2022

Facility Plan Addendum

City of Middleton Wastewater Treatment Plant

City of Middleton

T O ENGINEERS

Facility Plan Addendum

02-07-2022

REVISION 0

PREPARED FOR:

City of Middleton
1103 West Main Street
Middleton, ID 83644

Middleton

PROFESSIONAL ENGINEER
REGISTERED
20491
STATE OF IDAHO
GRANT T. MOORE

02/07/2022

Prepared by:

T-O Engineers
1998 W. Judith Lane
Boise, Idaho 83705

T-O ENGINEERS

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ABBREVIATIONS AND ACRONYMS

µg/L ....micrograms per liter
µm ....micrometer
A^2O.................... Anaerobic/Anoxic/Oxic
AC ....alternating current
ADD ....average day demand
BOD ....biochemical oxygen demand
BOD_5.................5- day biochemical oxygen demand
cfm ....cubic feet per minute
cfs ....cubic feet per second
CIP ....clean-in-place
CIPP ....cured-in-place pipe
COD ....chemical oxygen demand
CT ....contact time
DEQ ....(Idaho) Department of Environmental Quality
EBPR................. Enhanced Biological Phosphorus Removal
EDU ....equivalent dwelling unit
EID ....Environmental Information Document
EQ.....................equalization
fps.....................feet per second
gpad ....gallons per acre per day
gpcd..................gallons per capita per day
gpd ....gallons per day
gpm ....gallons per minute
hp ....horsepower
HRT ....hydraulic retention time
IDAPA ....Idaho Administrative Procedures Act
IPDES..................Idaho Pollutant Discharge Elimination System
MDF.................. Maximum Daily Flow
MMF................. Maximum Monthly Flow
I/I......................inflow and infiltration
ISRB ....Idaho Surveying and Rating Bureau
lb ....pound
MBR.................. Membrane Bioreactor
MCL ....maximum contaminant level
MDD ....maximum day demand
Mgal ....million gallons
MGD ....million gallons per day
mg/L ....milligrams per liter
MLE....................Modified Ludzack Ettinger
mm ....millimeter
NDN.................. Nitrification/Denitrification
NFIP ....National Flood Insurance Program
O&M ....operations and maintenance
SBR ....sequence batch reactor
SCADA ....supervisory control and data acquisition
SCFM ....standard cubic feet per minute
s.u..................... standard units (for measurement of pH)
TDS ....total dissolved solids
TKN...................Total Kjeldahl Nitrogen
TSS....................total suspended solids
USDA ................U.S. Department of Agriculture
USDA-RD ..........U.S. Department of Agriculture - Rural Development
USGS ................U.S. Geological Survey
UV ....ultraviolet
VFD...................variable frequency drive
WWFP ....Wastewater Facility Plan
WWTP...............Wastewater Treatment Plan

ES.0 EXECUTIVE SUMMARY

This document is intended to update the Wastewater Facility Plan for the City of Middleton, originally completed in 2019 (hereafter referred to as the existing Facility Plan). Since the existing Facility Plan was published, the City has prepared updated population projections which forecast a much higher growth rate. The increased growth rate was adapted from historical growth data observed between late 2019 and 2021. This change has brought the need for a detailed assessment of the long-term feasibility of the City's wastewater infrastructure. This document is intended to update the following sections from the existing Facility Plan:

1.3 – Population Trends
1.4 – Wastewater Flows
1.5 – Effluent Discharge Permit
6.1 – Influent Quality
6.2 – WWTP Operations
6.3 – Capacity Limitations
8.2 – Ammonia Treatment Alternatives
8.3 – Phosphorus Treatment Alternatives
9.0 – Capital Improvement Plan

ES.1 – Facilities Planning Alternatives Evaluation Process

A wide range of treatment alternatives were considered for meeting Middleton's wastewater management and treatment requirements. In early 2021, the design team identified five feasible alternatives through an interactive process involving City staff, consultant staff, and wastewater operations staff. Preference was given to alternatives which increase treatment capacity within the existing SBR basin footprint. The following sections summarize the conclusions of the alternatives analysis.

ES.2 Design Conditions

ES2.1 – Population Trends

Middleton encompasses just over 22,000 acres with a high residential development rate. The existing Facility plan used a 3.4% population growth rate throughout the planning period (through 2040) which was based on historical population growth data prior to 2019. Currently, a variable growth rate between 5% and 13% is forecasted over the planning

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period. Table ES1 below compares the populations projections used in the existing Facility Plan to the current population estimates which will be used in this addendum. The more rapid growth in population for the area will result in a proportional increase in wastewater loadings to the WWTP. Therefore, new population estimates will be used as the basis for facility design and future infrastructure planning.

Table ES1. Population Projection Comparison.

Year	Original Population Estimate	Revised Population Estimate
2020	9,732	9,732
2030	13,613	24,555
2040	19,044	39,998

ES2.2 – Planning Permit Limits

The Facilities current NPDES permit is extended through 2022. Updated permit requirements are estimated through the 20-year planning period lasting until 2040. The updated NPDES permit will include changes in BOD, TSS, ammonia, and phosphorus limits. Changes in these permit limits are due to technology-based restrictions and newly updated discharge limits of certain constituents into defined Waters of the United States. Proposed biological treatment alternatives will be designed in accordance with the criteria presented by population growth and permit limits in order to meet anticipated 2040 conditions.

Table ES2. Summary of Key Permit Changes

Parameter	Average Monthly Limit		Average Weekly Limit	
	Existing	*Planning*	*Existing*	*Planning*
BOD_5	45 mg/L 687 lb/d	30 mg/L 640 lb/d	65 mg/L 992 lb/d	45 mg/L 960 lb/d
TSS	70 mg/L 1,070 lb/d	30 mg/L 640 lb/d	105 mg/L 1,605 lb/d	45 mg/L 960 lb/d
Total Ammonia as N[1]	No Limit	10.2 mg/L 171.1 lb/d	No Limit	No Limit
Total Phosphorus[1]	No Limit	-- mg/L 1.5 ppd	No Limit	No Limit

1. More stringent summer limits shown (May – September)

ES.3 Treatment Plant Existing Conditions

Currently, wastewater from the collection system is diverted and discharged in a manhole near the southeast corner of the WWTP. Wastewater flows through the headworks of the facility which includes influent screens, a lift station, and grit removal. Biological treatment and nutrient removal occur in two sequencing batch reactor (SBR) basins. This process treats wastewater in cycles of equalization, aeration, and clarification. Secondary effluent from the SBR basins flow to a covered post-equalization basin prior to UV disinfection before discharge via the Mill Slough outfall along the Boise River.

ES3.1 – Existing Equipment Assessment

Due to the increased population growth throughout the 20-year planning period, the expected useful life or capacities of existing facility processes are reduced. Table ES3 below represents the updated capacities for each major component of the Middleton WWTP.

Table ES3. Updated Hydraulic Capacities.

Component:	Governing Flow	Year Capacity Met	Capacity Provided (MGD)[1]	2040 Capacity Needed (MGD)[2]	Trigger for, Decommissioning, Replacement, or Expansion
Influent Screens	PHF	2029	4.2	6.49	Replacement: -Increase capacity -Improve operations and maintenance
Influent Lift Station[3]	PHF	2026	3.6	6.49	Replacement: -Increase capacity
Influent 14" PVC Force Main	PHF	2037	5.8	6.49	Replacement: -Increase capacity
Grit Removal / Classifier	PHF	2029	4.2	6.49	Expansion: -Increase capacity
SBR Basins	MMF	2025	1.5	3.47	Replacement (w/new technology): -Capacity increase -Efficiency upgrade
UV System	MDF	2032	2.7	3.96	Expansion: -Increase capacity -Add redundancy
15" PVC Gravity Pipe	MDF	2024	1.6	3.97	Replacement: -Increase capacity

1. Existing capacity of system process
2. Capacity required to meet new planning projections.
3. Assuming fourth pump, already in stock, is added to existing system

ES.4 Treatment Plant Alternatives

Current operation capacities at the WWTP rely on the batch cycles carried out by the SBR basins. The City wishes to evaluate alternative methods of treatment which may provide increased capacity, efficiency, and operational merits. This document presents and analyzes five proposed treatment alternatives to increase biological treatment and nutrient removal capacity (outlined in Table ES4 below).

Table ES4. List of Treatment Alternative Upgrades.

Alternative	Description
A-1 (MBR)	Membrane bioreactor with enhanced biological phosphorus removal (EBPR) and Nitrification/Denitrification (NDN)
A-2 (Conventional Activated Sludge)	Three (3) continuous flow processes were examined within this alternative. Each process includes the construction of secondary clarifiers.
A-2a (A^2O)	Conventional Activated Sludge. Anaerobic/Anoxic/Anoxic process. Includes EBPR and NDN.
A-2b (5-Stage Bardenpho)	Conventional Activated Sludge, 5-stage Bardenpho with EBPR and NDN.
A-2c (A^2O Step Feed)	Conventional Activated Sludge. A^2O step feed with EBPR and NDN.
A-3 (SBR)	Sequencing batch reactor with NDN only.

Each viable alternative had a process model developed with the wastewater process modelling software Biowin 6.2 (Envirosim, 2021) using the 20-year planning criteria (attached in Appendix B). Using the same influent loading for each alternative, the treatment capacity of each alternative in terms of wastewater throughput was calculated. Each alternative's capacity in Table ES5 below maintains compliance with future wastewater permit requirements. Each alternative assumes the existing SBR process basins are retrofitted for future treatment.

Table ES5. Alternative Hydraulic Capacity Summary.

Alternative	Capacity
A-1 MBR[1]	3.00 MGD
A-2a A^2O	3.36 MGD
A-2b 5-Stage Bardenpho	3.10 MGD
A-2c A^2O Step Feed	3.30 MGD
A-3 SBR[2]	1.50 MGD

1. MBR alternative can achieve 3.0 MGD capacity only using 1 existing SBR basin for treatment. It is assumed the city would retrofit one of the existing SBR basins to function as an equalization tank if this alternative was selected.
2. Capacity for the existing two-basin SBR system.

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ES.5 Capital Improvement Plan

The Capital Improvement Plan in this report is intended to address improvements related to the selected biological treatment system alternative, as well as existing facility improvements including screens, pumping facilities and other intermediate infrastructure. In this section the costs for the selected alternative as well as the required facility improvement costs will be presented. Any costs presented are planning level estimates with a contingency factor of ±30%. The estimate reflects opinion of probable costs at the time of preparation and is subject to change as the design matures. In depth cost estimates for each option are provided in Appendix C.

Table ES6 below summarizes the life cycle costs specific to the biological treatment alternatives presented. Life cycle costs include corresponding initial capital, operation, and maintenance costs over the 20-year planning period. Conventional activated sludge (CAS) refers to a continuous flow activated sludge system.

Table ES6. Life Cycle Costs per Treatment Alternative.

Alternative	Total Life Cycle Cost	Capital (Construction) Costs
A-1 MBR	$21,918,000	$ 12,894,000
A-2a CAS (A^2O)	$20,748,000	$ 12,587,000
A-2b CAS (5-Stage Bardenpho)	$21,531,000	$ 13,215,000
A-2c CAS (A^2O Step Feed)	$21,856,000	$ 13,566,000
A-3 SBR	$26,293,000	$ 18,671,000

MBR = Membrane Bioreactor

A^2O = Anaerobic/Anoxic/Aerobic

SBR = Sequencing batch reactor

Existing equipment and treatment components at the WWTP also require certain upgrades during the planning period. Table ES7 outlines intermediate treatment process upgrade costs.

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Table ES7. Existing Facility Upgrade Cost Estimate.

Category	Cost
Facility Improvements	
Influent Screens	$ 988,900
Influent Lift Station	$ 622,000
Influent Force Main	$ 500,000
Grit Removal / Classifier	$ 1,215,500
Primary Clarifiers and Sludge Wetwell	$ 2,890,000
UV System	$ 1,194,000
Effluent Outfall Piping	$ 348,000
Sludge Storage Tank	$ 561,000
Dewatering Infrastructure	$ 2,341,000
Tertiary Phosphorus Treatment	$ 3,806,000
Gravel Roadway	$ 363,000
Sludge Removal	$ 550,000
Vac Truck Dump Pad	$ 327,000
WWTP Office Sewer	$ 75,000
General Conditions	
Contingency (30%)	$ 5,775,383
Engineering Design (10%)	$ 2,656,676
Construction Management (5%)	$ 1,328,338
Mechanical (12%)	$ 1,893,568
Electrical, I&C (10%)	$ 1,577,973
Contractor OH&P (8%)	$ 1,540,102
TOTAL	**$ 30,552,000**

The final cost to the City will include one selected biological treatment alternative and the required existing facility improvements outlined in the tables above. The selection of biological treatment alternative is derived from a comparison matrix outline in the following section.

ES 5.1 – Alternative Evaluation and Comparison Matrix

The developed approach to alternative evaluation incorporates cost effectiveness and non-economic factors important to the City. The final list of evaluation criteria and corresponding weighting for each alternative includes:

- Life Cycle Costs (30%)
- Initial Capital Cost (20%)
- Relative Capacity (20%)

- Operational Complexity (10%)
- Expandability and Scalability (10%)
- Reliability and Resiliency (10%)

The comparative ranking of each alternative according to the category of evaluation is summarized in Table ES8 below. Alternatives were ranked numerically from 1 to 5, with higher values indicating a more desirable rating. Conventional activated sludge (CAS) has been selected as the preferred alternative. Selection of a specific CAS variation will occur during the design phase of the project.

Table ES8. Alternatives Comparison Matrix.

Category	Weight	A-1 MBR	A-2 Activated Sludge	A-3 SBR
Capital Cost	20%	4.8	5.0	1.0
Life Cycle Cost	30%	4.2	5.0	1.0
Capacity	20%	4.2	5.0	1.0
Operational Complexity	10%	1.5	4.0	3.0
Expandability and Scalability	10%	4.0	2.7	1.0
Reliability and Resiliency	10%	1.7	3.0	2.5
TOTAL	**100%**	**3.8**	**4.5**	**1.4**

Alternative Selection

Based on the results derived from alternative evaluation, a continuous flow activated sludge process is the preferred biological treatment retrofit as part of the Capital Improvement Plan. This alternative provides the best solution to meet the planning criteria needs for the City's wastewater system. Considering this alternative and additional facility improvements listed in Table ES7, the overall project cost for the City is expected to be around $37.3M throughout the 20-year planning period. Equipment replacement will be initiated based on the estimated remaining lifespan and capacity of equipment. A projection of existing equipment capacity was prepared in Chart 5 (pg. 38). A summary of total project costs to meet future population growth is provided below in Table ES9.

Table ES9. Summary of Total Project Construction Costs.

Category	Cost
Conventional Activated Sludge Retrofit[1]	$ 13,123,000
Additional WWTP Infrastructure Improvements	$ 30,552,000
TOTAL	$ 43,675,000

1. Average of all three Activated Sludge Alternatives (ranges from $12.5-$13.5 million per alternative).

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1.0 INTRODUCTION AND BASIS OF PLANNING

This chapter is intended to update Sections 1.3 and 1.4 from the existing Facility Plan.

1.1 Facility Plan Background

The City of Middleton's Wastewater Treatment Plant (WWTP) currently operates under a Facility Plan (Master Plan), approved by IDEQ in 2019. The plan outlines existing equipment/operations and describes potential capital improvement plans to the treatment plant. All design conclusions were based on 20-year population projections finalized in 2019. A recent increase in population growth has exceeded original estimates identified in the Facility Plan and caused the City to evaluate various treatment processes on an accelerated schedule.

This report will update population growth estimates, identify capacities of existing equipment, and evaluate treatment alternatives. The existing Facility Plan identified three treatment biological treatment alternatives. Each alternative was intended to address future ammonia and phosphorus limits and population growth.

1. Add Additional SBR basins.
2. Retrofit SBR basins to Aerobic Granular Sludge (AGS) system.
3. Convert one SBR basin to a Membrane Bioreactor system.

After internal discussion, the City considers AGS to be an emerging technology and feels that a lack of operational expertise, both within the City and regionally disqualifies it from further consideration. In its place, the City wishes to evaluate three treatment alternatives, including three variations of continuous flow activated sludge. The five processes currently under consideration are listed below:

1. SBR Basin retrofit into Membrane Bioreactor system.
2. Conventional Activated Sludge
    a. SBR Basin retrofit into A^2O (Anaerobic/Anoxic/Oxic) system.
    b. SBR Basin retrofit into 5-stage Bardenpho system.
    c. SBR Basin retrofit into an A^2O Step Feed system.
3. Add Additional SBR basins

Detailed descriptions of treatment processes associated with each alternative can be found in Chapter 8. The Capital Improvement Plan for each proposed biological treatment alternative is discussed in Chapter 9. Additional treatment infrastructure upgrades outside of the biological process are discussed in Chapter 6.

1.2 Existing Wastewater Treatment System

The collections system for the Middleton WWTP spans approximately 22,000 acres or 35 square miles. Wastewater is treated through a two-basin sequencing batch reactor (SBR) treatment system constructed in 2011. Existing wastewater treatment equipment and processes are listed in Table 10.

Table 10. Existing Treatment Facilities.

Process	Make/Model/Specifications	Description
Screening	Huber Rotamat RoK4, ¼" Rotary Screen	Solids greater than ¼" are screened out of influent via perforated plate screens
Lift Station	(3) KSB, 850 gpm, 15 HP, Pumps	Wastewater is directed to a wet well where it is then pumped to grit removal
Grit Separator and Cyclone Classifier	WesTech vortex grit separator, self-priming grit pump, grit cyclone/classifier	Smaller particles are separated from the wastewater stream
Sequencing Batch Reactor (SBR) Basins	1-million-gallon volume per basin, two active basins, (2) 15 HP Flygt submersible mixers (per basin), (1) Flygt submersible WAS pump (per basin), 1,540 Sanitaire EPDM membrane diffusers	Batch treatment process involves filling, aeration, decant, and discharge (per cycle). Aeration provided via external blowers
Post-Equalization Basin	570,000 gallons, HDPE lined and covered	Intermediate storage prior to disinfection
Ultraviolet Disinfection	Two channels, Siemens HydroRanger ultrasonic level sensor	Bacteria, viruses, and pathogens are inactivated
Outfall	15" PVC gravity line	Treated wastewater is discharged to the Mill Slough and Bose River confluence

Figure 1. Middleton WWTP Existing Processes Map.

Although the SBR system produces high quality effluent under current conditions, some major components have limited hydraulic and biological capacities that will be exceeded with the projected population increase over the planning period.

1.3 Population Trends

Population projections developed in the existing Facility Plan were originally assembled from the June 2015 West Middleton Area Wastewater Collection Planning study referred to as the "West Collection System Study". In September 2015, the City also conducted a South Area Sewer Hydraulic Analysis, referred to as the "South Collection System Study". Based on these studies, the estimated population for planning year 2040 was originally 19,044 individuals at a 3.4% growth rate. This growth rate and capita projection was used in the 2019 Facility Plan.

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Using recent growth projections and developments already platted for short term growth, the City has provided an updated population projection. Updated population estimates are provided in Table 11 and Chart 1. Residential development projections for the City of Middleton are provided in Appendix A.

Table 11. City of Middleton Population Projections.

Year	Population	Average Annual Growth (%)	Equivalent Dwelling Unit (EDU)
1970	739	--	249
1980	1,901	9.9%	640
1990	1,851	-0.3%	623
2000	2,978	4.9%	1,003
2010	5,524	6.4%	1,860
2020	9,732	6.9%	3,277
2021	11,461	6.9%	3,859
2022	12,946	13.0%	4,359
2023	14,431	11.5%	4,859
2024	15,916	10.3	5,359
2025	17,190	8.0%	5,788
2026	18,565	8.0%	6,251
2027	20,050	8.0%	6,751
2028	21,654	8.0%	7,291
2029	23,386	8.0%	7,874
2030	24,555	5.0%	8,268
2031	25,783	5.0%	8,681
2032	27,072	5.0%	9,115
2033	28,426	5.0%	9,571
2034	29,847	5.0%	10,049
2035	31,340	5.0%	10,552
2036	32,907	5.0%	11,080
2037	34,552	5.0%	11,634
2038	36,280	5.0%	12,215
2039	38,094	5.0%	12,826
2040	39,998	5.0%	13,467

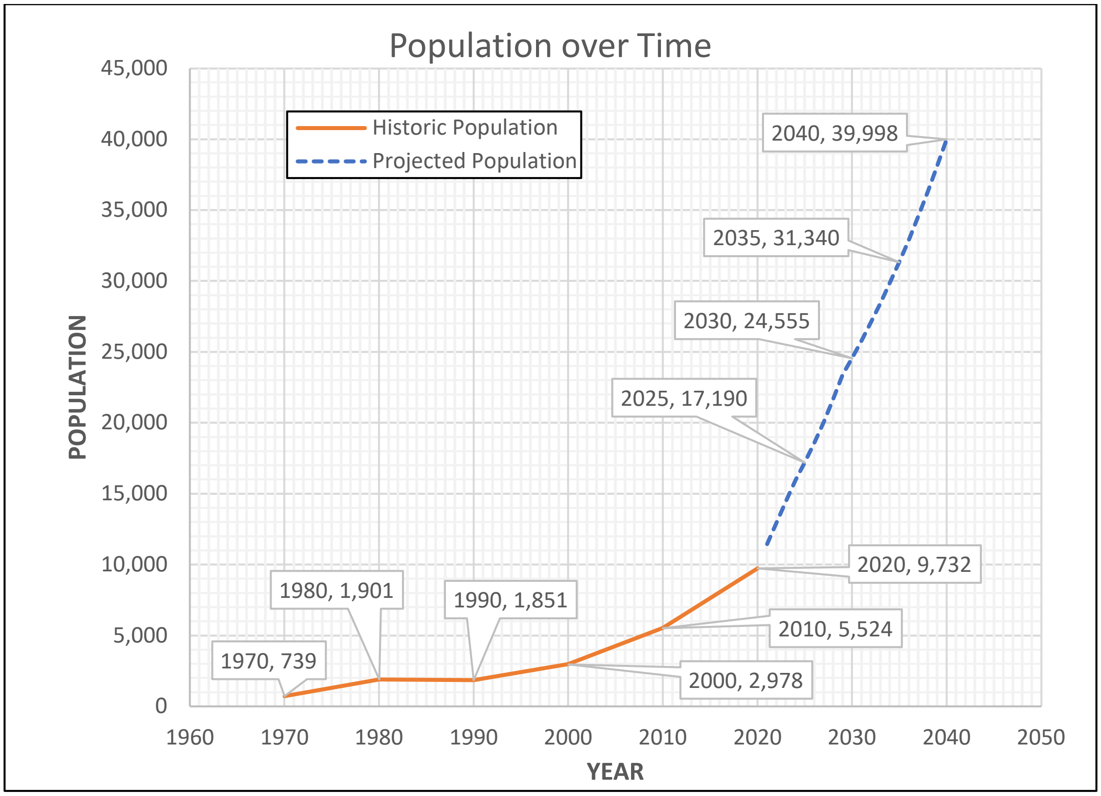

Chart 1. Population Projections over Time

1.4 Hydraulic Flow Planning Criteria

1.4.1 – Definition

The following flow parameters are used to define hydraulic capacities of existing and proposed treatment processes at the Middleton WWTP.

Annual Average Daily Flow (AADF):
The recorded daily flow averaged over a year.

Maximum Month Flow (MMF):
The largest volume of flow to be received during a continuous 30-day period.

Maximum Daily Flow (MDF):
The largest volume of flow to be received during a continuous 24-hour period.

Peak Hourly Flow (PHF):
The largest volume of flow to be received in a one-hour period.

1.4.2 – Existing Facility Plan Hydraulic Planning Criteria

The existing Facility Plan projected influent wastewater flows through the year 2040. Table 12 below presents the original hydraulic planning criteria.

Table 12. Existing Facility Plan Hydraulic Planning Criteria.

Parameter	Flow (MGD)							Domestic Flow (gpcd)
Year	2018	2020	2021	2025	2030	2035	2040	--
Population	9,100	9,732	11,461	11,510	13,613	16,101	19,044	--
AADF	0.82	1.04	0.76	1.23	1.45	1.70	2.01	90
MMF	1.05	1.34	0.96	1.57	1.85	2.18	2.56	115
PDF	1.14	1.45	1.07	1.70	2.01	2.36	2.79	125
PHF	1.82	2.32	3.09	2.73	3.21	3.78	4.46	200

Daily flow from January 2015 through July 2021 was plotted to review trends and is shown in Figure 2. Increasing hydraulic flows have been observed from the data set corresponding with increasing population growth. The historical flow data presented below is used to update per capita flow values for the facility. A summary of recent documented flows is provided in Table 13.

Table 13. Summary of Historic WWTP Influent Flows.

Year	Average Daily Flow (MGD)	Maximum Daily Flow (MGD)
2017	0.628	0.922
2018	0.661	0.982
2019	0.702	0.972
2020	0.743	1.059
2021[1]	0.756	1.066

1. Through July of 2021.

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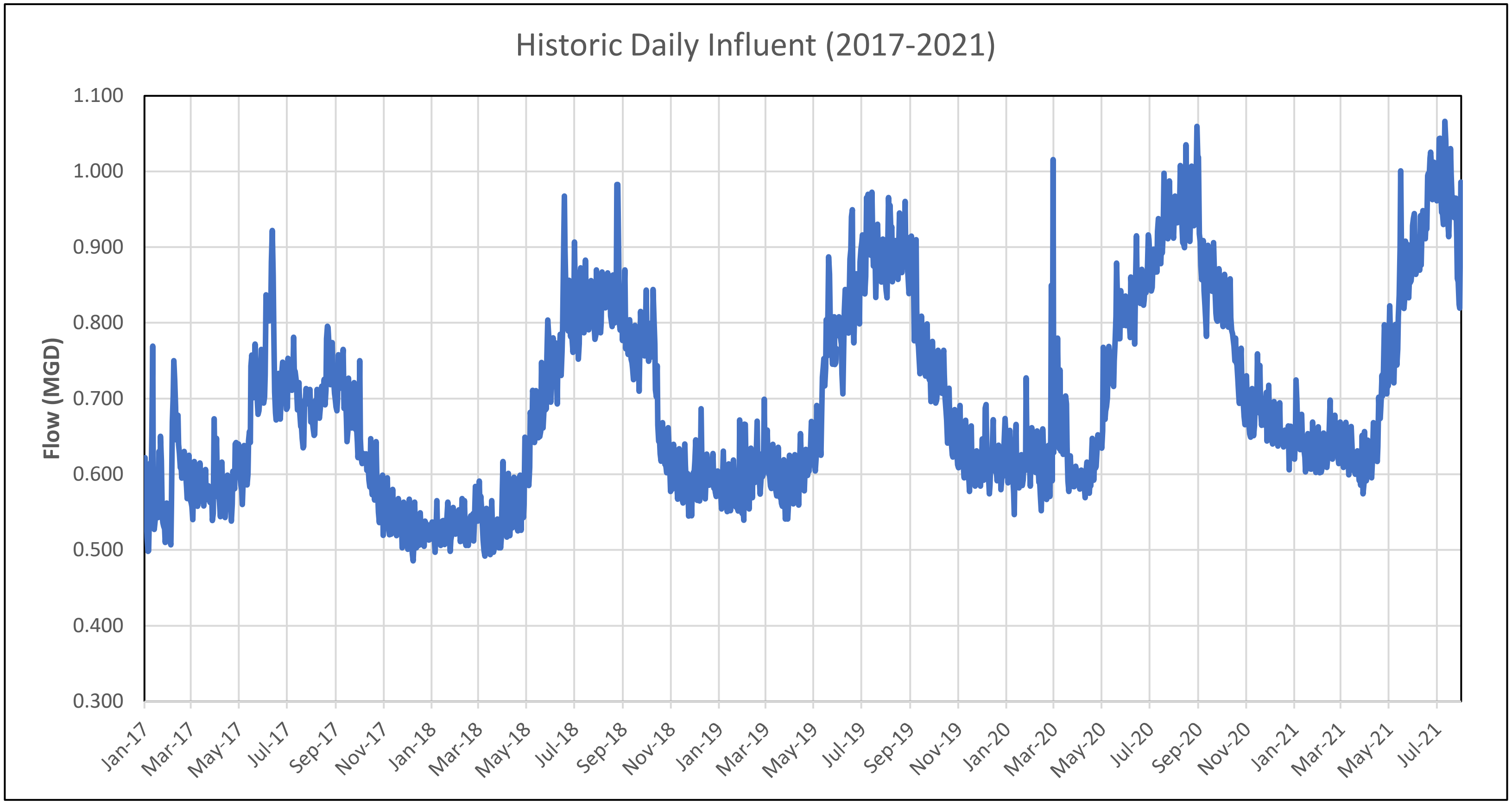

Figure 2. Historic Influent Hydraulic Flows.

1.4.3 – Amended Hydraulic Planning Criteria

Using recent WWTP influent flow rates and discussions with City staff, the following wastewater flow projections summarize updated planning flows based on new population projections. Each of these parameters are important in characterizing wastewater flows as well as adequately designing and planning for future growth. Per capita domestic influent flows were calculated using the most recent (2019-2021) data. This data set was selected due to the rapid community growth occurring during this period and compared against the full range of data from 2015 through 2021. Updated hydraulic planning projections using per capita flows are provided in Table 14. The planning criteria defined in Table 14 will be used as the hydraulic design basis throughout this report. The total hydraulic planning criteria below includes residential, and the small amount of commercial flow generation expected during the evaluation period.

Table 14. Updated hydraulic Planning Criteria.

Parameter	WWTP Flows (MGD)					Domestic Flow (gpcd)
Year	2020	2025	2030	2035	2040	
Population	9,732	17,190	24,555	31,340	39,998	--
AADF	0.69	1.2	1.7	2.16	2.75	68
MMF	0.87	1.51	2.14	2.73	3.47	86
MDF	1	1.73	2.45	3.11	3.96	98
PHF	2.03	3.25	4.35	5.31	6.49	Varies

Each of the calculated flow types has a corresponding flow factor. The max month flow factor is nearly identical to the existing Facility Plan max month flow factor of 1.27. Additional flow factors derived from recent data and used in planning criteria calculations are presented below in Table 15.

Table 15: Flow Factors

Flow Factors	
Flow Type	Factor
Average Daily Flow (ADF)	N/A
Maximum Month Flow (MMF)	1.26
Maximum Day Flow (MDF)	1.44
Peak Hour Flow (PHF)	Ten states standards method, varies with population

The flow categories defined in section 1.4. correspond with different treatment processes at the facility. For example, the headworks of the WWTP is based on peak hour flow (PHF) and the design flow for this component is 6.49 MGD through 2040. Discussions for each existing treatment component and corresponding design flows can be found in Chapter 6.

Compared to the existing Facility Plan, the estimated per capita flows are lower than originally projected. Recent community growth, low flow appliances, recent reductions in I&I and reducing wastewater point sources (splash pad) have all contributed to lower per capita flow rates. Using City provided historical population values and WWTP influent flow data, per capita wastewater generation has been updated in this addendum.

Industrial Flows

Currently there are no industrial entities connected to the City's wastewater collections system; however, planning for potential industrial development is strongly considered when comparing viable alternatives. Alternative's that can be quickly expanded to accommodate industrial sources will be given higher scores over other alternatives presented.

Commercial Flows

In the existing Facility Plan, the City identified several areas which are likely to develop with commercial services through 2040. The existing Facility Plan estimates an average commercial waste flow of 1,130 gallons per acre per day (gpad), with twenty-eight (28) acres of commercial development allocated for the planning period. The hydraulic planning flows in Table 14 above, include this limited commercial flow.

Infiltration and Inflow (I/I)

Infiltration and inflow (I/I) are excess groundwater and stormwater that enters the collection system. The existing Facility Plan indicates that approximately 71% of the City's collection system is newer plastic pipe installed since 2000. The City has also indicated that additional improvements to older areas of the collections system are being performed to reduce groundwater infiltration. Even though the City is planning on upgrading the collection system to reduce infiltration of groundwater, historical infiltration and inflow is still accounted for in the updated planning criteria presented in this report. The per capita flow rates adopted in Table 14 are based off historical flow rates and include provisions for groundwater infiltration into the collections system.

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1.5 Waste Load Development

1.5.1 – Waste Load Development

Projected waste loads in the Master Plan were developed from historical pounds per capita per day (ppcd) generation rates for BOD, TSS, nitrogen and phosphorus. The existing Facility Plan prepared normalized per capita generation rates for contaminants based on an analysis of DMR data from 2014 to 2018.

Additional data from 2019 and 2020 reporting years was also compared to the 2014-2018 design criteria developed in the existing Facility Plan. As shown in Table 16, per capita generation rates for these two additional years were generally consistent with the 2019 Facility Plan observations.

Table 16. Historical Per Capita Waste Loads.

Historical Per Capita Waste Loads								
Parameter	2014	2015	2016	2017	2018	2019	2020	AVG
Population	6,383	6,800	7,168	7,439	9,100	9,682	9,732	--
BOD (ppcd)								
ADF	0.171	0.145	0.114	0.199	0.187	0.157	0.155	0.16
MMF	0.228	0.209	0.189	0.281	0.307	0.182	0.204	0.23
TSS (ppcd)								
ADF	0.177	0.113	0.073	0.206	0.177	0.142	0.150	0.15
MMF	0.263	0.175	0.165	0.359	0.402	0.174	0.202	0.25
Ammonia (ppcd)								
ADF	0.024	0.020	0.022	0.024	0.023	0.019	0.019	0.022
MMF	0.029	0.025	0.025	0.028	0.027	0.023	0.027	0.026
Total Nitrogen (ppcd)								
ADF	0.032	0.028	0.028	0.034	0.033	0.026	0.028	0.030
MMF	0.036	0.031	0.033	0.044	0.039	0.029	0.035	0.035
Total Phosphorus (ppcd)								
ADF	0.004	0.005	0.005	0.007	0.006	0.005	0.005	0.005
MMF	0.005	0.007	0.006	0.010	0.008	0.005	0.008	0.007

Note: Data from years 2014 – 2018 was adapted from the 2019 facility plan. Years 2019 and 2020 were gathered from plant records. The 2018 value is missing data from December of 2018.

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1.5.2 – Waste Load and Hydraulic Design Summary

Historical plant influent data and City input was used to calculate base domestic flow and loadings. Population estimates for the planning period were provided by the City Planning Department. The design flow and loading for proposed plant improvements contained in this report is listed in Table 17 below.

Table 17: Design Flow and Loading Summary.

Parameter	Unit	2020	2025	2030	2035	2040
Population	---	9,732	17,190	24,555	31,340	39,998
Average Flow	MGD	0.69	1.20	1.70	2.16	2.75
Max Mo. Flow	MGD	0.87	1.51	2.14	2.73	3.47
Max Day Flow	MGD	1.00	1.73	2.45	3.11	3.96
Peak Hour Flow	MGD	2.03	3.25	4.35	5.31	6.49
BOD_5[1]	mg/L | lb/d	314 mg/L			9,092 lb/d	
TSS[1]	mg/L | lb/d	294 mg/L			8,513 lb/d	
Ammonia (NH_3-N)[1]	mg/L | lb/d	40.9 mg/L			1,186 lb/d	
Total Nitrogen[1]	mg/L | lb/d	55.4 mg/L			1,606 lb/d	
Total Phosphorus[1]	mg/L | lb/d	9.8 mg/L			284 lb/d	
Alkalinity[2]	mg/L as $CaCO_3$	250 mg/L				

1. Average winter concentration data used in the sizing of biological treatment process presented in Chapter 8. Loadings based on max month flow.
2. Alkalinity value is assumed.

1.6 Effluent Discharge Permit

1.6.1 – Existing Permit Criteria

The City of Middleton currently discharges treated effluent under National Pollution Discharge Elimination System (NPDES) Permit No. ID-002183-1 shown in Table 18. The City's existing permit went into effect on November 2, 1999 with an expiration date of November 2, 2004. In 2018 the State of Idaho began to administer the Idaho Pollutant Discharge Elimination System (IPDES program), thereby replacing the National Pollutant Discharge Elimination System. The existing NPDES for the Middleton WWTP is provided in Appendix E.

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Table 18: Current NPDES permit for Middleton.

Parameter	Effluent Limitations			Monitoring Requirements		
	Average Monthly Limit	Average Weekly Limit	Daily Maximum Limit	Sample Location	Sample Frequency	Sample Type
Flow, MGD	---	---	---	Effluent	Continuous	Recording
Biological Oxygen Demand (BOD5)	45 mg/L 687 lb/d	65 mg/L 992 lb/d	---	Influent and Effluent	1/week	8-hour composite
Total Suspended Solids (TSS)	70 mg/L 1070 lb/d	105 mg/L 1605 lb/d	---	Effluent	1/week	8-hour composite
Fecal Coliform Bacteria 05/01 – 09/30	50/100 mL	100/100 mL	500/100 mL	Effluent	5/week	grab
Fecal Coliform Bacteria 10/01 –04/30	100/100 mL	200/100 mL	800/100 mL	Effluent	5/week	grab
E. coli Bacteria	---	---	---	Effluent	5/week	grab
Total Residual Chlorine (Interim Limit)	0.5 mg/L	---	---	Effluent	1/week	grab
Total Residual Chlorine (Final Limit)	0.048 mg/L	---	0.067 mg/L	Effluent	1/week	grab
Total Ammonia as N, mg/L	---	---	---	Effluent	1/month	8-hour composite
Total Kjeldahl Nitrogen, mg/L	---	---	---	Effluent	1/month	8-hour composite
Nitrate-Nitrite, mg/L	---	---	---	Effluent	1/month	8-hour composite
Total Phosphorus, mg/L	---	---	---	Effluent	1/month	8-hour composite
Ortho-Phosphate, mg/L	---	---	---	Effluent	1/month	8-hour composite
Temperature, °C	---	---	---	Effluent	3/week	grab

1.6.2 – Updated Planning Permit Criteria

Idaho DEQ has administratively extended the City's current permit and it remains in effect. The City has had several discussions with IDEQ with regards to receiving a new IPDES permit. It is unknown when the new IPDES permit will be issued and what the compliance schedule will be. At this time, DEQ has provided a preliminary framework of planning effluent requirements that can be expected for the future IPDES permit. While not finalized,

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these limits will serve as the basis for future capital improvement projects at the plant. The updated IPDES limits are provided in Table 19.

