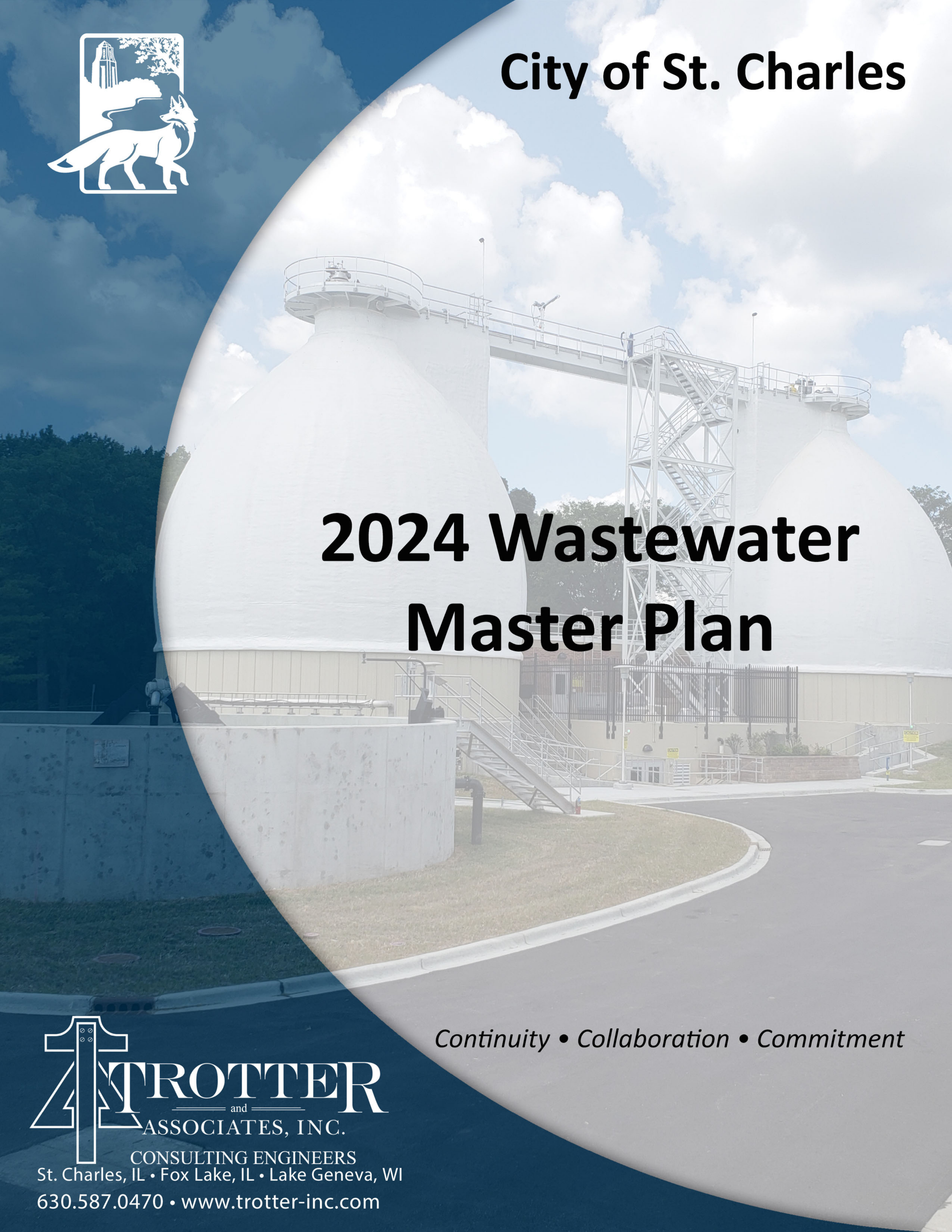

City of St. Charles

2024 Wastewater Master Plan

Continuity • Collaboration • Commitment

TROTTER and ASSOCIATES, INC.
CONSULTING ENGINEERS
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EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

INTRODUCTION AND BACKGROUND

The City of St. Charles is located along the Fox River in central Kane County approximately 35 miles west of downtown Chicago. The City is bordered by the Village of South Elgin to the north, the City of West Chicago to the east, the City of Geneva to the south and the Village of Campton Hills to the west. The St. Charles Service Area is comprised of approximately 10,340 acres. The City of St. Charles is served by two wastewater treatment facilities, the Main Wastewater Treatment Facility (MWWTF) and the West Side Water Reclamation Facility (WSWRF).

The purpose of this study is two-fold and will include a comprehensive Facility Master Plan. The intent of the report is to identify process upgrades and rehabilitation projects which should be incorporated into the City's five-year Capital Improvements Program, as well as address long-range needs of the community.

A Facility Plan Report (FPR) is a management and planning document used to identify, evaluate, and plan required wastewater facility improvements. It provides an assessment of the collection and treatment systems' abilities to meet both current and future loads, flows and regulatory requirements and provides critical information for improvements to correct current or projected deficiencies. FPRs are required by the Illinois Environmental Protection Agency (IEPA) for any wastewater improvements that change the treatment process or expand the capacity of the wastewater treatment plant. FPRs are typically updated every five to ten years, or when significant changes in growth or regulatory requirements have occurred or are expected. The City previously utilized separate FPRs for each Service Area; Main and West.

Main Service Area

The Main WWTF plant has a design average treatment capacity of 9.0 million gallons per day (MGD). The facility generally serves the community's wastewater needs east of Randall Road and discharges to the Fox River. The collection system tributary to the Main Wastewater Treatment Facility (Main WWTF) consists of approximately 162 miles of sanitary sewers, 6 miles of force main, and 16 lift stations. The Main WWTF is located at the Public Works Facility, 1405 S. 7th Avenue on the eastern shore of the Fox River, approximately nine-tenths of a mile south of the Illinois Route 64 Bridge. 8,317 acres of the St. Charles Service Area is tributary to the Main WWTF.

The City's National Pollutant Discharge Elimination System (NPDES) Permit for the Main WWTF (Permit No. IL0022705), as administered by the Illinois Environmental Protection Agency (IEPA), is currently pending a final draft issuance. The expired NPDES permit is included as Appendix A.

In 2002, the City updated its FPR which identified the need for nitrification capabilities. The 2002 Facility Plan Update was approved by the Illinois EPA in January of 2003 and construction of the MWWTF 2002 Nitrification Improvements project began in November of 2003. The 2002 Nitrification Improvements project scope included the construction of 2.5 million gallons of aeration capacity and blower building, rehabilitation of the existing aeration basins, expansion of the RAS/WAS pump station, conversion of the existing first flush holding tank to an excess flow clarifier and the construction of an ultraviolet disinfection system. The project was completed in July of 2005. In 2009, the City updated its FPR which identified the need for improved sludge handling infrastructure. The City elected to address this need with the 2012 Main and Sludge Handling Building Improvements, which was completed in the fall of 2014. In 2015, the City updated its FPR which identified the need for phosphorus removal and anaerobic digestion rehabilitation.

West Side Service Area

The West Side WRF has a design average treatment capacity of 1.05 MGD. The facility generally serves the community's wastewater needs west of Randall Road and discharges to Mill Creek. The collection system tributary to the West Side Water Reclamation Facility consists of approximately 16.3 miles of sanitary sewers, 1.2 miles of force main and 3 lift stations. The West Side Water Reclamation Facility (West Side WRF) is located at 3803 Illinois Route 38. 2,023 acres of the St. Charles Service Area is tributary to the West Side WRF.

The City's National Pollutant Discharge Elimination System (NPDES) Permit for the West Side WRF (Permit No. IL0026808), as administered by the Illinois Environmental Protection Agency (IEPA), was last issued on August 18, 2023 and expires on August 31, 2028. The NPDES permit is included as Appendix B.

In 1998, the City updated its FPR which outlined a phased approach for expansion of the treatment facility in three 0.35 MGD increments. The Illinois EPA approved Phases II and III as recommended within the FPR which would increase the treatment facility's capacity from 0.35 MGD to 1.05 MGD. The IEPA issued an NPDES Permit consistent with the recommendations allowing for the Phase II expansion to 0.70 MGD and Phase III expansion to 1.05 MGD. The Phase II Expansion was completed in 2001 and funded through the Illinois EPA Wastewater Loan Program. The City also completed a Facility Plan in 2019. It was determined based on future development and committed capacity in the West Side Service Area that the City needed to proceed with design of the Phase III Improvements. After the Facility Plan was approved, the project was designed, and construction was completed in 2022. This project was also funded through the Illinois EPA Wastewater Loan Program.

The purposes of this Master Plan are to:

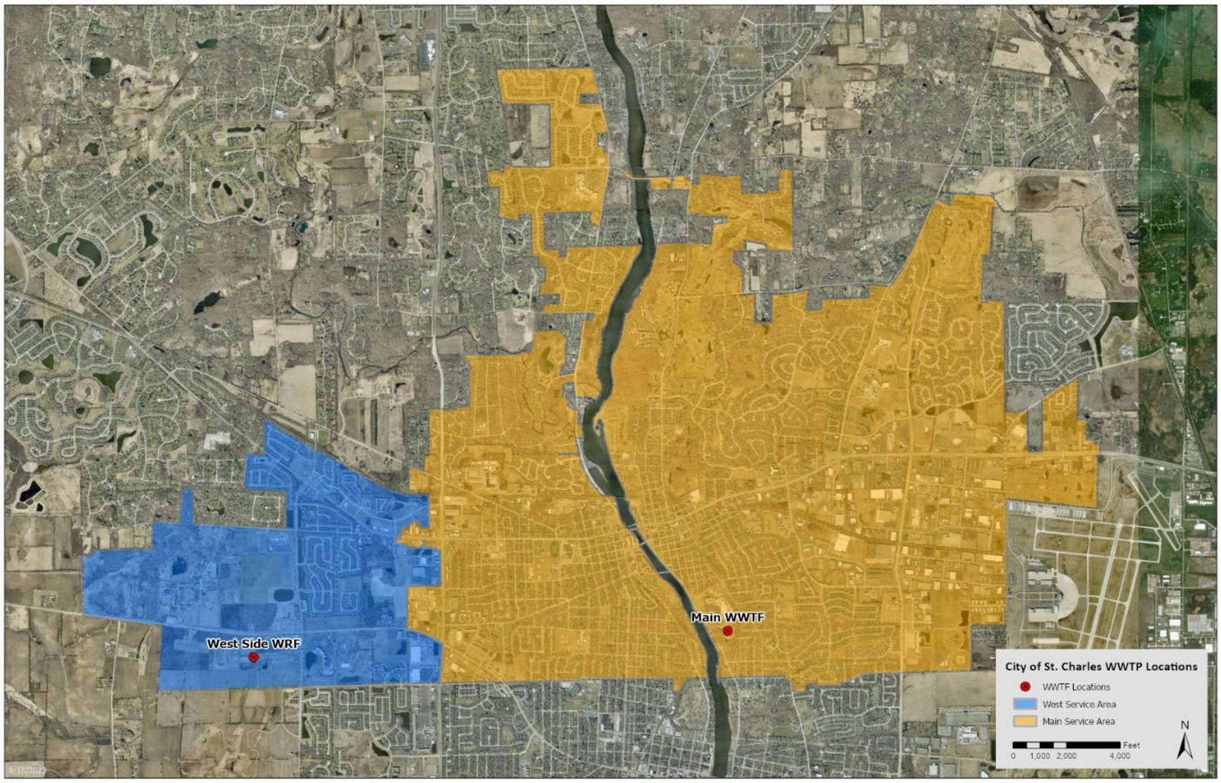
- Evaluate the adequacy of the existing collection and treatment facilities under the current flows, loads and regulatory requirements;
- Review the maintenance history and current condition of wastewater treatment units and lift stations and identify requirement maintenance repairs/replacements;
- Estimate the additional flows and loads associated with future growth within the planning area during the 20-year planning period;
- Summarize pending and potential future environmental regulations related to wastewater conveyance and treatment;
- Determine the impacts of future flows, loads and regulatory requirements on the existing system;
- Identify and evaluate alternatives to address both current and future deficiencies;
- Recommend cost effective alternatives; and
- Present costs, user fee analysis, implementation plans, cash flow projections and environmental impacts of the recommended alternatives.

The Community's Needs

Wastewater treatment capacity is usually rated either in Millions of Gallons per Day (MGD), or Population Equivalents (PE). In order to estimate the industrial and commercial contributions to the wastewater load, we reviewed water usage records, the City's Comprehensive Land Use Plan, and the City's collection system maps. We also met with members of the City's Environmental Services, Utilities Billing, and Planning Divisions to arrive at a consensus for current, future and build-out population projections.

The City of St. Charles has grown from a community of 17,492 in 1980 to 27,910 people in 2001 to 32,974 people in 2010, to 33,078 people in 2020, of which most (31,522 PE) live in the Main WWTF's service area. The estimated future development has been provided by the City and has been incorporated into the future population projections.

Exhibit 1: City of St. Charles Service Areas



Main Service Area

During 2022, the City of St. Charles Main Service Area had a metered water usage of 3.06 MGD, while the Main wastewater treatment facility (WWTF) received an average flow of 4.59 MGD. The current population equivalents were estimated by breaking down the water meter data by classifications:

Table 1: Main Service Area Current Population, Water Demands and Wastewater Flows (2022)

	Residential	Non-Residential	Total
Number of Customers	9,980	1,166	11,146
Population Equivalents	29,848	19,168	49,016
Water Usage Billed (MGD)	1.87	1.19	3.06
Water Usage / PE (GCD)	62.1	62.1	62.1
Wastewater Received (MGD)	2.80	1.79	4.59
Wastewater / PE (GCD)	93.64	93.64	93.64

The future population projection, which is the ultimate buildout of properties within the FPA, was developed by assigning PE values to the planned development and remaining open lands in accordance with the Land Use Plan.

Future Population Equivalent

Total Current PE	49,016	PE
Additional PE at Build-Out of Service Area	15,021	PE
Total Future PE	64,037	PE

It should be noted that population equivalent resulting from the ultimate buildout will not exceed the present IEPA rated population equivalent of the Main WWTF which is 90,000 PE. Taking into consideration ongoing development, governmental capacity commitments, and potential annexations, the population equivalent of the service area will eventually be increased by 15,021 PE from the 2023 total. This equates to a build-out projection of 64,037 PE at an average daily flow (ADDF) of 6,092,000 gal/day or 6.09 MGD.

Table 2: Main Service Area Projected Population and Wastewater Flow

Description	2023 Conditions		Constructed		Future Development		Buildout	
	PE	ADDF (MGD)	PE	ADDF (MGD)	PE	ADDF (MGD)	PE	ADDF (MGD)
Eastern 1	3,854	0.36	3,854	0.36	3,879	0.36	3,879	0.36
Eastern 2	4,495	0.42	7,359	0.71	12,569	1.23	13,254	1.30
Eastern 3	9,679	0.91	10,216	0.96	10,428	0.98	10,428	0.98
North Central	1,675	0.16	1,675	0.16	1,675	0.16	1,675	0.16
Northern	3,716	0.35	3,716	0.35	3,716	0.35	3,716	0.35
SC02	3,901	0.37	5,105	0.49	6,397	0.61	6,397	0.61
SC05_R3 and SC05_T1	3,133	0.29	3,133	0.29	3,133	0.29	3,441	0.32
SC05_T2 and SC05_C1	2,692	0.25	2,692	0.25	3,190	0.30	3,190	0.30
Second Place	1,858	0.17	1,858	0.17	1,858	0.17	1,858	0.17
Southeast Central 2	3,824	0.36	3,824	0.36	3,852	0.36	3,852	0.36
Southeast Central and Main	3,738	0.35	3,752	0.35	4,630	0.44	4,630	0.44
WOR East	4,032	0.38	4,576	0.43	5,190	0.49	5,190	0.49
WOR West	2,418	0.23	2,486	0.23	2,526	0.24	2,526	0.24
Total	**49,016**	**4.590**	**54,247**	**5.113**	**63,044**	**5.993**	**64,037**	**6.092**
Peaking Factor		**2.27**		**2.23**		**2.17**		**2.17**
Peak Hourly Flow (MGD)		**10.43**		**11.41**		**13.02**		**13.20**

Table 3: Main Service Area Commitments and Remaining Capacity

Description	Wastewater Committed (MGD)
Annual Average Wastewater Flow	4.590
Expected Avg. Flow with Constructed Development	5.113
Expected Avg. Flow with Future Development	5.993
Expected Avg. Flow at Buildout	6.092

The current Main WWTF has a capacity of 9,000,000 gallons per day (9.0 MGD). The updated 2022 wastewater projections for this service area are 4.59 MGD metered flow. The Illinois EPA places a facility under critical review when the average daily flow reaches 80% of the rated capacity. This occurs when flows reach 7.2 MGD at the Main WWTF. Based on the the build-out conditions of the plant to be 6.09 MGD, it is unlikely future development will exceed the capacity of the Main WWTF.

West Side Service Area

During 2022, the City of St. Charles West Side Service Area had a metered water usage of 0.33 MGD, while the West Side Water Reclamation Facility (WSWRF) received an average flow of 0.46 MGD. The 2022 PE based on water users, and accounting for water from the Illinois Youth Center (IYC), Kane County Judicial Center (KCJC), and the IDOT Facility on the corner of IL Route 38 and Peck Road is 7,351 (3,717 residential + 3,634 non-residential). Using this information, the wastewater received equates to 62.2 gcd.

Table 4: West Side Service Area Current Population, Water Demands and Wastewater Flows (2022)

	Residential	Non-Residential	Total
Population Equivalents (PE)	3,717	3,634	7,351
Wastewater Received (MGD)	0.23	0.23	0.46
Wastewater/PE	62.2	62.2	62.2

The future population projection, which is the ultimate buildout of properties within the West Side Service Area, was developed by assigning PE values to the planned development and remaining open lands in accordance with the Land Use Plan.

West Side Service Area Future Population Equivalent

Total 2022 PE	7,351	PE
Additional PE at Build-Out of Service Area	8,165	PE
Total Future PE	**15,516**	**PE**

Taking into consideration constructed and future development the population equivalent of the service area will eventually be increased to 11,403 PE. This equates to a build-out projection of 15,516 PE at an average daily flow (ADDF) of 1,270,000 gal/day or 1.27 MGD.

Table 5: West Side WRF Service Area Projected Population and Wastewater Flows

Description	2023 Conditions		Constructed		Future Development		Buildout	
	PE	ADDF (MGD)	PE	ADDF (MGD)	PE	ADDF (MGD)	PE	ADDF (MGD)
Renaux Manor Subbasin	2,372	0.15	2,703	0.18	2,733	0.18	4,649	0.38
Pine Ridge Subbasin	174	0.01	296	0.02	446	0.04	446	0.04
Zylstra Subbasin	357	0.02	466	0.03	511	0.04	511	0.04
Gravity Subbasin	4,447	0.28	5,261	0.36	7,712	0.60	9,859	0.82
Gravity WWTF Tributary Basin Total	**7,351**	**0.457**	**8,727**	**0.60**	**11,403**	**0.86**	**15,466**	**1.27**
Peaking Factor		3.09		3.01		2.90		2.76
Peak Hourly Flow (MGD)		1.41		1.79		2.50		3.51

Table 6: West Side WRF Commitments and Remaining Capacity

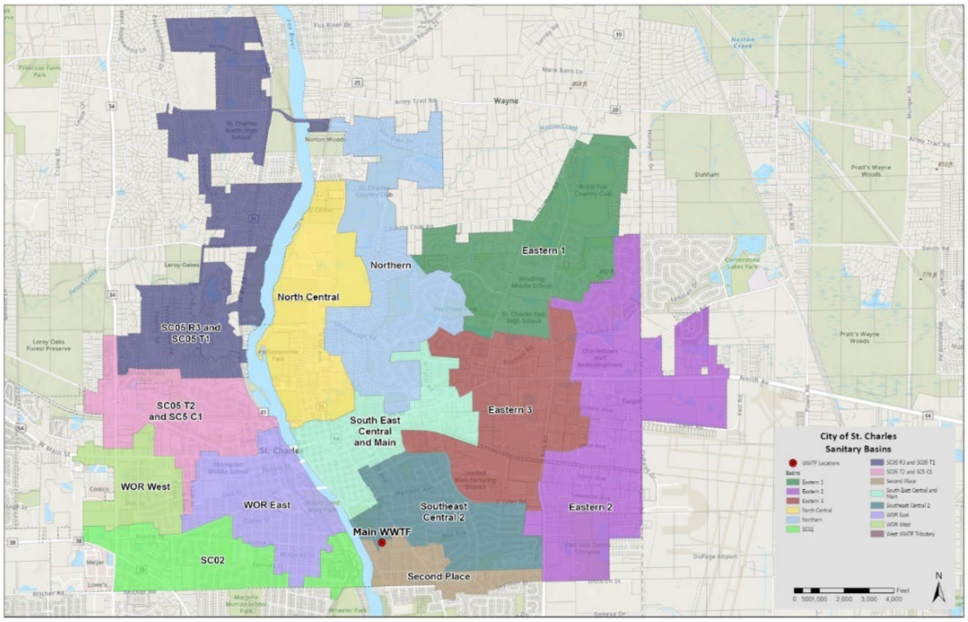
Description	Wastewater Committed (MGD)
2018-2022 Flow Average [(1)]	**0.540**
Expected Avg. Flow with Constructed Development	**0.678**
Expected Avg. Flow with Future Development	**0.945**
Expected Avg. Flow at Buildout	**1.351**
[(1)] = 5-year Flow Average utilized for flows projections due to 2022 being a drought year.	

The current West Side WRF has a capacity of 1,050,000 gallons per day (1.05 MGD). The average 2018-2022 wastewater flows for this service area are 0.54 MGD metered flow. The Illinois EPA places a facility under critical review when the average daily flow reaches 80% of the rated capacity. This occurs when flows reach 0.84 MGD at the West Side WRF. Based on the current flows and constructed development of 0.68 MGD and the build-out conditions of the plant to be 1.35 MGD, the West Side WRF's capacity must be addressed to accommodate existing and future development.

COLLECTION SYSTEM

The City of St. Charles wastewater collection system includes two service areas generally divided by Randall Road. The sanitary sewer system east of Randall Road is tributary to the Main WWTF. The sewers within this collection system are of varying age and condition. As with many older collection systems, infiltration and inflow is a concern.

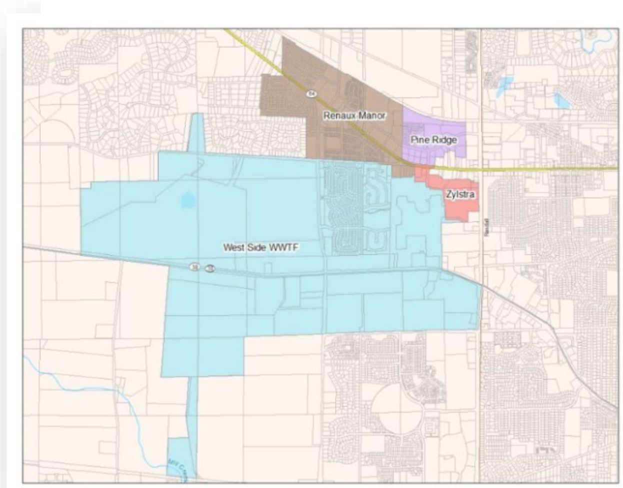
Exhibit 2: Main WWTF Service Area Drainage Basins



The City of St. Charles has developed a rigorous maintenance program including flow monitoring, root cutting, grouting, sewer lining and other rehabilitation and replacement of the collection system. The City's goal is to eliminate basement back-ups and SSO's. $500,000 is budgeted annually for sanitary sewer lining. The City completes sanitary sewer lining in zones that need to be rehabilitated.

The sanitary sewers west of Randall Road are tributary to the West Side Water Reclamation Facility (WRF). This service area is relatively new and the sewers have been constructed with modern materials, which minimize infiltration and inflow. The majority of the existing sanitary sewers within the West Side WRF's collection system are less than twenty years old.

Exhibit 3: West Side WRF Service Area Drainage Basins

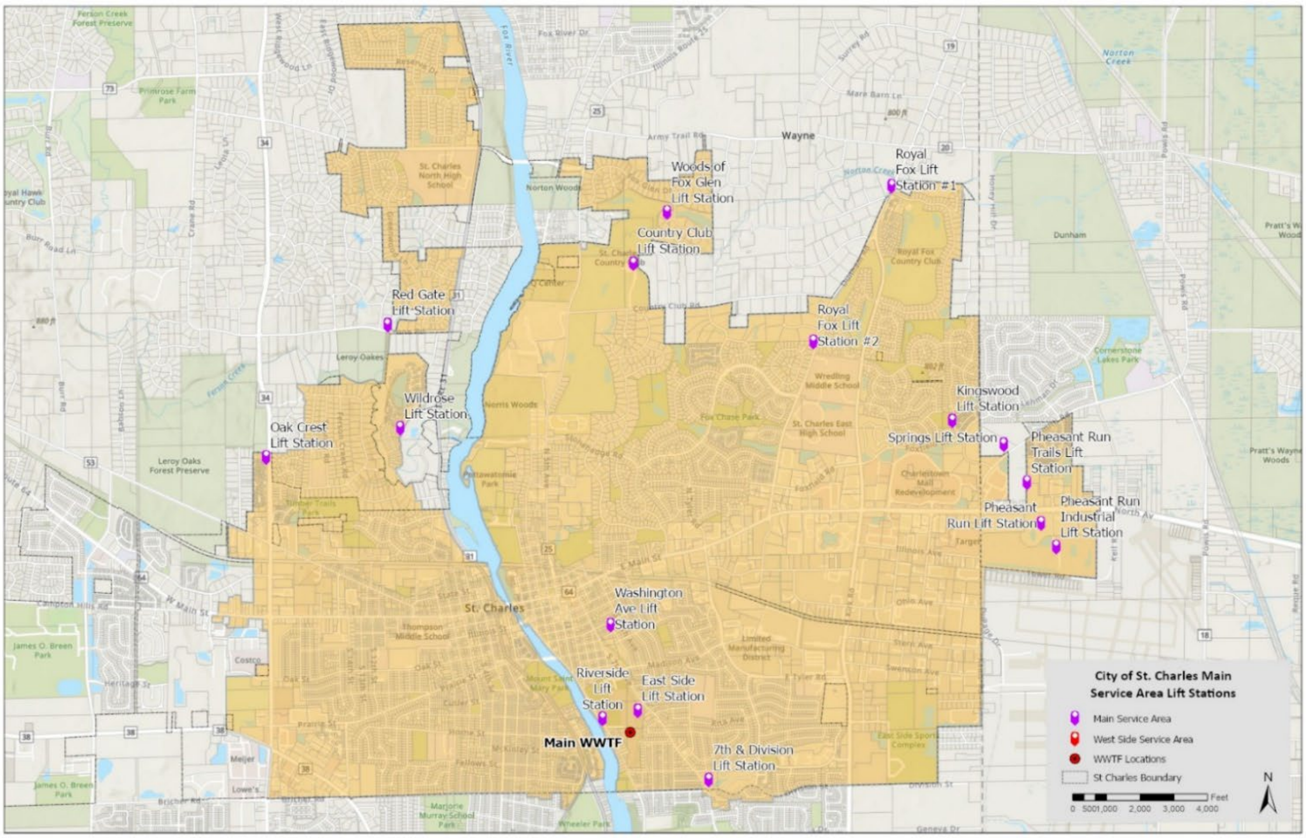


LIFT STATIONS

Main Service Area

The City of St. Charles' Service Area includes sixteen lift stations. The City of St. Charles' Main Service Area includes sixteen lift stations, two of which are directly tributary to the headworks at the Main WWTF.

Exhibit 4: Main Service Area Lift Station Locations



The lift stations vary in age and condition, however, most were constructed between 1987 and 1997 as the City developed further north and east. The two main lift stations are Riverside Lift Station and East Side Lift Station. Additionally, the City will be taking ownership of three new lift stations: Pheasant Run, Pheasant Run Industrial, and Springs. These lift stations are in good shape since they were recently built. They will be tributary to the collection system upstream of the East Side Lift Station. City staff have assisted in the development of this Section of the Facility Plan Update and provided input with respect to improvements needed at each station.

Table 7: Main Service Area Lift Station Asset Value (2023$)

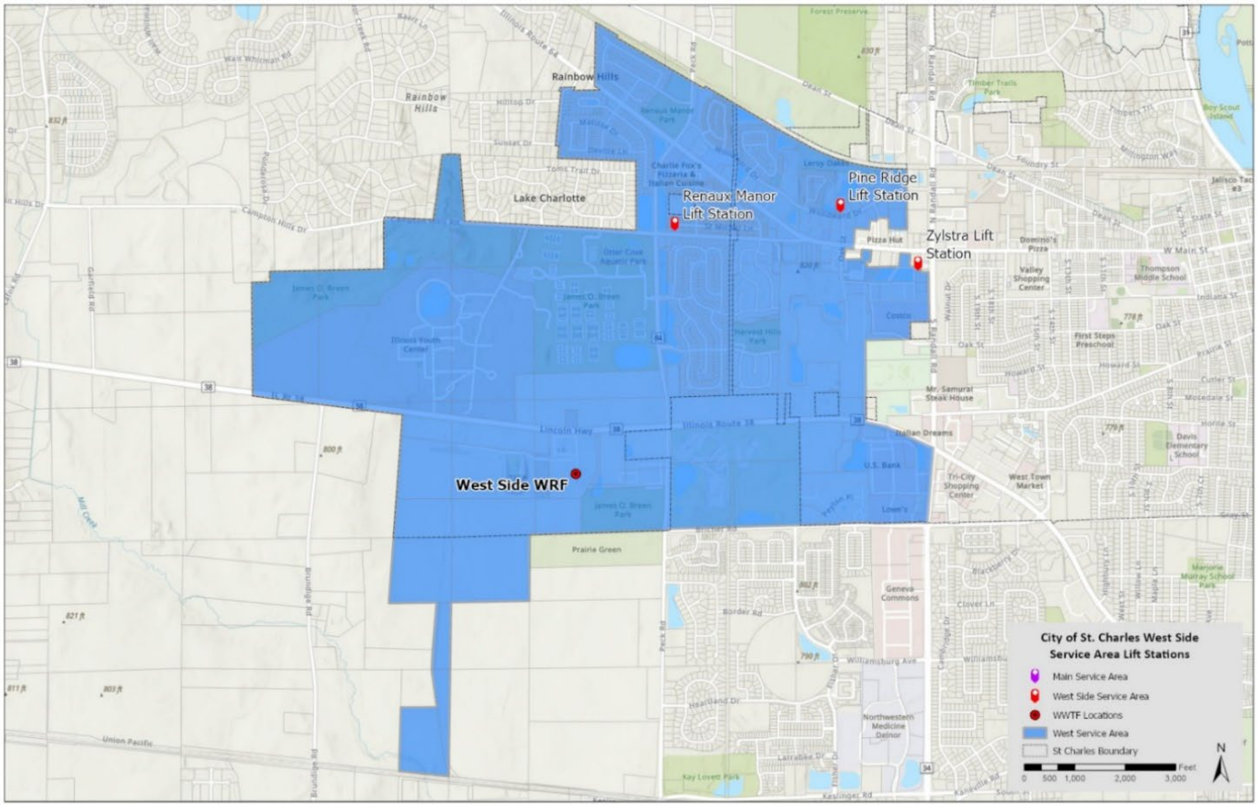
Lift Station	Equipment	Structure	Force Main	Totals
Pheasant Run	$280,000	$280,000	$120,000	$680,000
Pheasant Run Industrial	$350,000	$345,000	$90,000	$780,000
Springs	$380,000	$380,000	$60,000	$820,000
Riverside	$4,350,000	$6,840,000	$2,030,000	$13,220,000
East Side	$1,640,000	$2,380,000	$160,000	$4,180,000
7th & Division	$320,000	$230,000	$180,000	$730,000
Washington Ave.	$80,000	$80,000	$120,000	$280,000
Country Club	$320,000	$250,000	$210,000	$780,000
Pheasant Run Trails	$340,000	$300,000	$470,000	$1,110,000
Royal Fox #2	$350,000	$300,000	$790,000	$1,440,000
Royal Fox #1	$340,000	$270,000	$570,000	$1,180,000
Woods of Fox Glen	$340,000	$300,000	$900,000	$1,540,000
Kingswood	$340,000	$300,000	$320,000	$960,000
Wild Rose	$320,000	$260,000	$30,000	$610,000
Red Gate	$340,000	$300,000	$500,000	$1,140,000
Oak Crest	$320,000	$250,000	$120,000	$690,000
Totals	$10,410,000	$13,065,000	$6,670,000	$30,140,000
Design Life, Years	20	50	50	
Annual Replacement	$520,500	$261,300	$133,400	**$915,200**

It should be noted that the above figures do not include the engineering and contingencies that would be involved in a rehabilitation or replacement project. The value of the City's lift station and force main assets is approximately $30,140,000 for the Main Service Area. Based on a straight-line depreciation over the design life of the equipment, structures and force mains, the City should be reinvesting around $915,200 annually toward maintaining and replacing these assets within the Main Service Area.

West Side Service Area

The City of St. Charles operates and maintains three lift stations within the West Side Service Area. These installations are reasonably new and have been constructed as the City has grown over the past 20 years.

Exhibit 5: West Side Service Area Lift Station Locations



The lift stations in the West Service Area vary in age and capacity but were all constructed after 1998 as the City developed further west. The City's staff has assisted in the development of this portion of the Facility Plan Update and has provided input with respect to improvements needed at each station.

Table 8: West Side Service Area Lift Station Asset Value (2023$)

Lift Station	Equipment	Structure	Force Main	Totals
Pine Ridge	$360,000	$320,000	$190,000	$870,000
Renaux Manor	$410,000	$360,000	$630,000	$1,400,000
Zylstra	$360,000	$320,000	$670,000	$1,350,000
Totals	$1,130,000	$1,000,000	$1,490,000	$3,620,000
Design Life, Years	20	50	50	
Annual Replacement	$56,500	$20,000	$29,800	**$106,300**

It should be noted that the above figures do not include the engineering and contingencies that would be involved in a rehabilitation or replacement project. The value of the City's lift station and force main assets in the West Side Service Area is approximately $3,620,000. Based on a straight-line depreciation over the design life of the equipment, structures and force mains, the City should be reinvesting around $106,300 annually toward maintaining and replacing these assets within the West Side Service Area.

Operational staff has indicated that most of the recommended improvements for lift stations of both service areas could be accomplished utilizing in-house resources. The more significant improvements have been broken into capital projects and recommended budgets have been provided. These projects should be incorporated into the City's Capital Improvements Program, and assumes the project will be funded with a low-interest loan from the IEPA.

Table 9: Lift Station Capital Improvements Summary

EAST SIDE LIFT STATION REHABILITATION	**$1,100,000**
TOTAL LIFT STATION CAPITAL IMPROVEMENTS	**$1,100,000**

EXISTING TREATMENT FACILITIES

Main Service Area

The City of St. Charles original wastewater treatment facility was located along the banks of the Fox River near the Riverside Lift Station. In the early 1930's, a new plant was constructed up the hill on what is now the wastewater treatment facility site. Since its construction, the facility has been upgraded numerous times. The City has traditionally performed rehabilitation and replacement of aging equipment through the operation and maintenance budget, and has performed major process upgrades through the Illinois State Revolving Fund program (SRF).

The 2002 Nitrification Improvements included the construction of a single stage nitrification process to meet the new ammonia nitrogen limits, excess flow improvements consisting of the conversion of the existing first flush holding tank to an excess flow clarifier, and construction of an ultra violet disinfection system for use with the normal process flow (to allow the chlorine contact tanks to be used for excess flow only). This project was funded through the Illinois SRF.

In 2009, the City of St. Charles upgraded the East Side Lift Station and Riverside Lift Station. The improvements to the East Side Lift Station included replacement of all mechanical and electrical components including the fine screen, pumps, piping and controls. The rehabilitation to Riverside Lift Station was limited to screen, valve and variable frequency drive replacement. This project was funded through the Illinois SRF.

In late 2011, an assessment of the Main WWTF processes and infrastructure was completed. This assessment identified the need to structurally rehabilitate or replace the Main Sludge Handling Building. The City of St. Charles proceeded with replacement. The project was funded through the Illinois SRF, and construction was completed in 2014.

In 2019, the City completed the 2017 Phosphorus Removal and Digester Improvements project. The project included conversion of the existing nitrification basins to an A2O biological process, and rehabilitation of the anaerobic digesters. The biological process improvements included construction of a new Primary Sludge Fermenter, an Internal Recycle Pump Station, and a new Process Control Building with a Chemical Phosphorus Removal System for chemical polishing.

The City has completed an audit of each unit process, its capacity, age, and condition and developed a series of recommended improvements.

Table 10: Main WWTF Capital Improvements

PRIMARY CLARIFIER REHABILITATION	**$599,600**
DEWATERING EQUIPMENT REPLACEMENT	**$2,642,700**
TOTAL MAIN WWTF CAPITAL IMPROVEMENTS	**$3,242,300**

West Side Service Area

In 1989, the City of St. Charles was approached by property owners west of Randall Road requesting annexation and sanitary sewer service. In response, the City investigated several alternatives including the acquisition of the Department of Corrections wastewater treatment facility, which served the Illinois Youth Center and the Illinois Department of Transportation's garage. The treatment facility included a 0.35 MGD package treatment plant, polishing pond and sludge drying beds. Effluent from the facility was discharged to Mill Creek near Keslinger Road.

The City submitted a Facility Plan Amendment and request for Facility Planning Area Boundary change in late 1989 and an update in 1991. The boundary change and plan were approved by NIPC and Illinois EPA. The City commenced with Phase I in 1992, which included purchase of the treatment facility and upgrading the facility to meet NPDES standards. Phase I was completed in 1997.

The City updated the Facility Plan again in 1998. The update outlined a phased approach for expansion of the treatment facility, which expanded the plant's capacity in three 0.35 MGD increments. The Illinois EPA approved Phases II and III as recommended with the Facility Plan, which would increase the treatment facility's capacity to 1.05 MGD. However, the Illinois EPA requested that a Facility Plan Update be submitted prior to expansion of the plant to 1.4 MGD to verify capacity requirements. The Illinois EPA issued an NPDES Permit consistent with the recommendations allowing for the Phase II expansion to 0.70 MGD and Phase III expansion to 1.05 MGD.

Once the Facility Plan was approved, the City of St. Charles proceeded with design and construction of the Phase II Improvements. The project was completed in 2001 and funded through the Illinois EPA Revolving Loan Program.

In 2023, the City completed the Phase III Expansion Project. This project included expansion of the design average flow from 0.7 MGD to 1.05 MGD, conversion of the biological process to a Bardenpho, replacement and expansion of preliminary screening, rehabilitation of the existing final clarifiers, construction of a Tertiary Building with disc filters and replacement of the UV disinfection system, chemical polishing systems for phosphorus removal, and replacement of the NPW system. It also included rehabilitation of the existing aerobic digester and construction of a sludge storage tank and Sludge Handling Building with a belt filter press for dewatering. The project also included construction of a Sludge Storage Barn with storage for dewatered sludge from both the Main WWTF and West Side WRF and a Vactor Receiving Station. This project was funded through the Illinois EPA Revolving Loan Program.

The City updated the Facility Plan in 2008, 2015, and 2019. These updates incorporated phased approach for expansion of the treatment facility as well as an analysis of recently promulgated and pending environmental regulations. The regulatory issues included nutrient removal, suspended solids effluent requirements and bio-solids stabilization, as well as anti-degradation requirements and copper and radium concentrations in the effluent.

FACILITY UPGRADE AND EXPANSION PLANS

Main Service Area

The City of St. Charles' Main WWTF utilizes an A^2/O Process, enhanced with a primary sludge fermenter for carbon augmentation to the anaerobic zone. The existing basins used for the A^2/O process have a limited hydraulic retention time (HRT). The system performs very well at current flows of 6.5 MGD because HRT is roughly 14 hours in the existing basins. However, at design average flows of 9 MGD, the HRT is reduced to roughly 10 hours. To compensate for the reduced HRT, the basis of design utilized a MLSS concentration of 3,800 mg/L. This concentration is achievable and the City will be able to maintain effluent concentrations below current permit limits for ammonia and total phosphorus. However, from an operations standpoint this will be very difficult to manage. Any reduction in the effluent total phosphorus limit or the addition of a total nitrogen limit to the NPDES permit will make operations exceedingly more difficult. Therefore, before the WWTF receives a 0.5 mg/L effluent TP limit and potentially a limit on total nitrogen, it is recommended that the City consider improvements to their biological process.

It is recommended that the City extend the biological process from 10 hours detention time to 12 hours with additional tankage to achieve nitrification, denitrification, and biological phosphorus removal. The biological process expansion would allow it to function over the entire range of operational conditions at a more reasonable MLSS concentration of 3,200 mg/L.

This alternative would include construction of approximately 1.6 million gallons of detention time within the biological process. Construction will require tight control of wasting and thickening operations utilizing the existing interior WAS storage tank to maintain the biomass in the process. WAS production at 7 MGD for the chemical phosphorus removal facility during construction compared to the existing biological phosphorus removal process is estimated to increase by roughly 4%, so the GBT will need to run slightly more hours per week during construction. Dewatering operations are anticipated to *decrease* by roughly 7% due to sludge from the chemical phosphorus removal process being easier to dewater than sludge from biological phosphorus removal. The project will cost roughly $14.5 Million. A future study is recommended to evaluate implementation of tertiary filtration (See Section 5) to offset chemical costs required to achieve 0.5 mg/L effluent TP with the expanded biological process.

Table 11: Main WWTF Biological Process Expansion Cost Estimate

Description	Total Cost
GENERAL CONDITIONS	$2,691,000
SITE WORK	$1,821,104
WAS STORAGE & 1400 BASINS	$6,936,415
Construction Sub-total	**$11,448,519**
Contingency @ 10%	$1,144,900
Design Engineering @ 7.5%	$944,600
Construction Engineering @ 7.5%	$944,600
PROBABLE PROJECT COST:	**$14,490,000**

NOTE: Chemical costs during construction are forecasted to be roughly $49,000/month at 7 MGD.

Additionally, wasting and thickening operations would need to be considered as the City grows. It is recommended that an additional gravity belt thickener, polymer feed unit, and WAS pump be installed once the average annual influent exceeds 8 MGD. The sludge dewatering operations would also need to be considered as the City grows. It is recommended that the City consult with the centrifuge manufacturer to determine if the existing equipment can be reconfigured to provide a shallower beach slope, as the existing steep beach tends to build up grit and cause vibration issues. If the existing equipment cannot be modified to rectify this issue, it is recommended that an additional centrifuge, polymer feed unit, and centrifuge feed pump be installed once the influent exceeds 8 MGD.

The City should consider replacement of the excess flow disinfection system. It is recommended that the Chlorine Contact Tank and Chlorine Building be demolished a Tertiary Building be constructed adjacent to the Contact Tank. This building would normally treat process flow which would first pass through a rapid mix/coagulation/flocculation system with polymer and alum directly upstream of the filters. This system would bind up remaining phosphorus in the effluent prior to filtration more efficiently than chemical precipitation alone, and could be located generally in the area occupied by the Contact Tank. After the rapid mix system, flow would enter a low-head pump station before entering the tertiary disc filters. During an excess flow event, process flow would bypass the rapid mix/coagulation/flocculation system. Process flow and excess flow clarifier effluent would blend within the low-head pump station wet well prior to filtration. Blended flow would then be conveyed to the UV Building for disinfection.

