Report for

City of East Moline, Illinois

Regional Wastewater Treatment Plant Phosphorus Feasibility Study–Biological Phosphorus Removal Amendment

12/4/2024

Exp. 11/30/2025

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TABLE OF CONTENTS

INTRODUCTION

The City of East Moline, Illinois (City) Regional Wastewater Treatment Plant (WWTP) was reissued its National Pollution Discharge Elimination System (NPDES) permit on August 13, 2020. Special Condition 18 of this permit requires a feasibility study for phosphorus removal to meet potential future 1.0, 0.5, and 0.1 milligrams per liter (mg/L) effluent total phosphorus (TP) limits. The *Phosphorus Reduction Feasibility Study* dated June 2021 (2021 Study) evaluated the following alternatives:

- Alternative No. 1–Operation Changes for 1.0-mg/L TP Limit
- Alternative No. 2–Chemical Phosphorus Removal (CPR) for 0.5-mg/L TP Limit
- Alternative No. 3–CPR with Tertiary Filtration at 28-million-gallons-per-day (MGD) Capacity for 0.1-mg/L TP Limit
- Alternative No. 3A–CPR with Tertiary Filtration at 11.1-MGD Capacity for 0.1-mg/L TP Limit

Alternative No. 2 with CPR was selected in the 2021 Study to meet the 0.5-mg/L TP limit, which would be effective December 31, 2025. The 2021 Study also states Alternative No. 2 includes aeration tank modifications adding anaerobic zones and did not consider biological phosphorus removal (BPR) to be feasible to meet a 0.5-mg/L TP limit.

The focus of this report is the evaluation of BPR with CPR for back-up to meet the future 0.5-mg/L TP limit as an amendment to the 2021 Study. The potential modifications of the existing activated sludge process for BPR are evaluated further in this amendment. Opinions of Probable Construction Cost (OPCC), nonmonetary considerations for each alternative, and a preliminary implementation plan are presented. If BPR is implemented, Special Condition 20 of the City's WWTP NPDES permit states the effluent limit of 0.5 mg/L TP would be effective January 1, 2030. Furthermore, Special Condition 20.B.1 states the 0.5 mg/L TP limit would be in effect December 31, 2035, if the project includes a rebuild or replacement of the secondary treatment processes.

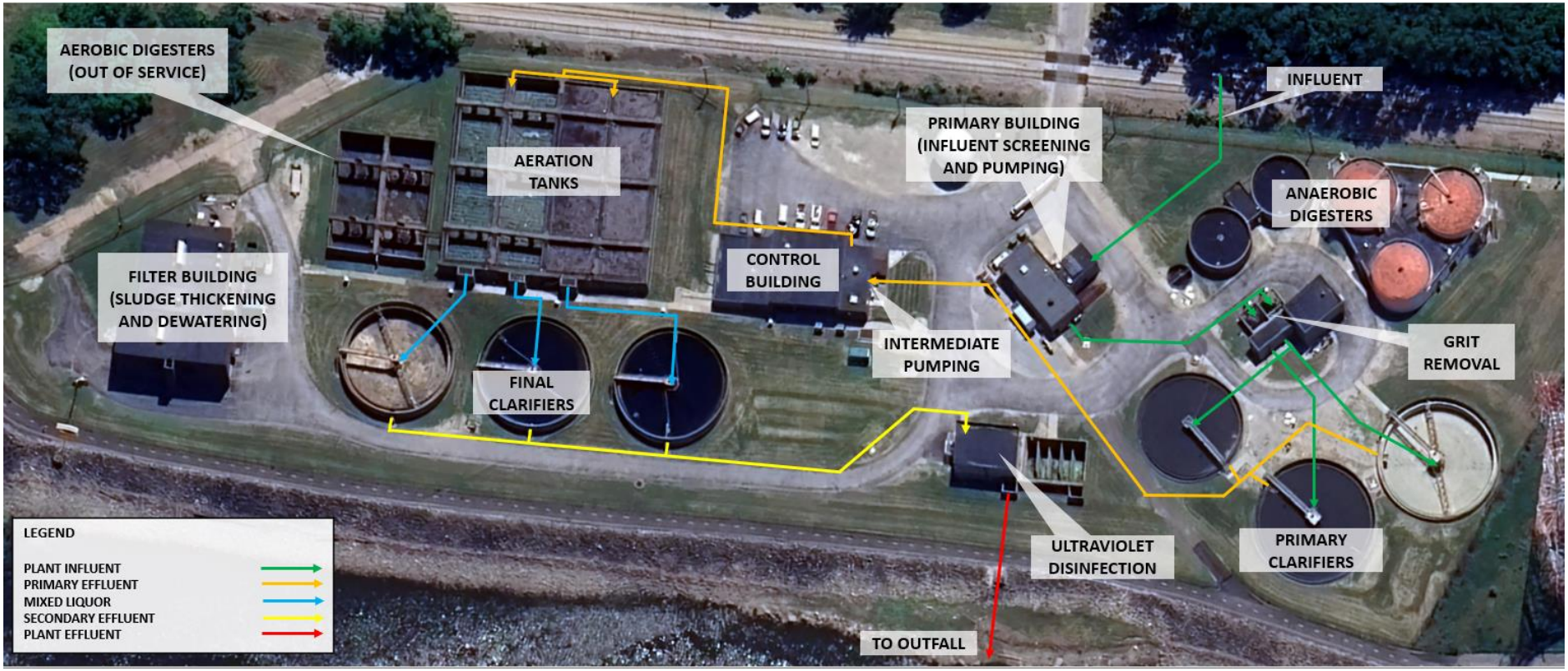
WWTP BACKGROUND

A. Existing Facilities

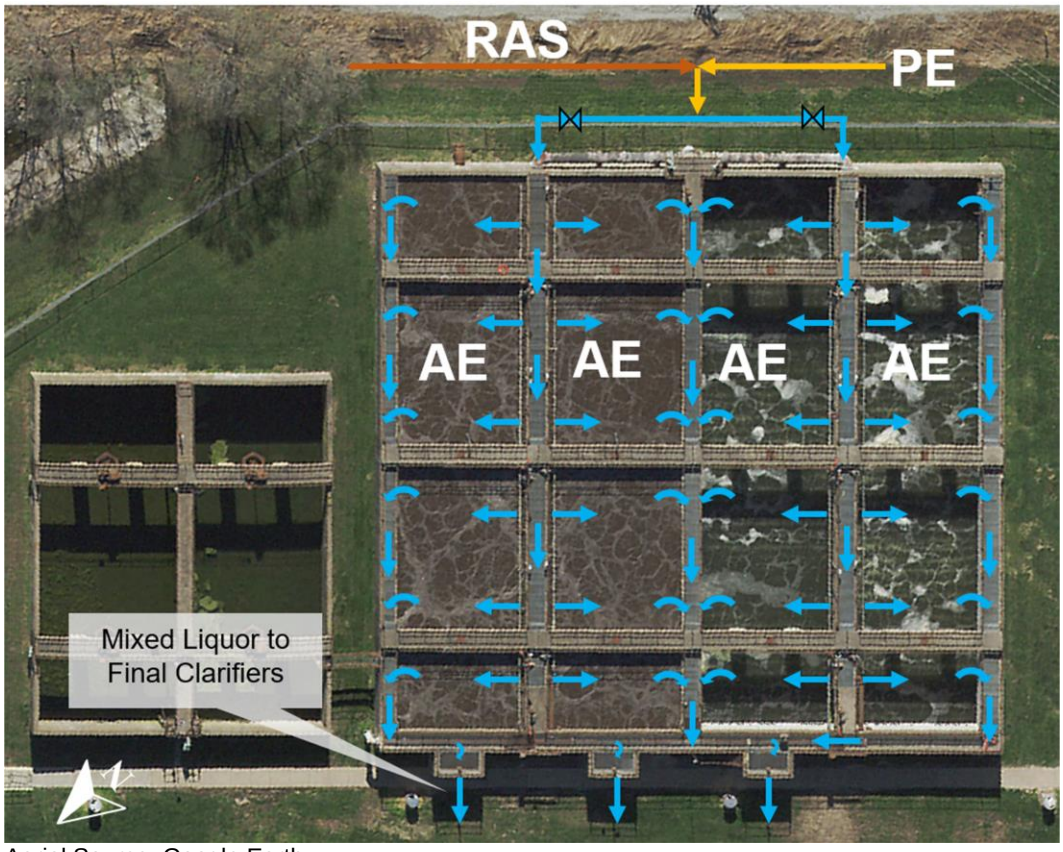
Liquid treatment processes at the WWTP consist of influent screening, influent pumping, grit removal, primary clarification, primary effluent pumping, secondary treatment using an activated sludge process, secondary clarification, and ultraviolet (UV) light disinfection. Biosolids stabilization is provided through an anaerobic digestion process and digested sludge is dewatered using belt filter presses (BFP) before landfilling. The overall process flow schematic is shown in Figure 1.

The existing activated sludge system at the WWTP consists of a conventional activated sludge process with four aeration basins, as shown in Figure 2. In this process, the primary effluent (PE) is pumped to the aeration tanks and return activated sludge (RAS) is piped to the PE piping. Mixed liquor (ML) flows to the three final clarifiers.

Figure 1 City WWTP Process Schematic



Aerial Source: Google Earth



Aerial Source: Google Earth

Figure 2 Existing Activated Sludge System Configuration

Based on information provided by the City, the current design flows and loadings for the WWTP are presented in Table 1.

Parameter	Design Value
Flow, MGD	11.1
BOD_5, lb/day	20,800
TSS, lb/day	22,100

BOD_5=5-day biochemical oxygen demand
TSS=total suspended solids
lb/day=pounds per day

Table 1 Existing WWTP Design Criteria

A summary of the WWTP influent data from January 2020 to December 2023 is presented in Table 2. As shown, the average influent flows and loads have been relatively consistent from year to year. Based on the influent flows and loads from this 4-year period, the WWTP is currently operating at approximately 42 percent of its design average flow (DAF) and 23 percent of its design average BOD_5 load.

	2020	2021	2022	2023
Influent Flow, MGD				
Average Day	5.12	4.96	4.28	4.39
Maximum Month (30-Day Maximum)	7.79	8.27	6.75	6.56
Maximum Day	21.60	24.00	10.10	9.60
BOD_5, lb/day				
Average Day	4,770	4,860	4,640	4,690
Maximum Month (30-Day Maximum)	5,160	5,580	5,730	6,240
Maximum Day	8,830	11,530	10,450	11,930
TSS, lb/day				
Average Day	4,210	4,030	4,030	4,230
Maximum Month (30-Day Rolling Average)	5,670	4,630	4,700	4,960
Maximum Day	22,100	14,950	8,560	12,900

Table 2 Influent Flow and Load Summary

B. NPDES Permit Requirements

The WWTP is currently operating under NPDES Permit No. IL0028550, which has an effective date of September 1, 2020, and is set to expire on August 31, 2025. A copy of the permit is included in Appendix A. The permit includes concentration limits for effluent 5-day carbonaceous biochemical oxygen demand ($CBOD_5$), TSS, and fecal coliform. The permit also requires monitoring of additional parameters. The NPDES effluent limits and monitoring requirements are shown in Table 3. The WWTP does not have an ammonia limit at this time because of the dilution and mixing provided by the outfall in the Mississippi River. The permit Special Condition 20 states the effluent TP limit of 0.5-mg/L TP 12-month rolling geometric mean that is calculated monthly to be met by January 1, 2030, if feasible, through the use of a BPR process.

Parameters	Limit Type	Limit and Units	Sample Frequency	Notes
Flow Rate			Continuous	
$CBOD_5$	Monthly Average	20 mg/L	3 days/week	
	Weekly Average	40 mg/L		
TSS	Monthly Average	25 mg/L	3 days/week	
	Weekly Average	45 mg/L		
pH	Daily Minimum	6 s.u.	3 days/week	
	Daily Maximum	9 s.u.		
Fecal Coliform	Daily Maximum	400/100 mL	5 days/week	
Ammonia Nitrogen (NH_3)			1 day/month	Monitor Only
TP			1 day/month	Monitor Only
Total Nitrogen (TN)			1 day/month	Monitor Only

Note: See Appendix A for mass limits and conditions.
s.u.=standard unit
NH_3=Ammonia Nitrogen
TN=total nitrogen

Table 3 NPDES Permit Effluent Limitations and Monitoring Requirements

C. Existing System Performance

1. Phosphorus

Phosphorus is present in raw, untreated wastewater in organic and inorganic forms (orthophosphate and polyphosphate). Polyphosphates slowly hydrolyze in wastewater and are converted to orthophosphate forms. The orthophosphate forms (phosphate [PO_4], hydrogen phosphate [HPO_4], dihydrogen phosphate [H_2PO_4], and phosphoric acid [H_3PO_4]) are readily available for biological metabolism in the wastewater treatment process and are incorporated into cell mass as a required growth element. Typically, phosphorus accounts for 2 to 6 percent of the total cell mass depending on the cell age and environmental conditions. As an example, 100 pounds of cell mass would generally be expected to include 2 to 6 pounds of phosphorus.

The TP is the sum of all phosphorus present in a liquid solution. This includes phosphorus metabolized and incorporated into the cell mass as well as dissolved phosphorus. The term “Dissolved Phosphorus” is the sum of the dissolved phosphorus forms with no cell mass or solids present. The TP concentration in a weak to medium strength domestically dominated wastewater typically ranges from 4 to 8 mg/L. The wastewater treatment process removes approximately 30 to 50 percent of the influent TP concentration through the standard biological treatment and clarification processes. This results in a TP concentration in the treated wastewater effluent of approximately 2 to 6 mg/L. Either BPR or CPR enhancements are necessary to meet an effluent limit less than 1 mg/L TP.

The WWTP has been routinely testing for effluent phosphorus 1 day per month, in accordance with its NPDES permit. Influent and effluent phosphorus concentrations and loading for the period between September 2020 to May 2024 are summarized in Table 4. Based on this sampling with influent and effluent TP, the WWTP currently reduces the phosphorus

concentration on average by approximately 0.78 mg/L, which represents a removal efficiency of approximately 29 percent. The TP concentration in a weak to medium strength domestically dominated wastewater ranges from 4 to 8 mg/L. There are seven influent TP samples in 2020 and 13 samples in 2024. The average influent phosphorus concentration of 2.71 mg/L is less than the lower range of typical domestic strength wastewater. There are 42 effluent phosphorus samples from 2020 through January 17, 2024, without influent TP data. The January 2020 through January 2024 average effluent TP is 2.44 mg/L. At 29 percent removal, the influent TP would be approximately 3.4 mg/L.

