Blowers

Three (3) hybrid centrifugal blowers will be provided, two (2) duty and one (1) stand-by to provide maximum airflow demand with the largest unit out of service, as per TR-16 Standards. Blowers will be housed in the new Process Building.

Secondary Clarifiers

Biological Process Alternative #1: A^2O will require rehabilitation of the two (2) existing secondary clarifiers as outlined in Section 4.7 of the *2023 Preliminary Engineering Report*. Rehabilitation will include direct replacement of components to restore the clarifiers to their original functionality. Concrete rehabilitation, inclusive of sand blasting, crack repair, and concrete coating, will be performed. Scum box improvements will include providing suction piping from the scum boxes to the WAS pumps to waste directly to the sludge holding tanks, and replacement of the level detection systems in each box. The Clarifier House that is located between the two clarifier tanks will be refurbished to improve physical and mechanical equipment access to the lower level, repair cracks in the top concrete slab/roof, relocation of electrical components to an above-grade climate-controlled structure, and refurbishment of the electrical and HVAC systems.

RAS & WAS

Biological Process Alternative #1: A^2O will require rehabilitation of the return activated sludge (RAS) and waste activated sludge (WAS) pumping systems as outlined in Section 4.8 of the *2023 Preliminary Engineering Report*. Rehabilitation will include replacement of the three (3) existing RAS/WAS pumps with two (2) pumps dedicated for RAS and two (2) pumps dedicated for WAS. RAS pumps will be provided with VFDs and a flow meter for flow pacing. RAS discharge piping will be directed to the new A^2O tankage. WAS discharge pumping will be directed to the existing sludge holding tanks. The flexibility to pump from the secondary clarifier scum boxes to the existing sludge holding tanks will be provided.

Design Criteria

Design criteria for Biological Process Alternative #1: A^2O is presented in Table 3-3. Information on the biological process tankage and equipment is presented in Table 3-4 and Table 3-5, respectively. Design criteria for the secondary clarifiers and RAS/WAS system are presented in Table 3-6.

Table 3-3 Biological Process Alternative #1: A^2O – Design Criteria

Item Description	Existing Design	Proposed Design	Design Standard
Design Flow	0.45 MGD	0.45 MGD	
Type	Step Feed/Contact Stabilization	A^2O	
Hydraulic Retention Time (Total)	12.4 hours	28 hours	
Hydraulic Retention Time (Anaerobic)	---	1.6 hours	0.5-1 hours (TR-16 Table 6-13)
Solids Retention Time (Total)	30 days	19 days	15-25 hours (TR-16 Table 6-14)
MLSS	3,000 mg/L	4,000 mg/L	
F:M (total)	0.31	0.09	
Design Sludge Production	--	900-1,000 lb/day	
Return Activated Sludge (RAS)	60%	50-100%	25-100% of influent (TR-16 Table 6-14)
Internal Mixed Liquor Recycle (IMLR)	---	400-500%	200-400% of influent (TR-16 Table 6-14)
Number of Process Trains	2	2	

Table 3-4 Biological Process Alternative #1: A^2O – Tankage

Item Description	Existing Design	Proposed Design	Design Standard
Anaerobic Reactor			
Quantity	---	2 total (common for two trains)	
Dimensions (each)	---	11-ft L x 12-ft W x 15-ft SWD	
Volume (each)	---	2,000 cf	
Volume (total)	---	4,000 cf	
Anoxic Reactor			
Quantity	---	1/train, 2 total	
Dimensions (each)	---	21-ft L x 23-ft W x 20-ft SWD	
Volume (each)	---	9,660 cf	
Volume (total)	---	19,320 cf	
Aerobic Reactor 1			
Quantity	---	1/train, 2 total	
Dimensions (each)	---	27-ft L x 23-ft W x 20-ft SWD	
Volume (each)	---	12,420 cf	
Volume (total)	---	24,840 cf	
Aeration System	---	Membrane Fine Bubble	
Residual DO (summer/winter)	---	1.5/2.0 mg/L	
Total Process Air Required (total)	---	252 scfm	

Item Description	Existing Design	Proposed Design	Design Standard
Aerobic Reactor 2			
Quantity	---	1/train, 2 total	
Dimensions (each)	---	27-ft L x 23-ft W x 20-ft SWD	
Volume (each)	---	12,420 cf	
Volume (total)	---	24,840 cf	
Aeration System	---	Membrane Fine Bubble	
Residual DO (summer/winter)	---	1.5/2.0 mg/L	
Total Process Air Required (total)	---	170 scfm	

Table 3-5 Biological Process Alternative #1: A^{2}O – Equipment

Item Description	Existing Design	Proposed Design	Design Standard
Blowers			
Quantity	2	3 (2 duty, 1 stand-by)	Maximum air demand met with largest unit out of service (TR-16)
Type	Positive Displacement	Hybrid Centrifugal Blowers	
Capacity (each)	900 scfm @ 6.9 psig	350 scfm at 10 psig	
Power (each)	50-HP	30-HP	
Compressed Gas Mixing			
Compressor Type	---	Rotary Screw Compressor	
Compressor Quantity	---	2 (1 duty, 1 stand-by)	
Capacity	---	27 scfm @ 125 psig	100% Redundancy with largest unit out of service
Motor		7.5 HP	
Receiver Tank		One (1) 120 gallon tank	
Nozzles		4/anaerobic zone 16/anoxic zone	
Internal Mixed Liquor Recycle (IMLR) Pumps			
Quantity	---	2	
Capacity	---	1.125 MGD @ 3-ft TDH	
Power (each)	---	5-HP	

Table 3-6 Biological Process Alternative #1: A^{2}O – Secondary Clarifier & RAS/WAS Design Criteria

Item Description	Existing Design	Proposed Design	Design Standard
Secondary Clarifiers			
Quantity	2		
Type	Circular, Peripheral Feed		
Diameter	30-ft		
Weir Length	94-lf (each) 188-lf (total)		

Item Description	Existing Design	Proposed Design	Design Standard
Side Water Depth	12-ft		12-ft SWD for circular clarifiers up to 40-ft in diameter (TR-16)
Surface Area	707-ft (each) 1,414-ft (total)		
Capacity	8,482 cf / 63,450 gal (each) 16,965-cf / 126,907 gal(total)		
Average Daily Flow (MGD)	0.45	0.45	
Design Peak Hourly Flow	0.75	1.71	
Surface Loading Rate (gpd/sf)			
Peak Hourly Flow (2 units)	531	1,358	<1,200 gpd/sf (10 State Std)
75% Peak Hourly Flow (1 unit)	796	2,037	
Solids Loading Rate (lbs/day/sf)			
Peak Hourly Flow (2 units)	19	48	<50 lbs/d-ft (10 State Std)
75% Peak Hourly Flow (1 unit)	28	71	
Weir Loading Rate (gpd/lf)			
Peak Hourly Flow (2 units)	3,979	10,186	<20,000 gpd/ft (10 State Std)
75% Peak Hourly Flow (1 unit)	5,968	15,279	
RAS Pumps			
Quantity	2	2 (1 duty, 1 stand-by)	1 duty, 1 stand-by
Type	Flygt dry-pit vertical, non-clog		
Control Method	VFD	VFD	
Target RAS Flow	65% of Effluent Q	65%-150% of Effluent Q	
Capacity, each	160-30 gpm	200-470 gpm	
HP	3.7	*TBD*	
WAS Pumps			
Quantity	1	2 (1 duty, 1 stand-by)	1 duty, 1 stand-by
Type	Flygt dry-pit vertical, non-clog		
Capacity, each	160-330 gpm	150-220 gpm	>80 gpm (>2 fps in 4" dia. Pipe) (10 State Standards)
HP	3.7 HP	*TBD*	
Variable Speed Control	No	No	
Pump Control System	Manual	Timer/Manual	

Description

Biological Process Alternative #1: A^2O includes the following:

- A^2O process and instrumentation:
  - PLC Control Panel
  - Four (4) DO Probes
  - Two (2) pH Meters

    - One (1) ORP Probe
    - Four (4) Thermal Mass Flowmeters
- Internal Mixed Liquor Recycle (IMLR)
    - Two (2) 5-HP Modulating Pumps
    - Four (4) 4" Actuated Butterfly Modulating Airflow Control Valves
    - Two (2) Magnetic Flow Meters
- Compressed Gas Mixing System
    - One (1) 7.5 HP Rotary Screw Compressor
    - One (1) 120 gallon Vertical Receiver Tank
    - 304 SS Header Piping, Headers, and Nozzles
    - One (1) Valve Module
    - One (1) Control Panel
- Four (4) Fine Bubble Aeration Systems
    - One (1) per Oxic Reactor
- Three (3) 30-HP Hybrid Centrifugal Blowers
- Concrete Tanks w/ access platforms/grating/handrail gates
- 25-ft x 40-ft Process Building for blowers, compressed gas mixing equipment, and chemical storage and feed systems.

Exhibit

Figure 3-1 presents a process flow diagram of an A^2O process.

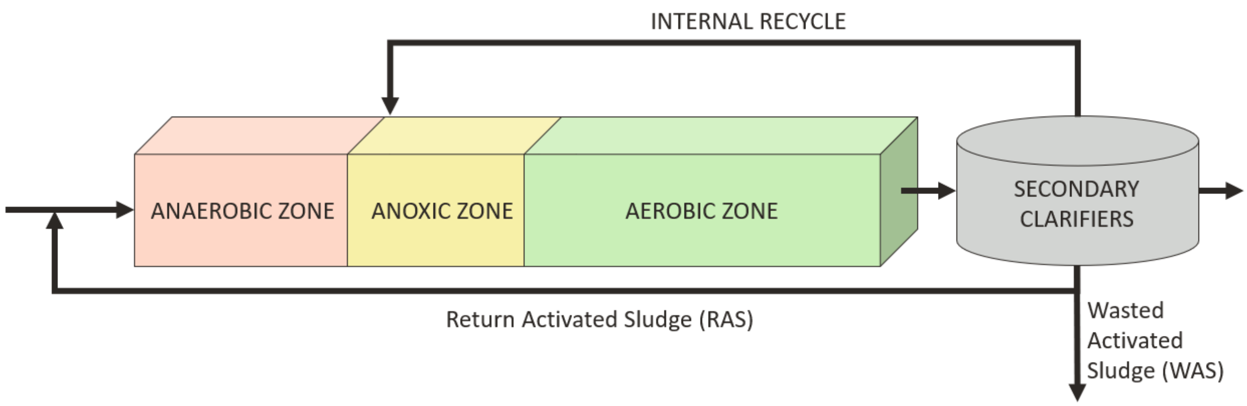

Figure 3-1 A^2O Process Flow Diagram

A proposed site plan for biological process Alternative #1 is provided in Figure 3-2 on the following page.

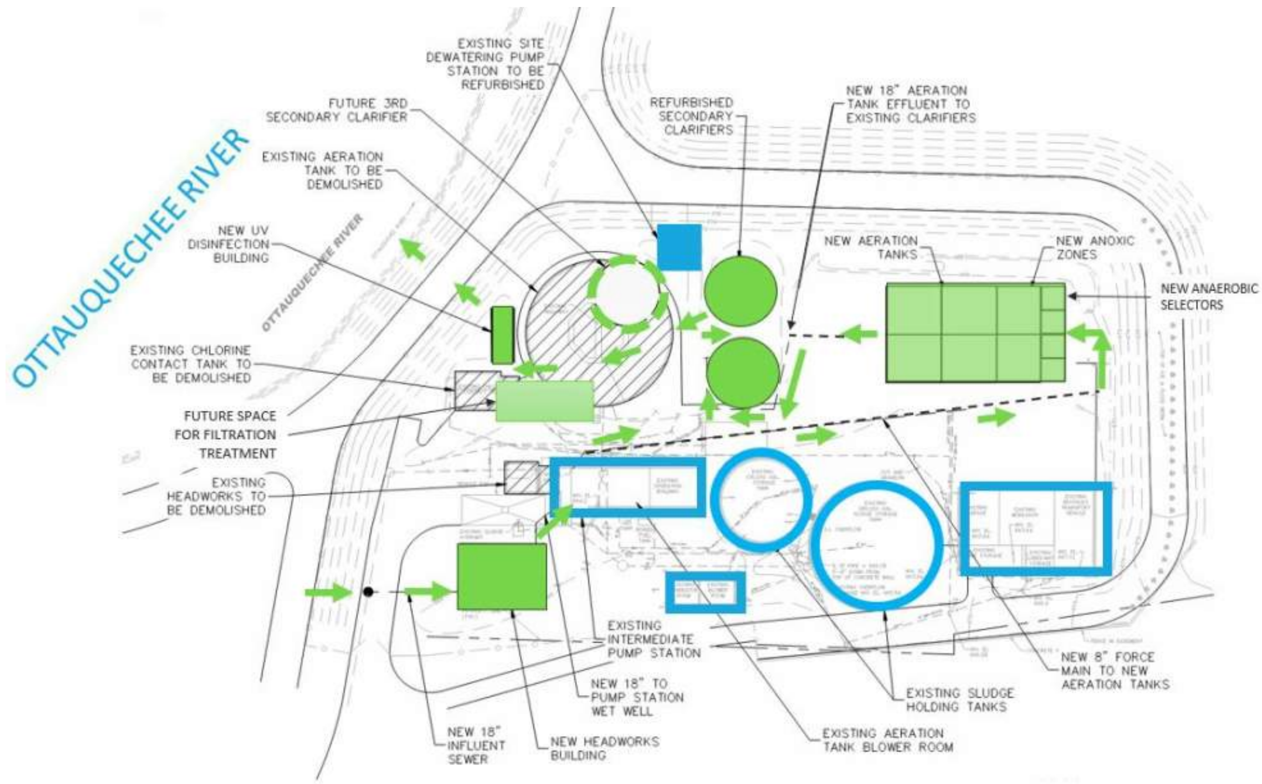

Figure 3-2 – A^{2}O Proposed Site Plan

Non-Monetary Factors

Advantages

- Block and Hong modification of anaerobic selector allows for ideal anaerobic conditions and a high soluble BOD:P ratio to be maintained, as required for effective phosphorus removal.
- Anaerobic selectors prevent the excessive growth of filamentous bacteria responsible sludge bulking and encourage the formation of a dense, rapidly settling floc.
- Feedback control features can eliminate costly and wasteful over-aeration that can compromise process stability and operational budgets.
- Provides more efficient blowers with improved turn down capabilities than existing blowers, reducing energy consumption.

Disadvantages

- Difficult to achieve conditions optimal for enhanced biological phosphorus removal.

Cost Estimate

A preliminary opinion of probable construction cost for Biological Process Alternative #1: A^{2}O is provided in Table 3-7. A detailed breakdown of this opinion of probable construction cost is provided in Appendix B.

Table 3-7 Biological Process Alternative #1: A^2O – Construction Cost Estimate

Item	Cost[1]
A^2O Tank & Equipment (includes concrete, equipment, site/civil work, electrical)	$5,718,200
Process Building	$1,008,300
Secondary Clarifiers & Clarifier House Rehabilitation	$1,531,000
RAS/WAS Rehabilitation	$752,000
Construction Cost Subtotal (rounded)[2]	**$9,010,000**
Contractor Mark-Up[3]	$2,702,000
Total Construction Cost[4]	**$11,712,000**

Notes:

1. ENR Construction Cost Index = 13782.50, March 2025.
2. Construction Costs include mark-up for BABA compliance and tariff contingency.
3. Contractor Mark-Up is inclusive of Contractor's overhead and profit (20%), mobilization and demobilization (8%), and bonds (2%).
4. Total Construction Costs do not include project contingency, engineering services, legal and administrative costs.

3.2.2. Biological Process Alternative #2: Aerobic Granular Sludge (AGS)

Biological Process Alternative #2: Aerobic Granular Sludge (AGS) provides a dense, granular biomass that contains multiple layers of microbes, achieving all phases of treatment within each granular. The outer layer consists of an aerobic environment that accesses dissolved oxygen in the water, promoting the growth of microbes that perform BOD removal and nitrification. The middle layer consists of an anoxic environment, allowing for conditions that promote the growth of microbes that perform denitrification. The inner-most layer provides an anaerobic environment, allowing for the growth of polyphosphate accumulating organisms to perform enhanced biological phosphorus removal. Aerobic granular sludge allows carbon to be shared between microbes within the granule, given its layered structure. This differs from conventional activated sludge processes where carbon can be a limiting substrate and an external carbon source can be required to achieve optimal treatment. The growth of multiple microbes on the same granular allows for denser floc formation, resulting in higher settling velocities and increased sludge compaction.

Aerobic granular sludge treatment is a batch process with the following phases:

- **Anaerobic fill:** The tank is filled with no aeration to encourage the production of extracellular polymeric substances (EPS), which encourage the creation of AGS particles.
- **React:** Aeration and mixing occur allowing for BOD removal, nitrification, and denitrification within the AGS particles. Wasting occurs from the surface.
- **Settle:** Aeration and mixing are terminated, allowing for solids to settle.
- **Filled decant:** Effluent withdrawal occurs, and anaerobic fill begins.

Typical Operations

In anaerobic fill, raw influent enters the basin without aeration to encourage the production of extracellular polymetric substances (EPS), which is a key component that promotes the creation of granular sludge particles. In the react phase, when the basin is done filling, aeration and mixing occur and dissolved oxygen (DO) is monitored to determine when residual DO starts to form. Wasting occurs during this stage by surface wasting and waste sludge is transferred to a sludge thickening tank. During the settle phase, aeration and mixing are turned off, and the reactor settles, allowing for liquid and solids separation. During the filled decant stage, the floating decanter will withdraw 30-40% of the basin volume while being anaerobically filled. Two (2) AGS tanks will be provided. In the case where a tank has to be taken offline, the AGS tank will operate on accelerated cycles and use the pre-equalization basin to damper influent flows.

Sludge Thickening Tank

The sludge thickening tank, known as the sludge buffer, is equipped with electrically actuated plug valves to convey supernatant back to the beginning of the process. A sludge transfer pump is provided to transfer thickened sludge to sludge storage. If on-site dewatering facilities are added to the project, one of the existing sludge holding tanks could be used for sludge buffering.

Pre-Equalization Tank

Biological Process Alternative #2: AGS will include a pre-equalization tank prior to the biological tankage. The pre-equalization tank will be sized for approximately 51,000 gallons. The volume of the pre-equalization tank reflects that needed to achieve the effluent design criteria under design flows.

A new Process Building will be provided that will house the new blowers.

Design Criteria

Design criteria for Biological Process Alternative #2: Aerobic Granular Sludge is presented in Table 3-8 below. Design criteria for the pre-equalization tank is provided in Table 3-9.

Table 3-8 Biological Process Alternative #2: AGS – Design Criteria

Item Description	Proposed Design	Design Standard
Basin Dimensions		
Number of Basins	2	
Dimensions/basin	39-ft x 21-ft	
Top of Wall	25-ft	
Discharge Level/Process Level	23.4-ft/22.0-ft	
Total Volume	0.26 MG	
Process Parameters		
Design MLSS	8,000 mg/L	
System Solids Retention Time (SRT)	17.5 days	
Hydraulic Retention Time (HRT)	0.48 days	
F:M	0.08 lbs BOD/lb MLSS-day	
Estimated Net Sludge Yield	0.67 lbs WAS/lb BOD	
Estimated Dry Solids Produced	961 lb WAS/day	
Aeration System		
Actual Oxygen Required (AOR)	2,824 lbs O_2/day	
Max Air Flowrate/Basin	461 scfm	
Blower Quantity	2 (1 duty, 1 stand-by)	Maximum air demand met with largest unit out of service (TR—16)
Blower Type	Rotary Positive Displacement	
Power	60-HP	
Sludge Buffer		
Number of Basins	1	
Dimensions Needed if New Tank	12.5-ft x 8-ft	
Min/Max Level	1-ft/15-ft	
Max Basin Volume	11,169 gallons	
Max Sludge Flow Rate	31 gpm	
Max Supernatant Flow Rate	123 gpm	
Transfer Pump Quantity	2	
Transfer Pump Power	5-HP	

Table 3-9 Biological Process Alternative #2: AGS – Pre-Equalization – Design Criteria

Item Description	Proposed Design	Design Standard
Pre-Equalization		
Number of Basins	1	
Dimensions	22-ft x 20-ft	
Max Water Level	15.4-ft	
Max Basin Volume	50,721 gallons	

Description

Biological Process Alternative #2: Aerobic Granular Sludge includes the following:

- Influent Pre-Equalization Tank
    - One (1) 22’ x 20’ x 18’ H concrete tank

  - One (1) pressure transducer
  - One (1) float switch
- Two (2) 50' x 40' x 25' concrete AGS Basins
- Two (2) Influent Distribution Assemblies
- Two (2) Influent Valves
  - 10" electrically actuated plug valves
- Two (2) Effluent Weir Assemblies
- Two (2) Solids Waste Systems
- Two (2) Sludge Decant Valve Sets
  - Four (4) 10" electrically actuated butterfly valves
  - Four (4) Manual plug valves
- Two (2) Air Valve Sets
  - Four (4) 4" butterfly valves
  - Two (2) 4" electrically actuated butterfly valves
- Two (2) Fixed Fine Bubble Diffuser Assemblies
  - 304 SS Drop Pipes
  - SCH 40 PVC Manifolds
  - PVC Air Distributors
  - 304 SS Piping Supports
  - Fine Bubble Diffuser Assemblies
  - Air Mufflers
- Two (2) 60-HP Positive Displacement Blowers
  - Two (2) 6" butterfly valves
  - Two (2) 4" electrically actuated air control butterfly valves
  - Two (2) Airflow meters
  - Two (2) 6" air isolation butterfly valves
- Level Sensing Assemblies – AGS Tanks
  - Two (2) Pressure Transducers
  - Two (2) Level Sensors
- Instrumentation
  - Two (2) Dissolved Oxygen Probes
  - Three (3) TSS Probes – (2) for AGS Tanks, (1) for WAS
  - Two (2) ORP Probes
  - Two (2) pH Probes
  - Two (2) Nitrate Sensors
  - Three (3) Process Controllers and Displays
  - One (1) Process Control System and Server
- Sludge Buffer Tank
  - One (1) 12.5' x 8' x 17' H concrete tank if not using one of the existing sludge holding tank
- Sludge Transfer Pumps & Valves
  - Two (2) 5-HP Sludge Pump

- Two (2) 3” electrically actuated sludge plug valve
- Two (2) 3” electrically actuated supernatant plug valve

- Sludge Removal System
  - One (1) Solids Removal Assembly
- Level Sensing Assemblies – Sludge Buffer Tank
  - One (1) Pressure Transducer
  - One (1) Level Sensor Assembly
- One (1) Control Package
  - NEMA 12 Panel Enclosure
  - Remote access ethernet modems
- 25-ft x 40-ft Process Building for blowers, equipment, and chemical storage and feed systems.