Table 19: Planning IPDES permit for Middleton

Parameter	Unit	2040 Planning Effluent Requirements					
		Monthly Average Limit	Monthly Geometric Mean Limit	Weekly Average Limit	Weekly Maximum Limit	Daily Maximum Limit	Instantaneous Maximum Limit
Flow, MGD	mg/L	---	---	---	---	---	---
Biological Oxygen Demand (BOD_5)	mg/L lb/d %removal	30 640 85 (min)	--- --- ---	45 960 ---	--- --- ---	--- --- ---	--- --- ---
Total Suspended Solids	mg/L	30	---	45	---	---	---
	lb/d	640	---	960	---	---	---
	%removal	85 (min)	---	---	---	---	---
Total Nitrogen	mg/L lb/d	--- ---	--- ---	--- ---	--- ---	--- ---	--- ---
Ammonia as N 05/1 –09/30	mg/L lb/d	10.2 171.1	--- ---	--- ---	--- ---	--- ---	--- ---
Ammonia as N 10/ 1 – 04/30	mg/L lb/d	10.5 175.8	--- ---	--- ---	--- ---	--- ---	--- ---
Total Phosphorus 05/01 – 09/ 30	mg/L lb/d	--- 1.5	--- ---	--- ---	--- ---	--- ---	--- ---
Total Phosphorus 10/ 1 –4/ 30	mg/L lb/d	--- 5.3	--- ---	--- ---	--- ---	--- ---	--- ---
E. coli	#/100mL	---	126	---	---	---	---
pH	s.u.	Instantaneous min. and max. between 6.5 and 9.5					
Temperature 11/01 – 05/ 31	°C	---	---	---	13	---	---
Temperature 06/1 –10 31	°C	---	---	---	19	---	22

The differences between the City's administratively extended NDPES permit and proposed IPDES permit is summarized in Table 20 below. The delivery and implementation of the new IPDES permit is not yet known at this time.

Table 20. Summary of IPDES Permit Changes.

Constituent	Unit	Current (Avg Monthly Limit)	Proposed (Avg Monthly Limit)	Current (Avg Weekly Limit)	Proposed (Avg Weekly Limit)
BOD	mg/L	45	30	65	45
	lb/d	687	640	992	960
TSS	mg/L	70	30	105	45
	lb/d	1070	340	1605	960
Ammonia	mg/L	---	10.5	---	---
	lb/d	---	175.8	---	---
Phosphorus	lb/d	---	5.3	---	---
		Current (Weekly Limit)	Proposed (Weekly limit)	Current (Inst. Limit)	Proposed (Inst. Limit)
Temperature	°C (11/01-05/31)	---	13	---	---
	°C (06/01-10/31)	---	19	---	22
		Current (Monthly Mean Limit)		Proposed (Monthly Mean Limit)	
E. Coli	#/100 mL	---		126	

The change in BOD and TSS permit requirements comes as part of stricter technology-based limits triggered by Middleton's treatment upgrades since the previous permit cycle. Changes in ammonia and phosphorus limits are a result of updated allowable discharge concentration into the Boise River. The ammonia requirement is expected to be applied in the first permit cycle, phosphorus compliance will be expected in the second permit cycle, and compliance for temperature in the third permit cycle.

Updated Effluent Limits with Respect to Flow

Since Middleton projects a significant population growth increase within the planning period, it is prudent to examine the effect of flow rate on the planned effluent requirements. Table 21 lists the concentrations required to meet the effluent mass limits for BOD, TSS, ammonia, and phosphorus over a range of flows. For total phosphorus, only a mass based effluent requirement is planned. For BOD, TSS, and ammonia, effluent concentration currently constitutes a more stringent permit requirement. However, as Middleton's wastewater flows increase, the mass limits will eventually become the more stringent requirement. When this occurs, treatment to below the permit effluent concentration will be required to fulfil the permit mass discharge requirements. In Table 21, empty cells indicate that concentration is the controlling effluent requirement; filled cells represent the concentrations required to meet the mass limit once mass rate has become the more stringent effluent requirement. For BOD and TSS, flows above 2.56 MGD will cause the BOD and TSS discharge to be mass rate controlled. For ammonia, a flow above 2.01 MGD will cause ammonia discharge to be mass rate controlled. At a 2040 flow of 3.47 MGD, effluent monthly average concentrations of approximately 21.9, 5.9, and 0.05 mg/L will be required for BOD and TSS, ammonia, and phosphorus, respectively.

Table 21: Concentrations required to meet the planning IPDES permit mass discharge requirements.

	Future Permit Effluent Requirements					
	BOD and TSS		Ammonia		Phosphorus	
Unit	Monthly Average	Weekly Average	Monthly Average (Summer)	Monthly Average (Winter)	Monthly Average (Summer)	Monthly Average (Winter)
lb/d	640	960	171.1	175.8	1.5	5.3
mg/L	45	30	10.2	10.5	N/A	N/A
Flow (MGD)	Required Effluent Concentration to Meet Mass Limit (mg/L)					
1.00	---	---	---	---	0.18	0.64
1.25	---	---	---	---	0.14	0.51
1.50	---	---	---	---	0.12	0.42
1.75	---	---	---	---	0.10	0.36
2.00	---	---	---	10.5	0.09	0.32
2.25	---	---	9.1	9.36	0.08	0.28
2.50	---	---	8.2	8.43	0.07	0.25
2.75	27.9	41.8	7.5	7.66	0.07	0.23
3.00	25.6	38.3	6.8	7.02	0.06	0.21
3.25	23.6	35.4	6.3	6.48	0.06	0.20
3.50	21.9	32.9	5.9	6.02	0.05	0.18
3.75	20.5	30.7	5.5	5.62	0.05	0.17
4.00	19.2	28.8	5.1	5.27	0.04	0.16

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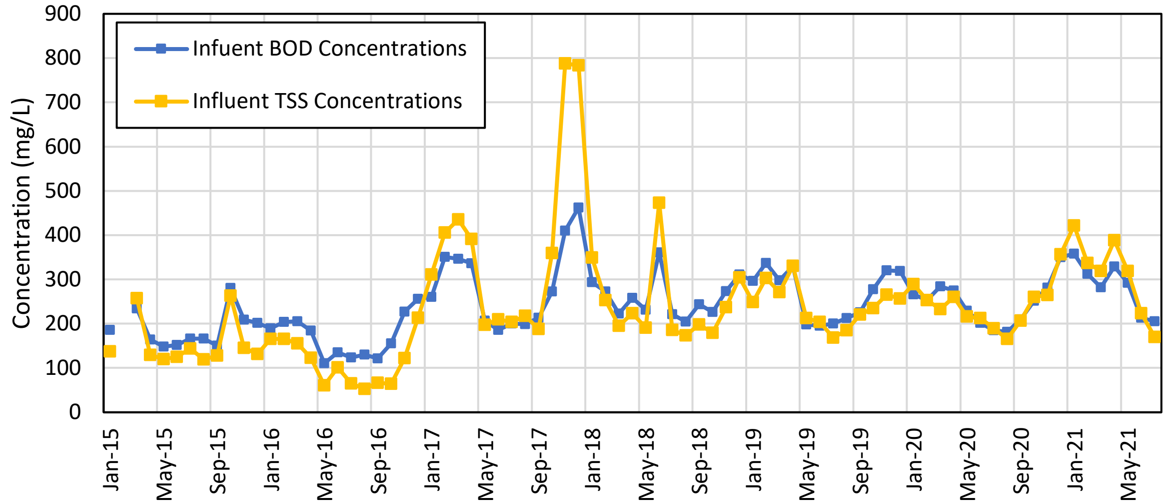
6.0 WWTP CAPACITY AND PERFORMANCE

This chapter will update Sections 6.1, 6.2, and 6.3 of the existing Facility Plan.

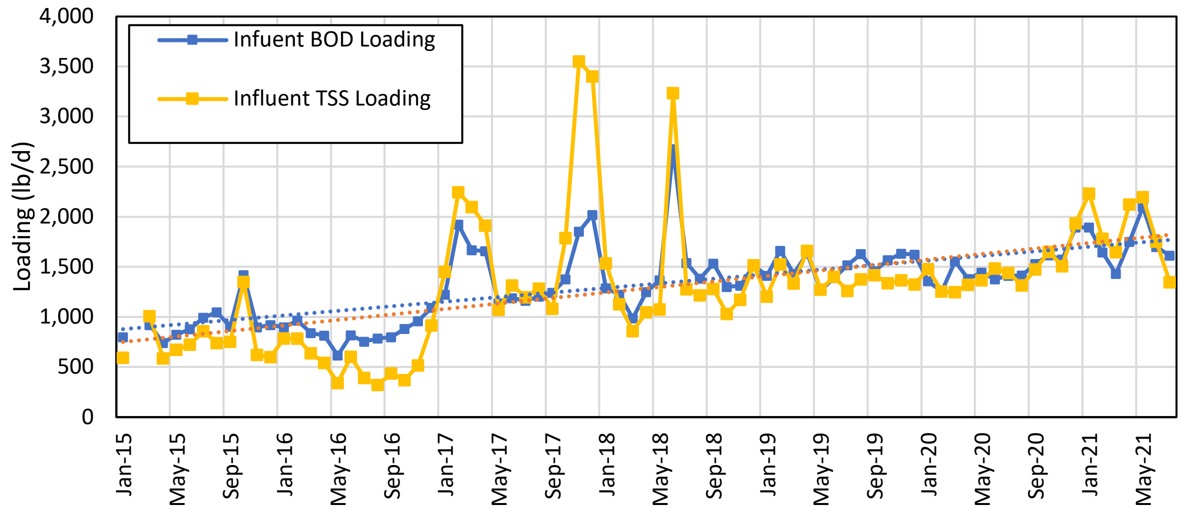
6.1 Influent Quality

In the existing Facility Plan, influent concentrations and loadings were provided from 2014 through November of 2018 for BOD_5, TSS, ammonia, total nitrogen, total phosphorus, and temperature. This section will further update influent characterization through July of 2021. These changes present minor alterations to the original planning basis for the WWTP. The planning changes are necessary due to rapid population growth for the area than originally anticipated. Data in the following charts are provided beginning in 2015 to provide continuity to the existing Facility Plan.

Influent BOD_5 and TSS monthly average concentrations and loadings are provided in the charts below. During the winter of 2017 to 2018 as well as the summer of 2018, high loading events for BOD and TSS were observed. These outliers are assumed to be due to the use of Geotubes as a trial for dewatering effectiveness where filtrate was returned back to the headworks and sampling area. Abnormally high readings have not been repeated since. Beginning in July of 2018, BOD and TSS concentrations have held steady and exhibit typical winter concentrating and summer diluting effects. Loadings for BOD and TSS have been observed to steadily increase during the observed period. See Chart 2 below for documented BOD and TSS loadings at the WWTP.



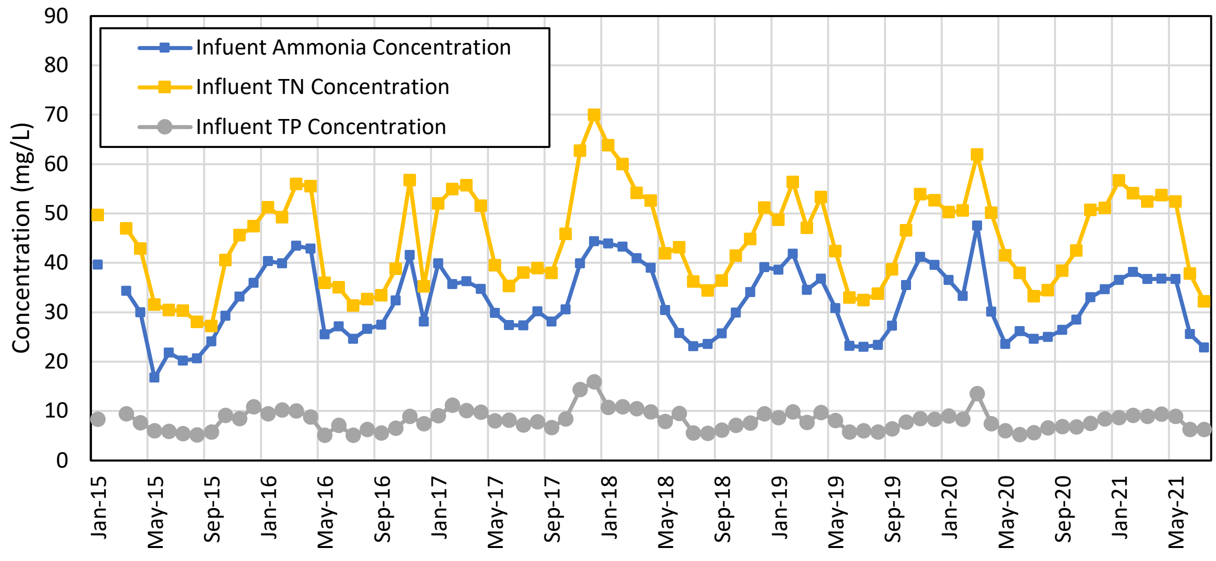
a) Concentrations



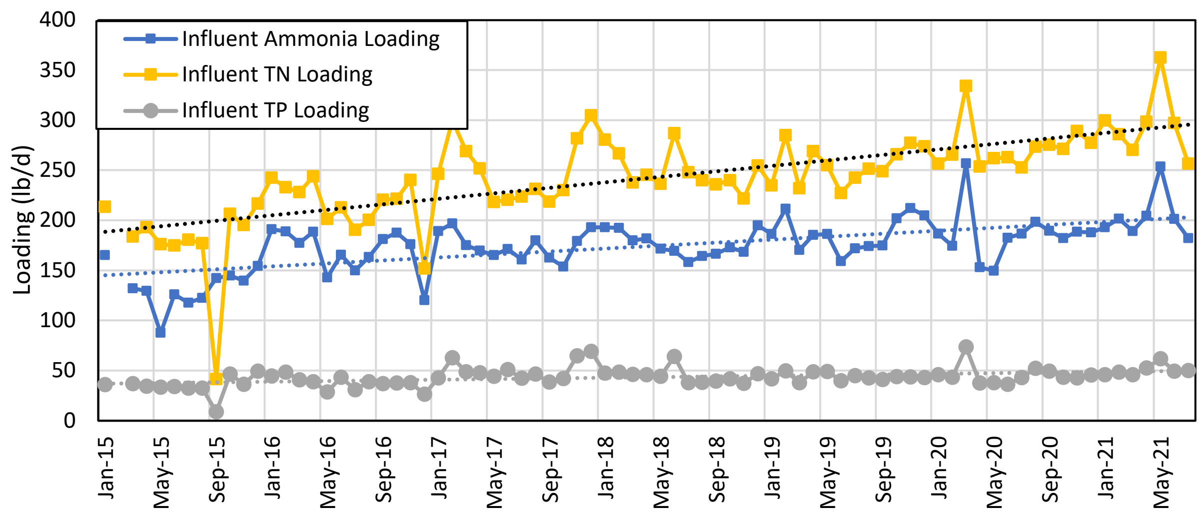
b) Loadings

Chart 2: BOD5 and TSS influent monthly averages

Influent average monthly ammonia, total nitrogen (TN), and total phosphorus (TP) concentrations and loadings are provided in Chart 3. The winter of 2017 to 2018 appears to include a high concentration event, though this is not as pronounced as with BOD_5 and TSS. Concentrations of these nutrients hold constant from year to year, whereas loadings have increased gradually from 2017 onwards, due to local population increases and correlating increase in influent flows to the plant.



a) Concentrations



b) Loadings

Chart 3: Ammonia influent monthly averages

Maximum and minimum monthly influent temperatures are presented in Chart 4. Summer maximum temperature is 22°C and winter minimum temperature is 10°C. No year-to-year increase or decrease is observable in the influent temperature.

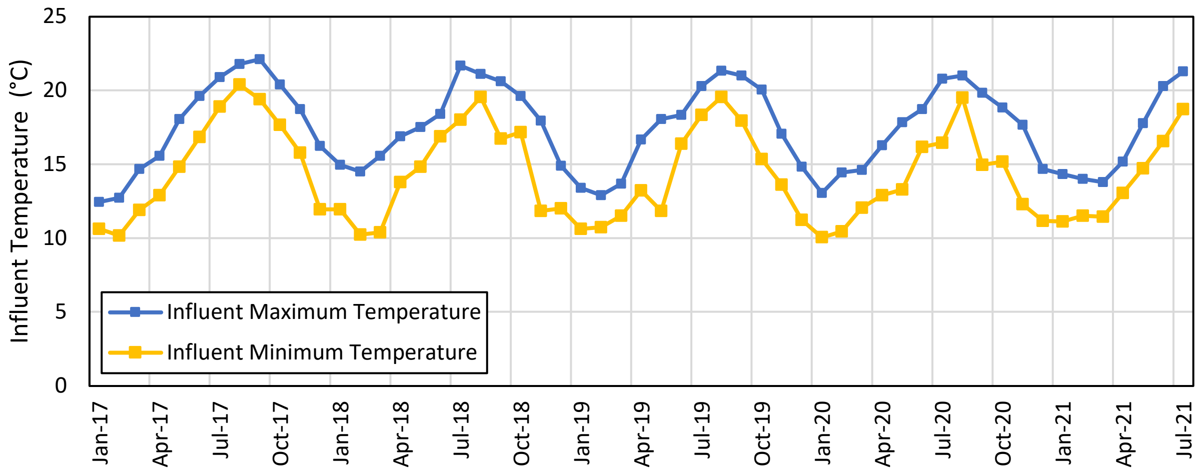


Chart 4: Maximum and minimum monthly average influent temperatures

6.2 Effluent Quality

In the existing Facility Plan, effluent concentrations, loadings, and percent removals are published from 2014 through November of 2018 for BOD_5, TSS, fecal coliform count, E. coli count, pH, ammonia, total phosphorus, and temperature. This section updates these charts through July of 2021. Data is provided beginning in 2015 to provide continuity. All charts discussed in the following sections are provided in Appendix D (*if denoted by "Chart #A"*). A summary of data discussed throughout this section is provided in Table 22 below.

Table 22. Effluent Quality Data Summary.

Parameter	Average Monthly Effluent Quality (mg/L)
BOD	4.32
TSS	3.99
Fecal Coliform (CFU/100mL)[1]	75
E. Coli (CFU/100mL)[1]	1.61
Ammonia	8.52
Total Phosphorus	3.54
Temperature (°C)	16.56

1. Unit of measurement is colony forming unit (CFU) per 100 mL of water.

BOD

BOD effluent concentration, loading, and percent removal are shown in Chart 1A. The WWTP has no exceedances during this period for BOD_5. The plant produces BOD_5 effluent with concentrations less than 10 mg/L, and regularly less than 5 mg/L, which is sufficient to meet both the planning monthly requirement (30 mg/L, 640 lb/d, and 85% removal) and weekly requirement (45 mg/L and 960 lb/d).

TSS

TSS effluent concentrations, loading, and percent removal are shown in Chart 2A. The WWTP has no exceedances during this period for TSS. The plant produces an excellent TSS effluent with concentrations ranging from 5 mg/L to 10 mg/L which is sufficient to meet the planning monthly requirement (30 mg/L, 640 lb/d, and 85% removal) and weekly requirement (45 mg/L and 960 lb/d).

Coliform

Effluent fecal coliform count is displayed in Chart 3A and E. coli count is displayed in Chart 4A. The WWTP has no exceedances for fecal coliform count during the period of January 2017 through July 2021, either for monthly geometric mean, weekly geometric mean, or daily maximum. Though the WWTP does not have an E. coli effluent limit as part of its current NPDES permit, the facility produces an effluent E coli count well below what is required by the planning IPDES permit for monthly geometric mean.

Ammonia

Effluent ammonia concentration and loading is shown in Chart 5A. The current NPDES permit in effect does not have an effluent ammonia limit and therefore, ammonia is not currently treated to what is required by the planning IPDES permit. Treatment of ammonia during summer conditions is typically adequate, however violations of the planning permit will occur nearly every winter due to lower influent temperature and reduced nitrification rate. Future treatment of ammonia is of high importance when considering viable upgrade alternatives for the City.

Phosphorus

Effluent total phosphorus loading is displayed in Chart 6A. Middleton's current SBR system does not have the capability to biologically treat phosphorus to the level required by the planning IPDES permit. Operators experimented with enhanced biological phosphorus removal (EBPR) during 2020 summer season with mixed results. It is expected that future tertiary treatment for phosphorus will be required to meet the mass limits presented in the

IPDES planning permit. The City is currently engaged in a pilot program with aim to meet future phosphorus limits via reuse.

Temperature

Effluent weekly average temperature and maximum daily temperature are shown in Chart 7A. Neither the summer nor winter maximum temperature limits are currently achieved by the WWTP. Weekly average temperatures of 23°C are often reacted during peak summer months (compared to the planning maximum of 19°C). Weekly average temperatures of 17°C are often reached during the beginning or end of the winter months (compared to the planning maximum of 13°C). The planning instantaneous maximum temperature of 22°C is also not met during peak summer conditions.

6.3 Capacity Limitations

A detailed overview of the treatment capacity and conditions of Middleton's existing wastewater treatment infrastructure is provided in the existing Facility Plan. This section presents updated life cycles of each major treatment process which have changed as a result of the updated population planning criteria. This section will update the existing section 6.3 of the Facility Plan with respect to capacity, reliability, and redundancy.

Middleton's wastewater treatment system currently consists of influent screens, influent lift station, grit removal, sequencing batch reactor (SBR) basins, a post-equalization basin, and UV disinfection. Figure 3 on the next page illustrates the process flow diagram of the existing treatment facilities at the Middleton WWTP.

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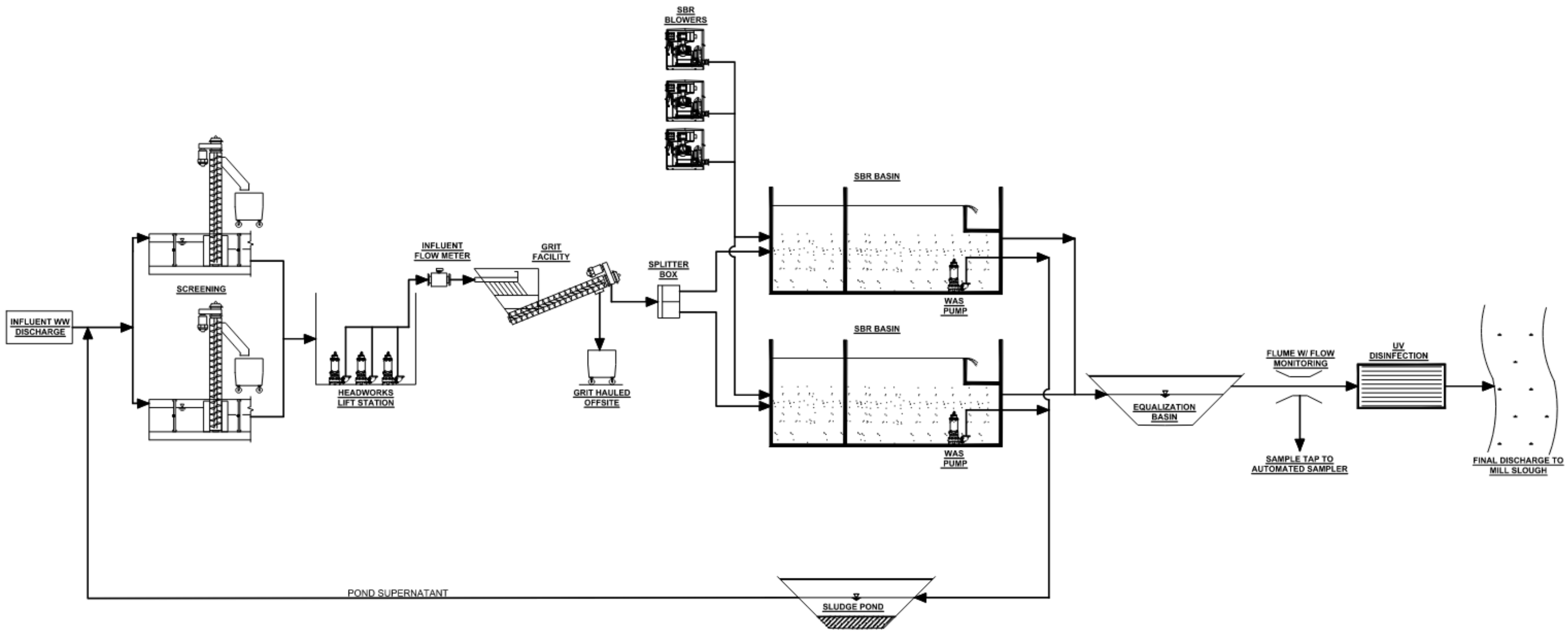

Figure 3. Middleton WWTP Existing Process Flow Diagram.

6.3.1 – Influent Screens

Process Description:

The influent screens are located within the headworks building situated at the southeast corner of the plant. The screens receive influent from a 30-inch gravity sewer trunk that transfers wastewater from the collections system. Here, solids greater than 1/4-inch size are removed from the influent stream. Currently there are two vertical, perforated plate screens receiving raw influent. The screens are cleaned on an as-needed basis and screenings are discarded to a City receptacle.

Current Condition and Comments:

The screens do not always receive an equal division of influent flow. Influent gates are manually used by City staff in an attempt to regulate flow. The City commented that automatically actuated gates would be ideal for this system process which will be considered when screens need a capacity upgrade. Each unit's screening basket is located in a 15-foot-deep influent wet well. To maintain the system, operators must either pull the screens through a hatch in the headworks building roof or enter a confined space in the wet well. Ideally, new screens added to the system would be located above grade or provided with easier maintenance access. This would require additional solids handling pumps or major modifications to the wet well configuration.

Capacity:

The hydraulic capacity of each screen is 4.2 MGD based on the manufacturer's rating. Two screens are provided in case one should be out of service. Influent screens are projected for upgrades by the year 2029, with an estimated maximum service population of 23,386 people.

Cost Estimate:

Upgrades to influent screens are projected to be required during the planning period. Planning level cost estimates for this upgrade include the replacement of both screens, modifications to the existing screen building, and procurement of valves and instruments. This treatment component upgrade is estimated to cost $988,900 as a one-time cost during the planning period.

Trigger for Decommissioning, Replacement, or Upgrade:

This unit operation is expected to reach capacity within the planning period. Replacement of the screens will be primarily to (1) increase screening hydraulic capacity, and (2) to implement a more operationally and maintenance friendly screening type. As the screens

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have been in use for 10 years, it is estimated that they will need to be replaced by the time a capacity upgrade is scheduled.

6.3.2 – Influent Lift Station

Process Description:

From the screens, wastewater then flows to the influent lift station where three (3) 15 HP, submersible KSB pumps currently transport water via a 14-inch, C-900 PVC force main to the grit removal building. Each pump has a rated capacity of 825 gpm.

Current Condition and Comments:

Three (3) pumps are currently active in the influent lift station with room for a fourth pump available. Capacity requirements must be satisfied with one pump out of service.

Capacity:

The lift station has a firm capacity of 3.56 MGD with three active pumps and one standby pump. The existing spare shelf influent pump must be added to the lift station to meet increasing demand. The 4-pump lift station's capacity will be exceeded by 2027 where the peak hourly flow is projected to be greater than 2,500 gpm.

Cost Estimate:

The cost estimate of the influent lift station upgrade includes the replacement of pumps with larger capacity ones and adjustments to mechanical piping. This component is expected to cost $622,000 as a one-time cost during the 20-year planning period.

Trigger for Decommissioning, Replacement, or Upgrade:

Equipment condition (wear and tear) is not expected to be an issue with this unit operation if pumps are maintained regularly, and spare parts are on hand. Replacement of this unit operation will be triggered by capacity limitations.

6.3.3 – Influent Force Main

Process Description:

A 14-inch C-900 PVC force main transfers wastewater from the headworks to the grit facility located near the SBR basins.

Capacity:

At a peak flow velocity just over 8 ft/s, the 14-inch force main has an approximate hydraulic capacity of 5.8 MGD. Based on PHF conditions, this pipe is estimated to exceed its capacity

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by 2037. Therefore, this component will require an upgrade near the end of the 20-year planning period.

Cost Estimate:

The influent force main is proposed to be upgraded to an 18-inch HDPE DR17 pipe that spans approximately 1000 feet. The estimated cost for this component is $500,000 for the planning period.

Trigger for Decommissioning, Replacement, or Upgrade:

Equipment condition (wear and tear) is not expected to be an issue with this infrastructure. Rather, replacement of this unit operations will be triggered by capacity limitations.

6.3.4 – Grit Removal

Process Description:

Grit removal takes place in a single building housing multiple processes including a WesTech vortex grit separator, grit pump, and grit cyclone/classifier. The grit facility is located just south of the existing SBR basins.

Current Condition and Comments:

The grit facility was installed in 2011. Grit is discharged in a dumpster located outside of the grit building where City staff report freezing issues in the winter months. There is only one grit separator, so if the system is out of service, the bypass channel must be used.

Capacity:

The estimated hydraulic capacity of this process is calculated to be 4.2 MGD. The hydraulic capacity for this component is expected to be exceeded by 2029.

Cost Estimate:

The grit facility is proposed to be expanded during the 20-year planning period. The cost estimate for this treatment component includes new equipment, building expansion, new piping and instrumentation, as well as general site work. During the 20-year planning period this facility is estimated to require $1,215,500 in upgrades.

Trigger for Decommissioning, Replacement, or Upgrade:

Equipment condition (wear and tear) is not expected to be an issue with this infrastructure. Rather, expansion of this unit operations will be triggered by capacity limitations.

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6.3.5 – SBR Basins

Process Description:

A splitter box directs flow from the grit removal building to two SBR basins. Each basin has an approximate storage volume of one million gallons. Each basin comes equipped with a fine bubble diffuser grid and two 15-HP submersible mixers to provide anoxic mixing. Three, positive displacement 75 HP blowers provide oxygen to the system. Middleton's SBR operates as a continuous flow system using Sanitaire's intermittent cycle extended aeration (ICEAS) SBR design.

Current Conditions and Comments:

The SBR basins and ancillary equipment are in relatively good shape and working order. The SBR system consistently meets Middleton's existing NPDES permit but does not have the treatment capacity to meet future IPDES planning limits or community growth. Additionally, the SBR cycles must be offset from one another as the existing blowers can only supply oxygen for one basin during the react phase.

Capacity:

Middleton's ICEAS SBR system was modeled using Biowin wastewater simulation software. The plant's current equipment was integrated into the model, including blowers, diffusers, basin volumes, WAS pumps and cycle times. The current WWTP's capacity was based on future IPDES effluent planning limits and the design influent criteria in Table 17, located in section 1.5.2. The winter influent temperature of 10° C and the future effluent ammonia limit of 10.5 mg/L (175.8 lb/d) control the capacity of the existing plant. This is due to decreased nitrifier growth observed at lower wastewater temperatures. The process model anticipates the existing plant will have a maximum capacity of 1.5 MGD under the limiting winter scenario. This corresponds to an estimated lifespan being exceeded by year 2025. As the City approaches the maximum capacity estimate, the aeration portion of the SBR cycle must be extended to meet planning limits for ammonia.

Trigger for Decommissioning, Replacement, or Upgrade:

As a whole, retrofit of this unit operation is expected due to the City's desire to move to a higher capacity secondary treatment technology. Within this unit operation however, the blowers have reached the end of their useful life and will not be able to be reused as part of a different treatment technology. The existing SBR basins will be reused with a different treatment technology.

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6.3.6 – Post-Equalization Basin

Process Description:

The SBR's discharge to a covered pond with a 570,000-gallon working volume. The purpose of this step is to equalize decanted flow from the SBR basins before being processed through the UV disinfection channels. It is likely that a portion of the pond will be used as a wastewater reuse storage volume.

Current Condition and Comment:

This basin is covered with an HDPE liner to prevent debris from contaminating the treated water and prohibit sunlight interactions that promote algae growth. The pond influent and effluent equalization pipe are adjacent to each other, which may cause some short-circuiting within the system.

Capacity:

The existing EQ pond has enough capacity for two simultaneous SBR decants. The pond serves to equalize rapidly decanted flow from the SBR system. If the City moves to a continuous flow treatment system, the ponds' function is less critical for adequate disinfection contact time. Therefore, no major upgrades are required to maintain performance of this treatment component.

Trigger for Decommissioning, Replacement, or Upgrade:

Neither equipment condition (wear and tear) nor capacity limitations are expected to be an issue with this unit operation. Rather, it is expected to be decommissioned as it will no longer be required without operation of the SBRs.

6.3.7 – UV Disinfection

Process Description:

Water from the equalization basin is directed to an ultraviolet (UV) disinfection basin via an 18-inch gravity pipeline. Here, pathogenic organisms are inactivated and spread of waterborne disease is reduced.

Current Condition and Comments:

This UV system was installed in 2003. City staff have reported that the UV dose does not control based on flow due to automatic actuator failure and programming issues. Algae growth is also an issue to the system since the UV channels are not covered. Despite these minor issues, the City frequently achieves non-detect limits for fecal coliform.

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Capacity:

The capacity of this unit process is 2.72 MGD and is expected to be reached by year 2032. The UV disinfection system was rated at the corresponding max day flow rather than the peak hour flow requirement. The preceding equalization basin reduces hydraulic fluctuations that would negatively affect the UV system's performance. The life expectancy of this system can potentially be extended if TSS removal is improved through other treatment train upgrades. Improvements to UV controls and covering the channels will address current issues.

Cost Estimate:

Capacity upgrades to the UV disinfection system are proposed to include new disinfection equipment, building modifications, and channel modifications, as well as associated piping and instruments. This upgrade is estimated to cost $1,194,000 during the span of the 20-year planning period.

Trigger for Decommissioning, Replacement, or Upgrade:

Replacement of this unit operation is not expected due to equipment condition (wear and tear). Rather this unit operation is expected to be expanded through installation of additional units. This will be triggered by capacity issues.

6.3.8 – 15-Inch Gravity Pipe (Effluent Outfall)

Process Description:

Treated water from the facility is discharged via a 15-Inch PVC gravity fed pipe. The pipe discharges water into the Mill Slough, upstream from the Boise River. Control gates and valves can divert flow from the outfall to Pond 4 if need be.

Capacity:

The current capacity of this pipeline is calculated at 1.6 MGD for a 15-inch gravity pipe with minimum slope of 0.15%. At the max day flow condition, the pipe's capacity is expected to last until year 2024. Upgrading the outfall to a 22-inch size pipe will achieve a capacity of 3.97 MGD, lasting though 2040 with respect to the 20-year planning period.

Cost Estimate:

Upgrades to the effluent outfall at the WWTP will include new piping, valves, and trenching. This upgrade is estimated to cost $348,000 during the span of the 20-year planning period.

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Trigger for Decommissioning, Replacement, or Upgrade:

Replacement of this infrastructure is expected due to capacity issues. Equipment condition (wear and tear) is not expected to be an issue within its capacity lifespan.

6.3.9 – Existing WWTP Capacity Summary

A summary of the hydraulic capacities of every major component to the Middleton WWTP is summarized in Table 23. The final governing flow capacity and year met is also illustrated in Chart 5 below.

Table 23. Existing Treatment Processes Hydraulic Capacities.

Component:	Governing Flow	Year Capacity Met	Capacity Provided (MGD)[1]	2040 Capacity Needed (MGD)[2]	Trigger for, Decommissioning, Replacement, or Expansion
Influent Screens	PHF	2029	4.2	6.49	Replacement: -Increase capacity -Improve operations and maintenance
Influent Lift Station[3]	PHF	2026	3.6	6.49	Replacement: -Increase capacity
Influent 14" PVC Force Main	PHF	2037	5.8	6.49	Replacement: -Increase capacity
Grit Removal / Classifier	PHF	2029	4.2	6.49	Expansion: -Increase capacity
SBR Basins	MMF	2025	1.5	3.47	Replacement (w/new technology): -Capacity increase -Efficiency upgrade
UV System	MDF	2032	2.7	3.96	Expansion: -Increase capacity -Add redundancy
15” PVC Gravity Pipe	MDF	2024	1.6	3.97	Replacement: -Increase capacity

1. Existing capacity of system process based derived from equipment manufacturer information or historical data
2. Capacity required to meet new planning projections.
3. Assuming fourth pump, already in stock, is added to existing pipe header

Major components of the existing treatment process will require upgrades to meet the 20-year planning flows. Chart 5 below displays the order in which existing treatment systems will exceed their rated capacity over the 20-year planning period.

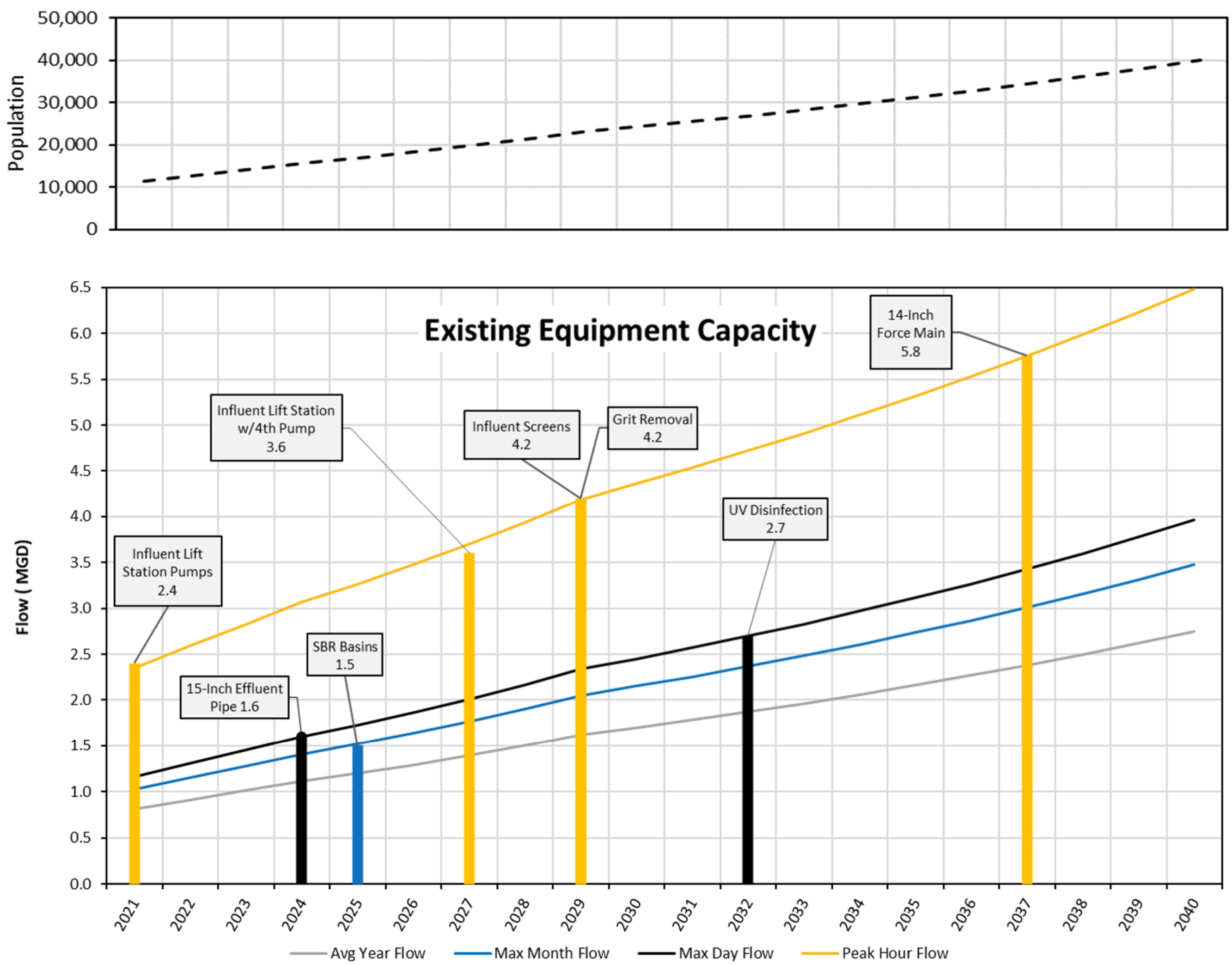

Chart 5. WWTP Process and Equipment Hydraulic Capacities over Time.