Table 12: Tertiary Treatment Building – Probable Costs

Description	Total Cost
GENERAL CONDITIONS	$3,404,500
SITEWORK	$1,870,620
FILTER BUILDING	$11,557,180
Construction Sub-total	**$16,832,300**
Contingency @ 10%	$1,683,300
Design Engineering @ 7.5%	$1,388,700
Construction Engineering @ 7.5%	$1,388,700
PROBABLE PROJECT COST:	**$21,300,000**
IEPA Contingency (3%)	$555,468
Construction Period Interest (1.5%)	$327,832
TOTAL LOAN AMOUNT (nearest half $M)	**$22,500,000**

West Side Service Area

The analysis provided in Section 2 demonstrates that the existing 1.05 MGD has capacity to serve approved development. The IEPA recommends expansion when the forecasted hydraulic loading from the additional property, pending development or redevelopment, would result in an average daily flow of 80% of the design capacity (0.84 MGD). To prevent being placed on critical review status with the IEPA, expansion should be considered if the capacity is expected to exceed 80% of the facility's capacity in the next 5 years. This process will include permitting for Phase 4, which could take over a year to complete. The design of the Phase 4 project would take roughly 18 months to complete, and roughly 2 years to construct. Therefore, it is recommended that the City begin planning for the Phase 4 expansion.

The 2021 Phase 3 Improvements and Expansion project generally rehabilitated and upgraded the facility in its entirety. This project was completed in 2023. This project generally laid the pathway for the Phase 4 expansion when the time comes. Most of the equipment was installed to accommodate the increased hydraulic demand when the facility is expanded to 1.4 MGD. Expansion of the biological process is recommended to maintain the 24-hour Hydraulic Retention Time (HRT). A fourth process basin will be constructed in Phase 4 including baffle walls, mixers, diffusers, and process monitoring equipment. An additional process blower to meet increased oxygen demand with the expanded process is not required until Phase V.

The RAS/WAS Pump station was originally designed for expansion. Two pumps were installed as part of the Phase 2 Project. An additional pump was installed as part of the Phase 3 Project. It is recommended that the fourth pump is installed during the Phase 4 project. Additionally, the two original pumps should be considered for replacement.

The aerobic digestion facility capacity is limited and will require expansion to adequately digest sludge under Phase 4 design conditions. It is recommended that four new aerobic digesters are constructed on the south side of the site. A WAS Thickening Building using a rotary drum thickener or similar technology is also recommended. It is recommended that the digesters are covered to help maintain temperature and reduce odors. The Sludge Handling Building was also constructed in the Phase 3 improvements and currently has adequate capacity to handle Phase 4 loads.

Exhibit 6: West Side WRF Phase 4 Expansion Conceptual Layout

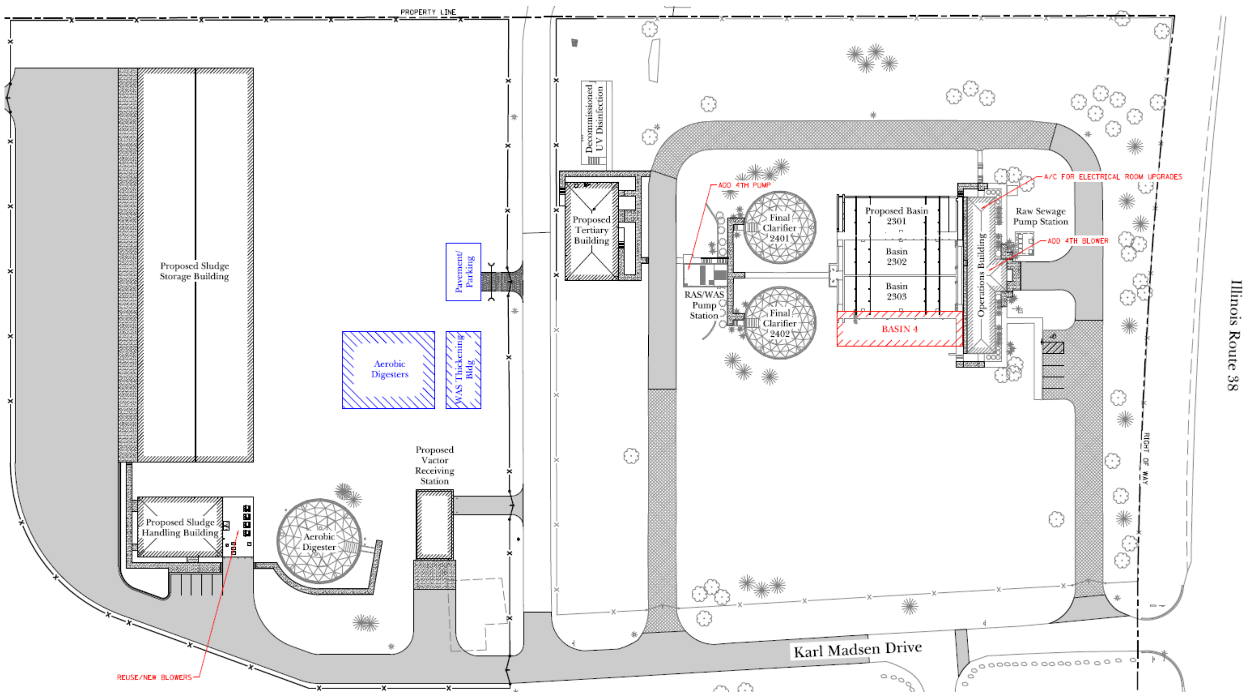


Table 13: West Side WRF Phase 4 Expansion

Description	Total Cost
GENERAL CONDITIONS	$3,358,000
SITE WORK	$2,644,200
RSPS AND OPERATIONS BUILDING	$333,700
BIOLOGICAL PROCESS	$2,003,228
RAS/WAS PUMP STATION	$112,500
AEROBIC DIGESTERS	$3,758,710
WAS THICKENING BUILDING	$2,519,626
Construction Sub-total	**$14,729,964**
Contingency @ 10%	$1,473,000
Design Engineering @ 7.5%	$1,215,300
Construction Engineering @ 7.5%	$1,215,300
PROBABLE PROJECT COST:	**$18,640,000**

IMPLEMENTATION PLAN

Main Service Area

After careful consideration of the alternatives for biological process expansion at the Main WWTF, the City has elected to pursue replacement of the 1400 biological process basins and WAS holding tanks with four new, 26'-deep basins. The City is also electing to replace the excess flow disinfection system and construct a Tertiary Building. The City of St. Charles intends on funding both projects through the Water Pollution Control Loan Program administered by the Illinois EPA with the intention of servicing the debt through user fees.

West Side Service Area

The alternatives for the Phase 4 expansion of the West Side WRF are analyzed in Section 6 of this report. The City of St. Charles intends on funding the project through the Water Pollution Control Loan Program administered by the Illinois EPA with the intention of servicing the debt through user fees. The complete list of all capital improvements recommended in this report is provided below.

Table 14: Capital Improvements Summary

EAST SIDE LIFT STATION REHABILITATION	$970,000
TERTIARY TREATMENT BUILDING	$21,293,000
PRIMARY CLARIFIER REHABILITATION	$599,600
DEWATERING EQUIPMENT REPLACEMENT	$2,642,700
MAIN WWTF BIOLOGICAL PROCESS EXPANSION	$14,490,000
WEST SIDE WRF PHASE 4 EXPANSION	$18,640,000
TOTAL CAPITAL IMPROVEMENTS	$58,635,300

The City currently has a capital improvements budget of approximately $3.52 Million. This cost represents the existing debt service on previously completed improvements that were funded through the Illinois SRF, and are labeled below as "Existing Debt Service". The additional costs of the recommended capital improvements recommended in Sections 3 – 6 are labeled below as "Proposed Debt Service". These projects were discussed with City staff to gain concurrence on the desired start and completion dates for each recommended improvement. A detailed user rate study is recommended to assess how the City should cover the recommended capital improvements.

Table 15: Debt Service for Capital Improvements – Implementation Plan

	'23-'24	'24-'25	'25-'26	'26-'27	'27-'28	'28-'29 to '37-'38
EXISTING DEBT SERVICE						
2002 NITRIFICATION IMPROVEMENTS	$0.65	$0.65	$0.29			
EAST SIDE AND RIVERSIDE LIFT STATIONS	$0.10	$0.10	$0.10	$0.10	$0.10	$0.29
2012 MAIN AND SLUDGE HANDLING BUILDING	$0.61	$0.61	$0.61	$0.61	$0.61	$4.30
2017 P-REMOVAL & DIG. IMPR.	$1.03	$1.03	$1.03	$1.03	$1.03	$10.32
WEST SIDE WRF PH. III EXPANSION	$1.12	$1.12	$1.12	$1.12	$1.12	$11.23
RIVERSIDE LIFT STATION REPLACEMENT		$0.19	$0.95	$0.95	$0.95	$9.51
PROPOSED DEBT SERVICE						
COLLECTION SYSTEM REPLACEMENT	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
EAST SIDE LIFT STATION REHABILITATION						$0.44
TERTIARY TREATMENT BUILDING						$2.77
PRIMARY CLARIFIER REHABILITATION				$0.60		
DEWATERING EQUIPMENT REPLACEMENT						$0.34
MAIN WWTF BNR EXPANSION						$7.12
WEST SIDE WRF PHASE 4 EXPANSION						$10.05
TOTAL CAPITAL IMPROVEMENTS	$3.52	$3.71	$4.11	$4.42	$3.82	$56.38

Projected costs are in millions of dollars

Environmental Impacts

Main Service Area

As the designated management agency, the City is responsible for meeting the long-range goals of the Clean Water Act and to minimize the environmental impacts of pollution from the sanitary waste generated within the Facility Planning Area and the Main and West Side Service Areas.

The City has and continues to work with each of the affected communities by providing sanitary service, encouraging responsible development practices, and working with state and local agencies to protect the Fox River (Main Service Area) and Mill Creek (West Side Service Area) from pollutants.

In addition to actively pursuing solutions to the communities wastewater collection needs, the City has invested in upgrading the Main WWTF with newer technologies to meet the needs of the Fox River Watershed. Some of the improvements to protect the environment incorporated into the recent projects include:

- Expansion of the biological process to include phosphorus and nitrogen removal
- Upgrade of the sludge stabilization facilities

As shown in Section 5, the performance of the Main WWTF has been outstanding. The BOD_5, suspended solids, ammonia, and total phosphorus loadings are continuously well below the NPDES Permit Limits.

The City is committed to upgrading the wastewater treatment facilities in a manner that will be a benefit to both the communities served and the ecosystem surrounding the Fox River and Mill Creek.

For the Main Service Area, the areas of environmental concern include not only the Fox River, but the wetlands and nature preserves within the area. The wildlife habitat and open space represent a significant portion of the Facility Planning Area. The comprehensive plan prepared by the City within the FPA recognizes the importance of preserving open space and incorporating responsible development. Ordinances and development practices to minimize urban run-off from impacting the environment is encouraged.

The most significant concern for the Main WWTF includes the quality of the final effluent. The facility's current effluent quality is exceptional. However, concerns over impacts on the surrounding environment including wetlands, wildlife habitat, and endangered species must be considered.

West Side Service Area

The City has invested in upgrading the West Side WRF with newer technologies to meet the needs of the Mill Creek Watershed. Some of the improvements to protect the environment incorporated into the recent projects include:

- Expansion of the biological process to include phosphorus and nitrogen removal
- Upgrade of the sludge stabilization facilities
- Construction of a Sludge Dewatering Building and Sludge Storage Building
- Construction of a Tertiary Building for tertiary treatment and UV disinfection

The performance of the West Side WRF has also been outstanding. The BOD5, suspended solids, and ammonia loadings are continuously well below the NPDES Permit Limits.

For the West Side Service Area, the areas of environmental concern include not only Mill Creek, but the wetlands and nature preserves within the area. The wildlife habitat and open space represent a significant portion of the West Service Area. The comprehensive plan prepared by the City recognizes the importance of preserving open space and incorporating responsible development. Ordinances and development practices to minimize urban run-off from impacting the environment is encouraged.

In 1999, the City contracted with Huff and Huff, Inc. Environmental Consultants to perform a Non-Degradation Analysis for the West Side WRF's proposed expansions. This report found that the West Side WRF's effluent has not had, and is not expected to have, a negative impact on the Mill Creek environment. The Summary of this report states:

> *"In summary, no impact on the beneficial uses of Mill Creek (and Mooseheart Lake) are anticipated from the proposed change in the design average flow. In fact, the resultant higher stream flows under low flow conditions can be expected to benefit both Mill Creek and Mooseheart Lake"*

The City is planning to develop a stream characterization report to confirm the results of the 1999 analysis. The most significant concern for the West Side WRF includes the quality of the final effluent. The facility's current effluent quality is exceptional. However, growth within the Facility Planning Area will lead to higher pollutant loading from other sources. Concerns over impacts on the surrounding environment including wetlands, wildlife habitat, and endangered species must be considered in anticipation of potential development.

SECTION 1
INTRODUCTION AND BACKGROUND

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1. INTRODUCTION AND BACKGROUND

1.1 GENERAL BACKGROUND

The City of St. Charles is located along the Fox River in central Kane County approximately 35 miles west of downtown Chicago. The City is bordered by the Village of South Elgin to the north, the City of West Chicago to the east, the City of Geneva to the south and the Village of Campton Hills to the west. The St. Charles Service Area is comprised of approximately 10,340 acres. Within this Service Area, the City owns and operates a sanitary sewer collection system and two wastewater treatment facilities: the Main Wastewater Treatment Facility and the West Side Water Reclamation Facility.

1.1.1 Main Wastewater Treatment Facility

The Main Wastewater Treatment Facility (Main WWTF) is located at the Public Works Facility, 1405 S. 7th Avenue on the eastern shore of the Fox River, approximately nine-tenths of a mile south of the Illinois Route 64 Bridge. The Main WWTF plant has a design average treatment capacity of 9.0 million gallons per day (MGD). The facility generally serves the community's wastewater needs east of Randall Road and discharges to the Fox River. The collection system tributary to the Main Wastewater Treatment Facility (Main WWTF) consists of approximately 162 miles of sanitary sewers, 6 miles of force main, and 16 lift stations. The Main WWTF is located at the Public Works Facility, 1405 S. 7th Avenue on the eastern shore of the Fox River, approximately nine-tenths of a mile south of the Illinois Route 64 Bridge. 8,317 acres of the St. Charles Service Area is tributary to the Main WWTF.

The City's National Pollutant Discharge Elimination System (NPDES) Permit for the Main WWTF (Permit No. IL0022705), as administered by the Illinois Environmental Protection Agency (IEPA), is currently pending a final draft issuance. The expired NPDES permit is included as Appendix A.

1.1.2 West Side Water Reclamation Facility

The West Side Water Reclamation Facility (West Side WRF) is located at 3803 Illinois Route 38. The West Side WRF has a design average treatment capacity of 1.05 MGD. The facility generally serves the community's wastewater needs west of Randall Road and discharges to Mill Creek. The collection system tributary to the West Side Water Reclamation Facility consists of approximately 16.3 miles of sanitary sewers, 1.2 miles of force main and 3 lift stations. The West Side Water Reclamation Facility (West Side WRF) is located at 3803 Illinois Route 38. 2,023 acres of the St. Charles Service Area is tributary to the West Side WRF.

The City's National Pollutant Discharge Elimination System (NPDES) Permit for the West Side WRF (Permit No. IL0026808), as administered by the Illinois Environmental Protection Agency (IEPA), was last issued on August 18, 2023 and expires on August 31, 2028. The NPDES permit is included as Appendix B.

1.1.3 Local Newspaper Information

Daily Herald
3805 E. Main St.
Suite A
St. Charles, IL 60174

1.2 Study Purpose and Scope

The purpose of this study is two-fold and will include a comprehensive Facility Master Plan. The intent of the report is to identify process upgrades and rehabilitation projects which should be incorporated into the City's five-year Capital Improvements Program, as well as address long-range needs of the community.

1.3 PREVIOUS PLANNING DOCUMENTS

A Facility Plan Report (FPR) is a management and planning document used to identify, evaluate, and plan required wastewater facility improvements. It provides an assessment of the collection and treatment systems' abilities to meet both current and future loads, flows and regulatory requirements and provides critical information for improvements to correct current or projected deficiencies. FPRs are required by the Illinois Environmental Protection Agency (IEPA) for any wastewater improvements that change the treatment process or expand the capacity of the wastewater treatment plant. FPRs are typically updated every five to ten years, or when significant changes in growth or regulatory requirements have occurred or are expected. The City previously utilized separate FPRs for each Service Area; Main and West.

1.3.1 Main Service Area Facility Planning Reports

In 2002, the City updated its FPR which identified the need for nitrification capabilities. In 2009, the City updated its FPR which identified the need for improved sludge handling infrastructure. In 2015, the City updated its FPR which identified the need for phosphorus removal and anaerobic digestion rehabilitation.

1.3.2 West Service Area Facility Planning Reports

In 1998, the City updated its FPR which outlined a phased approach for expansion of the treatment facility in three 0.35 MGD increments. The Illinois EPA approved Phases II and III as recommended within the FPR which would increase the treatment facility's capacity from 0.35 MGD to 1.05 MGD. The IEPA issued an NPDES Permit consistent with the recommendations allowing for the Phase II expansion to 0.70 MGD and Phase III expansion to 1.05 MGD. The Phase II Expansion was completed in 2001 and funded through the Illinois EPA Wastewater Loan Program.

The City also completed a Facility Plan in 2019. It was determined based on future development and committed capacity in the West Side Service Area that the City needed to proceed with design of the Phase III Improvements. After the Facility Plan was approved, the project was designed, and construction was completed in 2022. This project was also funded through the Illinois EPA Wastewater Loan Program.

1.4 FACILITY MASTER PLAN SCOPE

The purposes of this Master Plan are to:

- Evaluate the adequacy of the existing collection and treatment facilities under the current flows, loads and regulatory requirements;
- Review the maintenance history and current condition of wastewater treatment units and lift stations and identify requirement maintenance repairs/replacements;
- Estimate the additional flows and loads associated with future growth within the planning area during the 20-year planning period;
- Summarize pending and potential future environmental regulations related to wastewater conveyance and treatment;
- Determine the impacts of future flows, loads and regulatory requirements on the existing system;
- Identify and evaluate alternatives to address both current and future deficiencies;
- Recommend cost effective alternatives; and
- Present costs, user fee analysis, implementation plans, cash flow projections and environmental impacts of the recommended alternatives.

SECTION 2

THE COMMUNITY'S NEEDS

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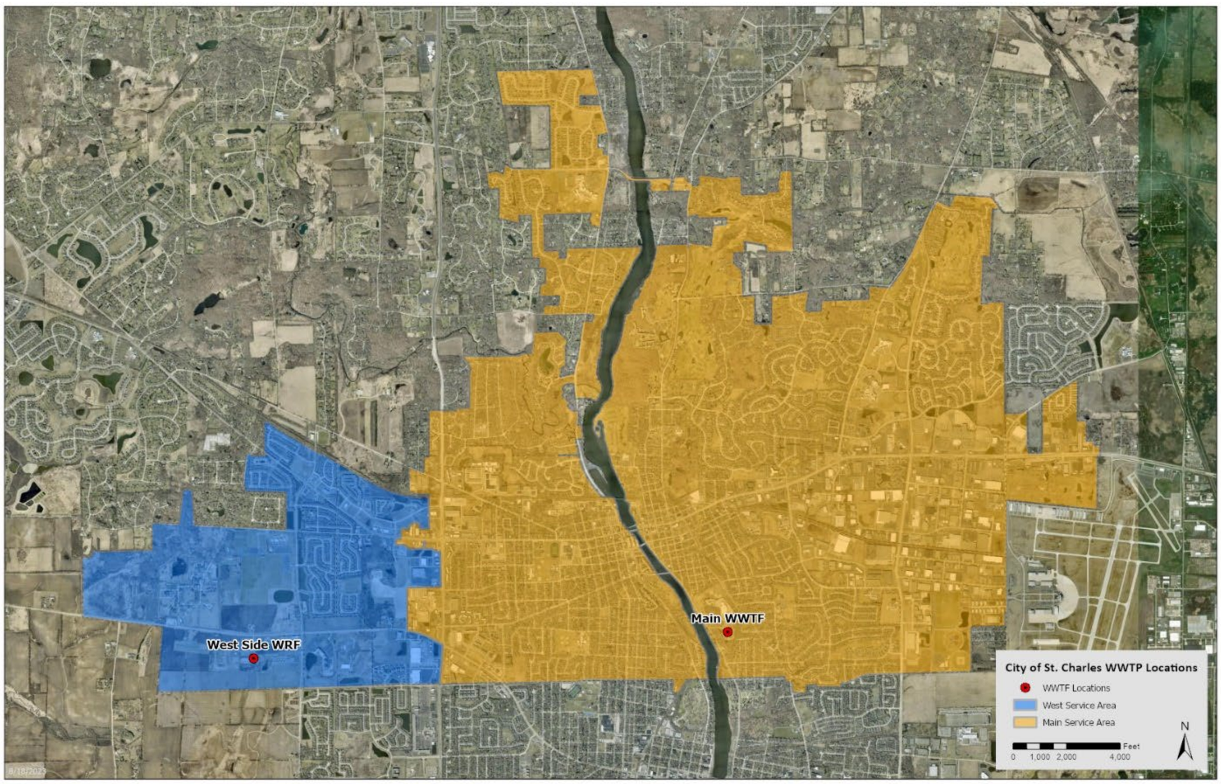
2. The Community's Needs

2.1 General Background

The City of St. Charles, Kane County, Illinois is situated along the Fox River between Geneva and South Elgin and its location has made it attractive to residential, industrial, and commercial development.

Exhibit 2-1: City of St. Charles Service Areas



The Main Wastewater Treatment Facility (WWTF) is located on the east bank of the Fox River and was originally built in the 1920's when the community was relatively small. Since that time the community has grown substantially. However, the treatment plant is restricted to its original site with limited room for expansion.

In 1989, the City of St. Charles was approached for service by properties west of Randall Road requesting annexation and sanitary sewer service. It was determined at that time that the properties located within this area would be tributary to the existing Illinois Department of Corrections wastewater treatment facility located on Illinois Route 38 west of Peck Road. This wastewater treatment facility was subsequently purchased by the City of St. Charles and renamed the West Side Water Reclamation Facility (WRF).

The West Side WRF serves the area of St. Charles west of Randall Road including the Illinois Youth Center and the Kane County Judicial Center, commonly referred to as the West Side Service Area.

The City of St. Charles service areas are bounded on the south by Geneva, on the north by South Elgin, and West Chicago to the east. The FPA is shown in the figure above, with the Main WWTF Service Area shown in orange. The City of St. Charles has grown from a community of 17,492 in 1980 to 27,910 people in 2001 to 32,974 people in 2010, to 33,078 people in 2020, of which most (31,522 PE) live in the Main WWTF's service area. The estimated future development has been provided by the City and has been incorporated into the future population projections.

2.2 EXISTING POPULATION PROJECTIONS AND WATER DEMANDS

In order to accurately evaluate the current and future wastewater capacity needs, we established the current number of users, the users which are permitted or approved but not currently contributing and the potential population from the remaining open lands in the service areas.

The existing and future population equivalents were established by reviewing the City's future development, water and sewer billing records, wastewater treatment plant flow monitoring records, approved development plans and the Land Use Plan. The City Planning Department provided support and information to establish the ultimate population equivalents.

In 2020, the U.S. Census Bureau estimated that the City of St. Charles served a total residential population of 33,081. The residential usage based on billing records was 2,098,351 gallons per day.

The historical growth of the residential population within the service areas has varied over the past 25 years. In 2023, the City had a total customer base (including residential and non-residential) of 12,428 accounts. However, this cannot necessarily be correlated with the total population served. In order to determine the total PE within the City's Service Area, the residential population is established as the first step. The City's population from the 2020 census was 33,081. The residential population equivalents were calculated by dividing the residential water sold by the total number of residents within the Service Area. In order to determine the 2023 residential population estimate, the Chicago Metropolitan Agency for Planning (CMAP) population projection of 0.7% growth per year was utilized to get a population forecast of 33,781. This per capita water billed equates to 62.1 gpd/capita during 2022. The average per capita billed from 2018-2022 of 65.8 gpd/capita was based on an average of 3.58 MGD of usage. The current City of St. Charles sewer use rate structure is set forth in Title 13, Chapter 12, Section 830 of the City Code. The City's current sewer use rate is $7.29 per 1,000 gallons of metered water consumption plus a demand charge of $23.01 per month.

Main Service Area

During 2022, the City of St. Charles Main Service Area had a metered water usage of 3.06 MGD, while the Main wastewater treatment facility (WWTF) received an average flow of 4.59 MGD.

The Main WWTF received an average flow of 4.94 MGD from 2018-2023. The current population equivalents were estimated by breaking down the water meter data by classifications:

Table 2-1: Main Service Area Current Population, Water Demands and Wastewater Flows (2022)

	Residential	Non-Residential	Total
Number of Customers	9,980	1,166	11,146
Population Equivalents	29,848	19,168	49,016
Water Usage Billed (MGD)	1.87	1.19	3.06
Water Usage / PE (GCD)	62.1	62.1	62.1
Wastewater Received (MGD)	2.80	1.79	4.59
Wastewater / PE (GCD)	93.64	93.64	93.64

The current population equivalents are based on the water meter data, except for two areas of water usage that there was water only users removed from the population equivalents.

The future population projection, which is the ultimate buildout of properties within the FPA, was developed by assigning PE values to the planned development and remaining open lands in accordance with the Land Use Plan.

Future Population Equivalent

Total Current PE	49,016	PE
Additional PE at Build-Out of Service Area	15,021	PE
Total Future PE	64,037	PE

Projected 2040 Population Equivalent for the Main Service Area is 64,037 PE. It should be noted that population equivalent resulting from the ultimate buildout will not exceed the present IEPA rated population equivalent of the Main WWTF which is 90,000 PE.

West Side Service Area

The current population equivalents (PE) of the West Side Service Area were established by reviewing the City's 2022 water and sewer billing records. The City of St. Charles billed an average of 328,954 gpd during 2022 within the West Side Service Area, not including wastewater metered from the Illinois Youth Center or Kane County Judicial Court. Based on a water consumption rate of 62.1 gcd, the population equivalent served with water was 5,296 PE. This includes approximately 3,717 Residential PE and 1,579 Non-residential PE.

The West Side WRF treated an average flow of 543,434 gallons per day, or 0.54 MGD from 2018-2022. In 2022, the West Side WRF treated 457,140 gallons per day or 0.46 MGD. The Illinois Youth Center (IYC) is served by a private water system but discharges wastewater to the West Side WRF. In 2022, this amount was approximately 67,132 gpd. Kane County Judicial Center (KCJC) is also on IYC water, but discharges to West Side WRF an average of 50,745 gpd. The IDOT Facility at the corner of IL Route 38 and Peck Road is also served by a private water system but discharges an estimated 1,000 gpd wastewater to the West Side WRF.

457,140 gpd – (67,132 gpd + 50,745 gpd + 1000 gpd) = 338,263 gpd

The 2022 PE based on water users alone is 5,296 (3,717 residential + 1,579 non-residential). Using this information, the wastewater received equates to 62.2 gcd. Based on 62.2 gcd wastewater, IYC equates to 1,079 additional non-residential PE, KCJC equates to an additional 816 P.E. and IDOT equates to an additional 16 P.E.

Well #13 at the Oak Street Water Filtration Facility discharges unmetered backwash wastewater to the West Side WRF. In 2017, Well#13 pumped 325.8 million gallons total, or approximately 0.89 million gallons/day. It is estimated that the backwash for the iron filter is approximately 1% of the forward flow, which equates to 8,927 gallons/day and an additional 151 Non-residential PE. Including these additions, the non-residential PE is 3,634 and the total P.E is 7,351. It is also noted that a new lift station completed as part of the Well 7/13 Interconnect project will also add additional PE tributary to the West Side WRF from backwash water for two additional filters and another well. The PE associated with that lift station is considered to be a future development for the purposes of this report.

Table 2-2: West Side Service Area Current Population, Water Demands and Wastewater Flows (2022)

	Residential	Non-Residential	Total
Population Equivalents (PE)	3,717	3,634	7,351
Wastewater Received (MGD)	0.23	0.23	0.46
Wastewater/PE	62.2	62.2	62.2

The future population projection, which is the ultimate buildout of properties within the FPA, was developed by assigning PE values to the planned development and remaining open lands in accordance with the Land Use Plan.

West Side Service Area Future Population Equivalent

Total 2022 PE	7,351	PE
Additional PE at Build-Out of Service Area	8,165	PE
Total Future PE	**15,516**	**PE**

2.3 MAIN SERVICE AREA INFILTRATION AND INFLOW

2.3.1 Infiltration

The USEPA considers average annual infiltration to be excessive if it exceeds 50 gcd. The current estimated population equivalent within the Main WWTF's service area is 49,016 PE. We have estimated the average amount of infiltration by comparing the water usage records with the plant effluent records. The average water usage per population equivalent is 62.1 gcd. The average wastewater received per population equivalent is 93.6 gcd. The annual average I/I is approximately 31.5 gcd, which is 63% of the USEPA's criteria. This is a significant improvement from the previous studies in 2002 and 2009 which outlined an estimated infiltration of 49 and 46 gcd, respectively.

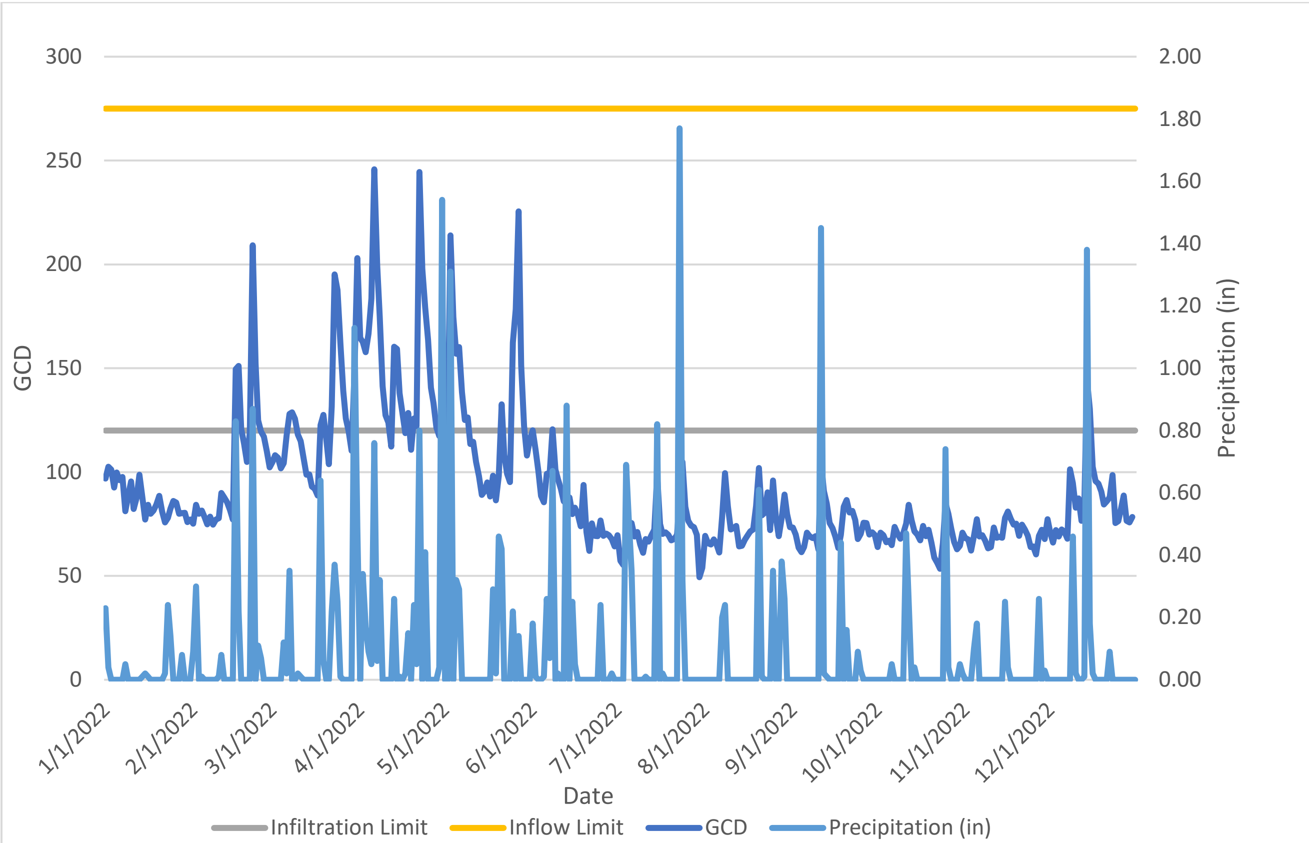
Based on total current PE and the USEPA definition of excess infiltration (120 gcd during periods of high groundwater), the Main WWTF experiences excess infiltration when flows exceed 5.88 MGD. In 2022, 24-hour influent exceeded 5.88 MGD a total of 64 times during rain events.

2.3.2 Inflow

The issue of inflow has become more sensitive over the last few decades due to unusually heavy rainfall events that resulted in flooding of some residential basements. The 10-year peak wet weather flow presented in a system-wide capacity study prepared in 1996 was estimated to be 35.7 MGD, or 7.56 times the average daily flow. The estimated 5-year peak wet weather flow stated in the 2009 Report (from the west side of the Fox River alone) was 11.49 MGD, or 6.68 times the average daily flow from this area. The USEPA considers inflow to be excessive in separate sanitary sewer systems if the total flow, water usage plus infiltration plus inflow, exceeds 275 gcd. Based on the 1996 Report for the entire system, the estimated 10-year Peak Wet Weather Flow was almost 1,000 gallons per day per PE. Based on the 2009 RJN report for the west side of town, the estimated 5-year peak wet weather flow equates to 738 gallons per day per PE. Both were above the USEPA recommended standard.

Based on total current PE and the USEPA definition of excess infiltration (275 gcd during storm events where there are no basement back-ups), the Main WWTF experiences excess inflow when flows exceed 13.48 MGD. In 2022, the 24-hour influent did not exceed 13.48 MGD.

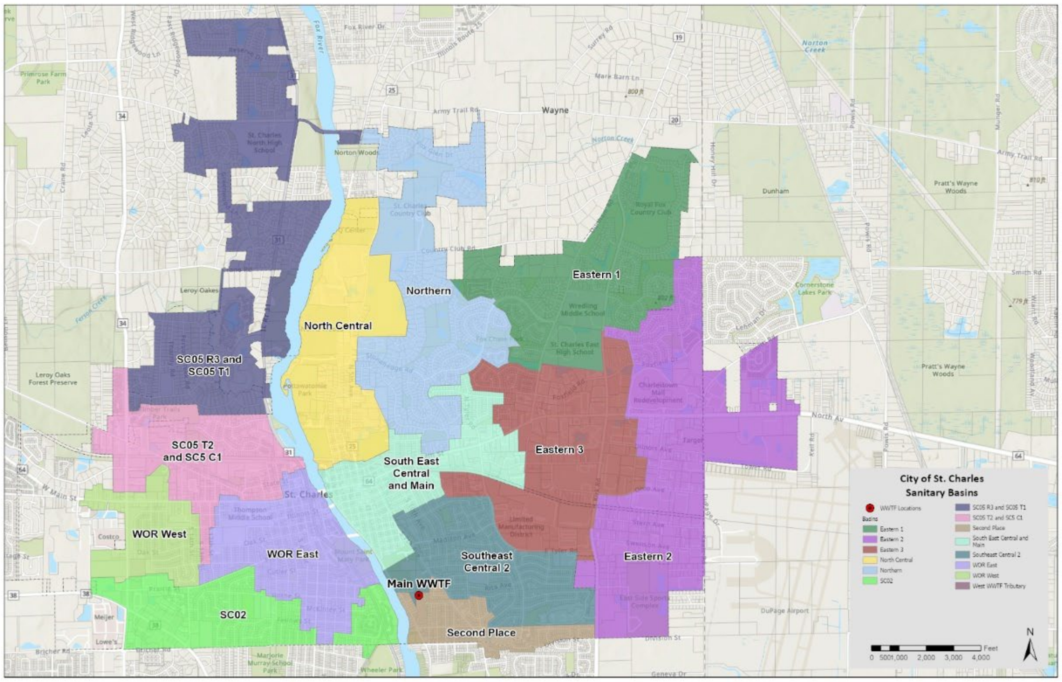
Figure 2-1: Main Service Area Infiltration/Inflow vs Per Capita Influent Flow (GCD) (2022)



2.4 MAIN SERVICE AREA FUTURE POPULATION PROJECTIONS

In order to accurately evaluate the City's current and future wastewater flows for the Main WWTF Service Area, the following data was reviewed and established:

Exhibit 2-2: City of St. Charles Main Service Area Drainage Basins



- Current number of users.
- Estimated future users (determined from information regarding developments currently under construction or approved by the City of St. Charles).
- Potential number of users from the remaining undeveloped properties located within the boundaries of the City's current and future service area (based on the Land Use Plan).

The existing and future population equivalents were established by reviewing the City's detailed water and sewer billing records, wastewater treatment plant flow monitoring records, the estimated future development provided by the City, and its Comprehensive Land Use Plan. Analysis of the projected land use was the basis for developing future population projections. The City of St. Charles' Comprehensive Plan indicates future residential, commercial, and industrial uses.

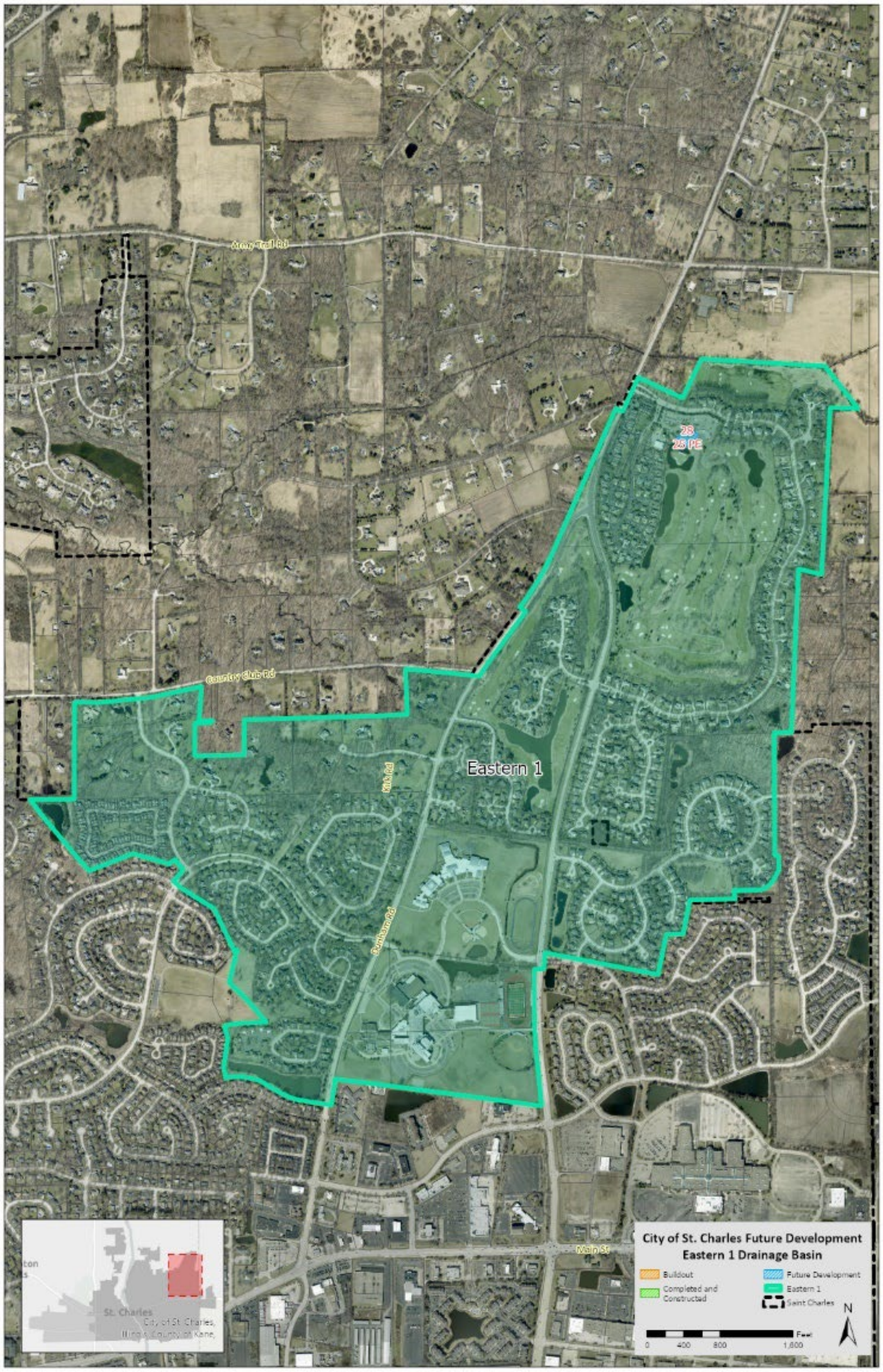
The Main Service Area currently contains fourteen drainage basins. Each drainage basin was analyzed to establish the 2022 Conditions and Build-Out Population Equivalents. A summary of all data indicated in the exhibits on the following pages is included in Appendix C.

2.4.1 Eastern 1 Drainage Basin

The Eastern 1 Basin includes mainly residential development with some institutional development. Areas included within this basin are bordered by the Royal Fox subdivision to the north and include areas from roughly Dunham Road to the eastern City limits. The collection system in this area is tributary to the Eastern 3 basin and ultimately the East Side Lift Station. The current PE in the basin is 3,854 PE.

The Eastern 1 Drainage Basin has been outlined by the City as a growth area. Commercial development has been slated for this area. The development will add approximately 25 Non-Residential PE and 0 Residential PE, for a total additional development of 25 PE at buildout.