Table 4 Influent and Effluent Phosphorus

Date	Influent Flow (MGD)	Influent Phosphorus Concentrations (mg/L)	Influent Phosphorus Loading (lb/day)	Effluent Phosphorus Concentration (mg/L)	Effluent Phosphorus Loading (lb/day)
January 6, 2020	4.8			2.8	112
February 3, 2020	7.4			1.7	105
March 2, 2020	4.4			2.5	92
April 6, 2020	5.6			1.2	56
May 4, 2020	5.0			2.2	92
June 15, 2020	5.3			1.1	49
July 6, 2020	4.7			2.1	82
August 24, 2020	3.6			2.9	87
September 7, 2020	4.5	2.8	105	1.7	64
September 16, 2020	5.9	2.5	123	1.6	79
October 5, 2020	4.1	4.0	137	3.3	113
October 27, 2020	4.0	3.4	113	3.5	117
November 2, 2020	3.6	4.0	120	2.5	75
November 16, 2020	3.6	4.4	132	2.6	78
December 7, 2020	3.8	3.6	114	2.3	73
January 4, 2021	4.2			2.3	81
February 2, 2021	4.6			2.5	96
March 8, 2021	7.3			1.2	73
April 5, 2021	5.6			2.1	98
May 3, 2021	5.2			2.4	104
June 28, 2021	6.0			2.1	105
July 5, 2021	4.1			2.3	79
August 9, 2021	3.6			2.6	78
September 27, 2021	3.5			2.6	76
October 4, 2021	3.2			2.7	72
December 13, 2021	3.7			2.3	71
January 17, 2022	3.3			2.3	63
February 7, 2022	3.7			3.3	102
March 7, 2022	4.6			2.3	88
April 4, 2022	6.5			1.6	87
May 2, 2022	5.3			1.7	75
June 6, 2022	4.6			3.0	115
July 11, 2022	5.5			2.1	96
August 1, 2022	3.8			3.4	108
September 5, 2022	3.5			2.9	85
October 17, 2022	3.2			3.2	85
November 7, 2022	3.9			3.3	107
December 5, 2022	3.6			3.4	102
January 16, 2023	4.3			4.8	172
February 14, 2023	5.2			1.3	56
March 20, 2023	5.1			1.6	68
April 3, 2023	7.1			1.3	77
May 1, 2023	5.1			2.1	89
June 12, 2023	3.5			2.2	64
July 10, 2023	3.6			2.4	72
August 7, 2023	4.0			3.3	110
September 4, 2023	2.9			3.5	85
October 2, 2023	3.5			3.2	93
January 17, 2024	4.4			2.3	83
February 7, 2024	6.0	2.4	118	1.2	62
February 22, 2024	4.4	2.6	94	2.0	73
February 28, 2024	4.2	2.9	100	2.1	74
March 6, 2024	4.5	2.0	74	2.1	80
March 13, 2024	4.9	2.1	78	1.7	68
April 1, 2024	7.9	2.0	132	1.9	125
April 30,2024	7.7	2.0	128	0.9	58
May 2, 2024	5.8	1.6	77	0.7	33
May 6, 2024	5.5	3.1	142	1.8	83
May 7, 2024	7.6	2.5	158	1.9	120
May 8, 2024	6.8	1.7	96	1.1	62
May 16, 2024	5.3	2.0	88	1.6	71
June 3, 2024	4.7	2.8	110	2.2	86
Average	**4.8**	**2.71**	**112**	**2.3**	**85**

2. TSS

Additionally, as the effluent TP limit becomes more stringent to 0.5 mg/L or less, the removal of TSS or biological cell mass in the treated effluent becomes increasingly important because the cell mass includes phosphorus that would be detected in the TP test. In general, average effluent TSS concentrations less than approximately 7 mg/L are desirable to consistently meet a 0.5-mg/L TP limit. The particulate phosphorus with BPR is approximately 5 to 6 percent. Figure 3 illustrates the challenge of meeting an effluent TP limit as the effluent TSS rises.

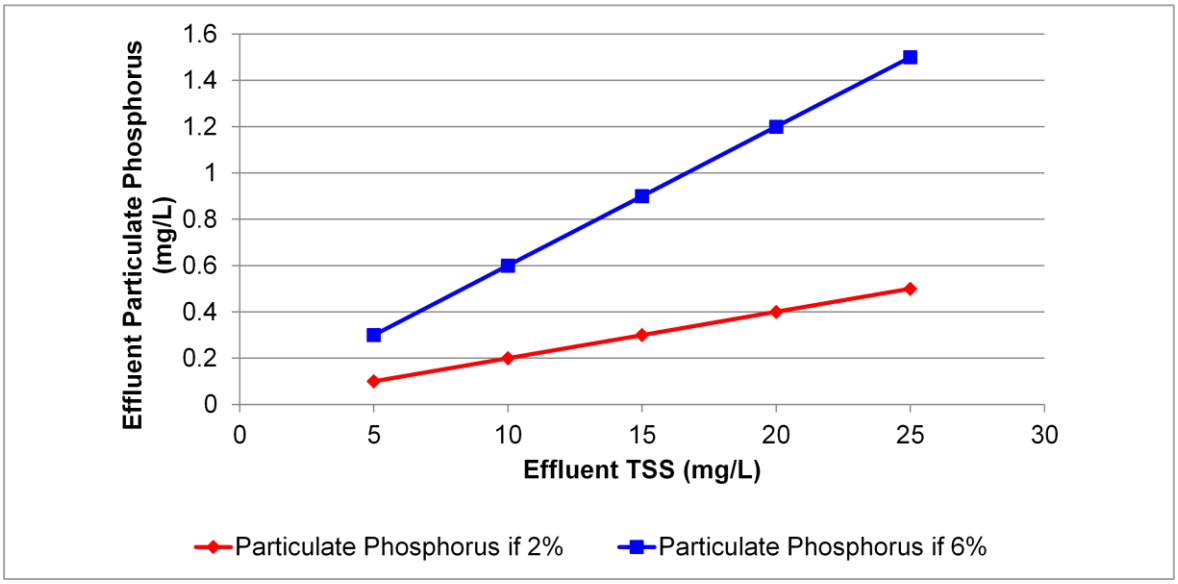


Figure 3 Effluent TSS Impact on Phosphorus Concentrations

The monthly average influent, primary effluent, and effluent TSS data from January 2020 through December 2023 are shown in Table 5. The WWTP meets its permitted limit of 25 mg/L monthly average TSS, but the annual averages for the previous 3 years are higher than the TSS concentrations that would be expected to consistently meet a 0.5-mg/L TP limit.

The performance and size of the final clarifiers were reviewed to determine the potential for improved TSS removal. The WWTP has three 85-foot-diameter final clarifiers (5,675 square feet [ft^2] surface area, each) with a 10-foot side water depth (SWD). Illinois Environmental Protection Agency (IEPA) 370 requires activated sludge final clarifiers to have a minimum 12-foot SWD. The Ten States Standards recommends greater than 12-foot SWD for final clarifiers greater than 4,000 ft^2 surface area. The 2011 Treatment Facilities Improvements project (2011 Project) added density current baffles to avoid currents from carrying solids to the effluent weirs, which may partially mitigate performance issues with a shallow depth clarifier. The WWTP Project Plan (Project Plan) to be completed in 2024 will review WWTP deficiencies and identify a potential project. The Project Plan could review raising the existing three final clarifier walls to provide more depth for separation of the sludge blanket and overflow weirs. Additionally, the existing surface overflow rate is 1,633 gallons per day per square foot (gpd/ft^2) at the design

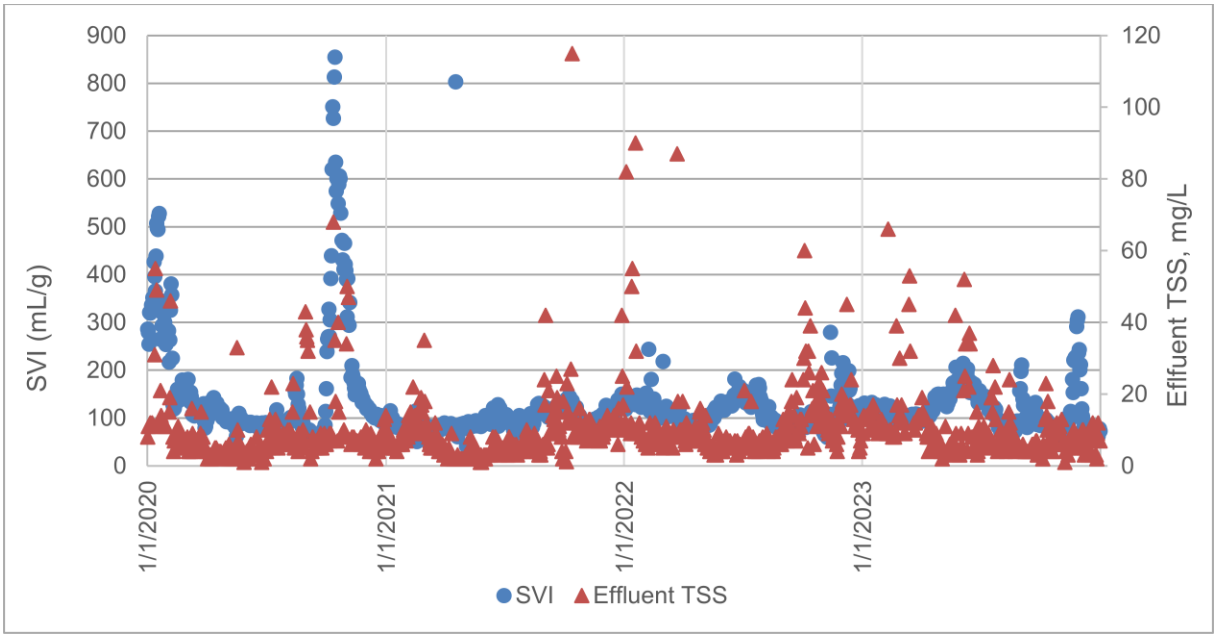
maximum flow of 27.8 MGD. IEPA 370 requires a surface overflow rate of less than 1,000 gpd/ft^2. In order to meet this surface overflow rate at a design maximum flow of 27.8 MGD, two additional 85-foot-diameter final clarifiers would be needed.

The impact of flows on the effluent TSS was reviewed and is shown in Figures 4 and 5. For Figures 4 and 5, effluent TSS data was not available on the highest flow events. The sludge volume index (SVI) is used as an indication of the settling characteristics of the sludge. High SVIs are often associated with activated sludge systems that contain filamentous organisms. Shown in Figure 4 is the effluent TSS with the SVI data. Operational changes to reduce the solids retention time (SRT) and the potential modifications to the aeration tanks with a plug flow through the tanks should reduce the growth of filamentous organisms. There are several higher effluent TSS periods that appear to be correlated with higher flows. Reducing the surface overflow rate with two new clarifiers, five total, should have more TSS removal at higher flows than with the current three final clarifiers. For the purpose of this report, two new 85-foot-diameter clarifiers with 15-foot SWD are included in the OPCC for the BPR and CPR alternatives.

The addition of tertiary filtration could be considered in the future, if needed, to achieve lower effluent TSS and TP. Tertiary filtration facilities could be located in the area of the abandoned chlorine contact tank adjacent to UV disinfection.

Table 5 Influent and Effluent TSS

	Influent Concentration (mg/L)	Primary Effluent Concentration (mg/L)	Effluent	
			Concentration (mg/L)	Load (lb/day)
January 2020	86	43	19	848
February 2020	87	45	12	598
March 2020	75	45	7	362
April 2020	82	35	3	169
May 2020	82	33	5	421
June 2020	96	39	4	171
July 2020	126	49	9	333
August 2020	151	62	11	328
September 2020	115	41	10	396
October 2020	124	54	19	600
November 2020	111	51	7	246
December 2020	111	51	7	246
January 2021	105	53	6	229
February 2021	98	54	14	684
March 2021	61	37	7	476
April 2021	85	56	3	224
May 2021	77	44	3	161
June 2021	118	56	4	155
July 2021	116	54	5	190
August 2021	134	62	6	228
September 2021	119	58	13	428
October 2021	101	51	16	710
November 2021	115	54	9	317
December 2021	118	55	14	417
January 2022	133	65	22	630
February 2022	115	62	8	243
March 2022	106	60	13	723
April 2022	75	41	9	508
May 2022	100	50	6	276
June 2022	124	61	6	205
July 2022	112	55	7	293
August 2022	151	58	6	190
September 2022	117	55	12	395
October 2022	108	54	23	637
November 2022	131	55	12	345
December 2022	137	65	15	476
January 2023	118	59	12	430
February 2023	104	51	16	879
March 2023	82	46	19	923
April 2023	97	47	9	475
May 2023	115	55	7	256
June 2023	139	65	16	477
July 2023	136	59	11	335
August 2023	136	64	8	237
September 2023	132	65	5	147
October 2023	128	62	9	307
November 2023	128	64	7	206
December 2023	111	64	7	232
2020 Average	**105**	**46**	**9**	**378**
2021 Average	**104**	**53**	**8**	**349**
2022 Average	**118**	**57**	**12**	**411**
2023 Average	**120**	**59**	**10**	**388**
Total Average	**112**	**54**	**10**	**381**



mL/g=milliliters per gram

Figure 4 Effluent TSS and SVI

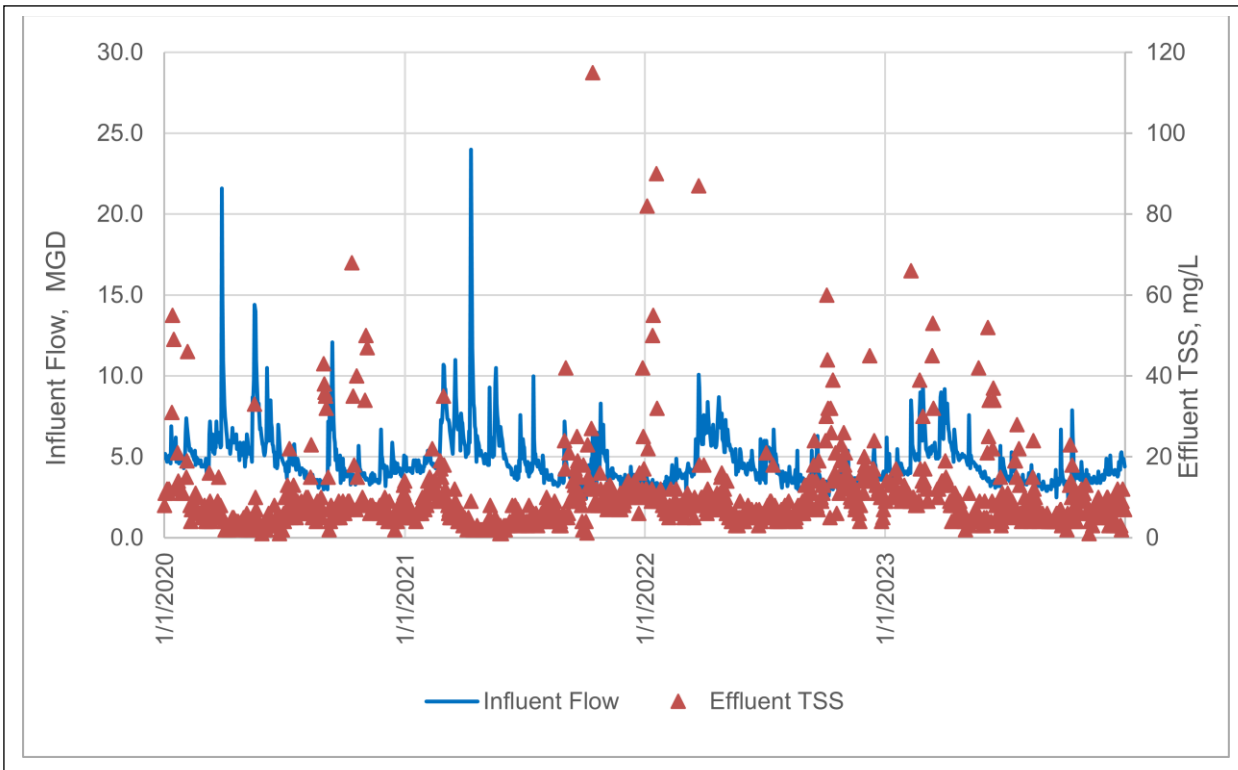


Figure 5 Effluent TSS and Influent Flow

BPR POTENTIAL TESTING

BPR is a wastewater treatment method applied to activated sludge systems to facilitate phosphorus removal. Treatment conditions in the activated sludge system are manipulated to promote growth of phosphate-accumulating organisms (PAO). In anaerobic conditions, these PAOs hydrolyze internal polyphosphate, releasing orthophosphate in the process. The energy from this hydrolysis is used to uptake readily degradable biochemical oxygen demand (BOD). When exposed to aerobic conditions, the PAOs uptake orthophosphate, storing it intracellularly as polyphosphate. PAOs in the aerobic zone uptake an excess of orthophosphate. Phosphorus removal is achieved when these organisms are settled in the final clarifier and removed via the waste activated sludge (WAS).

Not all wastewater is amenable to successful BPR. BPR potential testing was performed at the WWTP on June 6, 2023. The testing was performed on primary effluent from the WWTP to determine whether the wastewater is amenable to BPR. A gang mixer with four jars was used to simultaneously test the primary effluent (Jar Nos. 1 and 2). Using Jar No. 1 as a as positive control, sodium acetate was then added as an ideal BOD source. RAS from a facility successfully operating BPR was anaerobically mixed into each jar to supply PAOs. Each jar was then sampled at 30-minute intervals for 2 hours. Samples were filtered through a coarse filter and preserved for short-term storage. Samples were later analyzed to measure phosphorus release. If the initial test without an additional carbon source mimics the test with the additional carbon source, it is likely that the WWTP can support the BPR process.