Exhibit

Figure 3-3 provides a diagram of the AGS biological process as well as a section view of a granule.

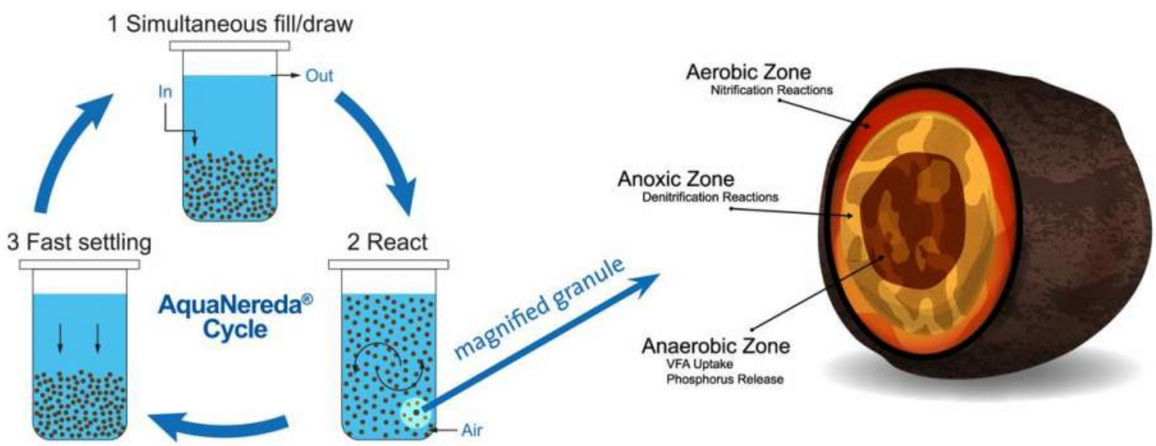

Figure 3-3 Aerobic Granular Sludge Process Cycle & Granule Depiction

Figure 3-4 on the following page provides a proposed site plan for biological process alternative #2.

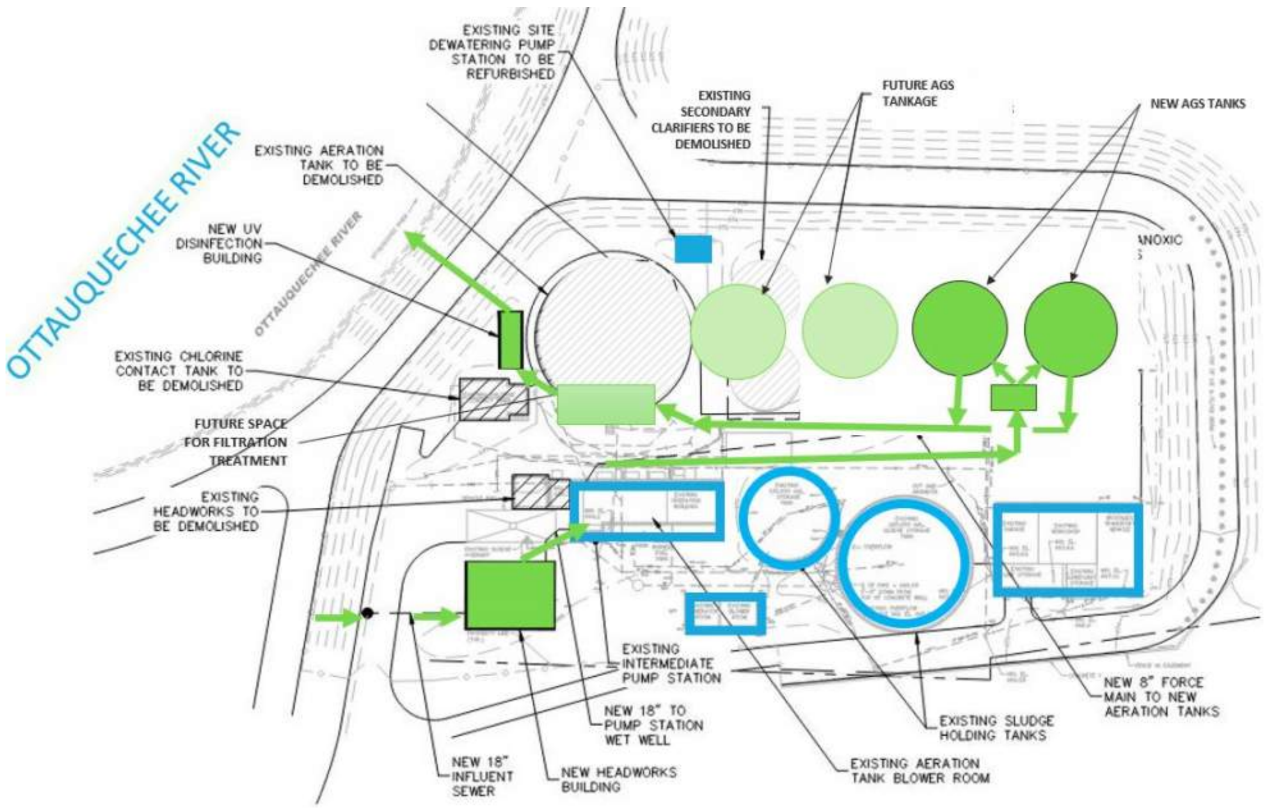

Figure 3-4 – AGS Proposed Site Plan

Non-Monetary Factors

Advantages

- The bacteria required to achieve all phases of treatment is in one tank, reducing need for secondary clarifier structures.
- Enhanced solids settling through selecting sludge granules that settle rapidly.
- Higher MLSS concentration when compared to conventional activated sludge. This greatly reduces tank sizes, footprint, and overall cost of construction.
- Enhanced biological phosphorus removal is achieved within the granule.
- Less air requirement than typical SBR systems, resulting in lower energy consumption.
- Simultaneous nitrification/denitrification within granule provides alkalinity recovery for pH control.
- Same carbon source used for denitrification.
- Utilizing a densified sludge provides more resilience in terms of maintaining treatment during sustained high peak flow events and changes to organic loading.
- Technology can be pilot tested prior to committing to design to demonstrate performance.

Disadvantages

- Longer start-up time to cultivate AGS community.
- Surface wasting requires wasted sludge to be gravity thickened prior to sludge processing.

Cost Estimate

A preliminary opinion of probable construction cost for Biological Process Alternative #2: AGS is provided in Table 3-10. This cost estimate assumes that one of the existing sludge holding tanks will be used as sludge buffering. A detailed breakdown of this opinion of probable construction cost is provided in Appendix B.

Table 3-10 Biological Process Alternative #2: AGS – Construction Cost Estimate

Item	Cost[1]
Pre-Equalization Tank (concrete, equipment, civil/site work, electrical)	$562,000
AGS Process (concrete, equipment, civil/site work, electrical)	$4,104,600
Process Building	$1,008,300
Construction Cost Subtotal (rounded)[2]	**$5,675,000**
Contractor Mark-Up[3]	$1,703,000
Total Construction Cost[4]	**$7,378,000**

Notes:
1. ENR Construction Cost Index = 13782.50, March 2025.
2. Construction Costs include mark-up for BABA compliance and tariff contingency.
3. Contractor Mark-Up is inclusive of Contractor's overhead and profit (20%), mobilization and demobilization (8%), and bonds (2%).
4. Total Construction Costs do not include project contingency, engineering services, legal and administrative costs.

3.2.3. Biological Process Alternative #3: Sequencing Batch Reactor (SBR)

Biological Process Alternative #3: Sequencing Batch Reactor (SBR) provides all phases of treatment in a single reactor tank. The SBR system features time-managed operation and control of aerobic, anoxic, and anaerobic processes within each reactor including some equalization and clarification. The potential phases of SBR operation are as follows:

- **Mixed Fill:** Influent wastewater flows into the SBR tank and mixing is provided. Nitrified mixed liquor from the previous cycle remains in the tank and mixes with influent wastewater in a low dissolved oxygen, anoxic, environment to allow for denitrification of the mixed liquor from the previous cycle with influent wastewater as the carbon source.
- **Aerated Fill (React Fill):** Influent flow continues into the SBR tank under mixed and aerated conditions. BOD removal would occur under aerobic conditions as well as nitrification of influent ammonia.
- **Aeration (React):** Influent flow is terminated creating true batch conditions. Mixing and aeration continue, providing continual BOD removal and nitrification of the influent ammonia.
- **Settle:** Mixing and aeration are terminated. Solids separation occurs as denser solids sink, leaving clarified mixed liquor at the surface.
- **Decant/Sludge Waste:** Mixing and aeration remain off. Subsurface decanting of the clarified effluent occurs. Sludge wasting also occurs near the end of the cycle.

Cycles times under standard operation would be similar to the following:

- Aeration: 120 minutes
- Mixing: 48 minutes
- Settle: 48 minutes
- Decant: 72 minutes

Biological Process Alternative #3: SBR will include a pre-equalization tank prior to the biological tankage to buffer influent flows during wet weather events. The pre-equalization tank will provide approximately 120,000 gallons of storage, which is the volume needed to achieve the effluent design criteria. The basin is designed to hold the design average daily flow over the course of a cycle's non-fill duration (2.4 hours), incorporating a safety factor of 1.25.

Additionally, a new Process Building will be provided to house biological process aeration equipment.

Design Criteria

Design criteria for Biological Process Alternative #3: SBRs is presented in Table 3-11. Design criteria for the pre-equalization tank is provided in Table 3-12.

Table 3-11 Biological Alternative #3: SBR – Design Criteria

Item Description	Existing Design	Proposed Design	Design Standard
SBR Tankage			
Basin Quantity	-	2	
Basin Dimensions	-	50-ft L x 40-ft W x 25-ft D	
High Water Level (HWL)	-	23-ft	
Average Water Level (AWL)	-	19.2-ft	
Low Water Level (LWL)	-	15.5-ft	
Biological Process			
F/M	-	0.082 lb BOD/lb MLSS-day	
SVI	-	150 ml/g	
MLSS at bottom water level	-	4,500 mg/L	
Waste Sludge Production	-	892 lb/day 10,696 gpd @ 0.85% solids	
Decant Rate	-	2,083 gpm	
HRT @ AWL	-	1.023 days	
Solids Retention Time	-	16.8 days	
Actual Oxygen Required	-	2,824 lb/day	
Aeration System			
Blower Quantity	-	2 (1 duty, 1 stand-by)	
Motor	-	100 HP	
Aeration System	-	Fine Bubble	
Waste Sludge			
Pump Type	-	Submersible	
Quantity	-	2	
Motor	-	2.4 HP	
Mixers			

Item Description	Existing Design	Proposed Design	Design Standard
SBR Tankage			
Basin Quantity	-	2	
Basin Dimensions	-	50-ft L x 40-ft W x 25-ft D	
High Water Level (HWL)	-	23-ft	
Average Water Level (AWL)	-	19.2-ft	
Low Water Level (LWL)	-	15.5-ft	
Biological Process			
F/M	-	0.082 lb BOD/lb MLSS-day	
SVI	-	150 ml/g	
MLSS at bottom water level	-	4,500 mg/L	
Waste Sludge Production	-	892 lb/day 10,696 gpd @ 0.85% solids	
Decant Rate	-	2,083 gpm	
HRT @ AWL	-	1.023 days	
Solids Retention Time	-	16.8 days	
Actual Oxygen Required	-	2,824 lb/day	
Aeration System			
Blower Quantity	-	2 (1 duty, 1 stand-by)	
Motor	-	100 HP	
Aeration System	-	Fine Bubble	
Quantity	-	2	
Motor	-	10 HP	
Type	-	Direct Drive	

Notes:

1. Designed to provide 1.25 lbs O^2/lb BOD and 4.6 lb O^2/lb TKN at design average loading conditions.

Table 3-12 Biological Process Alternative #3: SBR – Pre-Equalization – Design Criteria

Item Description	Proposed Design	Design Standard
Pre-Equalization		
Number of Basins	1	
Dimensions	28-ft x 25-ft	
Max Water Level	23-ft	
Max Basin Volume	120,354 gallons	

Description

Biological Process Alternative #3: SBR includes the following process elements:

- Influent Pre-Equalization Tank
  - One (1) 28’ x 25’ x 25’ H concrete tank
  - One (1) pressure transducer
  - One (1) float switch

    - Two (2) submersible transfer pumps
- Two (2) 50’ x 40’ x 25’ concrete SBR Basins
- Influent Valves
    - Two (2) 10” electrically actuated plug valves
- Mixers
    - Two (2) 10-HP Direct Drive Mixers
    - Two (2) Mixer Pivotal Mooring Assemblies
    - Two (2) Mixer Dewatering Supports
- Decanters
    - Two (2) Decanter Assemblies
        - Two (2) Decanters
        - Two (2) Decant pipes
        - Two (2) 304 SS mooring posts & supports
        - Two (2) 12” electrically actuated butterfly valves
- Sludge Transfer Pumps/Valves
    - Two (2) 2.4 HP submersible pumps
    - Two (2) 3” plug valves
    - Two (2) 3” check valves
- Fixed Fine Bubble Diffusers
    - Two (2) Fixed Fine Bubble Diffuser Assemblies
        - 304 SS Drop Pipes
        - SCH 40 PVC Manifolders & Air Distributors
        - 304 SS Pipe Supports
        - Air Mufflers
        - 6” butterfly valves
- Blowers
    - Two (2) 100-HP Rotary Positive Displacement Blowers
    - Two (2) 6” butterfly valves
    - Two 92) 6” electrically actuated butterfly valves
- Level Sensing
    - Two (2) Pressure Transducer Assemblies
    - Two (2) Level Sensing Assemblies
- Instrumentation
    - Two (2) DO Probes
    - Two (2) Process Controllers & Displays
- One (1) Control Package
    - NEMA 12 Panel Enclosure
    - Remote access ethernet modems
- 25-ft x 40-ft Process Building for blowers, equipment, and chemical storage and feed systems.

Exhibit

Figure 3-5 presents a diagram of a sequencing batch reactor in settle mode.

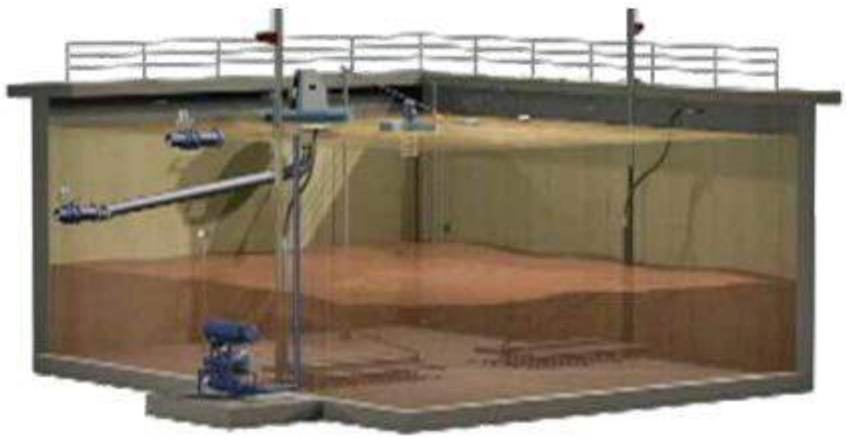

Figure 3-5 Sequencing Batch Reactor – Settle Mode

Figure 3-6 presents a proposed site plan for biological process alternative #3.

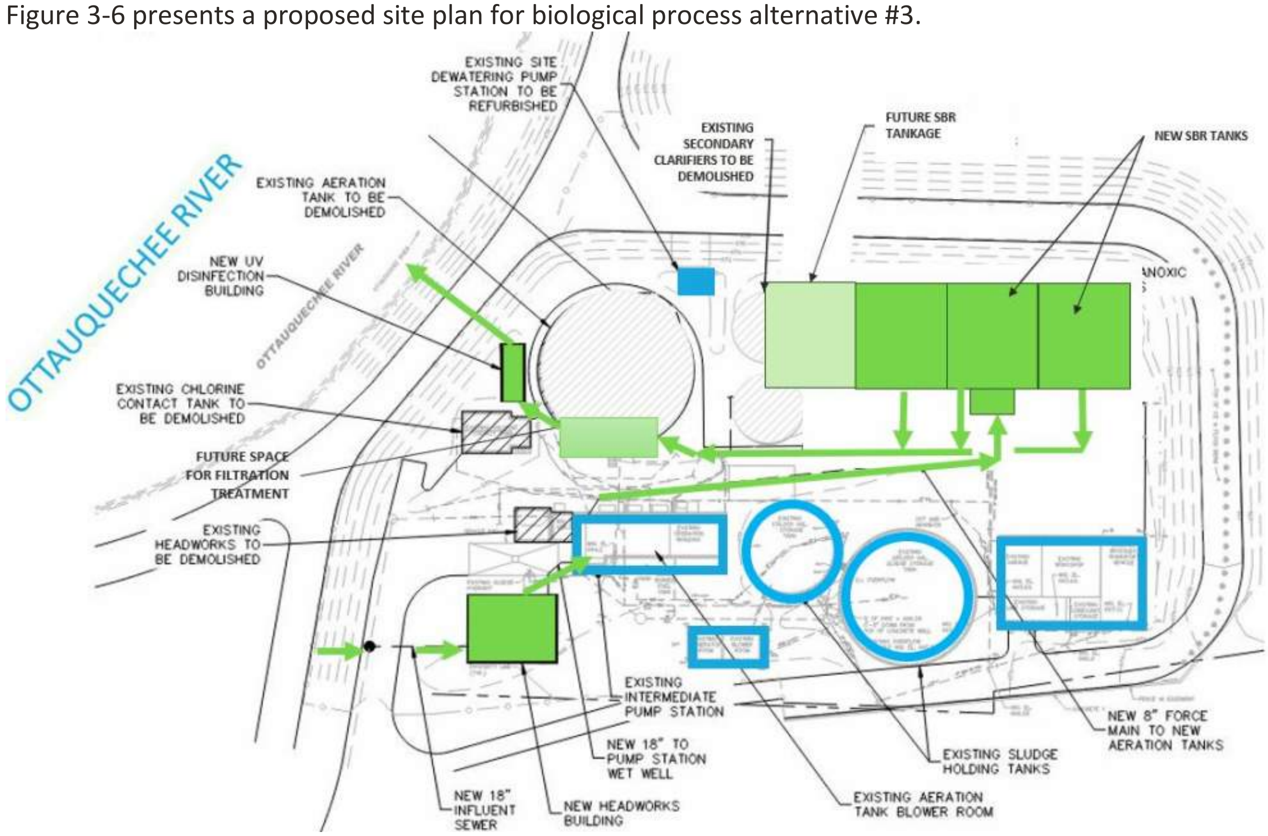

Figure 3-6 – SBR Proposed Site Plan

Non-Monetary Factors

Advantages

- Combines all secondary biological treatment functions in one basin, eliminating need for secondary clarifier structures.
- SBR can modify cycle times to meet nitrogen permit requirements.
- Adapts to different volumes of flow.
- Works with automated controls.

Disadvantages

- Requires sophisticated controls.

Cost Estimate

A preliminary opinion of probable construction cost for Biological Process Alternative #3: SBRs is provided in Table 3-13. A detailed breakdown of this opinion of probable construction cost is provided in Appendix B.