Exhibit 2-3: Eastern 1 Drainage Basin Future Development



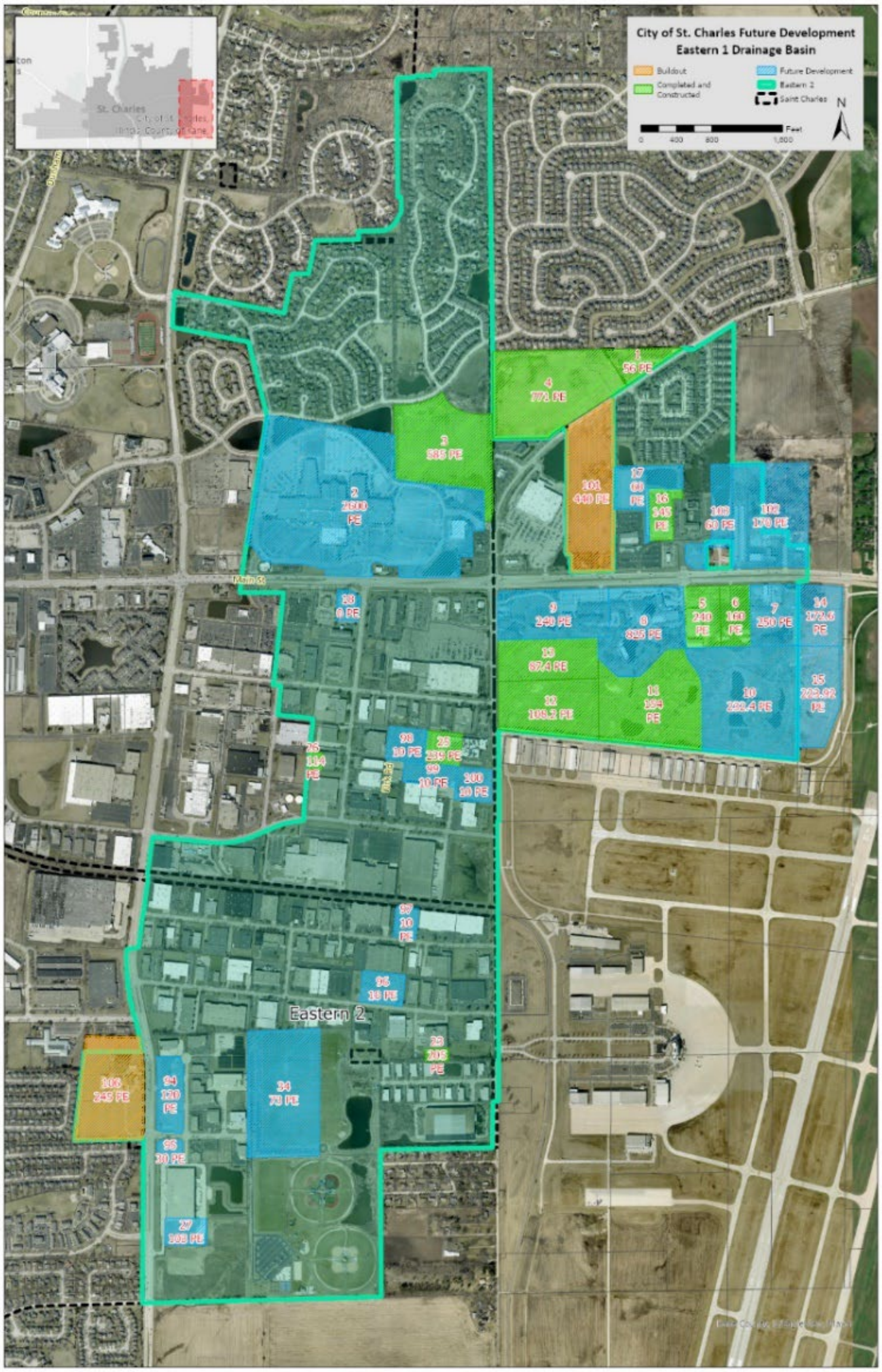
2.4.2 Eastern 2 Drainage Basin

The Eastern 2 drainage basin borders the southeastern edges of the City. The basin includes residential, commercial and light industrial development. The sanitary sewers in the area are of varying age and condition.

The basin currently serves 4,495 PE.

Exhibit 2-4 on the next page include future development in the Eastern 2 Basin. The future development will add approximately 4,399 Non-Residential PE and 4,361 Residential PE, for a total additional development of 8,760 PE at buildout.

Exhibit 2-4: Eastern 2 Basin Future Development

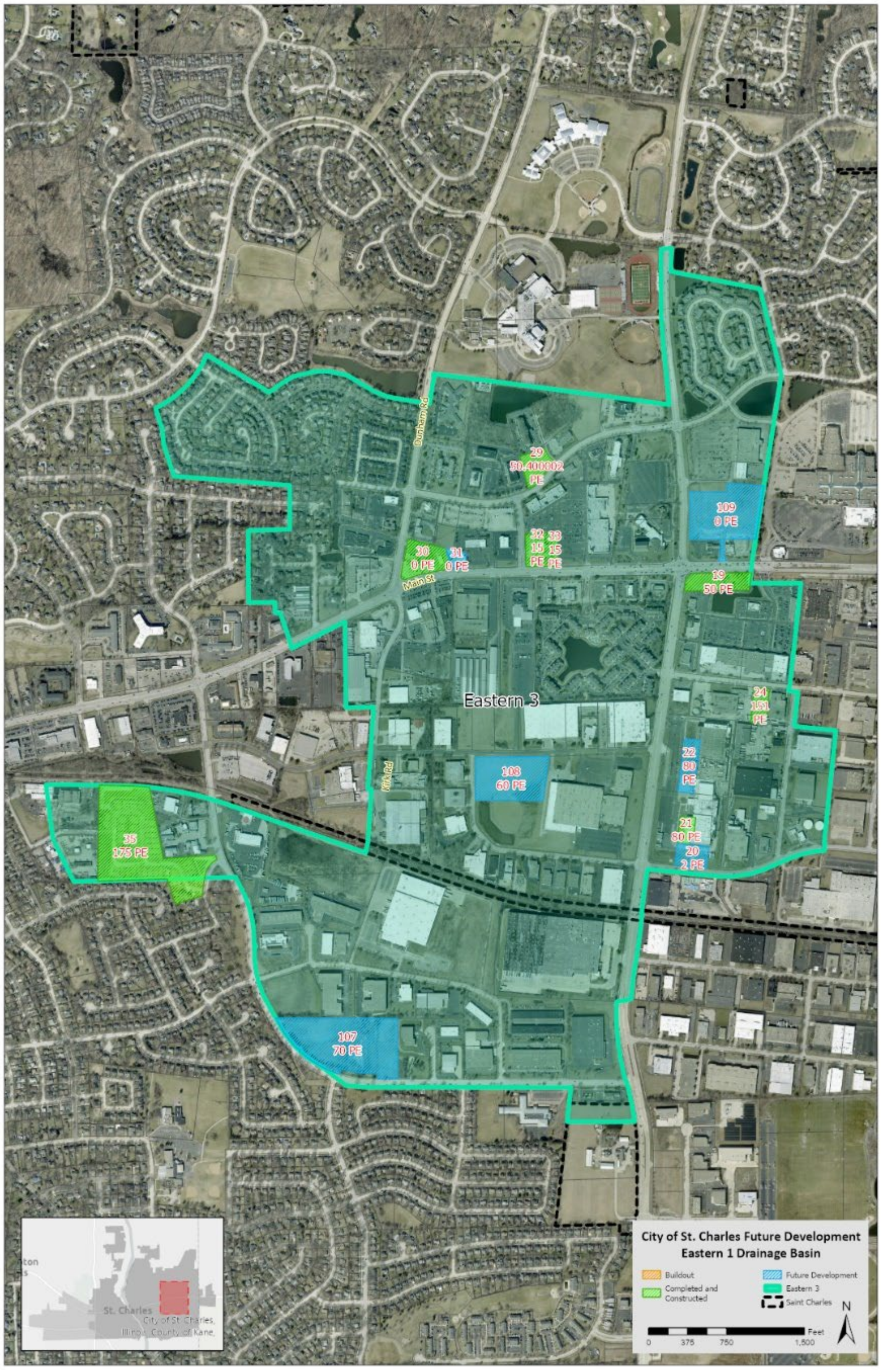


2.4.3 Eastern 3 Drainage Basin

The Eastern 3 basin includes mainly commercial and industrial users in the eastern section of the City. The drainage basin currently includes 9,679 PE.

Exhibit 2-5 on the next page includes the future development in the Eastern 3 Basin. **Error! Reference source not found.** also includes a summary of the future development in the drainage basin. The future development will add approximately 573 Non-Residential PE and 175 Residential PE, for a total additional development of 748 PE at buildout.

Exhibit 2-5: Eastern 3 Basin Future Development

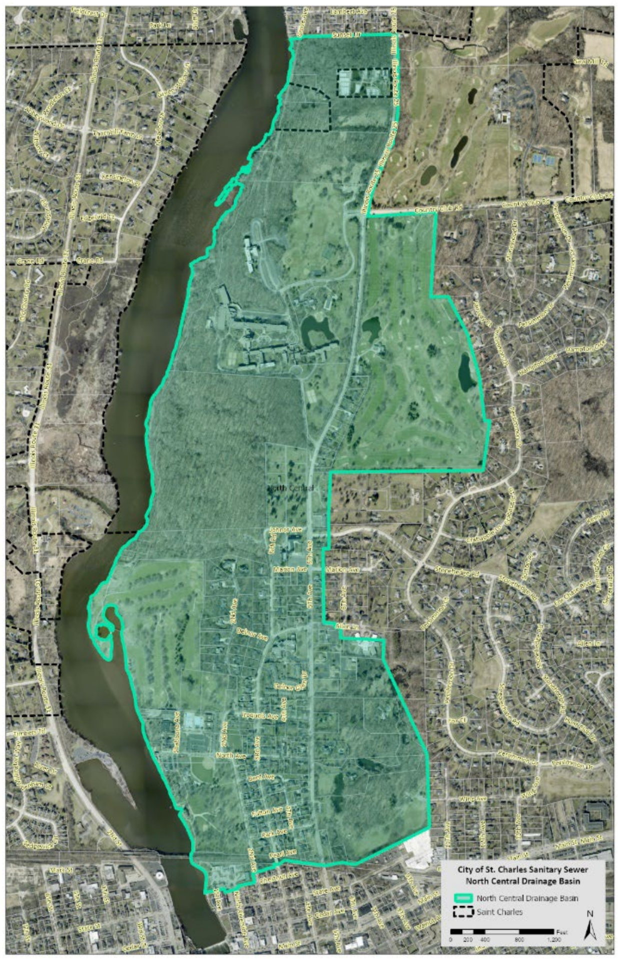


2.4.4 North Central Drainage Basin

The North Central Basin is bordered on the west by the Fox River, from Illinois Route 64 to the northern limits of the City. The basin includes 598 acres of commercial, institutional and residential development. The collection system in this area was constructed from the early 1930's to the early 1990's. The current PE in this drainage basin is 1,675 PE.

The majority of the North Central Basin has been developed, no major development is anticipated. the next page details the future development in the North Central drainage basin.

Exhibit 2-6: North Central Drainage Basin

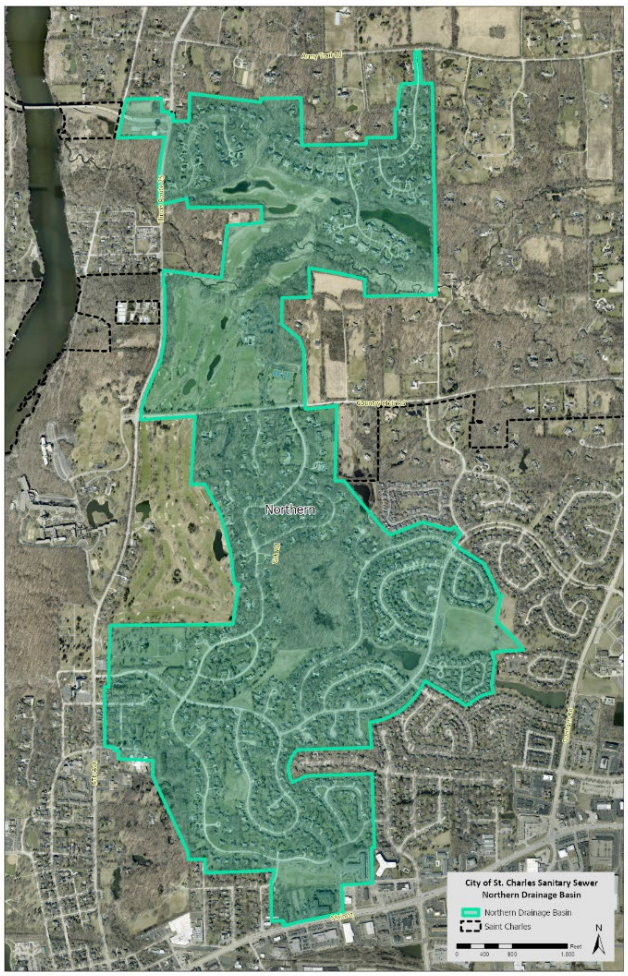


2.4.5 Northern Drainage Basin

The Northern Basin includes 599 acres of circa 1980's residential development. The basin includes two pump stations and extends from Illinois Route 64 north to Army Trail Road, covering 822 total acres. There is currently 3,716 PE in the drainage basin.

The Northern Drainage Basin is not anticipated to have any future development as the majority of the basin has been developed.

Exhibit 2-7: Northern Drainage Basin

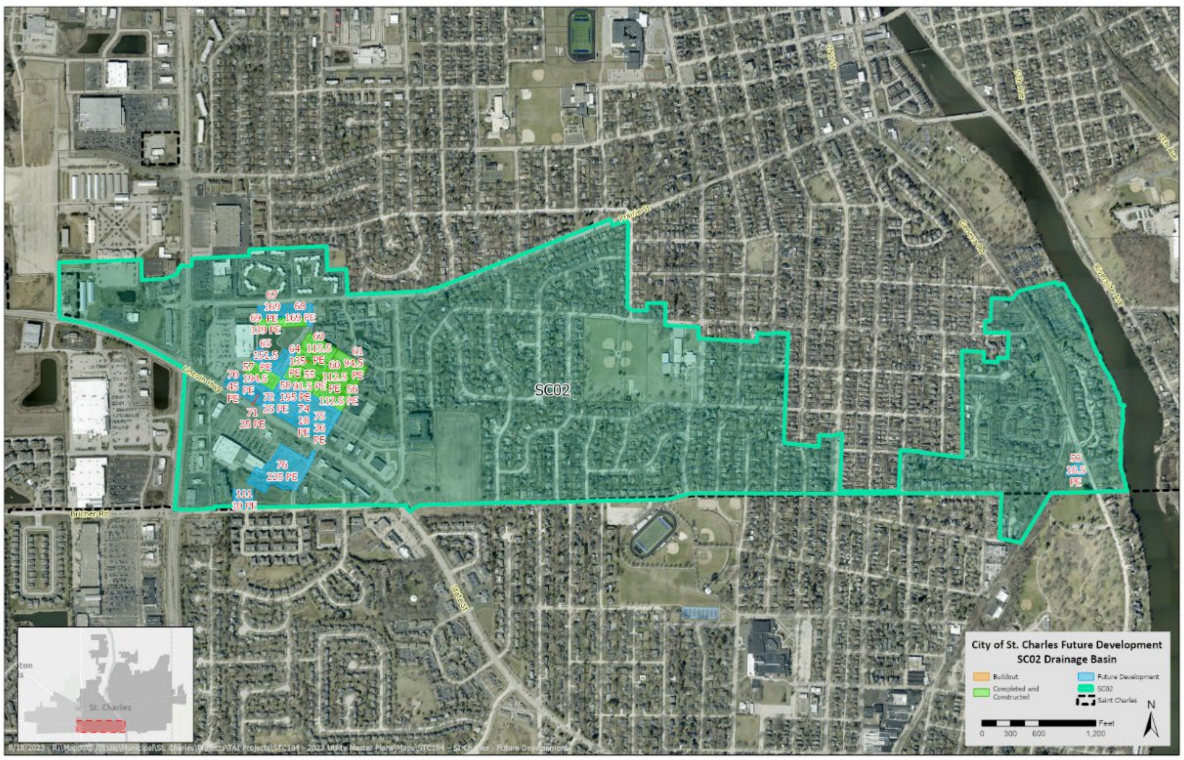


2.4.6 SC02 Drainage Basin

SC-02 is on the City's southwest side. The basin includes 458 acres and serves 3,901 PE. This basin is directly tributary to the South Siphon under the Fox River and ultimately to the Riverside Lift Station.

The City has identified the potential for additional growth within the SC-02 Basin. Both residential and commercial developments have been outlined for this area. The future development will add approximately 548 Non-Residential PE and 1,948 Residential PE, for a total additional development of 2,496 PE at buildout.

Exhibit 2-8: SC02 Drainage Basin Future Development



2.4.7 SC05_R3 and SC05_T1 Drainage Basin

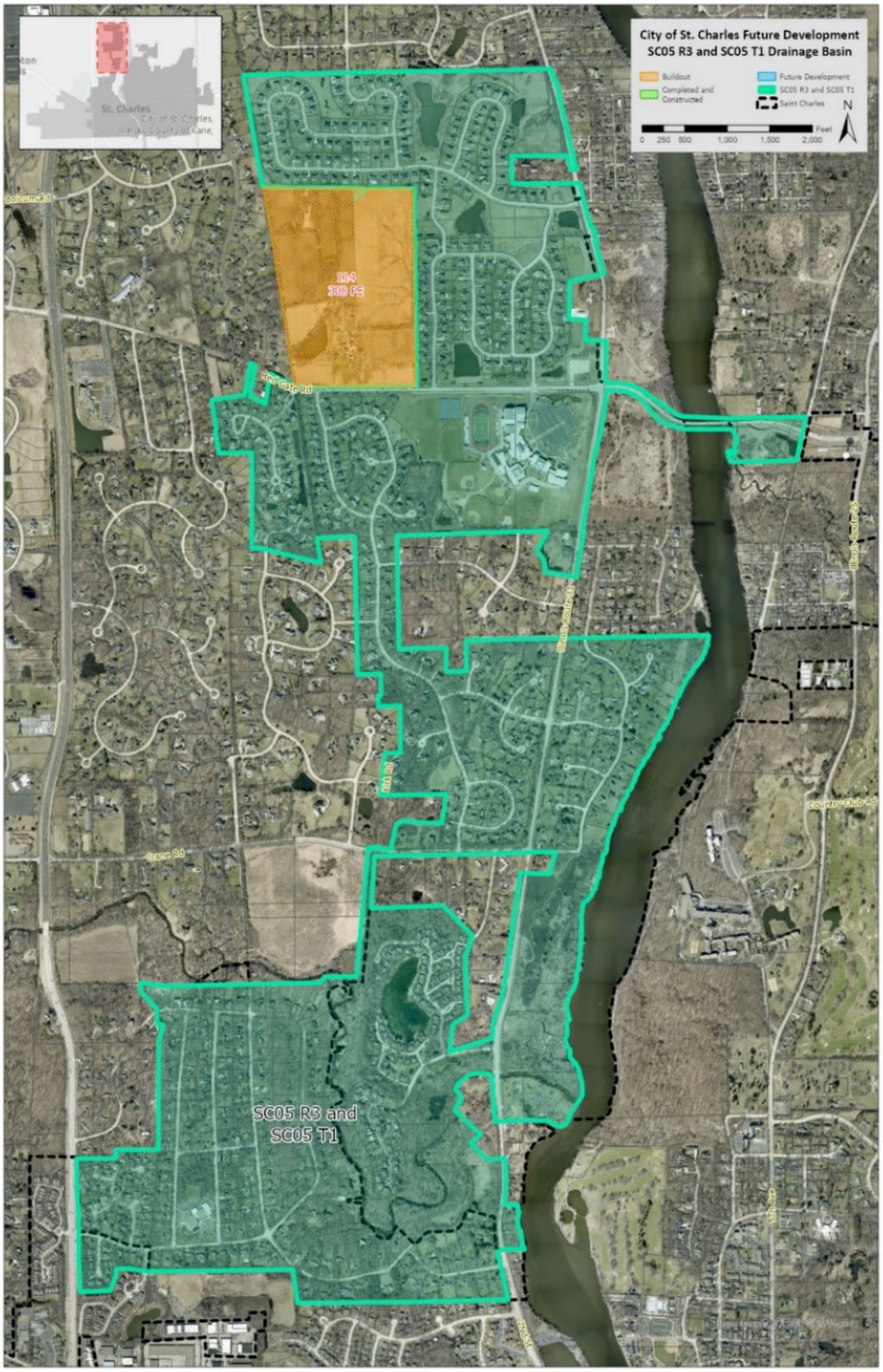
SC-05 is the designation provided to this drainage basin in the 1996 system-wide capacity study.This basin includes eight sub-basins, each of which were treated independently in the 2009 report.

Engineering Enterprises, Inc. completed a 2019 CMOM Annual Update for the City, which was completed in 2020. In the update, several of the City's existing subbasins were combined into drainage basins. In the update, the SC05_R3 and SC05_T1 subbasins were combined into the SC05_R3 and SC05_T1 drainage basin.

The drainage basin currently has 3,133 PE. Residential development has been outlined for this area. The future development will add approximately 308 Residential PE, with that being the additional development at buildout.

Future development in the basin is outlined in the table below for the SC05_R3 subbasin and in **Error! Reference source not found.** on the next page.

Exhibit 2-9: SC05_R3 and SC05_T1 Drainage Basin Future Development



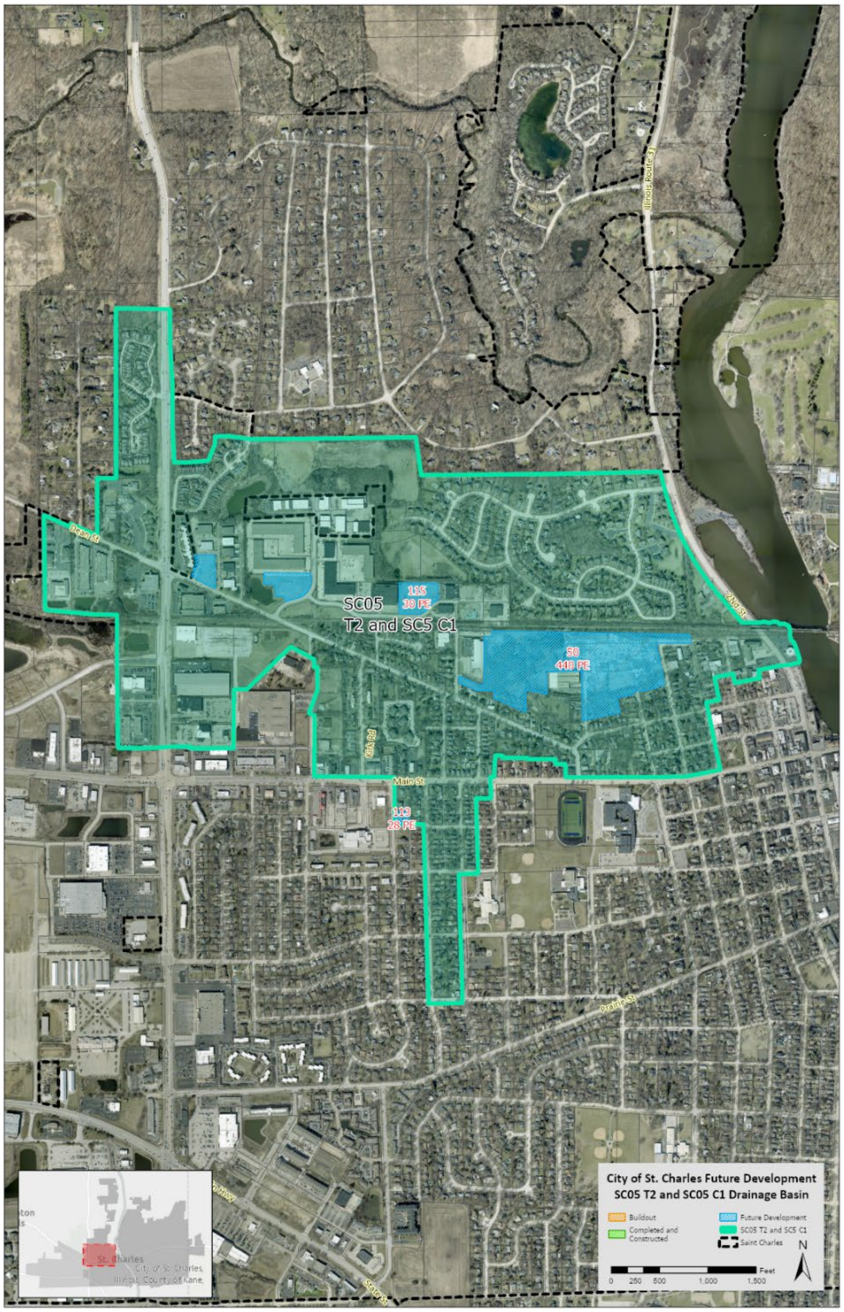
2.4.8 SC05_T2 and SC05_C1 Drainage Basin

The SC05_T1 Basin currently has 2,962 PE. Residential and Commercial development has been outlined for this area. The future development will add approximately 468 Residential PE and 30 Non-Residential PE, for a total future development of 498 PE at buildout.

The future development in the SC05_T2 and SC05_C1 basin is indicated on

Exhibit 2-10 on the next page.

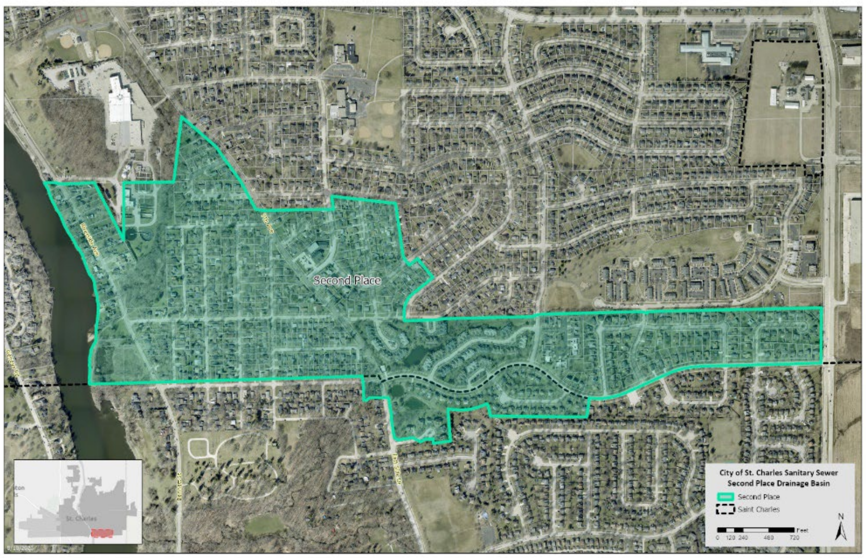
Exhibit 2-10: SC05_T2 and SC05_C1 Drainage Basin Future Development



2.4.9 Second Place Drainage Basin

The Second Place Basin includes 150 acres of residential development along Division Street west of 7th Avenue and an older residential neighborhood east of Seventh Avenue Creek. It also includes established residential development south of Seventh Avenue Creek.

Exhibit 2-11: Second Place Drainage Basin

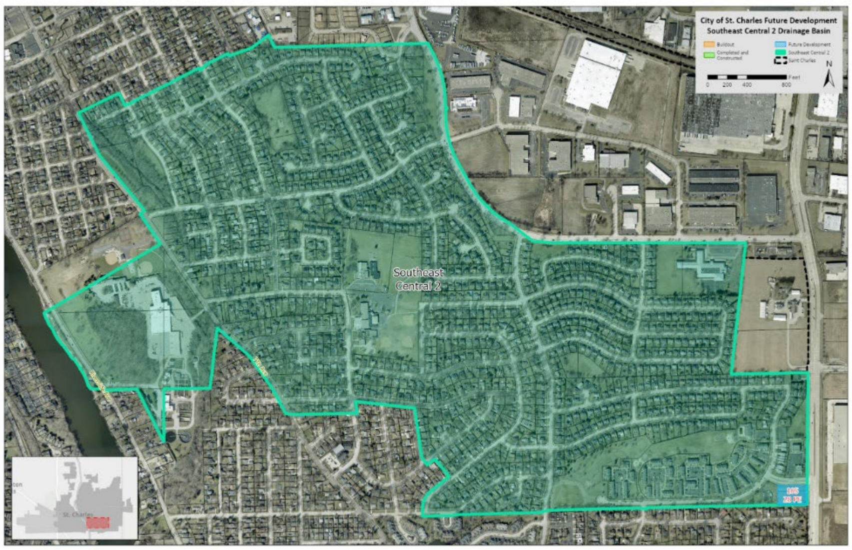


The Second Place Basin currently has 1,858 PE. The Second Place Drainage Basin is not anticipated to have any future development as the basin has been developed.

2.4.10 Southeast Central 2 Drainage Basin

The Southeast Central 2 Drainage Basin includes dense commercial, residential and light industrial users. The Southeast Central 2 drainage basin currently has 3,824 PE. Residential development has been outlined for this area. The future development will add approximately 28 Residential PE, with that being the additional development at buildout.

Exhibit 2-12: Southeast Central 2 Drainage Basin Future Development

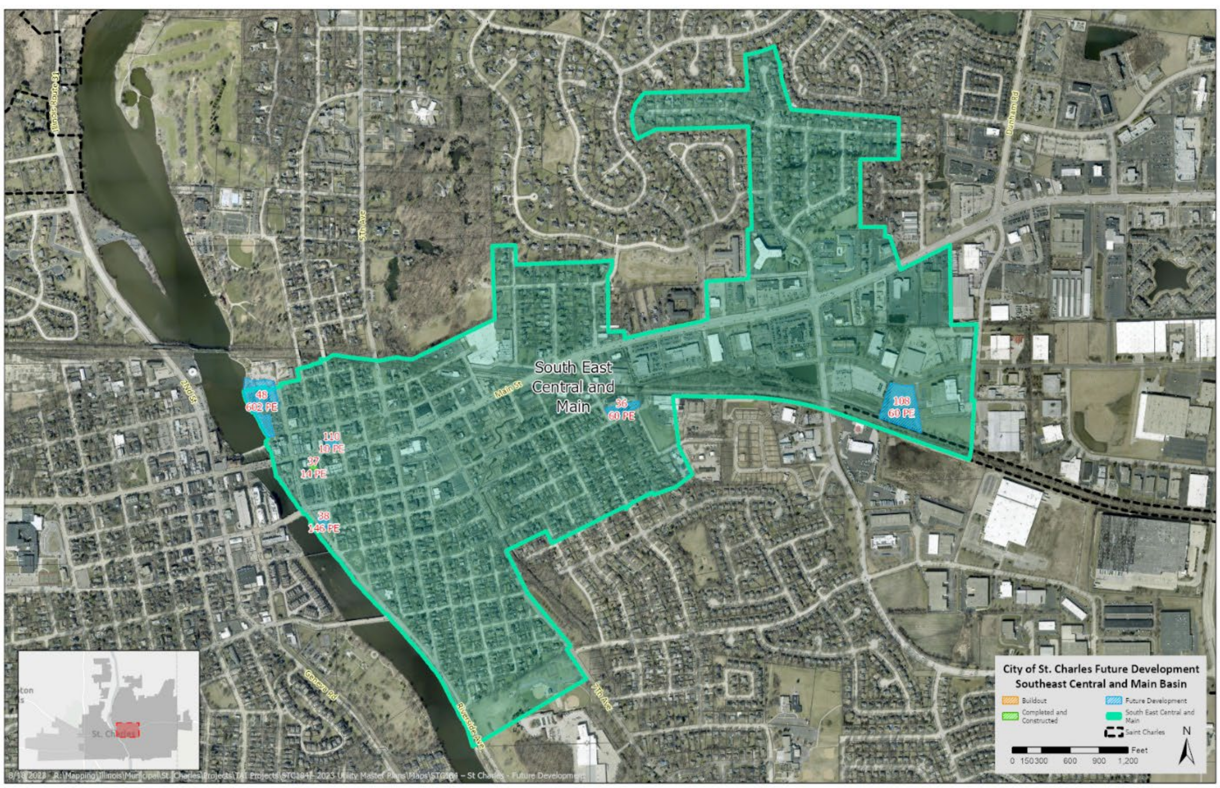


2.4.11 Southeast Central and Main Drainage Basin

The Main Subbasin serves a small area along Main Street (Illinois Route 64) from 14th Avenue to Dunham Road. The subbasin includes residential, commercial and light industrial users . The Southeast Central Subbasin also includes dense commercial, residential, and light industrial users. The current PE in the Southeast Central and Main drainage basin is 3,738 PE.

The Southeast Central and Main Drainage Basin has been identified as a growth area for Residential and Non-Residential Development The future development will add approximately 385 Non-Residential PE and 507 Residential PE, for a total additional development at buildout of 892 PE. Exhibit 2-13 includes future development in the Southeast Central and Main drainage basin.

Exhibit 2-13: Southeast Central and Main Drainage Basin Future Development

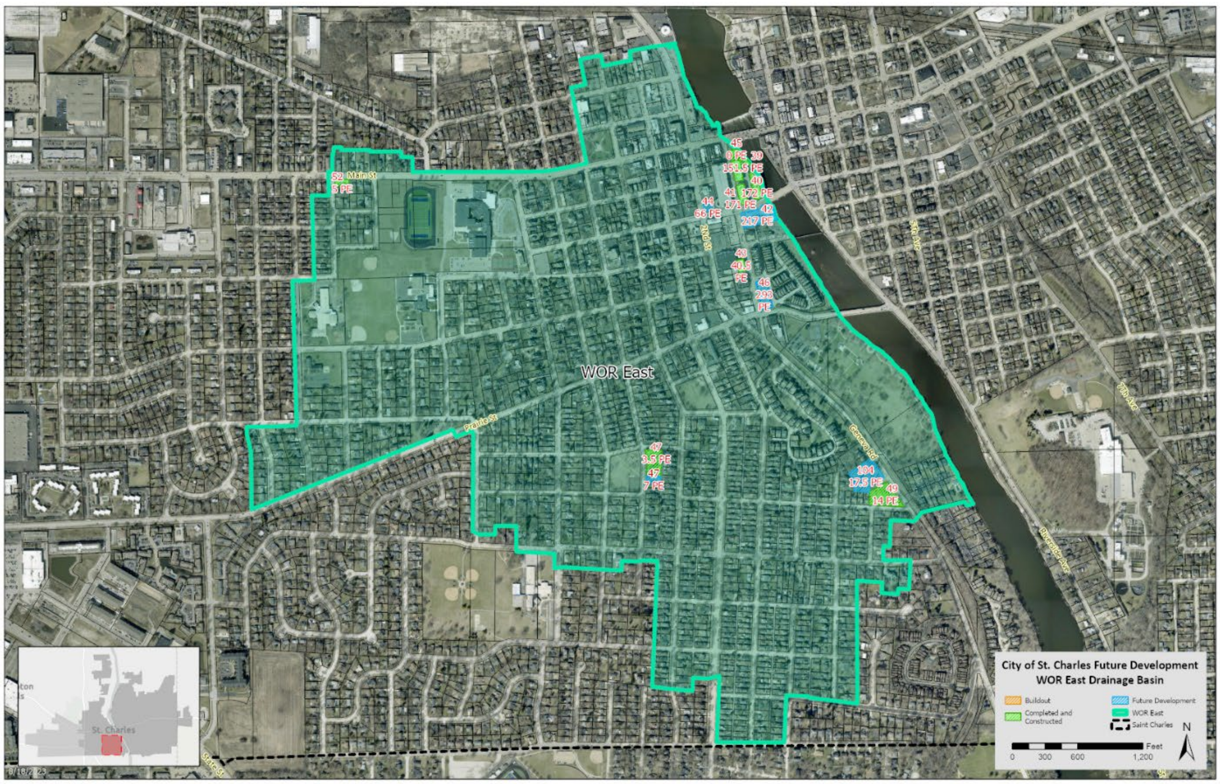


2.4.12 WOR East Drainage Basin

The WOR East Drainage Basin currently has 4,032 PE. The WOR East Drainage Basin includes the following subbasins: SC04, R4, and SC01. The WOR East Drainage Basin has been identified as a growth area for Residential and Non-Residential Development. The future development will add approximately 691.1 Non-Residential PE and 466.9 Residential PE, for a total additional development of 1,158 PE at buildout.

Exhibit 2-14 includes future development in the WOR East Drainage basin.

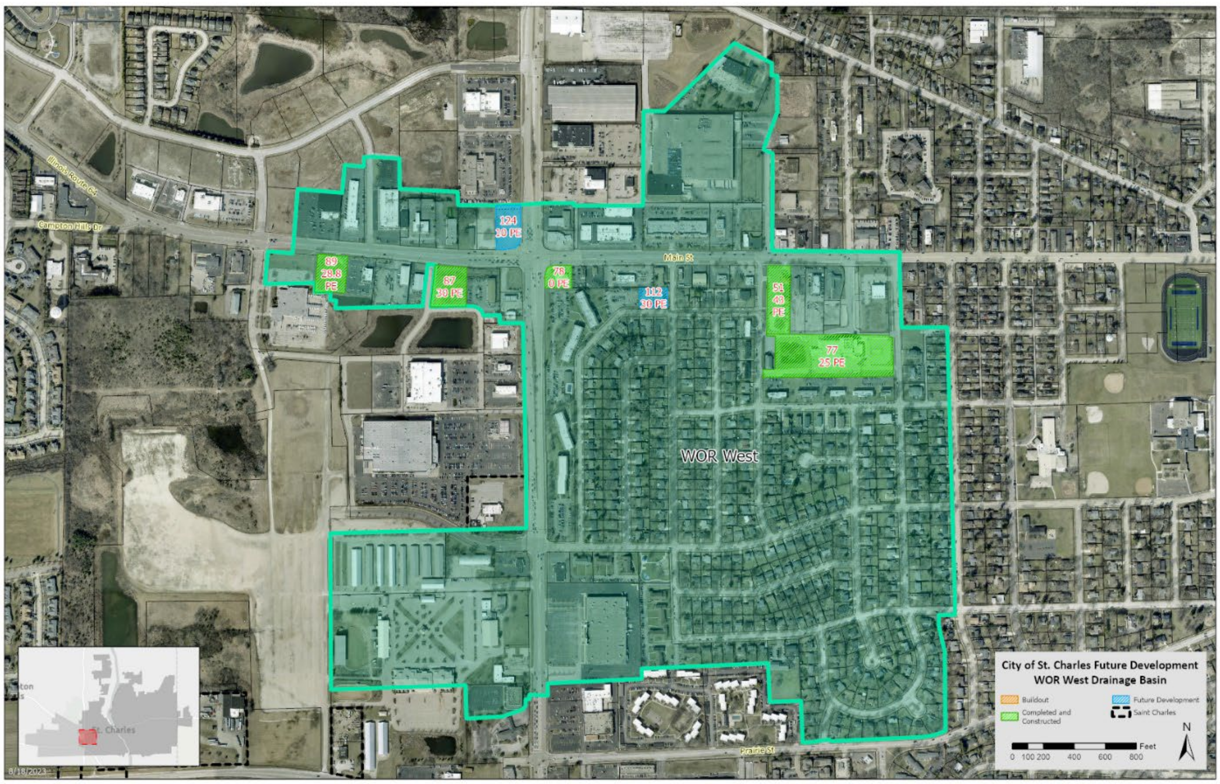
Exhibit 2-14: WOR East Drainage Basin Future Development



2.4.13 WOR West Drainage Basin

The WOR West Drainage Basin currently has 2,418 PE. The WOR West Drainage Basin has been identified as a growth area for Residential and Non-Residential Development The future development will add approximately 68 Non-Residential PE and 40 Residential PE, for a total additional development of 108 PE. Exhibit 2-15 includes a summary of future development in the WOR West drainage basin.

Exhibit 2-15: WOR West Drainage Basin Future Development



2.4.14 Summary of Population Projections

The Main Service Area served 49,016 PE in 2022 and the Main WWTF treated 4.59 MGD of wastewater. Taking into consideration ongoing development, governmental capacity commitments, and potential annexations, the population equivalent of the service area will eventually be increased by 15,021 PE from the 2023 total. This equates to a build-out projection of 64,037 PE at an average daily flow (ADDF) of 6,092,000 gal/day or 6.09 MGD.

Table 2-3: Main Service Area Projected Population and Wastewater Flow

Description	2023 Conditions		Constructed		Future Development		Buildout	
	PE	ADDF (MGD)	PE	ADDF (MGD)	PE	ADDF (MGD)	PE	ADDF (MGD)
Eastern 1	3,854	0.36	3,854	0.36	3,879	0.36	3,879	0.36
Eastern 2	4,495	0.42	7,359	0.71	12,569	1.23	13,254	1.30
Eastern 3	9,679	0.91	10,216	0.96	10,428	0.98	10,428	0.98
North Central	1,675	0.16	1,675	0.16	1,675	0.16	1,675	0.16
Northern	3,716	0.35	3,716	0.35	3,716	0.35	3,716	0.35
SC02	3,901	0.37	5,105	0.49	6,397	0.61	6,397	0.61
SC05_R3 and SC05_T1	3,133	0.29	3,133	0.29	3,133	0.29	3,441	0.32
SC05_T2 and SC05_C1	2,692	0.25	2,692	0.25	3,190	0.30	3,190	0.30
Second Place	1,858	0.17	1,858	0.17	1,858	0.17	1,858	0.17
Southeast Central 2	3,824	0.36	3,824	0.36	3,852	0.36	3,852	0.36
Southeast Central and Main	3,738	0.35	3,752	0.35	4,630	0.44	4,630	0.44
WOR East	4,032	0.38	4,576	0.43	5,190	0.49	5,190	0.49
WOR West	2,418	0.23	2,486	0.23	2,526	0.24	2,526	0.24
Total	**49,016**	**4.590**	**54,247**	**5.113**	**63,044**	**5.993**	**64,037**	**6.092**
Peaking Factor		**2.27**		**2.23**		**2.17**		**2.17**
Peak Hourly Flow (MGD)		**10.43**		**11.41**		**13.02**		**13.20**

Table 2-4: Main Service Area Commitments and Remaining Capacity

Description	Wastewater Committed (MGD)
Annual Average Wastewater Flow	4.590
Expected Avg. Flow with Constructed Development	5.113
Expected Avg. Flow with Future Development	5.993
Expected Avg. Flow at Buildout	6.092

The current Main WWTF has a capacity of 9,000,000 gallons per day (9.0 MGD). The updated 2022 wastewater projections for this service area are 4.59 MGD metered flow.

The Illinois EPA places a facility under critical review when the average daily flow reaches 80% of the rated capacity. This occurs when flows reach 7.2 MGD at the Main WWTF. Based on the the build-out conditions of the plant to be 6.09 MGD, it is unlikely future development will exceed the capacity of the Main WWTF.

2.5 WEST SIDE SERVICE AREA INFILTRATION AND INFLOW

2.5.1 Infiltration

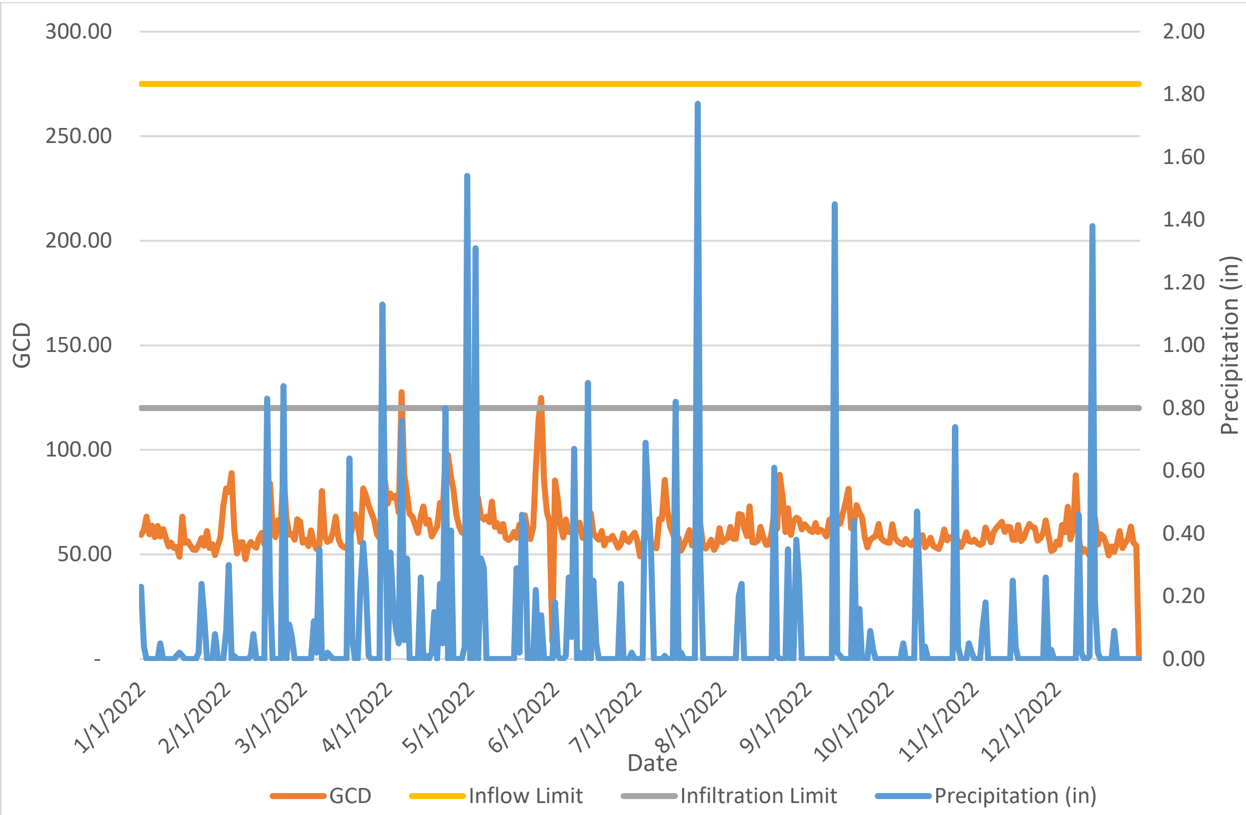
The USEPA considers average annual infiltration to be excessive if it exceeds 50 gcd. The current estimated population equivalent within the West Side WRF's service area is 7,351 PE. We have estimated the amount of infiltration by comparing the water usage records with the plant effluent records. The average water usage per population equivalent is 62.1 gcd. The average wastewater received per population equivalent is 62.2 gcd. The differential is approximately 0.1 gcd, which is 0.2% of the USEPA's criteria. As the system ages it is anticipated that the infiltration will increase due to pipe degradation, however at this time the system is tight and the City doesn't experience large amounts of infiltration.