Operations data for the month of June 2023 were reviewed to benchmark the conditions of the jar testing days. The average influent flow of the 3 days before chemical jar testing was 3.7 MGD, the influent flow recorded the day of testing was 3.5 MGD, and the average influent flow for the entire month of June 2023 was 3.6 MGD. The influent flow the day of testing was slightly below average.

The jar test results data is presented in Figure 6. A phosphorus release of two to three times the initial concentration is indicative of an amenable wastewater. For the primary effluent without sodium acetate, the phosphorus concentration increased from approximately 11 mg/L to a peak of approximately 26 mg/L. Given that the phosphorus release of the WWTP's influent has a phosphorus release ratio of 2.4, this suggests the WWTP's influent during the day of the test is amenable to BPR treatment. This can be further explored with full-scale BPR pilot testing and/or by repeating the test.

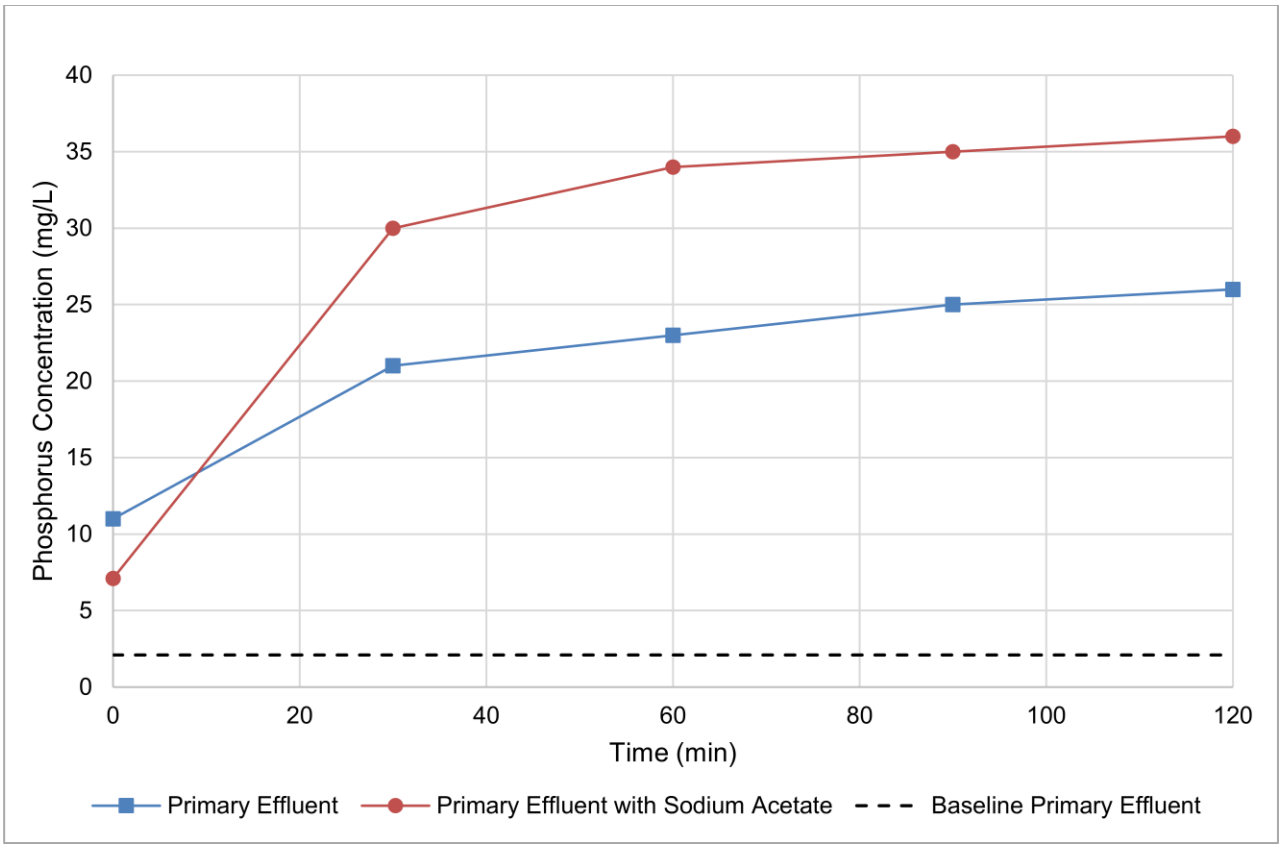


Figure 6 BPR Potential Jar Test Results

Because the PAOs in conventional BPR systems receive their volatile fatty acids (VFA) from the influent wastewater, conventional BPR processes are driven by readily biodegradable carbon sources in the influent. While PAOs rely on VFAs to take up phosphorus, readily biodegradable chemical oxygen demand (rbCOD) is the best indicator of available carbon for PAOs because it includes VFAs as well as carbon sources that can be easily fermented into VFAs in the anaerobic zone. Table 6 is a summary of the BOD:TP and rbCOD:TP ratios from the WWTP primary effluent compared to the minimum recommended values from *Water Environment Federation Manual of Practice No. 34: Nutrient Removal*. It should be noted that the minimum recommended influent ratios are based on the influent to the activated sludge process (including recycle loads); and therefore, a potential increase in recycle TP loads from the implementation of BPR should also be considered. The WWTP sampling is relatively close to the minimum values. With the WWTP's low influent phosphorus concentrations, 0.5 mg/L effluent TP with BPR appears achievable with effluent TSS less than 6 mg/L.

	WWTP Primary Effluent	Minimum Recommended Value
BOD:TP	24	25
rbCOD:TP	13	15

Table 6 WWTP Special Sampling and Minimum Recommended Substrate-to-Phosphorus Ratios for Conventional BPR Processes

AERATION TANK CAPACITY FOR BPR

One important consideration in the design of BPR modifications is the future design conditions that will be used for sizing processes. This is of particular importance if a portion of the existing aeration basins will be converted to unaerated anaerobic zones for BPR (or anoxic zones for nutrient removal), thereby reducing the aerobic volume. The Project Plan will review current loads and projected design year loading based on available population growth projections. It is anticipated that as part of the Project Plan, the new BOD_5 load could be reduced because current loadings are approximately 23 percent of the design loading and small amount additional loadings from projected growth. For the purposes of this study, it is assumed that the future loadings are closer to the current loadings indicated in Table 2, allowing a portion of the existing aerated volume to be converted to unaerated volume for BPR.

The City's current discharge permit does not have an ammonia limit, which means nitrification in the aeration tanks is not necessary for treatment. However, at current conditions, the WWTP typically operates with two aeration tanks in service and completely nitrifies throughout most of the year. SRT expresses the average time that a microorganism will spend in the activated sludge process. For a BPR activated sludge system without nitrification, a typical design SRT is four days. At current maximum month conditions and operating with 3,500 mg/L MLSS, approximately 0.48 million gallons (MG) would provide a 4-day SRT. Each aeration tank has a volume of approximately 0.62 MG, and the total aeration volume is approximately 2.49 MG with all four tanks. With an anaerobic zone sized to be approximately 15 percent of the aeration tank volume, a single aeration tank with approximately 0.53-MG aerated zone could be in service the majority of the time to meet current loadings. Modifications are assumed for four aeration tanks to be converted to BPR for operational flexibility.

PHOSPHORUS REMOVAL ALTERNATIVES

In this section, following two potential alternatives for phosphorus removal at the WWTP are described and compared based on capital cost and nonmonetary factors such as operational flexibility, constructability, and resiliency.

- Alternative No. 1–BPR Activated Sludge System Modifications
- Alternative No. 2–CPR

There are common elements included with both alternatives to modify the aeration tanks flow pattern, address deficiencies, and add influent splitter structures for even flow distribution. The aeration tanks will

be modified for flow to enter the tank at the southeast end and exit the northwest end for a plug flow configuration. Two splitter structures for the ML are included to be constructed within the tanks, one between Aeration Tank Nos. 1 and 2 and one between Aeration Tank Nos. 3 and 4, to provide an even flow split to the aeration tanks.

The existing aeration tanks were constructed in 1974. The walkways at the effluent channels have concrete supports that need repair (Figure 7). The effluent channel wall openings will be filled in with concrete, and the existing concrete walkway supports will be replaced. There are three cast iron sluice gates between the aeration tanks that do not function properly and should be replaced (Figure 8). Costs for three new stainless-steel sluice gates are included. The exterior walls of the aeration tanks have joints and cracks that need repair to seal leaks. An allowance is included for leak repairs. The existing precast bridges were previously used to support vertical mixers, which were removed in the 2011 Project. The stairs at each precast bridge impedes walkway access along the tanks. These bridges and support columns are included to be demolished. The existing steel railing appears to show signs of corrosion and is in need of replacement. New aluminum railing is included. Fine bubble aeration equipment was installed in each tank in the 2011 Project. The existing grid is assumed to be reused for the new aeration tank configuration, and costs for replacement of the membrane diffusers are included. Modifications to the aeration equipment grid may be considered during design.

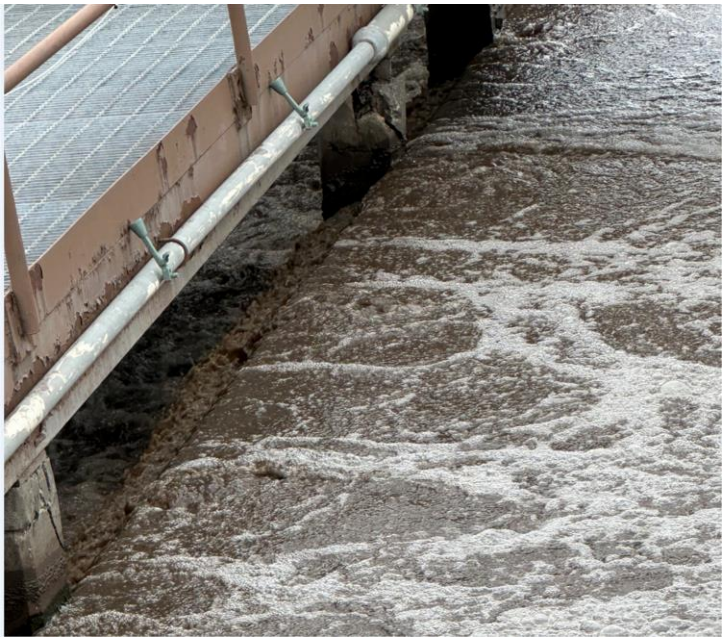


Figure 7 Walkway Concrete Supports at the Effluent Weirs Need Replacement

Figure 8 Existing Sluice Gate Between Aeration Tank Nos. 2 and 3

Figure 9 Aeration Tank Precast Bridges

As discussed previously, two new final clarifiers are needed to meet Illinois Administrative Code requirements. Both alternatives include the two final clarifiers, ML piping to the final clarifiers, piping associated with the final clarifiers, three RAS pumps, and RAS piping. Two additional outlet boxes are needed to split flow to the two new final clarifiers. Hydraulic losses along the effluent channel would result in an uneven distribution of flow to each final clarifier. The weirs at the existing three outlet boxes should be raised to increase the effluent channel water level and reduce hydraulic water surface difference along the channel. The existing outlet sluice gates should be demolished, and new downward opening weir gates are included to replace the weirs. A new ML splitter structure could provide a more equal split than using the effluent channel but would have higher costs for the structure and additional ML piping to each final clarifier.

National Fire Protection Association (NFPA) 820 standards for wastewater treatment facilities should also be considered with installation of new equipment. While NFPA 820 is a standard used in the wastewater industry, it is not a code requirement unless specifically adopted by a municipality or entity. At this time, no modifications to the existing structures have been included in the alternatives for following NFPA 820. An NFPA 820 review should be completed during preliminary design.

A. Alternative No. 1–BPR Activated Sludge System Modifications

1. Conventional BPR Process

There are several BPR processes that have been developed over time, including anaerobic/oxic (AO), anaerobic/anoxic/oxic (A^2O), University of Cape Town (UCT), and Modified UCT. These “conventional” BPR processes include an anaerobic zone on the mainstream (meaning that influent wastewater flows through the anaerobic zone) along with an aerated zone. Anoxic zones are also provided in biological nutrient removal (BNR) process in which TP and TN removal are provided. In the anaerobic zone, PAOs in the ML take up VFAs from the influent wastewater and store the VFAs as polyhydroxyalkanoates (PHA), generating energy for this process through the breakdown of internal polyphosphate compounds. This results in a release of phosphorus in the anaerobic zone. When the PAOs enter the anoxic and aerated zones, the stored PHA is used for energy and cell growth and phosphorus is taken up, removing it from the wastewater when the PAOs are wasted from the system.

The AO BPR process is considered for Alternative No. 1. A process schematic of an AO BPR process is presented in Figure 10.

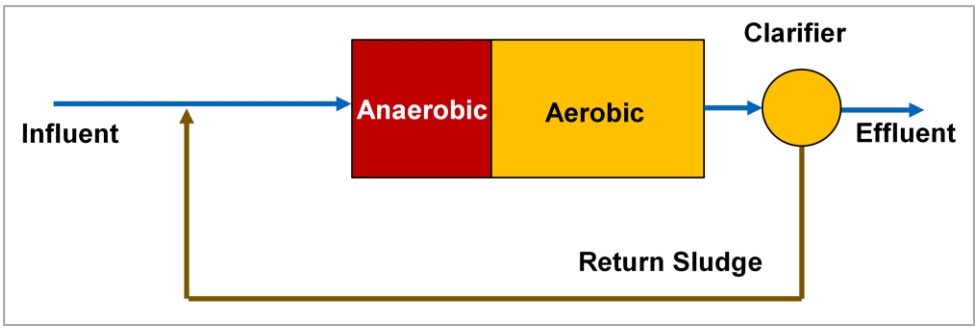
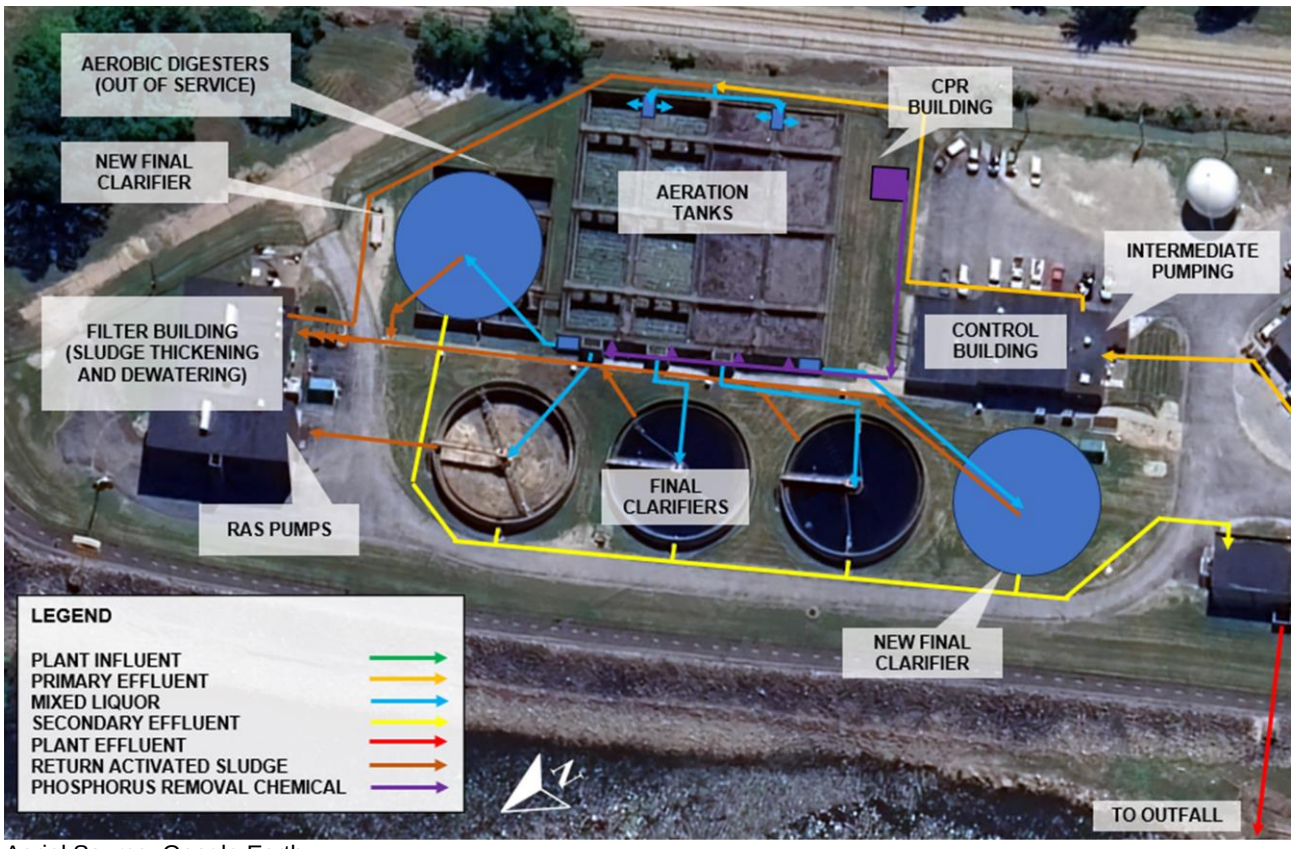