6.3.10 – Additional WWTP Improvements

There are additional upgrades required of the facility within the 20-year planning period. Unlike the previous sections, these upgrades are not associated with existing treatment equipment. These upgrades are operations-based, quality of life improvements or cost savings improvements that were presented in the existing facility plan. These upgrades are anticipated regardless of the selected biological treatment alternative (discussed in Chapter 8).

Dewatering

A new dewatering system and combined blower building is proposed as a cost savings improvement for the facility regardless of the alternative selected. This component will include a new screw press, sludge feed pumps, blowers, a polymer blend system, solid cake handling equipment, piping and associated instrumentation. The cost for this component is approximately $2,888,000 for equipment and a new building.

Sludge Storage

Additional sludge storage will be required at the facility to contain liquid sludge produced from the biological system prior to dewatering. This will include a new sludge storage tank, blowers, sludge transfer pumps, piping, and associated instrumentation/controls. This improvement is estimated to cost $561,000.

Gravel Roadway Improvements

The existing gravel roadway used for access and maintenance of the facility will require general improvements during the planning period. The general improvements are proposed to include new gravel, earthwork, excavation, and SWPPP materials. The estimated cost associated with these improvements is $363,000.

Sludge Removal

Within the 20-year planning period it is anticipated that sludge will need to be removed from the existing sludge pond. This action is estimated to cost $550,000. The current sludge storage pond will be decommissioned, and the space will be reclaimed for future treatment. Decommissioning the pond will be required in order to eliminate annual seepage tests and DEQ reporting.

WWTP Office Sewer Updates

The administrative office at the WWTP will also require a sanitary lift station to pump back to the headworks. The upgrades will primarily consist of the installation of a new pump station, piping, and associated equipment. A total of $75,000 is the estimated cost for this upgrade.

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Vac-Truck Dump Pad

A pad for offloading street sweepings, composting brush, vac-truck excavation material, etc., has been requested by the City. This item will consist of a covered concrete pad with a curb and gutter on three sides. There will be an influent drain screen, solids catchment basin, and oil/water separator. This facility will likely be located adjacent to a manhole on the 12-inch gravity main directly across Willow Creek from the WWTP plant. A total of $327,000 is estimated for this upgrade.

6.3.11 – WWTP General Improvement Cost Summary

The costs associated with upgrading the existing WWTP equipment and improving current facilities are summarized in Table 24.

Table 24. WWTP Facility Upgrade Cost Summary.

Category	Cost
Facility Improvements	
Influent Screens	$ 988,900
Influent Lift Station	$ 622,000
Influent Force Main	$ 500,000
Grit Removal / Classifier	$ 1,215,500
Primary Clarifiers and Sludge Wetwell	$ 2,890,000
UV System	$ 1,194,000
Effluent Outfall Piping	$ 348,000
Sludge Storage Tank	$ 561,000
Dewatering Infrastructure	$ 2,341,000
Tertiary Phosphorus Treatment*	$ 3,806,000
Gravel Roadway	$ 363,000
Sludge Removal	$ 550,000
Vac Truck Dump Pad	$ 327,000
WWTP Office Sewer	$ 75,000
General Conditions	
Contingency (30%)	$ 5,775,383
Engineering Design (10%)	$ 2,656,676
Construction Management (5%)	$ 1,328,338
Mechanical (12%)	$ 1,893,568
Electrical, I&C (10%)	$ 1,577,973
Contractor OH&P (8%)	$ 1,540,102
TOTAL	**$ 30,552,000**

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*Phosphorus treatment costs shown for planning purposes only. Phosphorus treatment with tertiary filtration may not be required depending on the selected alternative, efficiency of biological phosphorus removal and the City's ongoing phosphorus reuse efforts. The City is currently participating in a phosphorus reuse pilot study to determine long term viability.

6.3.12 – Collection System

Though analysis of Middleton's sewer collection system is generally outside the scope of this document, a brief treatment of the effect of the City's updated population projections on the collection system will be provided here. The 2019 Facility Plan projected a study area buildout population of 51,234. Pipe capacity for the City's sewer collection system was modelled based on this buildout population and the results were included in the 2019 Facility Plan. The results of this analysis indicated that the 30-inch main leading from Highway 44 to the WWTP and the proposed Hartley trunk lines will be the nearest to reaching capacity (d/D ratio of 0.65-0.75).

The current 2040 projections estimate a 2040 population of 39,998. Though the current 20-year population is roughly 11,000 less than was estimated for study area buildout, new development mapping highlights several areas of concern for the collections system. First, increased development mapping along Middleton Road south of the Boise River (area D) indicates that the Boise River lift station will reach capacity. Installation of new pumps will be required during the planning period to meet peak hour flow. Second, increased development between Cemetery Road and Lansing Lane (areas A, G, and H) indicate that the Prospector lift station will also require new pumps during the planning period to meet peak hour flow. Thirdly, increased development in the southeast corner of the study area (area C) will likely result in significantly higher flows to the 21-inch trunk main running along Highway 44 and to the 30" trunk main leading from Highway 44 to the WWTP. These mains may need to be upsized during the planning period to account for these developments. Refer to the 2019 Facility plan for mapping of the existing collection system and to Appendix A in this addendum for the current development mapping within the study area.

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8.0 BIOLOGICAL TREATMENT ALTERNATIVES

This chapter will update sections 8.2 and 8.3 of the existing Facility Plan. These sections address ammonia and phosphorus treatment alternatives. The 20-year influent planning criteria from Table 17 were used in sizing all alternatives. Winter influent concentrations were used when comparing the relative organic nutrient removal capacity of different treatment alternatives. In the existing Facility Plan, adding additional sequencing batch reactors (SBR), aerobic granular sludge (AGS) and membrane bioreactors (MBR) were identified as ammonia treatment alternatives. Chemical addition and filtration were identified as potential phosphorus treatment alternatives. Of the three proposed alternatives in the existing Facility Plan, both SBR and MBR were brought forth for additional consideration. Aerobic granular sludge was not selected for further analysis by the design team. Because AGS is a relatively new treatment process, the City believes that this treatment technology carries too much risk and operational complexity to be considered as a viable alternative.

Due to Middleton's rapid growth, this addendum will examine several additional biological treatment technologies within a decision-making matrix that will include capital and operational costs, ease of operation, treatment efficiency, and upgradeability. Enhanced biological phosphorus removal (EBPR) will also be considered in addition to tertiary chemical addition and filtration and the City's ongoing reuse efforts. Phosphorus removal options are presented for planning level discussion only. The City is currently engaged in a phosphorus reuse pilot to determine long term viability for permit compliance.

8.1 Discharge Alternatives

No additional discharge alternatives will be presented in this addendum. The current outfall location into the Mill Slough will continue to be used.

8.2 Ammonia Treatment Alternatives

The existing 2-basin SBR system is expected to reach capacity by 2025. Discussions with the City have determined that a retrofit of the existing SBR process basins will provide value by extending their useful life, thereby saving the City from the construction of costly future process basins. The design team has considered five treatment technologies for further analysis presented in Table 25 below.

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Table 25. Ammonia Treatment Alternatives.

Alternative	Description
A-1 (MBR)	Membrane bioreactor with enhanced biological phosphorus removal (EBPR) and Nitrification/Denitrification (NDN).
A-2 Conventional Activated Sludge	Three (3) processes were examined within his alternative. Each process includes the construction of secondary clarifiers.
A-2a (A^2O)	Anaerobic/Anoxic/Anoxic process. Includes EBPR and NDN.
A-2b (5-Stage Bardenpho)	Conventional activated sludge, 5-stage Bardenpho with EBPR and NDN.
A-2c (A^2O Step Feed)	A^2O step feed with EBPR and NDN.
A-3 (SBR)	Sequencing batch reactor with NDN only, tertiary phosphorus filtration considered in lieu of EBPR.

8.2.1 – A-1 Membrane Bioreactor (MBR)

One alternative for ammonia treatment is to convert a single existing SBR basin into a membrane bioreactor (MBR) system. MBR technology is widely used to produce reuse quality effluent in a small footprint. An MBR plant operates similarly to other activated sludge systems, however liquid-solids separation is carried out via membranes as opposed to clarifiers or other settling tanks. The existing Facility Plan proposed an MBR system for biological nutrient removal consisting of anaerobic, anoxic, aeration, and membrane sub-basins. This configuration will allow for biological removal of nitrogen through nitrification and denitrification as well as enhanced biological removal of phosphorus. In this proposal, a single SBR basin would be converted into two (2) separate treatment trains, as shown in Figure 4 and Figure 5 below. Additional walls will be constructed in an SBR basin to form each treatment train and sub-basin. The remaining basin may be reserved for conversion outside of the planning period or may be retrofitted to an equalization basin.

Each treatment train will include two membrane modules consisting of several membrane cassettes. Solids accumulated on the membrane surface will be removed via a coarse bubble air scour. Periodically, each membrane module will be cleaned using a chemical clean in place (CIP) system. The CIP system will consist of chemical storage, chemical feed pumps, a tank where the cleaning solution is formulated, and various process controls. Spent cleaning solution is often slowly bled back to the treatment process.

Process considerations for this alternative including the following:

1. Installation of new fine screens (1-2mm) prior to the MBR system.
2. Construction of walls and baffles to separate each treatment sub-basin.

3. It is anticipated that one existing SBR basin would be converted to the MBR process basin and the second SBR basin would be converted to an equalization tank.
4. New building or room in the proposed blower and dewatering building for CIP system and chemical storage.
5. Permeate pumps to draw through the membranes.
6. Recycle pumps for return sludge and internal recycle.
7. Catwalk, handrails, and membrane removal system
8. CIP system

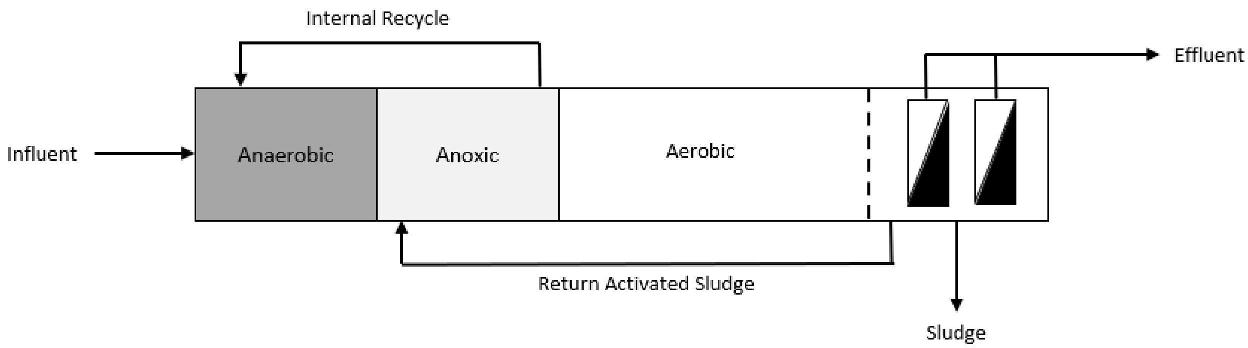

Figure 4: Process flow diagram of MBR retrofit alternative

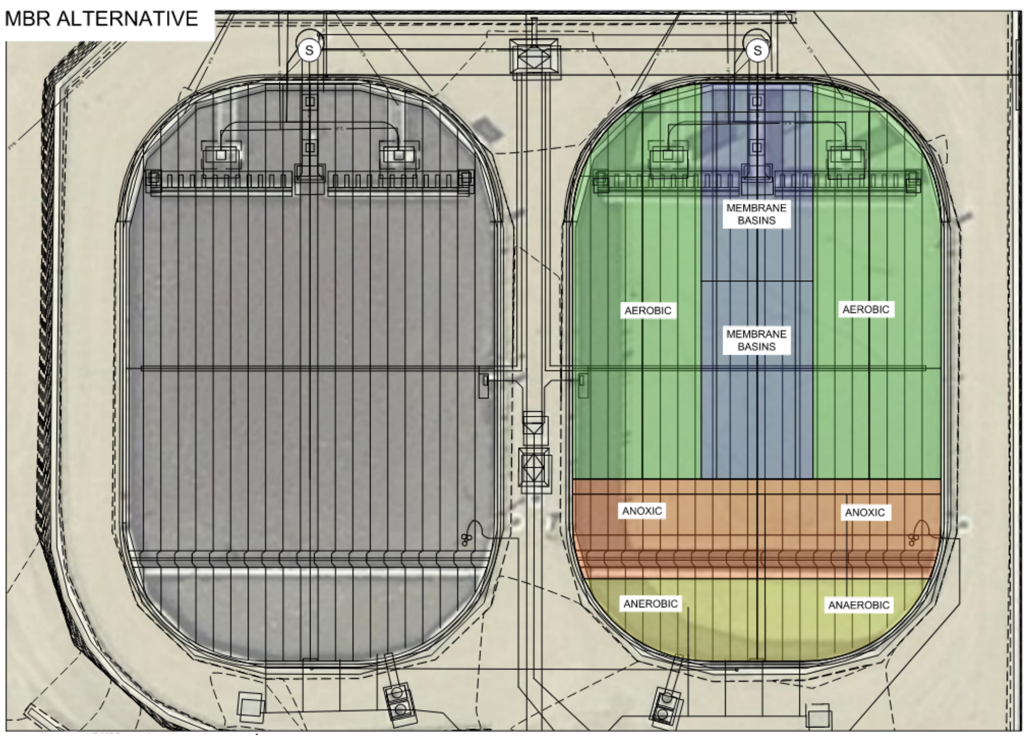

Figure 5: Plan view of MBR retrofit alternative

Process Sizing:

Conversion of a single SBR basin to an MBR process will allow for a capacity of 3.0 MGD. It is assumed that the City would convert the remaining SBR basin to an influent equalization tank. Of the existing basin volume, 123,000-gallons will be converted anaerobic zones, 156,000-gallons will be converted to anoxic zones, 439,000-gallons will be converted to aerobic zones, and 198,000-gallons will be converted to membrane tanks. A single basin will require approximately 346 lb/d of oxygen. The system will produce 6,542 lb/d of sludge of a dry mass basis.

Total oxygen demand is typically split between the aerobic basin (often termed pre-aeration) and the membrane basin(s), approximately 70% is supplied in the pre-aeration basin with the remaining 30% supplied via coarse bubble air scour in the membrane basin. Table 26 below presents process sizing information for the MBR alternative.

8.2.2 – A-2 Activated Sludge Alternatives

The three alternatives presented in this section all operate under continuous flow activated sludge treatment mechanisms followed by clarification. The primary removal mechanisms for these alternatives utilize aerobic microorganisms maintained in mixed/aerated environments to break down and remove wastewater constituents. The specific alternatives to activated sludge discussed in this section include:

- (A-2a) Anaerobic/Anoxic/Oxic (A^2O)
- (A-2b) 5-Stage Bardenpho
- (A-2c) A^2O Step Feed

The primary process considerations are similar for each of the three alternatives and are as follows:

1. Construction of basin walls and baffles to separate each treatment sub-basin.
2. Construction of a splitter box to direct flow to each treatment train.
3. Recycle pumps for internal recycles and return sludge.
4. Construction of secondary clarifier basin(s).

Although each of the three alternatives follow similar treatment mechanisms and process considerations, specific characteristics of each process are discussed in the following sections.

(A-2a) Anaerobic/Anoxic/Oxic (A^2O)

The A^2O is a process for biological nitrogen and phosphorus removal. The process consists of an anaerobic zone, anoxic zone, aerated zone, and an internal nitrate recycle. In the anaerobic basin, phosphorus accumulating organisms are selected for. In the aerobic basin, phosphorus accumulating organisms (PAOs) metabolize phosphate ions and incorporate them into cell mass. Phosphorus is removed by wasting a portion of the bulk MLSS which contains PAOs. During aerobic treatment, ammonia is oxidized to nitrate which is recycled back to the anoxic tank for denitrification. In the anoxic tank, nitrates are converted to nitrogen gas.

In the A^2O process, equalized influent would flow sequentially through each basin, and then to a secondary clarifier. Settled sludge from the clarifier is returned to the anaerobic basin as return activated sludge (RAS), with a portion of the sludge wasted (WAS). An internal nitrate recycle is provided from the aerobic to anoxic basin. A process flow diagram of the system is provided in Figure 6. For this alternative, a single SBR basin will be retrofitted into two (2) separate process trains for redundancy, as shown in Figure 9.

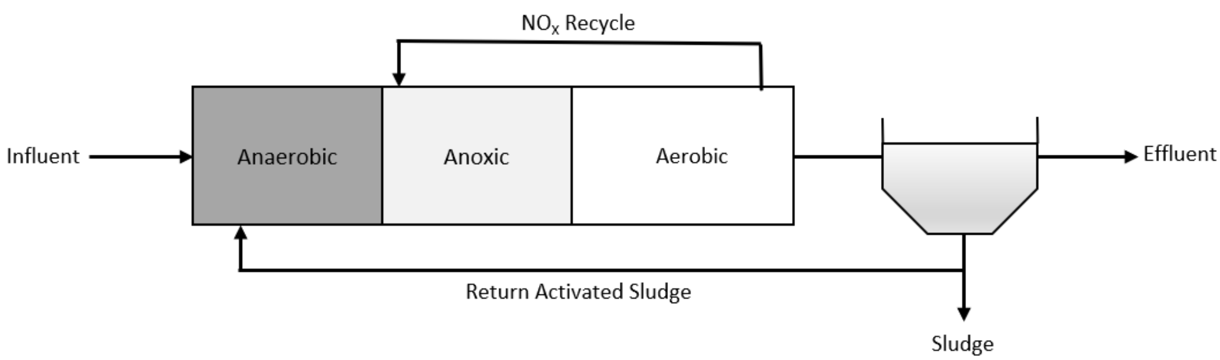

Figure 6: Process flow diagram for A^2O retrofit alternative

<u>Process Sizing:</u>

Conversion of both SBR basins to an A^2O process will increase the capacity of the biological process to 3.36 MGD (~1.68 MGD per basin). For a single basin, 99,900-gallons will be converted to anaerobic zones, 173,000-gallons will be converted to anoxic zones and 671,000-gallons will be converted to aerobic zones. Both basins operating at capacity will produce 6,240 lb/d of total sludge on a dry mass basis and require a total oxygen transfer of approximately 472 lb/hr. These numbers are presented in Table 26.

(A-2b) 5-Stage Bardenpho

The 5-Stage Bardenpho process is another common biological nitrogen and phosphorus removal process. The process consists of five (5) sub-basins: anaerobic, pre-anoxic, pre-aeration, post-anoxic, and post-aeration. A nitrified recycle from the pre-aeration to the pre-anoxic basin is also included. The pre-anoxic and pre-aeration basins provide high-rate denitrification and BOD removal, respectively. The post-anoxic basin has a lower denitrification rate and may require supplementation with an external carbon source. The post-aerobic basin serves as a BOD polishing step, to strip NO_3, and to raise DO to prevent phosphorus release in the clarifier. Equalized influent would flow sequentially through each basin, and then through a secondary clarifier. Settled sludge from the clarifier is returned to the anaerobic basin (RAS), with a portion of the sludge wasted (WAS). A process flow diagram of the system is provided in Figure 7. In this alternative, a single SBR basin will be retrofit into two (2) process trains split down the middle, as shown in Figure 10.

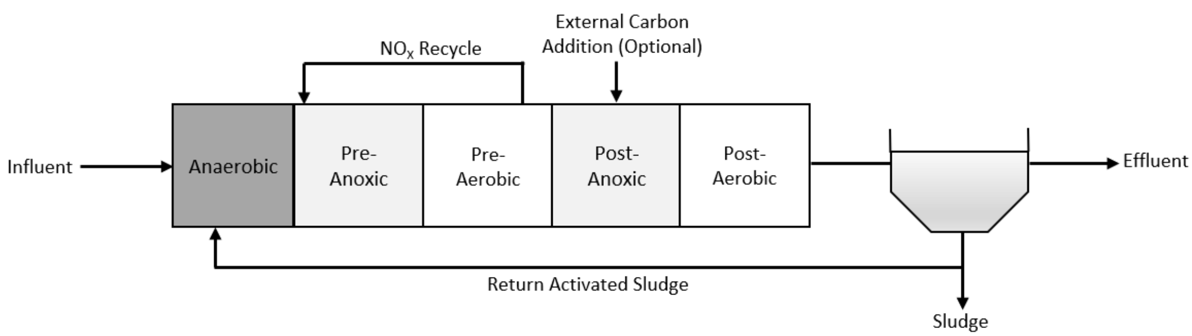

Figure 7: Process flow diagram for 5-stage Bardenpho retrofit alternative

<u>Process Sizing:</u>

Conversion of a two-basin SBR to a 5-Stage Bardenpho process will increase the capacity of the two-basin system to 3.1 MGD (~1.55 MGD per basin). For a single basin, 94,200-gallons will be converted to an anaerobic zone, 104,100-gallons will be converted to pre-anoxic zones, 586,500-gallons will be converted to pre-aerobic zones, 67,900-gallons will be converted into post-anoxic zones, and 84,800-gallons will be converted into post-aerobic zones. Both basins operating at capacity will require approximately 458 lb/hr of oxygen. Both basins operating at capacity will produce 5,542 lb/d of sludge on a dry mass basis. These numbers are presented in Table 26.

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(A-2c) A²O Step Feed Process

This process maintains the anaerobic/anoxic/aerobic configuration of the A^2O process but adds several additional basin modifications to allow operator flexibility for the control of bulking sludge and improved settling characteristics/dewatering. Additionally, both anaerobic and anoxic zones have been divided into three (3) distinct selectors. This configuration promotes an F/M gradient and the cultivation of specific floc-forming bacteria. Three anaerobic and anoxic selectors are proposed; the first two of which are each half the volume of the third.

The main aeration basin is proposed as 5 plug flow channels. Operators will have flexibility to feed from the anoxic selector into the first channel, or to operate the basin as a step-feed process. In the former scenario flow will progress through each channel in series. In the later scenario, gate valves will be operated to direct fractions of flow into each channel. The step feed flow configuration is commonly used as a biological nitrogen removal process and to aid in control of bulking sludge. Return sludge from the secondary clarifier may be fed to either the anaerobic or anoxic zones. A process flow diagram of the system is provided in Figure 8. The plan view schematic for this alternative is shown in Figure 11 in the “Process Layouts” section.

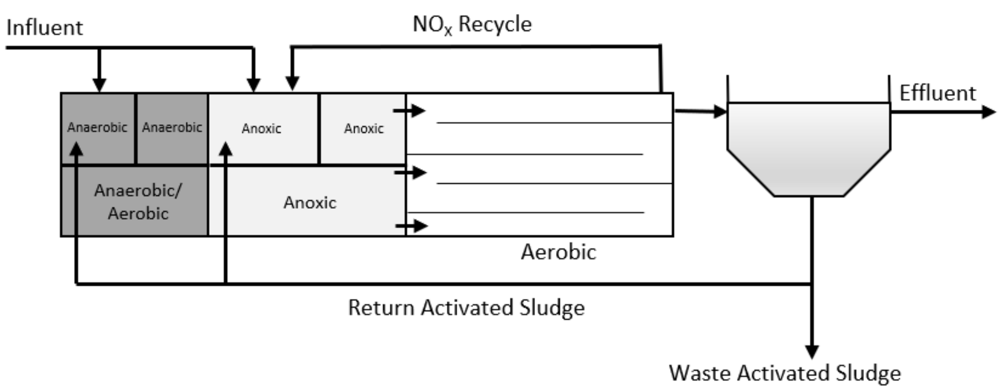

Figure 8: Process Flow Diagram for A2O-Step Feed Alternative

Process Sizing:

Conversion of both SBR basins to an A^2O-Step Feed process will increase the capacity of the two-basin system to 3.3 MGD (~1.65 MGD per basin). For a single basin 67,300-gallons will be converted to anaerobic zones, 260,300-gallons will be converted to anoxic zones, and 607,400-gallons will be converted into aerobic zones. Both basins operating at capacity will produce 6,320 lb/d of sludge on a dry mass basis and require a total oxygen transfer of 466 lb/hr. Full process results are presented in Table 26.

Process Layouts for Activated Sludge Alternatives

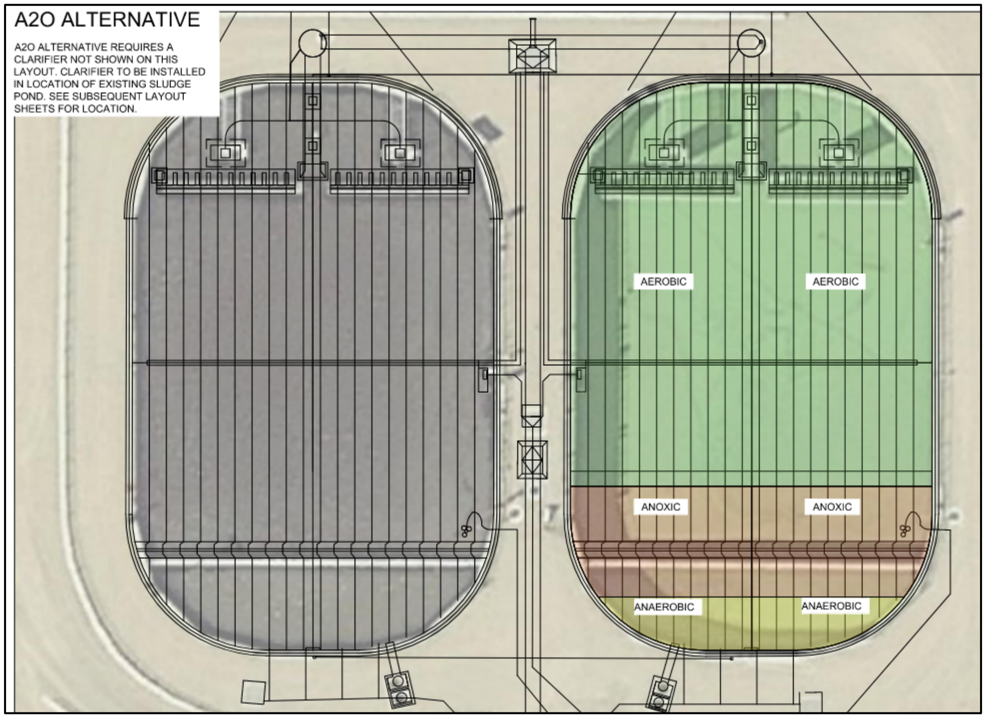

Figure 9: Plan view of A^2O retrofit alternative.

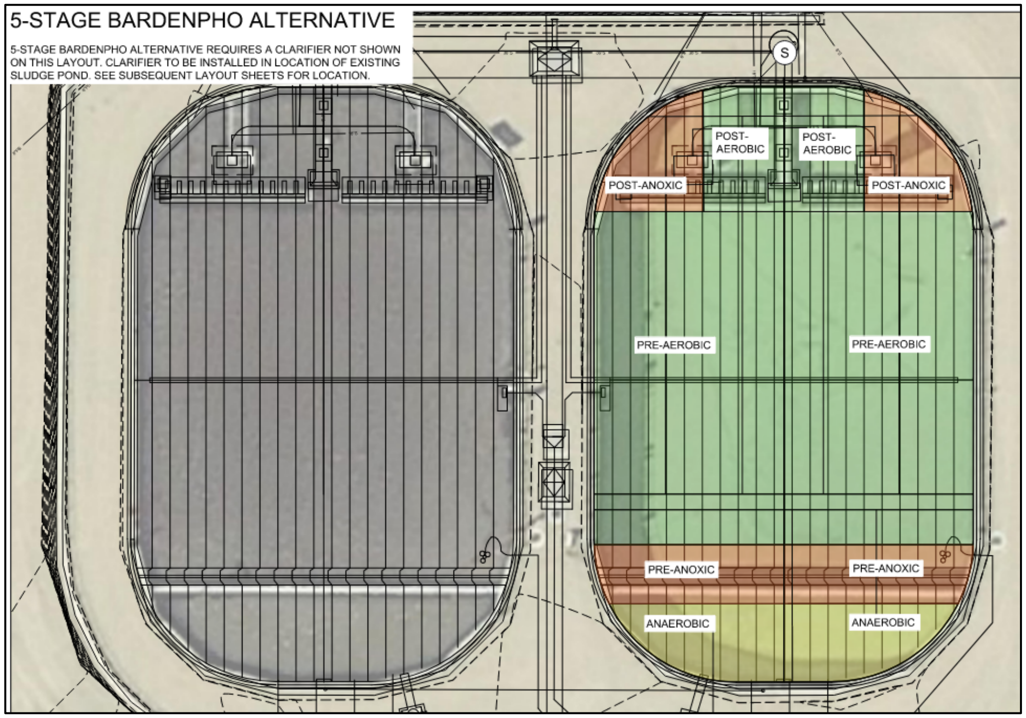

Figure 10: Plan view of 5-stage Bardenpho retrofit alternative.

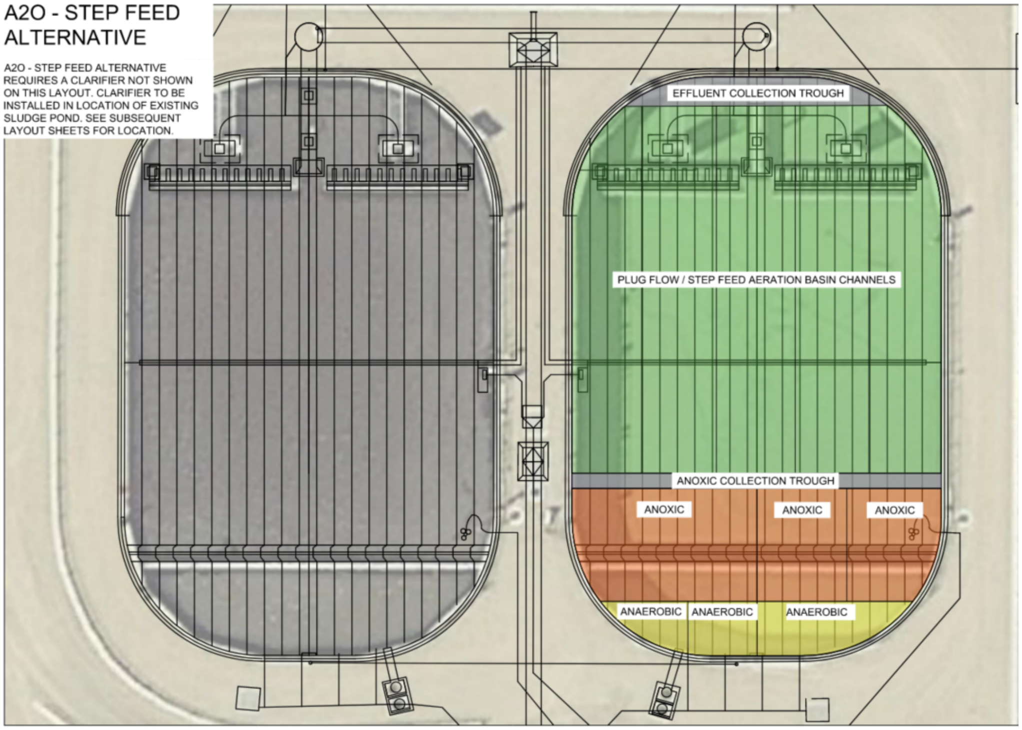

Figure 11. Plan view of A2O Step Feed retrofit alternative.

8.2.3 – A-3 Sequencing Batch Reactor (SBR)

Middleton currently operates a continuous feed intermittent discharge SBR system consisting of two SBR basins. Each basin has an approximate volume of one million gallons and is divided into two separate zones, a small pre-react zone and a larger react zone, separated by an interior baffle wall. During operation, screened and de-gritted wastewater is fed continuously to the pre-react zone. From the pre-react zone, wastewater flows under the interior baffle to the react zone. In this zone, the SBR sequences through three (3) phases: react, settle, and decant (as shown in Figure 12). In the react phase, blowers cycle ON/OFF to allow for aerobic and anoxic periods. During anoxic periods, mechanical mixing maintains mixed liquor in suspension. During the settle phase mixing is turned off to allow the biological floc to settle. During the decant phase, clarified effluent is decanted from the top of the basin and settled sludge is wasted from the bottom of the basin via a submersible WAS pump.

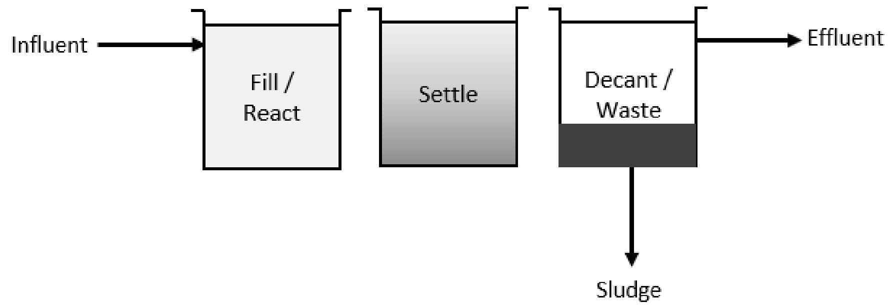

Figure 12: Process flow diagram for SBR alternative.

Process Sizing

To continue using SBR's throughout the planning period, the construction of 3 additional basins will be required. Each SBR Basin provides a hydraulic capacity of 0.75 MGD. SBR's are less efficient than other activated sludge variations because of the distinct anoxic mixing and settling times required during the cycle period, and volume inefficiency due to drawdown holdover. There are two SBR basins constructed at the Middleton WWTP with a current maximum capacity of 1.5 MGD. Construction can incrementally take place over the 20-year planning period. Each basin uses approximately 10,250 ft^2 of surface area. A total of five operational SBR basins (required to meet 2040 flows), requires a total area of over 50,000 ft^2 or 1.2 acres.

This alternative is the only batch-process treatment type and does not require a supplemental clarifier. This means wastewater is not continuously treated. Instead, the basins are filled, treatment occurs over a set amount of time, then basins are decanted. The other proposed alternatives operate on a continuous cycle.

8.2.4 – Comparison of Treatment Alternative Process Sizing

A summary of the findings of the Sections 8.2.1-8.2.5 is shown below in Table 26. Sections 8.3 through 8.5 will focus on comparing the costs, treatment capabilities, and other operational factors to determine which alternative is best suited to the City of Middleton's needs.

Table 26: Summary of Ammonia Treatment Alternatives

<table>
<tr><th rowspan="2">Parameter</th><th rowspan="2">Unit</th><th colspan="5">Value</th></tr>
<tr><th>A-1 (MBR)</th><th>A-2a (A2O)</th><th>A-2b (5-Stage)</th><th>A-2c (Step Feed)</th><th>A-3 (SBR)</th></tr>
<tr><td colspan="7">Design Parameters</td></tr>
<tr><td>SRT</td><td>days</td><td>10</td><td>10</td><td>10</td><td>10</td><td>21</td></tr>
<tr><td>MLSS</td><td>mg/L</td><td>12,000</td><td>4,000</td><td>4,000</td><td>4,000</td><td>3,000</td></tr>
<tr><td colspan="7">Effluent Concentrations</td></tr>
<tr><td>BOD</td><td>mg/L</td><td>1.1</td><td>3.1</td><td>2.8</td><td>3.0</td><td>5.0</td></tr>
<tr><td>TSS</td><td>mg/L</td><td>0.0</td><td>5.2</td><td>5.3</td><td>5.1</td><td>10</td></tr>
<tr><td>TN</td><td>mg/L</td><td>9.9</td><td>12.4</td><td>12.5</td><td>10.3</td><td>15.6</td></tr>
<tr><td>NH_3</td><td>mg/L</td><td>3.1</td><td>2.7</td><td>0.80</td><td>1.8</td><td>4.5</td></tr>
<tr><td colspan="7">Air Requirements</td></tr>
<tr><td>Oxygen Transfer Rate</td><td>lb/hr</td><td>346</td><td>472</td><td>460</td><td>466</td><td>500</td></tr>
<tr><td>Air Flowrate[1]</td><td>SCFM</td><td>4,516</td><td>5,400</td><td>4,674</td><td>5,388</td><td>4,530</td></tr>
<tr><td colspan="7">Process Sizing</td></tr>
<tr><td>Single Basin Flow Capacity</td><td>MGD</td><td>3.0</td><td>1.68</td><td>1.55</td><td>1.65</td><td>0.75</td></tr>
<tr><td>Anaerobic Volume per Basin</td><td>gal</td><td>123,000</td><td>99,900</td><td>94,200</td><td>67,300</td><td>N/A</td></tr>
<tr><td>Anoxic Volume per Basin</td><td>gal</td><td>156,000</td><td>173,000</td><td>Pre: 104,100
Post: 67,900</td><td>260,300</td><td rowspan="2">750,000[2]</td></tr>
<tr><td>Aerobic Volume per Basin</td><td>gal</td><td>439,000</td><td>671,000</td><td>Pre: 586,500
Post: 84,800</td><td>607,400</td></tr>
<tr><td>Sludge Generation[1]</td><td>lb/d</td><td>6,542</td><td>6,240</td><td>5,542</td><td>6,320</td><td>8,000</td></tr>
</table>

1. These numbers reflect the air requirements and sludge production of 2 retrofitted basins operating at capacity with the exception of the MBR alternative, of which only one (1) retrofitted basin is operating at capacity.
2. Anoxic and aerobic volumes are shared in SBR system. REACT volume available 750k gals, total basin volume is 1M gals

Treatment Capacity

Figure 13 below outlines each treatment alternative and respective capacity using the same influent criteria developed in Table 17. The year capacity is exceeded also represents the year upgrades must be online for treatment. Additionally, Table 27 summarizes the hydraulic capacities of each alternative.