Based on total current PE and the USEPA definition of excess infiltration (120 gcd during periods of high groundwater), the West Side WRF experiences excess infiltration when flows exceed 0.88 MGD. In 2022, 24-hour total influent exceeded 0.88 MGD a total of 2 times during rain events.

2.5.2 Inflow

The USEPA considers inflow to be excessive in separate sanitary sewer systems if the total flow, (water usage plus infiltration plus inflow) exceeds 275 gcd. Based on total current PE and the USEPA definition of excess infiltration (275 gcd during storm events where there are no basement back-ups), the West Side WRF experiences excess inflow when flows exceed 2.02 MGD. In 2022, the 24-hour total influent did not exceed 2.02 MGD.

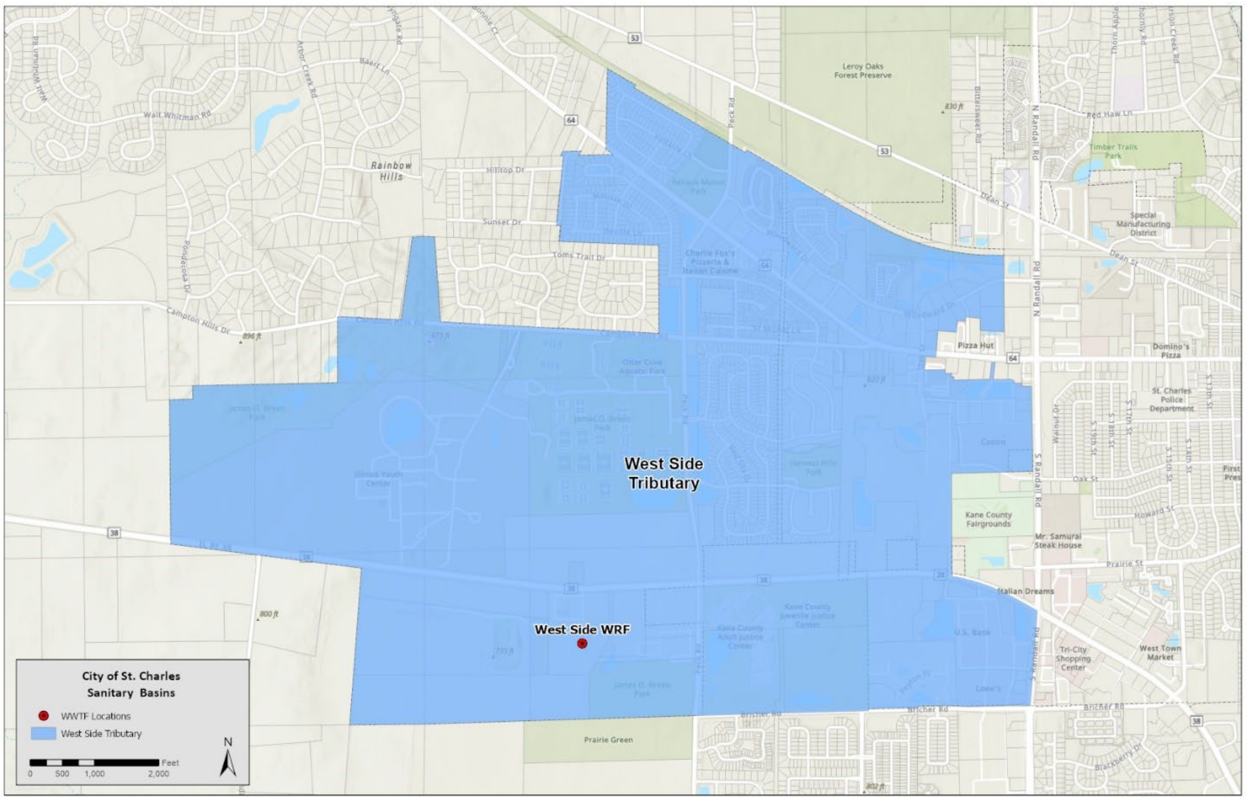
Figure 2-2: West Service Area Infiltration/Inflow vs Per Capita Influent Flow (GCD) (2022)



2.6 WEST SIDE SERVICE AREA FUTURE POPULATION PROJECTIONS

To accurately evaluate the City's future wastewater demands for the West Side WRF Service Area, the following data was reviewed and established:

Exhibit 2-16: West Side Service Area Drainage Basin



- Current number of users.
- Estimated future users (determined from information regarding developments currently under construction or approved by the City of St. Charles).
- Potential number of users from the remaining undeveloped properties located within the boundaries of the City's current and future service area.

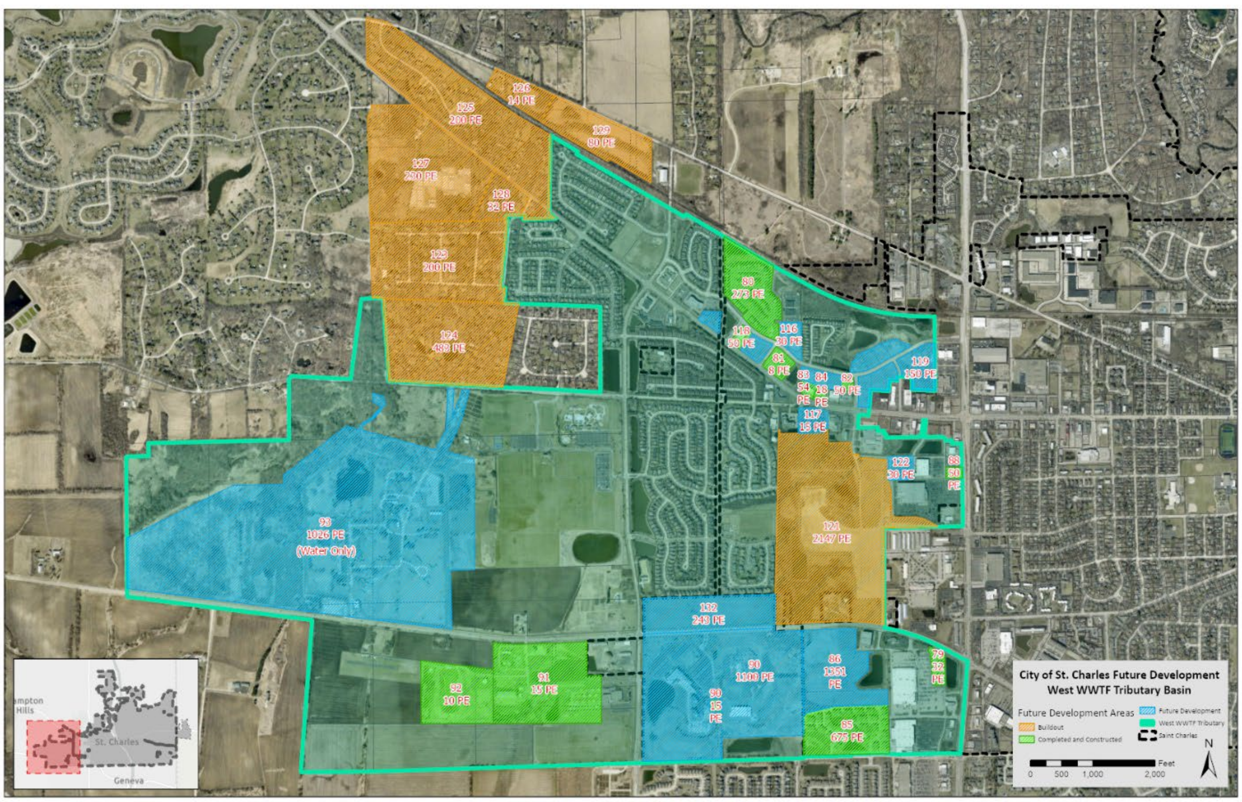
The West Side Service Area currently contains one drainage basin, with 4 subbasins. The drainage basin and its subbasins were analyzed to establish the 2022 Conditions and Build-Out Population Equivalents.

2.6.1 West WWTF Tributary Drainage Basin

The West WWTF Tributary Drainage Basin includes the entire West Service Area, with all flows tributary to the West Side WRF. There is currently 7,351 PE in the West WWTF Tributary Drainage Basin. The Pine Ridge Subbasin, Renaux Manor Subbasin, and the Zylstra Subbasins are all located in the West WWTF Tributary Drainage Basin.

Exhibit 2-17 below includes future development located in the West WWTF Tributary Basin. Both residential and commercial development has been slated for the area. At buildout, the developments will add approximately 4,225 Residential PE, and 3,940 Residential PE, for a total additional PE at buildout of 8,165 PE. Appendix D includes summaries of the future development located in the Pine Ridge, Renaux Manor, Zylstra, and Gravity subbasins of the West WWTF Tributary Drainage Basin.

Exhibit 2-17: West WWTF Tributary Drainage Basin Future Development



Pine Ridge Subbasin

The Pine Ridge Subbasin is tributary to the Pine Ridge Lift Station located at the intersection of Oak Street and Woodward Drive. This area contains the Regency Estates subdivision and Pine Ridge commercial development. The current PE in this subbasin is 174. Since the 2019 Facility Plan, several commercial lots have been constructed along Rt. 64 west of Randall Road.

Commercial development (retail or office space) is planned for a large portion of the subbasin (shown in green and blue). This commercial development is projected to add approximately 272 PE. The remaining property within this subbasin is designated as open space for stormwater drainage or public land use. This equates to a build-out total of 446 PE with a projected average daily flow of 0.04 MGD.

Renaux Manor Subbasin

The Renaux Manor Subbasin is tributary to the Renaux Manor Lift Station located on Campton Hills Drive. This service area encompasses the land that is north of Campton Hills Drive and west of the intersection with Route 64. From the 2022 water billing records, this area was estimated to use 147,359 gallons per day, which equates to 2,372 PE.

There are also multiple properties within the City's corporate boundary that are currently not served by public sewers. Since the 2019 Facility Plan, the Anthem Heights development has been constructed. The following table provides a breakdown of the properties with potential for development. This equates to a build-out total of 4,649 PE with a projected average daily flow of 0.38 MGD.

Zylstra Subbasin

In 2006, this area was not tributary to the West Side WRF. In 2007, the Zylstra Lift Station was constructed near the intersection of Route 64 and Randall Road to serve the Zylstra Harley Davidson Dealership (now Fox River Harley Davidson) and future development of the Zylstra property. Upon the completion of the lift station, the existing sanitary sewer serving the nearby Post Office, Amcore Bank and Oak Street Water Filtration Facility was rerouted from the City's Main WWTF Service Area to the Zylstra Lift Station.

Well #13 at the Oak Street Water Filtration Facility backwashes regularly and discharges to the Zylstra drainage basin. The backwash is estimated to be 8,927 gpd, or 144 PE. Existing non residential water usage equates to an average 13,244 gpd, or 213 PE. There is no residential usage in the Zlystra subbasin. As noted in Section 4, with the completion of the Well 7/13 Interconnect project, the PE associated with the Oak St. backwash will not longer be tributary to the Zlystra drainage basin. Therefore, the PE in the subbasin will be reduced to only that associated with Zlystra property.The water billing and projected usages for these properties are detailed in the table below.

Table 2-5: Zylstra Subbasin – Water Billing and Wastewater Projections

Description	Water Used (GPD)	PE	Wastewater Used (gpd)
Nonresidential Usage	13,244	213	13,259
Oak St Water Treatment		144	8,927
Total	**13,244**	**357**	**22,186**

The future development in this subbasin is limited and no future plans have been presented except for building out the Zylstra property outlots. The outlots are estimated to contribute an additional 153.8 PE. The addition of these properties gives a build-out population equivalent of 511 PE.

Gravity WWTF Subbasin

The Gravity WWTF Subbasin is directly tributary to the West Side WRF. This subbasin encompasses the area west of Randall Road between Campton Hills Drive and Bricher Road to the western limits of the City's corporate boundary. The 2022 water and sewer billing records indicated that this area contains approximately 2,536 PE without IYC. With IYC, the PE in this area is 4,447.

2022 meter data from the Illinois Youth Center and flow estimates from the Kane County Judicial Center and the IDOT maintenance garage indicate a total discharge of 118,877 gallons per day. It is also estimated the Illinois Department of Transportation utiltizes an estimated 1,000 gallons per day of wastewater transmitted at their facility at the intersection of Peck Road and Route 38.

Table 2-6: Gravity WWTF Subbasin– Water Billing and Wastewater Projections

Description	Water Used (GPD)	PE	Wastewater Used (GPD)
IYC – Wastewater Received		1,079	67,132
KCJ – Wastewater Received		816	50,745
IDOT – Estimated Wastewater Received		16	1,000
Gravity Subbasin Service Area	157,516	2,536	157,699
Total	**157,516**	**4,447**	**276,576**

The St. Charles Park District owns and operates a water park in the gravity drainage basin, named Otter Cove Water Park. The waterpark is a large water user for the City, and is one of the largest users on the West Side. Although the water usage is high for this facility, all of the water is not returned to the West Side WRF for treatment. Several types of losses are possible, evaporation, over spray, and splashing. During operation, only the backwash water from Otter Cove is sent to the West Side WRF. At the end of each season, the pool is drained and the water is sent down the storm sewer, and does not return to the West Side WRF.

Appendix D indicates constructed development, future development and buildout properties to be served within the Gravity Subbasin. It is estimated that the developments and properties could add 2,147 PE to the subbasinfor a build-out total of 9,909 PE. Based on a future daily usage of 100 gallons per day per PE, it is estimated that these developments could produce an addtional 214,700 gallons of wastewater per day.

The below table includes buildout property located in the Gravity WWTF Subbasin that is included in the total buildout PE in the subbasin.

Table 2-7: Potential Service Area Expansion

Description	Additional PE	Wastewater (gpd)
ID #133 – Far West Undeveloped Farmland – Undeveloped farmland that is not within the current service area but may be added in the future.	525	52,500
Total	**525**	**52,500**

2.6.4 Summary of Population Projections

The West Side Service Area served 7,351 PE in 2022 and the West Side WRF treated 0.457 MGD of wastewater. Taking into consideration constructed and future development the population equivalent of the service area will eventually be increased to 11,403 PE. This equates to a build-out projection of 15,516 PE at an average daily flow (ADDF) of 1,270,000 gal/day or 1.27 MGD.

Table 2-8: West Side WRF Service Area Projected Population and Wastewater Flows

Description	2023 Conditions		Constructed		Future Development		Buildout	
	PE	ADDF (MGD)	PE	ADDF (MGD)	PE	ADDF (MGD)	PE	ADDF (MGD)
Renaux Manor Subbasin	2,372	0.15	2,703	0.18	2,733	0.18	4,649	0.38
Pine Ridge Subbasin	174	0.01	296	0.02	446	0.04	446	0.04
Zylstra Subbasin	357	0.02	466	0.03	511	0.04	511	0.04
Gravity Subbasin	4,447	0.28	5,261	0.36	7,712	0.60	9,859	0.82
Gravity WWTF Tributary Basin Total	**7,351**	**0.457**	**8,727**	**0.60**	**11,403**	**0.86**	**15,466**	**1.27**
Peaking Factor		3.09		3.01		2.90		2.76
Peak Hourly Flow (MGD)		1.41		1.79		2.50		3.51

Table 2-9: West Side WRF Commitments and Remaining Capacity

Description	Wastewater Committed (MGD)
2018-2022 Flow Average [1]	**0.540**
Expected Avg. Flow with Constructed Development	**0.678**
Expected Avg. Flow with Future Development	**0.945**
Expected Avg. Flow at Buildout	**1.351**
[1] = 5-year Flow Average utilized for flows projections due to 2022 being a drought year.	

The current West Side WRF has a capacity of 1,050,000 gallons per day (1.05 MGD). The average 2018-2022 wastewater flows for this service area are 0.54 MGD metered flow.

The Illinois EPA places a facility under critical review when the average daily flow reaches 80% of the rated capacity. This occurs when flows reach 0.84 MGD at the West Side WRF. Based on the current flows and constructed development of 0.68 MGD and the build-out conditions of the plant to be 1.35 MGD, the West Side WRF's capacity must be addressed to accommodate existing and future development.

Section 3

Collection System

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3. Collection System

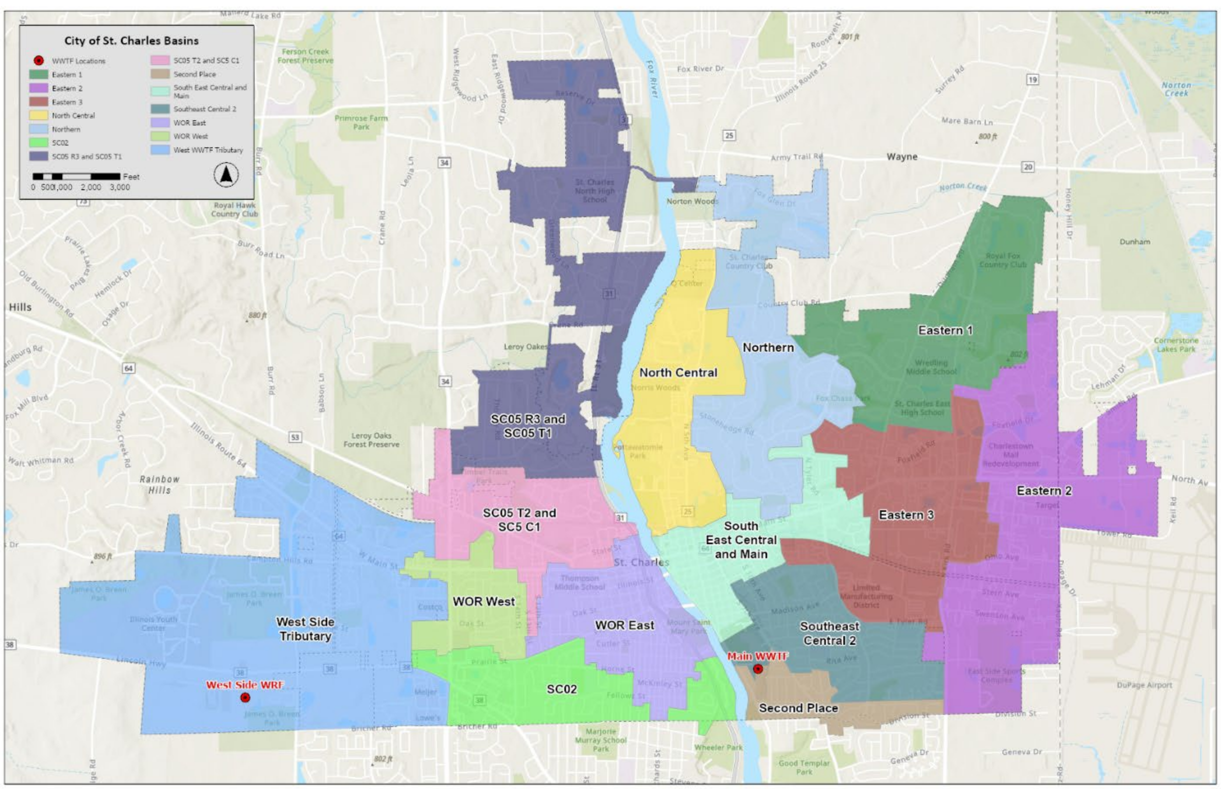
3.1 General

The City of St. Charles wastewater collection system includes two service areas generally divided by Randall Road.

The sanitary sewers west of Randall Road are tributary to the West Side Water Reclamation Facility (WRF). This service area is relatively new, and the sewers have been constructed with modern materials, which minimize infiltration and inflow.

The sanitary sewer system east of Randall Road is tributary to the Main WWTF. The sewers within this collection system are of varying age and condition. As with many older collection systems, infiltration and inflow is a concern. Recognizing the importance of removing infiltration and inflow from the collection system, the City of St. Charles has developed a rigorous maintenance program including flow monitoring, root cutting, grouting, sewer lining, and other rehabilitation and replacement of the collection system.

Exhibit 3-1: City of St. Charles Wastewater Drainage Basins



The City has developed an extensive televising, cleaning and inspection program for the entire collection system. The collection system was divided into four quadrants (NE, SE, NW, and SW). The north/south dividing line is the Fox River that runs through the heart of downtown St. Charles and the east/west dividing line is Route 64. This is a continuous program that will be repeated upon completion. This will assist the City in identifying problem locations for future projects. As of the City's 2019 CMOM Update, approximately 90% of the City's sanitary sewers have been inspected, and approximately 7% of the City's sewers have been lined since 2009.

In addition to the inspection and cleaning program, the City has identified that I/I is a large problem. The City has addressed the majority of the locations where spot repairs were needed. As a result of the repairs, the City has reduced a substantial amount of I/I. However, some locations continue to experience I/I. The City recognized that a large portion of I/I is a result of large private entities (schools, businesses and churches) not having the proper inspections during construction and the potential for illegal connections. The City plans on inspecting these locations to continue the reduction of I/I throughout the collection system.

The City also developed a CMOM Program in accordance with the Main WWTF NPDES Permit, and it addresses the needs of the entire collection system. In 2020, Engineering Enterprises Inc. completed a 2019 CMOM Annual Update for the City. The annual update included a recommended 3-step implementation schedule which was completed for subbasin evaluation and rehabilitation of I/I in the City's sanitary sewers. It was noted by the City that $500,000 is budgeted annually for sanitary sewer lining. The City completes sanitary sewer lining in zones that need to be rehabilitated. This report section will revisit each of the drainage basins, the recommendations of the 2019 CMOM annual update report, and the proposed or completed solutions.

The collection system is composed of roughly 910,000 feet of sanitary sewers, 31,000 feet of force main, and 5,100 manholes. For planning purposes, the value of the system components can be estimated to project a total system asset value. As shown in the table below, the existing City of St. Charles collection system value is estimated at approximately $370 Million.

Based on straight-line depreciation and a seventy-five-year service life for this infrastructure, an average of $4.98 Million would need to be reinvested annually into the collection system. It is highly recommended that the City move towards fully funding this collection system replacement program. This budgetary amount would need to be increased by the Construction Cost Index (CCI) each year, which has averaged 5% over the past decade. This annual reinvestment should be prioritized based on a number of criteria including main diameter, age, repair/lining history, soil conditions, and other factors specific to the City's needs.

Table 3-1: Collection System Asset Summary

Gravity Main				Force Main			
Diameter	Feet	Miles	%	Diameter	Feet	Miles	%
4"	466	0	0.05%	4"	6,291	1.2	20.37%
6"	13,387	3	1.47%	6"	12,824	2.4	41.53%
8"	660,934	125	72.47%	8"	8,056	1.5	26.09%
10"	71,679	14	7.86%	10"	0	0	0.00%
12"	52,599	10	5.77%	12"	1,614	0.3	5.23%
14"	3,011	1	0.33%	14"	0	0.0	0.00%
15"	39,470	7	4.33%	15"	0	0.0	0.00%
16"	4,515	1	0.50%	16"	1,348	0.3	4.37%
18"	13,678	3	1.50%	18"	0	0	0.00%
20"	422	0	0.05%	20"	0	0	0.00%
21"	14,218	3	1.56%	21"	0	0	0.00%
24"	18,040	3	1.98%	24"	743	0.1	2.41%
27"	12,352	2	1.35%	27"	0	0	0.00%
30"	1,155	0	0.13%	30"	0	0	0.00%
36"	5,769	1	0.63%	36"	0	0	0.00%
48"	275	0	0.03%	48"	0	0	0.00%
Total	**911,970**	**173**	**100%**	Total	**30,876**	**6**	**100%**

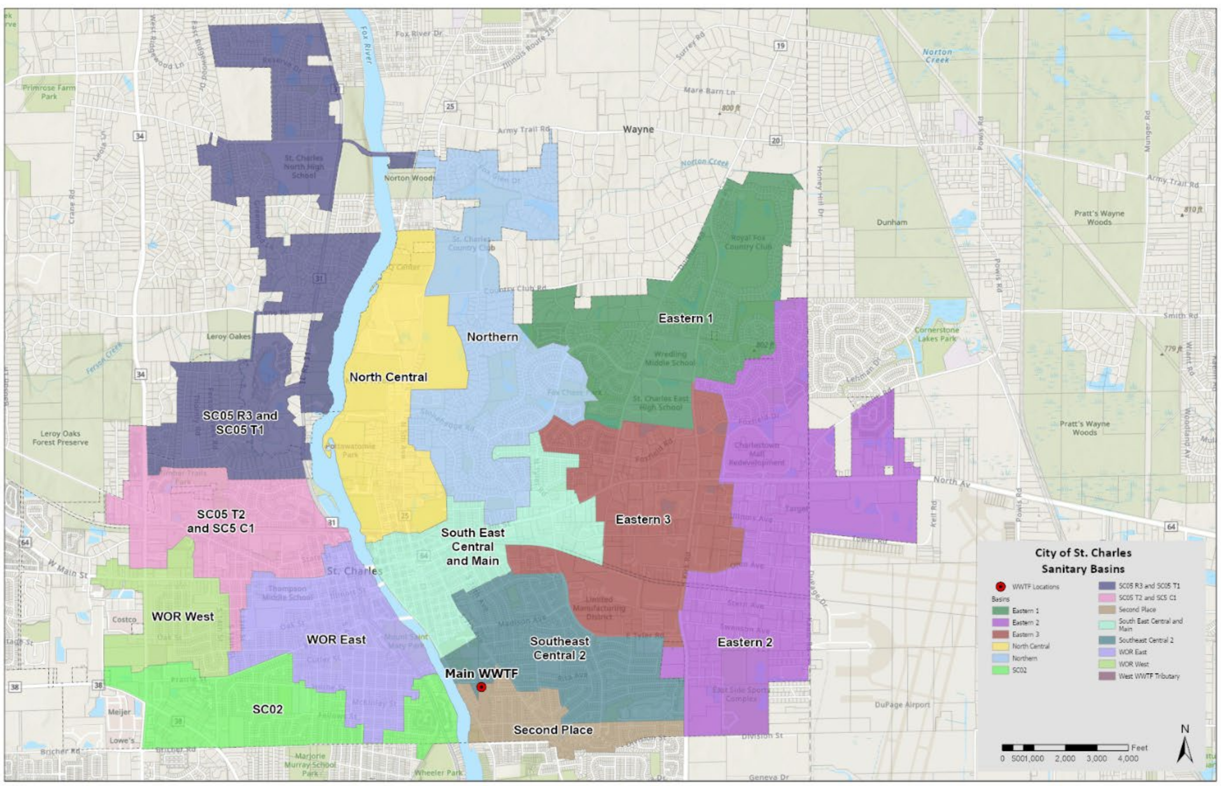
Table 3-2: Collection System Asset Replacement Summary

Total Sanitary Sewer Lines			
System Asset	Quantity	Unit cost	Total Replacement cost ($ Million)
4"	6,756	$350	$2.36
6"	26,211	$350	$9.17
8"	668,989	$350	$234.15
10"	71,679	$360	$25.80
12"	54,213	$400	$21.69
14"	3,011	$480	$1.45
15"	39,470	$600	$23.68
16"	5,863	$600	$3.52
18"	13,678	$630	$8.62
20"	422	$650	$0.27
21"	14,218	$690	$9.81
24"	18,783	$690	$12.96
27"	12,352	$980	$12.11
30"	1,155	$980	$1.13
36"	5,769	$1,110	$6.40
48"	275	$1,600	$0.44
Total	**942,845**		**$373.56**
Total Annual Replacement (75-Yr.)			**$4.98**

3.2 MAIN SERVICE AREA DRAINAGE BASINS

The collection system within the Main Service Area has been separated into 13 major drainage basins, with subbasins. Each subbasin is tributary to its own dedicated interceptor sewer or regional lift station. Thorough analysis of the drainage basin and its subbasins have been determined and are detailed in this Section. The remaining capacity in each pipe can then be monitored to determine if their size must be increased or if additional interceptor sewers are needed to accommodate flow from future development. While the City has made a commitment to improving the condition of the existing collection system, it also recognizes that infiltration and inflow cannot be completely eliminated.

Exhibit 3-2: Main WWTF Service Area Wastewater Drainage Basins



The City of St. Charles' Finance Department maintains its GASB 34 Report, however, the collection system is not broken out by treatment facility. Therefore, the actual value of this asset for the Main Service Area is not known. It has been estimated that the City currently maintains 179 miles of sanitary sewer mains (gravity and force main), as well as roughly 5,100 active sanitary manholes and 19 lift stations in the Main Service Area and West Side Service Area. The collection system tributary to the Main WWTF consists of approximately 161 miles of sanitary sewer mains (gravity and force main), and 16 lift stations.

Table 3-3 and Table 3-4 on the next two pages provide a breakdown of the projected build-out population equivalent, Average Dry Weather Flow (ADDF) and calculated Peak Hourly Flow for each drainage basin.

Table 3-3: Main Service Area Drainage Basins Existing Conditions

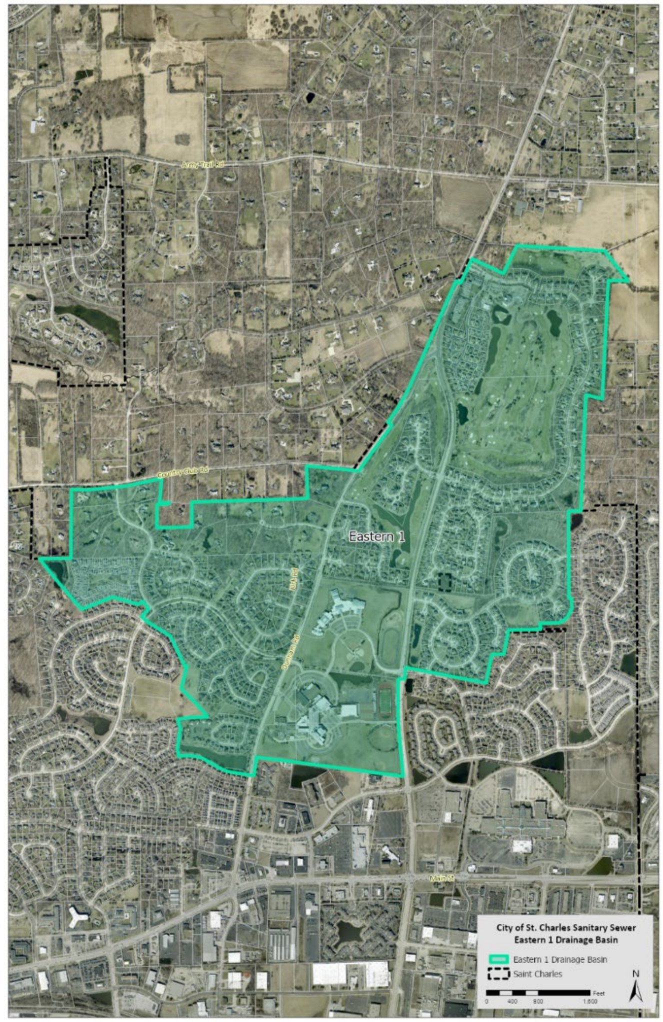
Description	2023 Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Eastern 1	3,854	0.36	3.35	1.21
Eastern 2	4,495	0.42	3.29	1.38
Eastern 3	9,679	0.91	2.97	2.69
North Central	1,675	0.16	3.64	0.57
Northern	3,716	0.35	3.36	1.17
SC02	3,901	0.37	3.34	1.22
SC05_R3 and SC05_T1	3,133	0.29	3.43	1.01
SC05_T2 and SC05_C1	2,692	0.25	3.48	0.88
Second Place	1,858	0.17	3.61	0.63
Southeast Central 2	3,824	0.36	3.35	1.20
Southeast Central and Main	3,738	0.35	3.36	1.18
WOR East	4,032	0.38	3.33	1.26
WOR West	2,418	0.23	3.52	0.80
Total	**49,016**	**4.590**	**2.27**	**10.43**
Peaking Factor		**2.27**		
Peak Hourly Flow (MGD)		**10.43**		

Table 3-4: Main Service Area Drainage Basins Buildout Conditions

Description	Buildout Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Eastern 1	3,879	0.36	3.35	1.22
Eastern 2	13,254	1.30	2.83	3.67
Eastern 3	10,428	0.98	2.94	2.88
North Central	1,675	0.16	3.64	0.57
Northern	3,716	0.35	3.36	1.17
SC02	6,397	0.61	3.14	1.93
SC05_R3 and SC05_T1	3,441	0.32	3.39	1.10
SC05_T2 and SC05_C1	3,190	0.30	3.42	1.03
Second Place	1,858	0.17	3.61	0.63
Southeast Central 2	3,852	0.36	3.35	1.21
Southeast Central and Main	4,630	0.44	3.28	1.44
WOR East	5,190	0.49	3.23	1.59
WOR West	2,526	0.24	3.50	0.83
Total	**64,037**	**6.092**	**2.17**	**13.20**
Peaking Factor		**2.17**		
Peak Hourly Flow (MGD)		**13.20**		

3.2.1 Eastern 1 Drainage Basin

Exhibit 3-3: Eastern 1 Drainage Basin



The Eastern 1 drainage basin includes 794 acres of mainly residential development with some institutional development. The developments date from the 1960's to the present. Areas included within this basin are bordered by the Royal Fox subdivision to the north and include areas from roughly Dunham Road to the eastern City limits. The collection system in this area is tributary to the Eastern 3 Basin and ultimately the East Side Lift Station. The Royal Fox #1 and #2 lift stations are located in the Eastern 1 drainage basin.

The current population equivalent for this drainage basin is 3,854 PE or 0.36 MGD. Limited future development is expected in the Eastern 1 Drainage Basin. At buildout, it is expected there will be an additional 25 PE in the drainage basin for a total of 3,879 PE, or 0.36 MGD. Exhibit 3-3 on the right includes the Eastern 1 drainage basin service area, while Table 3-5 and Table 3-6 on the next page include the Existing and Buildout PE and flow conditions in the drainage basin.

Based on the 2019 CMOM update, the Eastern 1 drainage basin is scheduled to start flow monitoring in the City's FY25, with a Sanitary Sewer Evaluation Survey (SSES) scheduled in FY26, and rehabilitation of the basin in FY27. It was estimated that rehabilitation will cost approximately $471,000 in FY27.

Table 3-5: Eastern 1 Basin Existing PE and Flow Conditions

Description	2023 Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Eastern 1 Basin	3,854	0.36	3.35	1.21

Table 3-6: Eastern 1 Basin Buildout PE and Flow Conditions

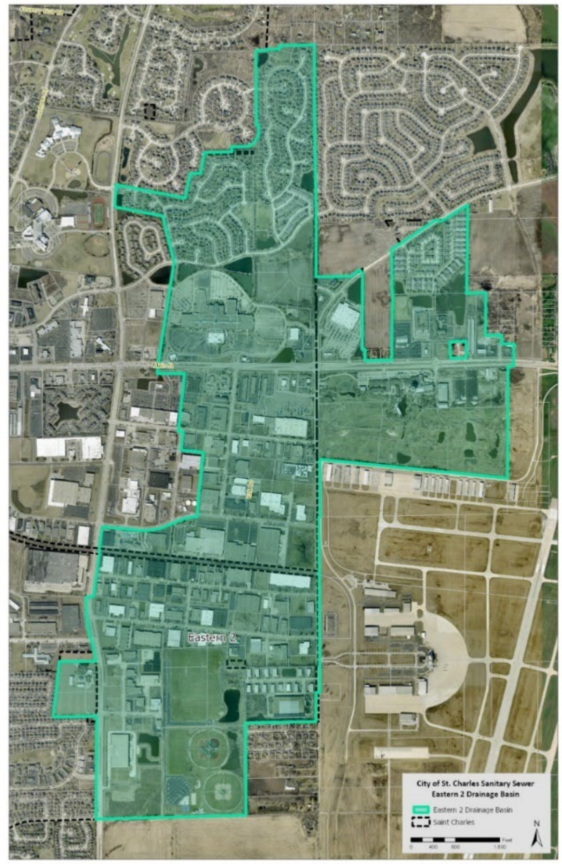
Description	Buildout Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Eastern 1 Basin	3,879	0.36	3.35	1.22

3.2.2 Eastern 2 Drainage Basin

The Eastern 2 drainage basin includes 1,158 acres with a broad mix of institutional, office, industrial, commercial and residential development. The collection system in this area is tributary to the Eastern 3 drainage basin to the west and ultimately the East Side Lift Station. The Pheasant Run Trails, Pheasant Run, Pheasant Run Industrial, Springs and Kingswood lift stations are all located in the Eastern 2 Drainage Basin.

The current population equivalent for this drainage basin is 4,495 PE or 0.42 MGD. Significant future development is expected in the Eastern 2 Drainage Basin. At buildout, it is expected there will be an additional 8,759 PE in the drainage basin for a total of 13,254 PE, or 1.30 MGD. Exhibit 3-4 on the right includes the Eastern 2 drainage basin service area, while Table 3-7 and Table 3-8 on the next page include the Existing and Buildout PE and flow conditions in the drainage basin.

Exhibit 3-4: Eastern 2 Drainage Basin



In 2019, the City completed the Eastern 2 Basin Flow Monitoring Study and East Interceptor Conveyance Analysis. The study included flow monitoring within the drainage basin, established dry and wet weather flows within the Eastern interceptor, conducted modeling to identify capacity issues, and identified potential gravity sewer upgrade alternatives. In 2020, the City completed the Eastern Sanitary Sewer Service Study, which provided several options for increasing capacity of the Eastern interceptor and included a phasing plan for the improvements. The study recommended three phases worth of improvements in the interceptor based on when development is expected in the basin.

The City has recently completed construction of Phase 1 of the Eastern Sanitary Sewer Interceptor Main Project in 2023. Phase 1 of the project consisted of 21" and 24" sanitary sewer upgrades in the Eastern 2 drainage basin. Phase 1 was required when approximately 1,000 PE in additional development occurred in the drainage basin. The project cost approximately $5.5 million including water main replacement adjacent to the sanitary sewer.

The City is also in the design stage for Phase 2 of the Eastern Sanitary Sewer Interceptor Main project. Phase 2 includes 24" and 27" sewer along the railroad tracks from Kautz Rd to Munhall Glen in the Eastern 2 and Eastern 3 drainage basins. Construction for the project is planned for 2025-2026 and is estimated to cost $17,920,000, including legal and property acquisition costs.

Table 3-7: Eastern 2 Drainage Basin Existing PE and Flow Conditions

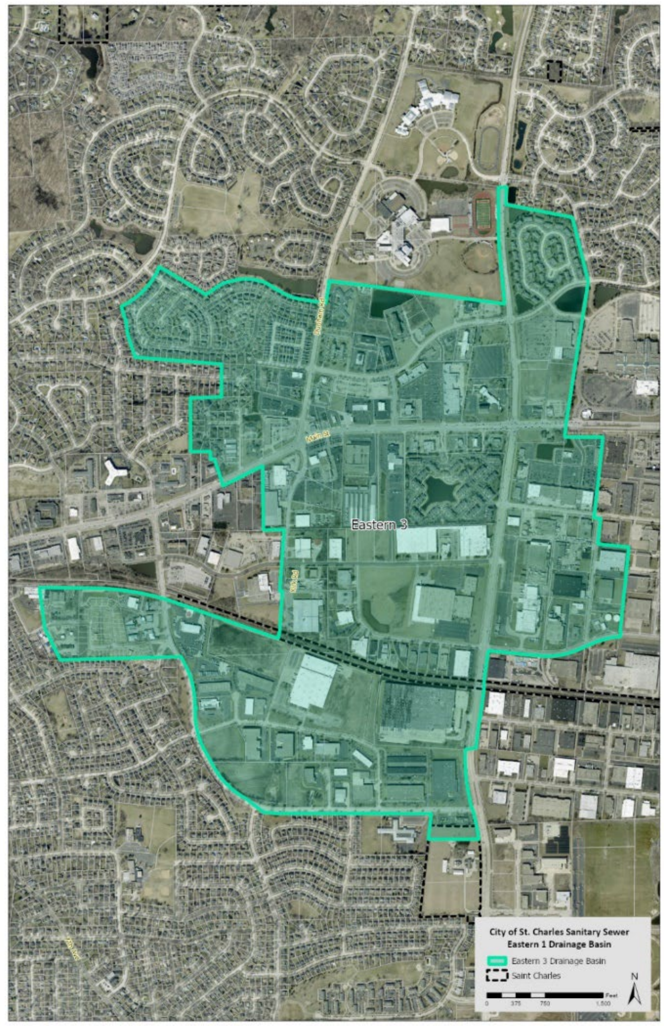
Description	2023 Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Eastern 2 Basin	4,495	0.42	3.29	1.38

Table 3-8: Eastern 2 Drainage Basin Buildout PE and Flow Conditions

Description	Buildout Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Eastern 2 Basin	13,254	1.30	2.83	3.67

3.2.3 Eastern 3 Drainage Basin

Exhibit 3-5: Eastern 3 Drainage Basin



The Eastern 3 drainage basin includes 756 acres of mainly office, industrial, commercial and some residential development. Both the Eastern 1 and Eastern 2 drainage basins are tributary to the Eastern 3 drainage basin. The collection system in this area is tributary to the Southeast Central 2 drainage basin to the southwest and ultimately the East Side Lift Station.

The current population equivalent for this drainage basin is 9,679 PE or 0.91 MGD. Future development is expected in the Eastern 3 Drainage Basin. At buildout, it is expected there will be an additional 749 PE for a total of 10,428 PE in the drainage basin, or 0.98 MGD. Exhibit 3-5 on the right includes the Eastern 3 drainage basin service area, while Table 3-9 and Table 3-10 on the next page include the Existing and Buildout PE and flow conditions in the drainage basin.

Based on the 2019 CMOM update, the Eastern 3 drainage basin is scheduled to start flow monitoring in the City's FY 26, with a Sanitary Sewer Evaluation Survey (SSES) scheduled in FY27, and rehabilitation of the basin in FY28. It was estimated that rehabilitation will cost approximately $500,000 in FY28.

As noted in the Eastern 2 drainage basin section, the City is in the preliminary design stage for Phase 2 of the Eastern Sanitary Sewer Interceptor Main project. Phase 2 includes 24" and 27" sewer along the railroad tracks from Kautz Rd to Munhall Glen in the Eastern 2 and Eastern 3 drainage basins. Construction of the project is planned for 2025-2026 and is estimated to cost $17,920,000, including legal and property acquisition costs.