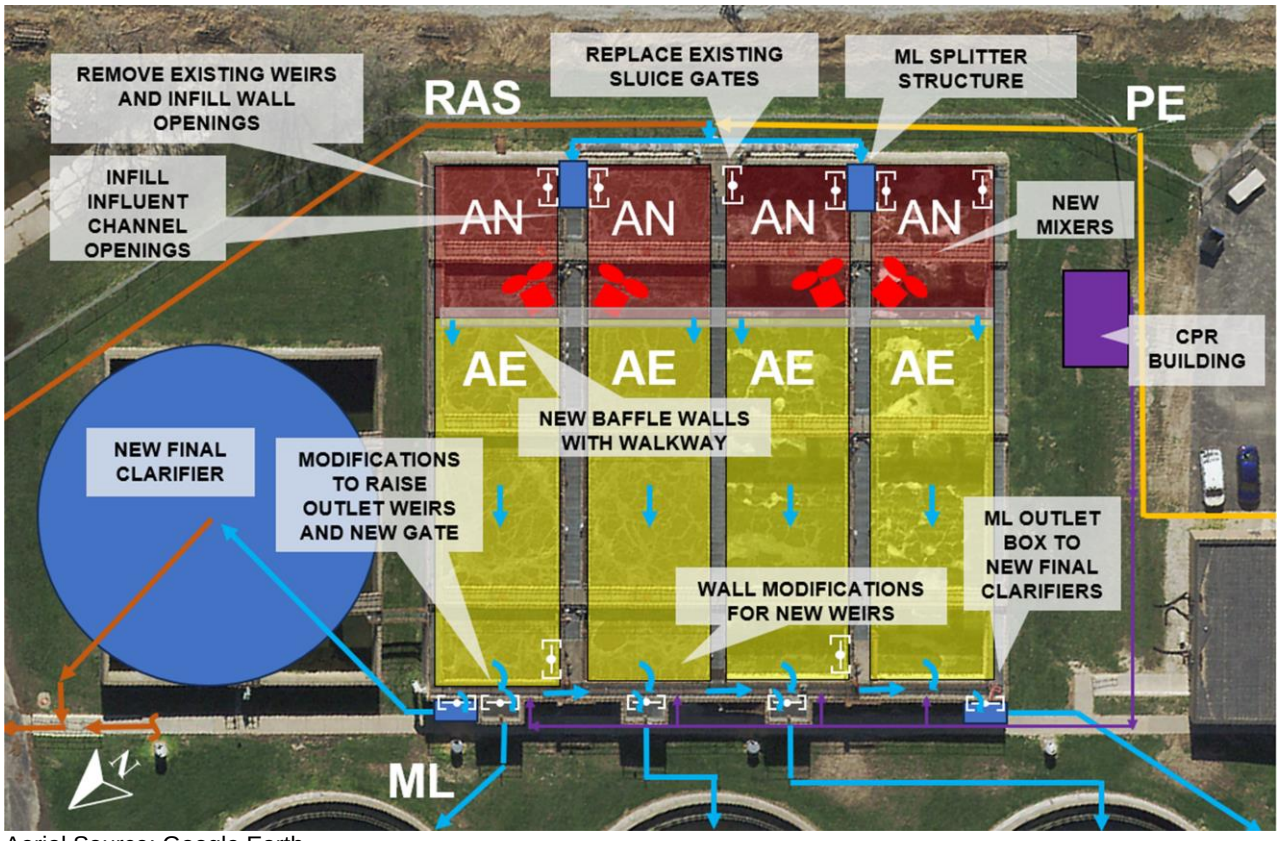
Figure 10 AO Process Schematic

A preliminary schematic of the AO BPR process alternative and common elements are presented in Figures 11 and 12.



Aerial Source: Google Earth

Figure 11 Overall Preliminary BPR Activated Sludge Modifications



Aerial Source: Google Earth

Figure 12 Aeration Tank Preliminary BPR Activated Sludge Modifications

These modifications would result in anaerobic zones in the existing activated sludge system. One important design metric for BPR systems is the anerobic mass fraction, which is the fraction of the biomass that is in the anaerobic zone at any given time. Typically, a conventional BPR system will have at least 10 to 20 percent of its biomass under anaerobic conditions, with even higher fractions used in some instances. The activated sludge system nitrifies ammonia to nitrate during current average loading conditions. With an AO process, the anaerobic zone may need to be sized larger in order to denitrify the nitrates returned in the RAS.

A summary of the preliminary zone sizes in presented is Table 7. These sizes are subject to change depending on the updated design criteria determined during preliminary design and final process modeling.

Additionally, a phased approach for a separate future modification could be considered for a potential future ammonia limit and reviewed further as part of the Project Plan. The first phase would be the modifications to an AO configuration. A future project could include modifications to the A^2O BPR configuration to add anoxic zones to reduce nitrates in the anaerobic zone when nitrifying to meet the future ammonia limit. The existing aeration tank volume appears to be sufficient for nitrification and an A^2O configuration at current loadings and anticipated future loadings. At current loading conditions, 3,500 mg/L MLSS, approximately a 1.25-MG aerated

zone would provide a 12-day SRT for nitrification. The aerated volume of the existing four aeration tanks could be 1.62-MG with 15 percent of the volume anaerobic and 20 percent of the volume anoxic. In order to meet the potential future ammonia limit using the existing aeration tank volume, the WWTP design loading would need to be reduced.

Another major consideration is the constructability of the modifications. Because the WWTP only uses two of the four tanks for treatment at current loads, this layout enables the tanks to be completely modified from the existing configuration to the proposed configuration one at a time without reducing active treatment volume.

Zone	Total Zone Volume (Four Tanks) (MG)	% of Total Volume	HRT at DAF (hours)
Anaerobic	0.38	15	0.8
Aerobic	2.12	85	4.6

HRT=hydraulic retention time

Table 7 Preliminary Anaerobic Zone Sizing

BPR with effective TSS removal can meet a 0.50-mg/L TP limit on a fairly consistent basis at many WWTPs, but BPR is vulnerable to upset conditions caused by higher hydraulic or lower organic loadings. The backup CPR system could be periodically used during process upsets.

This alternative includes the following elements:

a. Conversion of a portion of the existing aerated zones into anaerobic zones by modifying aeration system piping, constructing a concrete baffle wall, and installing mixers in the anaerobic zone. Construction of a concrete walkway on the new baffle walls.

b. Include a 6,000-gallon fiberglass reinforced plastic storage tank and three peristaltic phosphorus removal chemical (PRC) feed pumps in a new 20- by 20-foot building and PRC piping to the ML splitter structure upstream of the final clarifiers. An orthophosphate analyzer located in the UV disinfection building is included for automation of the PRC feed pumps based on an effluent orthophosphate concentration control setpoint.

c. Construction of two ML splitter structures in the aeration tanks.

d. Replacement of aeration equipment membrane diffusers. A portion of the existing aeration equipment grid in the anaerobic zones would be demolished.

e. Replacement of existing gates in the aeration tanks.

f. Repair concrete and leaks of the aeration tanks.

g. Modifications to fill in aeration tank inlet channels openings with concrete.

h. Modifications to fill in effluent weir walls along the sides of aeration tanks with concrete and concrete replacement of the walkway supports.

i. Modify wall for new effluent weirs at the end of the aerated zones.

j. Demolition of the aeration tank precast concrete bridges.

k. Replacement of railing replacement with aluminum railing in the aeration tanks.

l. Construction of two 85-foot-diameter final clarifiers with 15-foot SWD, clarifier collector equipment, and associated ML, RAS, and scum piping.

m. Demolition of the existing aerobic digesters.

n. Construction of two ML outlet boxes with downward opening weir gates for splitting flow to the two new final clarifiers.

o. Installation of ML piping from the ML outlet boxes to the two new final clarifiers. Installation of RAS piping from the two new final clarifiers to the RAS pumps.

p. Construction of three new RAS pumps and piping in the Filter Building. Remove and reinstall dissolved air floatation pumps in lower level and associated dissolved air floatation pump piping modifications to accommodate the additional RAS pumps.

q. Raise walls at the existing aeration tank outlet boxes to the existing final clarifiers and replacement of the existing sluice gates with downward opening weir gates.

r. Replacement of gravity thickener equipment, new covers, and addition of odor control equipment.

Replacement of the existing aeration blowers with more efficient blowers will be reviewed in the Project Plan. Blower and air piping modifications are not included.

2. Side Stream Enhanced Biological Phosphorus Removal (S2EBPR)

While conventional BPR processes are heavily reliant on influent characteristics, there are emerging BPR processes that incorporate fermentation of ML or return sludge and are less dependent on influent carbon sources for successful BPR. This results in improved BPR performance for facilities with lower influent rbCOD and VFA concentrations. One such process in the S2EBPR process. S2EBPR is an emerging BPR process that incorporates fermentation of return sludge in an anaerobic zone that is on the side stream, meaning that the influent wastewater does not flow through it. This side stream anaerobic zone receives only a portion of the RAS, with the remainder of the RAS mixed with the primary effluent in the mainstream tanks.

This process is less dependent on influent carbon sources for successful BPR, improving BPR performance for facilities with lower influent rbCOD and VFA concentrations. This process, or similar configurations, have been used in Europe and Canada for more than 20 years and have begun to be implemented in the United States in the past few years. A schematic of an S2EBPR process is presented in Figure 13.

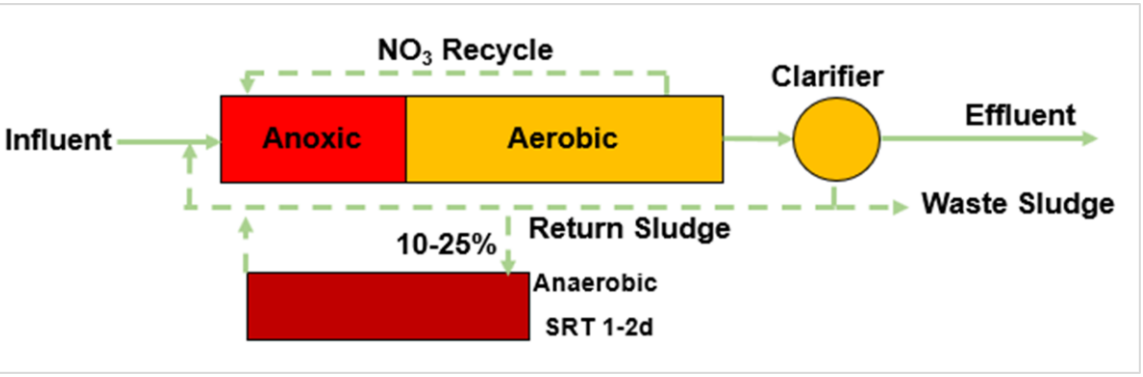


Figure 13 Example S2EBPR Process Schematic

In the side stream anaerobic reactor of the S2EBPR process, the RAS is exposed to deep anaerobic conditions in which the biomass is fermented, breaking down organic material into VFAs for use by PAOs. The effluent from the side stream anaerobic zone then passes into the mainstream anoxic/aerated zones where phosphorus is taken up by the PAOs and removed from the system through the waste activated sludge. S2EBPR have several benefits compared to conventional BPR process, including the following:

a. Improved BPR performance at facilities with inadequate influent carbon for conventional BPR because the carbon storage occurs in a side stream reactor using fermented RAS and increased anaerobic mass fraction greater than 30 percent

b. Improved wet-weather treatment performance by moving the anaerobic zone out of the main liquid treatment flow path where its retention time is unaffected by high influent flows.

c. Reduced of glycogen accumulating organisms (GAO) that typically compete with PAOs for readily biodegradable carbon sources in conventional anaerobic zones and can result in BPR process upsets.

d. Primary effluent does not enter the anaerobic zone and, therefore, dissolved oxygen (DO) or nitrate in the primary effluent does not impact BPR performance.

The Project Plan should further evaluate the anerobic zone and aerated zone sizing. Several modes (including conventional and S2EBPR configurations) could be considered to provide

flexibility with changing flows and loads, influent conditions, and operational or weather conditions.

As discussed previously, the anaerobic mass fraction (percentage of MLSS in the anaerobic zone compared to the total activated sludge system) is an important design parameter for BPR systems. The proposed configuration, either in the AO or S2EBPR mode, provides a significant increase in anaerobic mass fraction compared to the AO configuration, as shown in Table 8. Options to include flexibility to operate in an S2EBPR configuration could be evaluated further in the Project Plan.

Parameter	AO	S2EBPR
Anaerobic Zone MLSS	2,000 to 3,500 mg/L	>5,000 mg/L
Anaerobic Mass Fraction	15%	>30%

Table 8 Summary of Anaerobic Mass Fraction for Activated Sludge Configurations

3. Fermentation

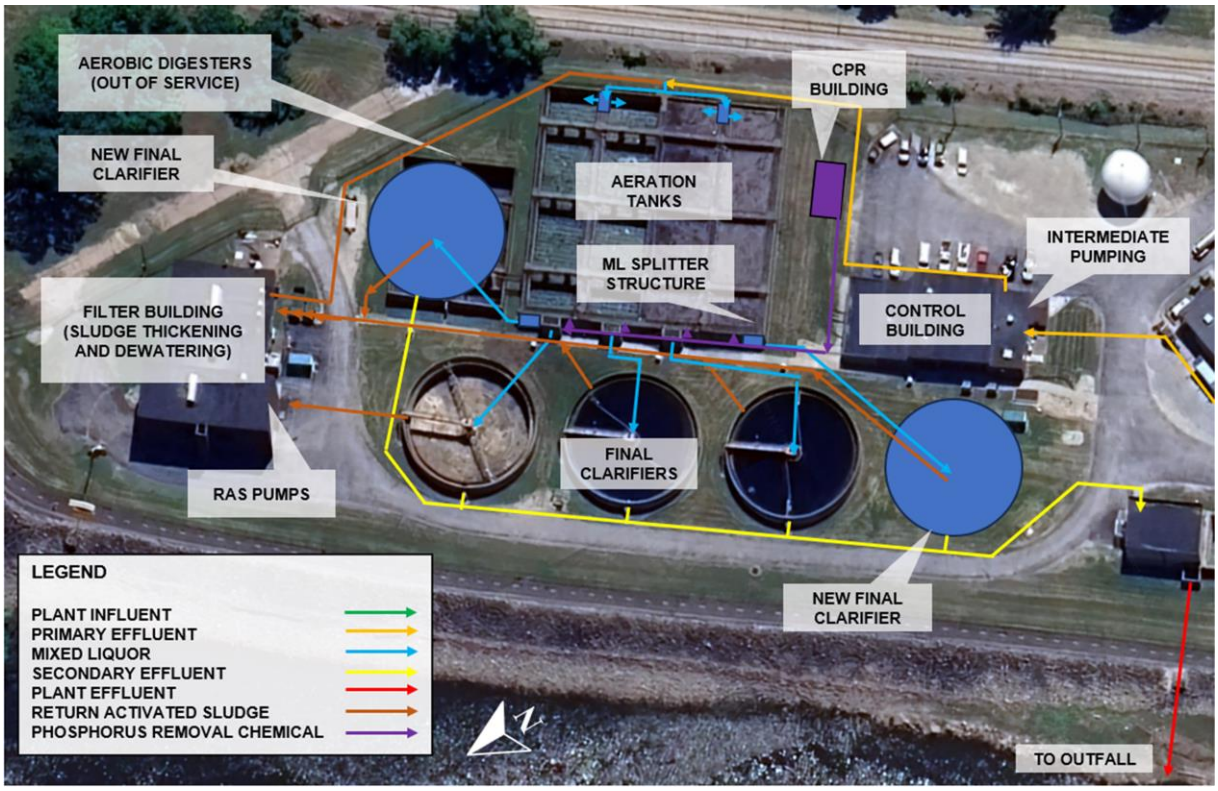
Some WWTPs have low strength wastewater and insufficient influent carbon sources (VFA) for reliable BPR. If S2EBPR is not implemented, there are several operational strategies to promote fermentation. Currently, primary sludge is thickened in a gravity thickener before being pumped to the anaerobic digesters. Primary sludge fermentation may be achieved with the gravity thickener with operational adjustments to promote fermentation. Additionally, cycling the mixers on and off in the anaerobic zone allows for solids to settle and remain in the anaerobic zone longer. This results in an SRT to be longer than the HRT in the anaerobic zone to promote VFA formation.