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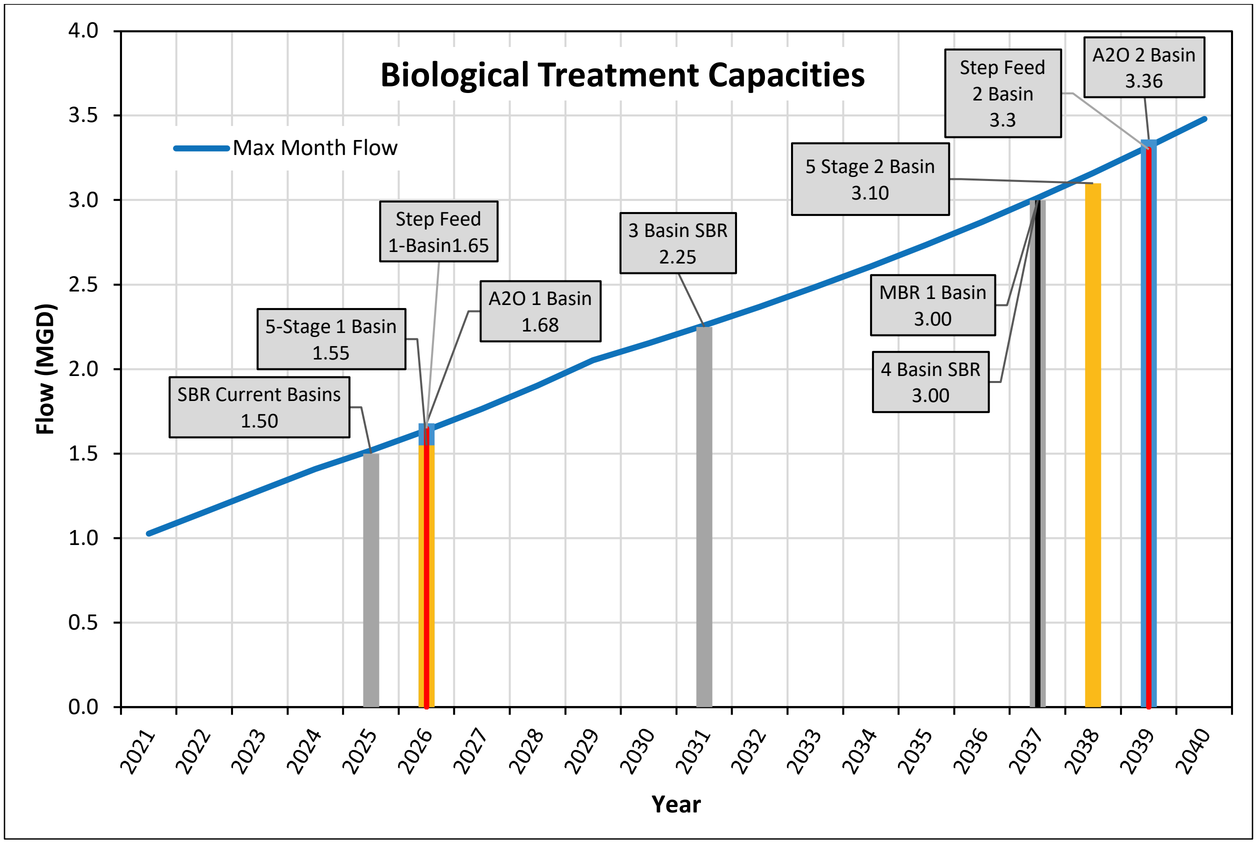

Legend:

SBR Process | A^2O Process | 5-Stage Bardenpho Process | MBR Process | Step Feed Process

Figure 13: Biological Treatment Alternatives over Time with Respective Hydraulic Capacities

Table 27. Alternative Hydraulic Capacity Summary.

Alternative	Description	Hydraulic Capacity (MGD)	Year Capacity Met
A-1 (MBR)	1 basin	3.00	2037
A-2a (A^2O)	1 basin	1.68	2026
	2 basins	3.36	2039
A-2b (5-Stage Bardenpho)	1 basin	1.55	2026
	2 basins	3.10	2038
A-2c (A^2O Step Feed)	1 basin	1.65	2026
	2 basins	3.30	2039
A-3 (SBR)	Existing	1.50	2025
	3 basins	2.25	2031
	4 basins	3.00	2037

8.2.5 – Effect of Primary Clarification

Primary clarification is a measure which, if implemented, can increase the hydraulic capacity of the secondary treatment system. The City may be interested in including primary clarification as part of their treatment upgrades project. If this is the case, a detailed process design of a primary clarification unit with the selected secondary treatment process will occur during the design phase of the project. However, for planning purposes, it is useful to understand the effect of primary clarification on the proposed secondary treatment alternatives.

Modelling has indicated that for the flow-through (MBR and conventional activated sludge) alternatives, implementation of primary clarification to remove 55% of influent TSS and 35% of influent BOD can improve the hydraulic capacity of a single basin by 1.2 MGD. For the existing SBR system, the hydraulic capacity of a single basin may be increased by 0.85 MGD.

Primary clarification should be implemented by constructing two (2) clarifier basins to be operated in parallel. The basins will likely be located alongside the proposed secondary clarifiers in the space currently occupied by the sludge pond. The clarifiers will each be sized at approximately 33 feet diameter and 14 feet side water depth. The proposed cost associated with construction and implementation of two clarifier basins to meet 2040 flows is $2,888,334.

Fermentation of the primary sludge blanket for purposes of increasing enhanced biological phosphorus removal has also been discussed with the City. Further evaluation of this alternative is outside the scope of this document but may be evaluated during preliminary engineering phase of a secondary treatment upgrade project. For planning purposes, the cost of primary clarification was prepared in the plant upgrade cost estimate. Primary clarifiers may not be targeted for the initial round of upgrades. A cost benefit analysis will be performed for primary clarification during the design stage to determine its feasibility as a process upgrade.

8.3 Cost Opinion

Each biological treatment alternative presented varies in cost and operation. The estimated capital improvement costs related to each alternative as well as annual operation and maintenance costs are presented in this section. Costs depend on market conditions and are intended to show planning-level estimates in line with the Class 4 cost opinion defined by the Association for the Advancement of Cost Engineering (see Table 28 below).

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Table 28: Cost Estimate Definition.

Estimate Class	Level of Project Definition (%)	End Usage	Methodology	Expected Accuracy Range	Preparation Effort
Class 4	1% to 15%	Study or Feasibility	Equipment Factored or Parametric Models	L: -30% H: +30%	Level 4 (ref. 20-300 hours for $20M project)

**Note: Adapted from AACE International Recommended Practice Publication No. 18R-97*

8.3.1 – Capital Cost Estimate for Treatment Alternatives

Capital cost estimates for each alternative reflect general design components for each system and the renovation work required to retrofit the existing SBR basins. Construction cost estimates are based on recent construction costs for similar facilities, published cost data and the Engineer's experience on similar projects. Detailed opinions of cost are presented in Appendix C, while a summary of capital costs is provided in Table 29 below.

The A^2O alternative requires less overall site work to the existing facility and includes fewer interior basin baffle walls, fewer overall basin modifications, and other miscellaneous items. Therefore, the A^2O alternative presents the lowest capital cost in comparison to the other alternatives evaluated.

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Table 29: Initial Cost Investment

Category	(A-1) MBR	(A-2a) A^2O	(A-2b) 5-Stage Bardenpho	(A-2c) A^2O Step Feed	(A-3) SBR
Process Equipment & Earthwork	$5,340,390	$2,353,230	$2,621,690	$2,858,960	$8,263,490
EQ Tank[1]	$384,450	$1,379,760	$1,379,760	$1,379,760	$1,379,760
New Fine Screens	$935,000	---	---	---	---
Secondary Clarifiers	---	$2,768,222	$2,768,222	$2,768,222	---
Contingency (30%)	$2,437,510	$2,379,443	$2,498,152	$2,564,538	$3,529,427
Engineering Design (10%)	$1,121,260	$1,094,544	$1,149,150	$1,179,687	$1,623,536
Construction Management (5%)	$560,630	$547,272	$574,575	$589,844	$811,770
Mechanical (12%)	$799,190	$780,145	$819,066	$840,832	$1,157,189
Electrical, I&C (10%)	$665,990	$650,121	$682,555	$700,693	$964,324
Contractor OH&P (8%)	$650,010	$634,518	$666,174	$683,877	$941,181
TOTAL	**$12,894,000**	**$12,587,000**	**$13,215,000**	**$13,566,000**	**$18,671,000**

1. The second SBR basin will be retrofitted into an equalization tank for the MBR alternative.

8.3.2 – O&M Cost Comparison

Operation and maintenance costs include energy, chemicals, monitoring, maintenance, replacement and other miscellaneous costs. Labor costs are not factored into the O&M costs presented below in Table 30. Each alternative is assumed to require four (4) full time operations staff. Labor costs are factored into life cycle costs presented in the next section.

Table 30. Summary of Labor Costs per Each Alternative.

Category	(A-1) MBR	(A-2a) A^2O	(A-2b) 5-Stage Bardenpho	(A-2c) A^2O Step Feed	(A-3) SBR
Daily Cost	$1,177	$959	$991	$986	$847
Annual Cost	$429,567	$349,941	$361,700	$359,740	$309,082

1. MBR costs assume only 1 basin is used for treatment

8.3.3 – Life Cycle Costs

Life cycle cost includes initial investment costs (capital cost), operating costs, maintenance costs and replacement costs. Annual O&M costs include WWTP personnel requirements, energy usage, chemical use, maintenance, monitoring costs and other miscellaneous costs. Salvage or residual values are assumed to be zero for all screened alternatives. Life cycle costs are calculated based on the following criteria:

- Labor Rate: $35/hr, 48 week working year
- Energy Rate: $0.06/kilowatt-hour (kWh)
- Interest Rate: 3.5%
- Evaluation Period: 18 years (2022-2040)
- Residual Salvage Value: $0

Full size figures of life cycle cost calculations are available in Appendix C. A summary is provided in Table 31 and Chart 6 below.

Table 31. Summary of Alternative Life Cycle Costs.

Alternative	Total Life Cycle Cost
A-1 MBR	$21,918,000
A-2a A^2O	$20,748,000
A-2b 5-Stage Bardenpho	$21,531,000
A-2c A^2O Step Feed	$21,856,000
A-5 SBR	$26,293,000

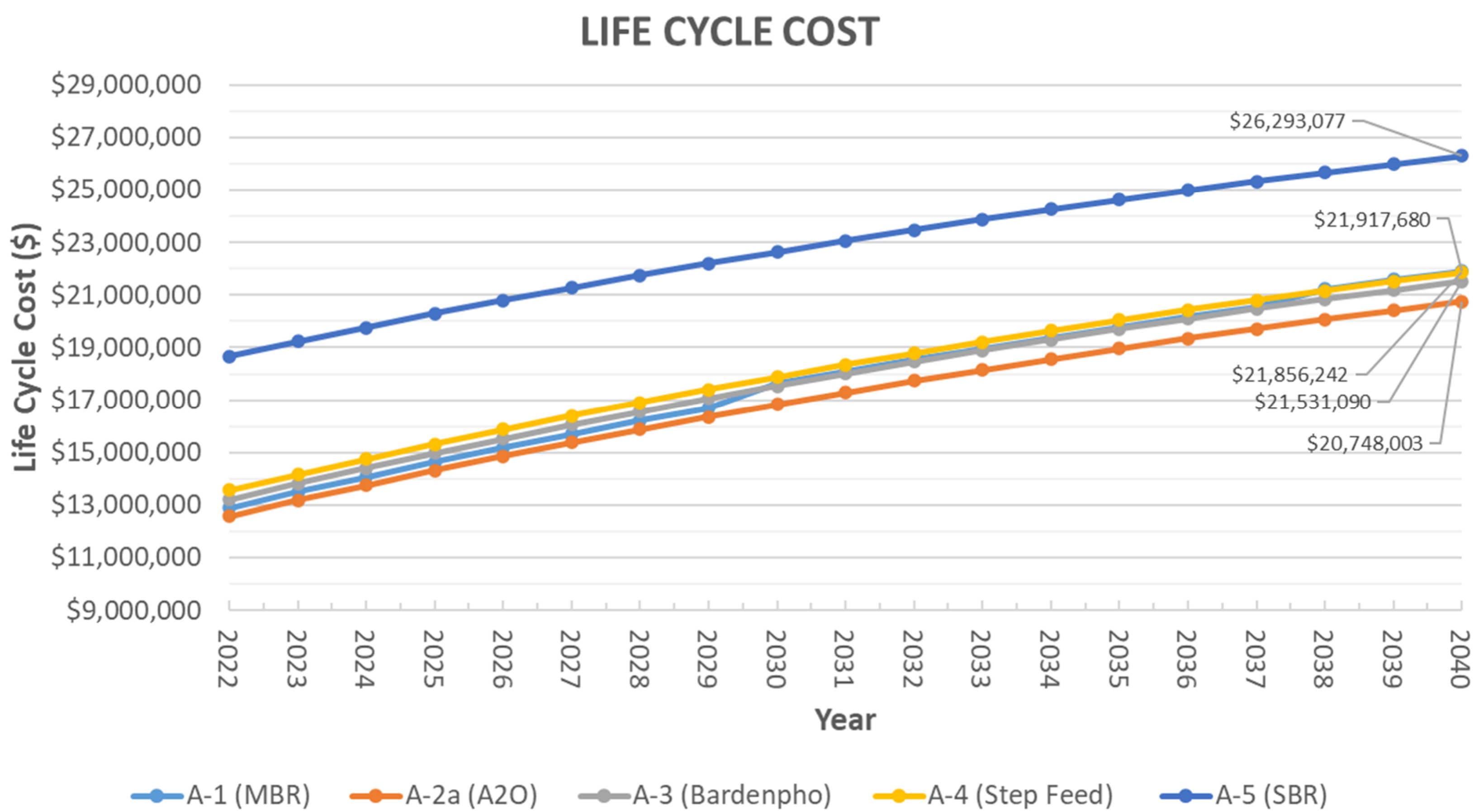

Chart 6. Life Cycle Costs of Each Alternative over a 20-Year Planning Period

8.4 Non-Economic Alternative Comparison

The following sections present non-economic (non-cost) factors that are important to the City when comparing one alternative against another. These include efficiency, ease of operation, ease of expansion, reliability, complexity, and various other criteria.

8.4.1 – Treatment Efficiency

This section describes the general treatment capabilities of the existing and proposed systems. This includes the biological capacity of the basins and the level of treatment that is achievable within that capacity. Different wastewater treatment processes operate at various efficiencies, which is to say they can treat a greater or less amount of waste within a given volume. A comparison of alternative treatment efficiency is provided in Table 32.

Of the treatment alternatives explored, the MBR process is capable of the highest treatment efficiency. As a semi-permeable barrier, a membrane is capable of excellent secondary solids separation. The membrane also allows for operation at mixed liquor concentrations greater than conventional activated sludge processes (approximately 3-4x). These factors combined allow for the MBR process to have a greater capacity and a higher treatment efficiency than the other alternatives currently explored. The MBR process being currently proposed is an alteration of the conventional A^2O process. As such, the process with be designed to biologically remove phosphorus as well as nitrogen.

The conventional activated sludge processes rank below the MBR process in treatment efficiency and capacity. With the addition of a secondary clarifier, a flow-through process will be more efficient than a batch process for two reasons. First, treatment is not required to periodically stop to allow for settling and wasting of sludge. Second, the design range of mixed liquor for a CMAS process is 1,500mg/L – 4,000 mg/L, the high end of which is above the recommended mixed liquor operating range for an SBR.

The SBR process is the least efficient due to the multiple basin functions as reactor and clarifier and batch process treatment cycle. Additionally, design guidelines for mixed liquor concentrations for SBRs recommend no greater than approximately 3,000 mg/L, less than the other alternatives under discussion.

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Table 32: Treatment Efficiency Comparison

Treatment Efficiency	Rank (Higher is better)	Basins Req'd for Treatment
A-1 (MBR)	4.2	1
A-2a (A^2O)	5.0	2
A-2b (Bardenpho)	4.4	2
A-2c (Step Feed)	4.2	2
A-3 (SBR)	1.0	5

8.4.2 – Reliability and Ease of Operation

This section describes the reliability and relative ease of operation of the existing and proposed systems. A comparison of the alternatives according to reliability and operational complexity are provided in Table 33.

Of the five treatment alternatives explored, the A^2O-Step Feed process has been designed to provide operators with the largest 'tool-box' to avoid the most common causes of process upsets. The sizing of the anaerobic and anoxic zones and the step-feed flow configuration have been sized to allow operators to select away from filamentous organisms which are the cause of bulking, poor settling sludge. Alternation between a plug flow and step feed flow configuration may be achieved through operation of manual gate valves, so an additional automated control framework is not required.

The A^2O and 5-Stage Bardenpho processes together constitute the next simplest alternatives to operate. Both are continuous flow-through processes and are intended to operate at a steady state. As such, operation of basin appurtenances is also constant. Blowers will operate continuously based on a dissolved oxygen setpoint. This will require some controls and programming, but less overall monitoring compared to an MBR system. Though these alternatives are simple from a process flow perspective, that simplicity also affords operators less flexibility than the A^2O-Step Feed process to avoid common operational issues such as bulking sludge and toxic shock.

All three conventional activated sludge alternatives all require a secondary clarifier for secondary solids separation. The clarifier is a relatively simple process to operate and has a minimal energy requirement. Water is fed and discharged by gravity. Motors which will require regular maintenance are needed for the sludge rake and scum skimmer. A scum pit with scum pump will also be included which will require regular maintenance.

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The SBR process constitutes the next easiest alternative to operate. Operations staff are already familiar with the SBR process because it is the current technology. This is a semi-batch process which cycles through phases of operation. Batch and semi batch processes require more operator oversight and are more complicated to run. Operating parameters such as SRT, MLSS, and oxygen demand change continuously within each phase. Blowers are cycled on and off multiple times during each cycle. When a third basin is added to the system, blowers will, at times, be required to direct air to multiple basins at different points in their cycles. This will add to the operational complexity of the system. A significant amount of SCADA control and programming is required to operate this system.

Lastly, the MBR process is the most difficult of the proposed alternatives to operate. The MBR is a steady state process and as such shares the same advantages discussed previously for steady state systems. Unlike the other steady state alternatives discussed, the MBR process utilizes membranes for secondary solids separation. As discussed previously each membrane module will be periodically cleaned using a chemical clean in place (CIP) system consisting of chemical storage, chemical feed pumps, and CIP tank. Operation of the membrane modules and clean-in-place system are a significant undertaking that adds mechanical complexity to the plant and requires investment in operator education. Additionally, cleaning of the membrane generates a waste residual which must be stored prior to disposal or must be metered back to the plant headworks. Membranes can also be prone to clogging if not regularly maintained.

Each alternative must be able to handle a wide range of influent flows as will be experienced over the planning period. Based on historic flow data, a flow of 0.65 MGD will likely be typical of a low flow winter day. At this flow, the 3 conventional activated sludge alternatives can be operated with 1 basin (2 trains) online with a 10-SRT and approximately 1,500 mg/L MLSS. The MBR option may be operated with 1 train online with a 10-day SRT and an approximately 4,700 mg/L membrane basin MLSS. These scenarios are well within typical operating ranges. Lower flows and loadings may be experienced as isolated events. Successful management of these events is largely up to skilled plant operation. Internal recycles, which are present in each retrofit alternative, allows operators an additional process management tool. As discussed above, the A2O-Step Fee alternative allows operators the greatest control in managing variable loading conditions.

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Table 33. Summary of Reliability and Operation Ranking of Alternatives.

Alternative	Reliability Rank (Higher is better)	Operation Rank (Higher is better)
A-1 (MBR)	1.7	1.5
A-2a (A^2O)	3.0	4.0
A-2b (Bardenpho)	3.0	3.8
A-2c (Step Feed)	4.7	3.8
A-3 (SBR)	2.5	3.0

8.4.3 – Ease of Expansion

This section focuses on the ease of expansion of the various alternatives. The City has communicated that ease of expansion will be a desirable quality in their planning criteria as it will allow Middleton to attract potential industrial users. In this context, ease of upgradability does not refer to the cost of upgrading, but rather to the number and extent of engineering and construction activities required. Results are summarized in Table 34 below.

The MBR process has the highest expandability rating of the alternatives under discussion. As a high-rate treatment technology, one existing basin volume is nearly sufficient to meet planning flows. Because a membrane cassette is modular in nature, addition of extra membrane units can be deployed quickly with less engineering analysis or construction activity required.

The A^2O, 5-Stage Bardenpho, and A^2O-Step Feed are more upgradable processes than the SBR but require significantly more engineering and construction than the MBR. If, during the planning period, additional treatment volume is required for an industrial user, addition of a single treatment train (as opposed to a full 1 MG basin) may meet the demand. Construction of additional clarifiers, as may be required by increased flows, represents an additional hurdle to expanding any of the conventional activated sludge processes. Like the construction of a new SBR basin, this activity is a major geotechnical, civil, and mechanical undertaking. The A^2O-Step Feed process may be considered marginally more difficult to expand due to the extra basin walls and baffles required.

The SBR process is the least able to be upgraded quickly. Because the SBR process is the least efficient of the treatment technologies that have been discussed, the addition of new basins will be required within the planning period. Construction of a new basin is a large engineering task requiring significant geotechnical, civil, and mechanical, and electrical

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disciplines. Addition of a third SBR basin will not trigger blower upgrades, however addition of a fourth basin will require more or larger blowers to be installed.

Table 34. Summary of Expandability Ranking of Alternatives.

Ease of Expansion	Rank (Higher is better)
A-1 (MBR)	4.0
A-2a (A^2O)	2.7
A-2b (Bardenpho)	2.1
A-2c (Step Feed)	2.0
A-3 (SBR)	1.0

8.5 Alternative Development Methodology

8.5.1 – Comparison Methodology

This section summarizes the methodology for developing, evaluating, and selecting alternatives for the biological treatment system to be included in the recommended plan. The alternatives will be based on the existing and future flow projections. The recommended approach to alternatives evaluation uses cost effectiveness and non-economic factors, including those factors that the City considers important (e.g. life cycle costs, capital costs, capacity, operational complexity, expandability, reliability). At a minimum, each screened alternative must meet future planning IPDES permit limits for the City. On August 31, 2021, the design team participated in a workshop with the City to identify feasible alternatives. Of the 6 alternatives initially considered for screening, one alternative, Granular Aerobic Sludge, was considered too operationally complex and high risk to be brought forth for additional consideration.

Each of the alternatives brought forth for screening were selected for detailed analysis which includes process schematic drawings, process narratives, summary of key components and sizing, discussion of full-scale treatment and development of life cycle costs.

8.5.2 – Scoring Procedure

Alternatives are evaluated using a weight-based matrix approach incorporating cost and non-cost evaluation criteria. Scores are calculated by scoring each alternative relative to others and assigning a relative importance, or weighting, to each criterion. The alternative with the highest score represents the preferred alternative for the City.

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$$TOTAL = \sum criteria \ (Score * Weighting)$$

Alternatives are scored from best to worst based on the number of alternatives being evaluated. Scores for each criterion range from 5 (best) to 1 (worst). Comparable alternatives may receive the same score.

8.5.3 – Weighting

The weighting factor is a percentage multiplier allowing the City to place greater emphasis on specific criterion which are of greater importance. For example, life cycle and capital costs are important to the City and given a higher weighting in the overall evaluation. Weighting and criterion were developed with input from the design team and City staff to total 100%.

8.5.4 – Evaluation Criteria

The evaluation criteria selected for comparing alternatives includes the following factors.

- Initial Capital Cost (20%)
- Life Cycle Cost (30%)
- Relative Capacity (20%)
- Operational Complexity (10%)
- Expandability and Scalability (10%)
- Reliability and Resiliency (10%)

Capital Cost (20%)

Capital costs are those associated with constructing facilities and appurtenances required for each alternative. Capital costs may include, pipelines, aeration facilities, solids settling facilities, or pumping facilities. Capital improvements for each alternative are based on using the facility's existing SBR basins for treatment and the 20-year flow and load projections. Costs presented are specific to the biological treatment process and do not include treatment systems common between alternatives such as influent screens or influent pumping facilities. Estimates are prepared using an accuracy range between -30% to +30%, as shown in Table 28 in section 8.3. Alternatives with the lowest capital cost were given scores of 5 (best) while alternatives with the highest cost were given scores of 1 (worst). Alternatives between the highest and lowest values were proportionally scaled. This scoring method was completed for capital cost, life cycle cost and capacity categories.

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Life Cycle Costs (30%)

Life cycle costs include initial capital costs as well as annual O&M and labor costs required for facilities. Life cycle costs are based on the planning period which ends in year 2040.

Relative Capacity (20%)

Each alternative is ranked between values 1 (worst) and 5 (best) by comparing treatment capacity. An alternative's treatment capacity is defined as the maximum flow rate (MGD) that can be processed through the system while maintaining permit planning limits. Each alternative's capacity was generated through a process model using Biowin simulation software. Each alternative was modeled using the same influent criteria. The maximum hydraulic flowrate includes influent wastewater flows and associated constituent loading including nutrients that do not exceed volume or treatment capacities for specific processes. The exception to this criterion is meeting phosphorus and total suspended solids (TSS) limits.

Each alternative is capable of biological nutrient removal (BNR) to meet the City's future ammonia limit and is also provided with biological phosphorus removal capability (EBPR). Initial wastewater characterization and testing has shown that EBPR may not be effective in meeting the City's future planning limit regardless of the alternative chosen. Inclusion of a primary clarifier/fermenter in the selected project may increase the EBPR capabilities of any secondary treatment process. This may save on chemical expenses at the cost of increased operational complexity. Additionally, the City is actively engaged in a pilot project for phosphorus removal outside of EBPR. All alternatives are assumed to meet TSS limits through clarification or membrane separation and therefore compliance with TSS limits was excluded from the evaluation.

Each alternative's capacity is evaluated by using the existing two SBR basins for an identical treatment volume comparison. Therefore, the capacity of alternative A-3 SBR, is categorized as the existing 2-basin capacity. The MBR has the largest capacity relative of the two-basin footprint.

Operational Complexity (10%)

Operational complexity is both a subjective and objective ranking of an alternative's various monitoring, operation, and maintenance efforts. For example, operational complexity can include increased monitoring of hydraulic flow splitting, increased maintenance and cleaning activities, risk associated with component failure or timed ability to procure replacement parts. In general, a higher wastewater treatment plant system classification rating is considered more operationally complex.

Expandability/Scalability (10%)

Each alternative is ranked on its ability to expand treatment capacity by assuming a hypothetical scenario of an industrial user connecting to the system. An alternative's scalability is considered by the extent of construction required for expansion and the length of time which construction will occur.

Reliability and Resiliency (10%)

All alternatives are expected to meet effluent requirements, but some may be considered more reliable than others if they require additional unit processes to meet performance requirements. An alternatives risk or susceptibility to missing compliance under peak wet weather events, unusual high loading, or biological upsets are also factored in its resiliency.

8.5.5 – Matrix Development

A comparison matrix was developed to rank feasible alternatives. The highest ranked alternative represents the preferred alternative for the City. As can be seen from Table 32, Table 33, and Table 34, the 3 conventional activated sludge alternatives rank generally higher than the MBR and SBR processes and tend to have very comparable scores. At this time, the City is not prepared to select one of the A2 options over the others. Therefore, based on the ranking shown in Table 35, the conventional activated sludge alternative is recommended for implementation, offering the best long-term approach for the City's wastewater system. This ranking is calculated as an average of the scores of the A2O, 5-Stage Bardenpho, and Step Feed alternatives.

8.5.6 – Alternative Selection

The preferred alternative is derived from the calculated comparison matrix. The general conventional activated sludge alternative scored the best when compared to the other proposed alternatives with a 4.3 out of 5. This alternative provides the best option when considering capital costs, life cycle costs, hydraulic capacity, and ease of operation. The conventional activated sludge alternative will be further discussed as the preferred, selected alternative in Capital Improvement Plan presented Chapter 9.

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Comparison Matrix

Table 35: Alternative Comparison Matrix

Category	Weight	A-1 MBR	A-2 Conventional Activated Sludge	A-3 SBR
Capital Cost	20%	4.8	5.0	1.0
Life Cycle Cost	30%	4.2	5.0	1.0
Capacity	20%	4.2	5.0	1.0
Operational Complexity	10%	1.5	4.0	3.0
Expandability and Scalability	10%	4.0	2.7	1.0
Reliability and Resiliency	10%	1.7	3.0	2.5
TOTAL	**100%**	**3.8**	**4.5**	**1.4**

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9.0 CAPITAL IMPROVEMENT PLAN

The plan to address the wastewater system deficiencies identified in the previous chapters are discussed in this section. In summary, the treatment alternatives proposed in chapter 8 include a membrane bioreactor (MBR), an anaerobic/anoxic/aerobic process, a 5-stage bardenpho system, an A^2O step feed process, or the addition of thee more SBR basins. Of the alternatives evaluated, the Activated Sludge options are the best alternatives for the City's wastewater system. Three alternatives of the five evaluated are activated sludge processes including, A^2O, 5- stage bardenpho, and A^2O step feed.

The Capital Improvement Plan will discuss the recommended infrastructure improvements and define a framework for implementation. Ancillary treatment infrastructure identified in Chapter 6 will be included in the recommended improvement plan as part of a larger project to encompass a significant portion of the City's treatment equipment.

9.1 Preliminary Project Design

Upgrades to the existing WWTP, including a capacity expansion are needed to meet planning horizon requirements. Additionally, there are a series of critical capacity upgrades required for existing facility equipment. These include but are not limited to the 15-inch effluent outfall pipe and installation of a fourth influent lift station pump. Recommended project improvements are divided into three phases, with Priority 1 improvements occurring during the first upgrade cycle and further improvements occurring in subsequent upgrade cycles. Priority 1 improvements should be implemented immediately due to anticipated community growth. Priority 2 improvements will be driven by capacity limitations as the City continues to grow and priority 3 improvements may be implemented as needed.

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Table 36: Capital Improvement Plan

ID	Item	Purpose	Year Capacity Met
Priority 1 Improvements			
1.0	Install 4th Influent Lift Station Pump	Capacity	2021/2022
1.1	Effluent Outfall Pipe	Capacity	2024
1.2	Biological Treatment Upgrade	Capacity/Permit Compliance	2025
1.3	Dewatering System	Capacity/Cost Savings	--
Priority 2 Improvements			
1.4	Influent Screens	Capacity	2029
1.5	Grit Removal	Capacity	2029
1.6	Disinfection System	Capacity	2032
1.7	Influent Force main	Capacity	2037
1.8	Sludge Pond Decommissioning and Removal	Permit Compliance	--
1.9	Phosphorus Treatment	Permit Compliance	--
Priority 3 Improvements			
2.0	Gravel Roadway	Operations	--
2.1	WWTP Office Lift Station & Sewer	Operations	--

9.2 Total Project Cost Estimate

The series of improvements identified above in Table 36 will be part of a large wastewater infrastructure upgrade for the City of Middleton. Upgrades may be phased throughout the 20-year planning period based on community growth and remaining capacity assessments. The overall project cost in terms of 2021 dollars is presented below in Table 37. The cost estimate for the A2O process is used as a placeholder for the general conventional activated sludge alternative that was selected in Section 8.5.6. See Appendix C for line-item cost estimates for each proposed equipment upgrade.

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Table 37: Total Project Cost

Category	Cost
Facility Improvements	
Influent Screens	$ 988,900
Influent Lift Station	$ 622,000
Influent Force Main	$ 500,000
Grit Removal / Classifier	$ 1,215,500
Primary Clarifiers and Sludge Wetwell	$ 2,890,000
UV System	$ 1,194,000
Effluent Outfall Piping	$ 348,000
Sludge Storage Tank	$ 561,000
Dewatering Infrastructure	$ 2,341,000
Tertiary Phosphorus Treatment*	$ 3,806,000
Gravel Roadway	$ 363,000
Sludge Removal	$ 550,000
Vac Truck Dump Pad	$ 327,000
WWTP Office Sewer	$ 75,000
Contingency (30%)	$ 5,775,383
Engineering Design (10%)	$ 2,656,676
Construction Management (5%)	$ 1,328,338
Mechanical (12%)	$ 1,893,568
Electrical, I&C (10%)	$ 1,577,973
Contractor OH&P (8%)	$ 1,540,102
Subtotal	**$ 30,552,000**
Biological Treatment System[1]	
Conventional Activated Sludge Process	$ 6,777,898
Contingency (30%)	$ 2,480,711
Engineering Design (10%)	$ 1,141,127
Construction Management (5%)	$ 570,563
Mechanical (12%)	$ 813,348
Electrical, I&C (10%)	$ 677,790
Contractor OH&P (8%)	$ 661,523
Subtotal	**$ 13,123,000**
1. Average of all three Activated Sludge Alternatives (ranges from $12.5-$13.5 million per alternative).	
PROJECT TOTAL	**$43,675,000**

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9.3 Revenue Projection

The City collects revenue from the connections of new homes to its sewer system and from existing system connections monthly fees. The City may choose to finance a portion of its selected project through this revenue instead of through the judicial confirmation process. The accumulation of this revenue is summarized in Table 38.

The fees associated with new residential sewer connections were provided by the City of Middleton at $6,364.16 per connection. The revenue from existing connections is reflective of the base rates for sewer utilities at $24.64 per connection per month, provided by the City's published Utility Policies. In addition to the existing sewer connection base rates, the City implements a water in excess fee of $1.32 for an additional 1-1,000 gallons used per connection per month. The additional fee is not accounted for in the revenue table. Therefore, the City should expect a slightly higher value for total revenue.

Table 38: Projected Revenue from Sewer Connection.

Year	New Homes	Total Homes	Revenue from New Connections Rate, $/home $ 6,364.13		Revenue from Existing Connections Rate, $/home/mo. $ 24.64		Total Revenue	
			Yearly	Cumulative	Yearly	Cumulative	Yearly	Cumulative
2022	480	4,338	$3,054,782	$3,054,782	$1,282,660	$1,282,660	$4,337,442	$4,337,442
2023	997	5,335	$6,345,038	$9,399,820	$1,577,453	$2,860,113	$7,922,490	$12,259,933
2024	1,053	6,388	$6,701,429	$16,101,249	$1,888,804	$4,748,916	$8,590,233	$20,850,165
2025	1,178	7,566	$7,496,945	$23,598,194	$2,237,115	$6,986,031	$9,734,060	$30,584,225
2026	1,386	8,952	$8,820,684	$32,418,878	$2,646,927	$9,632,959	$11,467,612	$42,051,837
2027	1,206	10,158	$7,675,141	$40,094,019	$3,003,517	$12,636,476	$10,678,658	$52,730,495
2028	906	11,064	$5,765,902	$45,859,921	$3,271,404	$15,907,880	$9,037,305	$61,767,800
2029	906	11,970	$5,765,902	$51,625,823	$3,539,290	$19,447,169	$9,305,191	$71,072,992
2030	906	12,876	$5,765,902	$57,391,724	$3,807,176	$23,254,345	$9,573,077	$80,646,069
2031	906	13,782	$5,765,902	$63,157,626	$4,075,062	$27,329,407	$9,840,964	$90,487,033
2032	631	14,413	$4,015,766	$67,173,392	$4,261,636	$31,591,043	$8,277,402	$98,764,435
2033	631	15,044	$4,015,766	$71,189,158	$4,448,210	$36,039,252	$8,463,976	$107,228,411
2034	631	15,675	$4,015,766	$75,204,924	$4,634,784	$40,674,036	$8,650,550	$115,878,961
2035	631	16,306	$4,015,766	$79,220,690	$4,821,358	$45,495,395	$8,837,124	$124,716,085
2036	631	16,937	$4,015,766	$83,236,456	$5,007,932	$50,503,327	$9,023,698	$133,739,783
2037	711	17,648	$4,524,896	$87,761,353	$5,218,161	$55,721,487	$9,743,057	$143,482,840
2038	436	18,084	$2,774,761	$90,536,113	$5,347,077	$61,068,564	$8,121,838	$151,604,678
2039	436	18,520	$2,774,761	$93,310,874	$5,475,994	$66,544,558	$8,250,754	$159,855,432
2040	436	18,956	$2,774,761	$96,085,635	$5,604,910	$72,149,468	$8,379,671	$168,235,103
2041	436	19,392	$2,774,761	$98,860,395	$5,733,827	$77,883,295	$8,508,587	$176,743,690
2042	411	19,803	$2,615,657	$101,476,053	$5,855,351	$83,738,646	$8,471,008	$185,214,699
2043	261	20,064	$1,661,038	$103,137,091	$5,932,524	$89,671,169	$7,593,561	$192,808,260
2044	205	20,269	$1,304,647	$104,441,737	$5,993,138	$95,664,307	$7,297,785	$200,106,045
2045	80	20,349	$509,130	$104,950,868	$6,016,792	$101,681,100	$6,525,923	$206,631,967
2046	80	20,429	$509,130	$105,459,998	$6,040,447	$107,721,546	$6,549,577	$213,181,544
2047	80	20,509	$509,130	$105,969,129	$6,064,101	$113,785,647	$6,573,232	$219,754,776

9.4 Permit Requirements

The planning permit requirements listed in the existing facility plan were used as the design basis for all recommended improvements. The City's current permit went into effect in 1999 and has been administratively extended and remains in effect. It is unknown when IDEQ will implement a permit compliance schedule for the City.