Table 3-13 Biological Process Alternative #3: SBR – Construction Cost Estimate

Item	Cost[1]
Pre-Equalization Tank (concrete, equipment, civil/site work, electrical)	$705,500
SBR Process (concrete, equipment, civil/site work, electrical)	$4,215,000
Process Building	$1,008,300
Construction Cost Subtotal (rounded)[2]	**$5,929,000**
Contractor Mark-Up[3]	$1,779,000
Total Construction Cost[4]	**$7,708,000**

Notes:

1. ENR Construction Cost Index = 13782.50, March 2025.
2. Construction Costs include mark-up for BABA compliance and tariff contingency.
3. Contractor Mark-Up is inclusive of Contractor's overhead and profit (20%), mobilization and demobilization (8%), and bonds (2%).
4. Total Construction Costs do not include project contingency, engineering services, legal and administrative costs.

3.2.4. Life Cycle Cost Comparison – Biological Process Alternatives

Life Cycle Costs

Life cycle costs were prepared for each biological process alternative considered. Life cycle costs include estimates of annual power consumption, replacement parts, and operation and maintenance time. Detailed information for each alternative is included in Appendix C.

The following assumptions and variables were considered in the development of life cycle costs:

- Estimated annual electrical cost of operation based on equipment operating horsepower and operating hours and an average utility electric rate of $0.163/kW-hr and $629/month customer service charge estimated based on the Woodstock WWTF's electric bill.
- Estimated labor requirements for operation and maintenance at an assumed labor rate of $50/hr.

Table 3-14 summarizes the life cycle costs for each biological process alternative.

Table 3-14 Biological Process Alternatives – Life Cycle Cost Analysis

	Alternative #1 A^2O	Alternative #2 AGS	Alternative #3 SBR
Annual Power Cost	$44,400	$31,500	$49,700
Annual Equipment Replacement Costs	$28,700	$28,100	$19,700
Annual Labor Cost	$19,500	$15,600	$15,600
Total Annual O&M Cost (rounded)	**$92,600**	**$75,200**	**$85,000**

Present Worth Analysis

A present worth analysis was performed to further compare the various alternatives. The results are summarized in Appendix D and below.

The following assumptions and variables were considered in the present worth analysis.

- Planning period of 20 years
- Escalation rate of 3% annually
- Discount rate of 2.75% (based on EPA Fiscal Year 2024)

A summary of present worth analysis for the biological process alternatives is presented in Table 3-15.

Table 3-15 Biological Process Alternatives – Present Worth Analysis

	Alternative #1 A^2O	Alternative #2 AGS	Alternative #3 SBR
Total Project Cost of Alternative[1,2]	$11,712,000	$7,378,000	$7,708,000
Annual O&M Cost of Alternative	$93,000	$75,000	$85,000
Present Worth of Alternative	**$13,658,000**	**$8,948,000**	**$9,487,000**

Notes:

1. Total project costs are inclusive of construction costs, contractor mark-up, BABA compliance, and tariff contingency, but do not include project contingency, engineering services, legal and administrative costs.
2. ENR Construction Cost Index = 13782.50, March 2025.

As shown in Table 3-15, Alternative #2 has the lowest present worth value based on the lowest initial capital cost and lowest annual operational and maintenance costs. Alternative #1 has the highest present worth cost based on the highest initial capital cost and the highest annual operating cost. There is an approximate 34% difference between Alternative #1 and Alternative #2 and a 6% difference between Alternative #2 and Alternative #3.

3.2.5. Non-Monetary Factor Comparison – Biological Process Alternatives

Table 3-16 presents a comparison of non-monetary factors for the biological processes evaluated.

Table 3-16 – Non-Monetary Factor Comparison – Biological Process Alternatives

Biological Process	Total Nitrogen Limits	Phosphorus Limits	Biological Tankage	Reliability	Complexity	Chemical	Final Score
A^2O	Denitrification capabilities are greater than LE, with nitrate recycled through both the NRCY and RAS lines.	A pre-anaerobic zone allows for the growth of PAO's to promote EBPR. Hypothetical coagulant usage is decreased. May meet TP without tertiary treatment.	Typical activated sludge tankage size + clarifiers	More reliable than MLE due to EBPR and automated operational controls to optimize process using digital performance platform.	Multiple treatment tanks (ATs, clarifiers) increase complexity, however simpler operation with computerized controls	Lower chemical usage anticipated due to EBPR	**12/18**
	Score: 3/3	Score: 2/3	Score: 1/3	Score: 2/3	Score: 2/3	Score: 2/3	
AGS	Denitrification will occur within the AGS granules, simultaneously with other processes.	PAO's grow in the inner layer of each granule, promoting EBPR. Hypothetical coagulant usage is decreased. May meet TP without tertiary treatment.	Smaller tank sizes than sequencing batch reactors and typical activated sludge processes (no clarifiers).	Significantly improves reliability. Operational control of AGS offers opportunity to extend or shorten treatment time to meet influent flow and water quality conditions and improve compliance reliability.	Simpler operation with biological and settling treatment contained in one tank and computerized controls	Lower chemical usage anticipated due to EBPR.	**17/18**
	Score: 3/3	Score: 3/3	Score: 3/3	Score: 3/3	Score: 2/3	Score: 3/3	
SBR	SBR's cycle aeration and mixing, allowing nitrification and denitrification to occur within one tank.	No means for EBPR. Will require chemical addition and tertiary to achieve future TP limit.	Smaller tanks sizes than typical active sludge	Operational control of SBR offers opportunity to adjust treatment time to meet influent flow and water quality conditions	Familiar process since same as South Woodstock. Simple operation with biological and settling treatment contained in one tank and computerized controls	Higher chemical usage as no EBPR.	**11/18**
	Score: 3/3	Score: 0/3	Score: 2/3	Score: 2/3	Score: 3/3	Score: 1/3	

3.3 Dewatering

Currently, sludge is removed from the sludge storage tanks twice a year, dewatered by a contract dewatering company, and hauled to New Hampshire for disposal by RMI. As contract dewatering prices as well as the cost for transportation and disposal continue to rise, opportunities for Woodstock to dewater to a higher cake solids content would result in hauling and final disposal cost savings. One of the bays of the existing maintenance garage would be renovated to provide an enclosed space for new dewatering equipment.

Several alternatives were investigated to provide the Woodstock Main WWTF with onsite dewatering. The dewatering facility will be sized to process all accumulated sludge over the course of a week in three business days for 7 hours each day, however with the large amount of storage currently available, the operators could store sludge and dewater only several times a year for longer periods of time. The supernatant generated from dewatering will be directed back to the Headworks for processing through the biological process.

The existing maintenance garage was identified as a space that could be retrofitted to house new dewatering equipment. Each alternative would make use of this existing space and include costs associated with renovating the first garage bay into a new Sludge Dewatering Room.

The following dewatering alternatives were investigated:

1. Rotary Press
2. Centrifuge
3. Screw Press

3.3.1. Dewatering Alternative #1: Rotary Press

In a rotary press dewatering unit, sludge is fed at low pressure into the channel and rotates between two parallel revolving stainless steel filter elements. As free water passes through the screens, the sludge continues to dewater as it travels around the channel. The flocculated sludge builds up solids until enough pressure is generated against the outlet restricted arm. The frictional force of the slow-moving filtering elements and outlet restriction generates enough back pressure to dewater the remaining solids and extrudes a dry cake. The rotary press is anticipated to produce cake with greater than 20% total solids. Dewatering Alternative #1: Rotary Press, provides a five (5) channel rotary press, with the ability to expand to six (6) channels should the need arise in the future. The system includes feed pumps, polymer feed system, flocculator, rotary press, enclosed dewatered cake screw conveyor and roll-off sludge trailer.

Design Criteria

Design criteria for Dewatering Alternative #1: Rotary Press is presented in Table 3-17 on the following page.

Table 3-17 Dewatering Alternative #1: Rotary Press – Design Criteria

Item Description	Existing Design	Proposed Design	Design Standard
Sludge Production			
Sludge Type	WAS	WAS	
Total Solids	2%[1]	2%[1]	
Estimated Net Sludge Yield	-	1.02 lb WAS/lb BOD	
Specific Gravity	-	1.05[2]	
Estimated Dry Solids Produced	-	1,168 lb/day[3]	
Estimate Sludge Flow Rate	-	6,666 gpd	
Sludge Dewatering			
Weekly Volume of Sludge	-	46,665 gal/week	
Weekly Dry Mass of Sludge	-	8,178 lb/week	
Daily Volumetric Processing Rate	-	15,555 gpd[4]	
Daily Dry Solids Processing Rate	-	2,726 lb/day[4]	
Maximum Volumetric Processing Rate	-	37 gpm[4]	
Rotary Press			
Expected Cake Dryness	No Data	≥18%	
Expected Capture Rate	No Data	≥98%	
Number of Channels	-	5	
Throughput	-	75 dry-lbs/hr-channel 375 dry lbs/hr total	
Motor	-	7.5 HP	
Hours Operated to Dewater Max Day Sludge Load	-	7 hrs/day	
Hours Operated to Dewater Max Week Sludge Load	-	21 hrs/week	
Sludge Feed Pumps			
Quantity	2 (1 duty, 1 stand-by)	2 (1 duty, 1 stand-by)	
Motor	10 HP	10 HP *(estimated)*	
Type	Self-Priming Centrifugal	Positive Displacement Rotary Lobe	

Notes:

1. Based on January 2016 – December 2024 historical data.
2. Metcalf & Eddy, 5th Edition – Table 13-7 Typical Specific Gravity for Activated Sludge.
3. Based on influent BOD load of 1,145 lb-BOD/day at design ADF of 0.45 MGD. (See Appendix A for calculations).
4. Based on dewatering 3 days/week, 7 hours/day at maximum sludge production.

Exhibit

Figure 3-4 on the following page presents a diagram of a rotary press.

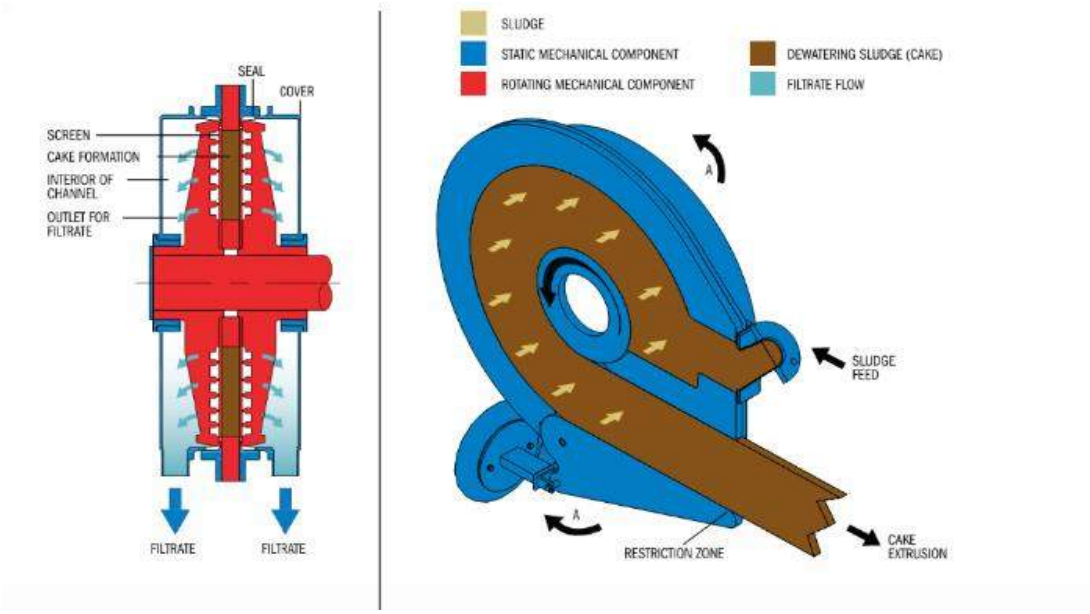

Figure 3-4 Rotary Press Schematic

Description

Dewatering Alternative #1: Rotary Press includes the following:

- Five (5) Channel Rotary Press Unit, *expandable to six channel unit for future dewatering needs*
  - One (1) Flocculator
  - One (1) Sludge Flow Meter
  - One (1) Polymer Flow Meter
  - Five (5) Cake Chutes
  - One (1) Filtrate Collector Pipe
  - Five (5) Wash Water Solenoids for the Automatic Wash Sequence
  - Two (2) Two-way Air-Actuated Valves for Automatic Sludge Recirculation and Dewatering
  - One (1) NEMA 12 Control Panel
    - One (1) PLC
    - One (1) HMI
    - Two (2) VFD's – for Rotary Press & Flocculator
- One (1) Inline Emulsion Polymer Feed System
- Two (2) Sludge Feed Pumps
  - Magnetic Flow Meters
  - Variable Frequency Drives
  - Radar Level Sensing
- Renovation of Existing Maintenance Garage into Dewatering Room
- Dewatered Sludge Screw Conveyor
- Roll-off Sludge Trailer

Non-Monetary Considerations

Advantages

- Reliable automated operation results in less operator hands-on time
- Likely lowest polymer consumption compared to other technologies
- Quieter than centrifuge
- Low power consumption
- Equipment is fully enclosed, reducing airborne contaminants and odors.
- Expandable to increase capacity
- Several installations in New England

Disadvantages

- Lower initial throughput

Cost Estimate

A preliminary opinion of probable construction cost for Dewatering Alternative #1: Rotary Press is provided in Table 3-18. A detailed breakdown of this opinion of probable construction cost is provided in Appendix B.

Table 3-18 Dewatering Alternative #1: Rotary Press – Construction Cost Estimate

Item	Cost[1]
Polymer Feed System	$188,900
Sludge Dewatering (Rotary Press, Sludge Day Tank, Conveyor, Pumps, Valves, Electrical)	$1,054,700
Garage Bay Modifications	$150,000
Construction Cost Subtotal (rounded)[2]	**$1,394,000**
Contractor Mark-Up[3]	$419,000
Total Construction Cost[4]	**$1,813,000**

Notes:

1. ENR Construction Cost Index = 13782.50, March 2025.
2. Construction Costs include mark-up for BABA compliance and tariff contingency.
3. Contractor Mark-Up is inclusive of Contractor’s overhead and profit (20%), mobilization and demobilization (8%), and bonds (2%).
4. Total Construction Costs do not include project contingency, engineering services, legal and administrative costs.

3.3.2. Dewatering Alternative #2: Centrifuge

A centrifuge operates with a horizontal cylindrical bowl and an internal scroll conveyor rotating at a high rate of speed. Sludge feed enters the centrifuge through a stationary inlet tube in the center and is accelerated into the feed zone of the bowl by a distributor. Centrifugal force results from rotation and causes sedimentation of solids onto the wall of the bowl. The bowl and conveyor rotate at different speeds allowing the conveyor to push cake solids up the incline of the bowl and out of the unit while the centrate exits the other end of the centrifuge. The centrifuge is expected to produce cake with 18-22% total solids. The system includes feed pumps, polymer feed system, centrifuge, enclosed dewatered sludge screw conveyor and roll-off sludge trailer.

Design Criteria

Design criteria for Dewatering Alternative #2: Centrifuge is presented in Table 3-19.

Table 3-19 Dewatering Alternative #2: Centrifuge – Design Criteria

Sludge Storage	Existing Design	Proposed Design	Design Standard
Sludge Production			
Sludge Type	WAS	WAS	
Total Solids	2%[1]	2%[1]	
Estimated Net Sludge Yield		1.02 lb WAS/lb BOD	
Specific Gravity		1.05[2]	
Estimated Dry Solids Produced		1,168 lb/day[3]	
Estimate Sludge Flow Rate		6,666 gpd	
Sludge Dewatering			
Weekly Volume of Sludge		46,665 gal/week	
Weekly Dry Mass of Sludge		8,178 lb/week	
Daily Volumetric Processing Rate		15,555 gpd[5]	
Daily Dry Solids Processing Rate		2,726 lb/day[4]	
Maximum Volumetric Processing Rate		37 gpm[4]	
Centrifuge			
Expected Cake Dryness	No Data	18-22%	
Expected Capture Rate		≥98%	
Main Drive Motor	-	30 HP	
Scroll Drive Motor	-	10 HP	
Hydraulic Loading Capacity	-	53 gpm	
Sludge Feed Pumps			
Quantity	-	2 (1 duty, 1 stand-by)	
Motor	-	10 HP *(estimated)*	
Type	-	Positive Displacement Rotary Lobe	

Notes:

1. Based on January 2016 – December 2024 historical data.
2. Metcalf & Eddy, 5th Edition – Table 13-7 Typical Specific Gravity for Activated Sludge.
3. Based on influent BOD load of 1,145 lb-BOD/day at design ADF of 0.45 MGD.
4. Based on dewatering 3 days/week, 7 hours/day at maximum sludge production.

Description

Dewatering Alternative #2: Centrifuge includes the following:

- Centrifuge Unit
  - 3-Phase AC Motors
  - PLC
  - Variable Frequency Drive
  - Stainless Steel Covers
  - Flame Sprayed Tungsten Carbide Scroll Protection

    - Feed Pipe Flange Comepnsator
- Polymer Feed System
- Two (2) Sludge Feed Pumps
    - Magnetic Flow Meters
    - Variable Frequency Drives
    - Radar Level Sensing
- Renovation of Existing Maintenance Garage into Dewatering Room
- Dewatered Sludge Screw Conveyor
- Roll-off Sludge Trailer

Exhibit

Figure 3-5 presents a diagram of a centrifuge.

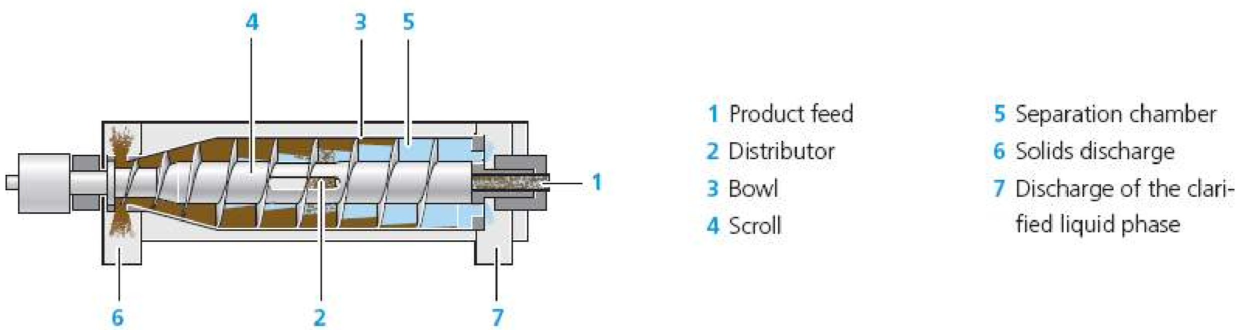

Figure 3-5 Centrifuge Diagram

Non-Monetary Considerations

Advantages

- Reliable automated operation
- Equipment is fully enclosed, reducing airborne contaminants and odors.
- Many installations in New England

Disadvantages

- Significantly higher electrical consumption due to required horsepower for main drive.
- Relatively noisy with high vibration.

Cost Estimate

A preliminary opinion of probable construction cost for Dewatering Alternative #2: Centrifuge is provided in Table 3-20 on the following page. A detailed breakdown of this opinion of probable construction cost is provided in Appendix B.

Table 3-20 Dewatering Alternative #2: Centrifuge – Construction Cost Estimate

Item	Cost[1]
Polymer Feed System	$188,900
Sludge Dewatering (Centrifuge, Sludge Day Tank, Conveyor, Pumps, Valves, Electrical)	$916,000
Garage Bay Modifications	$150,000
Construction Cost Subtotal (rounded)[2]	**$1,255,000**
Contractor Mark-Up[3]	$376,000
Total Construction Cost[4]	**$1,631,000**

Notes:

1. ENR Construction Cost Index = 13782.50, March 2025.
2. Construction Costs include mark-up for BABA compliance and tariff contingency.
3. Contractor Mark-Up is inclusive of Contractor's overhead and profit (20%), mobilization and demobilization (8%), and bonds (2%).
4. Total Construction Costs do not include project contingency, engineering services, legal and administrative costs.

3.3.3. Dewatering Alternative #3: Screw Press

For a screw press, sludge is fed into a mixing tank where polymer is mixed into the sludge. Sludge then passes through a flocculation tank. Flocculated sludge overflows into a dewatering drum where sludge is thickened and dewatered. In the dewatering drum, spacers and fixed rings are held in place on tie rods. Moving rings are located between the fixed rings and are moved by the screw. The constant movement of the moving rings cleans the fine gaps between the rings, preventing clogging, while cutting into the sludge cake, allowing additional surface area for moisture release. The dewatering drum is separated into two zones: a thickening zone and a dewatering zone. The pitch of the screw narrows and the gaps between the rings decrease towards the end-plate where solids are discharged. The system includes feed pumps, polymer feed system, screw press, enclosed dewatered sludge screw conveyor and roll-off sludge trailer.

Design Criteria

Design criteria for Dewatering Alternative #3: Screw Press is presented in Table 3-21 on the following page.