B. Alternative No. 2–CPR

Implementation of a CPR alternative would include bulk chemical storage tanks, dosing pumps, and a new building to house the new equipment. Alternative No. 2 includes a 40- by 20-foot CPR building to house two 6,000-gallon chemical storage tanks for approximately 30 days of storage at a DAF of 11.1 MGD. The WWTP uses UV disinfection, and UV light transmittance can be reduced by ferric chloride addition. For this reason, this alternative assumes alum is used. The CPR building could be located between the aeration tanks and the Control Building. A preliminary schematic of the CPR process alternative and common elements are presented in Figure 14

Ultimately, the ability of CPR to reliably meet a 0.5-mg/L effluent depends on the design and performance of the final clarifiers to reliably maintain lower effluent TSS.

The main drawback to using CPR is a high production of biosolids and the resulting need for more digestion volume and dewatered cake storage. The existing primary digester has capacity for the projected additional sludge produced by CPR. Cake storage of the additional CPR sludge is not a concern because the WWTP hauls sludge to a landfill.



Aerial Source: Google Earth

Figure 14 Preliminary CPR Alternative Schematic

This alternative includes the following elements:

1. The CPR system includes two 6,000-gallon fiberglass reinforced plastic storage tank and three peristaltic PRC feed pumps in a new 40- by 20-foot building and PRC piping to the ML splitter structure upstream of the final clarifiers. An orthophosphate analyzer located in the UV disinfection building is included for automation of the PRC feed pumps based on an effluent orthophosphate concentration control setpoint.

2. Construction of two ML splitter structures in the aeration tanks.

3. Replacement of aeration equipment membrane diffusers.

4. Replacement of existing gates in the aeration tanks.

5. Repair concrete and leaks of the aeration tanks.

6. Modifications to fill in aeration tank inlet channels openings with concrete.

7. Modifications to fill in effluent weir walls along the sides of aeration tanks with concrete and replacement of the concrete walkway supports.

8. Provide wall modifications for new effluent weirs at the end of the aerated zones.

9. Demolition of the aeration tank precast concrete bridges.

10. Replacement of railing replacement with aluminum railing in the aeration tanks.

11. Construction of two 85-foot-diameter final clarifiers with 15-foot SWD, clarifier collector equipment, and associated ML, RAS, and scum piping.

12. Demolition of the existing aerobic digesters.

13. Construction of two ML outlet boxes with downward opening weir gates for splitting flow to the two new final clarifiers.

14. Installation of ML piping from the ML outlet boxes to the two new final clarifiers. Installation of RAS piping from the two new final clarifiers to the RAS pumps.

15. Construction of three new RAS pumps and piping in the Filter Building. Remove and reinstall dissolved air floatation pumps in lower level and associated DAF pump piping modifications to accommodate the additional RAS pumps.

16. Raise walls at the existing aeration tank outlet boxes to the existing final clarifiers and replacement of the existing sluice gates with downward opening weir gates.

C. Monetary Comparison

The OPCC, additional operation and maintenance (O&M), and the total 20-year present worth for each alternative described are presented in Table 9. Additional cost information on each alternative is included in Appendix B.

The BPR alternative has lower O&M costs because the BPR process should remove phosphorus to less than 0.5 mg/L and less chemical is added to remove the remaining portion of phosphorus. The CPR alternative, however, requires more PRC to remove the phosphorus to the 0.5 mg/L limit and produces more sludge, resulting in additional disposal costs. The BPR alternative has a lower 20-year precent worth than the CPR alternative.

Alternative	Total Capital Cost	Replacement Costs	Present Worth O&M Costs	Salvage Value	20-Year Present Worth
BPR	$21,070,000	$130,000	$1,088,000	($1,416,900)	$20,871,000
CPR	$19,400,000	$130,000	$3,476,000	($1,419,900)	$21,586,000

Table 9 20-Year Present Worth Comparison of TP Removal Alternatives to Meet 0.5-mg/L Annual Geometric Mean Limit

D. Nonmonetary Comparison

BPR treatment, being a solely biological treatment process, can be susceptible to upsets. As stated previously, a back-up chemical system is required. BPR has the advantage of not generating additional sludge and not requiring frequent chemical deliveries.

CPR is a relatively simple process to operate and is generally reliable. The additional sludge generated by CPR, in addition to the increased cost of disposal, can stress solids processing systems and equipment.

RECOMMENDATIONS

The BPR removal modifications should be included as part of the larger project to be identified in the WWTP Project Plan because one larger construction project is typically more cost-effective than separating projects into phases.

The City plans to proceed with a BPR process that would require a rebuild or replacement of the secondary treatment processes. The planned upgrades include rebuilding the existing aeration tanks, modifications to the existing final clarifiers, and the addition of two new final clarifiers. Therefore, in accordance with Special Condition 20.B.1, the 0.5 mg/L TP 12-month rolling geometric mean limit would be in effect December 31, 2035. A preliminary project implementation schedule is presented in Table 10 based on design beginning July 2025. Based on recent experience on WWTP construction projects, the most significant factor in the ability for the project to be in operation to meet the schedule is the lead time on various equipment and materials. The project scope and potential implementation schedule will be evaluated further in the WWTP Project Plan.

Milestone	Date
Complete Project Plan and Submittal to IEPA	December 2024
IEPA Approval of Project Plan	June 2025
Begin Design	July 2025
Submit Design Documents to IEPA	July 2027
IEPA Loan Commitment (City on Fiscal Year 2028 Intended Use Plan)	July 2027
IEPA Loan Application	August 2027
IEPA Approval of Design	October 2027
IEPA Loan Commitment	October 2027
Advertise for Bids	December 2027
Construction Begins	June 2028
Construction Substantial Completion	December 2031
Construction Final Completion	March 2032
BPR Operation and Optimization (Determine if Filtration is Needed)	2032 to 2035
Meet 0.5-mg/L TP Effluent Limit	2035

Table 10 Preliminary Project Schedule

APPENDIX A
NPDES PERMIT

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 · (217) 782-3397

JB PRITZKER, GOVERNOR JOHN J. KIM, DIRECTOR

217/782-0610

August 13, 2020

City of East Moline
915 16th Avenue
East Moline, Illinois 61244

Re: East Moline Regional WWTP
NPDES Permit No. IL0028550
Bureau ID: W1610250001

Final Permit

Gentlemen:

Attached is the final NPDES Permit for your discharge. The Permit as issued covers discharge limitations, monitoring, and reporting requirements. Failure to meet any portion of the Permit could result in civil and/or criminal penalties. The Illinois Environmental Protection Agency is ready and willing to assist you in interpreting any of the conditions of the Permit as they relate specifically to your discharge.

Pursuant to the Final NPDES Electronic Reporting Rule, all permittees must report DMRs electronically unless a waiver has been granted by the Agency. The Agency utilizes NetDMR, a web based application, which allows the submittal of electronic Discharge Monitoring Reports instead of paper Discharge Monitoring Reports (DMRs). More information regarding NetDMR can be found on the Agency website, https:www2.illinois.gov/epa/topics/water-quality/surface-water/netdmr/pages/quick-answer-guide.aspx. If your facility has received a waiver from the NetDMR program, a supply of preprinted paper DMR Forms will be sent to your facility. Additional information and instructions will accompany the preprinted DMRs. Please see the attachment regarding the electronic reporting rule.

The attached Permit is effective as of the date indicated on the first page of the Permit. Until the effective date of any re-issued Permit, the limitations and conditions of the previously-issued Permit remain in full effect. You have the right to appeal any condition of the Permit to the Illinois Pollution Control Board within a 35 day period following the issuance date

Should you have questions concerning the Permit, please contact Surinder Tandon at 217/782-0610.

Sincerely,

Amy L. Dragovich, P.E.
Manager, Permit Section
Division of Water Pollution Control

ALD:SKT:20011601.bah

Attachment: Final Permit

cc: Records
Compliance Assurance Section
Peoria Region
Billing

NPDES Permit No. IL0028550

Illinois Environmental Protection Agency

Division of Water Pollution Control

1021 North Grand Avenue East

Post Office Box 19276

Springfield, Illinois 62794-9276

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

Reissued (NPDES) Permit

Expiration Date: August 31, 2025

Issue Date: August 13, 2020
Effective Date: September 1, 2020

Name and Address of Permittee:

City of East Moline
915 16th Avenue
East Moline, Illinois 61244

Facility Name and Address:

East Moline Regional WWTP
101 19th Street
East Moline, Illinois 61244
(Rock Island County)

Receiving Waters: Mississippi River

In compliance with the provisions of the Illinois Environmental Protection Act, Title 35 of the Ill. Adm. Code, Subtitle C, Chapter I, and the Clean Water Act (CWA), the above-named Permittee is hereby authorized to discharge at the above location to the above-named receiving stream in accordance with the Effluent Limitations, Monitoring, and Reporting requirements; Special Conditions and Attachment H Standard Conditions attached herein.

Permittee is not authorized to discharge after the above expiration date. In order to receive authorization to discharge beyond the expiration date, the Permittee shall submit the proper application as required by the Illinois Environmental Protection Agency (IEPA) not later than 180 days prior to the expiration date.

Amy L. Dragovich, P.E.
Manager, Permit Section
Division of Water Pollution Control

ALD:SKT:20011601.bah

NPDES Permit No. IL0028550

Effluent Limitations, Monitoring, and Reporting

FINAL

Discharge Number(s) and Name(s): 001 STP Outfall

Load limits computed based on a design average flow (DAF) of 11.1 MGD (design maximum flow (DMF) of 27.8 MGD).

From the effective date of this Permit until the expiration date, the effluent of the above discharge(s) shall be monitored and limited at all times as follows:

	LOAD LIMITS lbs/day DAF (DMF)*			CONCENTRATION LIMITS mg/L				
Parameter	Monthly Average	Weekly Average	Daily Maximum	Monthly Average	Weekly Average	Daily Maximum	Sample Frequency	Sample Type
Flow (MGD)							Continuous	
$CBOD_5$**,****	1851 (4637)	3703 (9274)		20	40		3 Days/Week	Composite
Suspended Solids****	2314 (5796)	4166 (10433)		25	45		3 Days/Week	Composite
pH	Shall be in the range of 6 to 9 Standard Units						3 Days/Week	Grab
Fecal Coliform	Daily Maximum shall not exceed 400 per 100 mL						5 Days/Week	Grab
Chlorine Residual						0.40	***	Grab
Ammonia Nitrogen (as N)	Monitor Only						1 Day/Month	Composite
Total Phosphorus (as P)	Monitor only						1 Day/Month	Composite
Total Nitrogen (as N)	Monitor only						1 Day/Month	Composite

*Load limits based on design maximum flow shall apply only when flow exceeds design average flow.
**Carbonaceous BOD_5 ($CBOD_5$) testing shall be in accordance with 40 CFR 136.
***See Special Condition 10.
****BOD_5 and Suspended Solids (85% removal required): In accordance with 40 CFR 133, the 30-day average percent removal shall not be less than 85 percent. The percent removal need not be reported to the IEPA on DMRs but influent and effluent data must be available, as required elsewhere in this Permit, for IEPA inspection and review. For measuring compliance with this requirement, 5 mg/L shall be added to the effluent $CBOD_5$ concentration to determine the effluent BOD_5 concentration. Percent removal is a percentage expression of the removal efficiency across a treatment plant for a given pollutant parameter, as determined from the 30-day average values of the raw wastewater influent concentrations to the facility and the 30-day average values of the effluent pollutant concentrations for a given time period.

Flow shall be reported on the Discharge Monitoring Report (DMR) as monthly average and daily maximum.
Fecal Coliform shall be reported on the DMR as a daily maximum value.
pH shall be reported on the DMR as minimum and maximum value.
Chlorine Residual shall be reported on the DMR as Daily Maximum Value.
Dissolved oxygen shall be reported on the DMR as a minimum value.
Total Phosphorus shall be reported on the DMR as a monthly average and daily maximum value.
Total nitrogen shall be reported on the DMR as a daily maximum value. Total Nitrogen is the sum total of Total Kieldahl Nitrogen, Nitrate and nitrite.

NPDES Permit No. IL0028550

Influent Monitoring, and Reporting

The influent to the plant shall be monitored as follows:

Parameter	Sample Frequency	Sample Type
Flow (MGD)	Continuous	
BOD_5	3 Days/Week	Composite
Suspended Solids	3 Days/Week	Composite

Influent samples shall be taken at a point representative of the influent.

Flow (MGD) shall be reported on the Discharge Monitoring Report (DMR) as monthly average and daily maximum.

BOD_5 and Suspended Solids shall be reported on the DMR as a monthly average concentration.

Special Conditions

SPECIAL CONDITION 1. This Permit may be modified to include different final effluent limitations or requirements which are consistent with applicable laws and regulations. The IEPA will public notice the permit modification.

SPECIAL CONDITION 2. The use or operation of this facility shall be by or under the supervision of a Certified Class 1 operator.

SPECIAL CONDITION 3. The IEPA may request in writing submittal of operational information in a specified form and at a required frequency at any time during the effective period of this Permit.

SPECIAL CONDITION 4. The IEPA may request more frequent monitoring by permit modification pursuant to 40 CFR § 122.63 and Without Public Notice.

SPECIAL CONDITION 5. The effluent, alone or in combination with other sources, shall not cause a violation of any applicable water quality standard outlined in 35 Ill. Adm. Code 302 and 303.

SPECIAL CONDITION 6. The Permittee shall record monitoring results on Discharge Monitoring Report (DMR) electronic forms using one such form for each outfall each month.

In the event that an outfall does not discharge during a monthly reporting period, the DMR Form shall be submitted with no discharge indicated.

The Permittee is required to submit electronic DMRs (NetDMRs) instead of mailing paper DMRs to the IEPA unless a waiver has been granted by the Agency. More information, including registration information for the NetDMR program, can be obtained on the IEPA website, https:www2.illinois.gov/epa/topics/water-quality/surface-water/netdmr/pages/quick-answer-guide.aspx.

The completed Discharge Monitoring Report forms shall be submitted to IEPA no later than the 25th day of the following month, unless otherwise specified by the permitting authority.

Permittees that have been granted a waiver shall mail Discharge Monitoring Reports with an original signature to the IEPA at the following address:

Illinois Environmental Protection Agency
Division of Water Pollution Control
Attention: Compliance Assurance Section, Mail Code # 19
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

SPECIAL CONDITION 7. The provisions of 40 CFR Section 122.41(m) & (n) are incorporated herein by reference.

SPECIAL CONDITION 8. Samples taken in compliance with the effluent monitoring requirements shall be taken at a point representative of the discharge, but prior to entry into the receiving stream.

SPECIAL CONDITION 9. This Permit may be modified to include alternative or additional final effluent limitations pursuant to an approved Total Maximum Daily Load (TMDL) Study or upon completion of an alternate Water Quality Study.

SPECIAL CONDITION 10. For Discharge No. 001, any use of chlorine to control slime growths, odors or as an operational control, etc. shall not exceed the limit of 0.40 mg/L (daily maximum) total residual chlorine in the effluent. Sampling is required on a daily grab basis during the chlorination process. Reporting shall be submitted on the DMR's on a monthly basis.