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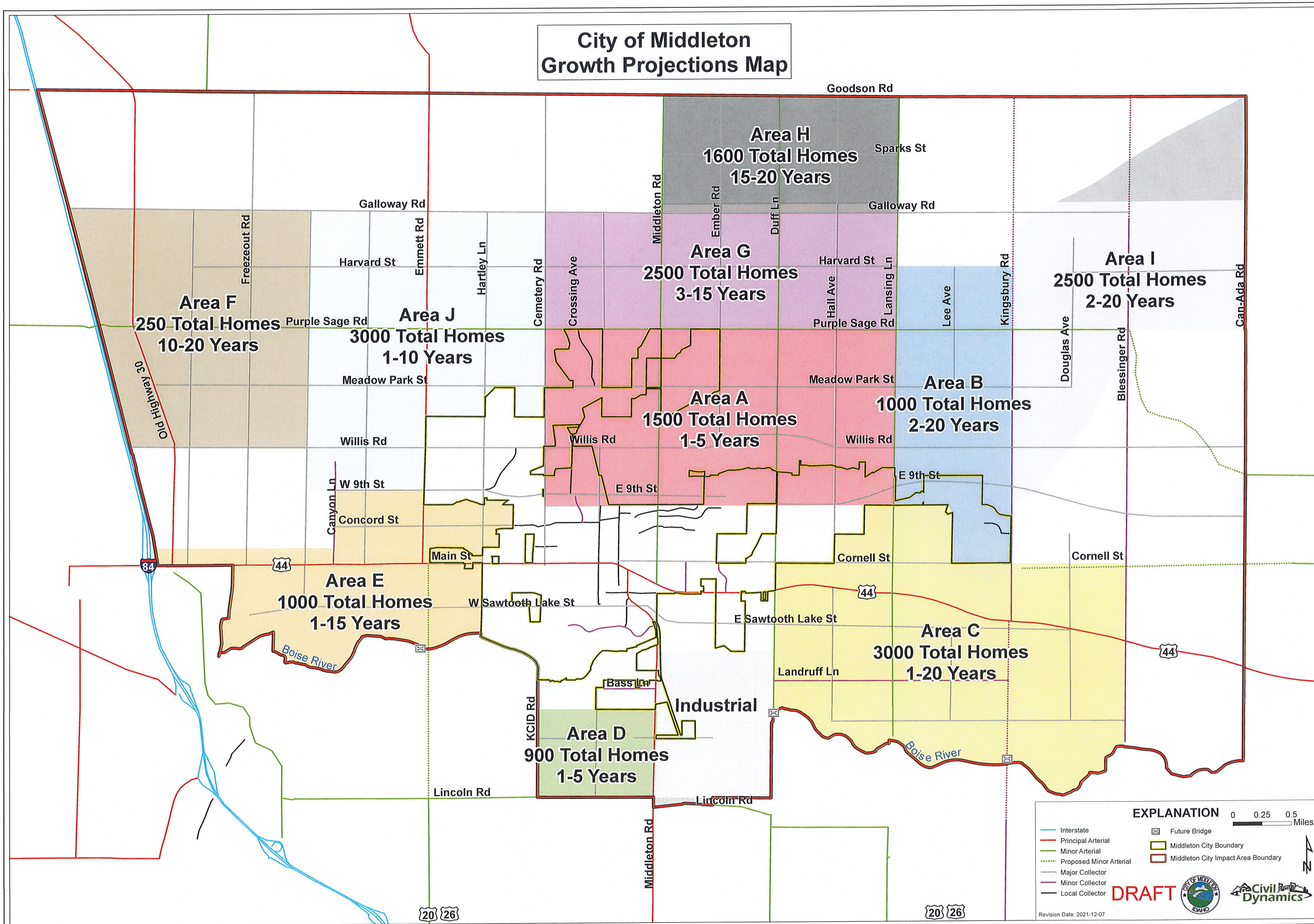
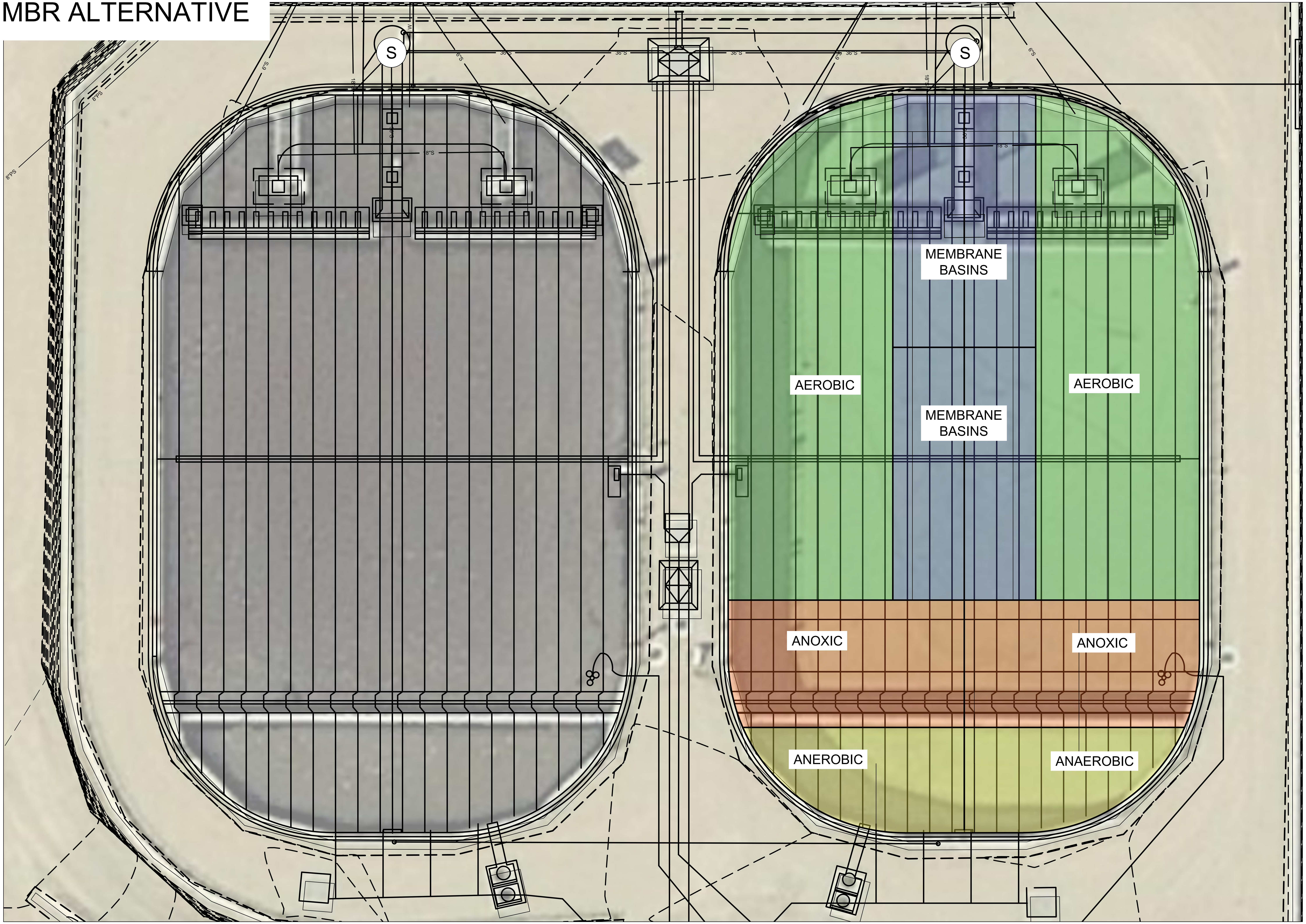
APPENDIX A - FULL SIZE FIGURES

Homes Added Per Year Per Area
*Middleton 2021 EDU Count is 3,858
Homes per Year
Cumulative Homes per Year
4,338
7,564
12,872
16,300
18,947
20,339
20,499
Area A
Area B
Area C
Area D
Area E
Area F
Area G
Area H
Area I
Area J
Total



City of Middleton
Growth Projections Map
Goodson Rd
Area H
1600 Total Homes
15-20 Years
Sparks St
Galloway Rd
Galloway Rd
Middleton Rd
Ember Rd
Duff Ln
Area G
2500 Total Homes
3-15 Years
Harvard St
Hall Ave
Lansing Ln
Purple Sage Rd
Lee Ave
Kingsbury Rd
Area I
2500 Total Homes
2-20 Years
Can-Ada Rd
Douglas Ave
Blessinger Rd
Area F
250 Total Homes
10-20 Years
Freezeout Rd
Old Highway 30
Harvard St
Emmett Rd
Hartley Ln
Cemetery Rd
Crossing Ave
Purple Sage Rd
Area J
3000 Total Homes
1-10 Years
Meadow Park St
Meadow Park St
Area A
1500 Total Homes
1-5 Years
Area B
1000 Total Homes
2-20 Years
Willis Rd
Willis Rd
Willis Rd
W 9th St
Canyon Ln
E 9th St
E 9th St
Concord St
Main St
Cornell St
Cornell St
84
44
44
44
Area E
1000 Total Homes
1-15 Years
W Sawtooth Lake St
E Sawtooth Lake St
Boise River
Area C
3000 Total Homes
1-20 Years
Landruff Ln
Bass Ln
Industrial
KCID Rd
Area D
900 Total Homes
1-5 Years
Boise River
Lincoln Rd
Lincoln Rd
Middleton Rd
20 26
20 26
EXPLANATION
0 0.25 0.5 Miles
Interstate
Principal Arterial
Minor Arterial
Proposed Minor Arterial
Major Collector
Minor Collector
Local Collector
Future Bridge
Middleton City Boundary
Middleton City Impact Area Boundary
DRAFT
CITY OF MIDDLETON IDAHO
Civil Dynamics
Revision Date: 2021-12-07

MBR ALTERNATIVE



FUTURE MBR PLAN

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

0 1' 4'

DRAFT

BORDER SIZE	22X34
DESIGNED	WR
DESIGNER	KK
CHECKED	WR
APPROVED	KK

REVISIONS

NO.	DATE

ATTENTION: 0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" @ 22x34 or ½" @ 11x17, THEN DRAWING IS NOT TO SCALE - SCALE ACCORDINGLY

City of Middleton

WWTP SBR OVERFLOW MODIFICATION

MIDDLETON, IDAHO

FUTURE SITE PLAN

DATE: NOV 2021

PROJECT: 200555

REV: ----

C1.1

PRELIMINARY

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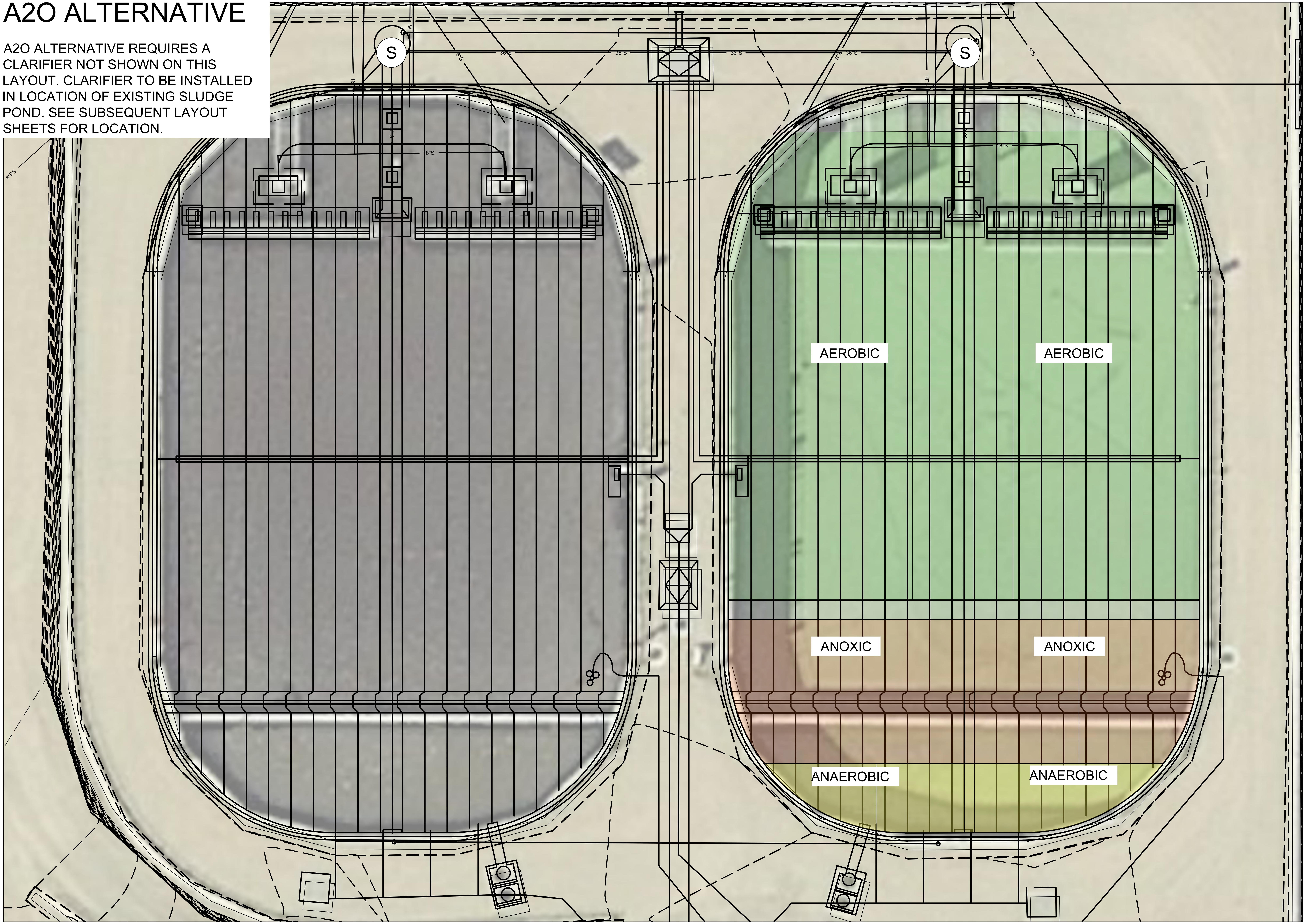
Q:\200555-BOI\3_ACAD\DWG\OBJECTS\PER BASIN EXHIBITS.DWG, 12/3/2021

A2O ALTERNATIVE

A2O ALTERNATIVE REQUIRES A CLARIFIER NOT SHOWN ON THIS LAYOUT. CLARIFIER TO BE INSTALLED IN LOCATION OF EXISTING SLUDGE POND. SEE SUBSEQUENT LAYOUT SHEETS FOR LOCATION.



FUTURE MLE PLAN

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

0 1' 4'

DRAFT

BORDER SIZE	DESIGNED	DESIGNER	CHECKED	APPROVED
22X34	WR	KK	WR	KK

REVISIONS

NO.	DATE

ATTENTION: 0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" @ 22x34 or ½" @ 11x17, THEN DRAWING IS NOT TO SCALE - SCALE ACCORDINGLY

City of Middleton

WWTP SBR OVERFLOW MODIFICATION

MIDDLETON, IDAHO

FUTURE SITE PLAN

DATE: NOV 2021

PROJECT: 200555

REV: ----

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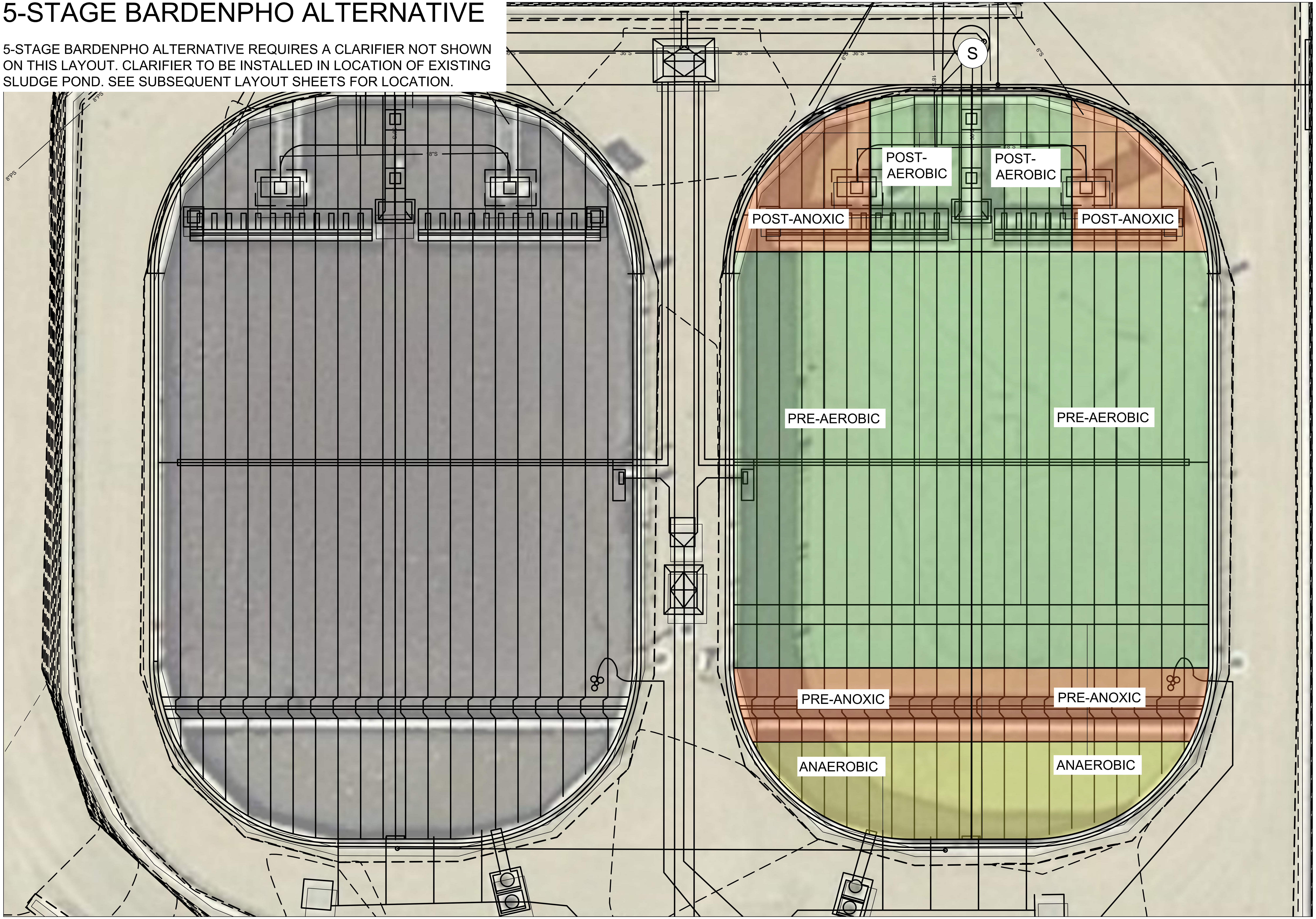
5-STAGE BARDENPHO ALTERNATIVE

5-STAGE BARDENPHO ALTERNATIVE REQUIRES A CLARIFIER NOT SHOWN ON THIS LAYOUT. CLARIFIER TO BE INSTALLED IN LOCATION OF EXISTING SLUDGE POND. SEE SUBSEQUENT LAYOUT SHEETS FOR LOCATION.



FUTURE 4-STAGE BARDENPHO PLAN

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

0 1' 4'

DRAFT

BORDER SIZE	22X34	DESIGNED	WR	DESIGNER	KK	CHECKED	WR	APPROVED	KK

REVISIONS

NO.		DATE

ATTENTION:

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" @ 22x34 or ½" @ 11x17, THEN DRAWING IS NOT TO SCALE - SCALE ACCORDINGLY

City of Middleton

WWTP SBR OVERFLOW MODIFICATION

MIDDLETON, IDAHO

FUTURE SITE PLAN

DATE: NOV 2021

PROJECT: 200555

REV: ----

C1.1

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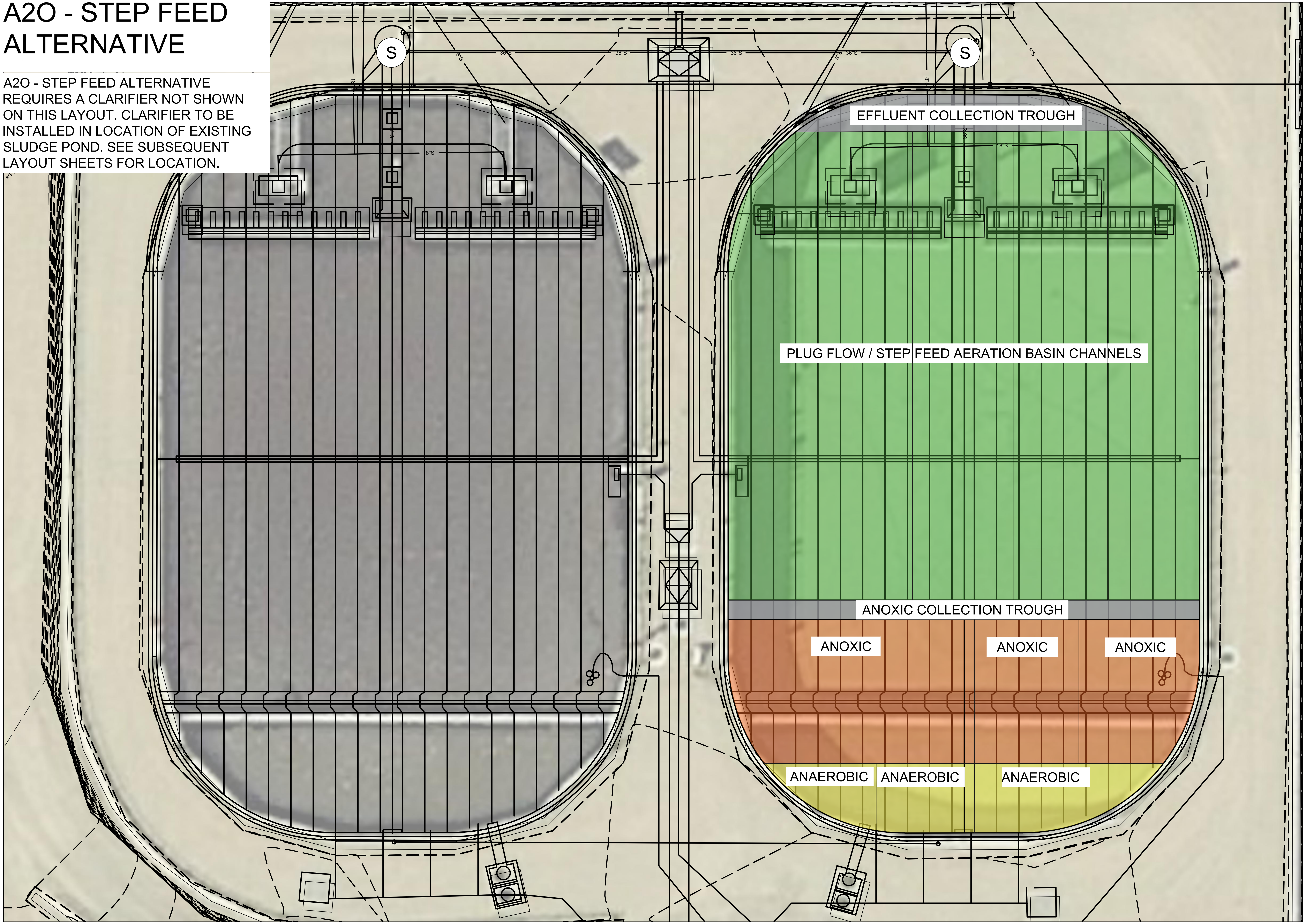
A2O - STEP FEED ALTERNATIVE

A2O - STEP FEED ALTERNATIVE REQUIRES A CLARIFIER NOT SHOWN ON THIS LAYOUT. CLARIFIER TO BE INSTALLED IN LOCATION OF EXISTING SLUDGE POND. SEE SUBSEQUENT LAYOUT SHEETS FOR LOCATION.



FUTURE MLE PLAN

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

0 1' 4'

DRAFT

BORDER SIZE	22X34
DESIGNED	WR
DESIGNER	KK
CHECKED	WR
APPROVED	KK

NO.	REVISIONS	DATE

ATTENTION: 0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" @ 22x34 or ½" @ 11x17, THEN DRAWING IS NOT TO SCALE - SCALE ACCORDINGLY

City of Middleton

WWTP SBR OVERFLOW MODIFICATION

MIDDLETON, IDAHO

FUTURE SITE PLAN

DATE: NOV 2021

PROJECT: 200555

REV: ----

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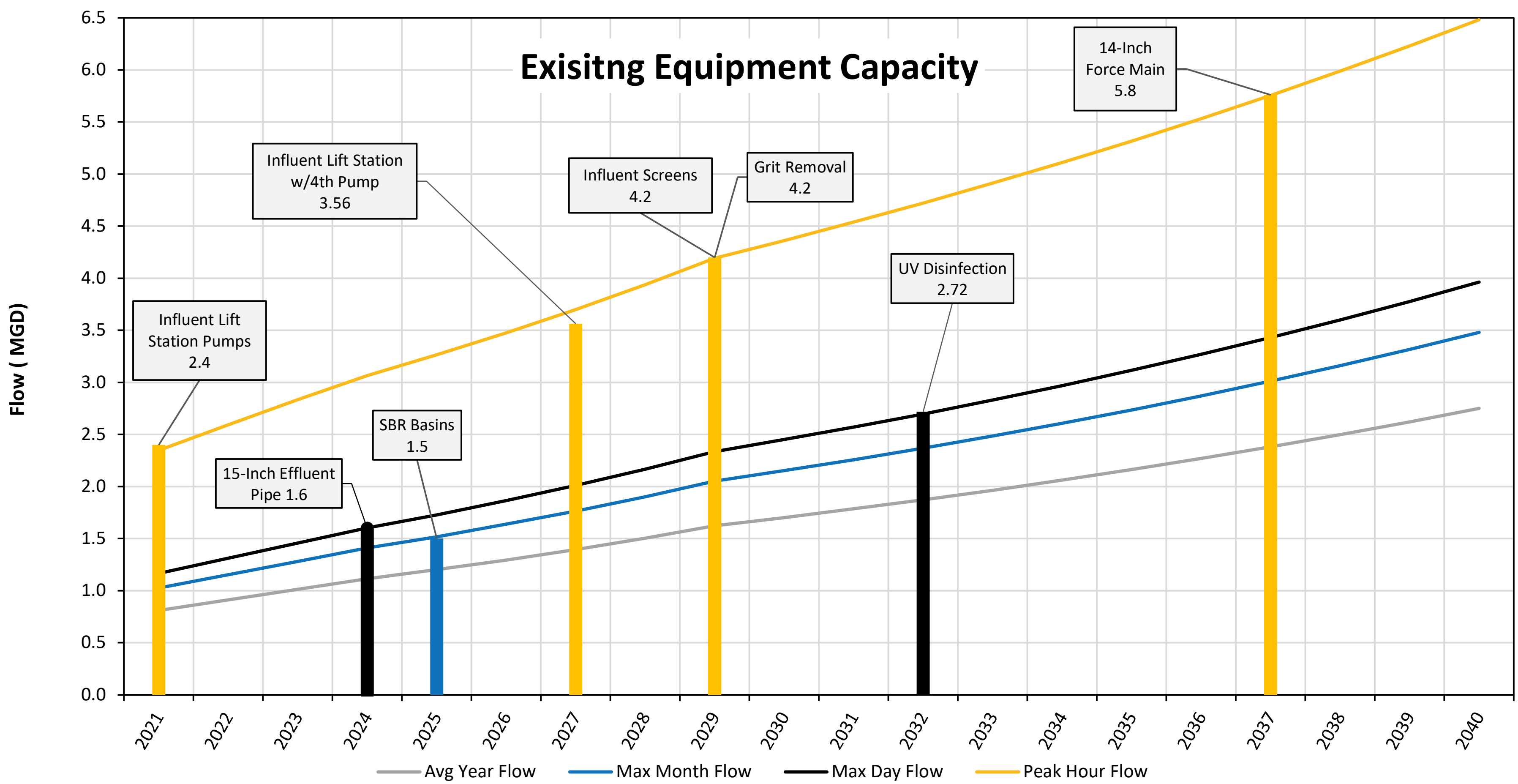
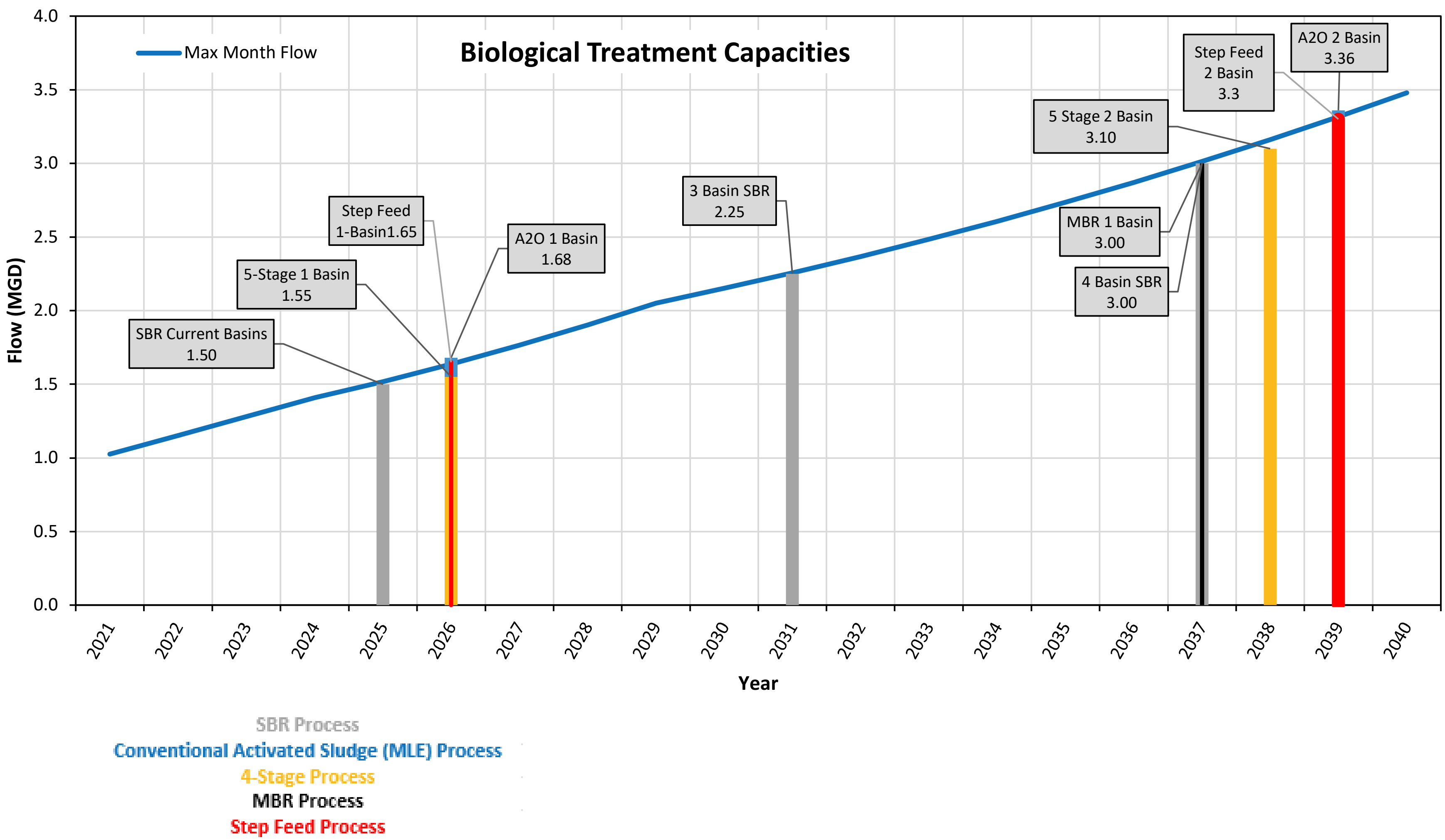
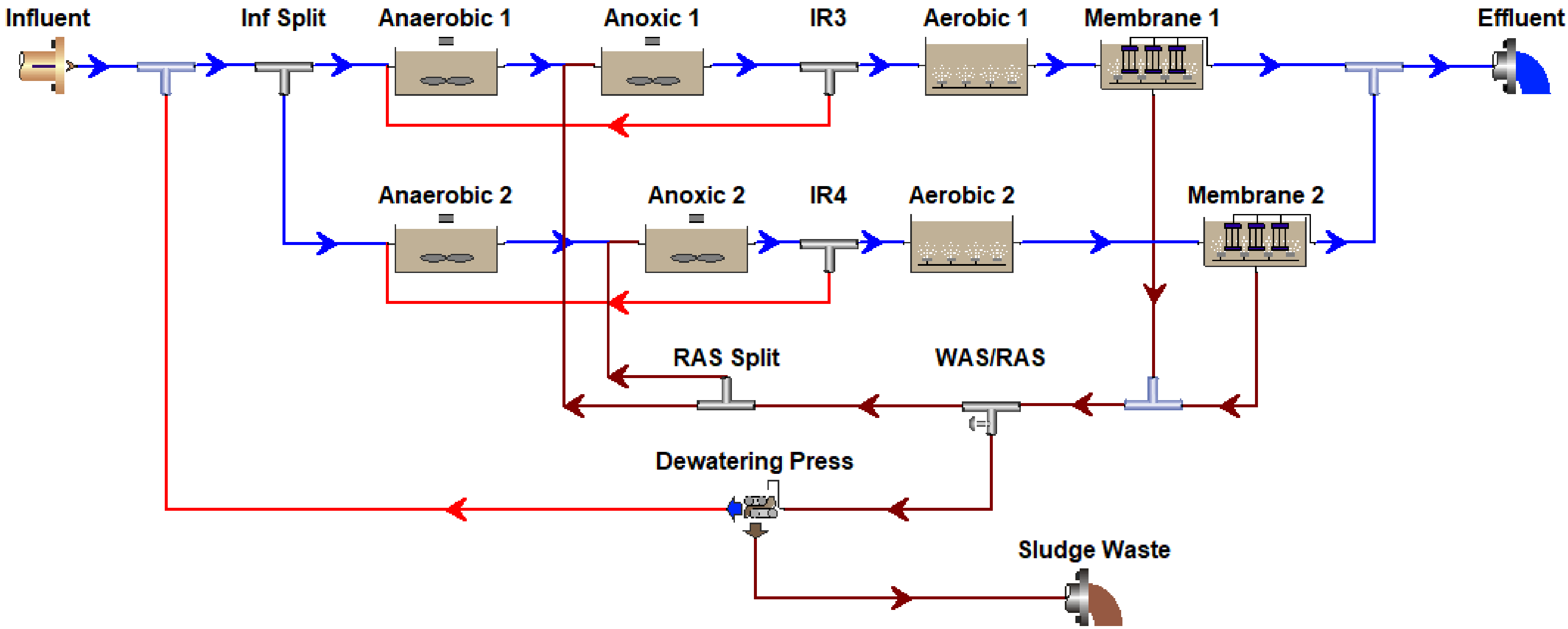

Exisitng Equipment Capacity
Flow (MGD)
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
Influent Lift Station Pumps 2.4
15-Inch Effluent Pipe 1.6
SBR Basins 1.5
Influent Lift Station w/4th Pump 3.56
Influent Screens 4.2
Grit Removal 4.2
UV Disinfection 2.72
14-Inch Force Main 5.8
Avg Year Flow
Max Month Flow
Max Day Flow
Peak Hour Flow

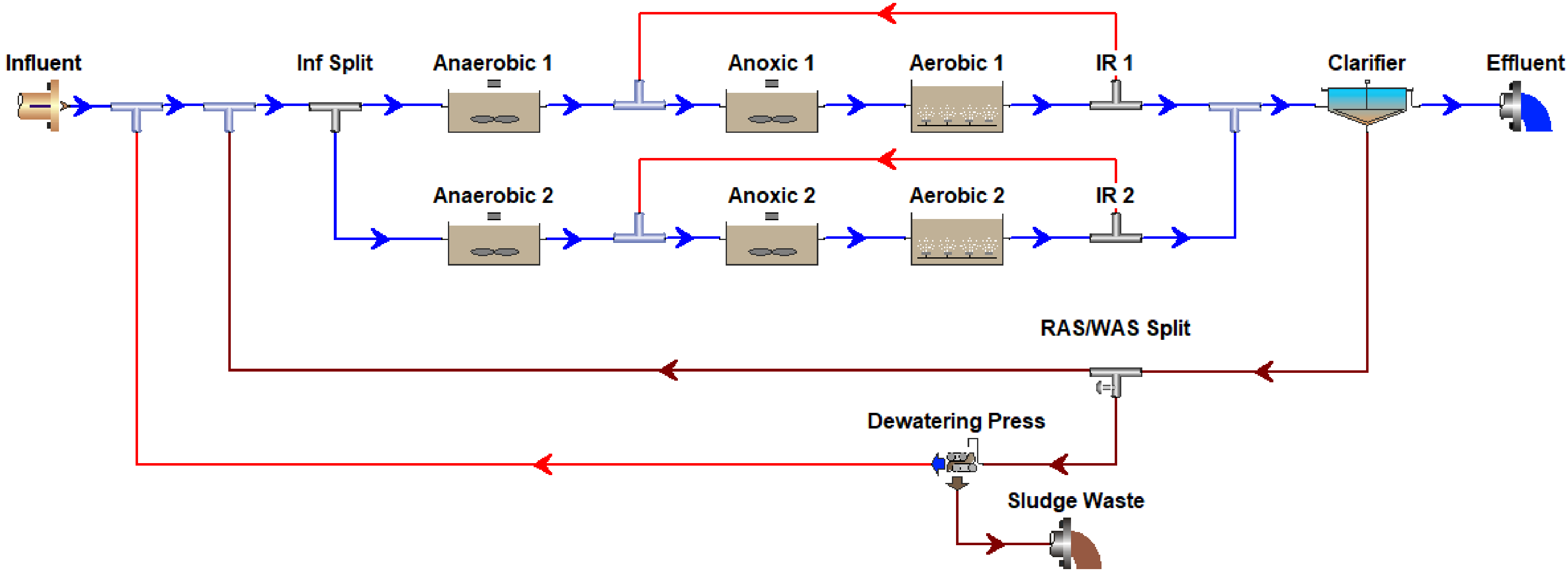

Biological Treatment Capacities
Max Month Flow
Flow (MGD)
Year
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
SBR Current Basins 1.50
5-Stage 1 Basin 1.55
Step Feed 1-Basin1.65
A2O 1 Basin 1.68
3 Basin SBR 2.25
MBR 1 Basin 3.00
4 Basin SBR 3.00
5 Stage 2 Basin 3.10
Step Feed 2 Basin 3.3
A2O 2 Basin 3.36
SBR Process
Conventional Activated Sludge (MLE) Process
4-Stage Process
MBR Process
Step Feed Process