Table 3-21 Dewatering Alternative #3: Screw Press – Design Criteria

Sludge Storage	Existing Design	Proposed Design	Design Standard
Sludge Production			
Sludge Type	WAS	WAS	
Total Solids	2%[1]	2%[1]	
Estimated Net Sludge Yield		1.02 lb WAS/lb BOD[2]	
Specific Gravity		1.05	
Estimated Dry Solids Produced		1,168 lb/day[3]	
Estimate Sludge Flow Rate		6,666 gpd	
Sludge Dewatering			
Weekly Volume of Sludge		46,665 gal/week	
Weekly Dry Mass of Sludge		8,178 lb/week	
Daily Volumetric Processing Rate		15,555 gpd[4]	
Daily Dry Solids Processing Rate		2,726 lb/day[4]	
Maximum Volumetric Processing Rate		37 gpm[4]	
Screw Press			
Number of Units		1	
Solids Loading Capacity (Total)		700 dry-lbs/hr	
Hydraulic Capacity (Total)		70 gpm	
Expected Cake Dryness		≥18%	
Expected Solids Capture		92-95%	
Power Draw		3.5 HP	

Notes:

1. Based on January 2016 – December 2024 historical data.
2. Metcalf & Eddy, 5th Edition – Table 13-7 Typical Specific Gravity for Activated Sludge.
3. Based on influent BOD load of 1,145 lb-BOD/day at design ADF of 0.45 MGD.
4. Based on dewatering 3 days/week, 7 hours/day at maximum sludge production.

Description

Dewatering Alternative #3: Screw Press includes the following:

- One (1) Volute Dewatering Press
    - 3.5 HP Motor
    - One (1) Flash Mixing Tank
        - ½ HP Motor
    - One (1) Flocculation Tank
        - 1 HP Motor
    - Two (2) Dewatering Drums
        - 1 HP Motor
    - One (1) Filtrate Collection Pan and Support Frame
    - One (1) Control Panel
- One (1) Polymer Preparation Unit
    - One (1) Polymer Mixing Chamber

        - ½ HP Motor
    - One (1) Neat Polymer Delivery Assembly
        - ½ HP Meter Pump
    - One (1) Dilution Water Inlet and Solution Outlet Assembly
    - One (1) Electrical Junction Box
- One (1) Magnetic Flowmeter
- Two (2) Sludge Feed Pumps
    - Magnetic Flow Meters
    - Variable Frequency Drives
    - Radar Level Sensing
- Renovation of Existing Maintenance Garage into Dewatering Room
- Dewatered Sludge Screw Conveyor
- Roll-off Sludge Trailer

Exhibit

Figure 3-6 presents a diagram of a screw press, with labeled equipment pieces.

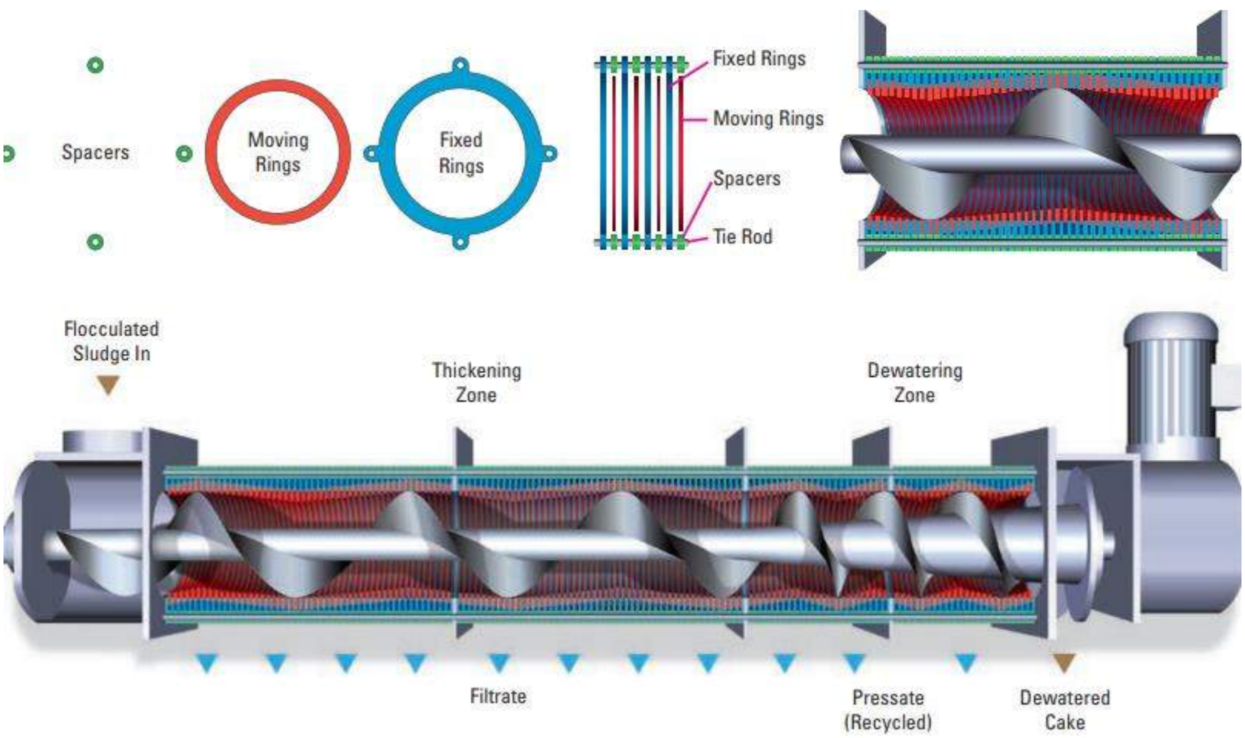

Figure 3-6 Volute Screw Press Diagram

Non-Monetary Considerations

Advantages

- Reliable automated operation
- Quieter than centrifuge

- Lower power consumption than centrifuge
- Equipment is fully enclosed, reducing airborne contaminants and odors.
- Several installations in New England

Disadvantages

- Larger footprint and building height required for equipment.

Cost Estimate

A preliminary opinion of probable construction cost for Dewatering Alternative #3: Screw Press is provided in Table 3-22. A detailed breakdown of this opinion of probable construction cost is provided in Appendix B.

Table 3-22 Dewatering Alternative #3: Screw Press – Construction Cost Estimate

Item	Cost[1]
Polymer Feed System	$169,500
Sludge Dewatering (Screw Press, Polymer Feed System, Sludge Day Tank, Conveyor, Pumps, Valves, Electrical)	$953,100
Garage Bay Modifications	$150,000
Construction Cost Subtotal (rounded)[2]	**$1,273,000**
Contractor Mark-Up[3]	$293,000
Total Construction Cost[4]	**$1,566,000**

Notes:

1. ENR Construction Cost Index = 13782.50, March 2025.
2. Construction Costs include mark-up for BABA compliance and tariff contingency.
3. Contractor Mark-Up is inclusive of Contractor's overhead and profit (20%), mobilization and demobilization (8%), and bonds (2%).
4. Total Construction Costs do not include project contingency, engineering services, legal and administrative costs.

3.3.4. Life Cycle Cost Comparison – Dewatering Alternatives

Life Cycle Costs

Life cycle costs were prepared for each dewatering alternative considered. Life cycle costs include estimates of annual power consumption, replacement parts, and operation and maintenance time. Detailed information for each alternative is included in Appendix C.

The following assumptions and variables were considered in the development of life cycle costs:

- Estimated annual electrical cost of operation based on equipment operating horsepower and operating hours and an average utility electric rate of $0.163/kW-hr and $629/month customer service charge estimated based on the Woodstock WWTF's electric bill.
- Estimated labor requirements for operation and maintenance at an assumed labor rate of $50/hr.

Table 3-23 on the following page summarizes the life cycle costs for each dewatering alternative.

Table 3-23 Dewatering Alternatives– Life Cycle Cost Analysis

	Alternative #1 Rotary Press	Alternative #2 Centrifuge	Alternative #3 Screw Press
Annual Power Cost	$8,600	$11,900	$8,400
Annual Equipment Replacement Costs	$7,900	$6,400	$7,000
Annual Labor Cost	$15,600	$39,000	$31,200
Total Annual O&M Cost (rounded)	**$32,100**	**$57,300**	**$46,600**

Present Worth Analysis

A present worth analysis was performed to further compare the various alternatives. The results are summarized in Appendix D and below.

The following assumptions and variables were considered in the present worth analysis.

- Planning period of 20 years
- Escalation rate of 3% annually
- Discount rate of 2.75% (based on EPA Fiscal Year 2024)

A summary of present worth analysis for the dewatering alternatives is presented in Table 3-24.

Table 3-24 Dewatering Alternatives – Present Worth Analysis

	Alternative #1 Rotary Press	Alternative #2 Centrifuge	Alternative #3 Screw Press
Total Project Cost of Alternative[1,2]	$1,813,000	$1,631,000	$1,566,000
Annual O&M Cost of Alternative	$32,000	$57,000	$47,000
Present Worth of Alternative	**$2,483,000**	**$2,824,000**	**$2,550,000**

Notes:

1. Total project costs are inclusive of construction costs, contractor mark-up, BABA compliance, and tariff contingency, but do not include project contingency, engineering services, legal and administrative costs.
2. ENR Construction Cost Index = 13782.50, March 2025.

As shown in Table 3-24, Alternative #1 has the lowest present worth value based on the lowest annual operating costs, though the rotary press does have the highest initial capital cost. Alternative 2 has the highest present worth cost based on the highest annual operating cost. There is an approximate 14% difference between Alternative #1 and Alternative #2 and an approximate 3% difference between Alternative #1 and Alternative #3, which is within the margin of error.

3.3.5. Payback on Investment of Dewatering Implementation

A payback analysis on investment of the capital cost to implement dewatering facilities at the Woodstock Main WWTF was performed to compare to the cost of continuing to contract dewater.

The following assumptions and variables were considered in the payback analysis:

- 83 dry tons of sludge dewatered annually.

  - The annual dry tons of sludge processed is based on the estimated daily sludge production from biological treatment process proposals at the current average daily flow.
  - Assumes no increase (growth) of average daily flows over a 20-year period.
- Contract dewatering unit price of $2,025.00/dry ton escalates 2.4% annually
  - Escalation based on actual increase of unit price between 2023 and 2024.
- Contract dewatering mobilization and demobilization price of $8,000.00/year escalates 2.0% annually.
- Hauling and disposal fees were not included in payback analysis.

The payback analysis results in a payback of approximately 9 to 10 years based on which dewatering technology is advanced to design. A summary of the annual cumulative cost associated with continued contract dewatering is presented in Table 3-25. The highlighted cells represent the approximate payback year.

Table 3-25 Dewatering Implementation Payback Analysis

Year	Annual Sludge Dewatered (dry tons)	Dewatering Unit Price	Dewatering Mob/Demob Price	Dewatering Annual Cost	Cumulative Cost
1	83	$ 2,025.00	$ 8,000.00	$ 176,075	$ 176,075
2	83	$ 2,072.68	$ 8,160.00	$ 180,192	$ 356,267
3	83	$ 2,121.48	$ 8,323.20	$ 184,406	$ 540,673
4	83	$ 2,171.42	$ 8,489.66	$ 188,718	$ 729,391
5	83	$ 2,222.55	$ 8,659.46	$ 193,131	$ 922,522
6	83	$ 2,274.88	$ 8,832.65	$ 197,647	$ 1,120,169
7	83	$ 2,328.44	$ 9,009.30	$ 202,269	$ 1,322,438
8	83	$ 2,383.26	$ 9,189.49	$ 207,000	$ 1,529,438
9	83	$ 2,439.37	$ 9,373.28	$ 211,841	**$ 1,741,279**
10	83	$ 2,496.80	$ 9,560.74	$ 216,795	**$ 1,958,074**
11	83	$ 2,555.59	$ 9,751.96	$ 221,866	$ 2,179,940
12	83	$ 2,615.75	$ 9,946.99	$ 227,055	$ 2,406,994
13	83	$ 2,677.34	$ 10,145.93	$ 232,365	$ 2,639,359
14	83	$ 2,740.37	$ 10,348.85	$ 237,800	$ 2,877,159
15	83	$ 2,804.89	$ 10,555.83	$ 243,362	$ 3,120,521
16	83	$ 2,870.93	$ 10,766.95	$ 249,054	$ 3,369,576
17	83	$ 2,938.53	$ 10,982.29	$ 254,880	$ 3,624,456
18	83	$ 3,007.71	$ 11,201.93	$ 260,842	$ 3,885,298
19	83	$ 3,078.52	$ 11,425.97	$ 266,944	$ 4,152,241
20	83	$ 3,151.01	$ 11,654.49	$ 273,188	$ 4,425,429

The payback analysis does not take into account the potential for improved dewatering performance that may be realized with a rotary press or screw press dewatering technology. While manufacturers will advertise a comparable dewatered cake percent solid performance to a centrifuge dewatering technology, anecdotal performance from other facilities indicates that upwards of 25% solids could be realized with either of the press dewatering technologies. Increased dewatering performance translates into savings on hauling and disposal because there is less water in the dewatered sludge cake and hailing and disposal costs are based on weight. Therefore, it is likely that implementing press dewatering technology will result in additional annual sludge handling savings.

4. PROPOSED PROJECT

4.1 Introduction

An upgrade of the Woodstock Main WWTF is recommended to address aging infrastructure and to provide the Town of Woodstock with a reliable, flexible treatment process. The proposed project outlined in the *2023 Preliminary Engineering Report* includes: a new center flow fine screen with washer compactor, a new vortex grit removal system, new influent pumping, new chemical storage and feed, clarifier tank rehabilitation and new equipment, new RAS and WAS pumping, new UV disinfection, new effluent channel with measurement, new plant water pumps, rehabilitation of sludge holding tanks, a new SCADA system, site work, and electrical upgrades. This amendment serves to evaluate more alternatives for the proposed biological process upgrade as well as evaluate implementation of dewatering equipment at the facility. An aerobic granular sludge (AGS) process is proposed for biological treatment and a rotary press is proposed for dewatering. Section 4 presents the recommended alternatives for each.

4.2 Design Criteria

Table 4-1 presents the 1983 original influent design criteria and the updated proposed influent design criteria for the liquid treatment processes at the Woodstock Main WWTF. A more detailed table of original design criteria, proposed design criteria, as well as historical data and design criteria from the *2023 Preliminary Engineering Report* is discussed in Section 3.1.

Table 4-1 Influent Design Criteria

Parameter	1983 Original Design[1]	Updated Proposed Design Criteria[2]
Average Daily Flow (ADF)	0.45 MGD	0.45 MGD
Peak Hourly Flow (PHF)	0.75 MGD	1.90 MGD
Biochemical Oxygen Demand (BOD)	117 mg/L 439 lb/day	305 mg/L 1,145 lb/day
Total Suspended Solids (TSS)	101 mg/L 379 lb/day	232 mg/L 871 lb/day
Total Nitrogen (TN)	--- ---	48 mg/L 180 lb/day
Temperature (min/avg/max)	7.7/14.8/23.4 Deg. C	7.7/15.0/23.4 Deg. C

Notes:

1. Source: Operations and Maintenance Manual, 1983.
2. Peak Hourly Flow is based on a historical peaking factor of 4.2 from January 2020 to December 2024 (PF = PDF/ADF = 0.97/0.23). Design loads are calculated based on current concentrations and design flows.

Effluent design criteria for the Woodstock WWTF is provided in Table 4-2. As discussed in detail in Section 3.1, the effluent design criteria is based on the existing NPDES permit and includes anticipatory effluent limits for total phosphorus and an estimated annual allocation for TN.

Table 4-2 Effluent Design Criteria

Parameter	Original Design Criteria	Proposed Design Criteria
Flow (Annual Average)	0.450 MGD	0.450 MGD
BOD (Monthly Average)	30 mg/L	30 mg/L
TSS (Monthly Average)	30 mg/L	30 mg/L
Total Phosphorus (Daily Maximum)	Monitor Only	0.8 mg/L 3 lb/day
Total Nitrogen (Annual Average)	Monitor Only	13.9 mg/L 52 lb/day
Total Kjeldahl Nitrogen (TKN) (Daily Maximum)	Monitor Only	Monitor Only
Nitrate/Nitrite Nitrogen (NOx) (Daily Maximum)	Monitor Only	Monitor Only
Settleable Solids (Instantaneous Maximum)	1.0 mL/L	1.0 mL/L
Total Residual Chlorine (Instantaneous Maximum)	0.1 mg/L	0.1 mg/L
E. Coli (Instantaneous Maximum)	77 CFU/100 mL	77 CFU/100 mL
pH	6.5-8.5 S.U.	6.5-8.5 S.U.

4.3 Recommended Project

The recommended alternatives for the biological process and dewatering components for the Woodstock Main WWTF are presented in this section.

4.3.1. Biological Process

Given the poor working condition of the existing treatment process at the Woodstock Main WWTF and the Town's desire to have a biological treatment process that is flexible to handle influent flow and water quality conditions and improve compliance reliability, the proposed project includes a new aerobic granular sludge (AGS) biological process.

A pre-equalization basin will be provided prior to the AGS basins with an approximate volume of 51,000 gallons. Two (2) aerobic granular sludge basins will be provided, each with approximate dimensions of 39-ft x 21-ft with a wall height of 25-ft. In the case where a basin must be taken offline, the other basin will run on accelerated cycles. The AGS basins will be equipped with fine bubble diffuser assemblies for aeration. A sludge thickening tank, known as a sludge buffer, will be provided with approximate dimensions of 12.5-ft x 8-ft with a maximum water level of 15-ft. (It should be noted that with the implementation of dewatering equipment and the flexibility of dewatering on a routine schedule, one of the sludge holding tanks could be used as the sludge buffer tank, thus eliminating the need to construct an additional tank.) The sludge thickening tank will be provided with electrically actuated plug valves to convey supernatant back to the beginning of the biological process after thickening. A sludge transfer pump will transfer thickened sludge to the sludge holding tank.

A new Process Building will be provided to store two (2) new rotary positive displacement blowers, as well as chemical feed and storage equipment. The new Process Building will have an approximate footprint of 25-ft x 40-ft.

Design Criteria

Design criteria for Aerobic Granular Sludge is presented in Table 4-3 below. Design criteria for the pre-equalization tank is provided in Table 4-4.

Table 4-3 AGS Design Criteria

Item Description	Proposed Design	Design Standard
Basin Dimensions		
Number of Basins	2	
Dimensions/basin	39-ft x 21-ft	
Top of Wall	25-ft	
Discharge Level/Process Level	23.4-ft/22.0-ft	
Total Volume	0.26 MG	
Process Parameters		
Design MLSS	8,000 mg/L	
System Solids Retention Time (SRT)	17.5 days	
Hydraulic Retention Time (HRT)	0.48 days	
F:M	0.08 lbs BOD/lb MLSS-day	
Estimated Net Sludge Yield	0.67 lbs WAS/lb BOD	
Estimated Dry Solids Produced	961 lb WAS/day	
Aeration System		
Actual Oxygen Required (AOR)	2,824 lbs O_2/day	
Max Air Flowrate/Basin	461 scfm	
Blower Quantity	2 (1 duty, 1 stand-by)	Maximum air demand met with largest unit out of service (TR—16)
Blower Type	Rotary Positive Displacement	
Power	60-HP	
Sludge Buffer		
Number of Basins	1	
Dimensions Needed if New Tank	12.5-ft x 8-ft	
Min/Max Level	1-ft/15-ft	
Max Basin Volume	11,169 gallons	
Max Sludge Flow Rate	31 gpm	
Max Supernatant Flow Rate	123 gpm	
Transfer Pump Quantity	2	
Transfer Pump Power	5-HP	

Table 4-4 AGS Pre-Equalization Tank Design Criteria

Item Description	Proposed Design	Design Standard
Pre-Equalization		
Number of Basins	1	
Dimensions	22-ft x 20-ft	
Max Water Level	15.4-ft	
Max Basin Volume	50,721 gallons	

Description

The new aerobic granular sludge biological process will include the following:

- Influent Pre-Equalization Tank
  - One (1) 22’ x 20’ x 18’ H concrete tank
  - One (1) pressure transducer
  - One (1) float switch
- Two (2) 50’ x 40’ x 25’ concrete AGS Basins
- Two (2) Influent Distribution Assemblies
- Two (2) Influent Valves
  - 10” electrically actuated plug valves
- Two (2) Effluent Weir Assemblies
- Two (2) Solids Waste Systems
- Two (2) Sludge Decant Valve Sets
  - Four (4) 10” electrically actuated butterfly valves
  - Four (4) Manual plug valves
- Two (2) Air Valve Sets
  - Four (4) 4” butterfly valves
  - Two (2) 4” electrically actuated butterfly valves
- Two (2) Fixed Fine Bubble Diffuser Assemblies
  - 304 SS Drop Pipes
  - SCH 40 PVC Manifolds
  - PVC Air Distributors
  - 304 SS Piping Supports
  - Fine Bubble Diffuser Assemblies
  - Air Mufflers
- Two (2) 60-HP Positive Displacement Blowers
  - Two (2) 6” butterfly valves
  - Two (2) 4” electrically actuated air control butterfly valves
  - Two (2) Airflow meters
  - Two (2) 6” air isolation butterfly valves
- Level Sensing Assemblies – AGS Tanks
  - Two (2) Pressure Transducers
  - Two (2) Level Sensors

- Instrumentation
  - Two (2) Dissolved Oxygen Probes
  - Three (3) TSS Probes – (2) for AGS Tanks, (1) for WAS
  - Two (2) ORP Probes
  - Two (2) pH Probes
  - Two (2) Nitrate Sensors
  - Three (3) Process Controllers and Displays
  - One (1) Process Control System and Server
- Sludge Buffer Tank
  - Existing sludge holding tank
- Sludge Transfer Pumps & Valves
  - Two (2) 5-HP Sludge Pump
  - Two (2) 3” electrically actuated sludge plug valve
  - Two (2) 3” electrically actuated supernatant plug valve
- Sludge Removal System
  - One (1) Solids Removal Assembly
- Level Sensing Assemblies – Sludge Buffer Tank
  - One (1) Pressure Transducer
  - One (1) Level Sensor Assembly
- One (1) Control Package
  - NEMA 12 Panel Enclosure
  - Remote access ethernet modems
- 25-ft x 40-ft Process Building for blowers, equipment, and chemical storage and feed systems.