SPECIAL CONDITION 11. The Permittee has undergone a Monitoring Reduction review and the influent and effluent sample frequency has been reduced for parameters due to sustained compliance. The IEPA may require that the influent and effluent sampling frequency for these parameters be increased without Public Notice. This provision does not limit EPA's authority to require additional monitoring, information or studies pursuant to Section 308 of the CWA.

SPECIAL CONDITION 12. During January of each year the Permittee shall submit annual fiscal data regarding sewerage system operations to the Illinois Environmental Protection Agency/Division of Water Pollution Control/Compliance Assurance Section. The Permittee may use any fiscal year period provided the period ends within twelve (12) months of the submission date.

Submission shall be on forms provided by IEPA titled "Fiscal Report Form For NPDES Permittees".

Special Conditions

SPECIAL CONDITION 13. The Permittee shall conduct biomonitoring of the effluent from Discharge Number(s) 001.

Biomonitoring

A. Acute Toxicity - Standard definitive acute toxicity tests shall be run on at least two trophic levels of aquatic species (fish, invertebrate) representative of the aquatic community of the receiving stream. Testing must be consistent with Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (Fifth Ed.) EPA/821-R-02-012. Unless substitute tests are pre-approved; the following tests are required:

   1. Fish 96-hour static LC_{50} Bioassay using fathead minnows (*Pimephales promelas*).

   2. Invertebrate 48-hour static LC_{50} Bioassay using *Ceriodaphnia*.

B. Testing Frequency - The above tests shall be conducted using 24-hour composite samples unless otherwise authorized by the IEPA. Sample collection and testing must be conducted in the 18th, 15th, 12th, and 9th month prior to the expiration date of this Permit. When possible, bioassay sample collection should coincide with sample collection for metals analysis or other parameters that may contribute to effluent toxicity.

C. Reporting - Results shall be reported according to EPA/821-R-02-012, Section 12, Report Preparation, and shall be mailed to IEPA, Bureau of Water, Compliance Assurance Section or emailed to EPA.PrmtSpecCondtns@Illinois.gov within one week of receipt from the laboratory. Reports are due to the IEPA no later than the 16th, 13th, 10th, and 7th month prior to the expiration date of this Permit.

D. Toxicity – Should a bioassay result in toxicity to >20% of organisms tested in the 100% effluent treatment, the IEPA may require, upon notification, six (6) additional rounds of monthly testing on the affected organism(s) to be initiated within 30 days of the toxic bioassay. Results shall be submitted to IEPA within one (1) week of becoming available to the Permittee. Should any of the additional bioassays result in toxicity to ≥50% of organisms tested in the 100% effluent treatments, the Permittee must contact the IEPA within one (1) day of the results becoming available to the Permittee and begin the toxicity identification and reduction evaluation process as outlined below.

E. Toxicity Identification and Reduction Evaluation - Should any of the additional bioassays result in toxicity to ≥50% of organisms tested in the 100% effluent treatment, the Permittee must contact the IEPA within one (1) day of the results becoming available to the Permittee and begin the toxicity identification evaluation process in accordance with Methods for Aquatic Toxicity Identification Evaluations, EPA/600/6-91/003. The IEPA may also require, upon notification, that the Permittee prepare a plan for toxicity reduction evaluation to be developed in accordance with Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants, EPA/833B-99/002, which shall include an evaluation to determine which chemicals have a potential for being discharged in the plant wastewater, a monitoring program to determine their presence or absence and to identify other compounds which are not being removed by treatment, and other measures as appropriate. The Permittee shall submit to the IEPA its plan for toxicity reduction evaluation within ninety (90) days following notification by the IEPA. The Permittee shall implement the plan within ninety (90) days or other such date as contained in a notification letter received from the IEPA.

   The IEPA may modify this Permit during its term to incorporate additional requirements or limitations based on the results of the biomonitoring. In addition, after review of the monitoring results, the IEPA may modify this Permit to include numerical limitations for specific toxic pollutants. Modifications under this condition shall follow public notice and opportunity for hearing.

SPECIAL CONDITION 14. For the duration of this Permit, the Permittee shall determine the quantity of sludge produced by the treatment facility in dry tons or gallons with average percent total solids analysis. The Permittee shall maintain adequate records of the quantities of sludge produced and have said records available for U.S. EPA and IEPA inspection. The Permittee shall submit to the IEPA, at a minimum, a semi-annual summary report of the quantities of sludge generated and disposed of, in units of dry tons or gallons (average total percent solids) by different disposal methods including but not limited to application on farmland, application on reclamation land, landfilling, public distribution, dedicated land disposal, sod farms, storage lagoons or any other specified disposal method. Said reports shall be submitted to the IEPA by January 31 and July 31 of each year reporting the preceding January thru June and July thru December interval of sludge disposal operations.
Duty to Mitigate. The Permittee shall take all reasonable steps to minimize any sludge use or disposal in violation of this Permit.

Sludge monitoring must be conducted according to test procedures approved under 40 CFR 136 unless otherwise specified in 40 CFR 503, unless other test procedures have been specified in this Permit.

Planned Changes. The Permittee shall give notice to the IEPA on the semi-annual report of any changes in sludge use and disposal.

The Permittee shall retain records of all sludge monitoring, and reports required by the Sludge Permit as referenced in Standard Condition 25 for a period of at least five (5) years from the date of this Permit.

Special Conditions

If the Permittee monitors any pollutant more frequently than required by this permit or the Sludge Permit, the results of this monitoring shall be included in the reporting of data submitted to the IEPA.

The Permittee shall comply with existing federal regulations governing sewage sludge use or disposal and shall comply with all existing applicable regulations in any jurisdiction in which the sewage sludge is actually used or disposed.

The Permittee shall comply with standards for sewage sludge use or disposal established under section 405(d) of the CWA within the time provided in the regulations that establish the standards for sewage sludge use or disposal even if the permit has not been modified to incorporate the requirement.

The Permittee shall ensure that the applicable requirements in 40 CFR Part 503 are met when the sewage sludge is applied to the land, placed on a surface disposal site, or fired in a sewage sludge incinerator.

Monitoring reports for sludge shall be reported on the form titled "Sludge Management Reports" to the following address:

Illinois Environmental Protection Agency
Bureau of Water
Compliance Assurance Section
Mail Code #19
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

SPECIAL CONDITION 15. Consistent with permit modification procedures in 40 CFR 122.62 and 63, this Permit may be modified to include requirements for the Permittee on a continuing basis to evaluate and detail its efforts to effectively control sources of infiltration and inflow into the sewer system and to submit reports to the IEPA if necessary.

SPECIAL CONDITION 16.

A. Publicly Owned Treatment Works (POTW) Pretreatment Program General Provisions

1. The Permittee shall implement and enforce its approved Pretreatment Program which was approved on November 12, 1987 and all approved subsequent modifications thereto. The Permittee shall maintain legal authority adequate to fully implement the Pretreatment Program in compliance with Federal (40 CFR 403), State, and local laws and regulations. All definitions in this section unless specifically otherwise defined in this section, are those definitions listed in 40 CFR 403.3. U.S. EPA Region 5 is the Approval Authority for the administration of pretreatment programs in Illinois. The Permittee shall:

   a. Develop and implement procedures to ensure compliance with the requirements of a pretreatment program as specified in 40 CFR 403.8(f)(2)

   b. Carry out independent inspection and monitoring procedures at least once per year, which will determine whether each significant industrial user (SIU) is in compliance with applicable pretreatment standards;

   c. Evaluate whether each SIU needs a slug control plan or other action to control slug discharges. If needed, the SIU slug control plan shall include the items specified in 40 CFR 403.8(f)(2)(vi). For IUs identified as significant prior to November 14, 2005, this evaluation must have been conducted at least once by October 14, 2006; additional SIUs must be evaluated within 1 year of being designated an SIU;

   d. Update its inventory of Industrial Users (IUs) at least annually and as needed to ensure that all SIUs are properly identified, characterized, and categorized;

   e. Receive and review self monitoring and other IU reports to determine compliance with all pretreatment standards and requirements, and obtain appropriate remedies for noncompliance by any IU with any pretreatment standard and/or requirement;

   f. Investigate instances of noncompliance, collect and analyze samples, and compile other information with sufficient care as to produce evidence admissible in enforcement proceedings, including judicial action;

   g. Require development, as necessary, of compliance schedules by each industrial user to meet applicable pretreatment standards; and,

   h. Maintain an adequate revenue structure and staffing level for continued operation of the Pretreatment Program.

Special Conditions

2. The Permittee shall issue/reissue permits or equivalent control mechanisms to all SIUs prior to expiration of existing permits or prior to commencement of discharge in the case of new discharges. The permits at a minimum shall include the elements listed in 40 CFR § 403.8(f)(1)(iii)(B).

3. The Permittee shall develop, maintain, and enforce, as necessary, local limits to implement the general and specific prohibitions in 40 CFR § 403.5 which prohibit the introduction of any pollutant(s) which cause pass through or interference and the introduction of specific pollutants to the waste treatment system from any source of nondomestic discharge.

4. In addition to the general limitations expressed in Paragraph 3 above, applicable pretreatment standards must be met by all industrial users of the POTW. These limitations include specific standards for certain industrial categories as determined by Section 307(b) and (c) of the Clean Water Act, State limits, or local limits, whichever are more stringent.

5. The USEPA and IEPA individually retain the right to take legal action against any industrial user and/or the POTW for those cases where an industrial user has failed to meet an applicable pretreatment standard by the deadline date regardless of whether or not such failure has resulted in a permit violation.

6. The Permittee shall establish agreements with all contributing jurisdictions, as necessary, to enable it to fulfill its requirements with respect to all IUs discharging to its system.

7. The Permittee shall evaluate its approved Pretreatment Program for compliance with 40 CFR 403 and within six (6) months of the effective date of this Permit submit to USEPA and IEPA a proposal to modify and update its approved Pretreatment Program to incorporate any necessary modifications to the Pretreatment Program. The proposal shall include all modifications to the approved program,the sewer use ordinance and the enforcement response plan which are necessary. The Permittee shall not implement changes or modification to the approved Pretreatment Program without notification to the Approval Authority. Any substantial modifications as outlined in 40 CFR 402.18(c) are subject to USEPA approval and public notice.

8. Within 6 months from the effective date of this permit, the Permittee shall conduct a technical re-evaluation of its local limitations consistent with U.S. EPA's Local Limits Development Guidance (July 2004), and submit the evaluation and any proposed revisions to its local limits to IEPA and U.S. EPA Region 5 for review and approval. U.S. EPA Region 5 will request Permittee to submit the evaluation and any proposed revisions to its local limits on the spreadsheet found at https://www.epa.gov/npdes-permits/illinois-npdes-permits. . To demonstrate technical justification for new local industrial user limits or justification for retaining existing limits, the following information must be submitted to U.S. EPA:

   a. Total plant flow
   b. Domestic/commercial pollutant contributions for pollutants of concern
   c. Industrial pollutant contributions and flows
   d. Current POTW pollutant loadings, including loadings of conventional pollutants
   e. Actual treatment plant removal efficiencies, as a decimal (primary, secondary, across the wastewater treatment plant)
   f. Safety factor to be applied
   g. Identification of applicable criteria:
      i. NPDES permit conditions
         •Specific NPDES effluent limitations
         •Water-quality criteria
         •Whole effluent toxicity requirements
         •Criteria and other conditions for sludge disposal
      ii. Biological process inhibition
         •Nitrification
         •Sludge digester
      iii. Collection system problems
   h. The Permittee's sludge disposal methods (land application, surface disposal, incineration, landfill)
   i. Sludge flow to digester
   j. Sludge flow to disposal
   k. % solids in sludge to disposal, not as a decimal
   l. % solids in sludge to digester, not as a decimal
   m. Plant removal efficiencies for conventional pollutants
   n. If revised industrial user discharge limits are proposed, the method of allocating available pollutants loads to industrial users
   o. A comparison of maximum allowable headworks loadings based on all applicable criteria listed in g, above
   p. Pollutants that have caused:
      i. Violations or operational problems at the POTW, including conventional pollutants
      ii. Fires and explosions

iii. Corrosion
iv. Flow obstructions
v. Increased temperature in the sewer system
vi. Toxic gases, vapors or fumes that caused acute worker health and safety problems
vii. Toxicity found through Whole Effluent Toxicity testing
viii. Inhibition

q. Pollutants designated as "monitoring only" in the NPDES permit

r. Supporting data, assumptions, and methodologies used in establishing the information a through q above

B. Reporting and Records Requirements

1. The Permittee shall provide an annual report briefly describing the permittee's pretreatment program activities over the previous calendar year. Permittees who operate multiple plants may provide a single report providing all plant-specific reporting requirements are met. Such report shall be submitted no later than April 28 of each year to USEPA, Region 5, 77 West Jackson Blvd., Chicago, Illinois 60604, Attention: Water Enforcement & Compliance Assurance Branch, and shall be in the format set forth in IEPA's POTW Pretreatment Report Package which contains information regarding:

a. An updated listing of the Permittee's significant industrial users, indicating additions and deletions from the previous year, along with brief explanations for deletions. The list shall specify which categorical Pretreatment standards, if any, are applicable to each Industrial User.

b. A descriptive summary of the compliance activities including numbers of any major enforcement actions, (i.e., administrative orders, penalties, civil actions, etc.), and the outcome of those actions. This includes an assessment of the compliance status of the Permittee's industrial users and the effectiveness of the Permittee's Pretreatment Program in meeting its needs and objectives.

c. A description of all substantive changes made to the Permittee's Pretreatment Program. Changes which are "substantial modifications" as described in 40 CFR § 403.18(c) must receive prior approval from the USEPA.

d. Results of sampling and analysis of POTW influent, effluent, and sludge.

e. A summary of the findings from the priority pollutants sampling. As sufficient data becomes available the IEPA may modify this Permit to incorporate additional requirements relating to the evaluation, establishment, and enforcement of local limits for organic pollutants. Any permit modification is subject to formal due process procedures pursuant to State and Federal law and regulation. Upon a determination that an organic pollutant is present that causes interference or pass through, the Permittee shall establish local limits as required by 40 CFR § 403.5(c).

2. The Permittee shall maintain all pretreatment data and records for a minimum of three (3) years. This period shall be extended during the course of unresolved litigation or when requested by the IEPA or the Regional Administrator of USEPA. Records shall be available to USEPA and the IEPA upon request.

3. The Permittee shall establish public participation requirements of 40 CFR 25 in implementation of its Pretreatment Program. The Permittee shall at least annually, publish the names of all IU's which were in significant noncompliance (SNC), as defined by 40 CFR § 403.8(f)(2)(viii), in a newspaper of general circulation that provides meaningful public notice within the jurisdictions served by the Permittee or based on any more restrictive definition of SNC that the POTW may be using.

4. The Permittee shall provide written notification to the USEPA, Region 5, 77 West Jackson Blvd., Chicago, Illinois 60604, Attention: NPDES Programs Branch and to the Deputy Counsel for the Division of Water Pollution Control, IEPA, 1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois 62794-9276 within five (5) days of receiving notice that any Industrial User of its sewage treatment plant is appealing to the Circuit Court any condition imposed by the Permittee in any permit issued to the Industrial User by Permittee. A copy of the Industrial User's appeal and all other pleadings filed by all parties shall be mailed to the Deputy Counsel within five (5) days of the pleadings being filed in Circuit Court.

C. Monitoring Requirements

1. The Permittee shall monitor its influent, effluent and sludge and report concentrations of the following parameters on Discharge Monitoring Report (DMR) electronic forms, unless otherwise specified by the IEPA, and include them in its annual report. Samples shall be taken at semi-annual intervals at the indicated reporting limit or better and consist of a 24-hour composite unless otherwise specified below. Sludge samples shall be taken of final sludge and consist of a grab sample reported on a dry weight basis.