Table 3-9: Eastern 3 Drainage Basin Existing PE and Flow Conditions

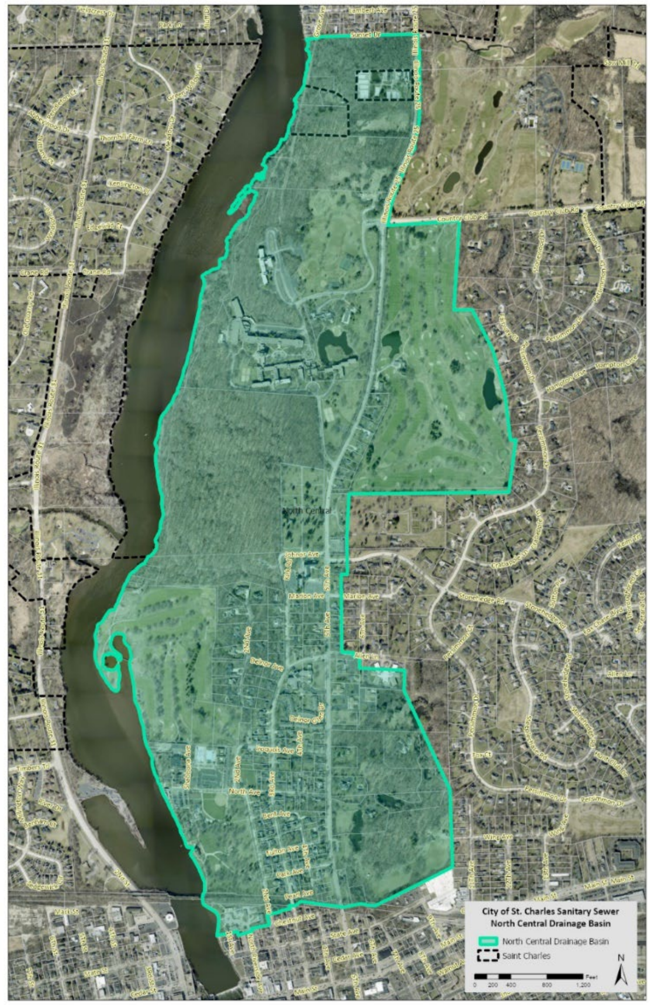
Description	2023 Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Eastern 3 Basin	9,679	0.91	2.97	2.69

Table 3-10: Eastern 3 Drainage Basin Buildout PE and Flow Projections

Description	Buildout Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Eastern 3 Basin	10,428	0.98	2.94	2.88

3.2.4 North Central Drainage Basin

Exhibit 3-6: North Central Drainage Basin



The North Central Basin is bordered on the west by the Fox River, from Illinois Route 64 to the northern limits of the City. The basin includes 583 acres of commercial, institutional, and residential development. The collection system in this basin was constructed from the early 1930's to the early 1990's.

The current population equivalent for this drainage basin is 1,675 PE or 0.16 MGD. No future development is expected in the North Central Drainage Basin. Exhibit 3-6 on the right includes the North Central drainage basin service area, while Table 3-11 and Table 3-12 on the next page include the Existing and Buildout PE and flow conditions in the drainage basin.

Based on the 2019 CMOM update, both Second Place and the North Central drainage basins had flow monitoring completed in the City's FY24, with a Sanitary Sewer Evaluation Survey (SSES) scheduled in FY25, and rehabilitation of the basins in FY28. It was estimated that rehabilitation of both will cost approximately $457,000 in FY26.

It was estimated in the 1996 Report that the Peak Wet Weather Flow in the 36-inch interceptor sewer was 13.9 MGD. This interceptor is tributary to a portion of the Southeast Central Basin and ultimately to the Riverside Lift Station.

Table 3-11: North Central Drainage Basin Existing PE and Flow Conditions

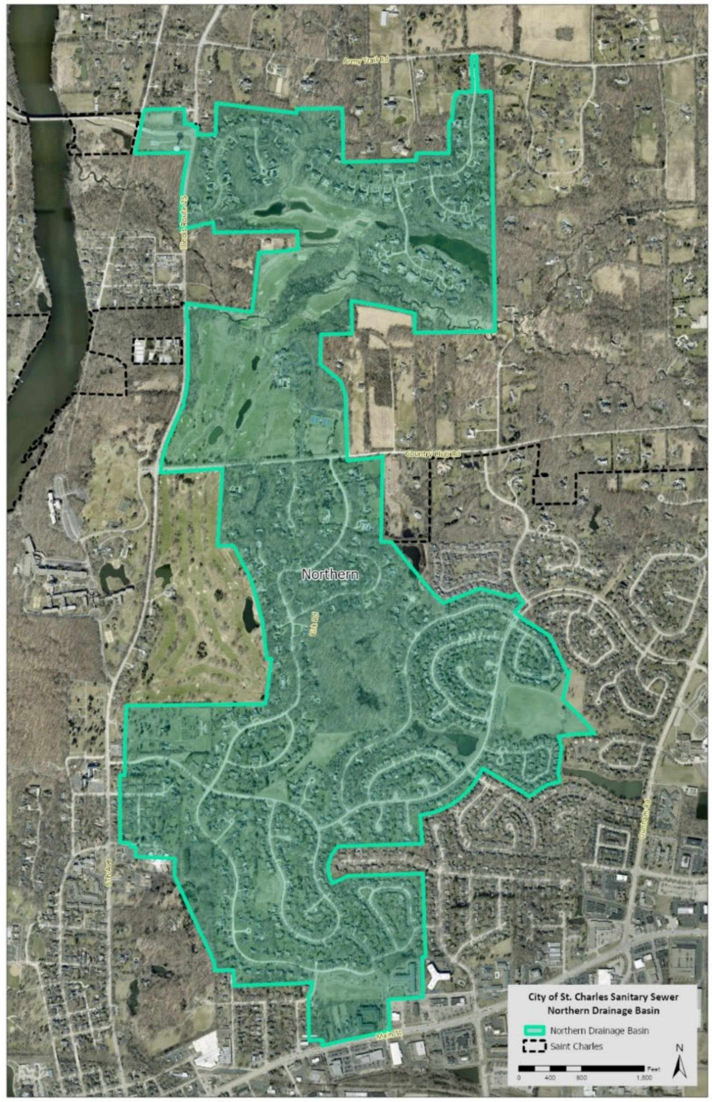
Description	2023 Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
North Central Basin	1,675	0.16	3.64	0.57

Table 3-12: North Central Drainage Basin Buildout PE and Flow Projections

Description	Buildout Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
North Central Basin	1,675	0.16	3.64	0.57

3.2.5 Northern Drainage Basin

Exhibit 3-7: Northern Drainage Basin



The Northern Basin includes 599 acres of (1980's) residential development. The basin extends from Illinois Route 64 north to Army Trail Road, encompassing a total of 825 acres. The Woods of Fox Glen and Country Club lift stations are located in the Northern drainage basin.

The current population equivalent for this drainage basin is 3,716 PE or 0.35 MGD of Average Daily Dry Weather Flow. No future development is expected in the Northern Drainage Basin. Exhibit 3-7 on the right includes the North Central drainage basin service area, while Table 3-13 and Table 3-14 on the next page include the Existing and Buildout PE as well as flow conditions in the drainage basin.

The Northern Basin is tributary to the Southeast Central and Main Drainage Basin and ultimately the East Side Lift Station. The Peak Hourly Flow in the Basin is estimated to be 1.17 MGD.

The collection system's capacity is nearly 3.0 MGD and provides the Northern Basin with a level of protection in excess of the 10-year Wet Weather Event. Additionally, the City has completed the inspection of the sewers in this area within the last 15 years.

Based on the 2019 CMOM update, flow monitoring in the Northern drainage basin was completed in the City's FY23, with a Sanitary Sewer Evaluation Survey (SSES) completed in FY24, and rehabilitation of the basin was recently completed. Rehabilitation was estimated to cost about $444,000 in FY25.

Table 3-13: Northern Drainage Basin Existing PE and Flow Conditions

Description	2023 Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Northern Basin	3,716	0.35	3.36	1.17

Table 3-14: Northern Drainage Basin Buildout PE and Flow Conditions

Description	Buildout Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Northern Basin	3,716	0.35	3.36	1.17

3.2.6 SC02 Drainage Basin

Drainage Basin SC-02 is on the southwest side of the Main Service Area. The drainage basin includes 458 acres of mostly residential development. This basin is directly tributary to South Siphon under the Fox River and ultimately to the Riverside Lift Station.

The current population for this drainage basin is 3,901 PE, or 0.37 MGD. Future development is expected in the SC02 Drainage Basin. At buildout, it is expected there will be an additional 2,496 PE for a total of 6,397 PE in the drainage basin, or 0.61 MGD. Exhibit 3-8 below includes the SC02 drainage basin service area, while Table 3-15 and Table 3-16 on the next page include the Existing and Buildout PE as well as flow conditions in the drainage basin.

Based on the 2019 CMOM update, flow monitoring in the SC02 drainage basin was completed in the City's FY17, with a Sanitary Sewer Evaluation Survey (SSES) completed in FY18, and rehabilitation of the basin completed in FY19 for approximately $207,000. In the flow monitoring study, it was shown that in SCO2, Subbasins SCO2-A, SCO2-B, SCO2-C, SCO2-D and SCO2-F had high amounts of inflow and Subbasins SCO2-B, SCO2-D, SCO2-E and SCO2-F had high infiltration. Manhole inspections were completed in 341 manholes and smoke testing was completed in 71,229 LF of main in Subbasins SCO2-A, SCO2-B, SCO2-C, SCO2-D and SCO2-F by RMS. In addition, historical televising videos of Subbasins SCO2-B, SCO2-D, SCO2-E and SCO2-F (approximately 56,280 LF of main) were reviewed and summarized in the results. Only the 'severe' and 'high' priority manholes were rehabilitated in SCO2.

Exhibit 3-8: SC02 Drainage Basin

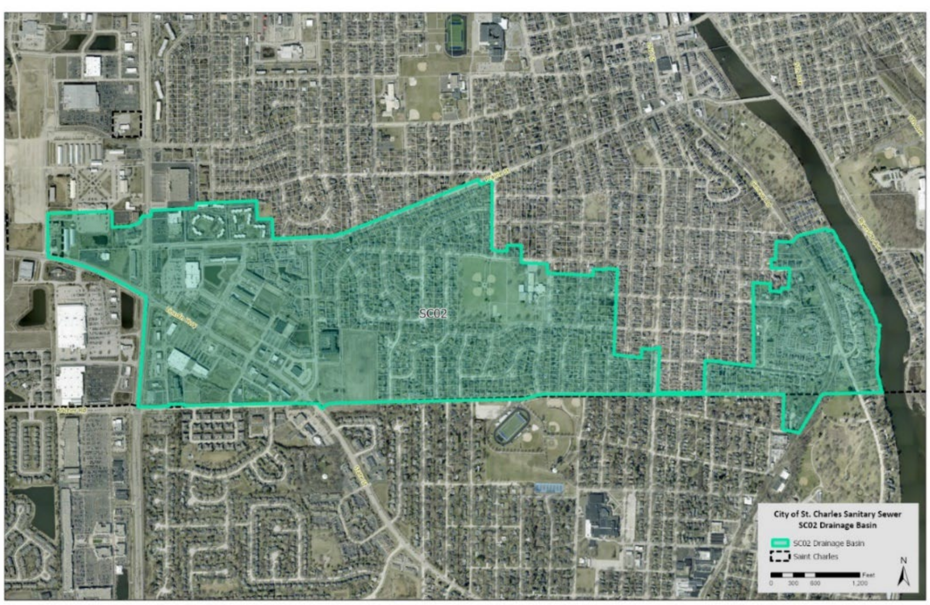


Table 3-15: SC02 Drainage Basin Existing PE and Flow Conditions

Description	2023 Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
SC02 Basin	3,901	0.37	3.34	1.22

Table 3-16: SC02 Drainage Basin Buildout PE and Flow Projections

Description	Buildout Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
SC02 Basin	6,397	0.61	3.14	1.93

3.2.7 SC05_R3 and SC05_T1 Drainage Basin

The SC05_R3 and SC05_T1 Drainage Basin includes 1,042 acres on the northwest side of the City. The Red Gate and Wild Rose lift stations are located in the SC05_R3 and SC05_T1 Drainage Basin.

The current population equivalent for this drainage basin is 3,133 PE, or 0.29 MGD. Future development is expected in the SC05_R3 and SC05_T1 drainage basin. At buildout, it is expected there will be an additional 308 PE for a total of 3,441 PE in the drainage basin, or 0.32 MGD. Exhibit 3-9 below includes the SC05_R3 and SC05_T1 drainage basin service area, while

Table **3-17** and Table 3-18 on the next page include the Existing and Buildout PE as well as flow conditions in the drainage basin.

Based on the 2019 CMOM update, flow monitoring in the SC05_R3 and SC05_T1 drainage basin was completed in the City's FY20, with a Sanitary Sewer Evaluation Survey (SSES) completed in FY21, and rehabilitation of the basin completed in FY22.

Exhibit 3-9: SC05_R3 and SC05_T1 Drainage Basin

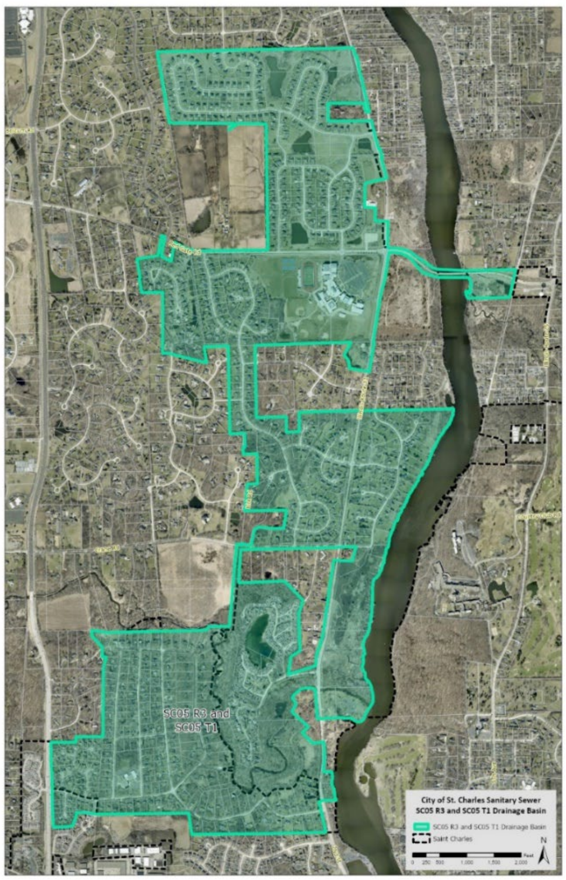


Table 3-17: SC05_R3 and SC05_T1 Drainage Basin Existing PE and Flow Conditions

Description	2023 Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
SC05_R3 and SC05_T1 Basin	3,133	0.29	3.43	1.01

Table 3-18: SC05_R3 and SC05_T1 Drainage Basin Buildout PE and Flow Projections

Description	Buildout Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
SC05_R3 and SC05_T1 Basin	3,441	0.32	3.39	1.10

3.2.8 SC05_T2 and SC05_C1 Drainage Basin

The SC05_T2 and SC05_C1 Drainage Basin includes 500 acres in the western part of the City. The Oak Crest Lift Station is located in the SC05_T2 and SC05_C1 drainage basin.

The current population equivalent in this drainage basin is 2,692 PE, or 0.25 MGD. Future development is expected in the SC05_T2 and SC05_C1 drainage basin. At buildout, it is expected there will be an additional 498 PE for a total of 3,190 PE in the drainage basin, or 0.30 MGD. Exhibit 3-10 below includes the SC05_R3 and SC05_T1 drainage basin service area, while Table 3-19 and Table 3-20 on the next page include the Existing and Buildout PE as well as flow conditions in the drainage basin.

Based on the 2019 CMOM update, flow monitoring in the SC05_T2 and SC05_C1 drainage basin was completed in the City's FY21, with a Sanitary Sewer Evaluation Survey (SSES) completed in FY22, and rehabilitation of the basin completed in FY23.

Exhibit 3-10: SC05_T2 and SC05_C1 Drainage Basin

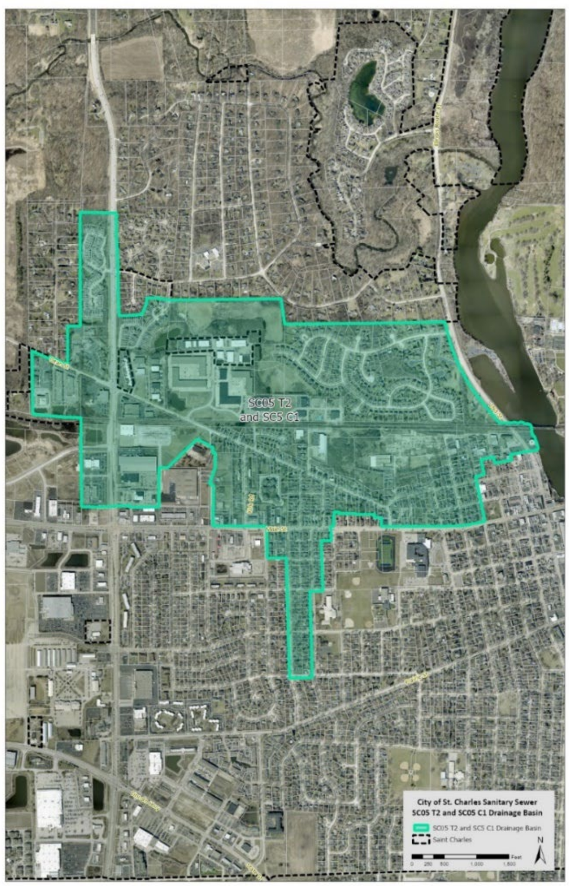


Table 3-19: SC05_T2 and SC05_C1 Drainage Basin Existing PE and Flow Conditions

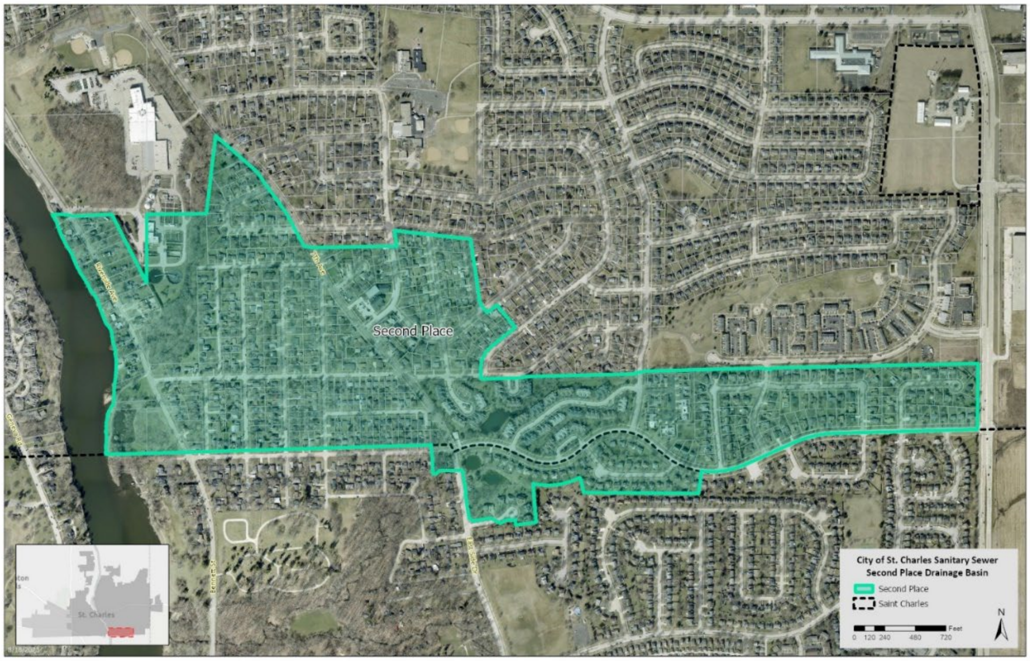
Description	2023 Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
SC05_T2 and SC05_C1 Basin	2,692	0.25	3.48	0.88

Table 3-20: SC05_T2 and SC05_C1 Drainage Basin Buildout PE and Flow Projections

Description	Buildout Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
SC05_T2 and SC05_C1 Basin	3,190	0.30	3.42	1.03

3.2.9 Second Place Drainage Basin

Exhibit 3-11: Second Place Drainage Basin



The Second Place Drainage Basin includes 196 acres of residential development along Division Street in the southeastern part of the City. The 7th and Division, Riverside, and East Side Lift Stations are located the Second Place Drainage Basin.

Second Place 1 subbasin includes residential development along Division Street west of 7th Avenue and an older residential neighborhood east of Seventh Avenue Creek. The service area is tributary to the Beatrice Avenue sewer, the Seventh Avenue Creek Interceptor and ultimately the Riverside Avenue Interceptor. The Riverside Avenue Interceptor is tributary to the Riverside Lift Station.

Second Place 2 subbasin includes established residential development south of Seventh Avenue Creek. This subbasin is tributary to the Riverside Avenue Interceptor Sewer and ultimately the Riverside Pump Station.

The current population equivalent for the Second Place drainage basin is 1,858 PE, or 0.17 MGD. No future development is expected in the Second Place drainage basin. Exhibit 3-10 above includes the Second Place drainage basin service area, while Table 3-21 and Table 3-22 on the next page include the Existing and Buildout PE as well as flow conditions in the drainage basin.

Based on the 2019 CMOM update, both the Second Place and the North Central drainage basins had flow monitoring completed in the City's FY24, with a Sanitary Sewer Evaluation Survey (SSES) scheduled in FY25, and rehabilitation of the drainage basins in FY28. It was estimated that rehabilitation of both will cost approximately $457,000 in FY26. It is also recommended that the Seventh Avenue Creek and Riverside Avenue Interceptor Sewers be evaluated for rehabilitation.

Table 3-21: Second Place Drainage Basin Existing PE and Flow Conditions

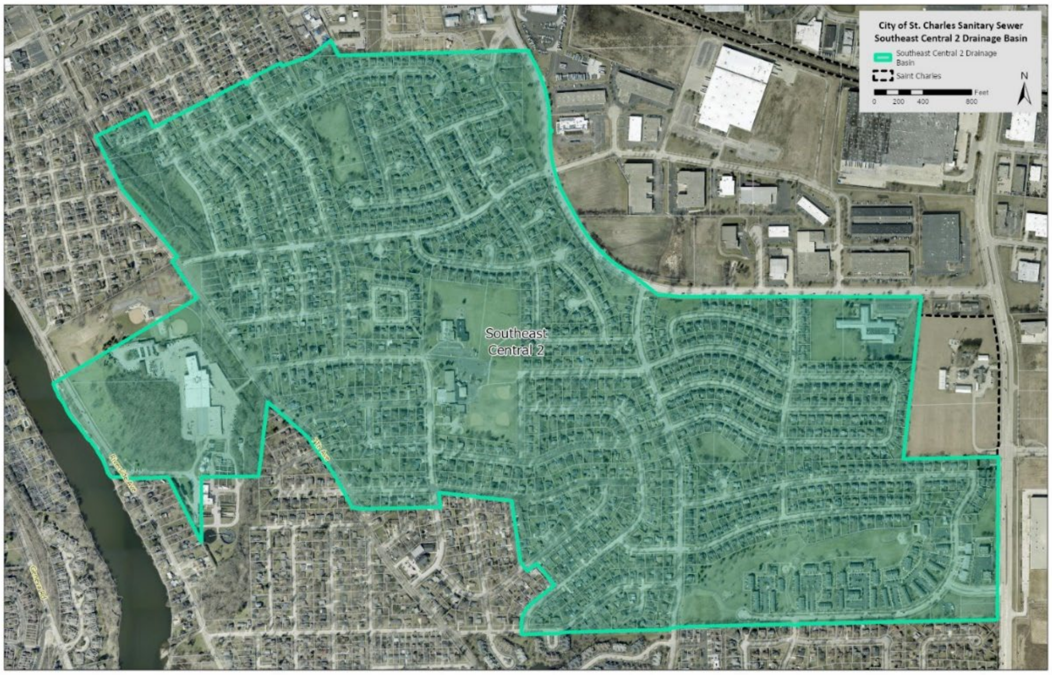
Description	2023 Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Second Place Basin	1,858	0.17	3.61	0.63

Table 3-22: Second Place Drainage Basin Buildout PE and Flow Projections

Description	Buildout Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Second Place Basin	1,858	0.17	3.61	0.63

3.2.10 Southeast Central 2 Drainage Basin

Exhibit 3-12: Southeast Central 2 Drainage Basin



The Southeast Central 2 Drainage Basin includes 494 acres of residential development in the eastern part of the City. The Washington Ave, Riverside, and East Side lift stations are located in the Southeast Central 2 Drainage Basin. The Riverside lift station receives tributary flow from drainage basins located on the West side of the Main Service Area, while the East Side lift station receives tributary flow from the East Side of the Main Service Area.

The current population equivalent for the Southeast Central 2 drainage basin is 3,824 PE, or 0.36 MGD. Future development is expected in the Southeast Central 2 drainage basin. At buildout, it is expected there will be an additional 28 PE for a total of 3,852 PE in the drainage basin, or 0.36 MGD. Exhibit 3-12 above includes the Southeast Central 2 drainage basin service area, while Table 3-23 and Table 3-24 on the next page include the Existing and Buildout PE as well as flow conditions in the drainage basin.

Based on the 2019 CMOM update, flow monitoring in the Southeast Central 2 drainage basin is scheduled in the City's FY28, with a Sanitary Sewer Evaluation Survey (SSES) completed in FY29, and rehabilitation of the basin scheduled in FY30 for approximately $530,000.

Table 3-23: Southeast Central 2 Drainage Basin Existing PE and Flow Conditions

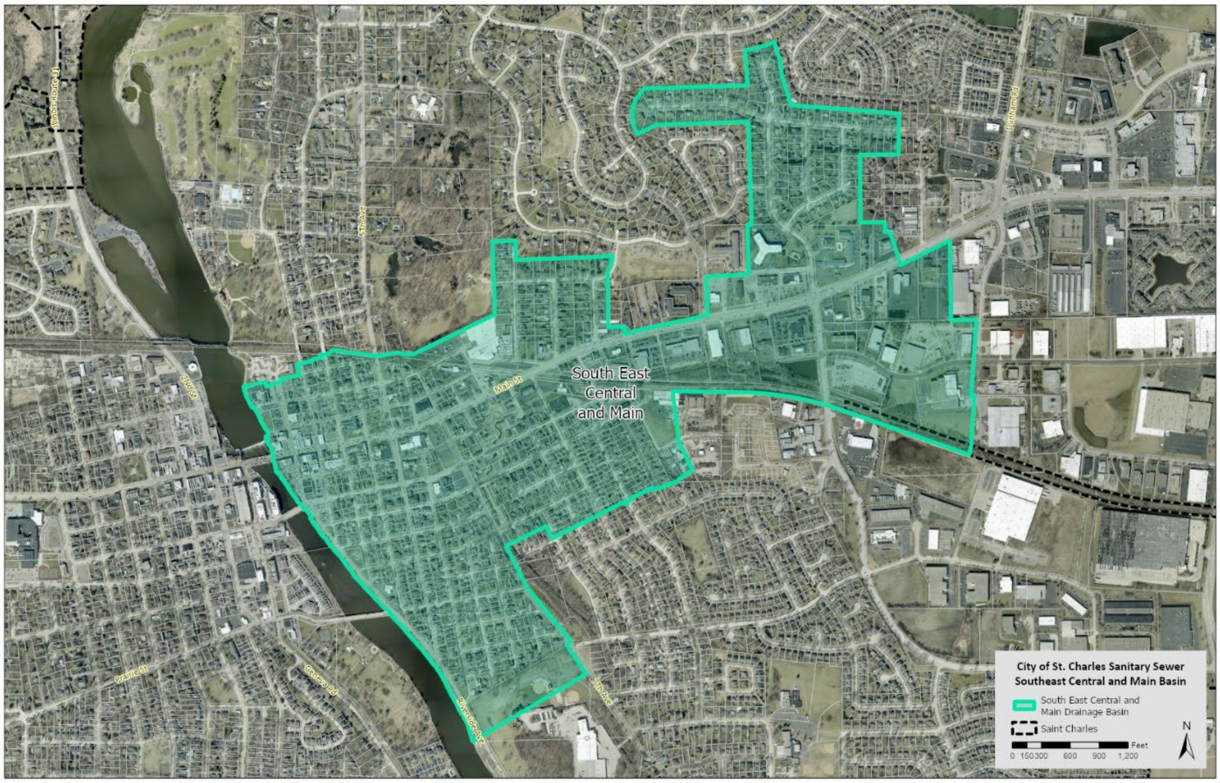
Description	2023 Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Southeast Central 2 Basin	3,824	0.36	3.35	1.20

Table 3-24: Southeast Central 2 Drainage Basin Buildout PE and Flow Projections

Description	Buildout Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Southeast Central 2 Basin	3,852	0.36	3.35	1.21

3.2.11 Southeast Central and Main Drainage Basin

Exhibit 3-13: Southeast Central and Main Drainage Basin



The Southeast Central and Main Drainage Basin includes 441 acres of dense commercial, residential and light industrial development. The drainage basin includes the Southeast Central and Main subbasins. The collection system is tributary to both of the lift stations tributary to the Main WWTF, Riverside Lift Station and East Side Lift Station. The sanitary sewers in the area are of varying age and condition.

The current population equivalent for the Southeast Central and Main drainage basin is 3,738 PE, or 0.35 MGD. Future development is expected in the Southeast Central and Main drainage basin. At buildout, it is expected there will be an additional 892 PE for a total of 4,630 PE in the drainage basin, or 0.44 MGD. Exhibit 3-13 above includes the Southeast Central and Main drainage basin service area, while Table 3-25 and Table 3-26 on the next page include the Existing and Buildout PE as well as flow conditions in the drainage basin.

Based on the 2019 CMOM update, the Southeast Central and Main drainage basin has flow monitoring scheduled in the City's FY27, with a Sanitary Sewer Evaluation Survey (SSES) scheduled in FY28, and rehabilitation of the drainage basin in FY29. It was estimated that rehabilitation will cost $514,000 in FY29.

Table 3-25: Southeast Central and Main Drainage Basin Existing PE and Flow Conditions

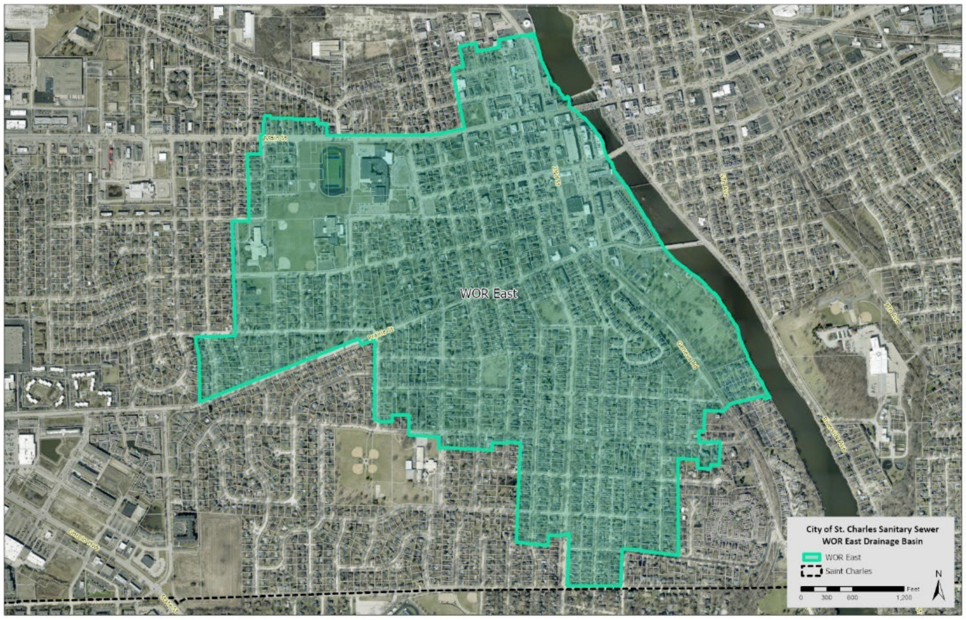
Description	2023 Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Southeast Central and Main Basin	3,738	0.35	3.36	1.18

Table 3-26: Southeast Central and Main Drainage Basin Buildout PE and Flow Conditions

Description	Buildout Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
Southeast Central and Main Basin	4,630	0.44	3.28	1.44

3.2.12 WOR East Drainage Basin

Exhibit 3-14: WOR East Drainage Basin



The WOR East drainage basin includes 493 acres of development. The collection system in this basin was constructed from the early 1930's to the early 1990's.

The current population equivalent for the WOR East drainage basin is 4,032 PE, or 0.38 MGD. Future development is expected in the WOR East drainage basin. At buildout, it is expected there will be an additional 1,158 PE for a total of 5,190 PE in the drainage basin, or 0.49 MGD. Exhibit 3-14 above includes the WOR East drainage basin service area, while Table 3-27 and Table 3-28 on the next page include the Existing and Buildout PE as well as flow conditions in the drainage basin.

Based on the 2019 CMOM update, the WOR East drainage basin had flow monitoring completed in the City's FY22, with a Sanitary Sewer Evaluation Survey (SSES) completed in FY23, and rehabilitation of the drainage basin completed in FY24.

Table 3-27: WOR East Drainage Basin Existing PE and Flow Conditions

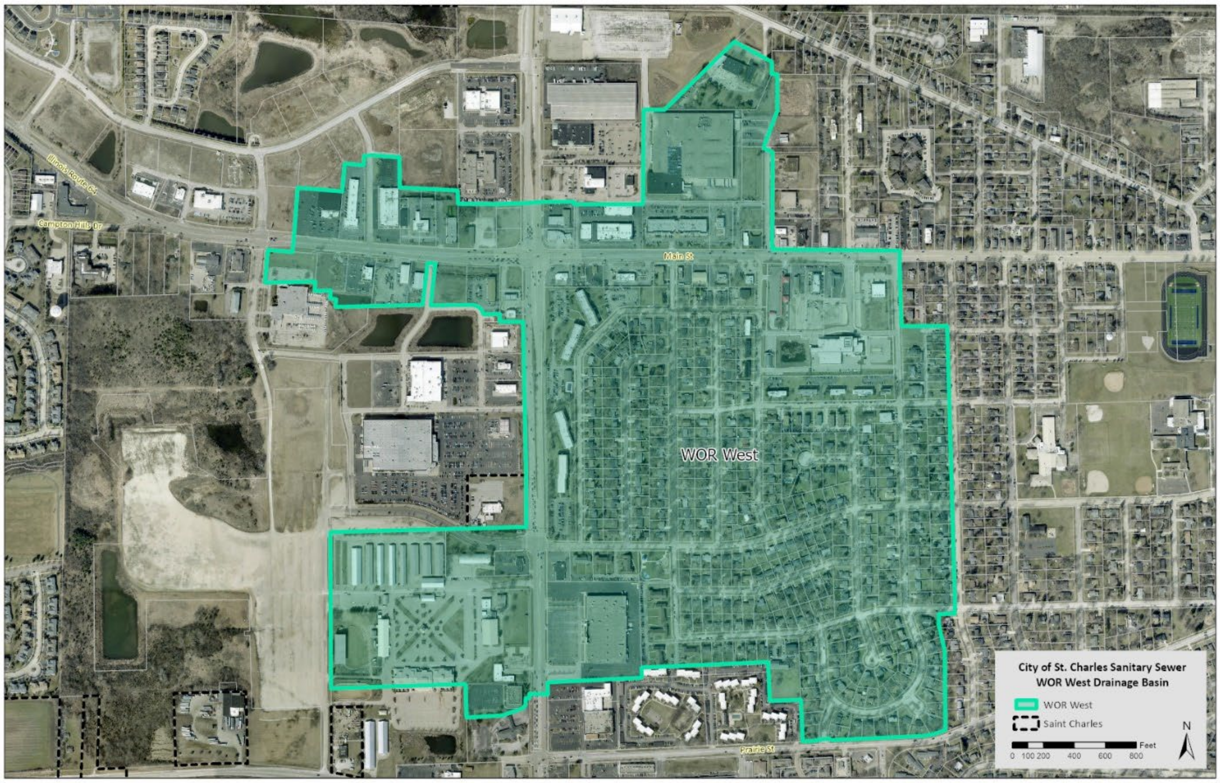
Description	2023 Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
WOR East	4,032	0.38	3.33	1.26

Table 3-28: WOR East Drainage Basin Buildout PE and Flow Conditions

Description	Buildout Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
WOR East	5,190	0.49	3.23	1.59

3.2.13 WOR West Drainage Basin

Exhibit 3-15: WOR West Drainage Basin



The WOR West drainage basin includes 263 acres. The current population equivalent for the WOR West drainage basin is 2,418 PE, or 0.23 MGD. Future development is expected in the WOR West drainage basin. At buildout, it is expected there will be an additional 108 PE for a total of 2,526 PE in the drainage basin, or 0.24 MGD. Exhibit 3-15 above includes the WOR West drainage basin service area, while Table 3-29 and Table 3-30 on the next page include the Existing and Buildout PE as well as flow conditions in the drainage basin.

Based on the 2019 CMOM update, the WOR West drainage basin had flow monitoring scheduled in the City's FY30, with a Sanitary Sewer Evaluation Survey (SSES) scheduled in FY31. Rehabilitation of the drainage basin was completed in FY20 for approximately $182,000.

Table 3-29: WOR West Existing PE and Flow Conditions

Description	2023 Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
WOR West	2,418	0.23	3.52	0.80

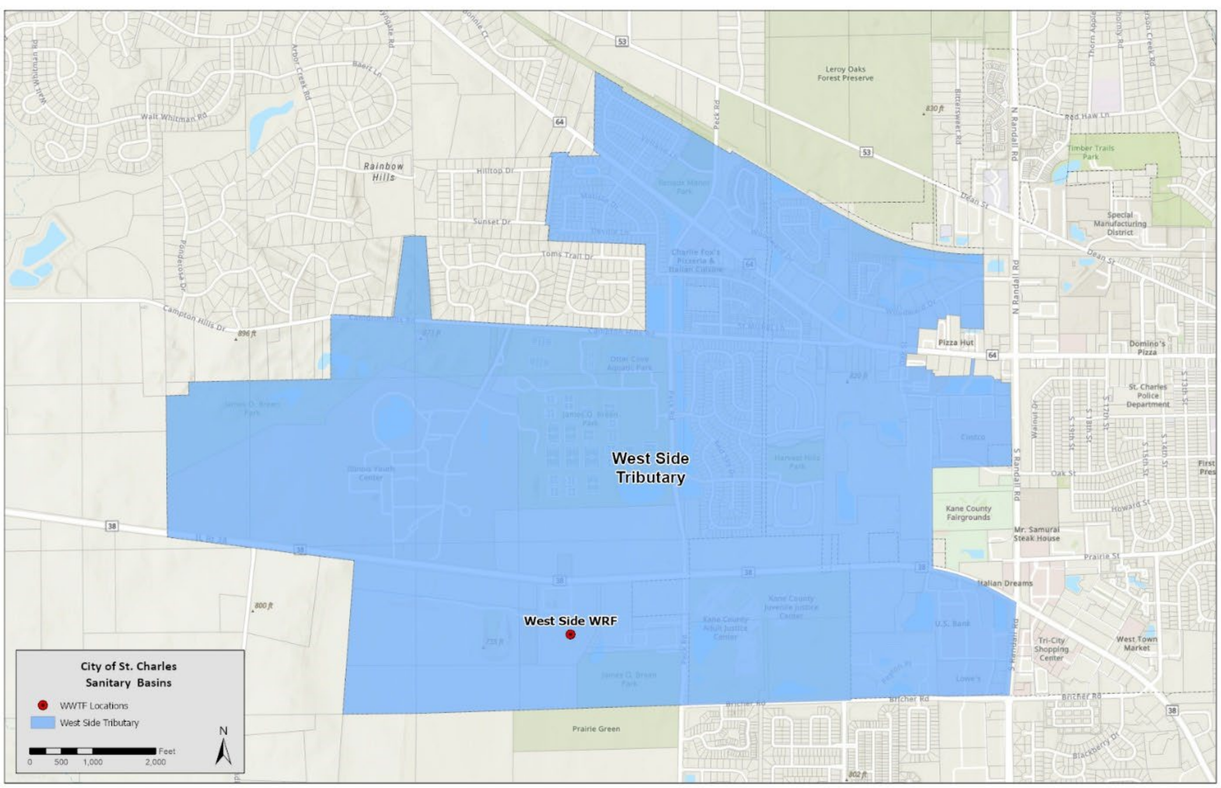
Table 3-30: WOR West Drainage Basin Buildout PE and Flow Conditions

Description	Buildout Conditions			
	PE	ADDF (MGD)	Peaking Factor	Basin PHF (MGD)
WOR West	2,526	0.24	3.50	0.83

3.1 WEST SIDE SERVICE AREA DRAINAGE BASINS

The majority of the existing sanitary sewers within the West Side WRF's collection system are less than twenty years old. Most of these properties consist of newer residential neighborhoods and commercial developments constructed with PVC sewer pipe. The exception would be the sewers contained within the Illinois Youth Center which are maintained by the Department of Corrections. These sewers were originally installed in the 1960's and are generally constructed of clay pipe. The 1998 Facility Plan Amendment identified that the sanitary sewer system which serves the Illinois Youth Center had historically been subject to high infiltration and inflow (I/I) which is often found in older areas that contain clay sewer pipe. As a condition of the purchase agreement for the wastewater treatment facility, the Department of Corrections conducted an evaluation of the existing sanitary sewer system to identify and remove infiltration and inflow sources to the collection system. From this evaluation it was determined that the I/I was limited primarily to direct inflow which was substantially reduced through the improvements made throughout the evaluation.

Exhibit 3-16: City of St. Charles West Side WWTF Tributary Wastewater Drainage Basin



The collection system within the West Side Service Area has been separated into one major drainage basin, with 4 subbasins. Each subbasin is tributary to its own dedicated interceptor sewer or regional lift station. Through analysis of the drainage basin and its subbasins have been determined and are detailed in this Section. The remaining capacity in each pipe can then be monitored to determine if their size must be increased or if additional interceptor sewers are needed to accommodate flow from future development.

The City has developed an extensive televising, cleaning and inspection program for the entire collection system. The collection system was divided into four quadrants (NE, SE, NW, and SW). The north/south dividing line is the Fox River that runs through the heart of downtown St. Charles and the east/west dividing line is Route 64. This is a continuous program that will repeat upon completion. This will assist the City in identifying problem locations for future projects. The City also developed a CMOM Program in accordance with the West Side WRF NPDES Permit, and it addresses the needs of the entire collection system.

The City of St. Charles' Finance Department actively maintains its GASB 34 Report, however, the collection system is not broken out by treatment facility. Therefore, the actual value of this asset for the West Side Service Area is not calculated. It has been estimated that the City currently maintains 179 miles of sanitary sewer mains (gravity and force main), as well as roughly 5,100 active sanitary manholes and 19 lift stations in the Main Service Area and West Side Service Area. The collection system tributary to the West Side WRF consists of approximately 18 miles of sanitary sewer mains (gravity and force main), and 3 lift stations.

3.1.1 West WWTF Tributary Drainage Basin

Exhibit 3-17 shows the West WWTF Tributary Drainage Basin. It includes the entire West Service Area, with all flows tributary to the West Side WRF. There is currently 7,351 PE in the West WWTF Tributary Drainage Basin. The West WWTF Tributary Drainage Basin includes 3,717 residential PE and 3,634 non-residential PE. The Pine Ridge Subbasin, Renaux Manor Subbasin, and the Zylstra Subbasins are all located in the West WWTF Tributary Drainage Basin.

Table 3-31 on the next page includes the existing PE in the drainage basin and its subbasins. Table 3-32 also on the next page includes the buildout conditions in the drainage basin and its subbasins.