Exhibit

Figure 4-1 on the following page provides a proposed site plan for the proposed aerobic granular sludge biological process.

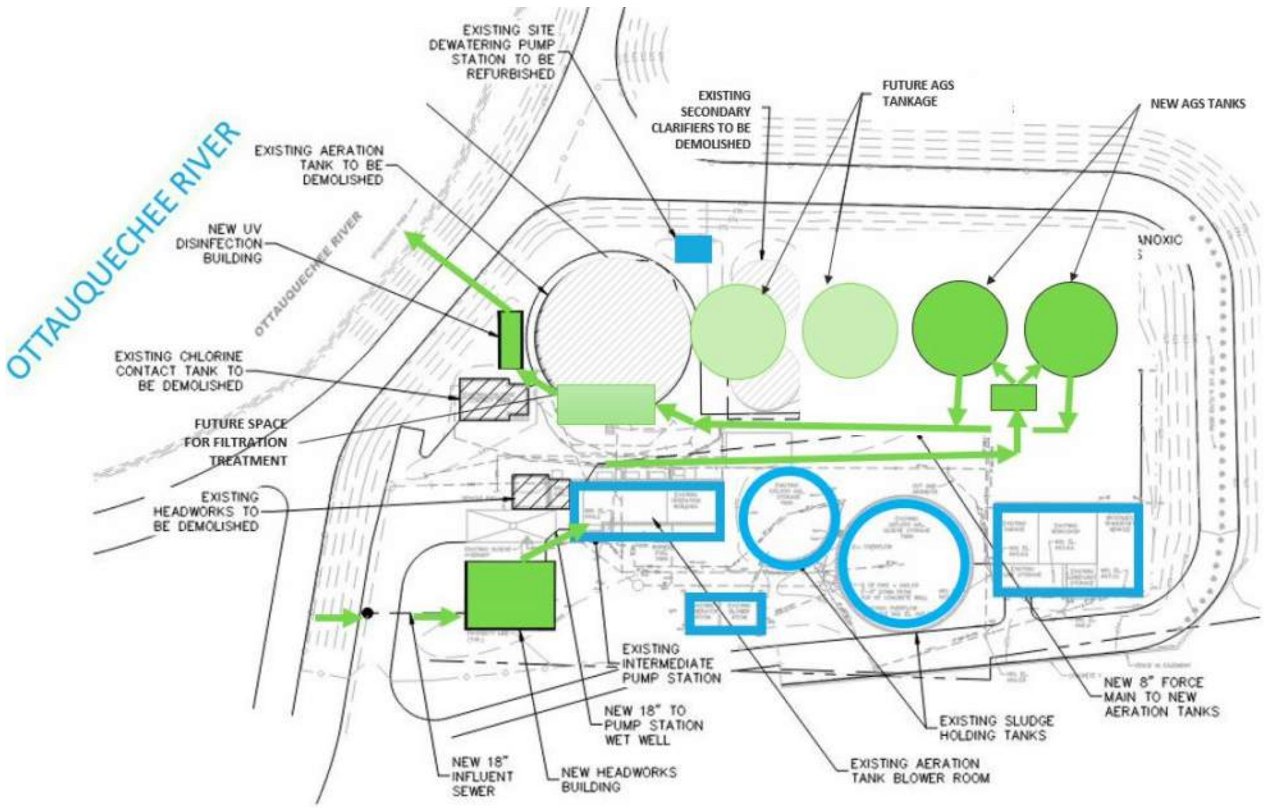

Figure 4-1 – AGS Proposed Site Plan

Cost Estimate

A preliminary opinion of probable construction cost for the proposed aerobic granular sludge biological process is provided in Table 4-5. This cost estimate assumes that one of the existing sludge holding tanks will be used as sludge buffering. A detailed breakdown of this opinion of probable construction cost is provided in Appendix B.

Table 4-5 Proposed Project - AGS – Construction Cost Estimate

Item	Cost[1]
Pre-Equalization Tank (concrete, equipment, civil/site work, electrical)	$562,000
AGS Process (concrete, equipment, civil/site work, electrical)	$4,104,600
Process Building	$1,008,300
Construction Cost Subtotal (rounded)[2]	**$5,675,000**
Contractor Mark-Up[3]	$1,703,000
Total Construction Cost[4]	**$7,378,000**

Notes:

1. ENR Construction Cost Index = 13782.50, March 2025.
2. Construction Costs include mark-up for BABA compliance and tariff contingency.
3. Contractor Mark-Up is inclusive of Contractor's overhead and profit (20%), mobilization and demobilization (8%), and bonds (2%).
4. Total Construction Costs do not include project contingency, engineering services, legal and administrative costs.

4.3.2. Dewatering

The Woodstock Main WWTF currently removes sludge from the sludge storage tanks twice a year. Sludge is dewatered by a contract dewatering company and hauled to New Hampshire for disposal by RMI.

The proposed project includes installing dewatering operations at the facility. The first garage bay of the existing maintenance garage will be retrofitted into a new Sludge Dewatering Room. The room will house a rotary press for dewatering. A five (5) channel rotary press will be provided with the ability to expand up to six (6) channels to meet future needs. The system will include feed pumps, a polymer feed system, a flocculator, a rotary press, an enclosed dewatered cake screw conveyor, and a roll-off sludge trailer.

Design Criteria

Design criteria for rotary press is presented in Table 4-6 on the following page.

Table 4-6 Rotary Press Design Criteria

Item Description	Existing Design	Proposed Design	Design Standard
Sludge Production			
Sludge Type	WAS	WAS	
Total Solids	2%[1]	2%[1]	
Estimated Net Sludge Yield	-	1.02 lb WAS/lb BOD	
Specific Gravity	-	1.05[2]	
Estimated Dry Solids Produced	-	1,168 lb/day[3]	
Estimate Sludge Flow Rate	-	6,666 gpd	
Sludge Dewatering			
Weekly Volume of Sludge	-	46,665 gal/week	
Weekly Dry Mass of Sludge	-	8,178 lb/week	
Daily Volumetric Processing Rate	-	15,555 gpd[4]	
Daily Dry Solids Processing Rate	-	2,726 lb/day[4]	
Maximum Volumetric Processing Rate	-	37 gpm[4]	
Rotary Press			
Expected Cake Dryness	No Data	≥18%	
Expected Capture Rate	No Data	≥98%	
Number of Channels	-	5	
Throughput	-	75 dry-lbs/hr-channel 375 dry lbs/hr total	
Motor	-	7.5 HP	
Hours Operated to Dewater Max Day Sludge Load	-	7 hrs/day	
Hours Operated to Dewater Max Week Sludge Load	-	21 hrs/week	
Sludge Feed Pumps			
Quantity	2 (1 duty, 1 stand-by)	2 (1 duty, 1 stand-by)	
Motor	10 HP	10 HP *(estimated)*	
Type	Self-Priming Centrifugal	Positive Displacement Rotary Lobe	

Notes:

1. Based on January 2016 – December 2024 historical data.
2. Metcalf & Eddy, 5th Edition – Table 13-7 Typical Specific Gravity for Activated Sludge.
3. Based on influent BOD load of 1,145 lb-BOD/day at design ADF of 0.45 MGD. (See Appendix A for calculations).
4. Based on dewatering 3 days/week, 7 hours/day at maximum sludge production.

Cost Estimate

A preliminary opinion of probable construction cost for the proposed dewatering upgrades is provided in Table 5-7 on the following page. A detailed breakdown of this opinion of probable construction cost is provided in Appendix B.

Table 5-7 Dewatering Construction Cost Estimate

Item	Cost[1]
Polymer Feed System	$188,900
Sludge Dewatering (Rotary Press, Sludge Day Tank, Conveyor, Pumps, Valves, Electrical)	$1,054,700
Garage Bay Modifications	$150,000
Construction Cost Subtotal (rounded)[2]	**$1,394,000**
Contractor Mark-Up[3]	$419,000
Total Construction Cost[4]	**$1,813,000**

Notes:

1. ENR Construction Cost Index = 13782.50, March 2025.
2. Construction Costs include mark-up for BABA compliance and tariff contingency.
3. Contractor Mark-Up is inclusive of Contractor's overhead and profit (20%), mobilization and demobilization (8%), and bonds (2%).
4. Total Construction Costs do not include project contingency, engineering services, legal and administrative costs.

4.4 Project Schedule

The proposed project schedule for the Woodstock Main WWTF Upgrade project is presented in Table 5-8 and is contingent on the PER Amendment approval in July 2025.

Table 5-8 Proposed Project Schedule

Task	Date
PER Amendment Submitted to VTDEC-WID	July 3, 2025
VTDEC – WID Review and Approval	July 25, 2025
Biological Treatment Process Equipment Pre-Procurement	
RFP Advertisement	August 12, 2025
RFP Proposals Due	September 12, 2025
Proposal Review and Manufacturer Selected	September 19, 2025
30% Design Submission	November 11, 2025
Basis of Final Design Submission	November 11, 2025
Bond Vote	March 2026
60% Design Complete	April 2026
90% Design Complete	August 2026
100% Design Complete	October 2026
Bid Advertisement	November 2026
Bid Award	December 2026
Construction	2027-2029

4.5 Total Project Cost

Total construction costs presented here include all proposed upgrades in the *2023 Preliminary Engineering Report* as well as the recommended biological process and dewatering upgrades in this report. Project costs associated with the project elements from the *2023 Preliminary Engineering Report* have been updated to today's dollars to account for costs associated with federal BABA compliance and contingency for tariffs on construction materials and equipment. An opinion of probable construction cost for the biological process and dewatering upgrades are presented in Sections 4.3.1 and 4.3.2 and includes contractor markups (overhead, profit, mobilization, demobilization, bonds and insurance) and a 30% project contingency. Detailed cost estimates for the full recommended upgrade project are presented in Appendix E.

The total project costs presented in Table 5-9 for the recommended project include construction, engineering, surveying, geotechnical investigations, permitting, legal and administrative fees and are escalated to a construction start date of March 2027 dollars using the ENR Construction Cost Index historical indices.

Table 5-9 Total Project Cost

	Current Cost [1]	**Projected Cost** [2]
	March 2025	**March 2027**
ENR Construction Cost Index	***13782.5***	***14700***
Screen and New Headworks Building	$2,967,000	$3,186,000
Grit Removal	$831,000	$892,000
Intermediate Lift Pumps	$1,201,000	$1,290,000
Biological Process - AGS	$7,378,000	$7,923,000
Coagulant Chemical Feed Systems	$560,000	$601,000
UV Disinfection System & Building	$2,002,000	$2,150,000
Plant Water System	$365,000	$392,000
Solids Holding Tank Improvements	$409,000	$439,000
Dewatering Facilities – Rotary Press	$1,813,000	$1,947,000
Control Building Modifications	$782,000	$840,000
Plant Drainage Pump Station and Site Modifications	$2,531,000	$2,718,000
Subtotal	**$20,839,000**	**$22,378,000**
Project Contingency		
Contingency @ 30%	$6,252,000	$6,252,000
Total Construction Cost [3]	**$27,091,000**	**$28,630,000**
Engineering Costs		
Preliminary Engineering - Step I [4]	$105,000	$105,000
Final Design - Step II [5]	$1,222,118	$1,222,118
Bid, Construction Administration & Inspection - Step III [6]	$2,179,000	$2,179,000
Legal, Administrative, Permitting (0.5%)	$143,000	$143,000
Total Project Cost	**$30,740,118**	**$32,279,118**

Notes:

1. ENR Construction Cost Index = 13782.5 (March 2025)
2. Projected ENR Construction Cost Index at start of Construction = 14800 (March 2028)
3. Total Construction Costs do not include engineering services, legal and administrative costs.
4. Signed Contract dated 10/21/21
5. Signed contract dated 6/7/2024 and PER Amendment dated 12/22/2024.
6. Engineering Fee is calculated based VTDEC-FED Engineering Fee Allowance Guidelines dated 9/1/2011.

4.6 Recommended Next Steps

In conclusion, the following next steps are recommended to advance the Woodstock Main WWTF Upgrade project:

1. **Regulatory Concurrence of Biological Treatment Process.** Aerobic granular sludge (AGS) is a cutting-edge biological treatment process that offers significant advantages in terms of footprint, energy efficiency, and performance, and would be the first installation of such technology in Vermont and the second in New England. As the selected biological treatment process, the Town is looking for concurrence with advancing this technology from the Vermont Department of Environmental Conservation Water Investment Division (VTDEC-WID) and NPDES Permit Program.

2. **Pre-Procurement of ASG Treatment Process Equipment.** There are currently two manufacturers offering AGS systems in North America. Early selection of a vendor is critical to allow for integration of proprietary equipment and sizing of tankage into the final design. Our goal is to develop and **issue a Request for Proposals (RFP) by mid-August 2025 so that we can complete vendor selection and contract negotiations by end of September 2025**. We will evaluate proposals based on technical merit, experience, support services, and cost.

3. **Public Outreach.** Public support will be crucial for successful bond vote. Given the innovative nature of the technology, the scale of the investment and the varied nature of the users including residents, businesses and visitors, HTA will support the Town with their community outreach efforts.

4. **Bond Vote.** The bond vote, scheduled for March 2026, will determine whether the Town can proceed with financing the project through construction. A successful vote will depend on effective communication of the project’s value, cost, and long-term benefits. To support this message HTA will have 30% Design Documentation and a supporting Construction Cost Estimate completed by the end of 2025.

APPENDIX A

SLUDGE GENERATION CALCULATIONS

Hoyle, Tanner & Associates, Inc.	Town of Woodstock, VT	Project No.:	129901
125 College St., 4th Floor	Woodstock Main WWTF	Project Name:	Woodstock Main WWTF
Burlington, VT 05401	Preliminary Engineering	By:	ACD
802-860-1331	Sludge Production & Dewatering	CK By:	

Description of Item	Value	Units	Notes
SECONDARY SLUDGE PRODUCTION			
Design ADF	0.45	MGD	
Influent BOD	305	mg/L	Average from 2020-2024 data
Influent BOD	1,145	lb/day	
Est. Net Sludge Yield	1.02	lb WAS/lb BOD	from Milford DEMO Model
Percent Solids	2	%	Historical Data
Specific Gravity of Sludge	1.05		M&E Typical Values
Est. Dry Solids Produced	1,168	lb/day	
WAS from Secondary Process	6,666	gpd	
Number of Days of Storage Needed	5	days	
Total Storage Volume Needed	33,332	gallons	
DEWATERING SOLIDS LOADING			
Daily Volume of Sludge for Dewatering	6,666	gpd	
Weekly Volume of Sludge for Dewatering	46,665	gal/week	
Daily Dry Mass of Sludge for Dewatering	1,168	lb/day	
Weekly Dry Mass of Sludge for Dewatering	8,178	lb/week	
Weekly Operating Schedule	3	days/week	
Number of Hours per Day	7	hours/day	
Daily Dry Solids Processing Rate	2,726	lb/day	
Hourly Dry Solids Processing Rate	389	lb/hr	
Daily Volumetric Processing Rate	15,555	gpd	
Volumetric Processing Rate	37	gpm	

APPENDIX B

COST ESTIMATES

Hoyle, Tanner	Town of Woodstock	Project No:	21.129901
125 College St., 4th Floor	Woodstock Main WWTF Upgrade PER	By:	ACD
Burlington, VT 05401	Engineer's Opinion of Probable Project Costs	CK By:	KDW
802-860-1331	**Biological Process Alternative #1 - A2O**	Date:	4/10/2025

Process Area	Division/ Discipline	Description	Qty.	Unit	Unit Cost (2)	Tarriff Cont. (3)	Install	Total Cost
Aeration Tank Structure								
	Site/Civil							
		Site Erosion Control	1	ALL	$5,000			$5,000
		Site Dewatering	1	LS	$10,000			$10,000
		Excavation	2892	CY	$27			$78,100
		Gravel Subbase	503	CY	$60			$30,200
		Structural Backfill	630	CY	$25			$15,800
		Demolition of Existing Aeration Tank	1	LS	$50,000			$50,000
	Structural							
		Concrete Slab	503	CY	$1,500			$754,500
		Concrete Walls (Tanks)	810	CY	$1,800			$1,458,000
		Stairs	38	EA	$560	20%		$25,600
		Handrails	533	LF	$100	20%		$64,000
		Bridges/Walkways	779	SF	$100	20%		$93,500
		Aeration Tank Structure - Subtotal						**$2,584,700**
A2O Process								
	Process Mechanical							
		A2O Equipment	1	LS	$1,397,000	20%	30%	$2,095,500
		Fine Bubble Aeration Systems	4					
		IMLR Modulating Valves	2					
		Modulating Airflow Control Valves	4					
		PD Blowers	2					
		PLC Control Panel	1					
		DO Probe	2					
		pH Meter	2					
		ORP Probe	2					
		Thermal Mass Flowmeter	2					
		Magnetic Flowmeter	2					
		Process Air Piping & Valve Allowance	1	ALL	$150,000	20%		$180,000
		IMLR Piping & Valve Allowance	1	ALL	$100,000	20%		$120,000
		Compressed Gas Mixing	1	LS	$227,000	20%	30%	$340,500
		Compressed Gas Piping & Valve Allowance	1	ALL	$50,000	20%		$60,000
	Electrical & Instrumentation							
		Electrical, Instrumentation & Controls Allowance	1	ALL	$250,000	20%		$300,000
		A2O Process - Subtotal						**$3,096,000**
Process Building								
	Site/Civil							
		Site Erosion Control	1	ALL	$5,000			$5,000
		Site Dewatering	1	LS	$5,000			$5,000
		Excavation (Frost Wall)	125	CY	$27			$3,400
		Backfill	15	CY	$25			$400
		Gravel Subbase	75	CY	$60			$4,500
		Water service extension to building	1	ALL	$25,000	20%		$30,000
	Structural							
		Building (Blower, Electrical, Mechanical, Chemical Rooms)	1000	SF	$250	20%		$300,000
		Concrete Slab on grade	38	CY	$1,500			$57,000
		Frost Wall Foundation Concrete	35	CY	$1,800			$63,000
	Process Mechanical							
		Process Piping and Valves	1	LS	$150,000	20%		$180,000
		Mechanical (HVAC & Plumbing)	1	LS	$150,000	20%		$180,000
	Electrical							
		Electrical, Instrumentation & Controls	1	LS	$150,000	20%		$180,000
		A2O Process Building - Subtotal						**$1,008,300**
Aeration Tank Effluent to Secondary Clarifiers								
	Site/Civil							
		New 18" DICL Aeration Tank Effluent to Clarifier Influent Trough	125	LF	$250	20%		$37,500
		Aeration Tank Effluent - Subtotal						**$37,500**
					Construction Subtotal (Rounded)			**$6,727,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$1,345,000
		Mobilization/Demobilization	8%					$538,000
		Bonds & Insurance	2%					$135,000
						Total Construction Cost		**$8,745,000**

Notes:

1 ENR Construction Cost Index = 13782.50 (March 2025)

2 Costs include markup associated with Federal BABA compliance for construction materials and equipment.

3 Markup contingency for tariffs on construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No:	21.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade PER					By:	ACD
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Biological Process Alternative #1 - Secondary Clarifier Rehabilitation**					Date:	4/10/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost (2)**	**Tariff Cont. (3)**	**Install**	**Total Cost**
Secondary Clarifier Rehabilitation								
	Site/Civil							
		N/A						
	Structural							
		Existing Clarifier Equipment Demo & Tank Cleaning	2	EA	$10,000			$20,000
		Concrete Repair Allowance	1	LS	$150,000			$150,000
		Crane Hoist System	2	EA	$10,000	20%	30%	$30,000
	Process Mechanical							
		Lakeside Spiraflo Clarifiers (30-ft Diameter, 12' SWD)	2	EA	$193,000	20%	30%	$579,000
		o Drive Motor w/torque overload protection						
		o Full-span bridge/walkway						
		o Scraper arms						
		o Inlet trough, effluent weir trough, inlet pipe						
		o Scum pipe, skimmer arm, supports, blades, scum flush						
		o FRP Weirs						
	Electrical/I&C							
		Sludge Blanket Level Detectors	2	EA	$10,000	20%	30%	$30,000
		Electrical, I&C Allowance	1	ALL	$30,000	20%		$36,000
		Secondary Clarifier Rehabilitation - Subtotal						**$845,000**
Clarifier House Rehabilitation								
	Site/Civil							
		N/A						
	Structural							
		Clarifier House - Lower Level Pump Room Addition	200	SF	$450	20%		$108,000
		Clarifier House - Upper Level Electrical Room Addition	200	SF	$450	20%		$108,000
		4' x 4' Access Hatch	1	EA	$15,000	20%	30%	$22,500
		Roof Slab Rehabilitation Allowance	1	ALL	$25,000			$25,000
		Stairs Replacement	1	LS	$25,000	20%	30%	$37,500
		Door Replacement	1	LS	$5,000	20%	30%	$7,500
		Finishes (Paint)	1	LS	$10,000			$10,000
	Process Mechanical							
		New Sump Pump	1	LS	$5,000	20%	30%	$7,500
	Building Mechanical							
		HVAC Replacement Allowance	1	ALL	$150,000	20%		$180,000
	Electrical/I&C							
		Electrical, I&C Allowance	1	ALL	$150,000	20%		$180,000
		Clarifier House Rehabilitation - Subtotal						**$686,000**
					Construction Subtotal (Rounded)			**$1,531,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$306,000
		Mobilization/Demobilization	8%					$122,000
		Bonds & Insurance	2%					$31,000
						Total Construction Cost		**$1,990,000**

Notes:

1 ENR Construction Cost Index = 13782.50 (March 2025)

2 Costs include markup associated with Federal BABA compliance for construction materials and equipment.

3 Markup contingency for tariffs on construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No:	21.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade PER					By:	ACD
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Biological Process Alternative #1 - RAS & WAS System Rehabilitation**					Date:	4/10/2025

Process Area	Division/ Discipline	Description	Qty.	Unit	Unit Cost (2)	Tariff Cont. (3)	Install	Total Cost
RAS System Rehabilitation								
	Site/Civil							
		New RAS Force Main to New Biological Process (4" Diameter DICL)	250	LF	$160	20%		$48,000
		Abandonment of Existing RAS lines	1	LS	$5,000			$5,000
		Yard valves with valve boxes & extension stem	1	LS	$25,000	20%		$30,000
	Structural							
		Pump Pad Modifications	2	EA	$2,500			$5,000
	Process Mechanical							
		Demo Existing RAS Pumps	1	LS	$10,000			$10,000
		New RAS Pumps	2	EA	$30,000	20%	30%	$90,000
		VFDs	2	EA	$10,000	20%	30%	$30,000
		Suction and Discharge Piping Modifications (inside Building)	1	ALL	$50,000	20%		$60,000
		Check Valve Replacement (4")	2	EA	$6,500	20%	30%	$19,500
		Plug Valve Replacement (4")	8	EA	$2,200	20%	30%	$26,400
	Electrical/I&C							
		Magnetic Flow Meter for RAS Discharge	1	EA	$15,000	20%		$18,000
		Electrical, I&C Allowance - (Conduit, wire, integration)	1	ALL	$60,000	20%		$72,000
		RAS System Rehabilitation - Subtotal						**$413,900**
WAS System Rehabilitation								
	Site/Civil							
		New WAS Force Main to Sludge Holding Tanks (4" Diameter DICL)	150	LF	$160	20%		$28,800
		Abandonment of Existing WAS lines	1	LS	$5,000			$5,000
		Yard valves with valve boxes & extension stem	1	LS	$25,000	20%		$30,000
	Structural							
		Pump Pad Modifications	2	EA	$2,500			$5,000
	Process Mechanical							
		Existing Pump Demolition	1	LS	$10,000			$10,000
		New WAS Pumps	2	EA	$25,000	20%	30%	$75,000
		Suction and Discharge Piping Modifications (inside Building)	1	LS	$50,000	20%		$60,000
		Check Valve Replacement (4")	2	EA	$6,500	20%	30%	$19,500
		Plug Valve Replacement (4")	8	EA	$2,200	20%	30%	$26,400
	Building Mechanical							
		N/A						
	Electrical/I&C							
		Magnetic Flow Meter for WAS Discharge	1	EA	$15,000	20%		$18,000
		Electrical, I&C Allowance - (Conduit, wire, integration)	1	ALL	$50,000	20%		$60,000
		WAS System Rehabilitation - Subtotal						**$337,700**
					Construction Subtotal (Rounded)			**$752,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$150,000
		Mobilization/Demobilization	8%					$60,000
		Bonds & Insurance	2%					$15,000
						Total Construction Cost		**$977,000**

Notes:

1 ENR Construction Cost Index = 13782.50 (March 2025)

2 Costs include markup associated with Federal BABA compliance for construction materials and equipment.

3 Markup contingency for tariffs on construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No:	21.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade PER					By:	ACD
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Biological Process Alternative #2 - AGS**					Date:	4/18/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost**	**Tarriff Cont.**	**Install**	**Total Cost**
Pre-Equalization Tank								
	Site/Civil							
		Site Erosion Control	1	ALL	$5,000			$5,000
		Site Dewatering	1	LS	$10,000			$10,000
		Excavation	749	CY	$27			$20,300
		Gravel Subbase	58	CY	$60			$3,500
		Structural Backfill	451	CY	$25			$11,300
	Structural							
		Concrete Slab	58	CY	$1,500			$87,000
		Concrete Walls (Tanks)	87	CY	$1,800			$156,600
		Stairs	15	EA	$560	20%		$10,100
		Handrails	88	LF	$100	20%		$10,600
		Bridges/Walkways	88	SF	$100	20%		$10,600
	Process Mechanical							
		Submersible transfer pumps	2	EA	$30,000	20%	30%	$90,000
		Process Piping and Valves Allowance	1	ALL	$50,000	20%		$60,000
	Electrical & Instrumentation							
		Level Control System (Radar)	1	EA	$2,000	20%	30%	$3,000
		Float Alarms	1	EA	$1,000	20%	30%	$1,500
		Magnetic Flowmeters	1	EA	$15,000	20%	30%	$22,500
		Electrical, Instrumentation & Controls Allowance	1	ALL	$50,000	20%		$60,000
		Pre-Equalization Tank - Subtotal						**$562,000**
AGS - Tank Structure								
	Site/Civil							
		Site Erosion Control	1	ALL	$5,000			$5,000
		Site Dewatering	1	LS	$5,000			$5,000
		Excavation	1712	CY	$27			$46,300
		Gravel Subbase	167	CY	$60			$10,100
		Structural Backfill	699	CY	$25			$17,500
	Structural							
		Concrete Slab	167	SF	$1,500			$250,500
		Concrete Walls (Tanks)	327	CY	$1,800			$588,600
		Stairs	31	LF	$560	20%		$20,900
		Handrails	168	LF	$100	20%		$20,200
		Bridges/Walkways	232.5	SF	$100	20%		$27,900
		AGS Tank Structure - Subtotal						**$992,000**
AGS - Process								
	Site/Civil							
		New Sludge Force Main to Sludge Holding Tanks (4" Diameter DICL)	150	LF	$160	20%		$28,800
	Process Mechanical							
		AGS Equipment	1	LS	$1,683,020	20%	20%	$2,356,300
		10" Electrically Actuated Influent Plug Valves	2					
		Influent Distribution Assemblies	2					
		Effluent Weir Assemblies	2					
		Solid Waste Systems	2					
		Sludge Decant Valve Sets	2					
		Air Valve Sets	2					
		Fixed Fine Bubble Diffuser Assemblies	2					
		Positive Displacement Blowers	2					
		Instrumentation (DO/TSS/pH/NO3)	1					
		Sludge Buffer Pump	1					
		Sludge Buffer Valves	1					
		Process Optimization Software & Controls, Control Panel	1					
		Process Air Piping Allowance	1	ALL	$150,000	20%		$180,000
		Process Piping and Valves	1	ALL	$150,000	20%		$180,000
	Electrical							
		Electrical, Instrumentation & Controls	1	ALL	$250,000	20%		$300,000
		AGS Process - Subtotal						**$3,045,100**

Hoyle, Tanner		Town of Woodstock					Project No:	21.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade PER					By:	ACD
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Biological Process Alternative #2 - AGS**					Date:	4/18/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost**	**Tarriff Cont.**	**Install**	**Total Cost**
Process Building								
	Site/Civil							
		Site Erosion Control	1	ALL	$5,000			$5,000
		Site Dewatering	1	LS	$5,000			$5,000
		Excavation (Frost Wall)	125	CY	$27			$3,400
		Backfill	15	CY	$25			$400
		Gravel Subbase	75	CY	$60			$4,500
		Water service extension to building	1	ALL	$25,000	20%		$30,000
	Structural							
		Building (Blower, Electrical, Mechanical, Chemical Rooms)	1000	SF	$250	20%		$300,000
		Concrete Slab on grade	38	EA	$1,500			$57,000
		Frost Wall Foundation Concrete	35	CY	$1,800			$63,000
	Process Mechanical							
		Process Piping and Valves	1	ALL	$150,000	20%		$180,000
		Mechanical (HVAC & Plumbing)	1	ALL	$150,000	20%		$180,000
	Electrical							
		Electrical, Instrumentation & Controls	1	ALL	$150,000	20%		$180,000
		AGS Process Building - Subtotal						**$1,008,300**
AGS Tank Effluent to UV								
	Site/Civil							
		New 18" DICL Aeration Tank Effluent to UV	225	LF	$250	20%		$67,500
		Aeration Tank Effluent - Subtotal						**$67,500**
							Total	**$5,674,900**
					Construction Subtotal (Rounded)			**$5,675,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$1,135,000
		Mobilization/Demobilization	8%					$454,000
		Bonds & Insurance	2%					$114,000
					Total Construction Cost			**$7,378,000**

Notes:

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3 Markup contingency for tariffs on construction materials and equipment.

Innovative Technology Pilot Test Demonstration								
		Pilot Testing Allowance	1	ALL	$250,000			**$250,000**

Hoyle, Tanner	Town of Woodstock	Project No:	21.129901
125 College St., 4th Floor	Woodstock Main WWTF Upgrade PER	By:	ACD
Burlington, VT 05401	Engineer's Opinion of Probable Project Costs	CK By:	KDW
802-860-1331	**Biological Process Alternative #3 - SBR**	Date:	4/10/2025

Process Area	Division/ Discipline	Description	Qty.	Unit	Unit Cost (2)	Tarriff Cont. (3)	Install	Total Cost
Pre-Equalization Tank								
	Site/Civil							
		Site Erosion Control	1	ALL	$5,000			$5,000
		Site Dewatering	1	LS	$10,000			$10,000
		Excavation	1146	CY	$27			$31,000
		Gravel Subbase	102	CY	$60			$6,200
		Structural Backfill	648	CY	$25			$16,200
	Structural							
		Concrete Slab	102	CY	$1,500			$153,000
		Concrete Walls (Tanks)	115	CY	$1,800			$207,000
		Stairs	15	EA	$560	20%		$10,100
		Handrails	110	LF	$100	20%		$13,200
		Bridges/Walkways	140	SF	$100	20%		$16,800
	Process Mechanical							
		Submersible transfer pumps	2	EA	$30,000	20%	30%	$90,000
		Process Piping and Valves Allowance	1	ALL	$50,000	20%		$60,000
	Electrical & Instrumentation							
		Level Control System (Radar)	1	EA	$2,000	20%	30%	$3,000
		Float Alarms	1	EA	$1,000	20%	30%	$1,500
		Magnetic Flowmeters	1	EA	$15,000	20%	30%	$22,500
		Electrical, Instrumentation & Controls	1	LS	$50,000	20%		$60,000
		Pre-Equalization Tank - Subtotal						**$705,500**
SBR - Tank Struction								
	Site/Civil							
		New Sludge Force Main to Sludge Holding Tanks (4" Diameter DICL)	150	LF	$160	20%		$28,800
		Site Erosion Control	1	ALL	$5,000			$5,000
		Site Dewatering	1	LS	$5,000			$5,000
		Excavation	3422	CY	$27			$92,400
		Gravel Subbase	374	CY	$60			$22,500
		Structural Backfill	1100	CY	$25			$27,500
	Structural							
		Concrete Slab	374	SY	$1,500			$561,000
		Concrete Walls (Tanks)	444	CY	$1,800			$799,200
		Stairs	26	LF	$560	20%		$17,500
		Handrails	795	LF	$100	20%		$95,400
		Bridges/Walkways	538	SF	$100	20%		$64,600
		SBR Tank Structure - Subtotal						**$1,718,900**
SBR - Process								
	Process Mechanical							
		SBR Equipment	1	LS	$1,179,040	20%	30%	$1,768,600
		Decanters	2					
		Fine Bubble Aeration Grids	2					
		PD Blowers	3					
		6" Air Control Valves	2					
		Sumbersible WAS Pumps	2					
		Submersible Mixers	2					
		Storm Floats	2					
		Level Transducers	2					
		Process Optimization Software & Controls, Control Panel	1					
		Process Air Piping Allowance	1	ALL	$150,000	20%		$180,000
		Process Piping and Valves	1	ALL	$150,000	20%		$180,000
	Electrical							
		Electrical, Instrumentation & Controls	1	ALL	$250,000	20%		$300,000
		SBR Process - Subtotal						**$2,428,600**
Process Building								

Hoyle, Tanner		Town of Woodstock					Project No:	21.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade PER					By:	ACD
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Biological Process Alternative #3 - SBR**					Date:	4/10/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost (2)**	**Tarriff Cont. (3)**	**Install**	**Total Cost**
	Site/Civil							
		Site Erosion Control	1	ALL	$5,000			$5,000
		Site Dewatering	1	LS	$5,000			$5,000
		Excavation (Frost Wall)	125	CY	$27			$3,400
		Backfill	15	CY	$25			$400
		Gravel Subbase	75	CY	$60			$4,500
		Water service extension to building	1	ALL	$25,000	20%		$30,000
	Structural							
		Building (Blower, Electrical, Mechanical, Chemical Rooms)	1000	SF	$250	20%		$300,000
		Concrete Slab on grade	38	EA	$1,500			$57,000
		Frost Wall Foundation Concrete	35	CY	$1,800			$63,000
	Process Mechanical							
		Process Piping and Valves	1	ALL	$150,000	20%		$180,000
		Mechanical (HVAC & Plumbing)	1	ALL	$150,000	20%		$180,000
	Electrical							
		Electrical, Instrumentation & Controls	1	ALL	$150,000	20%		$180,000
		SBR Process Building - Subtotal						**$1,008,300**
SBR Tank Effluent to UV								
	Site/Civil							
		New 18" DICL Aeration Tank Effluent to UV	225	LF	$250	20%		$67,500
		Aeration Tank Effluent - Subtotal						**$67,500**
							Total	**$5,928,800**
					Construction Subtotal (Rounded)			**$5,929,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$1,186,000
		Mobilization/Demobilization	8%					$474,000
		Bonds & Insurance	2%					$119,000
						Total Construction Cost		**$7,708,000**

Notes:

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3 Markup contingency for tariffs on construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No:	21.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade PER					By:	ACD
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Dewatering Alternative #1: Rotary Press**					Date:	4/18/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost (2)**	**Tariff Cont. (3)**	**Install**	**Total Cost**
Polymer Feed System								
	Structural							
		Containment for Polymer Totes	1	LS	$25,000	20%		$30,000
	Process Mechanical							
		Polymer System	1	EA	$22,920	20%	30%	$34,400
		Chemical Process Piping & Valves	1	ALL	$50,000	20%		$60,000
	Electrical / I&C							
		Level Control System (Radar)	1	EA	$2,000	20%	30%	$3,000
		Float Alarms	1	EA	$1,000	20%	30%	$1,500
		Misc. Electrical, I&C	1	ALL	$50,000	20%		$60,000
		Polymer Feed System Subtotal						**$188,900**
Sludge Dewatering								
	Process Mechanical							
		Rotary Press	1	EA	$471,583	20%	30%	$707,400
		Sludge Day Tank w/ Mixer	1	LS	$50,000	20%	30%	$75,000
		Dewatered Sludge Cake Screw Conveyor	1	LS	$14,560	20%	30%	$21,900
		Sludge Dewatering Feed Pumps	2	EA	$14,450	20%	30%	$43,400
		Dewatering Process Piping and Valves	1	ALL	$50,000	20%		$60,000
	Electrical / I&C							
		Magnetic Flow Meter	1	EA	$15,000	20%	30%	$22,500
		Level Control System (Radar)	1	EA	$2,000	20%	30%	$3,000
		Float Alarms	1	EA	$1,000	20%	30%	$1,500
		Electrical, Instrumentation & Controls	1	ALL	$100,000	20%		$120,000
		Sludge Dewatering Subtotal						**$1,054,700**
Garage Bay Modifications								
	Structural							
		Structural Building Modifications	1	LS	$50,000	20%		$60,000
	Electrical/I&C							
		HVAC	1	LS	$25,000	20%		$30,000
		Electrical, Instrumentation, & Controls	1	LS	$50,000	20%		$60,000
		Garage Bay Modifications Subtotal						**$150,000**
							Subtotal (Rounded)	**$1,394,000**
Contractor Markups								
		Contractor Overhead & Profit					20%	$279,000
		Mob/Demob					8%	$112,000
		Bonds					2%	$28,000
					Total Construction Cost (Rounded)			**$1,813,000**

Notes:

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3 Markup contingency for tariffs on construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No:	21.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade PER					By:	ACD
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Dewatering Alternative #2: Centrifuge**					Date:	4/18/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost (2)**	**Tarriff Cont. (3)**	**Install**	**Total Cost**
Polymer Feed System								
	Structural							
		Containment for Polymer Totes	1	LS	$25,000	20%		$30,000
	Process Mechanical							
		Polymer System	1	EA	$22,920	20%	30%	$34,400
		Chemical Process Piping & Valves	1	ALL	$50,000	20%		$60,000
	Electrical / I&C							
		Level Control System (Radar)	1	EA	$2,000	20%	30%	$3,000
		Float Alarms	1	EA	$1,000	20%	30%	$1,500
		Misc. Electrical, I&C	1	ALL	$50,000	20%		$60,000
		Polymer Feed System Subtotal						**$188,900**
Sludge Dewatering								
	Process Mechanical							
		Centrifuge	1	EA	$379,100	20%	30%	$568,700
		Sludge Day Tank w/ Mixer	1	LS	$50,000	20%	30%	$75,000
		Dewatered Sludge Cake Screw Conveyor	1	LS	$14,560	20%	30%	$21,900
		Sludge Dewatering Feed Pumps	2	EA	$14,450	20%	30%	$43,400
		Dewatering Process Piping and Valves	1	ALL	$50,000	20%		$60,000
	Electrical / I&C							
		Magnetic Flow Meter	1	EA	$15,000	20%	30%	$22,500
		Level Control System (Radar)	1	EA	$2,000	20%	30%	$3,000
		Float Alarms	1	EA	$1,000	20%	30%	$1,500
		Electrical, Instrumentation & Controls	1	LS	$100,000	20%		$120,000
		Sludge Dewatering Subtotal						**$916,000**
Garage Bay Modifications								
	Structural							
		Structural Building Modifications	1	LS	$50,000	20%		$60,000
	Electrical/I&C							
		HVAC	1	LS	$25,000	20%		$30,000
		Electrical, Instrumentation, & Controls	1	LS	$50,000	20%		$60,000
		Garage Bay Modifications Subtotal						**$150,000**
							Subtotal (Rounded)	**$1,255,000**
Contractor Markups								
		Contractor Overhead & Profit					20%	$251,000
		Mob/Demob					8%	$100,000
		Bonds					2%	$25,000
							Total Construction Cost (Rounded)	**$1,631,000**

Notes:

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3 Markup contingency for tariffs on construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No:	21.129901
125 College St., 4th Floo		Woodstock Main WWTF Upgrade PER					By:	ACD
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Dewatering Alternative #3: Screw Press**					Date:	4/18/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost (2)**	**Tarriff Cont. (3)**	**Install**	**Total Cost**
Polymer Feed System								
	Structural							
		Containment for Polymer Totes	1	LS	$25,000	20%		$30,000
	Process Mechanical							
		Polymer Feed System Covered under Centrifuge						
		Chemical Process Piping & Valves	1	LS	$50,000	20%	30%	$75,000
	Electrical / I&C							
		Level Control System (Radar)	1	EA	$2,000	20%	30%	$3,000
		Float Alarms	1	EA	$1,000	20%	30%	$1,500
		Misc. Electrical, I&C	1	ALL	$50,000	20%		$60,000
		Polymer Feed System Subtotal						**$169,500**
Sludge Dewatering								
	Process Mechanical							
		Screw Press	1	EA	$416,000	20%	30%	$624,000
		Polymer Feed System						
		Magnetic Flow Meter						
		Sludge Day Tank w/ Mixer	1	LS	$50,000	20%	30%	$75,000
		Dewatered Sludge Cake Screw Conveyor	1	LS	$14,560	30%	30%	$23,300
		Sludge Dewatering Feed Pumps	2	EA	$14,450	30%	30%	$46,300
		Dewatering Process Piping and Valves	1	ALL	$50,000	20%		$60,000
	Electrical / I&C							
		Level Control System (Radar)	1	EA	$2,000	20%	30%	$3,000
		Float Alarms	1	EA	$1,000	20%	30%	$1,500
		Electrical, Instrumentation & Controls	1	ALL	$100,000	20%		$120,000
		Sludge Dewatering Subtotal						**$953,100**
Garage Bay Modifications								
	Structural							
		Structural Building Modifications	1	LS	$50,000	20%		$60,000
	Electrical/I&C							
		HVAC	1	LS	$25,000	20%		$30,000
		Electrical, Instrumentation, & Controls	1	LS	$50,000	20%		$60,000
		Garage Bay Modifications Subtotal						**$150,000**
							Subtotal (Rounded)	**$1,273,000**
Contractor Markups								
		Contractor Overhead & Profit					15%	$191,000
		Mob/Demob					5%	$64,000
		Bonds					3%	$38,000
					Total Construction Cost (Rounded)			**$1,566,000**

Notes:

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3 Markup contingency for tariffs on construction materials and equipment.