Special Conditions

STORET CODE	PARAMETER	Minimum reporting limit
01097	Antimony	0.07 mg/L
01002	Arsenic	0.05 mg/L
01007	Barium	0.5 mg/L
01012	Beryllium	0.005 mg/L
01027	Cadmium	0.001 mg/L
01032	Chromium (hex) (grab not to exceed 24 hours)*	0.01 mg/L
01034	Chromium (total)	0.05 mg/L
01042	Copper	0.005 mg/L
00720	Cyanide (total) (grab)****	5.0 ug/L
00722	Cyanide (grab)*(available ***** or amenable to chlorination)****	5.0 ug/L
00951	Fluoride*	0.1 mg/L
01045	Iron (total)	0.5 mg/L
01046	Iron (Dissolved)*	0.5 mg/L
01051	Lead	0.05 mg/L
01055	Manganese	0.5 mg/L
71900	Mercury (effluent grab)***	1.0 ng/L**
01067	Nickel	0.005 mg/L
00556	Oil (hexane soluble or equivalent) (Grab Sample only)*	5.0 mg/L
32730	Phenols (grab)	0.005 mg/L
01147	Selenium	0.005 mg/L
01077	Silver (total)	0.003 mg/L
01059	Thallium	0.3 mg/L
01092	Zinc	0.025 mg/L

* Influent and effluent only
**1 ng/L = 1 part per trillion.
***Utilize USEPA Method 1631E and the digestion procedure described in Section 11.1.1.2 of 1631E, other approved methods may be used for influent (composite) and sludge.
****Analysis for cyanide (available or amenable to chlorination) is only required if cyanide (total) is detected at or above the minimum reporting limit.
***** USEPA Method OIA-1677 or Standard Method SM 4500-CN G.

The minimum reporting limit for each parameter is specified by Illinois EPA as the regulatory authority.

The minimum reporting limit for each parameter shall be greater than or equal to the lowest calibration standard and within the acceptable calibration range of the instrument.

The minimum reporting limit is the value below which data are to be reported as non-detects.

The statistically-derived laboratory method detection limit for each parameter shall be less than the minimum reporting limit required for that parameter.
All sample containers, chemical and thermal preservation, holding times, analyses, method detection limit determinations and quality assurance/quality control requirements shall be in accordance with 40 CFR Part 136.

Unless otherwise indicated, concentrations refer to the total amount of the constituent present in all phases, whether solid, suspended or dissolved, elemental or combined including all oxidation states. Where constituents are commonly measured as other than total, the phase is so indicated.

2. The Permittee shall conduct an analysis for the one hundred and ten (110) organic priority pollutants identified in 40 CFR 122 Appendix D, Table II as amended. This monitoring shall be done annually and reported on monitoring report forms provided by the IEPA and shall consist of the following:

   a. The influent and effluent shall be sampled and analyzed for the one hundred and ten (110) organic priority pollutants. The sampling shall be done during a day when industrial discharges are expected to be occurring at normal to maximum levels.

      Samples for the analysis of acid and base/neutral extractable compounds shall be 24-hour composites.

      Five (5) grab samples shall be collected each monitoring day to be analyzed for volatile organic compounds. A single analysis for volatile pollutants (Method 624) may be run for each monitoring day by compositing equal volumes of each

grab sample directly in the GC purge and trap apparatus in the laboratory, with no less than one (1) mL of each grab included in the composite.

Wastewater samples must be handled, prepared, and analyzed by GC/MS in accordance with USEPA Methods 624 and 625 of 40 CFR 136 as amended.

b. The sludge shall be sampled and analyzed for the one hundred and ten (110) organic priority pollutants. A sludge sample shall be collected concurrent with a wastewater sample and taken as final sludge.

Sampling and analysis shall conform to USEPA Methods 624 and 625 unless an alternate method has been approved by IEPA.

c. Sample collection, preservation and storage shall conform to approved USEPA procedures and requirements.

3. In addition, the Permittee shall monitor any new toxic substances as defined by the Clean Water Act, as amended, following notification by the IEPA or U.S. EPA.

4. Permittee shall report any noncompliance with effluent or water quality standards in accordance with Standard Condition 12(f) of this Permit.

5. Analytical detection limits shall be in accordance with 40 CFR 136. Minimum detection limits for sludge analyses shall be in accordance with 40 CFR 503.

D. Pretreatment Reporting

US EPA Region 5 is the approval Authority for administering the pretreatment program in Illinois. All requests for modification of pretreatment program elements should be submitted in redline/strikeout electronic format and must be sent to US EPA at r5npdes@epa.gov.

Permittee shall upon notice from US EPA, modify any pretreatment program element found to be inconsistent with 40 CFR 403.

SPECIAL CONDITION 17. A zone of initial dilution (ZID) is recognized for copper, ammonia, and TRC with dimensions of 10.6 feet across the river from the outfall point and 17.7 feet downstream from this point. Within the ZID 9.4:1 dilution is afforded. A mixing zone is recognized for nickel and zinc with dimensions of 23.3 feet across the river from the outfall point and 188 feet downstream from this point. Within the mixing zone 68.3:1 dilution is afforded.

SPECIAL CONDITION 18. The Permittee shall, within 18 months of the effective date of this permit, prepare and submit to the Agency a feasibility study that identifies the method, timeframe, and costs of reducing phosphorus levels in its discharge to a level consistently meeting a potential future effluent limit of 1.0 mg/L, 0.5 mg/L and 0.1 mg/L. The study shall evaluate the construction and O & M costs of the application of these limits on a monthly, seasonal and annual average basis.

SPECIAL CONDITION 19: The Permittee shall develop and submit to the Agency a Phosphorus Discharge Optimization Plan within 18 months of the effective date of this permit. The plan shall include a schedule for the implementation of these optimization measures. Annual progress reports on the optimization of the existing treatment facilities shall be submitted to the Agency by March 31 of each year beginning 12 months from effective date of the permit. In developing the plan, the Permittee shall evaluate a range of measures for reducing phosphorus discharges from the treatment plant, including possible source reduction measures, operational improvements, and minor facility modifications that will optimize reductions in phosphorus discharges from the wastewater treatment facility. The Permittee's evaluation shall include, but not be limited to, an evaluation of the following optimization measures:

A. WWTF influent reduction measures.
   1. Evaluate the phosphorus reduction potential of users.
   2. Determine which sources have the greatest opportunity for reducing phosphorus (i.e., industrial, commercial, institutional, municipal and others).
      a. Determine whether known sources (i.e., restaurant and food preparation) can adopt phosphorus minimization and water conservation plans.
      b. Evaluate implementation of local limits on influent sources of excessive phosphorus.

B. WWTF effluent reduction measures.
   1. Reduce phosphorus discharges by optimizing existing treatment processes.
      a. Adjust the solids retention time for either nitrification, denitrification, or biological phosphorus removal.
      b. Adjust aeration rates to reduce dissolved oxygen and promote simultaneous nitrification-denitrification.
      c. Add baffles to existing units to improve microorganism conditions by creating divided anaerobic, anoxic, and aerobic zones.
      d. Change aeration settings in plug flow basins by turning off air or mixers at the inlet side of the basin system.
      e. Minimize impact on recycle streams by improving aeration within holding tanks.

f. Reconfigure flow through existing basins to enhance biological nutrient removal.
g. Increase volatile fatty acids for biological phosphorus removal.

SPECIAL CONDITION 20.

A. Subject to paragraph B below, an effluent limit of 0.5 mg/L Total Phosphorus 12 month rolling geometric mean (calculated monthly), (hereinafter "Limit"), shall be met by the Permittee by January 1, 2030, unless the Permittee demonstrates that meeting such Limit is not technologically or economically feasible in one of the following manners:
   1. the Limit is not technologically feasible through the use of biological phosphorus removal (BPR) process(es) at the treatment facility; or
   2. the Limit would result in substantial and widespread economic or social impact. Substantial and widespread economic impacts must be demonstrated using applicable USEPA guidance, including but not limited to any of the following documents:
      a. Interim Economic Guidance for Water Quality Standards, March 1995, EPA-823-95-002;
      b. Combined Sewer Overflows – Guidance for Financial Capability Assessment and Schedule Development, February 1997, EPA-832—97-004;
      c. Financial Capability Assessment Framework for Municipal Clean Water Act Requirements, November 24, 2014; and
      d. any additional USEPA guidance on affordability issues that revises, supplements or replaces those USEPA guidance documents; or
   3. the Limit can only be met by chemical addition for phosphorus removal at the treatment facility in addition to those processes currently contemplated; or
   4. the Limit is demonstrated not to be feasible by January 1, 2030, but is feasible within a longer timeline, then the Limit shall be met as soon as feasible and approved by the Agency; or
   5. the Limit is demonstrated not to be achievable by the Permittee, then an effluent limit that is achievable by the Permittee (along with associated timeline) must be met, except that the effluent limit shall not exceed 0.6 mg/L Total Phosphorus 12 month rolling geometric mean (calculated monthly).

B. The Limit shall be met by the Permittee by January 1, 2030, except in the following circumstances:
   1. If the Permittee develops a written plan, preliminary engineering report or facility plan no later than January 1, 2025, to rebuild or replace the secondary treatment process(es) of the treatment facility, the Limit shall be met by December 31, 2035; or
   2. If the Permittee decides to construct/operate biological nutrient removal (BNR) process(es), incorporating nitrogen reduction, the Limit shall be met by December 31, 2035; or
   3. If the Permittee decides to use chemical addition for phosphorus removal instead of BPR, the effluent limits of 0.5 mg/L Total Phosphorus 12 month rolling geometric mean (calculated monthly) and 1.0 mg/L Total Phosphorus monthly average shall be met by December 31, 2025; or
   4. If the Permittee has already installed chemical addition for phosphorus removal instead of BPR, and has a 1.0 mg/L Total Phosphorus monthly average effluent limit in its permit, or the Permittee is planning to install chemical addition with an IEPA construction permit that is issued on or before July 31, 2018, the 1.0 mg/L Total Phosphorus monthly average effluent limit (and associated compliance schedule) shall apply, and the Limit shall not be applicable.

C. The Permittee shall identify and provide adequate justification of any exception identified in paragraph A or circumstance identified in paragraph B, regarding meeting the Limit. The justification shall be submitted to the Agency at the time of renewal of this permit or by December 31, 2023, whichever date is first. Any justification or demonstration performed by the Permittee pursuant to paragraph A or circumstance pursuant to paragraph B must be reviewed and approved by the Agency. The Agency will renew or modify the NPDES permit as necessary. No date deadline modification or effluent limitation modification for any of the exceptions or circumstances specified in paragraphs A or B will be effective until it is included in a modified or reissued NPDES Permit.

D. For purposes of this permit, the following definitions are used:
   1. BPR (Biological Phosphorus Removal) is defined herein as treatment processes which do not require use of supplemental treatment processes at the treatment facilities before or after the biological system, such as but not limited to, chemical addition, carbon supplementation, fermentation, or filtration. The use of filtration or additional equipment to meet other effluent limits is not prohibited, but those processes will not be considered part of the BPR process for purposes of this permit; and
   2. BNR (Biological Nutrient Removal) is defined herein as treatment processes used for nitrogen and phosphorus removal from wastewater before it is discharged. BNR treatment processes, as defined herein, do not require use of supplemental treatment processes at the treatment facilities before or after the biological system, such as but not limited to, chemical addition, carbon supplementation, fermentation or filtration. The use of filtration or additional equipment to meet other effluent limits is not prohibited, but those processes will not be considered part of the BNR process for purposes of this permit.

E. The 0.5 mg/L Total Phosphorus 12 month rolling geometric mean (calculated monthly) limit applies to the effluent from the treatment plant.

F. The Agency may re-open and modify this permit if additional information becomes available to the Agency concerning any phosphorus related impairment or risk of eutrophication of the receiving stream which may be affected by the Permittee's effluent. A phosphorus related impairment means that the downstream waterbody or segment is listed by the Agency as impaired due to

dissolved oxygen and/or algae and/or aquatic plant growth problem that is related to excessive phosphorus levels. A waterbody or segment is at risk of eutrophication if the Agency, based on the available information, determines there is reasonable evidence that plant, algal or cyanobacterial growth is causing or will cause violation of a water quality standard. The permit modification will require the Permittee to develop, or be part of a watershed group that develops, and implement a Nutrient Assessment Reduction Plan (NARP). The NARP shall identify phosphorus input reductions and other measures necessary to remove relevant dissolved oxygen and offensive condition impairments or the risk of eutrophication. Additional specific NARP requirements will be included in any permit modification. Any permit modification will be public noticed and made available for public review and comment prior to issuance of any permit modification.

Attachment H

Standard Conditions

Definitions

Act means the Illinois Environmental Protection Act, 415 ILCS 5 as Amended.

Agency means the Illinois Environmental Protection Agency.

Board means the Illinois Pollution Control Board.

Clean Water Act (formerly referred to as the Federal Water Pollution Control Act) means Pub. L 92-500, as amended. 33 U.S.C. 1251 et seq.

NPDES (National Pollutant Discharge Elimination System) means the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under Sections 307, 402, 318 and 405 of the Clean Water Act.

USEPA means the United States Environmental Protection Agency.

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 measurements, the "daily discharge" is calculated as the average measurement of the pollutant over the day.

Maximum Daily Discharge Limitation (daily maximum) means the highest allowable daily discharge.

Average Monthly Discharge Limitation (30 day average) 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.

Average Weekly Discharge Limitation (7 day average) 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.

Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State. BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Aliquot means a sample of specified volume used to make up a total composite sample.

Grab Sample means an individual sample of at least 100 milliliters collected at a randomly-selected time over a period not exceeding 15 minutes.

24-Hour Composite Sample means a combination of at least 8 sample aliquots of at least 100 milliliters, collected at periodic intervals during the operating hours of a facility over a 24-hour period.

8-Hour Composite Sample means a combination of at least 3 sample aliquots of at least 100 milliliters, collected at periodic intervals during the operating hours of a facility over an 8-hour period.

Flow Proportional Composite Sample means a combination of sample aliquots of at least 100 milliliters collected at periodic intervals such that either the time interval between each aliquot or the volume of each aliquot is proportional to either the stream flow at the time of sampling or the total stream flow since the collection of the previous aliquot.

(1) **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, permit termination, revocation and reissuance, modification, or for denial of a permit renewal application. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirements.

(2) **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. If the permittee submits a proper application as required by the Agency no later than 180 days prior to the expiration date, this permit shall continue in full force and effect until the final Agency decision on the application has been made.

(3) **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.

(4) **Duty to mitigate.** The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

(5) **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 conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up, or auxiliary facilities, or similar systems only when necessary to achieve compliance with the conditions of the permit.

(6) **Permit actions.** This permit may be modified, revoked and reissued, or terminated for cause by the Agency pursuant to 40 CFR 122.62 and 40 CFR 122.63. 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.

(7) **Property rights.** This permit does not convey any property rights of any sort, or any exclusive privilege.

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

(9) **Inspection and entry.** The permittee shall allow an authorized representative of the Agency or USEPA (including an authorized contractor acting as a representative of the Agency or USEPA), upon the presentation of credentials and other documents as may be required by law, to:

(a) 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;
(b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
(c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
(d) 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.

(10) **Monitoring and records.**
(a) Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.
(b) 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 3 years from the date of this permit, measurement, report or application. Records related to the permittee's sewage sludge use and disposal activities shall be retained for a period of at least five years (or longer as required by 40 CFR Part 503). This period may be extended by request of the Agency or USEPA at any time.
(c) 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.
(d) Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit. Where no test procedure under 40 CFR Part 136 has been approved, the permittee must submit to the Agency a test method for approval. The permittee shall calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at intervals to ensure accuracy of measurements.

(11) **Signatory requirement.** All applications, reports or information submitted to the Agency shall be signed and certified.
(a) **Application.** All permit applications shall be signed as follows:
(1) For a corporation: by a principal executive officer of at least the level of vice president or a person or position having overall responsibility for environmental matters for the corporation:
(2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or
(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.
(b) **Reports.** All reports required by permits, or other information requested by the Agency shall be signed by a person described in paragraph (a) or by a duly authorized representative of that person. A person is a duly authorized representative only if:
(1) The authorization is made in writing by a person described in paragraph (a); and
(2) The authorization specifies either an individual or a position responsible for the overall operation of the facility, from which the discharge originates, such as a plant manager, superintendent or person of equivalent responsibility; and
(3) The written authorization is submitted to the Agency.
(c) **Changes of Authorization.** If an authorization under (b) 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 (b) must be submitted to the Agency prior to or together with any reports, information, or applications to be signed by an authorized representative.
(d) **Certification.** Any person signing a document under paragraph (a) or (b) of 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.