APPENDIX B - PROCESS MODELS CONFIGURATION

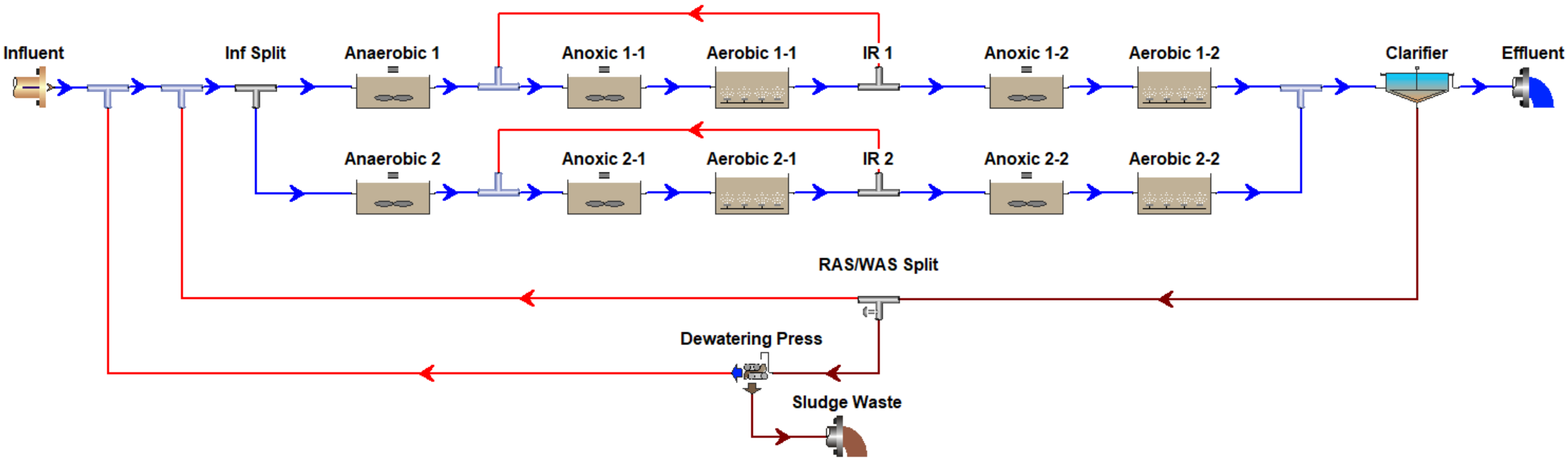
A-1 MBR


Influent
Inf Split
Anaerobic 1
Anoxic 1
IR3
Aerobic 1
Membrane 1
Effluent
Anaerobic 2
Anoxic 2
IR4
Aerobic 2
Membrane 2
RAS Split
WAS/RAS
Dewatering Press
Sludge Waste

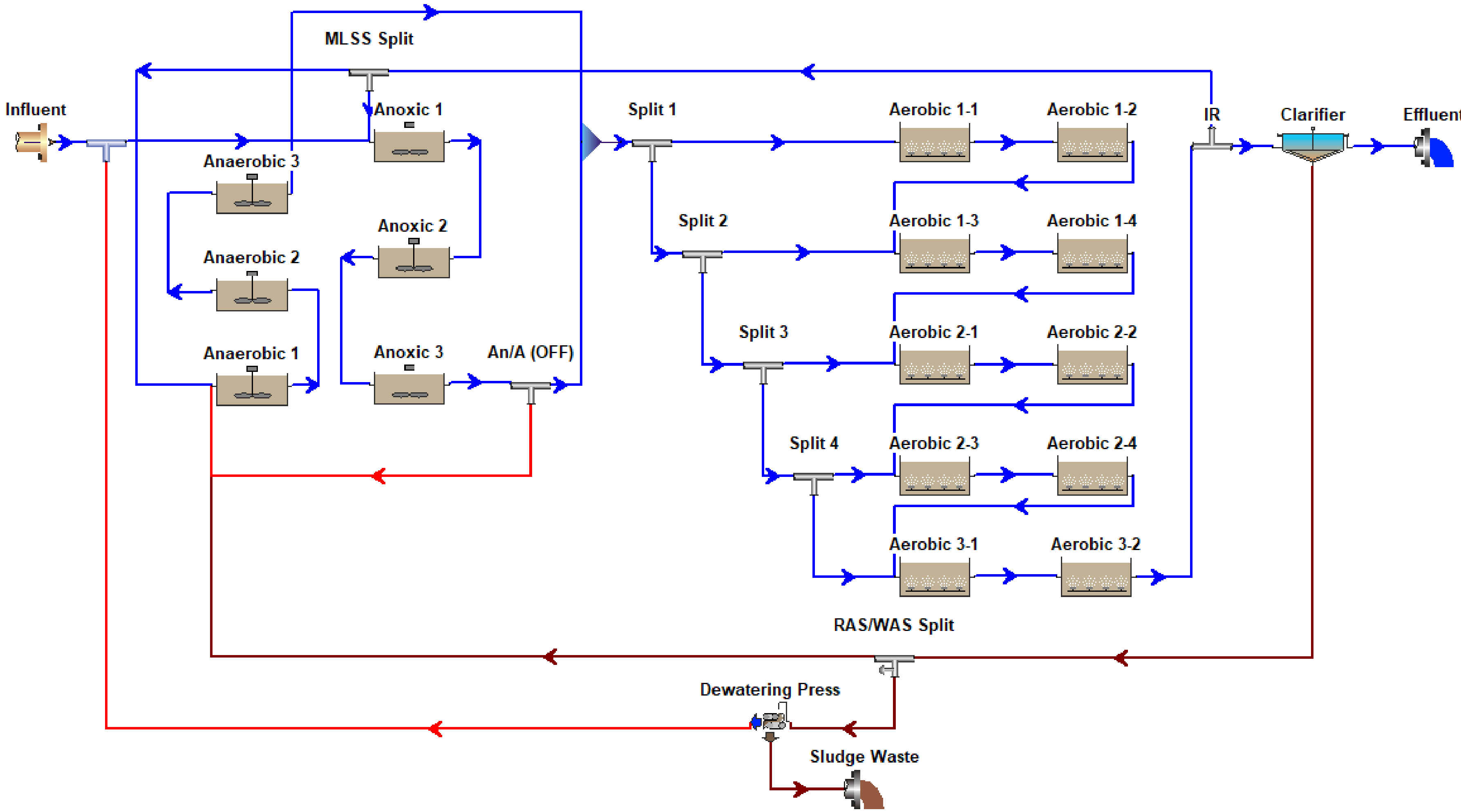
A-2 A^{2}O


Influent
Inf Split
Anaerobic 1
Anoxic 1
Aerobic 1
IR 1
Clarifier
Effluent
Anaerobic 2
Anoxic 2
Aerobic 2
IR 2
RAS/WAS Split
Dewatering Press
Sludge Waste

A-3 5-Stage Bardnepho



A-4 Step Feed



MLSS Split
Influent
Anoxic 1
Anaerobic 3
Anoxic 2
Anaerobic 2
Anaerobic 1
Anoxic 3
An/A (OFF)
Split 1
Split 2
Split 3
Split 4
Aerobic 1-1
Aerobic 1-2
Aerobic 1-3
Aerobic 1-4
Aerobic 2-1
Aerobic 2-2
Aerobic 2-3
Aerobic 2-4
Aerobic 3-1
Aerobic 3-2
IR
Clarifier
Effluent
RAS/WAS Split
Dewatering Press
Sludge Waste

APPENDIX C - COST ESTIMATES

COST ESTIMATES FOR BIOLOGICAL TREATMENT ALTERNATIVES

Capital Cost Summary (Budget Level, +30%/-30%)

City of Middleton - Wastewater Master Plan Addendum

MBR Process

MARK-UPS:	Percentage
ELEC/I&C	10%
MECHANICAL	12%
ALLOWANCE	0%
CONTINGENCY	30%
CONTRACTOR OH&P	8%
ENGINEERING DESIGN	10%
CONSTRUCTION MGMT	5%

Common items between alternatives such as dewatering, blower building, lift station improvements, etc, are not included in cost estimate for more direct comparison between alternatives

Construction Cost Index (CCI):	12555
**Source: Engineering News Record (January 2022)*	

NO.	DESCRIPTION	QTY	UNT	Budget UNIT $	Installation	TOTAL	RESOURCE
	01 MBR PROCESS						
1.	General Conditions	10	%	$48,549	0%	$485,490	Percent of subtotal
2.	Erosion Control	1	ls	$10,000	0%	$10,000	
3.	Demo	1	ls	$30,000	0%	$30,000	Demo existing baffle wall, partial aeration grid
4.	Yard Piping/Valves/instrumentation	1	ls	$350,000	0%	$350,000	
5.	Baffle Walls	304	cy	$850	0%	$258,400	Concrete
6.	Anoxic Mixers	3	ea	$15,000	15%	$51,750	2 active + 1 standby
7.	Anaerobic Mixers	3	ea	$15,000	15%	$51,750	2 active + 1 standby
8.	Pre-Aeration Diffuser grid	1	ls	$40,000	25%	$50,000	
9.	Pre-Aeration Blowers	3	ea	$180,000	25%	$675,000	
10.	Membrane Scour Diffuser Grid	1	ls	$25,000	25%	$31,250	
11.	Membrane Scour blower	4	ea	$90,000	25%	$450,000	
12.	RAS/WAS pump	3	ea	$30,000	25%	$112,500	
13.	Permeate Pumps	5	ea	$25,000	25%	$156,250	
14.	Membranes & Packaged Instruments	4	ea	$400,000	25%	$2,000,000	4 trains (2 per half basin) & associated equipment
15.	Recycle Pump	3	ea	$20,000	25%	$75,000	
16.	Chemical CIP System	1	ls	$100,000	25%	$125,000	
17.	Catwalk, handrails, grating, etc	1	ls	$250,000	0%	$250,000	
18.	Basin Effluent Transfer Box	1	ls	$60,000	30%	$78,000	
18.	Site Work	1	ls	$100,000	0%	$100,000	
	02 RETROFIT SBR BASIN #2 TO EQ TANK						
19.	General Conditions	10	%	$3,495	0%	$34,950	
20.	Pipe and Valve modifcations	1	ls	$150,000	25%	$187,500	
21.	EQ Pumps	2	ea	$30,000	20%	$72,000	
22.	EQ Tank Aeration Mixing	1	ls	$75,000	20%	$90,000	Piping changes
	03 FINE SCREENS						
23.	General Conditions	10	%	$8,500	0%	$85,000	Percent of subtotal
24.	Fine screen	2	ea	$250,000	10%	$550,000	
25.	Modifications to Screen Building	1	ls	$300,000	0%	$300,000	
A	**SUBTOTAL**					**$6,659,840**	
B	*ELECTRICAL/I&C*	(% of A)				$665,984	
C	*MECHANICAL*	(% of A)				$799,181	
D	**SUBTOTAL**					**$8,125,005**	
E	*ALLOWANCE*	(% of D)				$0	
F	*CONTINGENCY*	(% of D)				$2,437,501	
G	*CONTR. OH&P*	(% of D)				$650,000	
H	**SUBTOTAL**					**$11,212,507**	
I	*ENGINEERING DESIGN*	(% of H)				$1,121,251	
J	*CONSTRUCTION MGMT*	(% of H)				$560,625	and permitting
K	**SUBTOTAL**					**$12,894,383**	
L	**TOTAL ESTIMATED COST**					**$12,894,000**	

Capital Cost Summary (Budget Level, +30%/-30%)

City of Middleton - Wastewater Master Plan Addendum

A2O Process

MARK-UPS:	Percentage
ELEC/I&C	10%
MECHANICAL	12%
ALLOWANCE	0%
CONTINGENCY	30%
CONTRACTOR OH&P	8%
ENGINEERING DESIGN	10%
CONSTRUCTION MGMT	5%

Note: Cost presented below assumes both SBR basins are modified to the A2O process

Common items between alternatives such as dewatering, blower building, lift station improvements, etc, are not included in cost estimate presented below.

Construction Cost Index (CCI):	12555
**Source: Engineering News Record (January 2022)*	

NO.	DESCRIPTION	QTY	UNT	Budget UNIT $	Installation	TOTAL	RESOURCE
				01 A2O PROCESS			
1.	General Conditions	10	%	$21,393	0%	$213,930	Percent of subtotal
2.	Erosion Control	1	ls	$10,000	0%	$10,000	
3.	Demo	1	ls	$30,000	0%	$30,000	Demo existing baffle wall, partial aeration grid
4.	Yard Piping/Valves/Instrumentation	1	ls	$300,000	0%	$300,000	
5.	New Blowers	3	ea	$180,000	25%	$675,000	
6.	Diffusers	2	ea	$50,000	25%	$125,000	
7.	RAS/WAS pump	3	ea	$30,000	25%	$112,500	2+1 spare
8.	Baffle Walls	348	cy	$850	0%	$295,800	concrete
9.	Anoxic Mixers	6	ea	$15,000	15%	$103,500	2 active + 1 standby
10.	Anaerobic Mixers	6	ea	$10,000	15%	$69,000	2 active + 1 standby
11.	Recycle Pumps	3	ea	$30,000	25%	$112,500	
12.	Basin Effluent Transfer Box	2	ls	$60,000	30%	$156,000	2 basins
13.	Site Work	1	ls	$150,000	0%	$150,000	
				02 NEW EQ TANK			
14.	General Conditions	10	%	$12,543	0%	$125,433	
15.	Tank Materials & Install	948,000	GAL	$0.55	0%	$521,400	
16.	Tank Materials Freight	1	LS	$19,000	0%	$19,000	
17.	Tank Foundation Ring and Design	1	LS	$25,000	0%	$25,000	
18.	Foundation Design	1	LS	$5,000	0%	$5,000	
19.	Concrete Foundation	255	CY	$150	40%	$53,550	
20.	Recirculation Mixing Pumps (Jet Mix)	3	EA	$36,000	20%	$129,600	
21.	24" Gravity Transfer Pipe (Grit to EQ Tank)	750	FT	$175	30%	$170,625	
22.	Transfer Pumps	3	EA	$14,000	10%	$46,200	
23.	Triplex controller	1	EA	$10,000	10%	$11,000	
24.	VFD Drives	3	EA	$4,000	10%	$13,200	
25.	10" HDPE Force Main	750	FT	$60	60%	$72,000	
26.	Valve and Fittings	1	LS	$30,000	0%	$30,000	
27.	Instrumentation	1	LS	$30,000	10%	$33,000	
28.	Heat Trace Exposed pipe	1	LS	$5,000	0%	$5,000	
29.	Transfer Pumping Station Masonry Building	1	LS	$90,000	0%	$90,000	
30.	Earthwork & Excavation	1	LS	$2,000	0%	$2,000	
31.	Building Foundation	1	LS	$6,000	40%	$8,400	
32.	3/4" Crushed Rock - Slab Foundation	10	CY	$90	50%	$1,350	
33.	HVAC Miniature Split-System, Ductless	1	LS	$18,000	0%	$18,000	
				03 SECONDARY CLARIFIER			
34.	General Conditions	10	%	$19,995	0%	$199,950	
35.	Structural Backfill	2,100	cy	$70	0%	$147,000	
36.	Concrete	1,300	cy	$800	0%	$1,040,000	Walls, base, footing, slab, forms, for 2 clarifiers
37.	FRP Weir Covers	1	ls	$50,000	25%	$62,500	
38.	Mechanism	2	ls	$300,000	25%	$750,000	
39.	Catwalk	2	ea	$138,744	10%	$305,237	
40.	Stairway and Platform	2	ls	$6,450	10%	$14,190	
41.	Splitter box concrete	50	cy	$400	0%	$20,000	
42.	Splitter box slide gate	4	ea	$5,000	10%	$22,000	
43.	Splitter box sluice gate	4	ea	$2,500	10%	$11,000	
44.	Splitter box metal work	1	ls	$10,000	0%	$10,000	
45.	Wetwell and valve box concrete	160	cy	$450	0%	$72,000	
46.	Sludge Pump	2	ea	$10,500	10%	$23,100	
47.	Pump VFD and Harmonic Filter	2	ea	$4,000	10%	$8,800	
48.	6" Flow Meter	2	ea	$3,500	10%	$7,700	
49.	4" Flow Meter	1	ea	$3,100	10%	$3,410	
50.	6" Plug valves	10	ea	$800	5%	$8,400	
51.	4" Plug valves	5	ea	$600	5%	$3,150	
52.	6" Check valves	4	ea	$1,500	5%	$6,300	
53.	4" Check valves	3	ea	$900	5%	$2,835	

54.	Access hatch	16	ea	$2,000	5%	$33,600	
55.	Slide gate	1	ea	$3,500	10%	$3,850	
56.	Scum manhole	1	ea	$3,000	10%	$3,300	
57.	Scum submersible pump	2	ea	$4,500	10%	$9,900	
A	**SUBTOTAL**					**$6,501,209**	
B	*ELECTRICAL/I&C*	(% of A)				$650,121	
C	*MECHANICAL*	(% of A)				$780,145	
D	**SUBTOTAL**					**$7,931,475**	
E	*ALLOWANCE*	(% of D)				$0	
F	*CONTINGENCY*	(% of D)				$2,379,443	
G	*CONTR. OH&P*	(% of D)				$634,518	
H	**SUBTOTAL**					**$10,945,436**	
I	*ENGINEERING DESIGN*	(% of H)				$1,094,544	
J	*CONSTRUCTION MGMT*	(% of H)				$547,272	
K	**SUBTOTAL**					**$12,587,251**	
L	**TOTAL ESTIMATED COST**					**$12,587,000**	

Capital Cost Summary (Budget Level, +30%/-30%)

City of Middleton - Wastewater Master Plan Addendum

Bardenpho 5-Stage

MARK-UPS:	Percentage
ELEC/I&C	10%
MECHANICAL	12%
ALLOWANCE	0%
CONTINGENCY	30%
CONTRACTOR OH&P	8%
ENGINEERING DESIGN	10%
CONSTRUCTION MGMT	5%

Note: Cost presented below assumes both existing SBR basins are modified

Common items between alternatives such as dewatering, blower building, lift station improvements, etc, are not included in cost estimate for more direct comparison between alternatives

Construction Cost Index (CCI):	12555
**Source: Engineering News Record (January 2022)*	

NO.	DESCRIPTION	QTY	UNT	Budget UNIT $	Installation	TOTAL	RESOURCE
			01 BARDENPHO PROCESS				
1.	General Conditions	10	%	$23,834	0%	$238,335	Percent of subtotal
2.	Erosion Control	1	ls	$10,000	0%	$10,000	
3.	Demo/Excavation Haul Off	1	ls	$30,000	0%	$30,000	
4.	Yard Piping/Valves/Instrumentation	1	ls	$350,000	0%	$350,000	
5.	New Blowers	3	ea	$180,000	25%	$675,000	
6.	Diffusers	2	ea	$50,000	25%	$125,000	
7.	RAS/WAS pump	3	ea	$30,000	25%	$112,500	
8.	Baffle Walls	556	cy	$850	0%	$472,600	Concrete
9.	Anoxic Mixers	9	ea	$10,000	15%	$103,500	
10.	Anaerobic Mixers	5	ea	$15,000	15%	$86,250	
11.	Recycle Pumps	3	ea	$30,000	25%	$112,500	
12.	Basin Effluent Transfer Box	2	ls	$60,000	30%	$156,000	
13.	Site Work	1	ls	$150,000	0%	$150,000	
			02 NEW EQ TANK				
14.	General Conditions	10	%	$12,543	0%	$125,433	
15.	Tank Materials & Install	948,000	GAL	$0.55	0%	$521,400	
16.	Tank Materials Freight	1	LS	$19,000	0%	$19,000	
17.	Tank Foundation Ring and Design	1	LS	$25,000	0%	$25,000	
18.	Foundation Design	1	LS	$5,000	0%	$5,000	
19.	Concrete Foundation	255	CY	$150	40%	$53,550	
20.	Recirculation Mixing Pumps (Jet Mix)	3	EA	$36,000	20%	$129,600	
21.	24" Gravity Transfer Pipe (Grit to EQ Tank)	750	FT	$175	30%	$170,625	
22.	Transfer Pumps	3	EA	$14,000	10%	$46,200	
23.	Triplex controller	1	EA	$10,000	10%	$11,000	
24.	VFD Drives	3	EA	$4,000	10%	$13,200	
25.	10" HDPE Force Main	750	FT	$60	60%	$72,000	
26.	Valve and Fittings	1	LS	$30,000	0%	$30,000	
27.	Instrumentation	1	LS	$30,000	10%	$33,000	
28.	Heat Trace Exposed pipe	1	LS	$5,000	0%	$5,000	
29.	Transfer Pumping Station Masonry Building	1	LS	$90,000	0%	$90,000	
30.	Earthwork & Excavation	1	LS	$2,000	0%	$2,000	
31.	Building Foundation	1	LS	$6,000	40%	$8,400	
32.	3/4" Crushed Rock - Slab Foundation	10	CY	$90	50%	$1,350	
33.	HVAC Miniature Split-System, Ductless	1	LS	$18,000	0%	$18,000	
			03 SECONDARY CLARIFIER + SLUDGE WETWELL				
34.	General Conditions	10	%	$25,584	0%	$255,837	
35.	Structural Backfill	2,100	cy	$70	0%	$147,000	
36.	Concrete	1,300	cy	$800	0%	$1,040,000	0
37.	FRP Weir Covers	1	ls	$50,000	25%	$62,500	
38.	Mechanism	2	ls	$300,000	25%	$750,000	2 SECONDARY CLARIFIERS
39.	Catwalk	2	ea	$138,744	10%	$305,237	
40.	Stairway and Platform	2	ls	$6,450	10%	$14,190	
41.	Splitter box concrete	50	cy	$400	0%	$20,000	
42.	Splitter box slide gate	4	ea	$5,000	10%	$22,000	
43.	Splitter box sluice gate	4	ea	$2,500	10%	$11,000	
44.	Splitter box metal work	1	ls	$10,000	0%	$10,000	
45.	Wetwell and valve box concrete	160	cy	$450	0%	$72,000	
46.	Sludge Pump	2	ea	$10,500	10%	$23,100	
47.	Pump VFD and Harmonic Filter	2	ea	$4,000	10%	$8,800	
48.	6" Flow Meter	2	ea	$3,500	10%	$7,700	
49.	4" Flow Meter	1	ea	$3,100	10%	$3,410	
50.	6" Plug valves	10	ea	$800	5%	$8,400	
51.	4" Plug valves	5	ea	$600	5%	$3,150	
52.	6" Check valves	4	ea	$1,500	5%	$6,300	
53.	4" Check valves	3	ea	$900	5%	$2,835	

54.	Access hatch	16	ea	$2,000	5%	$33,600	
55.	Slide gate	1	ea	$3,500	10%	$3,850	
56.	Scum manhole	1	ea	$3,000	10%	$3,300	
57.	Scum submersible pump	2	ea	$4,500	10%	$9,900	
A	**SUBTOTAL**					**$6,825,551**	
B	*ELECTRICAL/I&C*	(% of A)				$682,555	
C	*MECHANICAL*	(% of A)				$819,066	
D	**SUBTOTAL**					**$8,327,173**	
E	*ALLOWANCE*	(% of D)				$0	
F	*CONTINGENCY*	(% of D)				$2,498,152	
G	*CONTR. OH&P*	(% of D)				$666,174	
H	**SUBTOTAL**					**$11,491,498**	
I	*ENGINEERING DESIGN*	(% of H)				$1,149,150	
J	*CONSTRUCTION MGMT*	(% of H)				$574,575	
K	**SUBTOTAL**					**$13,215,223**	
L	**TOTAL ESTIMATED COST**					**$13,215,000**	

Capital Cost Summary (Budget Level, +30%/-30%)

City of Middleton - Wastewater Master Plan Addendum

A2O Step Feed Process

MARK-UPS:	Percentage
ELEC/I&C	10%
MECHANICAL	12%
ALLOWANCE	0%
CONTINGENCY	30%
CONTRACTOR OH&P	8%
ENGINEERING DESIGN	10%
CONSTRUCTION MGMT	5%

Note: Cost presented below assumes both SBR basins are modified to the A2O process

Common items between alternatives such as dewatering, blower building, lift station improvements, etc, are not included in cost estimate presented below.

Construction Cost Index (CCI):	12555
**Source: Engineering News Record (January 2022)*	

NO.	DESCRIPTION	QTY	UNIT	Budget UNIT $	Installation	TOTAL	RESOURCE
				01 STEP FEED PROCESS			
1.	General Conditions	10	%	$25,991	0%	$259,905	Percent of subtotal
2.	Erosion Control	1	ls	$10,000	0%	$10,000	
3.	Demo	1	ls	$30,000	0%	$30,000	Demo existing baffle wall, partial aeration grid
4.	Yard Piping/Valves/Instrumentation	1	ls	$350,000	0%	$350,000	
5.	New Blowers	3	ea	$180,000	25%	$675,000	
6.	Diffusers	2	ea	$65,000	25%	$162,500	Diffusers in plug flow channel
7.	Baffle Walls	658	cy	$850	0%	$559,300	Concrete
8.	RAS/WAS pumps	3	ea	$30,000	25%	$112,500	
9.	Anoxic mixers	7	ea	$15,000	15%	$120,750	3 chambers per basin+ spare
10.	Anaerobic mixers	7	ls	$10,000	15%	$80,500	3 chambers per basin+ spare
11.	Anoxic Effluent trough	160	lf	$200	25%	$40,000	
12.	Effluent trough	160	lf	$200	25%	$40,000	
13.	Recycle Pumps	3	ea	$30,000	25%	$112,500	
14.	Basin Effluent Transfer Box	2	ls	$60,000	30%	$156,000	Modifications to effluent transfer manhole from decant
15.	Site Work	1	ls	$150,000	0%	$150,000	
				02 NEW EQ TANK			
16.	General Conditions	10	%	$12,543	0%	$125,433	
17.	Tank Materials & Install	948,000	gal	$0.55	0%	$521,400	
18.	Tank Materials Freight	1	ls	$19,000	0%	$19,000	
19.	Tank Foundation Ring and Design	1	ls	$25,000	0%	$25,000	
20.	Foundation Design	1	ls	$5,000	0%	$5,000	
21.	Concrete Foundation	255	cy	$150	40%	$53,550	
22.	Recirculation Mixing Pumps (Jet Mix)	3	ea	$36,000	20%	$129,600	
23.	24" Gravity Transfer Pipe (Grit to EQ Tank)	750	ft	$175	30%	$170,625	
24.	Transfer Pumps	3	ea	$14,000	10%	$46,200	
25.	Triplex controller	1	ea	$10,000	10%	$11,000	
26.	VFD Drives	3	ea	$4,000	10%	$13,200	
27.	10" HDPE Force Main	750	ft	$60	60%	$72,000	
28.	Valve and Fittings	1	ls	$30,000	0%	$30,000	
29.	Instrumentation	1	ls	$30,000	10%	$33,000	
30.	Heat Trace Exposed pipe	1	ls	$5,000	0%	$5,000	
31.	Transfer Pumping Station Masonry Building	1	ls	$90,000	0%	$90,000	
32.	Earthwork & Excavation	1	ls	$2,000	0%	$2,000	
33.	Building Foundation	1	ls	$6,000	40%	$8,400	
34.	3/4" Crushed Rock - Slab Foundation	10	cy	$90	50%	$1,350	
35.	HVAC Miniature Split-System, Ductless	1	ls	$18,000	0%	$18,000	
				03 SECONDARY CLARIFIER			
36.	General Conditions	10	%	$19,995	0%	$199,950	
37.	Structural Backfill	2,100	cy	$70	0%	$147,000	
38.	Concrete	1,300	cy	$800	0%	$1,040,000	
39.	FRP Weir Covers	1	ls	$50,000	25%	$62,500	
40.	Mechanism	2	ls	$300,000	25%	$750,000	
41.	Catwalk	2	ea	$138,744	10%	$305,237	
42.	Stairway and Platform	2	ls	$6,450	10%	$14,190	
43.	Splitter box concrete	50	cy	$400	0%	$20,000	
44.	Splitter box slide gate	4	ea	$5,000	10%	$22,000	
45.	Splitter box sluice gate	4	ea	$2,500	10%	$11,000	
46.	Splitter box metal work	1	ls	$10,000	0%	$10,000	
47.	Wetwell and valve box concrete	160	cy	$450	0%	$72,000	
48.	Sludge Pump	2	ea	$10,500	10%	$23,100	
49.	Pump VFD and Harmonic Filter	2	ea	$4,000	10%	$8,800	
50.	6" Flow Meter	2	ea	$3,500	10%	$7,700	
51.	4" Flow Meter	1	ea	$3,100	10%	$3,410	
52.	6" Plug valves	10	ea	$800	5%	$8,400	
53.	4" Plug valves	5	ea	$600	5%	$3,150	

54.	6" Check valves	4	ea	$1,500	5%	$6,300	
55.	4" Check valves	3	ea	$900	5%	$2,835	
56.	Access hatch	16	ea	$2,000	5%	$33,600	
57.	Slide gate	1	ea	$3,500	10%	$3,850	
58.	Scum manhole	1	ea	$3,000	10%	$3,300	
59.	Scum submersible pump	2	ea	$4,500	10%	$9,900	
A	**SUBTOTAL**					**$7,006,934**	
B	*ELECTRICAL/I&C*	(% of A)				$700,693	
C	*MECHANICAL*	(% of A)				$840,832	
D	**SUBTOTAL**					**$8,548,460**	
E	*ALLOWANCE*	(% of D)				$0	
F	*CONTINGENCY*	(% of D)				$2,564,538	
G	*CONTR. PROFIT*	(% of D)				$683,877	
H	**SUBTOTAL**					**$11,796,875**	
I	*ENGINEERING DESIGN*	(% of H)				$1,179,687	
J	*CONSTRUCTION MGMT*	(% of H)				$589,844	and permitting
K	**SUBTOTAL**					**$13,566,406**	
L	**TOTAL ESTIMATED COST**					**$13,566,000**	

Capital Cost Summary (Budget Level, +30%/-30%)

City of Middleton - Wastewater Master Plan Addendum **_Additional SBR Basins_**

MARK-UPS:	Percentage
ELEC/I&C	10%
MECHANICAL	12%
ALLOWANCE	0%
CONTINGENCY	30%
CONTRACTOR OH&P	8%
ENGINEERING DESIGN	10%
CONSTRUCTION MGMT	5%

Note: Cost presented below assumes additon of three SBR basins

Common items between alternatives such as dewatering, blower building, lift station improvements, etc, are not included in cost estimate for more direct comparison between alternatives

Construction Cost Index (CCI):	12555
**Source: Engineering News Record (January 2022)*	

NO.	DESCRIPTION	QTY	UNIT	Budget UNIT $	Installation	TOTAL	RESOURCE
				01 GENERAL			
1.	General Conditions	10	%	$87,666	0%	$876,659	Percent of project subtotal
2.	Erosion Control	1	ls	$10,000	0%	$10,000	
3.	Demo/Haul Off	1	ls	$30,000	0%	$30,000	
				02 NEW SBR BASIN			
Earthwork							
4.	Structural Backfill (sludge pond)	31,000	cy	$25	0%	$775,000	Partial fill of sludge pond
5.	Structural Pad	27,400	cy	$25	0%	$685,000	New pad for 3 SBR basins
Concrete (3 basins)							
6.	Outside Walls	1,200	cy	$850	0%	$1,020,000	
7.	Base Footing (Concrete)	90	cy	$850	0%	$76,500	
8.	Basin Floor (Concrete)	600	cy	$850	0%	$510,000	
9.	Base Floor (Grout)	105	cy	$150	0%	$15,750	
10.	Baffle Wall and Footing	630	cy	$850	0%	$535,500	
Metals							
11.	Pipe Supports	1	ls	$30,000	0%	$30,000	
12.	Miscellaneous Metals (handrails, grating, etc.)	1	ls	$300,000	0%	$300,000	For 3 basins
Equipment (3 basins)							
13.	Fine bubble membrane diffuser grid	3	ea	$50,000	25%	$187,500	1540 EPDM diffusers per basin
14.	WAS Pump	4	ea	$30,000	25%	$150,000	Flygt, submersible, one per basin + spare
15.	Anoxic Mixers	7	ea	$15,000	15%	$120,750	15 HP Flygt submersible, 2 per basin + spare
16.	Splitter Box	1	ls	$165,000	30%	$214,500	Split between 3 basins
17.	Basin Effluent Transfer Box	3	ea	$60,000	30%	$234,000	Effluent transfer "manhole"
18.	Decanter	3	ea	$115,000	25%	$431,250	
19.	Blowers	4	ea	$180,000	25%	$900,000	Size for 3 basins (2 basins in react phase)
20.	Instrumentation	1	ls	$100,000	0%	$100,000	
20.	Blower Building Extension	1	ls	$350,000	0%	$350,000	Room to house additional blowers req'd
Piping and Valves (3 basins)							
21.	Influent Header Piping (18")	400	lf	$75	30%	$39,000	
22.	SBR Effluent Piping (36" HDPE)	350	lf	$210	30%	$95,550	
23.	Drain Piping (6" perforated HDPE)	1110	lf	$30	30%	$43,290	Drain piping around basin to match existing
24.	Gravity Sewer/overflow Piping (18")	385	lf	$75	30%	$37,538	
25.	Aeration Piping (16" Ductile iron)	550	lf	$140	30%	$100,100	Main line from blower building
26.	Aeration Piping (8" Ductile iron)	120	lf	$80	30%	$12,480	
27.	Aeration Piping (8" SST dropleg)	90	lf	$230	60%	$33,120	Dropleg into basins, welded stainless 304
28.	Valve and Fittings	1	ls	$200,000	25%	$250,000	
28.	Misc Yard piping	1	ls	$100,000	0%	$100,000	
				03 NEW EQ TANK			
29.	General Conditions	10	%	$12,543	0%	$125,433	
30.	Tank Materials & Install	948,000	gal	$0.55	0%	$521,400	
31.	Tank Materials Freight	1	ls	$19,000	0%	$19,000	
32.	Tank Foundation Ring and Design	1	ls	$25,000	0%	$25,000	
33.	Foundation Design	1	ls	$5,000	0%	$5,000	
34.	Concrete Foundation	255	cy	$150	40%	$53,550	
35.	Recirculation Mixing Pumps (Jet Mix)	3	ea	$36,000	20%	$129,600	
36.	24" Gravity Transfer Pipe (Grit to EQ Tank)	750	ft	$175	30%	$170,625	
37.	Transfer Pumps	3	ea	$14,000	10%	$46,200	
38.	Triplex controller	1	ea	$10,000	10%	$11,000	
39.	VFD Drives	3	ea	$4,000	10%	$13,200	
40.	10" HDPE Force Main	750	ft	$60	60%	$72,000	
41.	Valve and Fittings	1	ls	$30,000	0%	$30,000	
42.	Instrumentation	1	ls	$30,000	10%	$33,000	
43.	Heat Trace Exposed pipe	1	ls	$5,000	0%	$5,000	
44.	Transfer Pumping Station Masonry Building	1	ls	$90,000	0%	$90,000	
45.	Earthwork & Excavation	1	ls	$2,000	0%	$2,000	
46.	Building Foundation	1	ls	$6,000	40%	$8,400	

47.	3/4" Crushed Rock - Slab Foundation	10	cy	$90	50%	$1,350	
48.	HVAC Miniature Split-System, Ductless	1	ls	$18,000	0%	$18,000	
A	**SUBTOTAL**					**$9,643,244**	
B	*ELECTRICAL/I&C*	(% of A)				$964,324	
C	*MECHANICAL*	(% of A)				$1,157,189	
D	**SUBTOTAL**					**$11,764,757**	
E	*ALLOWANCE*	(% of D)				$0	
F	*CONTINGENCY*	(% of D)				$3,529,427	
G	*CONTR. OH&P*	(% of D)				$941,181	
H	**SUBTOTAL**					**$16,235,365**	
I	*ENGINEERING DESIGN*	(% of H)				$1,623,536	
J	*CONSTRUCTION MGMT*	(% of H)				$811,768	
K	**SUBTOTAL**					**$18,670,669**	
L	**TOTAL ESTIMATED COST**					**$18,671,000**	

COST ESTIMATES FOR ADDITIONAL PLANT IMPROVEMENTS

Capital Cost Summary (Budget Level, +30%/-30%)

City of Middleton - Wastewater Master Plan Addendum

WWTP IMPROVEMENTS

Cost estimate for additional plant improvements

MARK-UPS:	**Percentage**
ELEC/I&C	**10%**
MECHANICAL	**12%**
ALLOWANCE	**0%**
CONTINGENCY	**30%**
CONTRACTOR OH&P	**8%**
ENGINEERING DESIGN	**10%**
CONSTRUCTION MGMT	**5%**

Construction Cost Index (CCI):	12555
**Source: Engineering News Record (January 2022)*	

NO.	DESCRIPTION	QTY	UNT	BUDGET UNIT $	INSTALL	TOTAL
	01 SCREENS					
1.	General Conditions	10	%	$8,990	0%	$89,900
2.	Fine screen	2	EA	$250,000	0%	$500,000
3.	Modifications to Screen Building	1	LS	$300,000	25%	$375,000
4.	Valves and Instruments	1	LS	$20,000	20%	$24,000
	SUBTOTAL					**$988,900**
	02 INFLUENT LIFT STATION AND FORCE MAIN					
5.	General Conditions	10	%	$10,200	0%	$102,000
6.	18-inch HDPE DR 17 Force Main	1,000	LF	$220	0%	$220,000
7.	Mechanical Pipe, Valves and Instruments	1	LS	$200,000	20%	$240,000
8.	Pipe trenching and bedding	1,000	LF	$40	0%	$40,000
9.	Pumps (30 HP)	4	EA	$25,000	20%	$120,000
10.	Building Modifications	1	LS	$400,000	0%	$400,000
	SUBTOTAL					**$1,122,000**
	03 GRIT FACILITY					
11.	General Conditions	10	%	$11,050	0%	$110,500
12.	Site Work	1	LS	$50,000	0%	$50,000
13.	Piping/Valves	1	LS	$50,000	20%	$60,000
14.	Instrumentation	1	LS	$25,000	20%	$30,000
15.	Grit Building expansion	1	LS	$250,000	0%	$250,000
16.	Grit Equipment	1	LS	$650,000	10%	$715,000
	SUBTOTAL					**$1,215,500**
	04 PRIMARY CLARIFIERS AND SLUDGE WETWELL					
17.	General Conditions	10	%	$26,258	0%	$262,576
18.	Excavation	10,000	cy	$16	0%	$155,000
19.	Structural Backfill	4,000	cy	$70	0%	$280,000
20.	Gravel	600	sy	$35	0%	$21,000
21.	Clarifiers floor and footing	800	cy	$450	0%	$360,000
22.	Clarifiers concrete wall and launder	1,100	cy	$500	0%	$550,000
23.	Clarifier floor grout	9,000	sf	$2	0%	$18,000
24.	Wetwell and valve box concrete	160	cy	$450	0%	$72,000
25.	Splitter box concrete	50	cy	$400	0%	$20,000
26.	Splitter box slide gate	4	ea	$5,000	10%	$22,000