APPENDIX C

LIFE CYCLE COST ESTIMATES

Hoyle, Tanner	Town of Woodstock	Project No:	21.129901
125 College St., 4th Floor	Woodstock Main WWTF Upgrade PER	By:	ACD
Burlington, VT 05401	Engineer's Opinion of Probable Project Costs	CK By:	KDW
802-860-1331	**Biological Process Alternative #1 - A2O**	Date:	4/8/2025

Operation & Maintenance Cost Estimates

Biological Process Alternative #1 - A2O

Electric	**Quantity (duty)**	**Hours/Day**	**HP (each)**	**kW (each)**	**kWh/day**	**Annual kWh**
Blowers	1	24	30	22.371	537	195,970
Compressed Gas Mixing Compressor	1	24	4.6	3.430	82	30,049
					Total Annual kWh	226,019
					Annual Electrical Cost	$ 44,397.55
					Say	**$ 44,400.00**

Electric Rates	
$ 0.16305	per kwh
$ 629	per month

Replacement Parts	**Frequency (yrs)**	**Unit Cost**	**Annual Total**
A2O Equipment (1/3 of total cost)	20	$ 465,667	$ 23,283.33
Clarifier Equipment (1/3 of total cost)	20	$ 64,333	$ 3,216.67
RAS/WAS Pumps (1/3 of pump total cost)	20	$ 43,333	$ 2,166.67
		Annual Replacement Parts Cost	**$ 28,666.67**
		Say	**$ 28,700.00**

Operation		**Hours/week**	**Annual Hours**
A2O Operations and Maintenance		2.5	130
Clarifier Operations and Maintenance		2.5	130
RAS/WAS Pumps		2.5	130
	Total	7.5	390
		Labor rate	$ 50.00
		Annual Labor cost	**$ 19,500.00**

Total Annual O&M	**$ 92,600.00**

Hoyle, Tanner	Town of Woodstock	Project No.:	146401
125 College St., 4th Floor	Woodstock Main WWTF Upgrade PER	By:	ACD
Burlington, VT 05401	Engineer's Opinion of Probable Project Costs	CK By:	KDW
802-860-1331	**Biological Process Alternative #2 - AGS**	Date:	3/7/2025

Operation & Maintenance Cost Estimates

Biological Process Alternative #3: AGS

Electric	**Quantity (duty)**	**Hours/Day**	**HP (each)**	**kW (each)**	**kwh/day**	**Annual KwH**	**Electric Rates**	
Blowers	2				393	143,445	$ 0.16305	per kwh
Sludge Pump	1				8	2,920	$ 629	per month
					Total	146,365		
					Annual Electrical Cost	$ 31,410.03		
					Say	**$ 31,500.00**		

Replacement Parts	**Frequency (yrs)**	**Unit Cost**	**Annual Total**
AGS Equipment (1/3 of total cost)	20	$ 561,007	$ 28,050.33
		Annual Replacement Parts Cost	**$ 28,050.33**
		Say	**$ 28,100.00**

Operation	**Hours/week**	**Annual Hours**
AGS Operations and Maintenance	6.0	312
Total	**6.0**	**312**
	Labor rate	$ 50.00
	Annual Labor cost	**$ 15,600.00**

Total Annual O&M	**$ 75,200.00**

Hoyle, Tanner	Town of Woodstock	Project No:	21.129901
125 College St., 4th Floor	Woodstock Main WWTF Upgrade PER	By:	ACD
Burlington, VT 05401	Engineer's Opinion of Probable Project Costs	CK By:	KDW
802-860-1331	**Biological Process Alternative #3 - SBR**	Date:	4/8/2025

Operation & Maintenance Cost Estimates

Biological Process Alternative #2 - SBR

Electric	Quantity (duty)	Hours/Day	HP (each)	kW (each)	kwh/day	Annual KwH
Blowers, Mixer Drive Unit and Waste pumps					708	258,493
					Total	258,493
					Annual Electrical Cost	$ 49,692.48
					Say	**$ 49,700.00**

Electric Rates	
$ 0.16305	per kwh
$ 629	per month

Replacement Parts	Frequency (yrs)	Unit Cost	Annual Total
SBR Equipment (1/3 of total cost)	20	$ 393,013	$ 19,650.67
		Annual Replacement Parts Cost	**$ 19,650.67**
		Say	**$ 19,700.00**

Operation	Hours/week	Annual Hours
SBR Operations and Maintenance	6.0	312
Total	6.0	312
	Labor rate	$ 50.00
	Annual Labor cost	**$ 15,600.00**

Total Annual O&M	**$ 85,000.00**

Hoyle, Tanner	Town of Woodstock	Project No.:	146401
125 College St., 4th Floor	Woodstock Main WWTF Upgrade PER	By:	ACD
Burlington, VT 05401	Engineer's Opinion of Probable Project Costs	CK By:	KDW
802-860-1331	**Dewatering Alternative #1 - Rotary Press**	Date:	3/7/2025

Operation & Maintenance Cost Estimates

Dewatering Alternative #1: Rotary Press

Electric	Quantity (duty)	Hours/Day	HP (each)	kW (each)	kwh/day	Annual KwH
Rotary Press Main Drive	1	3	7.5	5.593	17	6,124
					Total	6,124
					Annual Electrical Cost	$ 8,543.77
					Say	**$ 8,600.00**

Electric Rates	
$ 0.16305	per kwh
$ 629	per month

Replacement Parts	Frequency (yrs)	Unit Cost	Annual Total
Rotary Press Equipment (1/3 of total cost)	20	$ 157,194	$ 7,859.72
		Annual Replacement Parts Cost	**$ 7,859.72**
		Say	**$ 7,900.00**

Operation	Hours/week	Annual Hours
Rotary Press Operations and Maintenance	6	312
Total	**6**	**312**
	Labor rate	$ 50.00
	Annual Labor cost	**$ 15,600.00**

Total Annual O&M	**$ 32,100.00**

Hoyle, Tanner	Town of Woodstock	Project No.:	146401
125 College St., 4th Floor	Woodstock Main WWTF Upgrade PER	By:	ACD
Burlington, VT 05401	Engineer's Opinion of Probable Project Costs	CK By:	
802-860-1331	**Dewatering Alternative #2 - Centrifuge**	Date:	3/7/2025

Operation & Maintenance Cost Estimates

Dewatering Alternative #2: Centrifuge

Electric	Quantity (duty)	Hours/Day	HP (each)	kW (each)	kwh/day	Annual KwH
Centrifuge Main Drive Motor	1	3	30	22.371	67	24,496
Centrifuge Scroll Drive Motor	1	3	10	2.000	6	2,190
					Total	26,686
					Annual Electrical Cost	$ 11,896.43
					Say	**$ 11,900.00**

Electric Rates	
$ 0.16305	per kwh
$ 629	per month

Replacement Parts	Frequency (yrs)	Unit Cost	Annual Total
Centrifuge Equipment (1/3 of total cost)	20	$ 126,367	$ 6,318.33
		Annual Replacement Parts Cost	**$ 6,318.33**
		Say	**$ 6,400.00**

Operation	Hours/week	Annual Hours
Centrifuge Operations and Maintenance	15.0	780
Total	**15.0**	**780**
	Labor rate	$ 50.00
	Annual Labor cost	**$ 39,000.00**

Total Annual O&M	**$ 57,300.00**

Hoyle, Tanner	Town of Woodstock	Project No.:	146401
125 College St., 4th Floor	Woodstock Main WWTF Upgrade PER	By:	ACD
Burlington, VT 05401	Engineer's Opinion of Probable Project Costs	CK By:	KDW
802-860-1331	**Dewatering Alternative #3 - Screw Press**	Date:	3/7/2025

Operation & Maintenance Cost Estimates

Dewatering Alternative #3: Screw Press

Electric	Quantity (duty)	Hours/Day	HP (each)	kW (each)	kwh/day	Annual KwH
Screw Press Main Drive	1	3	3.5	2.610	8	2,858
Dewatering Drum Drive	1	3	1	0.746	2	817
Flash Mixing Tank	1	3	0.5	0.373	1	408
Flocculation Tank	1	3	1	0.746	2	817
					Total	4,899
					Annual Electrical Cost	$ 8,344.06
					Say	**$ 8,400.00**

Electric Rates	
$ 0.16305	per kwh
$ 629	per month

Replacement Parts	Frequency (yrs)	Unit Cost	Annual Total
Screw Press Equipment (1/3 of total cost)	20	$ 138,667	$ 6,933.33
		Annual Replacement Parts Cost	**$ 6,933.33**
		Say	**$ 7,000.00**

Operation	Hours/week	Annual Hours
Screw Press Operations and Maintenance	12.0	624
Total	**12.0**	**624**
	Labor rate	$ 50.00
	Annual Labor cost	**$ 31,200.00**

Total Annual O&M	**$ 46,600.00**

APPENDIX D

PRESENT WORTH ANALYSIS

Hoyle, Tanner & Associates, Inc.	Town of Woodstock		Project No.:	146401
125 College St., 4th Floor	Woodstock Main WWTF Upgrade PER		By:	ACD
Burlington, VT 05401	Engineer's Opinion of Probable Project Costs		CK By:	KDW
802-860-1331	**Biological Process Alternatives - Present Worth**		Date:	4/7/2025

Description of Item		Alternative 1	Alternative 2	Alternative 3
		A2O	**AGS**	**SBR**
Alternative Project Cost				
	Biological Process & Process Building	$8,745,000	$7,378,000	$7,708,000
	Secondary Clarifier Rehabilitaiton	$1,990,000	--	--
	RAS & WAS System Rehabilitation	$977,000	--	--
	Innovative Technology Pilot Testing	--		--
	Total Project Cost of Alternative [1]	**$11,712,000**	**$7,378,000**	**$7,708,000**
Alternative Annual O&M Cost		$92,600	$75,200	$85,000
	Annual O&M Cost of Alternative (rounded)	**$93,000**	**$75,000**	**$85,000**
Present Worth of Alternatives				
	Escalation rate, e (assumed)	3.0%	3.0%	3.0%
	Discount rate, i (as per EPA Fiscal Year 2024)	2.75%	2.75%	2.75%
	Planning period, n (years)	20	20	20
	Present Worth of Alternatives	**$13,658,000**	**$8,948,000**	**$9,487,000**

Notes:

1 Total project costs are inclusive of construction costs, contractor mark-up, BABA compliance markup, tariff markup, but do not include contingency, engineering services, legal and administrative costs.

Hoyle, Tanner & Associates, Inc.	Town of Woodstock		Project No.:	146401
125 College St., 4th Floor	Woodstock Main WWTF Upgrade PER		By:	ACD
Burlington, VT 05401	Engineer's Opinion of Probable Project Costs		CK By:	KDW
802-860-1331	**Dewatering Alternatives - Present Worth**		Date:	4/7/2025

Description of Item		Alternative 1 Rotary Press	Alternative 2 Centrifuge	Alternative 3 Screw Press
Alternative Project Cost				
	Dewatering	$1,813,000	$1,631,000	$1,566,000
	Total Project Cost of Alternative [1]	**$1,813,000**	**$1,631,000**	**$1,566,000**
Alternative Annual O&M Cost		$32,100	$57,300	$46,600
	Annual O&M Cost of Alternative (rounded)	**$32,000**	**$57,000**	**$47,000**
Present Worth of Alternatives				
	Escalation rate, e (assumed)	3.0%	3.0%	3.0%
	Discount rate, i (as per EPA Fiscal Year 2024)	2.75%	2.75%	2.75%
	Planning period, n (years)	20	20	20
	Present Worth of Alternatives	**$2,483,000**	**$2,824,000**	**$2,550,000**

Notes:

1 Total project costs are inclusive of construction costs, contractor mark-up, BABA compliance markup, tariff markup, but do not include contingency, engineering services, legal and administrative costs.

APPENDIX E

TOTAL PROJECT COSTS

Town of Woodstock	Project No:	21.129901
Woodstock Main WWTF	By:	ACD
Engineer's Opinion of Probable Project Costs	CK By:	KDW
Total Project Costs	Date:	6/30/2025
Construction Cost	**Current Cost**[1]	**Projected Cost**[2]
ENR Construction Cost Index	**Mar-25** **13782.5**	**Mar-27** **14800**
Screen and New Headworks Building	$2,967,000	$3,186,000
Grit Removal	$831,000	$892,000
Intermediate Lift Pumps	$1,201,000	$1,290,000
Biological Process - AGS	$7,378,000	$7,923,000
Coagulant Chemical Feed Systems	$560,000	$601,000
UV Disinfection System & Building	$2,002,000	$2,150,000
Plant Water System	$365,000	$392,000
Solids Holding Tank Improvements	$409,000	$439,000
Dewatering Facilities	$1,813,000	$1,947,000
Control Building Modifications	$782,000	$840,000
Plant Drainage Pump Station and Site Modifications	$2,531,000	$2,718,000
Subtotal	**$20,839,000**	**$22,378,000**
Project Contingency	30%	30%
Contingency @ 30%	$6,252,000	$6,252,000
Total Construction Cost[3]	**$27,091,000**	**$28,630,000**
Engineering Costs		
Step I - Preliminary Engineering		
Preliminary Engineering - Step I [4]	$105,000	$105,000
Step II - Final Design		
Final Design - Step II [5]	$1,222,118	$1,222,118
Step III - Construction Phase		
Bid, Construction Administration & Inspection - Step III[6]	$2,179,000	$2,179,000
Legal, Administrative, Permitting		
0.5%	$143,000	$143,000
Total Project Cost	**$30,740,118**	**$32,279,118**

Notes:

1) ENR Construction Cost Index = 13782.50 (March 2025)
2) Projected ENR Construction Cost Index at Construction Start of March 2027 = 14,800
3) Construction Costs are inclusive of 20% Contractor Overhead and Profit and 8% Bonds and Mobilization/Demobilization, 2% Bonds & Insurance, and markup associated with tarriffs Federal BABA compliance for construction materials and equipment.
4) Signed Contract dated 10/21/21
5) Signed Contract dated 6/7/24 and PER Amendment dated 12/22/2024
6) Engineering Fee is calculated based on the VTDEC-FED Engineering Fee Allowance Guidelines dated 9/1/2011.

Hoyle, Tanner	Town of Woodstock	Project No:	24.129901
125 College St., 4th Floor	Woodstock Main WWTF Upgrade	By:	KDW
Burlington, VT 05401	Engineer's Opinion of Probable Project Costs	CK By:	KDW
802-860-1331	**Headworks - Screen and Building**	Date:	4/18/2025

Process Area	Division/ Discipline	Description	Qty.	Unit	Unit Cost [2]	Tariff Cont. [3]	Install	Total Cost
Influent Sewer								
	Site/Civil							
		New 18" DICL Influent Pipe	50	LF	$250	20%		$15,000
		4' Diameter Sanitary Sewer Manhole	12	VF	$1,200			$14,400
		Abandonment of Existing 12" Influent Sewer	1	LS	$5,000			$5,000
		Influent Sewer - Subtotal						**$34,400**
Screening								
	Site/Civil							
		Covered under Headworks Building						
	Structural							
		Concrete - Channels	100	CY	$1,800			$180,000
		Channel Grating - FRP	190	SF	$50	20%		$11,400
	Mechanical							
		HydroDyne Center Flow Screen and Wash Compactor	1	LS	$330,000	20%	30%	$495,000
		Bypass Manual Bar Screen	1	LS	$10,000	20%		$12,000
		Slide Gates	4	EA	$12,000	20%		$57,600
		Process piping and valves allowance	1	ALL	$50,000	20%		$60,000
	Building Mechanical							
		Covered under Headworks Building						
	Electrical							
		Covered under Headworks Building						
		Screening - Subtotal						**$816,000**
Headworks Building								
	Site/Civil							
		Site Erosion Control	1	ALL	$5,000			$5,000
		Utility Relocation Allowance	1	ALL	$25,000			$25,000
		Excavation for Structures	1,490	CY	$27			$40,300
		Site Dewatering	1	LS	$10,000			$10,000
		Subbase	140	CY	$50			$7,000
		Structural Backfill	590	CY	$25			$14,800
		Water service extension to building	1	ALL	$25,000	20%		$30,000
	Structural							
		Headworks Building (40' x 30')	1200	SF	$250	20%		$360,000
		Frost Wall Foundation	80	CY	$1,800			$144,000
		Concrete Slab	60	CY	$1,500			$90,000
	Process Mechanical							
		Influent Sampler	1	EA	$12,000	20%		$14,400
		Process Piping and Valves Allowance	1	ALL	$50,000	20%		$60,000
	Buidling Mechanical							
		HVAC & Plumbing	1	ALL	$250,000	20%		$300,000
	Electrical/I&C							
		Gas Detection System	1	LS	$15,000	20%		$18,000
		Building Electrical (panels, basic, process, instrumentation)	1	ALL	$250,000	20%		$300,000
		Headworks Building - Subtotal						**$1,418,500**
Effluent Sewer to Intermediate Pump Station Wetwell								
	Site/Civil							
		New 18" Dia. 35 SDR PVC Pipe	50	LF	$250			$12,500
		Effluent Sewer - Subtotal						**$12,500**
					Construction Subtotal (Rounded)			**$2,282,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$456,000
		Mobilization/Demobilization	8%					$183,000
		Bonds & Insurance	2%					$46,000
						Total Construction Cost		**$2,967,000**

Notes:

1 ENR Construction Cost Index = 13782.50 (March 2025)

2 Costs include markup associated with Federal BABA compliance for construction materials and equipment.

3 Markup contingency for tariffs on construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No:	24.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade					By:	KDW
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Grit Removal**					Date:	4/18/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost [2]**	**Tarriff Cont. [3]**	**Install**	**Total Cost**
Grit Removal								
	Site/Civil							
		Covered under Headworks Building						
	Structural							
		Concrete - Grit Vortex Influent and Effluent Channel	50	CY	$1,800			$90,000
		Concrete - Grit Vortex Tank	70	CY	$2,000			$140,000
		Channel Grating - FRP	90	SF	$50	20%		$5,400
	Mechanical							
		Vortex Grit Chamber, Classifier, Grit Pump	1	LS	$200,000	20%	30%	$300,000
		Slide Gates	3	EA	$12,000	20%		$43,200
		Process piping and valves allowance	1	ALL	$50,000	20%		$60,000
	Building Mechanical							
		N/A - Covered un Headworks Building						
	Electrical							
		N/A - Covered un Headworks Building						
		Grit Removal - Subtotal						**$638,600**
					Construction Subtotal (Rounded)			**$639,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$128,000
		Mobilization/Demobilization	8%					$51,000
		Bonds & Insurance	2%					$13,000
						Total Construction Cost		**$831,000**

Notes:

1 Construction costs are inclusive of Contractor's overhead & profit, mobilization/demobilization, and bonds.

2 Construction costs do not include engineering services, legal and administrative costs.

3 Markup associated with Federal BABA compliance for construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No:	24.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade					By:	KDW
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Intermediate Pumps and Forcemain Upgrade**					Date:	4/18/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost [2]**	**Tariff Cont. [3]**	**Install**	**Total Cost**
Intermediate Lift Pump Replacement and Forcemain								
	Site/Civil							
		By-Pass Pumping Allowance	1	ALL	$50,000			$50,000
		Abandonment of Existing Force Main	1	LS	$5,000			$5,000
		New Force Main - Subtotal						**$55,000**
	Structural							
		Concrete Pump Pad Modifications	1	LS	$10,000			$10,000
		Pump Room Rehabilitation Allowance	1	LS	$50,000			$50,000
	Process Mechanical							
		Existing Pump Demolition	1	LS	$25,000			$25,000
		Intermediate Pumps (3 - 12 HP pumps)	1	LS	$149,573	20%	30%	$224,400
		Discharge Check Valves - 8"	3	EA	$10,000	20%		$36,000
		Pump Suction & Discharge 8" Plug Valve Replacements	12	EA	$4,500	20%		$64,800
		Process Piping Allowance	1	ALL	$100,000	20%		$120,000
	Buidling Mechanical							
		N/A						
	Electrical/I&C							
		Intermediate Pump VFDs	3	EA	$15,000	20%		$54,000
		Magnetic Flow Meter	1	LS	$10,000	20%		$12,000
		Intermediate Pump Level Control System with back-up floats	1	LS	$15,000	20%		$18,000
		Suction and Discharge Pressure Sensors	6	EA	$2,000	20%		$14,400
		Pump Process Electrical	1	ALL	$100,000	20%		$120,000
		I&C Equipment and Integration Allowance	1	ALL	$100,000	20%		$120,000
		Lift Pump Replacement - Subtotal						**$868,600**
					Construction Subtotal (Rounded)			**$924,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$185,000
		Mobilization/Demobilization	8%					$74,000
		Bonds & Insurance	2%					$18,000
						Total Construction Cost		**$1,201,000**