(12) **Reporting requirements.**
(a) **Planned changes.** The permittee shall give notice to the Agency as soon as possible of any planned physical alterations or additions to the permitted facility.
Notice is required when:
(1) The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source pursuant to 40 CFR 122.29 (b); or
(2) The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements pursuant to 40 CFR 122.42 (a)(1).
(3) The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan.
(b) **Anticipated noncompliance.** The permittee shall give advance notice to the Agency of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.
(c) **Transfers.** This permit is not transferable to any person except after notice to the Agency.
(d) **Compliance schedules.** Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.
(e) **Monitoring reports.** Monitoring results shall be reported at the intervals specified elsewhere in this permit.
(1) Monitoring results must be reported on a Discharge Monitoring Report (DMR).
(2) If the permittee monitors any pollutant more frequently than required by the permit, using test procedures approved under 40 CFR 136 or as specified in the permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.
(3) Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified by the Agency in the permit.

(f) **Twenty-four hour reporting.** The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24-hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and time; and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. The following shall be included as information which must be reported within 24-hours:

(1) Any unanticipated bypass which exceeds any effluent limitation in the permit.

(2) Any upset which exceeds any effluent limitation in the permit.

(3) Violation of a maximum daily discharge limitation for any of the pollutants listed by the Agency in the permit or any pollutant which may endanger health or the environment.

The Agency may waive the written report on a case-by-case basis if the oral report has been received within 24-hours.

(g) **Other noncompliance.** The permittee shall report all instances of noncompliance not reported under paragraphs (12) (d), (e), or (f), at the time monitoring reports are submitted. The reports shall contain the information listed in paragraph (12) (f).

(h) **Other information.** Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to the Agency, it shall promptly submit such facts or information.

(13) **Bypass.**

(a) Definitions.

(1) Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

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

(b) 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 (13)(c) and (13)(d).

(c) Notice.

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

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in paragraph (12)(f) (24-hour notice).

(d) Prohibition of bypass.

(1) Bypass is prohibited, and the Agency may take enforcement action against a permittee for bypass, unless:

(i) Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(ii) 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

(iii) The permittee submitted notices as required under paragraph (13)(c).

(2) The Agency may approve an anticipated bypass, after considering its adverse effects, if the Agency determines that it will meet the three conditions listed above in paragraph (13)(d)(1).

(14) **Upset.**

(a) Definition. 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.

(b) 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 (14)(c) 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.

(c) 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:

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

(2) The permitted facility was at the time being properly operated; and

(3) The permittee submitted notice of the upset as required in paragraph (12)(f)(2) (24-hour notice).

(4) The permittee complied with any remedial measures required under paragraph (4).

(d) Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

(15) **Transfer of permits.** Permits may be transferred by modification or automatic transfer as described below:

(a) Transfers by modification. Except as provided in paragraph (b), a permit may be transferred by the permittee to a new owner or operator only if the permit has been modified or revoked and reissued pursuant to 40 CFR 122.62 (b) (2), or a minor modification made pursuant to 40 CFR 122.63 (d), to identify the new permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

(b) Automatic transfers. As an alternative to transfers under paragraph (a), any NPDES permit may be automatically transferred to a new permittee if:
(1) The current permittee notifies the Agency 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 specified date for transfer of permit responsibility, coverage and liability between the existing and new permittees; and
(3) The Agency does not notify the existing permittee and the proposed new permittee of its 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.

(16) All manufacturing, commercial, mining, and silvicultural dischargers must notify the Agency as soon as they know or have reason to believe:
(a) That any activity has occurred or will occur which would result in the discharge of any toxic pollutant identified under Section 307 of the Clean Water Act which is not limited in the permit, if that discharge will exceed the highest of the following notification levels:
(1) One hundred micrograms per liter (100 ug/l);
(2) Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4,6 dinitrophenol; and one milligram per liter (1 mg/l) for antimony.
(3) Five (5) times the maximum concentration value reported for that pollutant in the NPDES permit application; or
(4) The level established by the Agency in this permit.
(b) That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the NPDES permit application.

(17) All Publicly Owned Treatment Works (POTWs) must provide adequate notice to the Agency of the following:
(a) Any new introduction of pollutants into that POTW from an indirect discharge which would be subject to Sections 301 or 306 of the Clean Water Act if it were directly discharging those pollutants; and
(b) Any substantial change in the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.
(c) For purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

(18) If the permit is issued to a publicly owned or publicly regulated treatment works, the permittee shall require any industrial user of such treatment works to comply with federal requirements concerning:
(a) User charges pursuant to Section 204 (b) of the Clean Water Act, and applicable regulations appearing in 40 CFR 35;
(b) Toxic pollutant effluent standards and pretreatment standards pursuant to Section 307 of the Clean Water Act; and
(c) Inspection, monitoring and entry pursuant to Section 308 of the Clean Water Act.

(19) If an applicable standard or limitation is promulgated under Section 301(b)(2)(C) and (D), 304(b)(2), or 307(a)(2) and that effluent standard or limitation is more stringent than any effluent limitation in the permit, or controls a pollutant not limited in the permit, the permit shall be promptly modified or revoked, and reissued to conform to that effluent standard or limitation.

(20) Any authorization to construct issued to the permittee pursuant to 35 Ill. Adm. Code 309.154 is hereby incorporated by reference as a condition of this permit.

(21) The permittee shall not make any false statement, representation or certification in any application, record, report, plan or other document submitted to the Agency or the USEPA, or required to be maintained under this permit.

(22) The Clean Water Act provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Clean Water Act is subject to a civil penalty not to exceed $25,000 per day of such violation. Any person who willfully or negligently violates permit conditions implementing Sections 301, 302, 306, 307, 308, 318 or 405 of the Clean Water Act is subject to a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than one year, or both.
Additional penalties for violating these sections of the Clean Water Act are identified in 40 CFR 122.41 (a)(2) and (3).

(23) The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than 2 years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than $20,000 per day of violation, or by imprisonment of not more than 4 years, or both.

(24) The Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

(25) Collected screening, slurries, sludges, and other solids shall be disposed of in such a manner as to prevent entry of those wastes (or runoff from the wastes) into waters of the State. The proper authorization for such disposal shall be obtained from the Agency and is incorporated as part hereof by reference.

(26) In case of conflict between these standard conditions and any other condition(s) included in this permit, the other condition(s) shall govern.

(27) The permittee shall comply with, in addition to the requirements of the permit, all applicable provisions of 35 Ill. Adm. Code, Subtitle C, Subtitle D, Subtitle E, and all applicable orders of the Board or any court with jurisdiction.

(28) The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit is held invalid, the remaining provisions of this permit shall continue in full force and effect.

APPENDIX B
OPCC

East Moline, Illinois
WWTP Phosphorus Feasibility Study
Alternative 1 - BPR to meet a 0.5 mg/L TP Annual Geometric Mean Effluent Limit

Discount Rate 2.500%

20 year total present worth

ITEM	Initial Capital Cost[1]	Future Capital Cost	Service Life	Replacement Cost (P.W.)	20 yr Salvage Value	Salvage Value (P.W.)
CPR FRP 6,000 Gallon Chemical Storage Tanks (1)	$ 80,000	$ -	20	$ -	$ -	$ -
CPR Chemical Metering Pumps (3)	$ 80,000	$ 116,000	15	$ 80,000	$ 53,333	$ 32,500
CPR Building (20'x20')	$ 400,000	$ -	40	$ -	$ 200,000	$ 122,100
In-situ Orthophosphate Monitoring Equipment	$ 50,000	$ 72,000	15	$ 50,000	$ 33,333	$ 20,300
Anaerobic Zone Baffle Wall and walkways	$ 270,000	$ -	40	$ -	$ 135,000	$ 82,400
Anaerobic Zone Mixers (4)	$ 260,000	$ -	20	$ -	$ -	$ -
Aeration Tank ML Splitter Structure	$ 580,000	$ -	40	$ -	$ 290,000	$ 177,000
Replace Aeration Equipment Diffusers	$ 300,000	$ -	20	$ -	$ -	$ -
Replace Existing Aeration Tank Sluice Gates (4)	$ 60,000	$ -	20	$ -	$ -	$ -
Aeration Tank wall repairs and leaks, walkway supports	$ 120,000	$ -	20	$ -	$ -	$ -
Aeration tank inlet channel opening modifications	$ 30,000	$ -	40	$ -	$ 15,000	$ 9,200
Aeration tank effluent channel modifications and effluent weirs	$ 80,000	$ -	40	$ -	$ 40,000	$ 24,400
Demolition aeration tank precast concrete bridges	$ 30,000	$ -	20	$ -	$ -	$ -
Aeration tank miscellaneous metals (grating, and railing)	$ 50,000	$ -	20	$ -	$ -	$ -
Two Final Clarifiers concrete, weirs, grating, railing (85' diameter, 15 foot sidewater depth, concrete drilled shaft deep foundations)	$ 3,050,000	$ -	40	$ -	$ 1,525,000	$ 930,700
Two Final Clarifiers Equipment (85' diameter)	$ 1,490,000	$ -	20	$ -	$ -	$ -
Clarifier excavation, and fill	$ 80,000	$ -	20	$ -	$ -	$ -
Aerobic digester demolition	$ 100,000	$ -	20	$ -	$ -	$ -
Aeration tank existing outlet box modifications	$ 60,000	$ -	40	$ -	$ 30,000	$ 18,300
Replacement Gates at existing outlet boxes	$ 50,000	$ -	20	$ -	$ -	$ -
Gravity thickener equipment replacement, cover, ordor control	$ 600,000	$ -	20	$ -	$ -	$ -
RAS Pumps (3)	$ 310,000	$ -	20	$ -	$ -	$ -
Relocation of dissolved air floatation pumps	$ 50,000	$ -	20	$ -	$ -	$ -
Subtotal	$ 8,180,000					
Sitework (5%)	$ 410,000					
Mechanical Piping and HVAC (25%)	$ 2,050,000					
Electrical and Controls (30%)	$ 2,450,000					
Subtotal	$ 13,090,000					
Contractors General Conditions @ 15%	$ 1,960,000					
Construction Costs	$ 15,050,000					
Contingencies and Technical Services @ 40%	$ 6,020,000					
Total Capital Costs	$ 21,070,000			$ 130,000	$ 2,321,667	$ 1,416,900

Estimated Annual O&M Costs Years 1 Through 10	
Relative Labor ($40/hr)	$ 9,000
Maintenance (~2% of Equipment)	$ 44,000
Power ($0.11/kWH)	$ 6,000
Additional Biosolids Disposal ($17/cubic yard)	$ 2,000
Total Years 1 Through 10 Annual O&M Costs	$ 61,000

Estimated Annual O&M Costs Years 11 Through 20	
Chemical Use-Alum ($1.68/gal)[2]	$ 20,000
Relative Labor ($40/hr)	$ 9,000
Maintenance (~2% of Equipment)	$ 44,000
Power ($0.11/kWH)	$ 6,000
Additional Biosolids Disposal ($17/cubic yard)	$ 2,000
Total Years 11 Through 20 Annual O&M Costs	$ 81,000
Present Worth of O&M Years 1 through 10[3]	$ 534,000
Present Worth of O&M Years 11 through 20[3]	$ 554,000
Total Present Worth of O&M Cost	$ 1,088,000

Summary of Present Worth Costs	
Capital Cost	$ 21,070,000
Replacement	$ 130,000
O&M Cost	$ 1,088,000
Salvage Value	$ (1,416,900)
TOTAL PRESENT WORTH	**$ 20,871,000**

1. Geotechnical considerations must be further evaluated. Depth to bedrock could impact the cost opinions.

2. Chemical use assumest dosing up to approximately 40 gallons per day for polishing, back-up, and struvite control based on effluent TSS less than 7 mg/L.

3. BPR alternative has the TP limit in effect 10 years later than the CPR alternative (December 31, 2035 vs. December 31, 2025). Chemical costs are included for the years when the limit is in effect.

East Moline, Illinois
WWTP Phosphorus Feasibility Study
Alternative 2 - CPR to meet a 0.5 mg/L TP Annual Geometric Mean Effluent Limit

Discount Rate 2.500%

20 year total present worth

ITEM	Initial Capital Cost[1]	Future Capital Cost	Service Life	Replacement Cost (P.W.)	20 yr Salvage Value	Salvage Value (P.W.)
CPR FRP 6,000 Gallon Chemical Storage Tanks (2)	$ 160,000	$ -	20	$ -	$ -	$ -
CPR Chemical Metering Pumps (3)	$ 80,000	$ 116,000	15	$ 80,000	$ 53,333	$ 32,500
CPR Building (40'x20')	$ 680,000	$ -	40	$ -	$ 340,000	$ 207,500
In-situ Orthophosphate Monitoring Equipment	$ 50,000	$ 72,000	15	$ 50,000	$ 33,333	$ 20,300
Aeration Tank ML Splitter Structure	$ 580,000	$ -	40	$ -	$ 290,000	$ 177,000
Replace Aeration Equipment Diffusers	$ 330,000	$ -	20	$ -	$ -	$ -
Replace Existing Aeration Tank Sluice Gates (4)	$ 60,000	$ -	20	$ -	$ -	$ -
Aeration tank wall repairs and leaks, walkway supports	$ 120,000	$ -	20	$ -	$ -	$ -
Aeration tank inlet channel opening modifications	$ 30,000	$ -	40	$ -	$ 15,000	$ 9,200
Aeration tank effluent channel modifications and effluent weirs	$ 80,000	$ -	40	$ -	$ 40,000	$ 24,400
Demolition aeration tank precast concrete bridges	$ 30,000	$ -	20	$ -	$ -	$ -
Aeration tank miscellaneous metals (grating, and railing)	$ 50,000	$ -	20	$ -	$ -	$ -
Two Final Clarifiers Concrete, weirs, grating, railing (85' diameter, 15 foot sidewater depth, concrete drilled shaft deep foundations)	$ 3,050,000	$ -	40	$ -	$ 1,525,000	$ 930,700
Two Final Clarifiers Equipment (85' diameter)	$ 1,490,000	$ -	20	$ -	$ -	$ -
Clarifier excavation, and fill	$ 50,000	$ -	20	$ -	$ -	$ -
Aerobic digester demolition	$ 100,000	$ -	20	$ -	$ -	$ -
Aeration tank existing outlet box modifications	$ 60,000	$ -	40	$ -	$ 30,000	$ 18,300
Replacement Gates at existing outlet boxes	$ 50,000	$ -	20	$ -	$ -	$ -
RAS Pumps (3)	$ 310,000	$ -	20	$ -	$ -	$ -
Relocation of dissolved air floatation pumps	$ 50,000	$ -	20	$ -	$ -	$ -
Subtotal	$ 7,410,000					
Sitework (5%)	$ 370,000					
Mechanical and HVAC[2]	$ 2,050,000					
Electrical and Controls (30%)	$ 2,220,000					
Subtotal	$ 12,050,000					
Contractors General Conditions @ 15%	$ 1,810,000					
Construction Costs	$ 13,860,000					
Contingencies and Technical Services @ 40%	$ 5,540,000					
Total Capital Costs	$ 19,400,000			$ 130,000	$ 2,326,667	$ 1,419,900

Estimated Annual O&M Costs

Relative Labor ($40/hr)	$ 9,000
Maintenance (~2% of Equipment)	$ 39,000
Power ($0.11/kWH)	$ 2,000
Chemical Use-Alum ($1.68/gal)[3]	$ 150,000
Additional Biosolids Disposal ($17/cubic yard)[4]	$ 23,000
Total Annual O&M Costs	$ 223,000
Present Worth of O&M	$ 3,476,000

Summary of Present Worth Costs

Capital Cost	$ 19,400,000
Replacement	$ 130,000
O&M Cost	$ 3,476,000
Salvage Value	$ (1,419,900)
TOTAL PRESENT WORTH	**$ 21,586,000**

1. Geotechnical considerations must be further evaluated. Depth to bedrock could impact the cost opinions.
2. The BPR alternative costs for mechanical and HVAC is used for the CPR alternative because both alternative have the same piping components.
3. Chemical use assumes dose of 250 gal/day based on an average flow of 4.7 MGD
4. Additional biosolids disposal costs based on approximately 10 CY sludge per day