Exhibit 3-17: West WWTF Tributary Drainage Basin

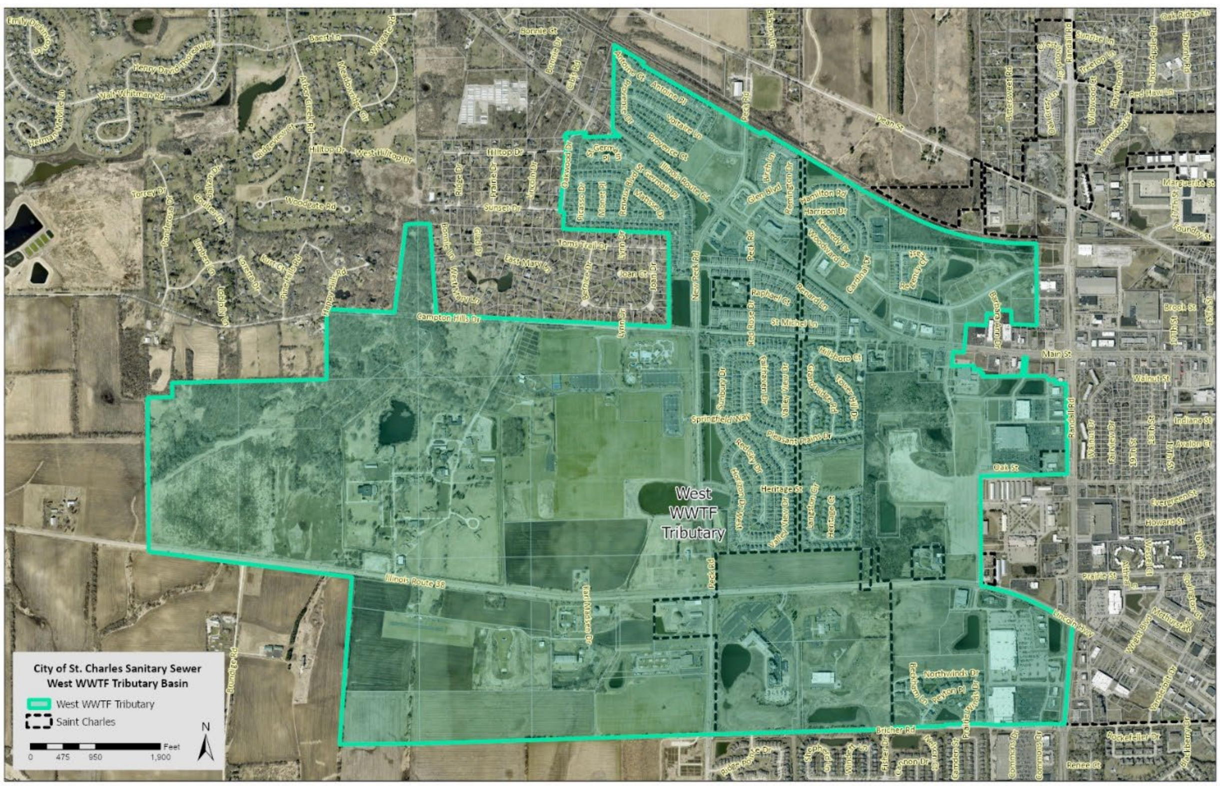


Table 3-31: West WWTF Tributary Drainage Basin Existing PE and Flow Conditions

Description	2023 Conditions			
	PE	Subbasin ADDF (MGD)	Peaking Factor	Subbasin PHF (MGD)
Renaux Manor Subbasin	2,372	0.15	3.53	0.52
Pine Ridge Subbasin	174	0.01	4.17	0.05
Zylstra Subbasin	357	0.02	4.05	0.09
Gravity Subbasin	4,447	0.28	3.29	0.91
Gravity WWTF Tributary Basin Total	**7,351**	**0.457**	**3.09**	**1.411**

Table 3-32: West WWTF Drainage Basin Buildout PE and Flow Conditions

Description	Buildout Conditions			
	PE	Subbasin ADDF (MGD)	Peaking Factor	Subbasin PHF (MGD)
Renaux Manor Subbasin	4,649	0.38	3.27	1.23
Pine Ridge Subbasin	446	0.04	4.00	0.15
Zylstra Subbasin	511	0.04	3.97	0.15
Gravity Subbasin	9,909	0.82	2.96	2.43
Gravity WWTF Tributary Basin Total	**15,516**	**1.27**	**2.76**	**3.52**

Pine Ridge Subbasin

The Pine Ridge Subbasin is located in the northeast corner of the West Side Service Area and includes nearly 70 acres. This basin contains the Regency Estates Subdivision and the Pine Ridge commercial development. The development has been in construction over the past few years, the majority of which was residential homes. Therefore, this subbasin is currently serving 174 PE. Commercial development is planned for a large portion of this subbasin, equating to a build out capacity of 446 PE. The Regency Estates and Pine Ridge developments are tributary to the Pine Ridge Lift Station. The remaining property within this subbasin is designated as open space for stormwater drainage or public land use. The 4-inch force main from this lift station discharges to a sanitary manhole in the Renaux Manor Subbasin. This flow is then conveyed via an 8" gravity line to the Renaux Manor Lift Station.

Renaux Manor Subbasin

The Renaux Manor Subbasin is located in the northern portion of the West Side Service Area. This basin includes the area north of Campton Hills Drive east of this road's intersection with Route 64. This basin includes nearly 285 acres of residential, commercial and industrial usage containing approximately 2,372 PE in 2022.

The 15-inch diameter Renaux Manor Interceptor Sewer serves the majority of the subbasin, as well as flow from the 8-inch diameter sewer which the Pine Ridge force main discharges to. Flow is conveyed from the Renaux Manor Lift Station to a sanitary manhole in the Gravity Subbasin.

Zylstra Subbasin

The Zylstra Subbasin consists of nearly 47 acres of commercial and industrial usage located near the southwest corner of the intersection of Route 64 and Randall Road. This subbasin was created in 2007 and the original design assumed 355 PE of commercial users tributary to the Zylstra Lift Station. This accounted for the Harley dealership (35 PE), three fast food restaurants (75 PE), three sit-down restaurants (180 PE) and one big box commercial store (65 PE). The Oak Street Water Facility backwash was not accounted for in the original design.

Based on data from 2022, the Commercial water usage equated to an average of 13,244 gpd, or 213 PE. Municipal wastewater production (from the Oak Street Water Facility backwash) equated to an average of 8,927 gpd, or 144 PE, which brings the total to 24,880 gpd, or 363 PE. Therefore, the peaking factor for this area is 4.05 and the peak flow is 89,764 gpd. There is no residential usage in the Zylstra subbasin. Future development within the subbasin is estimated to contribute another 153.8 PE, leading to a build-out total of 511 PE.

As noted in Sections 2 and 4, with the completion of the Well 7/13 Interconnect project, the PE associated with the Oak St. backwash will no longer be tributary to the Zylstra drainage basin. Therefore, the PE in the subbasin will be reduced to only that associated with Zylstra property (213 PE).

The basin contains 8-inch diameter sewers that serve the entire basin and discharge directly to the Zylstra Lift Station. Wastewater from this lift station is conveyed through a 4-inch diameter force main to the Gravity Subbasin.

Gravity Subbasin

The Gravity Subbasin includes the majority of the West Side Service Area. The subbasin is bordered on the east by Randall Road and on the west by the City's corporate boundary. Campton Hills Drive and Bricher Road make up the northern and southern borders of the basin, respectively. The 2022 water and sewer billing records indicated that this area contains approximately 4,447 PE, of which 1,079 PE are contained within the 280-acre Illinois Youth Center property, 816 PE from the Kane County Judicial Center, and 16 PE from an IDOT facility. The Department of Corrections owns and maintains the sanitary sewer within this property, which then discharges into the drainage basin near the raw sewage pump station on the West Side WRF Site. The remaining 2,536 PE within the Gravity Drainage Basin consists of a mixed use of commercial, residential, industrial and governmental areas.

Within this basin, a 10-inch interceptor sewer receives flow from the Zylstra Lift Station, and also serves the northern half of the Harvest Hills Subdivisions. This sewer discharges to the 18-inch Peck Road Interceptor Sewer, which also receives flow from the Renaux Manor Lift Station and several properties along Peck Road. The 12-inch Route 38 Interceptor Sewer serves the commercial areas along Randall Road and Route 38 in the southeastern area of the Gravity Drainage Basin. The 18-inch and 12-inch interceptor sewers combine into the 24-inch Main Interceptor Sewer, which discharges directly to the West Side WRF. If significant additional hydraulic capacity is to be added to the 18" Peck Road or 12" Route 38 Interceptor Sewers, the City should confirm invert elevations and slope to determine if the actual capacities will be exceeded. Additionally, there may be potential to route some of the planned development along the 18" Route 38 Interceptor to the 10" Zylstra Interceptor.

3.1.2 West WWTF Tributary Drainage Basin Recommendations

As noted in Section 3.1, the City maintains a CMOM Program in accordance with its Main WWTF permit. In 2020, Engineering Enterprises Inc. completed a CMOM Annual Update for the City. The annual update included a recommended 3-step implementation schedule which was completed for subbasin evaluation and rehabilitation of inflow in the City's sanitary sewers.

It was recommended in the CMOM for the City to budget for flow monitoring of the West WWTF Tributary Drainage Basin during the City's FY29, with a Sanitary Sewer Evaluation Survey (SSES) completed during FY30, and rehabilitation of the drainage basin during FY31. It was estimated that rehabilitation of the West WWTF Tributary Basin would cost approximately $530,000 in FY31.

SECTION 4

LIFT STATIONS

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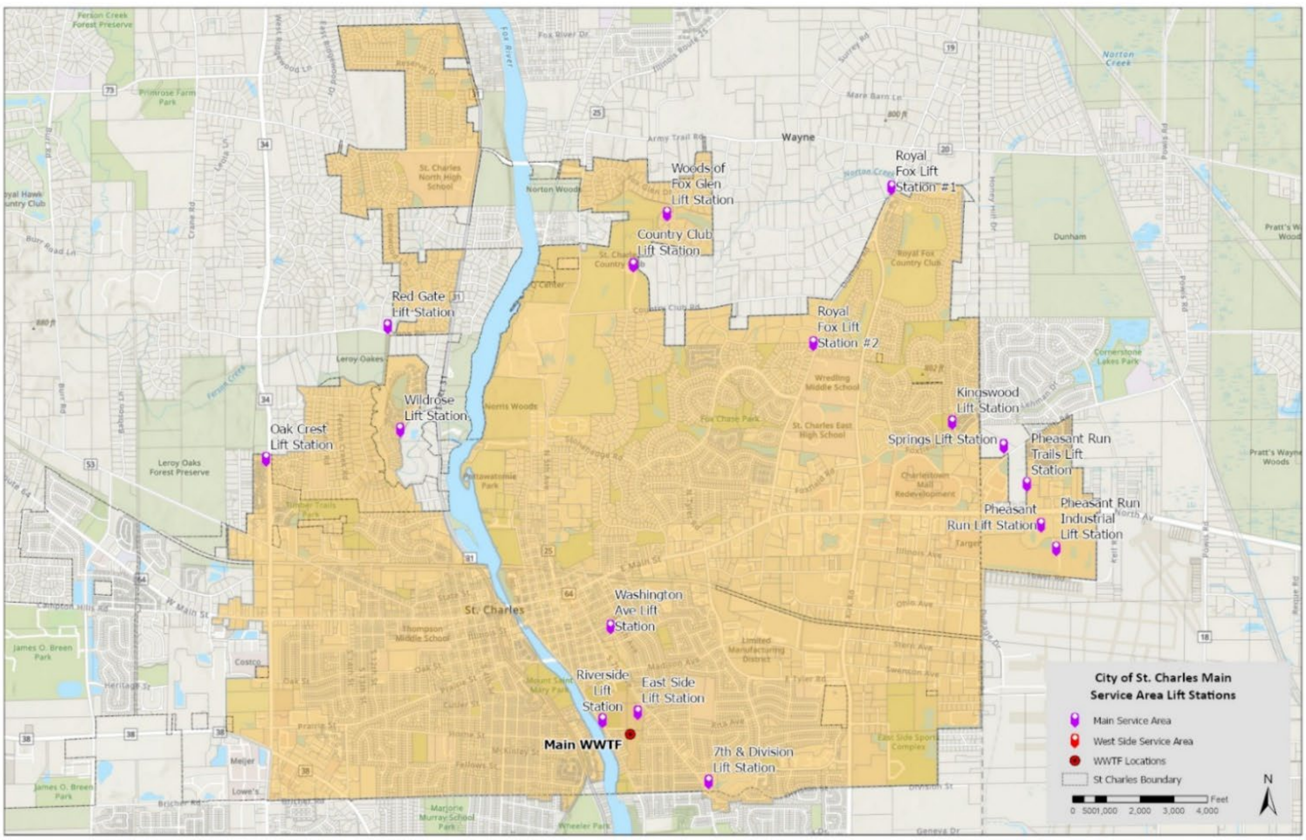
4. LIFT STATIONS

4.1 GENERAL BACKGROUND

Main Service Area

The City of St. Charles' Main Service Area includes sixteen lift stations, two of which are directly tributary to the headworks at the Main WWTF. Locations of the lift stations are shown on the exhibit below:

Exhibit 4-1: Main Service Area Lift Station Locations



The Main Service Area lift stations vary in age and condition; however, most were constructed between 1987 and 1997 as the City developed further north and east. The two main lift stations are Riverside Lift Station and East Side Lift Station. Additionally, the City will be taking ownership of three new lift stations: Pheasant Run, Pheasant Run Industrial, and Springs. Pheasant Run lift station is designed for 970 PE, while the Pheasant Run Industrial lift station is also designed for 970 PE. Springs lift station is designed for 771 PE. These lift stations are in good shape, since they were recently built. They will be tributary to the collection system upstream of the East Side Lift Station. City staff have assisted in the development of this Section of the Facility Plan Update and provided input with respect to improvements needed at each station.

Table 4-1: Main Service Area Lift Station Asset Value (2023$)

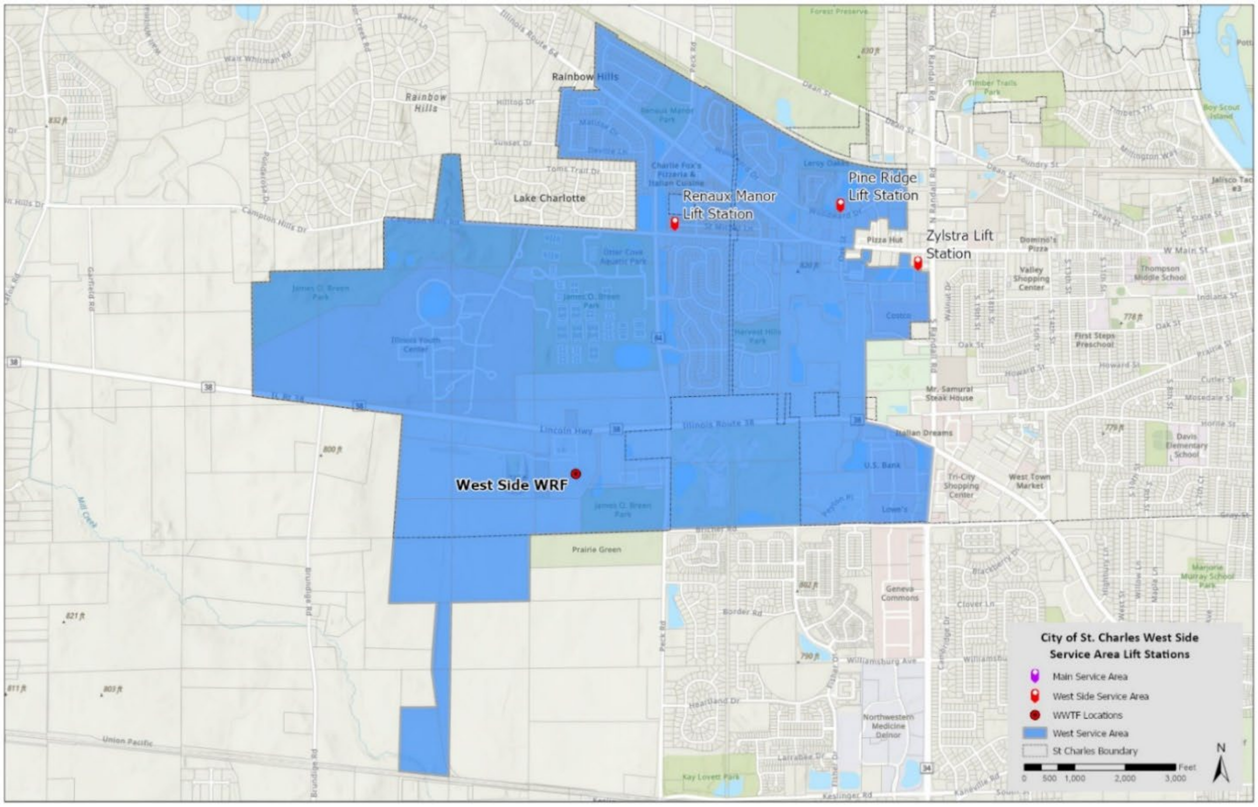
Lift Station	Equipment	Structure	Force Main	Totals
Pheasant Run	$280,000	$280,000	$120,000	$680,000
Pheasant Run Industrial	$350,000	$345,000	$90,000	$780,000
Springs	$380,000	$380,000	$60,000	$820,000
Riverside	$4,350,000	$6,840,000	$2,030,000	$13,220,000
East Side	$1,640,000	$2,380,000	$160,000	$4,180,000
7th & Division	$320,000	$230,000	$180,000	$730,000
Washington Ave.	$80,000	$80,000	$120,000	$280,000
Country Club	$320,000	$250,000	$210,000	$780,000
Pheasant Run Trails	$340,000	$300,000	$470,000	$1,110,000
Royal Fox #2	$350,000	$300,000	$790,000	$1,440,000
Royal Fox #1	$340,000	$270,000	$570,000	$1,180,000
Woods of Fox Glen	$340,000	$300,000	$900,000	$1,540,000
Kingswood	$340,000	$300,000	$320,000	$960,000
Wild Rose	$320,000	$260,000	$30,000	$610,000
Red Gate	$340,000	$300,000	$500,000	$1,140,000
Oak Crest	$320,000	$250,000	$120,000	$690,000
Totals	$10,410,000	$13,065,000	$6,670,000	$30,140,000
Design Life, Years	20	50	50	
Annual Replacement	$520,500	$261,300	$133,400	**$915,200**

It should be noted that the above figures do not include the engineering and contingencies that would be involved in a rehabilitation or replacement project. The value of the City's lift station and force main assets in the Main Service Area is approximately $30,140,000. Based on a straight-line depreciation over the design life of the equipment, structures and force mains, the City should be reinvesting around $915,200 annually toward maintaining and replacing these assets within the Main Service Area.

West Side Service Area

The City of St. Charles operates and maintains three lift stations within the West Side Service Area. These installations are reasonably new and have been constructed as the City has grown over the past 20 years. The locations of these lift stations are indicated on the map below.

Exhibit 4-2: West Side Service Area Lift Station Locations



The lift stations in the West Service Area vary in age and capacity but were all constructed after 1998 as the City developed further west. The City's staff has assisted in the development of this portion of the Facility Plan Update and has provided input with respect to improvements needed at each station.

Table 4-2: West Side Service Area Lift Station Asset Value (2023$)

Lift Station	Equipment	Structure	Force Main	Totals
Pine Ridge	$360,000	$320,000	$190,000	$870,000
Renaux Manor	$410,000	$360,000	$630,000	$1,400,000
Zylstra	$360,000	$320,000	$670,000	$1,350,000
Totals	$1,130,000	$1,000,000	$1,490,000	$3,620,000
Design Life, Years	20	50	50	
Annual Replacement	$56,500	$20,000	$29,800	**$106,300**

It should be noted that the above figures do not include the engineering and contingencies that would be involved in a rehabilitation or replacement project. The value of the City's lift station and force main assets in the West Side Service Area is approximately $3,620,000. Based on a straight-line depreciation over the design life of the equipment, structures and force mains, the City should be reinvesting around $106,300 annually toward maintaining and replacing these assets within the West Side Service Area.

This section will discuss each lift station's strengths, deficiencies, and future needs independently in both service areas. Operational staff has indicated that most of the recommended improvements could be accomplished utilizing in-house resources. The more significant improvements have been broken into capital projects and recommended budgets have been provided. These projects should be incorporated into the City's Capital Improvements Program.

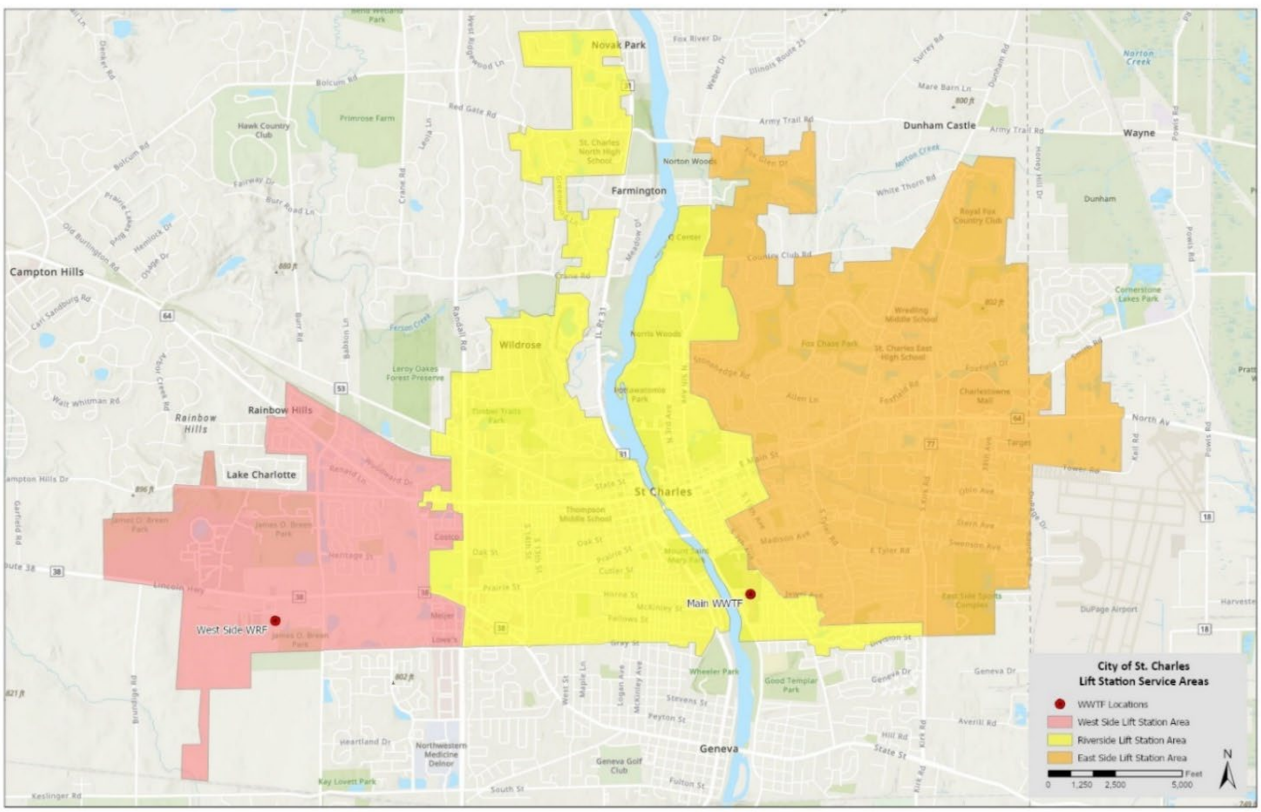
4.2 Main Service Area Lift Stations

4.2.1 Riverside Lift Station:

General Description

Riverside Lift Station is located at the intersection of Riverside Avenue (Illinois Route 25) and Devereaux Way. The lift station used to be located at the site of what was the City of St. Charles' first wastewater treatment facility, which was an Imhoff tank. When the wastewater treatment facility was relocated up the hill to the east in the 1930's, this site remained as a collection point for the City of St. Charles' wastewater infrastructure. In 2021, the City made the decision to move forward with removal of the existing lift station and construction of a new lift station. As of the writing of this report, construction of the new lift station is ongoing.

Exhibit 4-3: Riverside Lift Station Service Area (Yellow)



The Riverside Lift Station serves the majority of downtown area and west to Randall Road. The lift station service area, shown above in yellow contains 21,952 PE. A mixture of land uses is served, including residential, commercial and light industrial. The new lift station will be rated for 35 MGD.

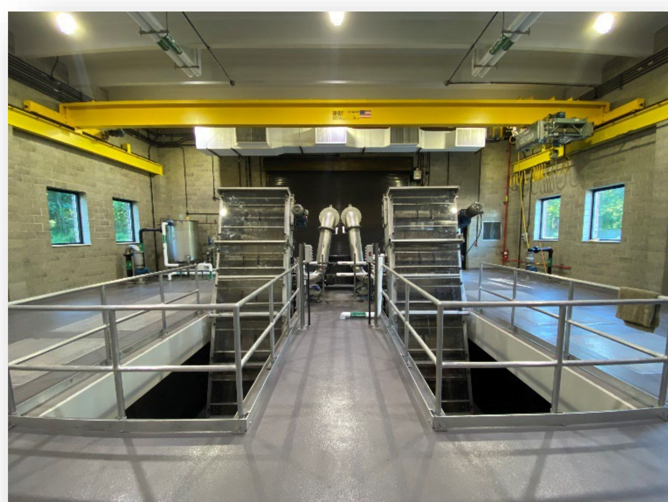
Table 4-3: Riverside Lift Station – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)	Installation Date
8	Flygt Submersible	4 @ 110 & 4 @ 140	2,327 (110 HP) & 5,000 (140 HP)	16 & 24	118 & 82	2024

This lift station utilizes two bar screens to separate non-biological solids from the raw sewage prior to conveyance to the wet wells. The trapped solids are sent to a washer and compactor that deposits the resulting debris into a dumpster for disposal. The screening system is served by a protected water system. The lift station has a dual wet well design, with four pumps in each wet well. Each wet well normally pumps to a dedicated force main, with an interconnecting valve for force main isolation. The two active force mains are tributary to the influent channel at the Main WWTF just upstream of the influent flow meter (Parshall flume). The channel is roughly 600 feet from Riverside Lift Station.

4.2.2 Strengths and Deficiencies

The Riverside Lift Station replacement project is currently under construction and should be complete in 2024. Improvements include construction of a new Riverside Lift Station and decommissioning of the existing lift station. The new lift station includes screening/washer-compactor equipment, dual wet wells with submersible pumps, an odor control system, and a new diesel generator. The station also includes new electrical and mechanical support systems.



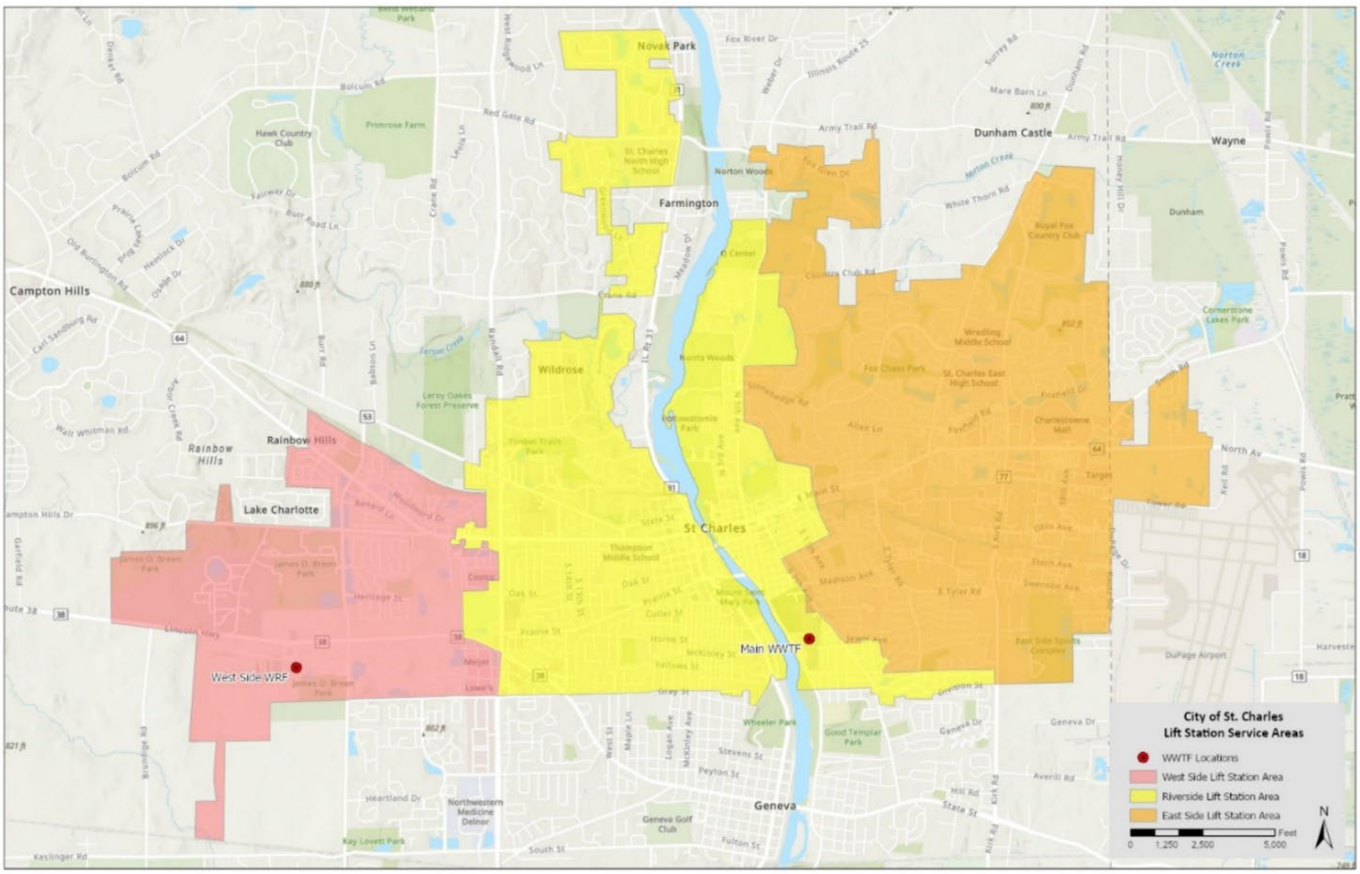
Description	Elevation (ft.)	Height Above Wet Well Floor (ft.)
Top of Influent Pipe	677.65	14.15
High Water Level Upstream of Screen*	678.00	14.50
Invert of Influent Pipe	673.65	10.15
Mean Water Level Downstream of Screen*	677.07	13.57
North Wet Well		
High Water Level	673.00	9.50
Lag Pump On	672.00	8.50
Lead Pump On	671.00	7.50
Operating Level	670.50	7.00
All Pumps Off	669.00	5.50
Low Water Level	667.00	3.50
South Wet Well		
High Water Level	673.00	9.50
Lag Pump On	671.00	7.50
Operating Level	670.50	7.00
Lead Pump On	670.00	6.50
All Pumps Off	668.00	4.50
Low Water Level	666.00	2.50
Floor of Both Wet Wells	663.50	0.00

4.2.3 East Side Lift Station

General Description

East Side Lift Station, originally constructed in 1973, is located along Seventh Avenue Creek at the northeast corner of the Main WWTF property. Prior to construction of this lift station, the service area was tributary to the Riverside Lift Station via an interceptor sewer along Seventh Avenue Creek. The interceptor is currently maintained as an emergency overflow in the event that the East Side Lift Station is unable to handle peak wet weather flows. The lift station service area shown below in orange, serves 27,064 PE.

Exhibit 4-4: East Side Lift Station Service Area (Orange)



The capacity of the existing wet well is 11,445 gallons at high water level. The range in the wet well is only two feet from "Pump On" to "High Level Alarm". As a result, flow pacing over the entire flow range is vital to minimize start and stop operations, which is attained by level transducers and VFD's on the pumps.

Table 4-4: East Side Lift Station – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)
4	Flowserve Submersible	100	4,345	16	62

The 2010 rehabilitation of the lift station included the replacement of the existing 50 horsepower dry-well pumps with 100 horsepower submersible pumps, the installation of variable frequency drives and controls, and the replacement of the bar screen with a mechanical fine screen and washer/grinder/compactor. This rehabilitation expanded the lift station's rated capacity to 14.0 MGD. Two of the four pumps have been rehabilitated since that project. One was recently rehabilitated in FY22-23, and one will be rehabilitated in FY24-25.

Strengths and Deficiencies

Description	Elevation (ft.)	Height Above Wet Well Floor (ft.)
Top of Diverter Gates	697.33	8.83
Top of Influent Pipe	696.60	8.10
High Water Level Upstream of Screen*	695.51	7.01
Invert of Influent Pipe	694.60	6.10
High Water Level Downstream of Screen*	694.11	5.61
Current Level Setting in Wet Well*	694.00	5.50
Floor of Influent Channels	693.00	4.50
Floor of Sump Prior to Wet Well	691.50	3.00
Low Water Level	690.22	1.72
Floor of Wet and Dry Wells	688.50	0.00

*NOTE: These numbers are from as-built drawings, and may have been modified.

Due to the constraints of the lift station influent channel, the depth of flow at the end of the channel must be approximately 1.06 feet to convey 14 MGD (PWWF and the lift station's rated capacity). The depth of flow immediately downstream of the fine screen is calculated to be 1.11 feet. Design head loss through the screen is approximately 1.41 feet, which makes a depth of flow upstream of the fine screen 2.51 feet. The existing fine screen, even when run in HAND, surcharges the upstream collection system and overflows the four-foot-tall diversion gates and bypasses to the 7th Avenue Creek sewer and ultimately to the Riverside Lift Station.

During flow surges, the mechanical fine screen does not permit enough throughput and the collection system surcharges (this reportedly occurs when the flows exceed 4 MGD). When the wet well height is greater than 7', it leads to bypassing the station. When the surcharge gets to be 0.73 feet above the top of the influent pipe, flow is able to go over the diverter gates. This means that the fine screen is currently creating more than 3.22 feet of head loss. This might be due to the perforated plates on the screen not be getting cleared of debris by the spray nozzles and brushes at the top section of the equipment. It is recommended that the condition of the fine screen be evaluated by the manufacturer to determine the cause for this increased headloss. It is also recommended that the City determine what impact it will have on the upstream collection system if the water level downstream of the fine screen is brought back to manufacturer's recommendation (3.09 ft above channel bottom). If it is determined that the water levels may be increased, the set point in the wet well should be raised and the diversion gates should be provided with taller plates or extensions for the existing plates, accordingly.

The grinder, screen panels, auger and compactor were rehabilitated and replaced in 2021. The position of the trolley beam above the pumps makes it difficult to get pumps completely out of the wet well, and there is not a permanent hoist system for preventative maintenance on the fine screen. The City must use a portable A-frame crane to rotate the screen out of the channel, which poses safety concerns. Also, the discharge chute from this equipment makes it extremely difficult to remove pumps from the station for servicing. Consideration should be given for realigning the trolley beam above the pumps and installation of a new trolley beam above the screening equipment. The estimate below only includes the replacement of the screening and washer/compactor equipment, and installation of hoist system for this equipment.

Table 4-5: East Side Lift Station – Screening Replacement Cost Estimate

Description	Total Cost
GENERAL CONDITIONS	$204,000
RAW SEWAGE SCREENING REHABILITATION	$562,400
Construction Sub-total	**$766,400**
CONTINGENCY @ 10%	$76,700
DESIGN ENGINEERING @ 7.5%	$63,300
CONSTRUCTION ENGINEERING @ 7.5%	$63,300
PROBABLE PROJECT COST:	**$970,000**
IEPA Contingency (3%)	$25,293
Construction Period Interest (1.5%)	$14,929
TOTAL LOAN AMOUNT (nearest $100K)	**$1,100,000**

Additionally, it was noted in the City's Emergency Response Plan that the lift station is located in the flood zone. This means the lift station is at a moderate to high flood risk.

Table 4-6: East Side Lift Station – Strengths and Deficiencies

Category	Strength	Deficiency
Operations		• Leaking issue in the dry well (piping gallery).
Maintenance	• Bypass capabilities	• Difficult to lift the screen during maintenance.
Aesthetics	• Enclosed in a building on treatment plant property	• Building needs to be repainted.
Mechanical & Electrical	• Natural Gas Generator replaced in 2016 • SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via fiber	• MCC-1 and MCC-2 due for replacement within the next 5 years.
Miscellaneous		• Needs low temperature and heat alarms. • Located within a flood zone

4.2.4 7th & Division Lift Station

General Description

The 7th & Division Lift Station's service area is generally bound by Moore Avenue on the north, Division Street on the south, 7th Avenue on the west and Kirk Road on the east. The lift station serves 503 PE. The lift station discharges into the collection system at the intersection of 7th Avenue and Moore Avenue and is tributary to Riverside Lift Station.

The lift station was originally constructed in 1974 with a wet well/dry well configuration. This station was replaced in 2019, including a new lift station, valve vault and meter vault structures, pumps, control panel, electrical support systems, and enclosure. The emergency backup generator was reconnected in 2019.

Table 4-7: 7th & Division Lift Station – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)	Installation Date
2	ABS/Sulzer Submersible	7.5	344	6	43	2019

Table 4-8: 7th & Division Lift Station – Strengths and Deficiencies

Category	Strength	Deficiency
Operations	• Bypass capabilities • No I/I issues	
Maintenance	• Limited maintenance issues due to recent upgrades	
Aesthetics	• Has newer structures and fenced off from neighborhood	
Mechanical & Electrical	• Newer pumps and control panel	• Original generator
Miscellaneous	• SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via fiber	

Strengths and Deficiencies

The 7th & Division Lift Station Replacement was completed in 2019. The lift station is in good condition and has limited deficiencies due to the recent construction of the lift station. The 7th & Division Lift Station also has the ability to bypass flow. It is recommended the bypass be exercised and used regularly to prevent a blockage or valve failure.

4.2.5 Washington Avenue Lift Station

General Description

The Washington Avenue Lift Station serves only five houses in an area between Seventh Avenue and Ninth Avenue. The lift station discharges to a gravity sewer along Ninth Avenue and is tributary to the East Side Lift Station.

The Washington Avenue Lift Station was constructed in 1987 and has two small submersible pumps. The lift station is in fair to poor condition. The only rehabilitation to the station included replacement of one pump and replacement of the guiderail system. The Washington Avenue lift station currently serves 15 PE, and is not projected to have any future development.

Table 4-9: Washington Avenue Lift Station – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)
2	Hydromatic Pump	2	22	2	15

Strengths and Deficiencies

The pumps and plumbing in the lift station were recently rebuilt. Washington does not have a generator, nor does it have bypass pumping capabilities, however it has plenty of storage capacity due to the small number of tributary sanitary services. Its electrical system is original to the lift station, as are its valves and piping.

Table 4-10: Washington Avenue Lift Station – Strengths and Deficiencies

Category	Strength	Deficiency
Operations		• No bypass capabilities • Needs safety grates on wet well • Pump issues • Needs a flow meter • Original structure, valves and piping
Maintenance		• Aging lift station beyond service life
Aesthetics		• Located in a front lawn
Mechanical & Electrical		• No on-site generator • Original electrical systems
Miscellaneous	• SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via cellular	• Needs a new hatch

4.2.6 Country Club Lift Station

General Description

Country Club Lift Station was originally constructed in 1988 and replaced in 2021. The project included construction of a new concrete wet well with duplex submersible pumps, controls, valve vault, bypass vault, and meter vault. Additionally, the project included a new electrical service, and control panel. The lift station serves only the Country Club and is located north of the club house. The 4-inch force main discharges to the collection system at the intersection of Persimmon Drive and Country Club Road. From there, the flow is tributary to the East Side Lift Station. The County Club Lift Station currently serves 86 PE.

Table 4-11: Country Club Lift Station – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)	Installation Date
2	Sulzer Pumps	7.5	100	4	57	2021

Strengths and Deficiencies

Since the reconstruction project in 2021, most of the equipment is new. Only the generator and the force main were not replaced during the project. The force main needs to be cleaned out and evaluated. There is severe pipe corrosion in the outfall manhole 4.6021. Thus, it is recommended a smart ball or similar pipe thickness inspection be completed. Also, it is recommended the bypass be exercised and used regularly to prevent a blockage or valve failure.

Table 4-12: Country Club Lift Station – Strengths and Deficiencies

Category	Strength	Deficiency
Operations	• New Pumps	
Maintenance	• New Valves and Piping	• Original forcemain
Aesthetics	• Hidden by vegetation	• On country club property
Mechanical & Electrical	• New control panel	• Natural gas generator preferred
Miscellaneous	• SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via cellular	

4.2.7 Pheasant Run Trails Lift Station

General Description

The Pheasant Run Trails Lift Station serves multi-family development north of Illinois Route 64 and south of Smith Road. The lift station was constructed in 1997 and serves approximately 629 PE including the Hilton Inn & Gardens Hotel. The 6-inch force main extends to the intersection of Illinois Route 64 and Kautz Road. The flow is tributary to the East Side Lift Station. There is potential for residential and commercial development in the lift station.

Table 4-13: Pheasant Run Trails Lift Station – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)
2	Hydromatic Submersible, Pentair Submersible	15	468	8	42

Strengths and Deficiencies

The influent line to the wet well deposits flow, including rags and grease, directly on top of one of the pumps. This builds up debris over time, making the pumps difficult to remove for maintenance. This issue may be addressed by physically rotating the pumps and corresponding rails within the wet well. To address the ragging issues, the City may install a pump that will pass larger solids (i.e. screw centrifugal pumps), install a chopper pump to reduce the solid size, or require that the tributary users provide pretreatment screening. Vehicle access is a concern, and relocating the vehicle entrance to the south will allow easier access for maintenance and emergency repairs. Additionally, the asphalt and concrete at the site are in need of repairs. It is also recommended the bypass be exercised and used regularly to prevent a blockage or valve failure. Also, the City is dealing with electrical issues with the aging control panel, and the control cabinet has a significant amount of rust. The Pheasant Run Trails Lift Station is a candidate for rehabilitation.

Table 4-14: Pheasant Run Trails Lift Station – Strengths and Deficiencies

Category	Strength	Deficiency
Operations	• Bypass capabilities	• Wet well in poor shape • Aging pumps, valves and piping
Maintenance		
Aesthetics		• Asphalt and concrete issues
Mechanical & Electrical	• On-Site Generator	• Aging control panel in poor condition
Miscellaneous	• SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via fiber and cellular	• Pump location • Needs safety grates on wet well • I/I issues in wet well and valve vault

4.2.8 Royal Fox Lift Station No. 2

General Description

Royal Fox Lift Station No. 2 is located along Dunham Road immediately north of St. Charles East High School. The lift station was constructed in 1988 and rehabilitated in 2013. It serves 2,338 PE. The lift station firm capacity is 650 gpm. The 8-inch force main extends south to a 15-inch gravity sanitary sewer along Dunham Road. This force main was replaced in 2019. The flow from this service area is tributary to the East Side Lift Station.

Table 4-15: Royal Fox Lift Station No. 2 – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)
2	ABS Sulzer XFPD100G Submersible	28	650	8	95

Strengths and Deficiencies

The lift station was last rehabilitated in 2013. This work included replacement of pumps, valves, and piping within the station, replacement of the control systems and traffic box, rehabilitation of the lift station structure with a spray-applied structural lining, installation of a magnetic flow meter and bypass pump connection vault, installation of a new concrete lid, connection to the City SCADA, and site improvements.