Notes:

1 ENR Construction Cost Index = 13782.50 (March 2025)

2 Costs include markup associated with Federal BABA compliance for construction materials and equipment.

3 Markup contingency for tariffs on construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No:	21.129901
125 College St., 4th Floo		Woodstock Main WWTF Upgrade PER					By:	ACD
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Biological Process Alternative #2 - AGS**					Date:	4/18/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost [2]**	**Tarriff Cont. [3]**	**Install**	**Total Cost**
Pre-Equalization Tank								
	Site/Civil							
		Site Erosion Control	1	ALL	$5,000			$5,000
		Site Dewatering	1	LS	$10,000			$10,000
		Excavation	749	CY	$27			$20,300
		Gravel Subbase	58	CY	$60			$3,500
		Structural Backfill	451	CY	$25			$11,300
	Structural							
		Concrete Slab	58	CY	$1,500			$87,000
		Concrete Walls (Tanks)	87	CY	$1,800			$156,600
		Stairs	15	EA	$560	20%		$10,100
		Handrails	88	LF	$100	20%		$10,600
		Bridges/Walkways	88	SF	$100	20%		$10,600
	Process Mechanical							
		Submersible transfer pumps	2	EA	$30,000	20%	30%	$90,000
		Process Piping and Valves Allowance	1	ALL	$50,000	20%		$60,000
	Electrical & Instrumentation							
		Level Control System (Radar)	1	EA	$2,000	20%	30%	$3,000
		Float Alarms	1	EA	$1,000	20%	30%	$1,500
		Magnetic Flowmeters	1	EA	$15,000	20%	30%	$22,500
		Electrical, Instrumentation & Controls Allowance	1	ALL	$50,000	20%		$60,000
		Pre-Equalization Tank - Subtotal						**$562,000**
AGS - Tank Structure								
	Site/Civil							
		Site Erosion Control	1	ALL	$5,000			$5,000
		Site Dewatering	1	LS	$5,000			$5,000
		Excavation	1712	CY	$27			$46,300
		Gravel Subbase	167	CY	$60			$10,100
		Structural Backfill	699	CY	$25			$17,500
	Structural							
		Concrete Slab	167	SF	$1,500			$250,500
		Concrete Walls (Tanks)	327	CY	$1,800			$588,600
		Stairs	31	LF	$560	20%		$20,900
		Handrails	168	LF	$100	20%		$20,200
		Bridges/Walkways	232.5	SF	$100	20%		$27,900
		AGS Tank Structure - Subtotal						**$992,000**
AGS - Process								
	Site/Civil							
		New Sludge Force Main to Sludge Holding Tanks (4" Diameter DICL)	150	LF	$160	20%		$28,800
	Process Mechanical							
		AGS Equipment	1	LS	$1,683,020	20%	20%	$2,356,300
		10" Electrically Actuated Influent Plug Valves	2					
		Influent Distribution Assemblies	2					
		Effluent Weir Assemblies	2					
		Solid Waste Systems	2					
		Sludge Decant Valve Sets	2					
		Air Valve Sets	2					
		Fixed Fine Bubble Diffuser Assemblies	2					
		Positive Displacement Blowers	2					
		Instrumentation (DO/TSS/pH/NO3)	1					
		Sludge Buffer Pump	1					
		Sludge Buffer Valves	1					
		Process Optimization Software & Controls, Control Panel	1					
		Process Air Piping Allowance	1	ALL	$150,000	20%		$180,000
		Process Piping and Valves	1	ALL	$150,000	20%		$180,000
	Electrical							
		Electrical, Instrumentation & Controls	1	ALL	$250,000	20%		$300,000
		AGS Process - Subtotal						**$3,045,100**

Hoyle, Tanner	Town of Woodstock	Project No:	21.129901
125 College St., 4th Floo	Woodstock Main WWTF Upgrade PER	By:	ACD
Burlington, VT 05401	Engineer's Opinion of Probable Project Costs	CK By:	KDW
802-860-1331	**Biological Process Alternative #2 - AGS**	Date:	4/18/2025

Process Area	Division/ Discipline	Description	Qty.	Unit	Unit Cost [2]	Tariff Cont. [3]	Install	Total Cost
Process Building								
	Site/Civil							
		Site Erosion Control	1	ALL	$5,000			$5,000
		Site Dewatering	1	LS	$5,000			$5,000
		Excavation (Frost Wall)	125	CY	$27			$3,400
		Backfill	15	CY	$25			$400
		Gravel Subbase	75	CY	$60			$4,500
		Water service extension to building	1	ALL	$25,000	20%		$30,000
	Structural							
		Building (Blower, Electrical, Mechanical, Chemical Rooms)	1000	SF	$250	20%		$300,000
		Concrete Slab on grade	38	CY	$1,500			$57,000
		Frost Wall Foundation Concrete	35	CY	$1,800			$63,000
	Process Mechanical							
		Process Piping and Valves	1	ALL	$150,000	20%		$180,000
		Mechanical (HVAC & Plumbing)	1	ALL	$150,000	20%		$180,000
	Electrical							
		Electrical, Instrumentation & Controls	1	ALL	$150,000	20%		$180,000
		AGS Process Building - Subtotal						**$1,008,300**
AGS Tank Effluent to UV								
	Site/Civil							
		New 18" DICL Aeration Tank Effluent to UV	225	LF	$250	20%		$67,500
		Aeration Tank Effluent - Subtotal						**$67,500**
							Total	**$5,674,900**
					Construction Subtotal (Rounded)			**$5,675,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$1,135,000
		Mobilization/Demobilization	8%					$454,000
		Bonds & Insurance	2%					$114,000
							Total Construction Cost	**$7,378,000**

Notes:

1 ENR Construction Cost Index = 13782.50 (March 2025)

2 Costs include markup associated with Federal BABA compliance for construction materials and equipment.

3 Markup contingency for tariffs on construction materials and equipment.

Innovative Technology Pilot Test Demonstration								
		Pilot Testing Allowance	1	ALL	$250,000			**$250,000**

Hoyle, Tanner	Town of Woodstock					Project No:	24.129901
125 College St., 4th Floor	Woodstock Main WWTF Upgrade					By:	KDW
Burlington, VT 05401	Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331	**Chemical Feed Systems**					Date:	4/18/2025

Process Area	Division/ Discipline	Description	Qty.	Unit	Unit Cost [2]	Tariff Cont. [3]	Install	Total Cost
Chemical Storage & Feed Systems								
	Site/Civil							
		New Chemical Feed Yard Piping Allowance	1	ALL	$50,000	20%		$60,000
		Heat Tracing of Chemical Lines	1	ALL	$25,000	20%		$30,000
	Structural							
		Covered under Biological Process Building						
	Process Mechanical							
		Coagulant Pump Skid (2 Peristaltic Pumps, Skid Mount)	2	EA	$8,000	20%	30%	$24,000
		Coagulant Storage Tanks (2 tanks)	2	EA	$20,000	20%	30%	$60,000
		Hydroxide Pump Skid (2 Peristalic Pumps, Skid Mount)	2	EA	$8,000	20%	30%	$24,000
		Hydroxide Storage Tank	1	EA	$15,000	20%	30%	$22,500
		PVC Piping, Valves, Fittings, and Appurtenance Allowance	1	ALL	$50,000	20%		$60,000
		Storage Tank Level Detection Systems	3	EA	$4,000	20%		$14,400
		Electrically Actuated Chemical Feed Line Ball Valve	3	EA	$1,000	20%		$3,600
	Building Mechanical							
		Safety Shower and Eyewash	2	EA	$25,000	20%		$60,000
		HVAC & Plumbing - Covered under Process Building						
	Electrical/I&C							
		Flow Meters	2	LS	$5,000	20%		$12,000
		Electrical, Instrumentation & Controls	1	ALL	$50,000	20%		$60,000
		Chemical Storage & Feed Systems - Subtotal						**$430,500**
					Construction Subtotal (Rounded)			**$431,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$86,000
		Mobilization/Demobilization	8%					$34,000
		Bonds & Insurance	2%					$9,000
						Total Construction Cost		**$560,000**

Notes:

1 ENR Construction Cost Index = 13782.50 (March 2025)

2 Costs include markup associated with Federal BABA compliance for construction materials and equipment.

3 Markup contingency for tariffs on construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No:	24.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade					By:	KDW
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**New UV Disinfection System**					Date:	4/18/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost [2]**	**Tariff Cont. [3]**	**Install**	**Total Cost**
UV Building								
	Site/Civil							
		Site Erosion Control	1	LS	$5,000			$5,000
		Site Dewatering	1	LS	$10,000			$10,000
		Excavation for Structures	230	CY	$27			$6,300
		Subbase	50	CY	$60			$3,000
		Structural Backfill	83	CY	$25			$2,100
	Structural							
		Concrete for channels						
		Concrete Channel Walls	30	CY	$1,800			$54,000
		Concrete Channel Bottom	20	CY	$1,500			$30,000
		UV Building						
		UV Building (15' x 25')	375	SF	$500	20%		$225,000
		Frost Wall Foundation	50	CY	$1,800			$90,000
		Concrete Slab	30	CY	$1,500			$45,000
		FRP Grating for Channels	110	SF	$50	20%		$6,600
		Effluent Weir	1	LS	$5,000			$5,000
		Baffle Plate	1	LS	$2,500			$2,500
	Process Mechanical							
		Demolition of Existing Chemical Feed/Storage Facilities	1	LS	$10,000			$10,000
		Effluent Sampler	1	LS	$12,000	20%		$14,400
		Process piping and valves	1	ALL	$25,000	20%		$30,000
	Buidling Mechanical							
		HVAC & Plumbing	1	LS	$150,000	20%		$180,000
	Electrical/I&C							
		Ultrasonic Level Sensor for Effluent Q Measurement	1	LS	$4,000	20%		$4,800
		Building Electrical (panels, basic, process, instrumentation)	1	LS	$150,000	20%		$180,000
		UV Building - Subtotal						**$903,700**
UV Disinfection System								
		UV Disinfection System (3 banks - 2 duty, 1 standby)	1	LS	$340,000	20%	30%	$510,000
		UV Disinfection System - Subtotal						**$510,000**
Yard Piping to and from UV								
	Site/Civil							
		New 24" DICL Biological Process to UV & UV to Effluent	300	LF	$350	20%		$126,000
		Yard Piping - Subtotal						**$126,000**
					Construction Subtotal (Rounded)			**$1,540,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$308,000
		Mobilization/Demobilization	8%					$123,000
		Bonds & Insurance	2%					$31,000
						Total Construction Cost		**$2,002,000**

Notes:

1 ENR Construction Cost Index = 13782.50 (March 2025)

2 Costs include markup associated with Federal BABA compliance for construction materials and equipment.

3 Markup contingency for tariffs on construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No:	24.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade					By:	KDW
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Plant Water System**					Date:	4/18/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost [2]**	**Tarriff Cont. [3]**	**Install**	**Total Cost**
Plant Water System								
	Site/Civil							
		N/A - Carried under Disinfection						
	Structural							
		Precast Concrete Tank (4,000 gals) for Plant Water Sump	1	LS	$15,000			$15,000
	Process Mechanical							
		Grundfos Pump Skid	1	LS	$109,000	20%	30%	$163,500
		Process Piping, Valves, Fittings, and Appurtenance	1	ALL	$50,000	20%		$60,000
	Buidling Mechanical							
		N/A						
	Electrical/I&C							
		Plant Water Level Control System	1	LS	$15,000	20%		$18,000
		Electrical, I&C Allowance	1	ALL	$20,000	20%		$24,000
		Plant Water System - Subtotal						$280,500
						Subtotal (Rounded)		**$281,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$56,000
		Mobilization/Demobilization	8%					$22,000
		Bonds & Insurance	2%					$6,000
						Total Construction Cost		**$365,000**

Notes:

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3 Markup contingency for tariffs on construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No:	24.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade					By:	KDW
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Solids Holding Facility Improvements**					Date:	4/18/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost [2]**	**Tarriff Cont. [3]**	**Install**	**Total Cost**
Solids Holding Improvements								
	Site/Civil							
		N/A						
	Structural							
		Sludge Blower Room Modificaitons and Improvements	1	ALL	$25,000			$25,000
	Process Mechanical							
		Floating Decanters for Sludge Holding Tanks	1	EA	$37,500	20%	30%	$56,300
		Coarse Bubble Diffuser Replacement	2	EA	$50,000	20%	30%	$150,000
		Process Piping and Valves	1	LS	$50,000	20%		$60,000
	Electrical							
		Electrical/Instrumentation	1	LS	$20,000	20%		$24,000
		Solids Holding Improvements - Subtotal						**$315,000**
					Construction Subtotal (Rounded)			**$315,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$63,000
		Mobilization/Demobilization	8%					$25,000
		Bonds & Insurance	2%					$6,000
						Total Construction Cost		**$409,000**

Notes:

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3 Markup contingency for tariffs on construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No:	21.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade PER					By:	ACD
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Dewatering Alternative #1: Rotary Press**					Date:	4/18/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost [2]**	**Tarriff Cont. [3]**	**Install**	**Total Cost**
Polymer Feed System								
	Structural							
		Containment for Polymer Totes	1	LS	$25,000	20%		$30,000
	Process Mechanical							
		Polymer System	1	EA	$22,920	20%	30%	$34,400
		Chemical Process Piping & Valves	1	ALL	$50,000	20%		$60,000
	Electrical / I&C							
		Level Control System (Radar)	1	EA	$2,000	20%	30%	$3,000
		Float Alarms	1	EA	$1,000	20%	30%	$1,500
		Misc. Electrical, I&C	1	ALL	$50,000	20%		$60,000
		Polymer Feed System Subtotal						**$188,900**
Sludge Dewatering								
	Process Mechanical							
		Rotary Press	1	EA	$471,583	20%	30%	$707,400
		Sludge Day Tank w/ Mixer	1	LS	$50,000	20%	30%	$75,000
		Dewatered Sludge Cake Screw Conveyor	1	LS	$14,560	20%	30%	$21,900
		Sludge Dewatering Feed Pumps	2	EA	$14,450	20%	30%	$43,400
		Dewatering Process Piping and Valves	1	ALL	$50,000	20%		$60,000
	Electrical / I&C							
		Magnetic Flow Meter	1	EA	$15,000	20%	30%	$22,500
		Level Control System (Radar)	1	EA	$2,000	20%	30%	$3,000
		Float Alarms	1	EA	$1,000	20%	30%	$1,500
		Electrical, Instrumentation & Controls	1	ALL	$100,000	20%		$120,000
		Sludge Dewatering Subtotal						**$1,054,700**
Garage Bay Modifications								
	Structural							
		Structural Building Modifications	1	LS	$50,000	20%		$60,000
	Electrical/I&C							
		HVAC	1	LS	$25,000	20%		$30,000
		Electrical, Instrumentation, & Controls	1	LS	$50,000	20%		$60,000
		Garage Bay Modifications Subtotal						**$150,000**
						Subtotal (Rounded)		**$1,394,000**
Contractor Markups								
		Contractor Overhead & Profit					20%	$279,000
		Mob/Demob					8%	$112,000
		Bonds					2%	$28,000
					Total Construction Cost (Rounded)			**$1,813,000**

Notes:

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3 Markup contingency for tariffs on construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No:	24.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade					By:	KDW
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Control Building Improvements**					Date:	4/18/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost [2]**	**Tariff Cont. [3]**	**Install**	**Total Cost**
Control Building Improvements								
	Site/Civil							
		N/A						
	Structural							
		Rehab of Office Area/Lab Area into separate areas	1	LS	$100,000			$100,000
		Laboratory - Fume Hood	1	LS	$10,000	20%		$12,000
		Insulation of CMU Walls	1	LS	$50,000			$50,000
		Painting - Interior and Exterior	1	LS	$50,000			$50,000
	Process Mechanical							
		N/A						
	Buidling Mechanical							
		HVAC & Plumbing	1	LS	$25,000	20%		$30,000
	Electrical/I&C							
		Electrical, Instrumentaion & Control Upgrades	1	ALL	$175,000	20%		$210,000
		SCADA System Upgrade Allowance	1	ALL	$150,000			$150,000
		Control Building Improvements - Subtotal						**$602,000**
					Construction Subtotal (Rounded)			**$602,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$120,000
		Mobilization/Demobilization	8%					$48,000
		Bonds & Insurance	2%					$12,000
						Total Construction Cost		**$782,000**

Notes:

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3 Markup contingency for tariffs on construction materials and equipment.

Hoyle, Tanner		Town of Woodstock					Project No.:	24.129901
125 College St., 4th Floor		Woodstock Main WWTF Upgrade					By:	KDW
Burlington, VT 05401		Engineer's Opinion of Probable Project Costs					CK By:	KDW
802-860-1331		**Plant Drainage Effluent Pump Station & Site Improvements**					Date:	4/18/2025
Process Area	**Division/ Discipline**	**Description**	**Qty.**	**Unit**	**Unit Cost [2]**	**Tariff Cont. [3]**	**Install**	**Total Cost**
Plant Drainage/Effluent Pump Station Upgrade								
	Site/Civil							
		New 12" ductile iron force main	160	LF	$200	20%		$38,400
		Abandonment of existing 8" force main	1	LS	$5,000			$5,000
	Structural							
		Wetwell Improvements						
		Grout fill to raise invert	10	CY	$1,200			$12,000
		Concrete repair	1	ALL	$25,000			$25,000
		New grating	1	LS	$10,000	20%	30%	$15,000
		New trash baskets	2	EA	$2,000	20%	30%	$6,000
		New misc. metals	1	LS	$5,000	20%	30%	$7,500
		New winches	2	EA	$2,000	20%	30%	$6,000
		Weatherproof Enclosure	1	LS	$50,000	20%		$60,000
	Process Mechanical							
		Existing Pump Demolition	1	LS	$5,000			$5,000
		New Stormwater Dewatering Pumps (2)	2	EA	$48,000	20%	30%	$144,000
		Process piping and valves	1	ALL	$50,000	20%		$60,000
	Building Mechanical							
		N/A						
	Electrical/I&C							
		Intermediate Pump Level Control System with back-up floats	1	LS	$15,000	20%		$18,000
		Pump Process Electrical	1	ALL	$25,000	20%		$30,000
		Plant Drainage Pump Station Upgrade - Subtotal						**$431,900**
Site								
	Site/Civil							
		Demolition of Existing Structures (Headworks, Aeration Tanks, Clarifiers, CCT)	1	ALL	$400,000			$400,000
		Abandonment of existing yard piping	1	ALL	$50,000			$50,000
		New Chain-Link Security Fence	1300	LF	$60	20%		$93,600
		New Security Gate - 24' wide	1	EA	$15,000	20%		$18,000
		Process Yard Piping & Valve Allowance	1	ALL	$200,000	20%		$240,000
		Yard Hydrants for Plant Water System	4	EA	$10,000	20%		$48,000
		Cold Planing Existing Pavement	2000	SY	$10			$20,000
		New Pavement (4")	460	TON	$160			$73,600
		Pavement Subbase of Gravel, Fine Graded	1000	CY	$60			$60,000
		Site Restoration	1	LS	$50,000			$50,000
		Stormwater Treatment Practice Allowance	1	ALL	$250,000			$250,000
		Relocation of Existing Utilities	1	ALL	$25,000			$25,000
	Structural							
		N/A						
	Process Mechanical							
		N/A						
	Buidling Mechanical							
		HVAC Replacement in Maintenance Garage	1	LS	$75,000	20%		$90,000
	Architectural							
		N/A						
	Electrical/I&C							
		Generator Building PLC Panel & Wiring	1	LS	$10,000	20%		$12,000
		Maintenance Garage Electrical Upgrades	1	LS	$15,000	20%		$18,000
		Electrical Site Work - Conduit & Wire	1	ALL	$25,000	20%		$30,000
		Site Lighting Rewiring	1	LS	$10,000	20%		$12,000
		Fiber Optic Network Equip w/underground	1	LS	$20,000	20%		$24,000
		Site - Subtotal						**$1,515,000**
							Construction Subtotal (Rounded)	**$1,947,000**
Contractor Markups								
		Contractor Overhead & Profit	20%					$389,000
		Mobilization/Demobilization	8%					$156,000
		Bonds & Insurance	2%					$39,000
							Total Construction Cost	**$2,531,000**

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