27.	Splitter box sluice gate	4	ea	$2,500	10%	$11,000
28.	Splitter box metal work	1	ls	$10,000	0%	$10,000
29.	Primary clarifier mechanism, sst	2	ea	$172,000	25%	$430,000
30.	FRP Weir & Scum Baffles	2	ea	$30,300	10%	$66,660
31.	Tank	2	ea	$155,445	10%	$341,979
32.	Catwalk (full perimeter)	2	ea	$62,720	10%	$137,984
33.	Stairway & Platform	2	ea	$6,450	10%	$14,190
34.	Sludge Pump	2	ea	$10,500	10%	$23,100
35.	Pump VFD and Harmonic Filter	2	ea	$4,000	10%	$8,800
36.	Scum submersible pump	2	ea	$4,500	10%	$9,900
37.	Flow Meter	2	ea	$3,500	10%	$7,700
38.	Flow Meter	1	ea	$3,100	10%	$3,410
39.	Plug valves	10	ea	$800	5%	$8,400
40.	Plug valves	5	ea	$600	5%	$3,150
41.	Check valves	4	ea	$1,500	5%	$6,300
42.	Check valves	3	ea	$900	5%	$2,835
43.	Access hatch	16	ea	$2,000	10%	$35,200
44.	Slide gate	1	ea	$3,500	10%	$3,850
45.	Scum manhole	1	ea	$3,000	10%	$3,300
	SUBTOTAL					**$2,888,334**
			05 SLUDGE STORAGE			
46.	General Conditions	10	%	$5,099	0%	$50,987
47.	Sludge Tank	150,000	GAL	$1.25	0%	$187,500
48.	Sludge Tank Pad	63	CY	$155	40%	$13,671
49.	Tank Foundation Ring and Design	1	LS	$16,000	0%	$16,000
50.	Tank Freight	1	LS	$17,000	0%	$17,000
51.	Blower for Mixing	1	EA	$125,000	10%	$137,500
52.	Blower Mixing Grid	1	LS	$50,000	10%	$55,000
53.	Pipe and Valves	1	LS	$25,000	0%	$25,000
54.	Instrumentation	1	LS	$30,000	10%	$33,000
55.	WAS Piping Reroute	130	LF	$50	20%	$7,800
56.	Transfer Piping to Dewatering Building	80	LF	$50	20%	$4,800
57.	Instrumentation	1	LS	$12,000	5%	$12,600
	SUBTOTAL					**$561,000**
			06 DEWATERING + BLOWER BUILDING			
58.	General Conditions	10	%	$21,277	0%	$212,775
59.	Interior Piping and Valves	1	LS	$110,000	20%	$132,000
60.	Screw Press (Huber)	2	EA	$314,000	10%	$690,800
61.	Sludge Feed Pump (Seepex)	2	EA	$15,000	10%	$33,000
62.	Pump Controller	1	LS	$6,000	10%	$6,600
63.	Sludge Feed Pump VFD	2	EA	$4,000	10%	$8,800
64.	Polymer Blend System	1	EA	$20,000	10%	$22,000
65.	Cake Screw Conveyor	2	EA	$15,000	10%	$33,000
66.	Instrumentation	1	LS	$20,000	5%	$21,000
67.	Cake Storage Pad	700	SF	$12	0%	$8,400
68.	Canopy	1	LS	$10,000	0%	$10,000
69.	Cake Dumpster (30 CY)	2	EA	$1,500	0%	$3,000
70.	Filtrate Piping	250	LF	$65	0%	$16,250
71.	Manhole	1	EA	$5,000	10%	$5,500
72.	Air Compressor + Air Piping	1	LS	$10,000	10%	$11,000

73.	HVAC	1	LS	$100,000	0%	$100,000
74.	Plumbing	1	LS	$55,000	0%	$55,000
75.	Building Electrical	1	LS	$210,000	0%	$210,000
76.	Dewater and Blower Masonry Building	1	LS	$550,000	30%	$715,000
77.	Earthwork & Excavation	1	LS	$10,825	20%	$12,990
78.	Building Foundation + East Sidewalk	204	CY	$85	20%	$20,808
79.	3/4" Crushed Rock - Slab Foundation	102	CY	$95	30%	$12,597
	SUBTOTAL					**$2,341,000**
	07 UV SYSTEM UPGRADE					
80.	General Conditions	10	%	$10,850	0%	$108,500
81.	UV Building	1	LS	$350,000	0%	$350,000
82.	UV Channel Modifications	1	LS	$85,000	0%	$85,000
83.	UV Disinfection Equipment	1	LS	$500,000	0%	$500,000
84.	Instrumentation	1	LS	$50,000	0%	$50,000
85.	Pipe and Valves	1	LS	$100,000	0%	$100,000
	SUBTOTAL					**$1,194,000**
	08 TERTIARY PHOSPHORUS TREATMENT					
86.	General Conditions	10	%	$34,600	0%	$346,000
87.	Filter Package	1	ls	$2,000,000	20%	$2,400,000
88.	Flocculation Basin	1	ls	$75,000	0%	$75,000
89.	Flocculation Mixers	1	ls	$35,000	20%	$42,000
90.	Lift Station	1	ls	$190,000	20%	$228,000
91.	Yard Piping	1	ls	$150,000	20%	$180,000
92.	Valves & Instrumentation	1	ls	$100,000	20%	$120,000
93.	Filtration and Chemical Building	1	ls	$300,000	0%	$300,000
94.	Chemical Feed Pump Package	1	ls	$25,000	20%	$30,000
95.	Pilot Testing	1	ls	$35,000	0%	$35,000
96.	Site Work	1	ls	$50,000	0%	$50,000
	SUBTOTAL					**$3,806,000**
	09 EFFLUENT OUTFALL					
97.	General Conditions	10	%	$3,158	0%	$31,575
98.	22-inch HDPE DR 17 Gravity Main	450	LF	$400	50%	$270,000
99.	Mechanical Pipe, Valves and Instruments	1	LS	$10,000	20%	$12,000
100.	Pipe trenching and bedding	450	LF	$75	0%	$33,750
	SUBTOTAL					**$348,000**
	10 VAC TRUCK DUMP					
101.	General Conditions	10	%	$4,273	0%	$42,730
102.	Slab on grade and footing	5,100	sf	$11	0%	$53,754
103.	Concrete Install	95	cy	$40	0%	$3,800
104.	Roof framing	4,800	sf	$15	0%	$72,000
105.	Roofing	4,800	sf	$15	0%	$72,000
106.	Piped utilities	1	ls	$65,000	15%	$74,750
107.	Misc metals	1	ls	$10,000	0%	$10,000
108.	Sitework	1	ls	$45,000	0%	$45,000
109.	Waterproofing	4,800	sf	$20	0%	$96,000
	SUBTOTAL					**$471,000**
	11 MISCELLANEOUS IMPROVEMENTS					
Gravel Roadway						
110.	General Conditions	10	%	$3,300	0%	$33,000
111.	3/4" Minus Crushed Rock (6" layer)	240	CY	$90	50%	$32,400

112.	6-inch Minus Pitrun (14" layer)	560	CY	$50	50%	$42,000
113.	Earthwork & Excavation	1	LS	$250,000	0%	$250,000
114.	Demolition of Concrete Curb	17	LF	$35	0%	$595
115.	SWPPP Materials	1	EA	$5,000	0%	$5,000
	SUBTOTAL					**$363,000**
Sludge Removal From Pond						
116.	General Conditions	10	%	$5,000	0%	$50,000
117.	Sludge Removal	1	LS	$500,000	0%	$500,000
	SUBTOTAL					**$550,000**
Updates to WWTP Office Sewer						
118.	General Conditions	10	%	$680	0%	$6,800
119.	Install Lift Station	1	LS	$18,000	0%	$18,000
120.	Mechanical at Lift Station	1	LS	$28,000	0%	$28,000
121.	Electrical at Lift Station	1	LS	$13,000	0%	$13,000
122.	3" PVC Pressure Line	225	LF	$20	50%	$6,750
123.	Pipe trenching and bedding	225	LF	$10	0%	$2,250
	SUBTOTAL					**$75,000**
A	**SUBTOTAL**					**$15,923,734**
B	*ELECTRICAL/I&C*	(% of A)				$1,592,373
C	*MECHANICAL*	(% of A)				$1,910,848
D	**SUBTOTAL**					**$19,426,955**
E	*ALLOWANCE*	(% of D)				$0
F	*CONTINGENCY*	(% of D)				$5,828,087
G	*CONTRACTOR OH&P*	(% of D)				$1,554,156
H	**SUBTOTAL**					**$26,809,198**
I	*ENGINEERING DESIGN*	(% of H)				$2,680,920
J	*CONSTRUCTION MGMT*	(% of H)				$1,340,460
K	**SUBTOTAL**					**$30,830,578**
L	**TOTAL ESTIMATED COST**					**$30,831,000**

LIFE CYCLE COST ESTIMATES FOR BIOLOGICAL TREATMENT ALTERNATIVES

Life Cycle Cost

A-1 (MBR)

Discount Factor	3.5%

for net present value calculation

Year	Year	C_o (Initial Cost)	(OC) Labor	(MC) O&M	(RC) Replacement	Discount Factor	Discounted OC	Discounted MC	Discounted RC
2022	0	$12,894,000				1.00			
2023	1		$268,800	$354,567		0.9662	$259,710	$342,577	$0
2024	2		$268,800	$354,567		0.9335	$250,928	$330,992	$0
2025	3		$268,800	$354,567		0.9019	$242,442	$319,799	$0
2026	4		$268,800	$354,567		0.8714	$234,244	$308,984	$0
2027	5		$268,800	$354,567		0.8420	$226,322	$298,536	$0
2028	6		$268,800	$354,567		0.8135	$218,669	$288,440	$0
2029	7		$268,800	$354,567		0.7860	$211,274	$278,686	$0
2030	8		$268,800	$354,567	$600,000	0.7594	$204,130	$269,262	$455,647
2031	9		$268,800	$354,567		0.7337	$197,227	$260,157	$0
2032	10		$268,800	$354,567		0.7089	$190,557	$251,359	$0
2033	11		$268,800	$354,567		0.6849	$184,113	$242,859	$0
2034	12		$268,800	$354,567		0.6618	$177,887	$234,646	$0
2035	13		$268,800	$354,567		0.6394	$171,872	$226,711	$0
2036	14		$268,800	$354,567		0.6178	$166,060	$219,045	$0
2037	15		$268,800	$354,567		0.5969	$160,444	$211,638	$0
2038	16		$268,800	$354,567	$600,000	0.5767	$155,019	$204,481	$346,024
2039	17		$268,800	$354,567		0.5572	$149,776	$197,566	$0
2040	18		$268,800	$354,567		0.5384	$144,711	$190,885	$0
Total							$3,545,386	$4,676,623	$801,670

A-1 (MBR)	Life Cycle Cost (LCC)	**$21,917,680**

*Labor costs include 4 operations staff at $35/hr for a 48 week working year

**Replacement costs include membrane replacement every 8 years at $600k

Life Cycle Cost
A-2a (A2O)

Discount Factor	**3.5%**	*for net present value calculation*

Year	Year	C_o (Initial Cost)	(OC) Labor	(MC) O&M	(RC) Replacement	Discount Factor	Discounted OC	Discounted MC	Discounted RC
2022	0	$12,587,000				1.00			
2023	1		$268,800	$349,941		0.9662	$259,710	$338,108	$0
2024	2		$268,800	$349,941		0.9335	$250,928	$326,674	$0
2025	3		$268,800	$349,941		0.9019	$242,442	$315,627	$0
2026	4		$268,800	$349,941		0.8714	$234,244	$304,954	$0
2027	5		$268,800	$349,941		0.8420	$226,322	$294,641	$0
2028	6		$268,800	$349,941		0.8135	$218,669	$284,678	$0
2029	7		$268,800	$349,941		0.7860	$211,274	$275,051	$0
2030	8		$268,800	$349,941		0.7594	$204,130	$265,750	$0
2031	9		$268,800	$349,941		0.7337	$197,227	$256,763	$0
2032	10		$268,800	$349,941		0.7089	$190,557	$248,080	$0
2033	11		$268,800	$349,941		0.6849	$184,113	$239,691	$0
2034	12		$268,800	$349,941		0.6618	$177,887	$231,585	$0
2035	13		$268,800	$349,941		0.6394	$171,872	$223,754	$0
2036	14		$268,800	$349,941		0.6178	$166,060	$216,187	$0
2037	15		$268,800	$349,941		0.5969	$160,444	$208,877	$0
2038	16		$268,800	$349,941		0.5767	$155,019	$201,813	$0
2039	17		$268,800	$349,941		0.5572	$149,776	$194,989	$0
2040	18		$268,800	$349,941		0.5384	$144,711	$188,395	$0
Total							$3,545,386	$4,615,617	$0

A-2a (A2O) Life Cycle Cost (LCC)	**$20,748,003**

*Labor costs include 4 operations staff at $35/hr for a 48 week working year

Life Cycle Cost
A-2b (5-Stage Bardenpho)

Discount Factor	3.5%	*for net present value calculation*

Year	Year	C_o (Initial Cost)	(OC) Labor	(MC) O&M	(RC) Replacement	Discount Factor	Discounted OC	Discounted MC	Discounted RC
2022	0	$13,215,000				1.00			
2023	1		$268,800	$361,700		0.9662	$259,710	$349,468	$0
2024	2		$268,800	$361,700		0.9335	$250,928	$337,651	$0
2025	3		$268,800	$361,700		0.9019	$242,442	$326,232	$0
2026	4		$268,800	$361,700		0.8714	$234,244	$315,200	$0
2027	5		$268,800	$361,700		0.8420	$226,322	$304,541	$0
2028	6		$268,800	$361,700		0.8135	$218,669	$294,243	$0
2029	7		$268,800	$361,700		0.7860	$211,274	$284,293	$0
2030	8		$268,800	$361,700		0.7594	$204,130	$274,679	$0
2031	9		$268,800	$361,700		0.7337	$197,227	$265,390	$0
2032	10		$268,800	$361,700		0.7089	$190,557	$256,416	$0
2033	11		$268,800	$361,700		0.6849	$184,113	$247,745	$0
2034	12		$268,800	$361,700		0.6618	$177,887	$239,367	$0
2035	13		$268,800	$361,700		0.6394	$171,872	$231,272	$0
2036	14		$268,800	$361,700		0.6178	$166,060	$223,451	$0
2037	15		$268,800	$361,700		0.5969	$160,444	$215,895	$0
2038	16		$268,800	$361,700		0.5767	$155,019	$208,594	$0
2039	17		$268,800	$361,700		0.5572	$149,776	$201,540	$0
2040	18		$268,800	$361,700		0.5384	$144,711	$194,725	$0
Total							$3,545,386	$4,770,704	$0
A-2b (5-Stage Bardenpho)			Life Cycle Cost (LCC)						**$21,531,090**

*Labor costs include 4 operations staff at $35/hr for a 48 week working year

Life Cycle Cost

A-2c (A2O Step Feed)

Discount Factor	**3.5%**

for net present value calculation

Year	Year	C_o (Initial Cost)	(OC) Labor	(MC) O&M	(RC) Replacement	Discount Factor	Discounted OC	Discounted MC	Discounted RC
2022	0	$13,566,000				1.00			
2023	1		$268,800	$359,740		0.9662	$259,710	$347,575	$0
2024	2		$268,800	$359,740		0.9335	$250,928	$335,821	$0
2025	3		$268,800	$359,740		0.9019	$242,442	$324,465	$0
2026	4		$268,800	$359,740		0.8714	$234,244	$313,493	$0
2027	5		$268,800	$359,740		0.8420	$226,322	$302,891	$0
2028	6		$268,800	$359,740		0.8135	$218,669	$292,649	$0
2029	7		$268,800	$359,740		0.7860	$211,274	$282,752	$0
2030	8		$268,800	$359,740		0.7594	$204,130	$273,191	$0
2031	9		$268,800	$359,740		0.7337	$197,227	$263,952	$0
2032	10		$268,800	$359,740		0.7089	$190,557	$255,026	$0
2033	11		$268,800	$359,740		0.6849	$184,113	$246,402	$0
2034	12		$268,800	$359,740		0.6618	$177,887	$238,070	$0
2035	13		$268,800	$359,740		0.6394	$171,872	$230,019	$0
2036	14		$268,800	$359,740		0.6178	$166,060	$222,241	$0
2037	15		$268,800	$359,740		0.5969	$160,444	$214,725	$0
2038	16		$268,800	$359,740		0.5767	$155,019	$207,464	$0
2039	17		$268,800	$359,740		0.5572	$149,776	$200,448	$0
2040	18		$268,800	$359,740		0.5384	$144,711	$193,670	$0
Total							$3,545,386	$4,744,856	$0
A-2c (A2O Step Feed)	Life Cycle Cost (LCC)								**$21,856,242**

*Labor costs include 4 operations staff at $35/hr for a 48 week working year

Life Cycle Cost
A-5 (SBR)

Discount Factor	**3.5%**	*for net present value calculation*

Year	Year	C_o (Initial Cost)	(OC) Labor	(MC) O&M	(RC) Replacement	Discount Factor	Discounted OC	Discounted MC	Discounted RC
2022	0	$18,671,000				1.00			
2023	1		$268,800	$309,082		0.9662	$259,710	$298,630	$0
2024	2		$268,800	$309,082		0.9335	$250,928	$288,531	$0
2025	3		$268,800	$309,082		0.9019	$242,442	$278,774	$0
2026	4		$268,800	$309,082		0.8714	$234,244	$269,347	$0
2027	5		$268,800	$309,082		0.8420	$226,322	$260,239	$0
2028	6		$268,800	$309,082		0.8135	$218,669	$251,438	$0
2029	7		$268,800	$309,082		0.7860	$211,274	$242,935	$0
2030	8		$268,800	$309,082		0.7594	$204,130	$234,720	$0
2031	9		$268,800	$309,082		0.7337	$197,227	$226,783	$0
2032	10		$268,800	$309,082		0.7089	$190,557	$219,114	$0
2033	11		$268,800	$309,082		0.6849	$184,113	$211,704	$0
2034	12		$268,800	$309,082		0.6618	$177,887	$204,545	$0
2035	13		$268,800	$309,082		0.6394	$171,872	$197,628	$0
2036	14		$268,800	$309,082		0.6178	$166,060	$190,945	$0
2037	15		$268,800	$309,082		0.5969	$160,444	$184,488	$0
2038	16		$268,800	$309,082		0.5767	$155,019	$178,249	$0
2039	17		$268,800	$309,082		0.5572	$149,776	$172,222	$0
2040	18		$268,800	$309,082		0.5384	$144,711	$166,398	$0
Total							$3,545,386	$4,076,690	$0

A-5 (SBR)	Life Cycle Cost (LCC)	**$26,293,077**

*Labor costs include 4 operations staff at $35/hr for a 48 week working year

OPERATION AND MAINTENANCE COST ESTIMATES FOR BIOLOGICAL TREATMENT ALTERNATIVES

O&M COSTS

20-Year Planning Period

A-1 MBR

Electricity Cost **$0.060** per kW-hr

NO.	DESCRIPTION	HP (ea)	Energy Use	UNT	TOTAL ($/day)
	DAILY ENERGY USE				
1.	Anoxic Mixers	7.5	268	kW-hrs/d	$16.11
2.	Anaerobic Mixers	5	179	kW-hrs/d	$10.74
3.	Permeate Pump	25	1,790	kW-hrs/d	$107.38
4.	Feed Forward Pump	25	1,790	kW-hrs/d	$107.38
5.	RAS/WAS Pumps	30	1,074	kW-hrs/d	$64.43
6.	MBR Scour Blowers	75	2,685	kW-hrs/d	$161.07
7.	Pre-aeration Blowers	150	8,054	kW-hrs/d	$483.21
	SUBTOTAL		**15,839**	**kW-hrs/d**	**$950.32**
	MISC CHEMICAL CLEANING & O&M				
8.	Sodium Hypochlorite (10.3% w/w)		500	gal/yr	$4,000
9.	Citric Acid (50% w/w)		200	gal/yr	$3,600
10.	Misc O&M		1	daily	$100
11.	Membrane replacement (every 8 yrs)		1	ls	$600,000
	ESTIMATED COSTS				
	DAILY COST		$1,177	$/d	
	YEARLY COST		$429,567	$/yr	
	20-YEAR COST		$8,591,000	$	

*estimate based on flat plate membrane maintenance with 4 dedicated clean in place (CIP) events per year. Additional membrane types have varying degrees of maintenance and operational costs

**Estimate reflects only 1 MBR basin in service

***Does not include labor costs

O&M COSTS

20-Year Planning Period

A-2a CAS A2O

Electricity Cost **$0.060** per kW-hr

NO.	DESCRIPTION	HP (ea)	Energy Use	UNT	TOTAL ($/day)
DAILY ENERGY USE					
1.	Anoxic Mixers	7.5	537	kW-hrs/d	$32.21
2.	Anaerobic Mixers	5	358	kW-hrs/d	$21.48
3.	IR Pump	30	2,148	kW-hrs/d	$128.86
4.	RAS/WAS Pumps	30	2,148	kW-hrs/d	$128.86
5.	Blowers	175	9,396	kW-hrs/d	$563.75
6.	Clarifier (2 total)	2	143	kW-hrs/d	$8.59
	SUBTOTAL		**14,729**	**kW-hrs/d**	**$883.74**
MISC O&M					
7.	Misc O&M		1	$/d	$75
ESTIMATED COSTS					
	DAILY COST		$959	$/d	
	YEARLY COST		$349,941	$/yr	
	20-YEAR COST		$6,999,000	$	

*Does not include labor costs

O&M COSTS

20-Year Planning Period

A-2b CAS Bardenpho

Electricity Cost **$0.060** per kW-hr

NO.	DESCRIPTION	HP (ea)	Energy Use	U N T	TOTAL ($/day)
			DAILY ENERGY USE		
1.	Anoxic Mixers	7.5	1,074	kW-hrs/d	$64.43
2.	Anaerobic Mixers	5	358	kW-hrs/d	$21.48
3.	IR Pump	30	2,148	kW-hrs/d	$128.86
4.	RAS/WAS Pumps	30	2,148	kW-hrs/d	$128.86
5.	Blowers	175	9,396	kW-hrs/d	$563.75
6.	Clarifier (2 total)	2	143	kW-hrs/d	$8.59
	SUBTOTAL		**15,266**	**kW-hrs/d**	**$915.96**
			MISC O&M		
7.	Misc O&M		1	$/d	$75
			ESTIMATED COSTS		
	DAILY COST		$991	$/d	
	YEARLY COST		$361,700	$/yr	
	20-YEAR COST		$7,234,000	$	

*Does not include labor costs

O&M COSTS

20-Year Planning Period

A-2c CAS A2O Step Feed

Electricity Cost **$0.060** per kW-hr

NO.	DESCRIPTION	HP (ea)	Energy Use	UNT	TOTAL ($/day)
DAILY ENERGY USE					
1.	Anoxic Mixers	7.5	805	kW-hrs/d	$48.32
2.	Anaerobic Mixers	5	537	kW-hrs/d	$32.21
3.	IR Pump	30	2,148	kW-hrs/d	$128.86
4.	RAS/WAS Pumps	30	2,148	kW-hrs/d	$128.86
5.	Blowers	175	9,396	kW-hrs/d	$563.75
6.	Clarifier (2 total)	2	143	kW-hrs/d	$8.59
	SUBTOTAL		**15,176**	**kW-hrs/d**	**$910.59**
MISC O&M					
7.	Misc O&M		1	$/d	$75
ESTIMATED COSTS					
	DAILY COST		$986	$/d	
	YEARLY COST		$359,740	$/yr	
	20-YEAR COST		$7,195,000	$	

*Does not include labor costs

O&M COSTS

20-Year Planning Period

A-3 SBR

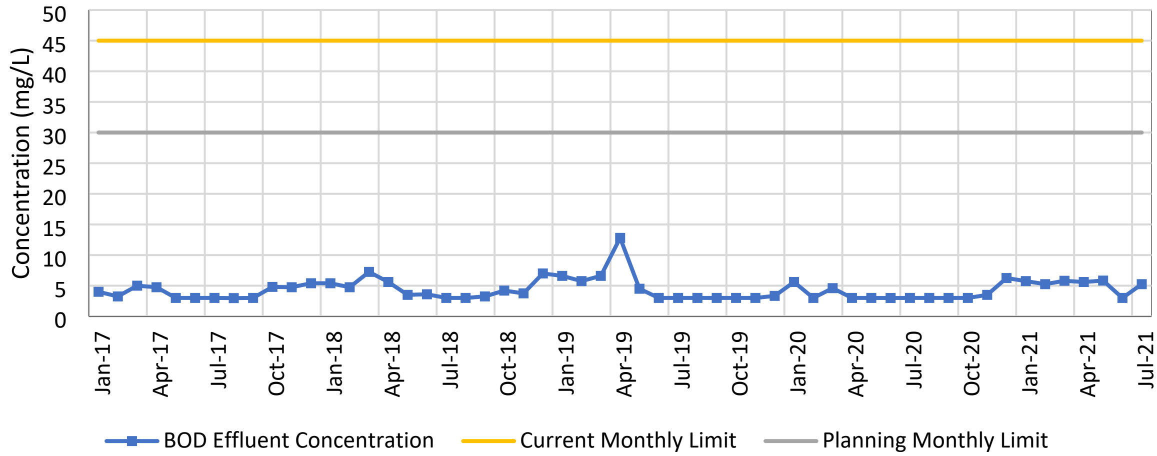
Electricity Cost **$0.060** per kW-hr

NO.	DESCRIPTION	HP (ea)	Energy Use	UNT	TOTAL ($/day)
DAILY ENERGY USE					
1.	Anoxic Mixers (for 5 basins)	15	3,356	kW-hrs/d	$201.34
2.	Decanter	3	112	kW-hrs/d	$6.71
3.	Blowers (5 basins total)	175	9,396	kW-hrs/d	$563.75
	SUBTOTAL		**12,863**	**kW-hrs/d**	**$771.80**
MISC O&M					
4.	Misc O&M		1	$/d	$75
ESTIMATED COSTS					
	DAILY COST		$847	$/d	
	YEARLY COST		$309,082	$/yr	
	20-YEAR COST		$6,182,000	$	

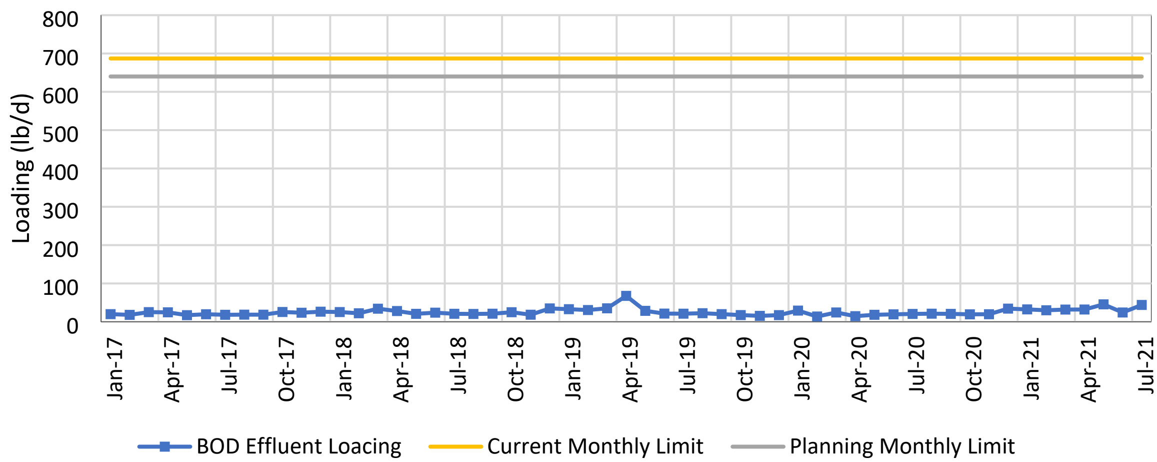
*Does not include labor costs

APPENDIX D - INFLUENT FLOW STATISTICS

Chart 1A: BOD effluent as compared to current NPDES and planning IPDES limits



a) Monthly Average Concentration



b) Monthly Average Loading

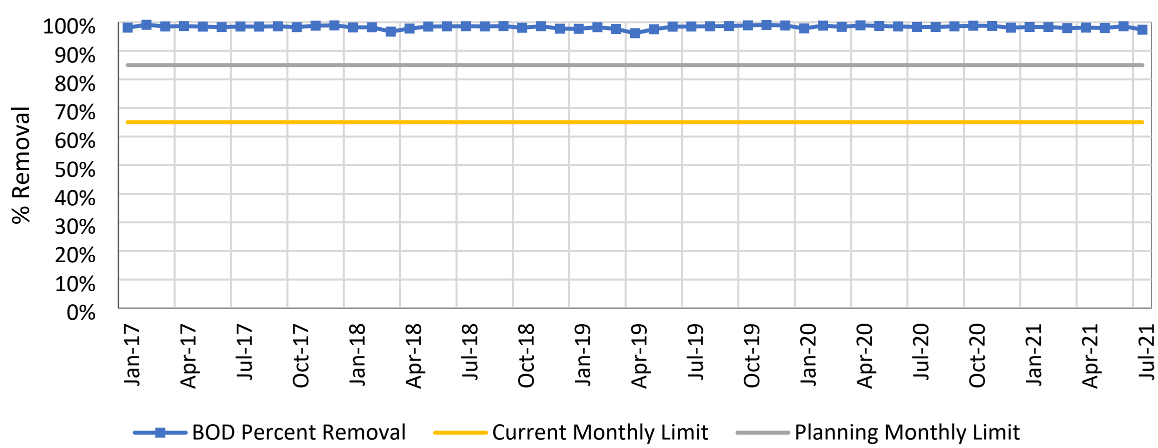
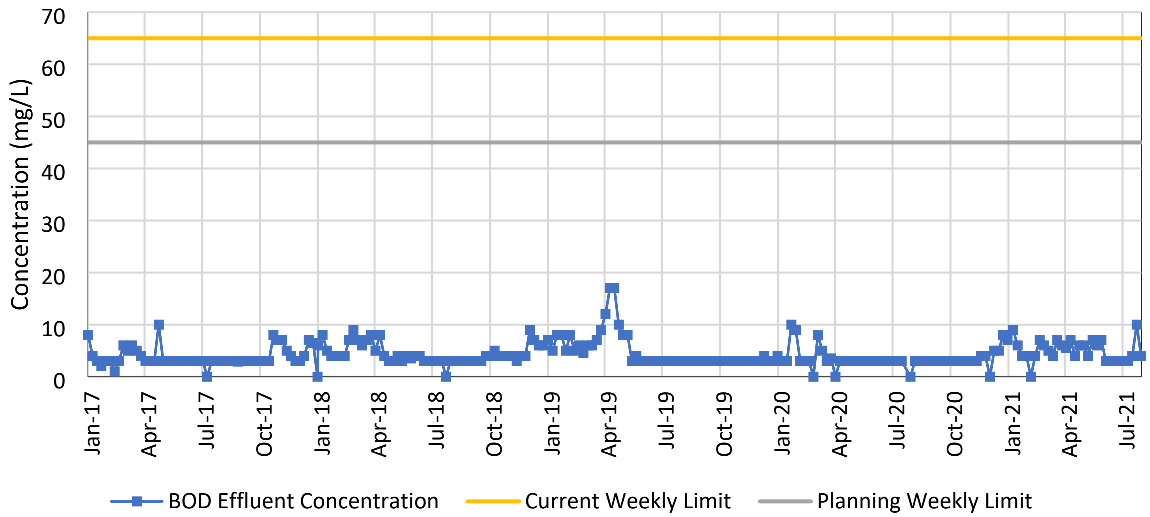
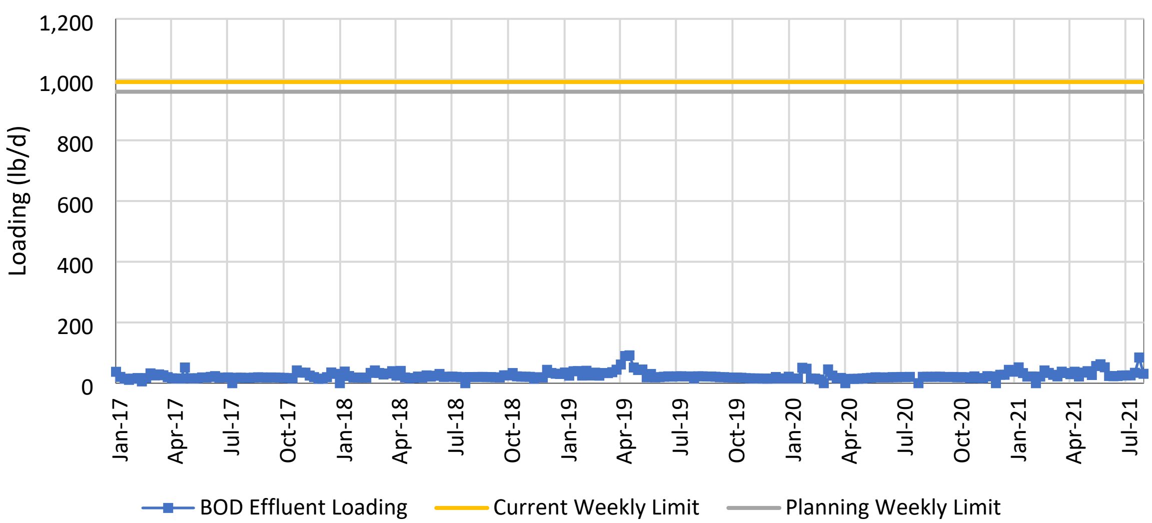


Chart 1A (continued to next page): BOD effluent as compared to current NPDES and planning IPDES limits

Chart 1A: BOD effluent as compared to current NPDES and planning IPDES limits

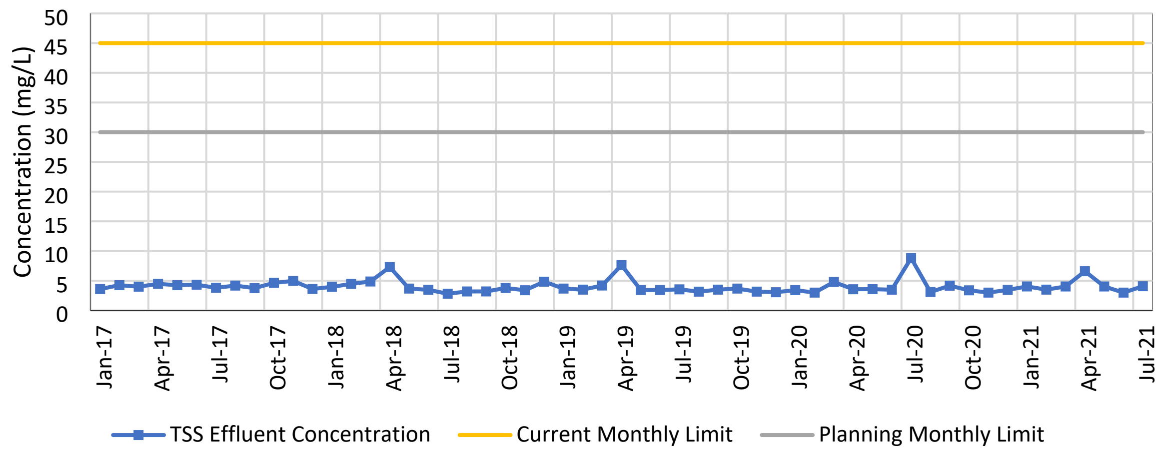


c) Weekly Average Concentration

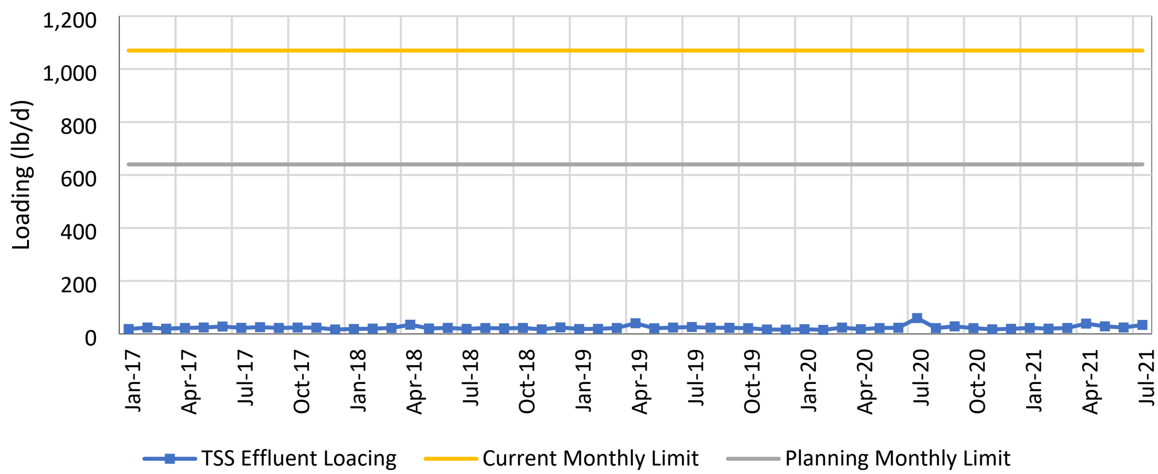


d) Weekly Average Loading

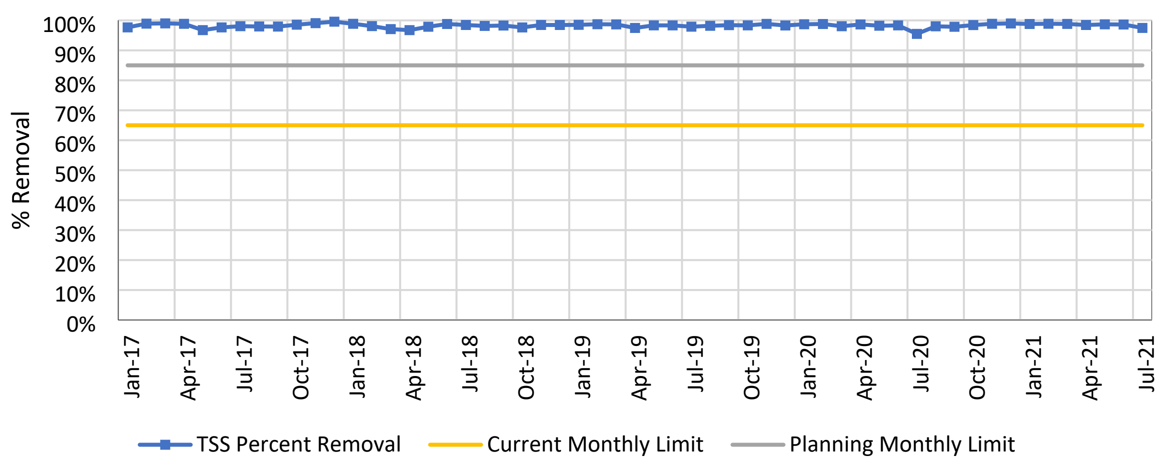
Chart 2A: TSS effluent compared to current NPDES and planning IPDES limits



a) Monthly Average Concentration



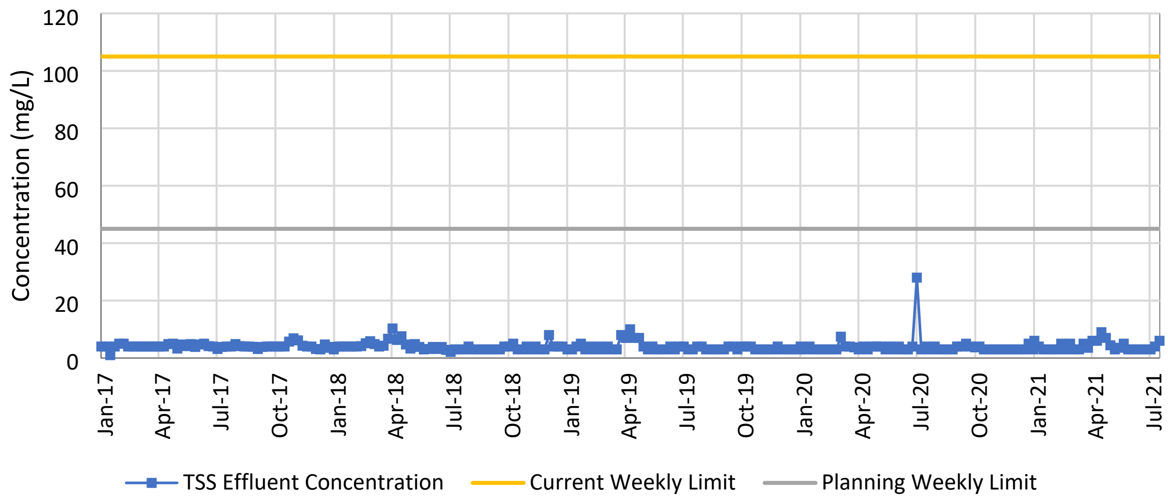
b) Monthly Average Loading



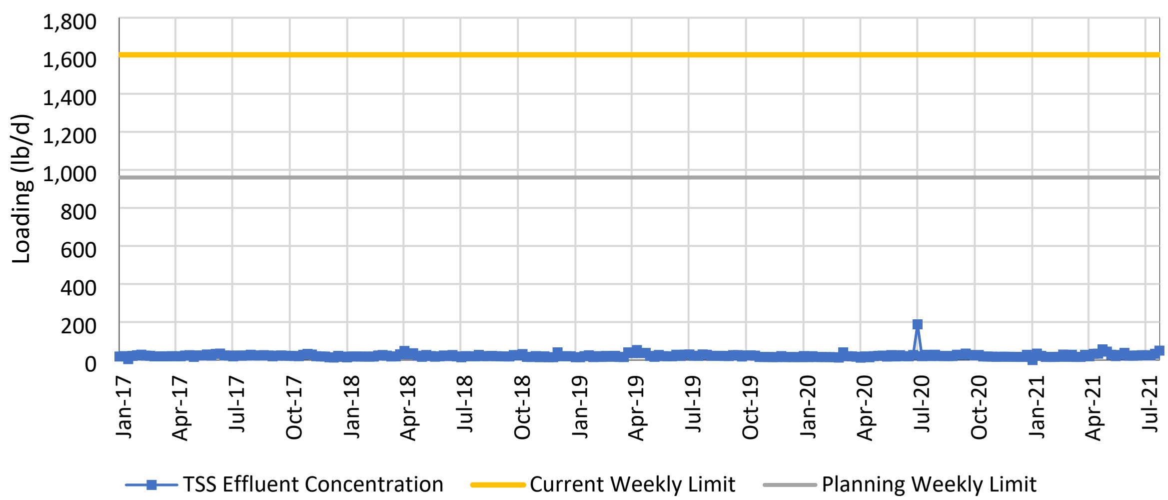
c) Monthly Average Percent Removal

Chart 2A (continued to next page): TSS effluent compared to current NPDES and planning IPDES limits