The lift station is in good condition. However, the generator was not replaced during the last rehabilitation project and its condition needs to be considered. Lastly, it is recommended the bypass be exercised and used regularly to prevent a blockage or valve failure.

Table 4-16: Royal Fox Lift Station No. 2 – Strengths and Deficiencies

Category	Strength	Deficiency
Operations	• Bypass capabilities	• Aging valves, piping and wet well, valve vault
Maintenance		
Aesthetics		• Needs improvement
Mechanical & Electrical	• Control panel in good condition	• Aging generator
Miscellaneous	• SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via fiber	• Some I&I in valve vault • Needs safety grates over wet well

4.2.9 Royal Fox Lift Station No. 1

General Description

Royal Fox Lift Station No. 1, constructed in 1988, is located at the intersection of Royal Fox Drive and Dunham Road. The lift station serves the northern part of Royal Fox Subdivision, approximately 591 PE. The lift station contains two submersible pumps each rated for 200 gpm and receives a peak hourly flow of approximately 111 gpm. Therefore, the lift station has plenty of remaining capacity. The lift station was rehabilitated in the summer of 2014 for roughly $335,000.

Table 4-17: Royal Fox Lift Station No. 1 – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)
2	4-inch ABS XFPD 100E-CB1 Submersible	10	200	6	60

Strengths and Deficiencies

The rehabilitation of this lift station was completed in the fall of 2014, and included replacement of pumps, valves, and piping within the station, replacement of the control systems and traffic box, rehabilitation of the lift station structure with a spray-applied structural lining, installation of an above-grade bypass pump connection, installation of a new concrete lid, and site improvements. Since the lift station was rehabilitated in 2014, most of the lift station is in good condition. There are limited issues with the lift station. It is recommended that the City complete this work through the budget process. It is also recommended to update the landscaping around the lift station to hide it from the entrance to the neighborhood. Lastly, it is recommended the bypass be exercised and used regularly to prevent a blockage or valve failure.

Table 4-18: Royal Fox Lift Station No. 1 – Strengths and Deficiencies

Category	Strength	Deficiency
Operations	• Pumps in good condition	• Wet well needs cleaning • Needs a flow meter
Maintenance	• Bypass capabilities	
Aesthetics		• Needs more bushes and plants to hide lift station from neighborhood
Mechanical & Electrical	• Control system in good condition	• Aging but operational generator
Miscellaneous	• SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via cellular	• Needs safety grates over wet well

4.2.10 Woods of Fox Glen Lift Station

General Description

The Woods of Fox Glen Lift Station is located in the center of Glenbriar Court in the Woods of Fox Glen Subdivision on the north edge of St. Charles. The 6-inch force main extends through the St. Charles Country Club property and is tributary to the sanitary sewer at the intersection of Country Club Road and Persimmon Drive, and eventually to the East Side Lift Station. The lift station was constructed in 1989 and serves approximately 752 PE. No future development is expected in the basin.

Table 4-19: Woods of Fox Glen Lift Station – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)
2	Myers Submersible	20	160	6	112

Strengths and Deficiencies

The Woods of Fox Glen Lift Station is in good condition. The pumps at the lift station have been replaced within the last five years. be New guide rails and new floats were installed within the last two years. The electrical control panel is beyond its service life and needs to be replaced.

The lift station piping has a unique design with the check valves installed in the discharge riser within the wet well. Installation of the check valves in vertical piping is not sound engineering practice, is not code compliant, and solids will settle atop the closed check valve disc. City staff recommends relocating the check valves to a valve vault where they can be installed horizontally and will be more accessible for maintenance. The lift station should also be upgraded with a flow meter and replacement of the electrical system. Also, it is recommended that the aging generator’s condition be reviewed during design of the rehabilitation of the electrical system. Lastly, it is recommended the bypass be exercised and used regularly to prevent a blockage or valve failure.

Table 4-20: Woods of Fox Glen Lift Station – Strengths and Deficiencies

Category	Strength	Deficiency
Operations	• Bypass capabilities	• Check valves need to be moved out of the wet well • Needs a flow meter
Maintenance		
Aesthetics	• Hidden by vegetation	
Mechanical & Electrical		• Electrical system needs to be replaced • Aging generator
Miscellaneous	• SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via cellular	• Need safety grates over wet well

4.2.11 Kingswood Lift Station

General Description

The Kingswood Lift Station is a duplex submersible lift station located north of Foxfield Drive on King Edwards Street. The lift station serves approximately 734 PE. The existing pumps provide a firm capacity of 400 gpm. The force main discharges to the sanitary sewer system near the intersection of Indian Way and Foxfield Drive. The flow is tributary to the East Side Lift Station.

Table 4-21: Kingswood Lift Station – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)
2	Hydromatic Submersible	15	400	8	50

Strengths and Deficiencies

The Kingswood Lift Station is in fair working condition. The presence of an on-site generator allows the lift station to continue to operate during a power outage. The electrical system was connected to SCADA in 2021; however, the electrical system and generator are original to the lift station. The valves and piping are original to the lift station and need to be replaced. The wet well is also original steel construction and should be lined or replaced. It is also recommended that a flow meter be installed, and safety grates over the wet well be installed for fall protection.

It was also noted by the City that although the lift station does not have capacity issues, upcoming future development will use up a significant amount of remaining capacity at the lift station.

Engineering Resource Associates, Inc. (ERA) prepared a "Lift Station Report" for the Kingswood PUD dated October 3, 1995. In that report, ERA noted that the lift station would be designed to serve the Kingswood subdivision as well as the adjacent 31-acre Oliver Hoffman property. The detailed calculations reserved a peak flow of 221,544 gpd for the future Oliver Hoffman development (proposed Charlestowne Lakes). This equates to 543 PE (100 gpd per PE) of average daily flow. The proposed sanitary design for Charlestowne Lakes only has 479.5 PE tributary to the lift station; less flow than was allocated in the design of the lift station.

A portion of the proposed Charlestowne Lakes Subdivision has been directed east to a gravity sewer in the King Edward Avenue stub road. Based upon the excess capacity in the pump flow rate, it may be possible for all of Charlestowne Lakes to be tributary to the lift station. The total waste load from Charlestowne Lakes would be 167 units x 3.5 PE = 584.5 PE and 58,450 GPD daily average flow. When combined with the Kingswood flow, the waste load is 1403.5 PE and 140,350 GPD daily average flow. The peaking factor is calculated as (18+1403.5/1000)/(4+1403.5/1000) = 3.59. The peak flow generated from Kingswood and all of Charlestowne Lakes is 140,350 x 3.59 = 503,857 GPD = 350 GPM. It would appear that the existing lift station has the pumping capacity for Kingswood plus all of Charlestowne Lakes.

Table 4-22: Kingswood Lift Station – Strengths and Deficiencies

Category	Strength	Deficiency
Operations		• Needs a bypass connection • Needs a flow meter • Aging valves and wet well
Maintenance		
Aesthetics	• Hidden by vegetation	• Needs new pavement and visual improvements
Mechanical & Electrical	• On-site generator	• Aging electrical system
Miscellaneous	• SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via cellular	• Needs safety grates and fall protection on wet well

4.2.12 Wild Rose Lift Station

General Description

The Wild Rose Lift Station was constructed in 1980, rehabilitated in 2011 and reconstructed in 2023. The lift station is located along Wild Spring Drive and serves approximately 247 PE. The pumps provide a firm capacity of 118 gpm. The force main is tributary to the 18-inch Interceptor, the North Siphon, and ultimately to the Riverside Lift Station.

Table 4-23: Wild Rose Lift Station – Pump and Motor Data

Number of Pumps	Pump Manuf. & Type	Min/Max Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)
2	Sulzer ABS Submersible	2/3	118	4	27

Strengths and Deficiencies

The Wild Rose lift station was reconstructed in 2023. The project included significant improvements to the lift station, including construction a of a new wet well with an access hatch and new submersible pumps, new bypass/valve vault, new meter vault, and sanitary sewer improvements. Additionally, a new generator was installed at the lift station, as well as new electrical equipment, control, and SCADA connections. The existing lift station was demolished. Also, the road leading to the station was paved. However, the lift station is still located in a flood zone. This means the lift station is at a moderate to high risk of flooding.

Table 4-24: Wild Rose Lift Station – Strengths and Deficiencies

Category	Strength	Deficiency
Operations	• Lift station is in excellent condition due to recent reconstruction • Has level transducer • New submersible pumps	
Maintenance		
Aesthetics	• Good distance from roadway • Has paved road to the station	
Mechanical & Electrical	• New natural gas generator • New control panel	
Miscellaneous	• SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via cellular	• Located within a flood zone

4.2.13 Red Gate Lift Station

General Description

The Red Gate Lift Station, constructed in 1988 and upgraded in 1999 and 2006, is located on the south side of Crane Road across from Crane Road Estates. The lift station currently serves the St. Charles North High School and 196 residential lots, which equates to 2,139 PE. There is projected future development in the collection system that will be tributary to this lift station. The lift station has a firm capacity of 506 gpm.,

The lift station includes two submersible pumps, valve vault and stand-by generator. The 6-inch force main extends southward across Ferson Creek and discharges into the collection system in the Wild Rose Subdivision. From there, flow is conveyed by gravity to the Riverside Lift Station. Additionally, one of the pumps was replaced in 2022.

Table 4-25: Red Gate Lift Station – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)	Installation Date
1	Hydromatic Submersible	20	506	6	66	2005
1	Flygt NP3153.095 HT	20	541	6	66.4	2022

Strengths and Deficiencies

Red Gate is currently in good operating condition. One of the pumps is in new condition, since it was just replaced in 2022 for approximately $19k. However, the other pump is in poor condition and needs to be replaced. Additionally, the pavement around the lift station is broken and needs to be replaced. The valves, piping, electrical system and generator are original to the lift station but are in fair condition. It is recommended the bypass be exercised and used regularly to prevent a blockage or valve failure. Also, the lift station is located in a flood zone. This means the lift station is at a moderate to high risk of flooding.

Table 4-26: Red Gate Lift Station – Strengths and Deficiencies

Category	Strength	Deficiency
Operations	• New pump • Bypass capabilities • No I/I issues	• Old pump needs to be replaced • Valves and piping are original
Maintenance		
Aesthetics		• Close to road, needs traffic protection • Needs pavement replacement and updated landscaping
Mechanical & Electrical		• Original electrical system and generator
Miscellaneous	• SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via cellular	• Located within a flood zone • Need safety grates installed on wet well

4.2.14 Oak Crest Lift Station

General Description

The Oak Crest Lift Station was constructed in 2000. The lift station is located on Crestwood Lane in the Oak Crest Subdivision. The lift station includes two submersible pumps, back-up generator, and auto-transfer switch. The Oak Crest lift station serves 67 PE.

Table 4-27: Oak Crest Lift Station – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)
2	Myers 4RX50M4-21 Submersible	5	100	6	43

Strengths and Deficiencies

The Oak Crest Lift Station is in good operating condition. The presence of an on-site generator allows the station to operate under power outages. However, the pumps, piping, control system, electrical system, and generator are nearing the end of their service life and should be replaced with any future rehabilitation. The lift station is close to the road, and traffic protection improvements should be included with future rehabilitation of the lift station. A flow meter vault should also be included with a future rehabilitation project. It is recommended the bypass be exercised and used regularly to prevent a blockage or valve failure.

Table 4-28: Oak Crest Lift Station – Strengths and Deficiencies

Category	Strength	Deficiency
Operations	• Bypass capabilities	• Needs a flow meter • Aging pumps, valves, and piping
Maintenance	• No issues noted	
Aesthetics		• Close to road, needs traffic protection
Mechanical & Electrical	• On-site generator	• Original electrical system and generator
Miscellaneous	• SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via cellular	• Needs safety grates over the wet well

4.3 West Side Service Area Lift Stations

4.3.1 Pine Ridge Lift Station

General Description

The Pine Ridge Lift Station is located at the intersection of Oak Street and Woodward Drive. This lift station was constructed in 2007 to serve the Pine Ridge Park commercial development and Regency Estates residential subdivision. This lift station currently serves 174 PE but is projected to serve 446 PE at buildout.

This lift station employs a submersible duplex pumping system that discharges through a 906-foot-long, 4-inch diameter force main. This force main conveys wastewater south to Route 64 and east along Campton Hills Drive until it discharges to a sanitary manhole in the Renaux Manor Drainage Basin located near the northwest corner of Campton Hills Drive and Renard Lane.

Table 4-29: Pine Ridge Lift Station – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)
2	Hydromatic Submersible	15	160	4	61

Strengths and Deficiencies

Pine Ridge is in good working condition. The pumps, valves and piping are in good condition. The control panel and electrical system are old but are in acceptable condition. The station has bypass capabilities in the valve vault. A significant amount of development can be facilitated in the sanitary basin served by this station as it was designed for larger flows. The collection system tributary to this lift station is relatively new and does not have significant inflow and infiltration.

Table 4-30: Pine Ridge Lift Station – Strengths and Deficiencies

Category	Strength	Deficiency
Operations	• Pumps are in good condition	
Maintenance	• Bypass capabilities	• Needs safety grates over wet well for fall protection
Aesthetics	• Hidden by vegetation	
Mechanical & Electrical	• On-site generator	
Miscellaneous	• SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via fiber	

4.3.2 Renaux Manor Lift Station

General Description

The Renaux Manor Lift Station is located along the north side of Campton Hills Road, east of Peck Road. This lift station was constructed in 1998 and serves the Renaux Manor Drainage Basin. This basin includes 285 acres of mixed residential and commercial, which currently has 2,487 PE. The Pine Ridge Lift Station discharges into the Renaux Manor Drainage Basin. Tributary flow from the Pine Ridge Lift Station currently adds 174 PE to the Renaux Manor Lift Station loading. Considering this and future development within Renaux Manor subbasin and Pine Ridge subbasin, this lift station is projected to serve approximately 4,649 PE from the Renaux Manor subbasin plus an additional 446 PE from Pine Ridge at buildout for a total PE at buildout of 5,095 PE.

This lift station utilizes a submersible triplex pumping system that discharges through a 1,470-foot-long, 12-inch diameter force main. This force main conveys wastewater south along Peck Road until it discharges to a sanitary manhole at the northeast corner of the intersection of Peck Road and Springfield Way.

Table 4-31: Renaux Manor Lift Station – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)
3	Pentair Myers Submersible	7.5	690	12	29

Strengths and Deficiencies

There is a bypass connection located in the valve vault. It is recommended that the bypass be exercised and used regularly to prevent a blockage or valve failure. Additionally, the lift station was connected to the City's SCADA in 2019 as part their SCADA upgrade program.

Table 4-32: Renaux Manor Lift Station – Strengths and Deficiencies

Category	Strength	Deficiency
Operations	• Bypass capability	
Maintenance		• Needs fall protection (grates) on well
Aesthetics	• Significant distance between station and roadway, hidden by vegetation	
Mechanical & Electrical	• On-site generator	• Older generator • Electrical equipment is original
Miscellaneous	• SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via cellular	

4.3.3 Zylstra Lift Station

General Description

The Zylstra Lift Station is located at the northeast corner of the Fox River (formerly Zylstra) Harley Davidson property located on Randall Road just south of Route 64. This lift station was completed in 2007 as a part of the Fox River Harley Davidson development to serve the Zylstra Drainage Basin. This basin consists of 47 acres of commercial and governmental use. The lift station currently serves 357 PE and is projected to serve 511 PE at buildout. With the completion of the Well 7/13 Interconnect project, the current PE is expected to be reduced to 213 PE. Additionally, as part of the project, a new submersible lift station was constructed to pump the backwash straight to the West Side WRF instead of to the Zylstra lift station. The new lift station is sized with (2) 200 gpm submersible pumps at 60' TDH, will add 67 PE to the WRF.

The City replaced one of the two 15 HP pumps with a 20 HP pump. The 4-inch force main discharges to a sanitary manhole located east of the intersection of Tower Hill Drive and Pleasant Plaines Drive in the Gravity Drainage Basin.

Table 4-33: Zylstra Lift Station – Pump and Force Main Data

Number of Pumps	Pump Manuf. & Type	Pump Motor (HP)	Pump Rated Capacity (GPM)	Force Main Dia. (inch)	Rated TDH (feet)
1	ABS Sulzer Submersible	20	200	4	89
1	Hydromatic Submersible	15	150	4	87.6

Strengths and Deficiencies

The pumps at the Zylstra Lift Station are functioning well. However, one of the pumps is too large for the existing generator. While the on-site generator allows the station to operate when there is a power outage, it can only run the smaller of the two pumps. The control panel is in good condition. The bypass connection is located just inside the access hatch to the valve vault. It is recommended the City exercise the bypass and use it regularly to prevent a blockage or valve failure. The collection system tributary to this lift station is relatively new and does not have significant inflow and infiltration. The lift station was connected to the City's SCADA as part of the City's SCADA upgrade program. As part of the Well 7/13 Interconnect project, an output signal from the Oak St. Facility's SCADA system via the local PLC indicates to the local backwash lift station when the Zylstra lift station is running. Two backwash pumps are permitted to run when Zylstra is not running while only one pump is allowed to run when Zylstra is running.

Table 4-34: Zylstra Lift Station – Strengths and Deficiencies

Category	Strength	Deficiency
Operations	• Bypass connection close to ground level • Newer pumps	• One of the pumps is too large for the generator size • High head loss
Maintenance		
Aesthetics	• Fenced off on a side street	
Mechanical & Electrical	• On-site generator	• Generator is too small
Miscellaneous	• SCADA updated in 2020, including panel views, logics, and level transducers • Connected to SCADA via fiber	• I/I issues in dry well and wet well

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SECTION 5

EXISTING MAIN WASTEWATER TREATMENT FACILITY AND WEST SIDE WATER RECLAMATION FACILITY

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5. EXISTING MAIN WWTF AND WEST SIDE WRF

5.1 GENERAL BACKGROUND AND EXPANSION HISTORY

Main Wastewater Treatment Facility

The City of St. Charles original wastewater treatment facility was located along the banks of the Fox River near the Riverside Lift Station. In the early 1930's, a new plant was constructed up the hill on what is now the wastewater treatment facility site. The first plant on this site consisted of an Imhoff tank. Shortly after construction of the first structure, a new sludge management process was introduced referred to as the Putnam process. At this time, the first section of the existing sludge handling building was constructed in addition to several sludge storage tanks. The Putnam Process was abandoned during later expansions, but the building that housed it was incorporated into the Sludge Handling Building.

In the early 1950's, the plant was expanded to include two primary clarifiers, a 130-foot diameter trickling filter and final clarifier. The existing Imhoff tank was converted to sludge digestion. In 1966, the City constructed a contact stabilization process and rectangular final clarifiers. The existing final clarifier was converted to a chlorine contact tank. Once the improvements were completed the existing trickling filter was abandoned.

Due to growth within the community, the wastewater treatment facility was expanded again in 1972. The Stage One project was funded through the newly implemented Federal Grants Program brought about by the Clean Water Act. The project included new headworks, primary clarifiers, final clarifier revisions and sludge pumping improvements.

The new headworks included a Parshall flume for flow monitoring, chemical addition for phosphorous removal and two aerated grit chambers for removal of inorganic settable solids. The two primary clarifiers were 100 feet long by 40 feet wide. They were fitted with a traveling bridge collector mechanism, which spanned both tanks. The improvements to the final clarifiers enhanced the sludge return capabilities of the existing biological process. The sludge pumping improvements allowed the existing primary clarifiers to be converted to waste activated sludge holding.

The second phase was constructed in 1973. The project scope included construction of the East Side Lift Station, two new 65-foot diameter roughing filters, two additional final clarifiers, and two chlorine contact tanks. The project also included renovation of the laboratory/ sludge handling building. The improvements included pumps, piping, a coil filter press and conversion of the old chlorine contact tank to sludge holding.

In 1981, Riverside Lift Station was rehabilitated and expanded to serve the community's increasing demands. The rehabilitation included conversion of the dry well to additional wet well capacity, installation of submersible pumps, fine mechanical screens and backup generator. The project also included construction of the brick and block building to allow the operators above grade access to the station. This project was also funded through the Illinois EPA Grant program.

In 1985, the City of St. Charles upgraded the wastewater treatment facility to include excess flow treatment facilities. The project included construction of two 120-foot diameter final clarifiers and conversion of the existing rectangular units to first flush and excess flow clarifiers. In addition, a new chlorine building was constructed.

In 1986, the City increased the plant's sludge dewatering capacity by installing a 2-meter belt filter press (BFP). The project included sludge pumping improvements and a serpentine conveyor, which collected the sludge from both the BFP and existing coil filter and discharged it to a truck dock.

In 1987, the City expanded the capacity of the East Side Lift Station. The lift station included a wet well/ dry well configuration with four centrifugal pumps in parallel. The pumps discharge directly to the wastewater treatment facility headworks through a 16” force main.

In 1989, the Sludge Handling and Excess Flow Improvements were prompted by the USEPA 503 Regulations, which were pending at that time, and applicable excess flow treatment requirements. The sludge handling facilities improvements included construction of an egg-shaped anaerobic digestion complex. The improvements also included sludge pumping and storage modifications. The existing first flush tanks were converted to waste activated sludge holding, while one of the excess flow clarifiers was converted to first flush holding. The project was completed in 1991.

In 1994, the Illinois Pollution Control Board began the promulgation of Rule 94-1, which addressed ammonia nitrogen discharge limits for communities along the Fox and Rock River. After receiving public comment from several of the impacted POTW’s and interested citizen groups the Pollution Control Board implemented the Rule.

In 1996, the City’s NPDES permit was under review for re-issuance. The IEPA incorporated both ammonia nitrogen standards and revised chlorine residual limits into the permit. The permit included a compliance schedule for the necessary improvements to meet the new limits. The City completed the construction of the de-chlorination facilities in 1996 utilizing in-house resources. This project included equipment installation and piping modifications.

The new ammonia nitrogen limits were 9.4 mg/L monthly during summer months and 8.0 during winter. The City reviewed their existing infrastructure, made minor improvements and adjusted their operational approach to meet the proposed limits. Concurrently the City was receiving odor complaints. Due to limited capital funds the City elected to break projects into phases, which could be implemented on an annual basis. The 1996 Odor and Ammonia Control Project included covering of the 65-foot trickling filters and conversion of the WAS holding tanks to side stream treatment aeration basins. The newly created aeration basins treat the high strength filtrate from sludge dewatering operations prior to the flow being returned to the head of the plant. Covering the trickling filters enhanced the units’ performance during winter operation and contained the odors from the units.

The City recognized that the coil filter installed in 1973 was nearing the end of its service life and investigated available sludge dewatering technologies. The City determined that centrifuge technology was the most cost-effective solution. The 1997 Sludge Dewatering Improvements included the removal of the coil filter and installation of the first centrifuge, a new conveyor, pump, and polymer unit. The project design and layout provided for installation of a second unit in the future.

The next phase of the odor control program was completed in 1998. The project included covering the existing Parshall flume, aerated grit basins and primary clarifier launders. The atmosphere under the covers was evacuated through an exhaust system and the odors treated by oxidation with ozone.

In 1999, the traveling bridge primary clarifier mechanism, installed in 1972, was nearing the end of its service life and becoming a maintenance liability. The 2000 Primary Clarifier Improvements included demolition of the existing equipment and installation of traditional chain and scraper collector mechanisms. The existing primary clarifiers were 40 feet wide, however the chain and scraper mechanisms can only span twenty feet. Intermediate walls and drive pads were constructed allowing installation of two mechanisms in each clarifier. The sludge hoppers and pumping system remained the same.

The City installed the second centrifuge, conveyor and polymer unit during the 2001 Sludge Dewatering Improvements. The belt filter press (installed in 1987) was removed shortly after start-up of the second centrifuge.

In May of 2001, the Illinois EPA issued the City's new NPDES Permit. The updated permit included more stringent ammonia nitrogen limits. Recognizing that the City would be forced to complete a major renovation to achieve the new limits the Illinois EPA incorporated a compliance schedule into the permit, which states that the new limits became effective June of 2004. The City commissioned a facility plan update in 2002, which provided a series of recommendations to maintain regulatory compliance and rehabilitate the existing facilities. The City completed construction of the 2002 Nitrification Improvements project in 2005.

The project scope included demolition of the existing trickling filters and salt storage building. The process upgrades included construction of 2.5 million gallons of aeration capacity, blower building, rehabilitation of the existing aeration basins and expansion of the RAS/WAS pump station. Upgrades to the excess flow facilities included conversion of the existing first flush holding tank to an excess flow clarifier. The excess flow treatment process continues to be tributary to the chlorine contact tank. An ultraviolet disinfection system was constructed for use with the process flow.

In 2009, the City of St. Charles upgraded the East Side Lift Station and Riverside Lift Station. The improvements to East Side Lift Station included replacement of all mechanical and electrical components including the fine screen, pumps, piping, and controls. The rehabilitation to Riverside Lift Station was limited to screen, valve, and variable frequency drive replacement.

The City removed the chemical (ferric chloride) phosphorous removal system and replaced the primary sludge pumping system, primary clarifier cross-collector drive mechanism, odor control system, and associated MCC in the 2010 Headworks Rehabilitation. Other improvements included replacement of the existing rolling grit unit draft tubes, suction lift pumps, grit and primary sludge piping.

In late 2011, an assessment of the Main WWTF was completed. This included an evaluation of all processes and infrastructure, including the Main Sludge Handling Building. The functions within the building included the main switch gear; sludge pumping, holding, thickening, and dewatering operations; maintenance facilities; inventory; and offices. The electrical systems, thickening and dewatering equipment had reached the end of their service life and the building required significant structural rehabilitation.

The City of St. Charles proceeded with replacement of the Main Sludge Handling Building in 2011, which included a Facility Plan Update. The improvements were designed in such a configuration that future treatment processes or sludge stabilization upgrades were not negatively impacted. Furthermore, the City and TAI evaluated several centrifuge manufacturers and selected two to perform on-site pilot testing of their equipment. Both manufacturers demonstrated the capability to meet the City’s performance requirements. In addition, the existing infrastructure needed to remain in service during construction. The project therefore included construction of the new building in two phases.

The first phase included electrical/ control, sludge thickening and dewatering facilities. The waste activated sludge improvements included WAS holding, sludge feed pumps, polymer unit, gravity belt thickener, TWAS holding and pumping systems. The sludge dewatering improvements included sludge feed pumps, polymer units, two centrifuges and a conveyor in a loading dock. The second phase included construction of an operations building that contains an office, break room, locker room, inventory, and maintenance garage. The Facility Plan Update was submitted in July 2011 and the project was funded through the Illinois State Revolving Fund (SRF) program. Design was completed in December 2011, and construction was completed in the fall of 2014.

The City's existing Main WWTF infrastructure is of varying age and condition. The City has completed a brief audit of each unit process, its capacity, age, and condition and developed a series of recommended improvements. The existing NPDES permit limits are included in the next section, followed by the analysis of each unit process starting at the Headworks.

In 2019, the City completed the 2017 Phosphorus Removal and Digester Improvements project. The project included conversion of the existing nitrification basins to an A2O biological process, and rehabilitation of the anaerobic digesters. The biological process improvements included construction of a new Primary Sludge Fermenter, an Internal Recycle Pump Station, and a new Process Control Building with a Chemical Phosphorus Removal System for chemical polishing.

In 2023, the City will complete the 2021 Riverside Lift Station Replacement project. The replacement includes construction of a new Riverside Lift Station and decommissioning of the existing lift station. The new lift station will be rated for 35 MGD and will include screening/washer-compactor equipment, dual wet wells with submersible pumps, an odor control system, and a diesel generator. The station will also include electrical and mechanical support systems.

West Side WRF

In 1989, the City of St. Charles was approached by property owners west of Randall Road requesting annexation and sanitary sewer service. In response, the City investigated several alternatives including the acquisition of the Department of Corrections wastewater treatment facility, which served the Illinois Youth Center and the Illinois Department of Transportation's garage. The treatment facility included a 0.35 MGD package treatment plant, polishing pond and sludge drying beds. Effluent from the facility was discharged to Mill Creek near Keslinger Road.

The City submitted a Facility Plan Amendment and request for Facility Planning Area Boundary change in late 1989 and an update in 1991. The boundary change and plan were approved by NIPC and Illinois EPA. The City commenced with Phase I in 1992, which included purchase of the treatment facility and upgrading the facility to meet NPDES standards. Phase I was completed in 1997.

The City updated the Facility Plan again in 1998. The update outlined a phased approach for expansion of the treatment facility, which expanded the plant's capacity in three 0.35 MGD increments. The Illinois EPA approved Phases II and III as recommended with the Facility Plan, which would increase the treatment facility's capacity to 1.05 MGD. However, the Illinois EPA requested that a Facility Plan Update be submitted prior to expansion of the plant to 1.4 MGD to verify capacity requirements. The Illinois EPA issued an NPDES Permit consistent with the recommendations allowing for the Phase II expansion to 0.70 MGD and Phase III expansion to 1.05 MGD.

Once the Facility Plan was approved, the City of St. Charles proceeded with design and construction of the Phase II Improvements. The project was completed in 2001 and funded through the Illinois EPA Revolving Loan Program.

In 2023, the City completed the Phase III Expansion Project. This project included expansion of the design average flow from 0.7 MGD to 1.05 MGD, conversion of the biological process to a Bardenpho, replacement and expansion of preliminary screening, rehabilitation of the existing final clarifiers, construction of a Tertiary Building with disc filters and replacement of the UV disinfection system, chemical polishing systems for phosphorus removal, and replacement of the NPW system. It also included rehabilitation of the existing aerobic digester and construction of a sludge storage tank and Sludge Handling Building with a belt filter press for dewatering. The project also included construction of a Sludge Storage Barn with storage for dewatered sludge from both the Main WWTF and West Side WRF and a Vactor Receiving Station. This project was funded through the Illinois EPA Revolving Loan Program.

The City updated the Facility Plan in 2008, 2015, and 2019. These updates incorporated phased approach for expansion of the treatment facility as well as an analysis of recently promulgated and pending environmental regulations. The regulatory issues included nutrient removal, suspended solids effluent requirements and bio-solids stabilization, as well as anti-degradation requirements and copper and radium concentrations in the effluent.

Section 2 provides an update of existing, proposed and future development that will be served by the West Side WRF. Section 3 provides a review of the collection system and Section 4 provides an analysis of the existing lift stations. This section is intended to address the existing facility's performance, capacity and needs.

5.2 MAIN WWTF NPDES PERMIT LIMITS

Flow	
Design Average Flow, MGD	9.0
Design Maximum Flow, MGD	18.35
$CBOD_5$	
Monthly Average, mg/L	20
Monthly Average, lbs.	1,501
Weekly Average, mg/L	40
Weekly Average, lbs.	3,002
Suspended Solids	
Monthly Average, mg/L	25
Monthly Average, lbs.	1,877
Weekly Average, mg/L	45
Weekly Average, lbs.	3,378
Fecal Coliform	
Monthly Maximum (Geometric Mean)	200 per 100 ml
pH	
Range	6 - 9
Chlorine Residual	
Daily Maximum, mg/L	0.05
Ammonia Nitrogen	
March-May, Sept.-Oct.	
Daily Maximum, mg/L	1.8
Daily Maximum, lbs.	135
Monthly Average, mg/L	1.5
Monthly Average, lbs.	113
June through August	
Daily Maximum, mg/L	1.4
Daily Maximum, lbs.	105
Monthly Average, mg/L	1.3
Monthly Average, lbs.	98

November through February	
Daily Maximum, mg/L	3.4
Daily Maximum, lbs.	255
Total Phosphorus	
Annual Average, mg/L	1.0
Annual Maximum, lbs.	75 (153)
Total Nitrogen	
Monthly Average	Monitor Only
Dissolved Phosphorus	
Monthly Average	Monitor Only
Nitrate/Nitrite	
Monthly Average	Monitor Only
Total Kjeldahl Nitrogen (TKN)	
Monthly Average	Monitor Only
Alkalinity	
Monthly Average	Monitor Only
Temperature	
Monthly Average	Monitor Only
Dissolved Oxygen	
March-July	
Monthly Average not less than, mg/L	N/A
Weekly Average not less than, mg/L	6.0
Daily Minimum, mg/L	5.0
August-February	
Monthly Average not less than, mg/L	5.5
Weekly Average not less than, mg/L	4.0
Daily Minimum, mg/L	3.5

5.3 MAIN WWTF PROCESS SUMMARY

The raw wastewater is transported from the collection system to the facility through two tributary lift stations: The Riverside Lift Station and the East Side Lift Station. A 24-inch, a 27-inch, and a 36-inch interceptor sewer all flow into a 48-inch interceptor sewer which discharges to the Riverside Lift Station. This station includes a 16-inch and a 24-inch force main that both discharge directly to the influent diversion structure at the head of the facility. A 24-inch interceptor sewer discharges to the East Side Lift Station. This station includes a 16-inch force main that also discharges directly to the influent diversion structure at the head of the facility. Both lift stations provide screening of rags and debris from the wastewater upstream of the pumps.

The influent diversion structure provides diversion to excess flow at peak flows prior to influent flow measurement. Flow then enters the grit removal process which utilizes two rolling grit units to separate inorganic material and grit from the screened wastewater. After grit removal, flow enters the four rectangular primary clarifiers, where solids are settled from the water and floatable material is skimmed from the surface. The settled solids are pumped to the primary sludge fermenter to enhance the biological phosphorus removal or to the anaerobic digesters for stabilization. Scum from the surface of the primary clarifiers is sent directly to the anaerobic digesters for stabilization. Flow passes over a weir, and is then blended with return activated sludge (RAS), which contains beneficial micro-organisms. The resulting thinner sludge is commonly referred to as mixed liquor suspended solids (MLSS). The MLSS is then introduced to the biological process.

The Main WWTF utilizes a biological nutrient removal process known as an A2O (Anaerobic, Anoxic, Oxic). This process uses a series of anaerobic, anoxic, and aerobic zones to remove phosphorus and total nitrogen through denitrification, as well as utilizes micro-organisms for the conversion of contaminants including dissolved organic material and ammonia-nitrogen. The micro-organisms or bio-mass utilize dissolved oxygen for respiration, which is supplied by compressed ambient air through fine bubble diffusers. Within the biological process, the total volume of bio-mass increases as it consumes the contaminants.

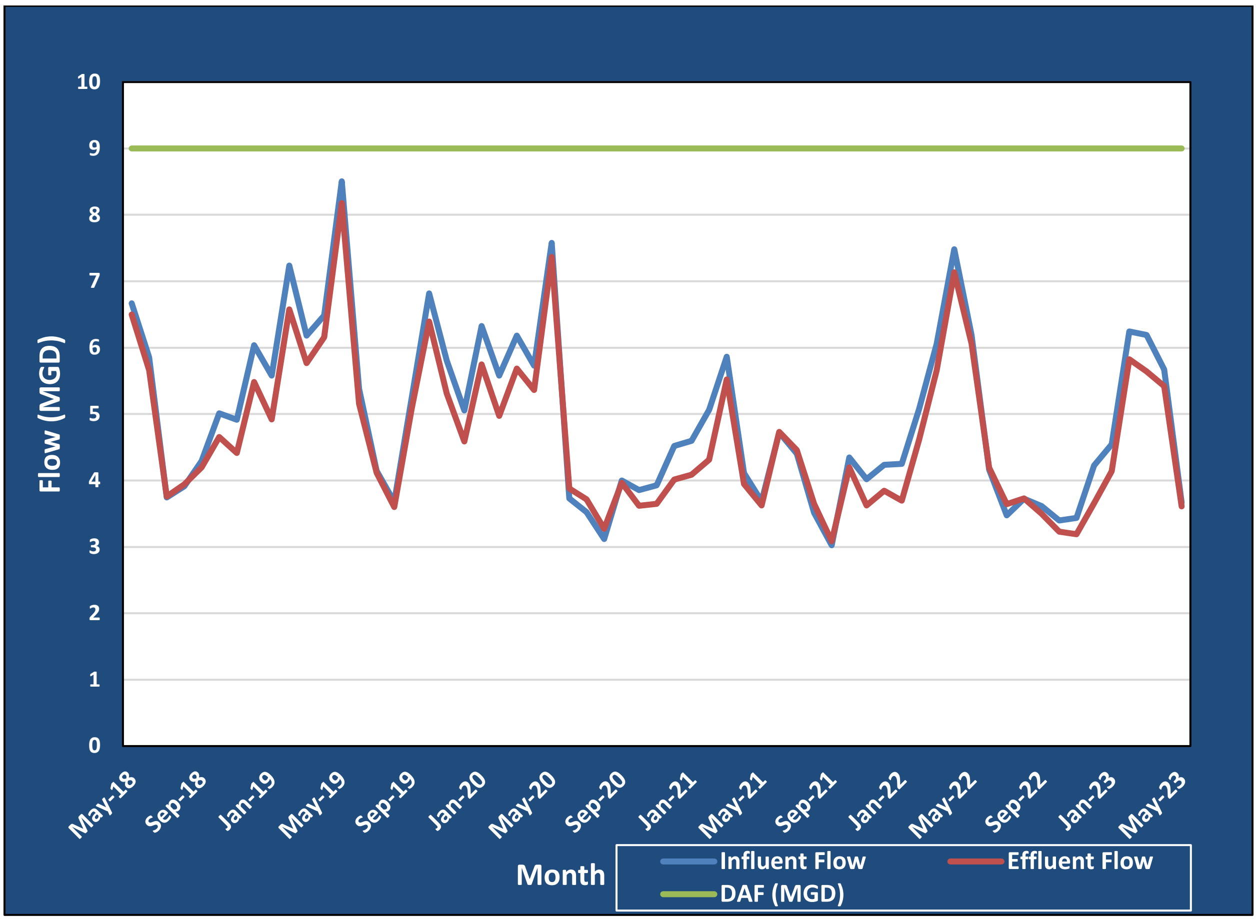
Following the biological process, solids are separated from the water through settling in final clarifiers. Most of the settled solids are returned to the beginning of the biological process in the form of RAS. A portion of the sludge must be wasted to maintain a proper balance. This waste activated sludge (WAS) is transferred to storage tanks for eventual thickening and transfer to the anaerobic digestion process for stabilization in the City’s egg-shaped anaerobic digesters. Once the sludge has been stabilized, it is transferred to a holding tank prior to dewatering and ultimate disposal. The clear water flows over the weirs of the final clarifiers to the U.V. disinfection structure. The U.V. light disrupts the remaining organisms’ ability to reproduce or accomplish cell division. The effluent is then conveyed through an outfall sewer to the Fox River where it is discharged.

5.4 MAIN WWTF PLANT PERFORMANCE

5.4.1 Influent and Effluent Data

Design Average Flow for the Main WWTF is 9.0 MGD. The Illinois EPA reviews the three low flows months for any twelve-month period. The average of the three low flow months is compared to the design average flow to determine the remaining capacity for connecting additional load and sewer extensions. Figure 5-1 below shows the Design Average Flow and the monthly influent and effluent flows from 2018 through 2023. Based on the consistency of the flow, it is evident that the collection system is subject to infiltration and inflow.

Figure 5-1: Main WWTF – Influent and Effluent Flows



The monthly average flow from 2018 through 2023 ranged from 3.02 MGD up to 8.51 MGD. The chart below shows the annual average flow and three low flow months for 2018 through 2023.

Table 5-1: Main WWTF – Average and Low Flow Data

	3 Month Low Flow Average	Months	Annual Average	Peak Month Flow
Influent Flow Meter				
2018	3.98 MGD	Jul/ Aug / Sept	5.05 MGD	6.67 MGD
2019	4.29 MGD	Aug / Jul / Dec	5.84 MGD	8.51 MGD
2020	3.46 MGD	Aug / Jul / Jun	4.84 MGD	7.58 MGD
2021	3.41 MGD	Sep / Aug / May	4.30 MGD	5.86 MGD
2022	3.44 MGD	Oct / Nov / Jul	4.59 MGD	7.48 MGD
2023	4.63 MGD	May / Jan / Apr	5.26 MGD	6.24 MGD
Effluent Flow Meter				
2018	3.97 MGD	Jul / Aug / Sept	4.83 MGD	6.50 MGD
2019	4.10 MGD	Aug / Jul / Dec	5.49 MGD	8.18 MGD
2020	3.51 MGD	Aug / Oct / Nov	4.60 MGD	7.36 MGD
2021	3.44 MGD	Sept / May / Nov	4.09 MGD	5.52 MGD
2022	3.31 MGD	Nov / Oct / Sept	4.36 MGD	7.13 MGD
2023	4.39 MGD	May / Jan / Apr	4.93 MGD	5.83 MGD

5.4.2 Carbonaceous Oxygen Demand ($CBOD_5$)

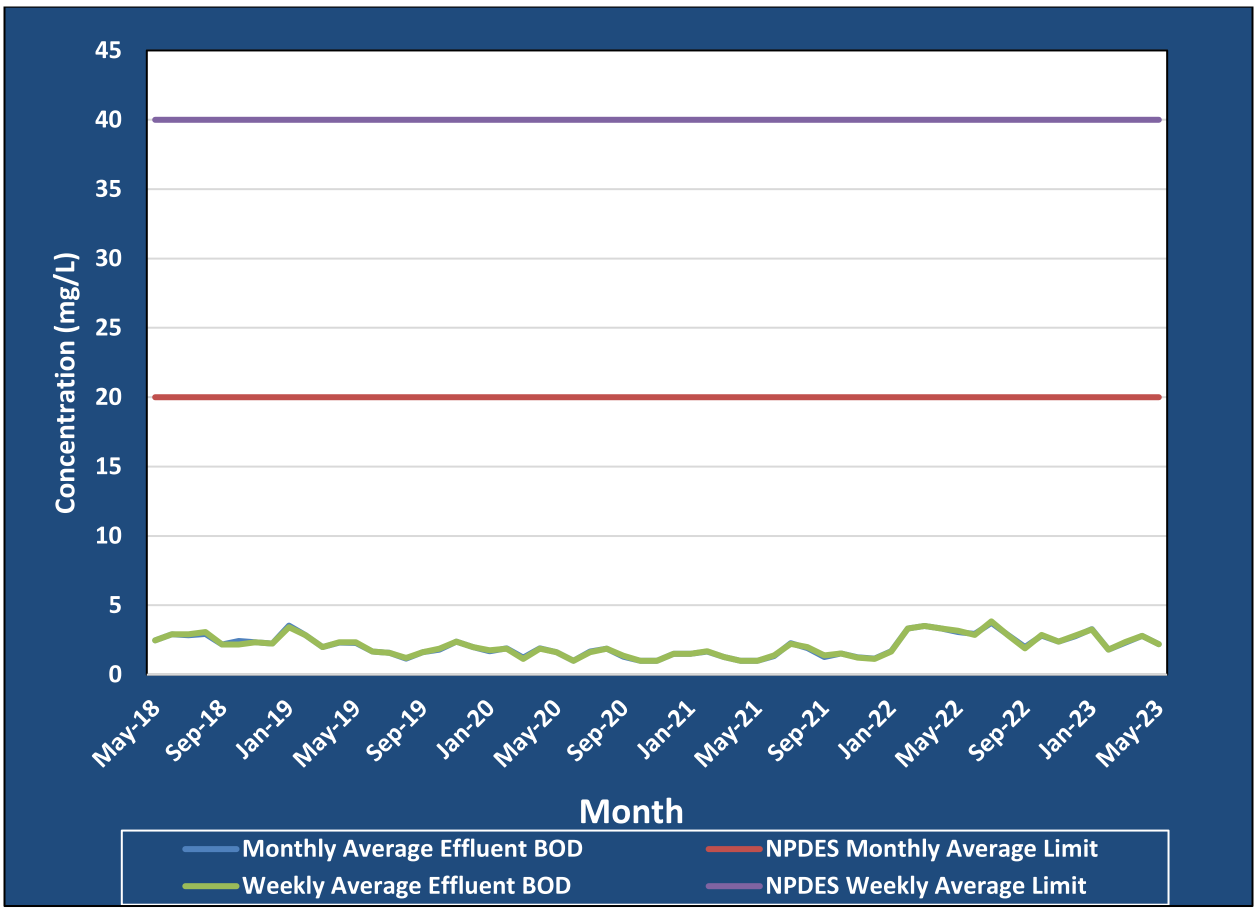
To determine the proper $CBOD_5$ design loading, the monthly average, the average monthly maximum, and the highest annual maximum was reviewed for the 2018-2023 time period.