Chart 2A: TSS effluent compared to current NPDES and planning IPDES limits

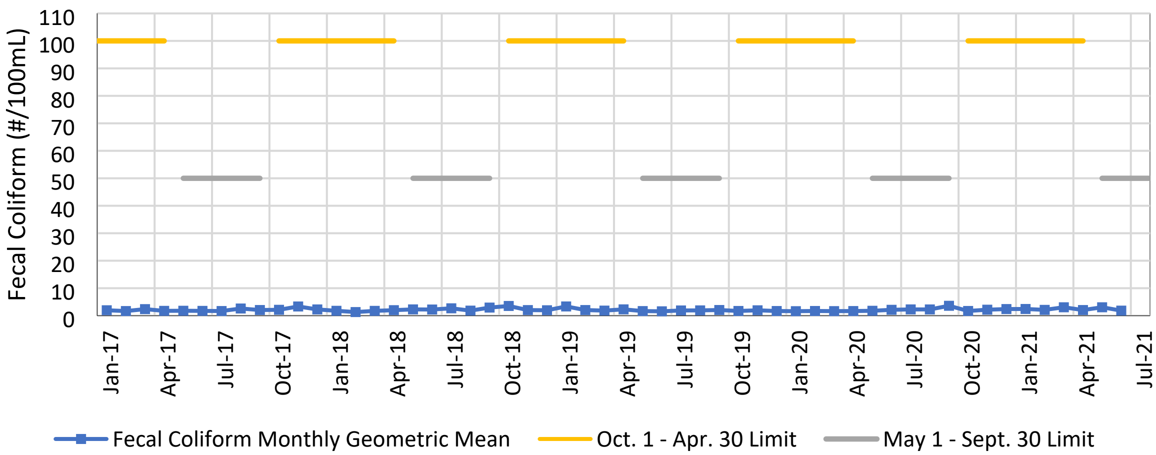


d) Weekly Average Concentration

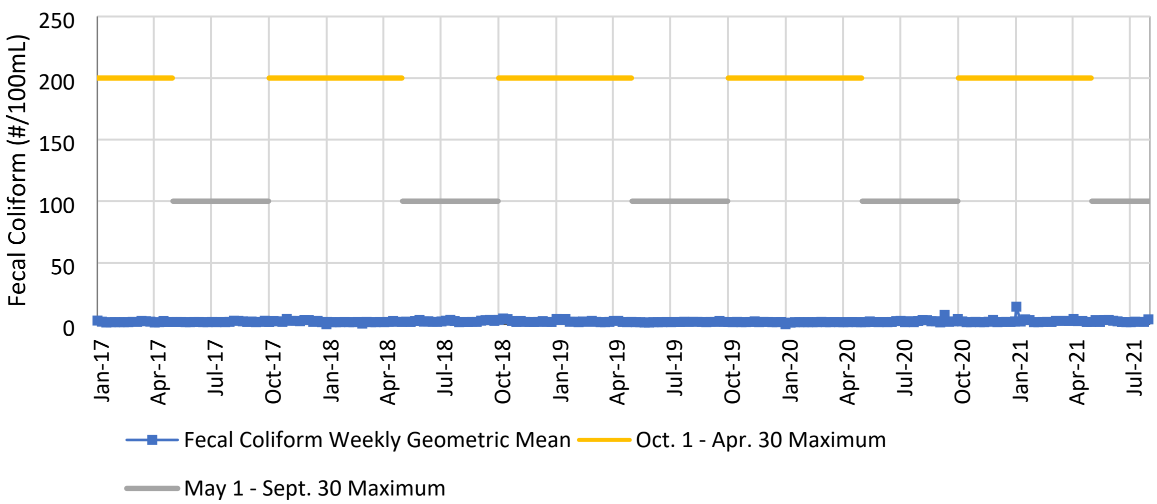


e) Weekly Average Loading

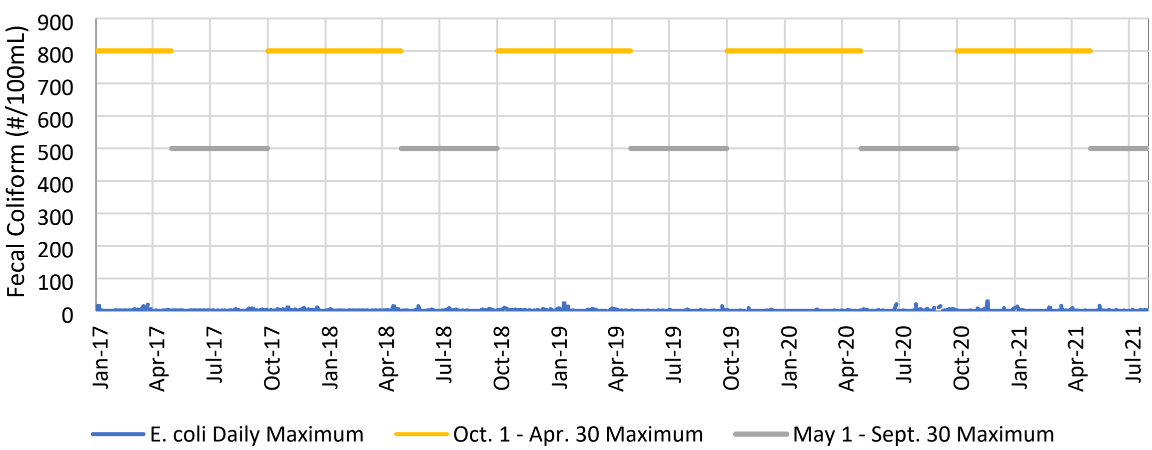
Chart 3A: Effluent fecal coliform counts



a) Monthly Geometric Mean



b) Weekly Geometric Mean



c) Daily Maximum

Chart 4A: Effluent monthly geometric mean for E. coli.

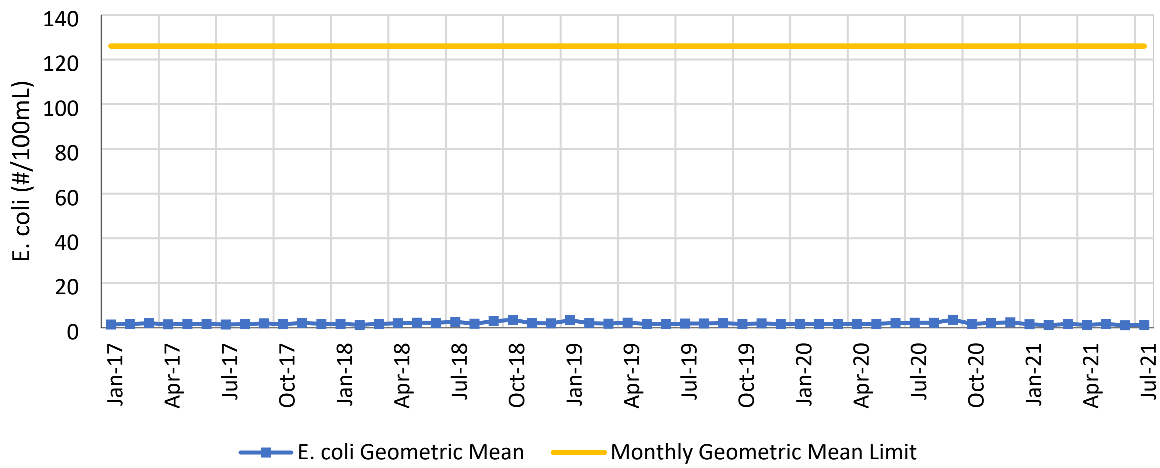
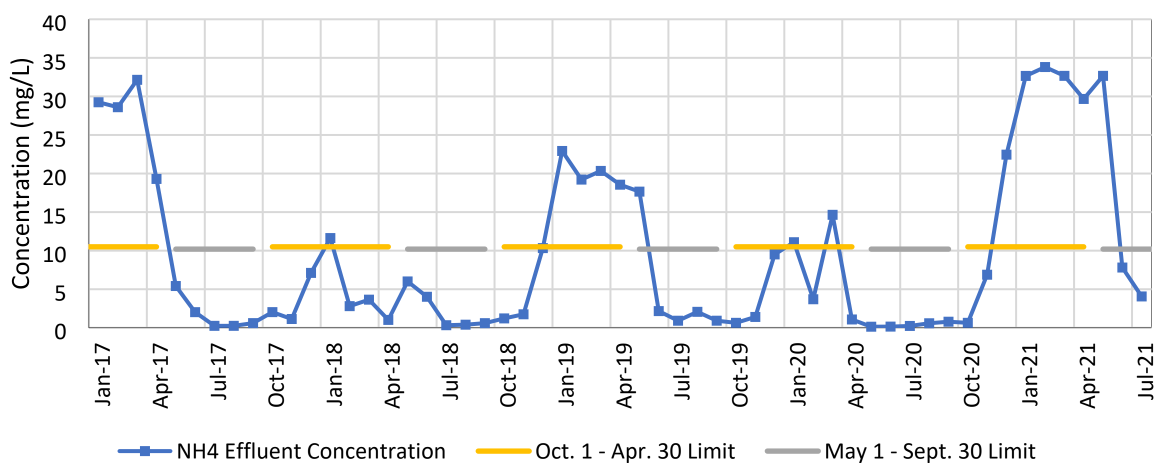
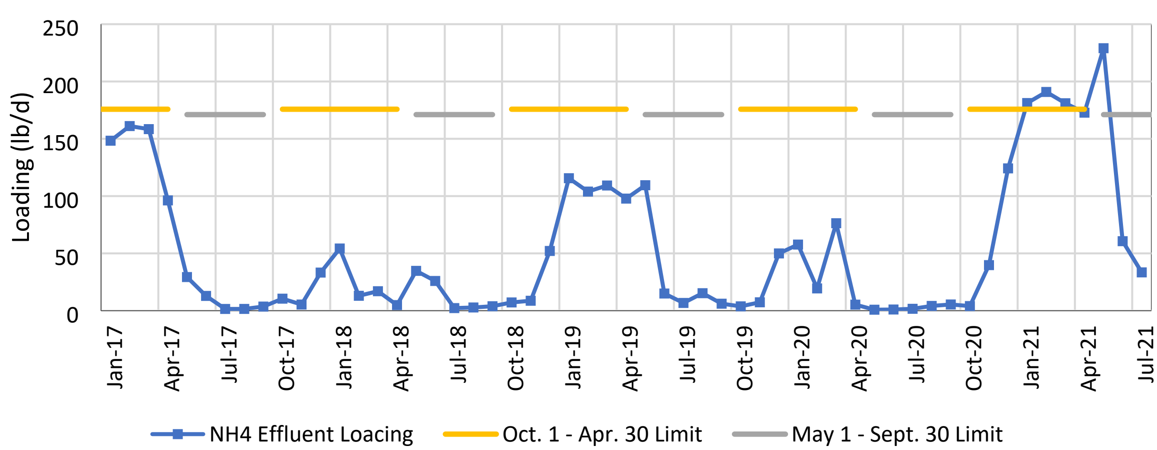


Chart 5A: Effluent ammonia compared to planning IPDES limits



a) Monthly Average Concentration



b) Monthly Average Loading

Chart 6A: Effluent total phosphorus compared to the planning IPDES mass limit

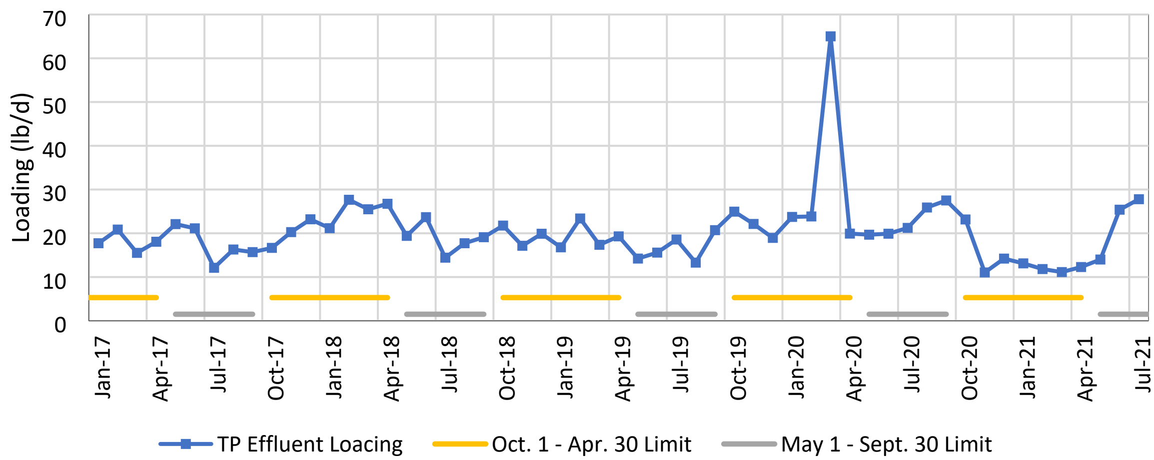
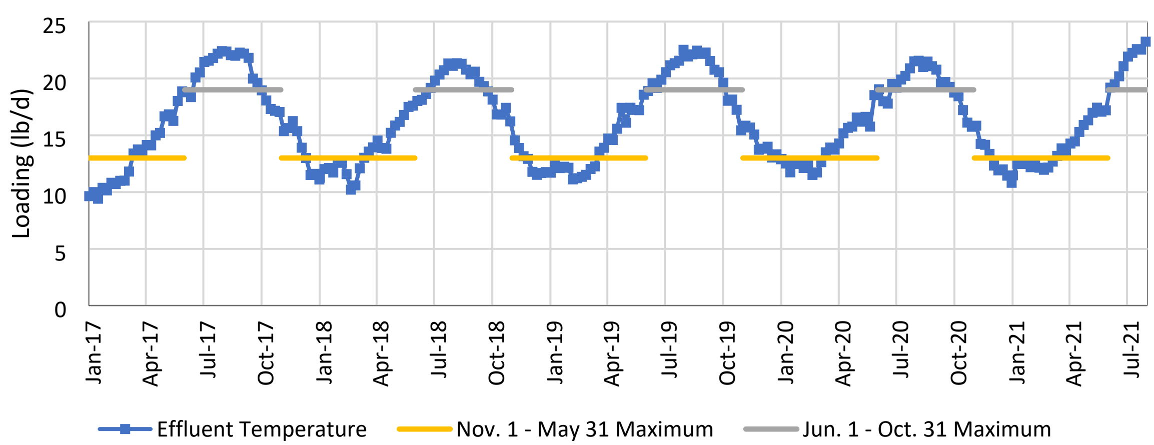
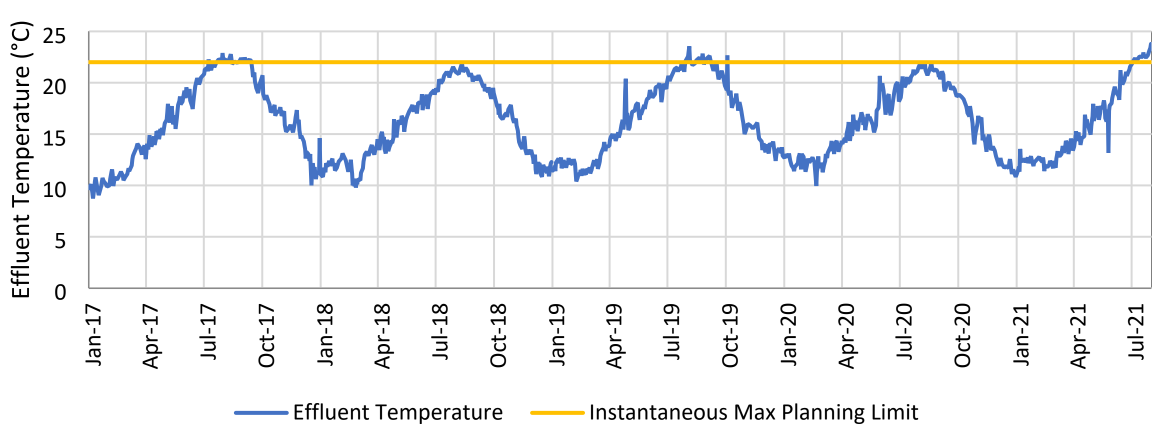


Chart 7A: Effluent temperature compared to planning IPDES limits



a) Average Weekly Maximums



b) Instantaneous Maximums

APPENDIX E - EXISTING NPDES PERMIT

United States Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, 33 U.S.C. §1251 et seq., as amended by the Water Quality Act of 1987, P.L. 100-4, the "Act",

City of Middleton
15 North Dewey Avenue
Middleton, Idaho 83664

is authorized to discharge from a wastewater treatment facility located at Middleton, Idaho

to receiving waters named Boise River,

in accordance with discharge point(s), effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective November 2, 1999.

This permit and the authorization to discharge shall expire at midnight, November 2, 2004.

Signed this 30th day of September, 1999.

/s/ Randall F. Smith
Randall F. Smith
Director
Office of Water
U.S. Environmental Protection Agency, Region 10

TABLE OF CONTENTS

I. SPECIFIC LIMITATIONS AND MONITORING REQUIREMENTS

A. Effluent Limitations and Monitoring Requirements

1. During the period beginning on the effective date of this permit the permittee is authorized to discharge wastewater to the Boise River from Outfall 001 provided the discharge meets the limitations and monitoring requirements set forth herein. This permit does not authorize the discharge of any waste streams, including spills and other unintentional or non-routine discharges of pollutants, that are not part of the normal operation of the facility as disclosed in the permit application.

PARAMETER	EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS		
	Average Monthly Limit	Average Weekly Limit	Daily Maximum Limit	Sample Location	Sample Frequency	Sample Type[1]
Flow, MGD	---	---	---	Effluent	Continuous	Recording
Biological Oxygen Demand (BOD_5)	45 mg/l 687 lbs/day	65 mg/l 992 lbs/day	--- ---	Influent and Effluent	1/week	8-hour composite
Total Suspended Solids (TSS)	70 mg/l 1070 lbs/day	105 mg/l 1605 lbs/day	---	Effluent	1/week	8-hour composite
Fecal Coliform Bacteria[2] **May 1 - September 30**	50/100 ml	100/100 ml	500/100 ml	Effluent	5/week	grab
Fecal Coliform Bacteria[2] **October 1 - April 30**	100/100 ml	200/100 ml	800/100 ml	Effluent	5/week	grab
E. coli Bacteria[3]	---	---	---	Effluent	5/week	grab
Total Residual Chlorine[4] (Interim Limit)	0.5 mg/l	---	—	Effluent	1/week	grab
Total Residual Chlorine[5,6] (Final Limit)	0.048 mg/l (48 Fg/l)	---	0.067 mg/l (67 Fg/l)	Effluent	1/week	grab
Total Ammonia as N, mg/L	---	---	---	Effluent	1/month	8-hour composite
Total Kjeldahl Nitrogen[7], mg/L	---	---	---	Effluent	1/month	8-hour composite
Nitrate-Nitrite[7], mg/L	---	---	---	Effluent	1/month	8-hour composite
Total Phosphorus[7]	---	---	---	Effluent	1/month	8-hour composite
Ortho-Phosphate[7], mg/L	---	---	---	Effluent	1/month	8-hour composite
Temperature, EC	—	—	—	Effluent	3/week	grab

Notes:

1. 8 hour composite samples shall consist of three discrete aliquots collected over an eight hour period. Each aliquot shall be a grab sample of not less than 100 ml and shall be collected and stored in accordance with procedures prescribed in *Standard Methods for the Examination of Water and Wastewater,* 18th Edition.
2. <u>Between May 1 and September 30</u>: The average monthly fecal coliform count must not exceed a geometric mean of 50/100 ml based on a minimum of five (5) samples taken over a thirty day period; the average weekly fecal coliform count must not exceed 100/100 ml based on a minimum of (5) samples taken over one week. <u>Between October 1 and April 30</u>: The average monthly fecal coliform count must not exceed a geometric mean of 100/100 ml based on a minimum of five (5) samples taken over a thirty day period; the average weekly fecal coliform count must not exceed 200/100 ml based on a minimum of (5) samples taken over one week.
3. Monitoring for E. coli shall start four (4) years from the effective date of the permit and continue for one year. Analytical results do not need to be reported on the DMR, but shall be retained on site. Sampling results for the first six months of monitoring shall be submitted to EPA with the permittee's next permit application which is due 180 days prior to the expiration date of this permit.
4. An interim monthly average limit of 0.5 mg/l for total residual chlorine shall apply upon the effective date of the permit and remain in effect for a period of 2 years.
5. Final limits for total residual chlorine shall become effective 2 years from the effective date of the permit.
6. The analytical method for total residual chlorine shall achieve a minimum level of 0.1 mg/l (100 Fg/l) in accordance with 40 CFR § 136. The permittee will be considered in compliance with the average monthly and maximum daily limits for total residual chlorine when measured values are below the minimum level of 0.1 mg/l.
7. Monitoring for these parameters shall start 120 days after the effective date of the permit, and shall continue for a period of two years.

2. The pH range of the effluent shall be between 6.5 - 9.0 standard units. The permittee shall monitor for pH once (1) per week. Sample analysis shall be conducted on a grab sample from the effluent.

3. 65 Percent Removal Requirements for BOD_5 : For any month, the monthly average effluent concentration shall not exceed 35 percent of the monthly average influent concentration.

   Percent removal of BOD_5 shall be reported on the Discharge Monitoring Reports (DMRs). The monthly average percent removal shall be calculated from the arithmetic mean of the influent value and the arithmetic mean of the effluent value for that month. Influent and effluent samples shall be taken over approximately the same time period.

4. There shall be no discharge of floating solids or visible foam other than trace amounts.

B. <u>Ambient Monitoring Requirements</u>

The permittee shall implement an ambient monitoring program in the Boise River. The program shall meet the following requirements:

1. A monitoring station shall be established in the Boise River above the influence of the facility's effluent discharge.

   Monitoring station shall be approved by the Idaho Division of Environmental Quality (IDEQ) and EPA.

2. Ambient samplings shall start 120 days after the effective date of the permit. To the extent practicable, ambient sample collection shall occur on the same day as effluent sample collection.

3. Ambient samples, except flow, shall be grab samples.

4. Monitoring for total kjeldahl nitrogen, nitrate-nitrite, ortho-phosphate, and total phosphorus shall continue for a period of two years only.

5. Ambient sampling shall be conducted as follows:

Parameter	Sample Frequency
pH, standard units	1/month
Temperature, EC	1/month
Total Ammonia as N, mg/L	1/month
Total Kjeldahl Nitrogen, mg/L	1/month
Nitrate-Nitrite, mg/L	1/month
Ortho-Phosphate, mg/L	1/month
Total Phosphorus, mg/L	1/month

C. Sludge Management Requirements:

1. The permittee shall handle and dispose of sewage sludge such that the public health and the environment are protected from any reasonably anticipated adverse effects due to any toxic pollutants that may be present.

2. The permittee shall comply with all existing federal and state laws and regulations that apply to its sewage sludge use or disposal practice, and with all future standards promulgated under Section 405(d) of the Clean Water Act of 1987.

3. The permittee shall ensure that the requirements of 40 CFR 503 Subparts A, C, and D are met when its sewage sludge is handled and disposed.

D. Quality Assurance Requirements

1. The permittee shall develop a Quality Assurance Plan. The primary purpose of the Quality Assurance Plan shall be to assist in planning for the collection and analysis of samples in support of the permit and in explaining data anomalies when they occur.

2. Throughout all sample collection and analysis activities, the permittee shall use the EPA approved quality assurance, quality control, and chain-of-custody procedures described in the following documents:

C *Requirements for Quality Assurance Project Plans*, EPA QA/R-5

EPA, and
- *Guidance on Quality Assurance Project Plans*, EPA QA/G-5

The following reference may be helpful in preparing the Quality Assurance Plan for this permit:

- *The Volunteer Monitors Guide to Quality Assurance Project Plans* EPA 841-B-96-003, September 1996.

3. The plan shall be submitted to EPA for review within 60 days of the effective date of this NPDES permit. No response from EPA within 30 days of receipt of the plan shall be interpreted as approval of the plan.

4. At a minimum the plan shall include the following:

   - Sampling techniques (field blanks, replicates, duplicates, control samples, etc).
   - Sampling preservation methods.
   - Sampling shipment procedures.
   - Instrument calibration procedures and preventive maintenance (frequency, standard, spare parts).
   - Qualification and training of personnel.
   - Analytical methods (including quality control checks, quantification/detection levels).

5. Name(s), address(es) and telephone number(s) of the laboratories, used by or proposed to be used by the permittee, shall be specified in the Quality Assurance Plan.

E. Definitions.

1. "Average monthly discharge limitation" means the highest allowable average of "daily discharges" over a calendar month, calculated as the sum of all "daily discharges" measured during a calendar month divided by the number of "daily discharges" measured during that month.

2. "Average weekly discharge limitation" means the highest allowable average of "daily discharges" over a calendar week, calculated as the sum of all "daily discharges" measured during a calendar week divided by the number of "daily discharges" measured during that week.

3. "Bypass" means the intentional diversion of waste streams from any portion of a treatment facility.

4. "Daily discharge" means the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. For pollutants with limitations expressed in units of mass, the "daily discharge" is calculated as the total mass of the

pollutant discharged over the day. For pollutants with limitations expressed in other units of measurement, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

5. An “eight hour composite” sample shall consist of three discrete aliquots collected over an eight hour period. Each aliquot shall be a grab sample of not less than 100 ml and shall be collected and stored in accordance with procedures prescribed in *Standard Methods for the Examination of Water and Wastewater,* 18th Edition.

6. A "Grab" sample is a single sample or measurement taken at a specific time or over as short a period of time as is feasible.

7. "Maximum daily discharge limitation" means the highest allowable "daily discharge."

8. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

9. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

II. MONITORING, RECORDING AND REPORTING REQUIREMENTS

A. Representative Sampling. Samples taken in compliance with the monitoring requirements established under Part I shall be collected from the effluent stream prior to discharge into the receiving waters. Samples and measurements shall be representative of the volume and nature of the monitored discharge.

B. Monitoring Procedures. Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

C. Reporting of Monitoring Results. Monitoring results shall be summarized each month on the Discharge Monitoring Report (DMR) form (EPA No. 3320-1). The reports shall be submitted monthly and are to be postmarked by the 10th day of the following month. Legible copies of these, and all other reports, shall be signed and certified in accordance with the requirements of Part IV.J., Signatory Requirements, and submitted to the Director, Water Division and the State agency at the following addresses:

original to: United States Environmental Protection Agency (EPA) Region 10
1200 Sixth Avenue, OW-133
Seattle, Washington 98101

copy to: Idaho Division of Environmental Quality (IDEQ)
1435 North Orchard
Boise, Idaho 83706

D. Additional Monitoring by the Permittee. If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR. Such increased frequency shall also be indicated.

E. Records Contents. Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements;

2. The individual(s) who performed the sampling or measurements;

3. The date(s) analyses were performed;

4. The individual(s) who performed the analyses;

5. The analytical techniques or methods used; and

6. The results of such analyses.

F. Retention of Records. The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time. Data collected on-site, copies of Discharge Monitoring Reports, and a copy of this NPDES permit must be maintained on-site.

G. Twenty-four Hour Notice of Noncompliance Reporting.

1. The following occurrences of noncompliance shall be reported by telephone to EPA within 24 hours from the time the permittee becomes aware of the circumstances (EPA NPDES Hotline 206-553-1846):

a. Any noncompliance which may endanger health or the environment;

b. Any unanticipated bypass which exceeds any effluent limitation in the permit (See Part III.G., Bypass of Treatment Facilities.);

c. Any upset which exceeds any effluent limitation in the permit (See Part III.H., Upset Conditions.); or

d. Violation of a maximum daily discharge limitation for any of the pollutants listed in the permit to be reported within 24 hours.

2. A written submission shall also be provided within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:

a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times;

c. The estimated time noncompliance is expected to continue if it has not been corrected; and

d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

3. The Director may waive the written report on a case-by-case basis if the oral report has been received within 24 hours by the Water Compliance Section in Seattle, Washington, by phone (see II.G.1. above).

4. Reports shall be submitted to the addresses in Part II.C., Reporting of Monitoring Results.

H. Other Noncompliance Reporting. Instances of noncompliance not required to be reported within 24 hours shall be reported at the time that monitoring reports for Part II.C. are submitted. The reports shall contain the information listed in Part II.G.2.

I. Inspection and Entry. The permittee shall allow the Director or an authorized representative (including an authorized contractor acting as a representative of the Administrator), upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring

and control equipment), practices, or operations regulated or required under this permit; and

4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Act, any substances or parameters at any location.

J. Compliance Schedule Reporting. The permittee shall submit by January 1 of each year until 2 years from the effective date of the permit, the progress the facility has made toward compliance with the state's water quality standards for total residual chlorine.

III. COMPLIANCE RESPONSIBILITIES

A. Duty to Comply. The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

B. Penalties for Violations of Permit Conditions.

1. Civil and Administrative Penalties. Any person who violates a permit condition implementing Sections Penalty. The Act provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act shall be subject to a civil or administrative penalty, not to exceed the maximum amounts specified in Sections 309(d) and 309(g) of the Act and the Federal Civil Penalties Inflation Adjustment Act (28 U.S. C. § 2461 note) as amended by the Debt collection Improvement Act (31 U.S.C. § 3701 note).

2. Criminal Penalties:

a. Negligent Violations. The Act provides that any person who negligently violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act; or negligently introduces into a sewer system or into a publicly owned treatment works any pollutant or hazardous substance which such person knew or reasonably should have known could cause personal injury or property damage or, other than in compliance with all applicable federal, state, or local requirements or permits, which causes such treatment works to violate any effluent limitation or condition in a permit issued to the treatment works under Section 402 of this Act; shall be punished by a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than 1 year, or by both.

b. Knowing Violations. The Act provides that any person who knowingly violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act; or knowingly introduces into a sewer system or into a publicly owned treatment works any pollutant or hazardous substance which such person knew or reasonably should have known could cause personal injury or property damage or, other than in compliance with all applicable federal, state, or local requirements or permits, which causes such treatment works to violate any effluent limitation or condition in a permit issued to the treatment works under Section 402 of this Act; shall be punished by a fine of not less than $5,000 nor more than $50,000 per day of violation, or by imprisonment for not more than 3 years, or by both.

c. Knowing Endangerment. The Act provides that any person who knowingly violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act, and who knows at that time that he thereby places another person in imminent danger of death or serious bodily injury, shall, upon conviction, be subject to a fine of not more than $250,000 or imprisonment of not more than 15 years, or both. A person which is an organization shall, upon conviction of violating this subparagraph, be subject to a fine of not more than $1,000,000.

d. False Statements. The Act provides that any person who knowingly makes any false material statement, representation, or certification in any application, record, report, plan, or other document filed or required to be maintained under this Act or who knowingly falsifies, tampers with, or renders inaccurate any monitoring device or method required to be maintained under this Act, shall upon conviction, be punished by a fine of not more that $10,000, or by imprisonment for not more than 2 years, or by both.

Except as provided in permit conditions in Part III.G., Bypass of Treatment Facilities and Part III.H., Upset Conditions, nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. Need to Halt or Reduce Activity not a Defense. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. Duty to Mitigate. The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. Proper Operation and Maintenance. The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

F. Removed Substances. Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

G. Bypass of Treatment Facilities.

1. Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs 2 and 3 of this section.

2. Notice:

   a. Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least 10 days before the date of the bypass.

   b. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required under Part II.G., Twenty-four Hour Notice of Noncompliance Reporting.

3. Prohibition of bypass.

   a. Bypass is prohibited and the Director may take enforcement action against a permittee for a bypass, unless:

      (1) The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

      (2) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

      (3) The permittee submitted notices as required under paragraph 2 of this section.

b. The Director may approve an anticipated bypass, after considering its adverse effects, if the Director determine that it will meet the three conditions listed above in paragraph 3.a. of this section.

H. Upset Conditions.

1. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of paragraph 2 of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

2. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

a. An upset occurred and that the permittee can identify the cause(s) of the upset;

b. The permitted facility was at the time being properly operated;

c. The permittee submitted notice of the upset as required under Part II.G., Twenty-four Hour Notice of Noncompliance Reporting; and

d. The permittee complied with any remedial measures required under Part III.D., Duty to Mitigate.

3. Burden of proof. In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

IV. GENERAL REQUIREMENTS

A. Notice of New Introduction of Pollutants. The permittee shall provide adequate notice to the Director, Water Division of:

1. Any new introduction of pollutants into the treatment works from an indirect discharger which would be subject to Sections 301 or 306 of the Act if it were directly discharging those pollutants; and

2. Any substantial change in the volume or character of pollutants being introduced into the treatment works by a source introducing pollutants into the treatment works at the time of issuance of the permit.

3. For the purposes of this section, adequate notice shall include information on:

a. The quality and quantity of effluent to be introduced into such treatment works; and

b. Any anticipated impact of the change on the quantity or quality of effluent to be discharged from such publicly owned treatment works.

B. Control of Undesirable Pollutants. Under no circumstances shall the permittee allow introduction of the following wastes into the waste treatment system:

1. Wastes which will create a fire or explosion hazard in the treatment works;

2. Wastes which will cause corrosive structural damage to the treatment works, but in no case, wastes with a pH lower than 5.0, unless the works is designed to accommodate such wastes;

3. Solid or viscous substances in amounts which cause obstructions to the flow in sewers, or interference with the proper operation of the treatment works;

4. Wastewaters at a flow rate and/or pollutant discharge rate which is excessive over relatively short time periods so that there is a treatment process upset and subsequent loss of treatment efficiency; and

5. Any pollutant, including oxygen demanding pollutants (BOD, etc.) released in a discharge of such volume or strength as to cause interference in the treatment works.

C. Requirements for Industrial Users. The permittee shall require any industrial user of these treatment works to comply with any applicable requirements of Sections 204(b), 307, and 308 of the Act, including any requirements established under 40 CFR Part 403.

D. Planned Changes. The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when the alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are not subject to effluent limitations in the permit.

E. Anticipated Noncompliance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

F. Permit Actions. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

G. Duty to Reapply. If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit. The application should be submitted at least 180 days before the expiration date of this permit.

H. Duty to Provide Information. The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

I. Other Information. When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director, it shall promptly submit such facts or information.

J. Signatory Requirements. All applications, reports or information submitted to the Director shall be signed and certified.

1. All permit applications shall be signed by either a principal executive officer or ranking elected official.

2. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described above and submitted to the Director, and

   b. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. Changes to authorization. If an authorization under paragraph IV.J.2. is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph IV.J.2. must be submitted to the Director prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. Certification. Any person signing a document under this section shall make the following certification:

> "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

K. Availability of Reports. Except for data determined to be confidential under 40 CFR Part 2, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Director. As required by the Act, permit applications, permits and effluent data shall not be considered confidential.

L. Oil and Hazardous Substance Liability. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

M. Property Rights. The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

N. Severability. The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

O. Transfers. This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least 30 days in advance of the proposed transfer date;

2. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.

P. State Laws. Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Act.