Year	*Annual Average*	*Maximum Monthly Average*	*Daily Maximum*
2018	151 mg/L	177 mg/L	348 mg/L
2019	158 mg/L	209 mg/L	330 mg/L
2020	141 mg/L	177 mg/L	300 mg/L
2021	148 mg/L	174 mg/L	224 mg/L
2022	158 mg/L	215 mg/L	337 mg/L
2023	153 mg/L	195 mg/L	470 mg/L
Average	151 mg/L	191 mg/L	335 mg/L

The facility should be designed with adequate biological reduction capacity to meet the effluent limits on a continuous basis. The influent concentrations should be evaluated based on 2018-2023 data. The 2014 design calculations were based around existing influent $CBOD_5$ of 181 mg/L. This is consistent with the monthly average design condition at that time. While this design parameter is adequate to determine basin sizing, the aeration system capacity was designed to treat the primary effluent BOD loading at peak hourly flow assuming no BOD removal in the anaerobic or anoxic zones.

The Daily Monitoring Reports were reviewed to document the efficiency of the existing process. The average influent and effluent CBOD5 for the period were 151 mg/L and 2.15 mg/L, respectively. This reflects an efficiency of 98.6%.

Figure 5-2: Main WWTF – $CBOD_5$ Performance



5.4.3 Total Suspended Solids Concentration

Total Suspended Solids (TSS) loadings were analyzed by comparing the monthly average, the maximum monthly average, and the daily maximum for the 2018-2023 data.

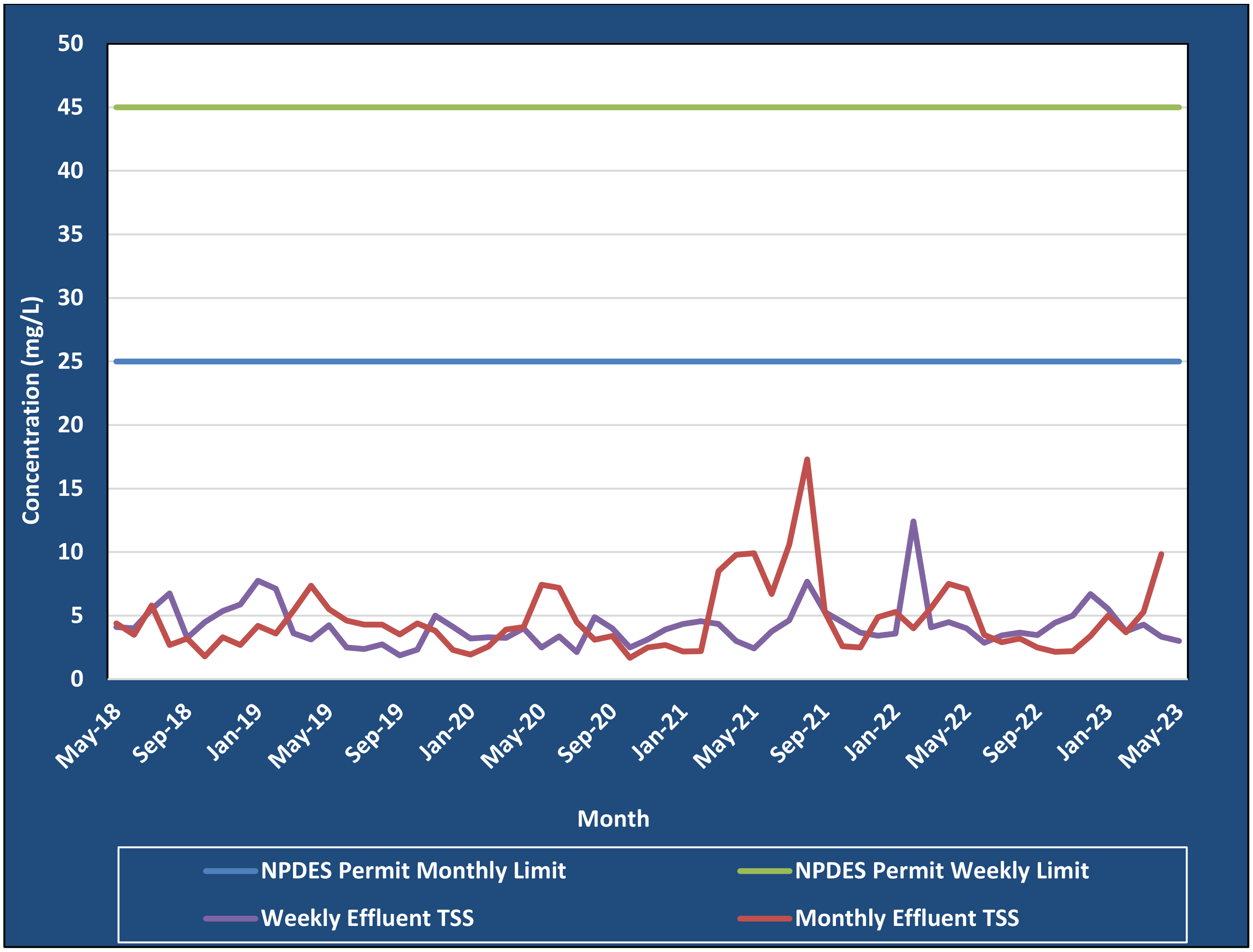
Year	***Annual Average***	***Maximum Monthly Average***	***Daily Maximum***
2018	167 mg/L	227 mg/L	464 mg/L
2019	184 mg/L	257 mg/L	486 mg/L
2020	167 mg/L	204 mg/L	316 mg/L
2021	183 mg/L	238 mg/L	344 mg/L
2022	207 mg/L	297 mg/L	652 mg/L
2023	171 mg/L	241 mg/L	1,182 mg/L
Average	180 mg/L	244 mg/L	574 mg/L

The facility should be designed with adequate solids handling capacity to meet the bio-solids reduction needs on a continuous basis. However, solids reduction is a continuous process in excess of 24 days detention time. Therefore, it is not adversely affected by increased solids loading from a single day and the monthly average loading will be utilized for design. The design in 2014 utilized the monthly average of 207 mg/L, which is between the annual average and the maximum monthly average:

TSS = 9.0 MGD x 207 mg/l x 8.34 lb./gal = 15,537 lb. /day

The NPDES Permit Limit for TSS is 20 mg/L monthly average and 40 mg/L weekly average. A similar analysis of the DMR data was completed for this limit. The plant's overall performance from 2018 through 2023 was 97.64% effective with an average effluent concentration of 4.25 mg/L. The plant has been able to meet its permit limits on a continuous basis over the past five years. Figure 5-3 on the next page demonstrates the facility's monthly performance.

Figure 5-3: Main WWTF – TSS Performance



5.4.4 Ammonia Concentration

Influent Ammonia should be considered similar to BOD5 loading to the biological process by comparing the monthly average, the average monthly maximum, and highest annual maximum for the last five years' DMR's.

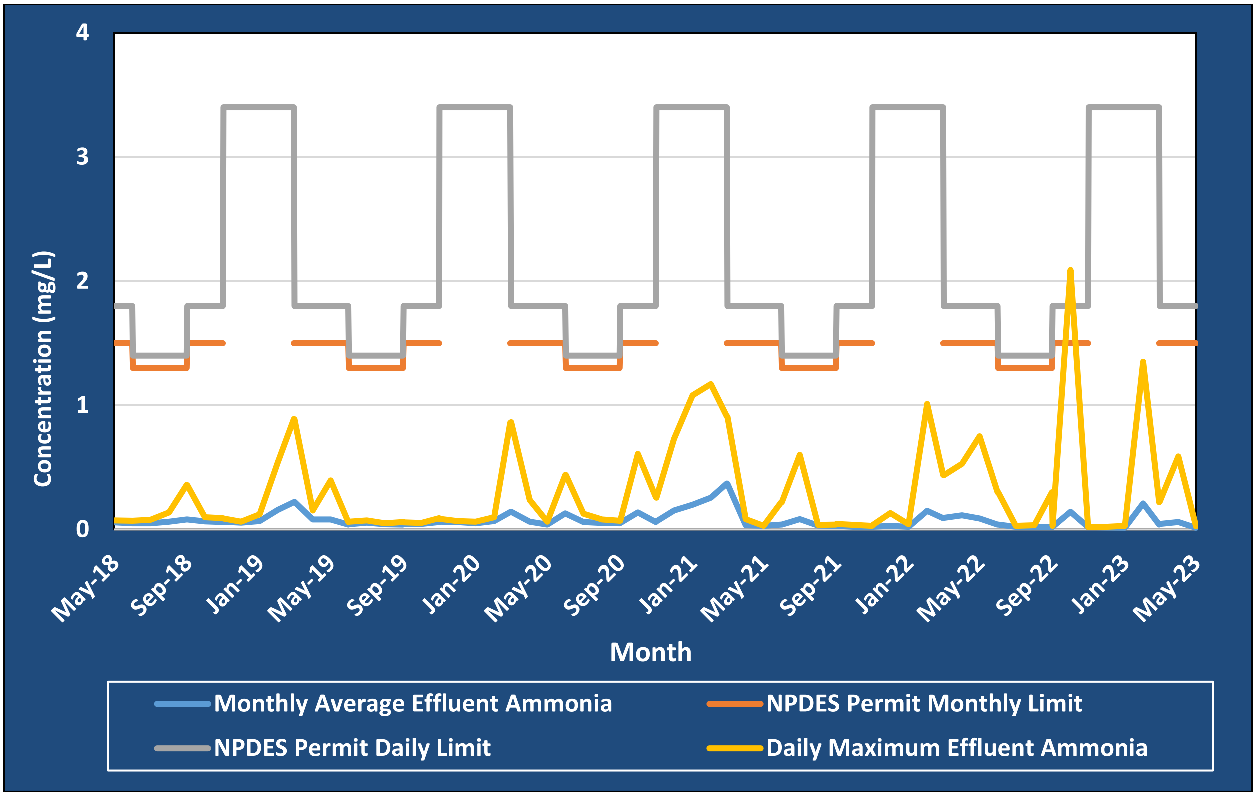
Year	*Monthly Average*	*Maximum Monthly Average*	*Daily Maximum*
2018	19 mg/L	22 mg/L	29 mg/L
2019	18 mg/L	23 mg/L	33 mg/L
2020	19 mg/L	25 mg/L	32 mg/L
2021	22 mg/L	26 mg/L	35 mg/L
2022	23 mg/L	29 mg/L	44 mg/L
2023	21 mg/L	28 mg/L	39 mg/L
Average	20 mg/L	26 mg/L	35 mg/L

The facility should be designed with adequate nutrient removal capacity to meet the effluent limits needs on a continuous basis. However, designing around the highest monthly maximum for each year seems too conservative. Therefore, it is recommended that the design be based around the Maximum Monthly Average.

NH_3-N = 9.0 MGD x 26 mg/L x 8.34 lb./gal. = 1,952 lb./day

The current NPDES Permit includes stringent ammonia nitrogen limits. Based on a decision from the Illinois Pollution Control Board, the permit was revised in 2015. The current NPDES permit limits provide three seasons: winter, spring/fall, and summer. The effluent ammonia concentrations were compared to the current and proposed monthly effluent limits. The plant's overall efficiency from 2018 through 2023 was 99.6% effective with an average effluent concentration of 0.08 mg/L. The plant has been able to meet its permit limits on a continuous basis over the past five years. However, the Main WWTF exceeded its daily maximum effluent limit in October 2022. The October 27, 2022, sample was 2.09 mg/L, which slightly exceeds its daily maximum limit of 1.80 mg/L. The remaining sample during the month ranged from 0.020 mg/L to 0.028 mg/L. The overall average monthly effluent ammonia concentration from 2018 through 2023 was 0.08 mg/L, as noted above. The graph on the next page demonstrates the plant's performance on a monthly basis. Note that there is not a monthly average limit from November through February included in the current NPDES permit.

Figure 5-4: Main WWTF – Ammonia Nitrogen Performance

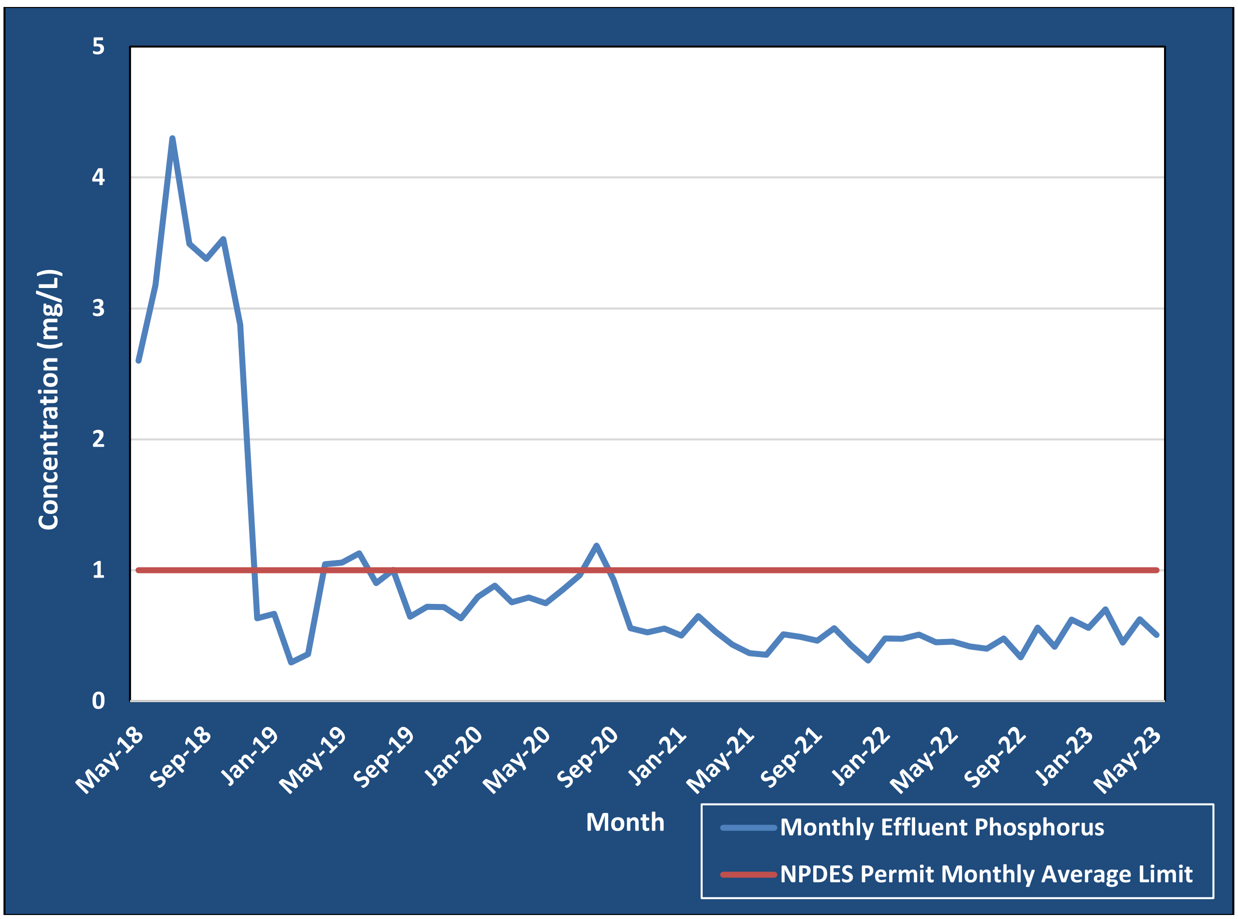


5.4.5 Phosphorus Concentration

Figure 5-5 below provides a graphical representation of the Main WWTF's effluent phosphorus concentration from 2018 through 2023.

The Main WWTF implemented an A2O biological process during the 2017 Phosphorus Removal and Digester Improvements project, which removes phosphorus through the A2O biological process. In addition, the City adds ferric chloride upstream of the final clarifiers for additional removal of phosphorus after the A2O process. In Figure 5-5 below, the red line shows the monthly average concentration limit (1 mg/L) in the Main WWTF's permit.

Figure 5-5: Main WWTF Phosphorus Performance



5.5 EXISTING MAIN WASTEWATER TREATMENT FACILITY

5.5.1 Influent Channel

Process Description

Flow is received at the head of the influent channel from three active force mains; a 16" and 24" force main from the Riverside Lift Station and a 16" force main from the East Side Lift Station. Outside of the influent channel, there are isolation gate valves with extended bonnets and hand-wheel operators on each of these force mains.

Flow measurement is obtained through a Parshall flume. Prior to flow measurement, flow in excess of 18.35 MGD is diverted over a weir trough and through a gravity drain to the excess flow clarifiers. This gravity drain is equipped with an isolation gate valve with an extended bonnet and hand-wheel operator. Downstream of flow measurement and upstream of the grit tanks, a 6" force main conveys flow from the Recycle Pump Station after an excess flow event to drain the excess flow clarifiers. This force main is equipped with an isolation plug valve outside of the influent channel.

IEPA Regulatory Requirements

Following is an excerpt from Title 35: Subtitle C: Chapter II: Part 370.550 Illinois Recommended Standards for Sewage Works.

Flow Measurement

Flow measurement facilities shall be provided so as to measure the following flows:

> *B) Plant influent flow, if significantly different from plant effluent flow, such as for lagoons and plants with excess flow storage or flow equalization.*

Design Data

Number of Tributary Force Mains	3
Design Average Flow (DAF), MGD	9.00
Peak Hourly Flow (PHF), MGD	18.35
Excess Flow Capacity, MGD	17.35
Excess Flow Fixed Weir Length, feet	40
Head over Fixed Weir @ 17.35 MGD, feet	0.146

Performance

The influent channel conveys process and excess flow adequately for the City.

Deficiencies

The valve on the force main from East Side Lift Station does not operate properly. The actuator for the excess flow gravity drain valve appears to operate properly, but the valve itself should be inspected and replaced if necessary. The heat tape and insulation on the exposed 6” recycle force main outside of the influent channel has deteriorated and no longer appears to be effective.

Recommendations

The valve on the force main from East Side Lift Station should be replaced. The heat tape and insulation on the exposed 6” recycle force main outside of the influent channel should also be replaced. The influent flow measurement device on the Parshall flume should be replaced, and the influent channel should be drained and inspected to confirm what minor rehabilitation may be necessary to this concrete. Finally, the City should continue to have this influent flow measurement device checked and calibrated regularly to ensure accurate data is being collected for submission to the EPA.

5.5.2 Excess Flow Facilities

Process Description

Flow is received at the head of the influent channel from three active force mains. Flow measurement is obtained through a Parshall flume. Prior to flow measurement, flow in excess of 18.35 MGD is considered to be Excess Flow. This flow is diverted over a weir trough and through a gravity drain to the Excess Flow Clarifiers. This gravity drain is equipped with an isolation gate valve with an extended bonnet and hand-wheel operator. The Excess Flow Clarifiers provide primary treatment (settling) in accordance with IEPA regulations. The efficiency of the Excess Flow Clarifiers are dependent on the hydraulic loading rate. Under the current design conditions, the excess flow clarifier could be expected to achieve roughly 26% BOD_5 removal and 46% suspended solids removal.

Once the Excess Flow Clarifiers begin to overflow, the flow is conveyed to Excess Flow Chlorine Contact Tanks mixing chamber, where chlorine gas is introduced, and a mechanical mixer ensures proper distribution. Flow then is disinfected as it flows through the contact tanks, under scum troughs, over an effluent weir trough, through a Parshall flume for flow measurement, then blended with treated process effluent from the UV disinfection system. Once combined, the flows are discharged together to the Fox River. This is allowed per the City of St. Charles' NPDES Permit, which contains wet weather limits allowing the treatment facility to discharge higher concentrations of BOD_5 and suspended solids during extreme events than under normal flow conditions.

Once the wet weather event is over and flows to the facility have normalized, the wastewater stored in the Excess Flow Clarifiers is slowly pumped back to the head of the treatment facility by the recycle pump station, where it receives full treatment. Once the tanks have been emptied, they are cleaned to remove any remaining debris and/or sludge.

City staff utilizes non-potable water to clean the Excess Flow Clarifiers using a series of tipping buckets that were installed as part of the 2002 Nitrification Improvements. The tipping buckets are filled with non-potable water and are designed to tip once they reach a certain volume. Once tipped, the water from the buckets creates a wave that has proven to be extremely effective in washing any debris and/or sludge from the floor of the tanks to the hopper at the west end.

IEPA Regulatory Requirements

Excess Flow Clarifier

Following is an excerpt from Title 35: Subtitle C: Chapter II: Part 370.710 Illinois Recommended Standards for Sewage Works.

Dimensions

The minimum length of flow from inlet to outlet should be 10 feet unless special provisions are made to prevent short circuiting. The side water depth for primary clarifiers shall be as shallow as practicable, but not less than 7 feet. Clarifiers following the activated sludge process shall have side water depths of at least 12 feet to provide adequate separation zone between the sludge blanket and the overflow weirs. Clarifiers following fixed film reactors shall have side water depth of at least 7 feet.

Surface Settling Rates (Overflow Rates)

The hydraulic design of settling tanks shall be based on the anticipated peak hourly flow.

B) Combined Sewer Overflow Bypass Settling:

The maximum surface settling rate shall not exceed 1,800 gallons per day per square foot based on peak hourly flow. Minimum liquid depth shall not be less than 10 feet. Minimum detention shall not be less than one hour. The minimum length of flow from inlet baffle to outlet should be 10 feet, unless special provisions are made to prevent short-circuiting.

Weirs

Overflow rates shall not exceed 30,000 gallons per day per lineal foot based on design peak hourly flow for plants having design average flow of greater than 1.0 mgd.

Excess Flow Chlorine Contact Tank

Following is an excerpt from Title 35: Subtitle C: Chapter II: Part 370.1020 Illinois Recommended Standards for Sewage Works.

After thorough mixing, a minimum contact period of 15 minutes at design peak hourly flow or maximum rate of pumpage shall be provided.

Design Data

Excess Flow Clarifier

Clarifier Quantity	2
Length, ft.	110
Width, ft.	44
Average Side Water Depth, ft.	9.93
Surface Area, sf	9,680
Surface Settling Rate at 17.35 MGD, gpd/sf	1,792
Total Weir Length, lf	640
Weir Loading Rate at 17.35 MGD, gpd/lf	27,109
Volume, gal	718,996
Detention Time, Hrs.	1.0

Excess Flow Chlorine Contact Tank

Number of Channels	2
Length, ft.	96
Width, ft.	21
Side Water Depth, ft.	7
Volume, gal.	105,558
Total Volume, gal	211,116
Detention Time at PWWF, min	17.5

Deficiencies

The Chlorine Building and Chlorine Contact Tank are showing signs of structural failure.

Recommendations

The City should consider replacement of the excess flow disinfection system. It is recommended that the City plan to remove the Chlorine Contact Tank and Chlorine Building and construct a Tertiary Building. This is discussed further in Section 6.

5.5.3 Grit Tanks

IEPA Regulatory Requirements

Following is an excerpt from Title 35: Subtitle C: Chapter II: Part 370.620 Illinois Recommended Standards for Sewage Works.

Inlet

The inlet shall be located and arranged to prevent short-circuiting to the outlet and oriented to the unit flow pattern so as to provide for adequate scouring segregation of organic and grit materials prior to discharge.

Detention

A detention time of at least 3 minutes at design peak flow should be provided.

Air Supply

Air should be supplied at 5 cubic feet per minute (cfm) per foot of tank length. The rate of air supplied shall be widely variable so as to maximize unit process effectiveness.

Design Data

Number of Units	2
Design	Aerated
Design Average Flow (DAF), MGD	9.00
Peak Hourly Flow (PHF), MGD	18.35
Length, ft.	22
Width, ft.	20
Side Water Depth, ft.	18
Total Volume, gallons	99,858
Total Volume, cu. ft.	13,350
Detention Time at DAF, min	16.0
Detention Time at PHF, min	7.8

The equipment in the Grit Handling process consists of the following:

- ✓ Two rectangular concrete tanks 22 feet long by 20 feet wide with a side water depth of 18'. The mechanisms within the tanks include Walker Rolling Grit System which consists of a draft tube, air lift pump, and head box. The system uses low head compressed air to develop a roll pattern within the basin. Due to entrained air, the grit is less buoyant and settles quickly. The air lift pump draws the grit from the bottom of the tank and transfers it to the grit classifier. These units were replaced in-kind in 2011.

- ✓ One Walker Process screw type grit classifier, Size GW350, driven by a 1 HP, 1,800 rpm, General Electric motor operates on 240 volt, 3-phase, 60 cycle current. The grit classifier was replaced in-kind in 2001. The classifier's auger has since been replaced in 2021.
- ✓ Two Hoffman centrifugal blowers with a rated capacity of 375 scfm at 7.0 psig for each blower. Each blower is driven by a General Electric 30 HP, 3,600 rpm, electric motor operating on 240 volt, 3-phase, 60 cycle current. The blowers were replaced in kind in 2005 and are located in the Blower Building.

Performance

The Design Peak Flow (DPF) is defined by the IEPA Section 370.211 as the instantaneous maximum flow rate to be received, which is 18.35 MGD. The Hydraulic Retention Time (HRT) at the DPF is 7.84 minutes which meets the IEPA requirements and manufacturer recommendations.

Deficiencies

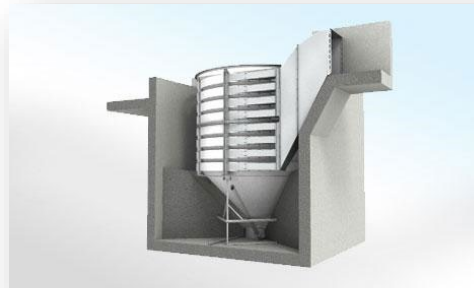
The HVAC system for the grit room was replaced in 2023. The effluent weir baffles within the grit tanks were removed during one of the headworks rehabilitation projects, which may allow lighter grit particles to bypass the grit removal system. Also, the grit classifier is currently hydraulically washing out the grit and recycling it back into the southern grit tank.

The City has noticed a decline in the performance of these units over the last couple years, and are seeing grit building up in the treatment facility. The City is currently removing 3 yards per week. While the quantity of grit received by a plant varies greatly, the City staff believes that the system should be more efficient. Improved grit removal would reduce this build up. The systems are aging and several components have rotted away and are in need of replacement.

It was noted during the site visit that several components of the existing Headworks need to be updated to meet code, such as existing lights need to be classified, and low temperature and heat alarms need to be added. The City also noted the augers on the sludge hopper need to be replaced as well.

The City has expressed interest in new technologies for grit removal. Several different options are discussed below:

- Plate Settler (i.e. Eutek HeadCell)
  - Probably most efficient design in terms of grit removal
  - Existing system can be retrofitted to incorporate this technology
  - Significant concerns regarding ragging exist and may negate the advantages of this type of system due to the potential for increased labor, maintenance.



- Vortex Grit Separation (i.e. Eutek Grit King)
  - Good resistance to negative effects of ragging
  - Does not require use of air, therefore more energy efficient with pump system
  - Not as effective as the plate settler
  - Settles 106 microns and larger

- Grit Washer (i.e. Eutek TeaCup)
  - No moving parts, resistance to negative effects of ragging
  - Can remove 95% of all grit 75 microns and larger
  - Can treat up to 8 MGD each
  - May present issue with head conditions on existing air-lift pump system, as well as existing grit room height, due to unit height and need to discharge into grit classifier, snail or decanter

- Grit Decanter (i.e. Eutek Decanter)
    - Grit dewatering through wedge wire screen
    - No moving parts, upgrade from current storage dumpster
    - Requires a grit washer/classifier upstream to remove organic material

Recommendations

A more detailed study of the grit system needs to be performed. The study should evaluate the benefits of each additional or modified component of the system, and should consider special limitations, head conditions and energy/labor cost comparisons. The existing grit classifier and dumpster should be replaced with a grit washer and grit decanter. At a minimum, the baffles on the grit unit effluent weirs should be reinstalled and the roof of these buildings should be inspected. Additionally, low temperature and heat alarms should be added.

5.5.4 Primary Clarifiers

IEPA Regulatory Requirements

Following is an excerpt from Title 35: Subtitle C: Chapter II: Part 370.710 Illinois Recommended Standards for Sewage Works.

Surface Settling Rates (Overflow Rates)

The hydraulic design of settling tanks shall be based on the anticipated peak hourly flow. Some indication of BOD removals may be obtained by reference to Appendix E, Figure No. 2. The figure should not be used to design units which receive wastewaters which have BOD and total suspended solids concentrations which are substantially different from normal domestic sewage. The operating characteristics of such units should be established by appropriate field and laboratory tests. If activated sludge is wasted to the primary settling unit, then the design surface settling rate shall not exceed 1,000 gallons per day per square foot based on design peak hourly flow, including all flows to the unit. Refer to subsection (b)(3) and Section 370.820.

Weir loadings

Weir loadings shall not exceed 20,000 gallons per day per lineal foot based on design peak hourly flows for plants having design average flows of 1.0 mgd or less. Overflow rates shall not exceed 30,000 gallons per day per lineal foot based on design peak hourly flow for plants having design average flow of greater than 1.0 mgd. Higher weir overflow rates may be allowed for bypass settling tanks. If pumping is required, weir loadings should be related to pump delivery rates to avoid short circuiting. Refer to Section 370.410(c)(8).

Design Data

Number	4
Length, ft.	100
Width, ft.	20
Surface Area, sf/clarifier	2,000
Total Surface Area, sf	8,000
Overflow Rate at DAF, gpd/sf	1,125
Weir Loading Rate, gpd/ft	15,000
Primary Influent BOD, lbs./day	13,834
Primary Influent TSS, lbs./day	16,088
Primary Influent NH_3-N, lbs./day	1,602
Removal Efficiency - BOD, %	29
Removal Efficiency - SS, %	50
BOD Removed, lbs./day	4,012
Suspended Solids Removed, lbs./day	8,044
Primary Effluent BOD, lbs./day	9,822
Primary Effluent TSS, lbs./day	8,044
Sludge Volume at 1%, gpd	96,454

Two primary settling tanks are provided at the plant. The settling tanks and associated equipment consist of:

- ✓ Two concrete tanks, each tank is 100’ long by 40’ wide with an average side water depth (SWD) of 8’3". A 5' deep sludge hopper is provided at one end for storage, thickening and withdrawal of sludge.
- ✓ Each tank is served by two chain and scraper mechanisms, which are supported by a concrete wall that bisects each tank lengthwise. This wall is only used to support the chain and scraper mechanisms, and is open at the west end of the tanks to hydraulically connect the two tank halves. These units were installed in 2001.
- ✓ Two Type RP Helithickener Cross Collectors as manufactured by Walker Process. Equipment is provided for sludge conveyance to the pump draw-off. One collector is located in the sludge hopper of each tank half, and is equipped with a 1 HP, 1750 RPM electric motor operating on 240 volt, 60-cycle, 3 phase current. The worm gear reducer has a ratio of 64:1 providing a rotational speed of 5 RPM for the collectors. These units were replaced in 2001, rehabilitated in 2011, and the worm gear reducer was modified in 2014 to cut the rotational speed for the collectors in half to 2.5 RPM.
- ✓ Each tank is equipped with inlet weirs, inlet baffles and outlet weir troughs. An effluent collection channel and drop box is located at the end of the settling tanks.

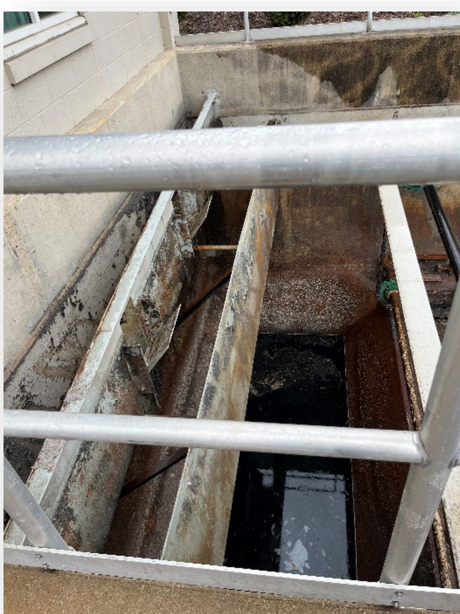
Performance

The primary clarifiers are an important part of the complete treatment process. The 2001 Facility Plan design criteria was based on an evaluation of actual performance data. A regression curve analysis was performed and predicted that the expected TSS and BOD removal at design flow should be 63% and 36%, respectively. At that time, the City of St. Charles was adding ferric chloride to aid in the settling of solids as well as address odor control issues and control of struvite formation. This capability has since been removed.

Based on recent DMR data, the existing clarifiers average TSS removal has been 66% and the average BOD_5 removal has been 45%. The facility is operating at roughly 55% capacity. The current performance is comparable to traditional removal efficiencies. These traditional values should be used for future design loading criteria.

The surface overflow rate at the DAF (9 MGD), is 1,125 gpd/sf. The surface overflow rate at the anticipated peak hourly flow (18.35 MGD) is 2,294 gpd/sf. A limit on surface overflow rate is not stipulated in Section 370 unless waste activated sludge (WAS) is returned to the primary tanks for thickening. Based on the WEF Manual of Practice Number 8, the primary clarifier suspended solids removal at roughly 1,100 gpd/sf can be estimated to be 56%. Using Figure 2, in Appendix E of Title 35 Section 370, the BOD_5 removal would be 32% at DAF. This BOD_5 removal through the primaries affects the design of the downstream unit processes.

Deficiencies



The primary clarifiers were rehabilitated in 2000, and again in 2011. The equipment and tankage has an expected service life of twenty years. Based on the design calculation, treatment capacity is at an acceptable level. The City replaced the flights, chains and weirs between 2019 and 2020.

The Helithickener Cross Collectors are an auger located within the sludge hopper. Their function is to transfer sludge in the hopper to the sludge draw-off pipe in the center of each pair of clarifiers. The Helithickener Cross Collectors have experienced corrosion and metal has rusted completely in some areas.

During the 2011 Headworks Rehabilitation, the mechanisms were modified to utilize a chain and sprocket drive system, which included replacement of the drives and modifications to one section of the torque tube in each clarifier. Due to mechanical failures after this rehabilitation, the gear reducer was replaced to provide a slower, steadier rotation and conveyance of primary sludge. This should reduce the wear on the equipment, as well as equipment shutdowns due to tripped limit switches.

The City will be replacing the pair of Cross Collectors in the north primary clarifiers, including the center and bearing between the two clarifiers and the end bearing, in 2024. The City is proceeding with contracting the work directly with the manufacturer (Walker Process) to rehabilitate the Cross Collectors at the center bearing assembly.

If the rehabilitation does not result in improved operation of the equipment, the design of the bearings and drives may need to be revised. A concrete stub wall, built down from the existing web wall above the trough, would allow for a fixed connection point for the Cross Collectors. It would leave a gap of about 6” between the bottom of the new wall and the bottom of the trough, which would maintain the hydraulic connection between each pair of tanks. This option would require that each helicoid be provided with its own chain and sprocket drive system.

The effluent weirs, the aluminum decking over these weirs and the drain valves at the east end of the clarifiers do not appear structurally sound and should be repaired or replaced.

Recommendations

The primary clarifiers were rehabilitated in 2011, but several items were not included in that rehabilitation and need to be replaced. The Cross Collectors are being rehabilitated in 2024/2025. A cost estimate was provided for the remainder of the recommended work in the 2015 facility plan, and this has been updated with 2024 costs.

Table 5-2:Primary Clarifier Rehabilitation – Probable Costs

GENERAL CONDITIONS	$109,800
PRIMARY CLARIFIER REHABILITATION	$337,000
ELECTRICAL & CONTROLS	$25,800
CONSTRUCTION SUB-TOTAL	**$472,600**
CONTIGENCY @ 10%	**$48,000**
ESTIMATED CONSTRUCTION COST	**$520,600**
ENGINEERING (15%)	**$79,000**
TOTAL PROJECT COST	**$599,600**

5.5.5 Primary Sludge and Scum Pumping

IEPA Regulatory Requirements

Following is an excerpt from Title 35: Subtitle C: Chapter II: Part 370.720 Illinois Recommended Standards for Sewage Works.

Sludge and Scum Removal (Sludge Removal Piping)

Each hopper shall have an individually valved sludge withdrawal line at least 6 inches in diameter. The static head available for withdrawal of sludge shall be 30 inches or greater, as necessary to maintain a 3 feet per second velocity in the withdrawal pipe. Clearance between the end of the withdrawal line and the hopper walls shall be sufficient to prevent "bridging" of the sludge. Adequate provisions shall be made for rodding or back-flushing individual pipe runs. Piping shall also be provided to return waste sludge from secondary and tertiary processes to primary clarifiers where they are used. Refer to Section 370.820.

Sludge and Scum Removal (Sludge Removal Control)

Sludge wells equipped with telescoping valves or swing pipes are recommended for primary sludge and fixed film sludges where periodic withdrawal is proposed. Air lift type of sludge removal will not be approved for removal of primary sludges.

Design Data

Number	3
Run Time, hrs./day	24
Capacity, gpm	33

- ✓ Primary sludge pumping consists of three rotary lobe pumps which were installed during the 2011 Headworks Rehabilitation. These pumps are provided with upstream in-line grinders, temperature and pressure switches for run-dry protection, and variable frequency drives.
- ✓ Primary sludge flow to the digesters is measured with a magnetic flow meter within the primary sludge pumping room.
- ✓ Two hand-wheel operated skimmers are located on the discharge end of each primary clarifier. These units were installed in 2001. The skimmers convey scum from the east end of the primary clarifiers by gravity to a wet well located in the grit classifier room. From here, scum was pumped directly to the digesters within the primary sludge pipe with a submersible scum pump. During the 2017 improvements, the piping was reconfigured to allow scum to be pumped to the digesters while primary sludge is sent to the Primary Sludge Fermenter. Two pipes exit the grit building and join a common primary sludge pipe that is isolated by two plug valves to run to either the Anaerobic Digesters or Primary Sludge Fermenter.

Performance

The existing rotary lobe pumps draw sludge directly from the primary clarifiers and transfer it to primary sludge fermenter to enhance the biological phosphorus removal or to the anaerobic digesters for stabilization. The pumping system has adequate capacity to transfer primary sludge.

The hand-wheel operated skimmers convey scum from the east end of the primary clarifiers by gravity to a wet well located in the grit classifier room. From here, scum is pumped directly to the digesters within the primary sludge pipe with a submersible scum pump. This pump was installed in 2005 and has performed well over the past 18 years.

Deficiencies

The HVAC system for the primary sludge pump room is beyond its service life and should be replaced. The existing primary sludge pumps went through several iterations of operating speeds and rotor materials before being able to operate efficiently and continuously. During the 2017 improvements, the pumps were modified to convey sludge continuously at a higher rate to the Primary Sludge Fermenter, which addressed the issues with pumping efficiency and lobe erosion. It was noted during the site visit that the primary sludge pump room needs to be updated with low temperature and heat alarms added.

Recommendations

The HVAC system should be replaced. Additionally, the City should also add low temperature and heat alarms.

5.5.6 Primary Sludge Fermenter

Design Data

Number	1
Diameter, ft.	28
Surface Area – Each	616
Overflow Rate at DAF	127
Solids Loading at DAF, gpd/sf	13.1
Thickened Primary Sludge Volume at 5%, gpd	18,326
Supernatant Volume	78,127
VSS Solids to Digestion (78%), lbs./day	5,961

✓ The Primary Sludge Fermenter is located on the northeast side of the existing aeration basins. Thin (1%-2%) primary sludge from the primary clarifiers is fed to the Fermenter on a continuous basis. Sludge is withdrawn from this process by progressive cavity pumps which are located in the lower level of the Blower Building. The thickened primary sludge (4%-5%) is conveyed to the anaerobic digestion process or returned to the fermenter. Supernatant from this fermenter is introduced and blended in the influent diversion chamber between basins 1301 and 1302. In the fermenter supernatant, the BOD is in the form of Volatile Fatty Acids (VFAs) and readily biodegradable chemical oxygen demand (rbCOD). Ragging and grit build-up is prevented through the use of a macerator that is installed on the primary sludge line into the Fermenter.

Performance

The fermenter has performed well since its construction in 2017. The City has experienced issues with the macerator operations which has been addressed through work with the manufacturer in 2022. The thickened primary sludge pumps are on a forced alternation and have performed well against head conditions from the thickened primary sludge recycle and the anaerobic digesters. The wet ends of the thickened primary sludge pumps were replaced in 2022.

Deficiencies

At this time, the City has no issues to report regarding the primary sludge fermenter.

Recommendations

No recommendations at this time.

5.5.7 Biological Process

Process Description

The City of St. Charles Main WWTP secondary treatment process utilizes an A2O process. The process control variables used are sludge age and feed to mass ratio. The primary effluent is blended with RAS in the inlet box to form MLSS. The design includes two anaerobic selector basins (Basins 1301 and 1302) that are 19.25 feet wide by 40 feet long by 16 feet deep. The MLSS then enters a distribution channel to the first bank of four aeration basins (Basins 1303 and 1306). The aeration basins are 90 feet long by 30'-6" wide by 16 feet deep. These basins are split between anaerobic (1303A – 1306A) and anoxic basins (1303B – 1306B) by a baffle wall that is below the liquid level. All of these basins utilize bridge mounted top down mixers for mixing as they are unaerated. The internal recycle pump station returns flow from the end of the biological process back to the anoxic basins (basins 1303B – 1306B).

At the effluent end of the aeration basins, the MLSS flow over a fixed weir to the collection channel. The collection channel also serves as the distribution channel to the second bank of four aeration basins (Basins 1307 and 1310), which is identical in size to the first bank. Aeration to the 1300 basins is provided by seven blowers in the Blower Building (3 are hybrid screw positive displacement blowers, 4 are centrifugal blowers). The MLSS from the second bank of aeration basins flows over a second fixed weir to a collection channel. From the end of these basins, MLSS flows to the second bank of aeration basins (Basins 1401 through 1404). An internal recycle is drawn from basin 1403 back to the head of the anoxic zone (1303-6B) to denitrify approximately 67% of the flow. MLSS from basin 1404 flows into a diversion structure that sends flow to the final clarifiers.

Design Data

Aeration Basins

Number of Tanks	18
Side-Water Depth, ft.	16
Anaerobic Basin 1301 & 1302, total cu. ft.	24,640
Anaerobic Basin 1303A Thru 1306A, total cu. ft.	57,344
Anoxic Basin 1303B Thru 1306B, total cu. ft	122,880
Aerobic Basin 1307 Thru 1310, total cu. ft.	184,320
Aerobic Basin 1401 Thru 1404, total cu. ft.	109,760
Total Volume, cu. ft.	498,944
Total Volume, gal.	3,732,101
Detention Time at 9.00 MGD, hrs.	10.0
Organic Loading, lbs./day BOD	10,411
Organic Loading, mg/l BOD	136
Organic Loading Rate, lbs./day BOD/1,000 cu. ft.	20.9
MLSS, mg/l	3,800
Solids Inventory, lbs.	118,278
RAS Return Rate, MGD	10.5
WAS, lbs./day	7,905
WAS Volume at 0.76% TS, gpd	135,399
Anoxic Air Required, sfm	2,131
Anoxic Air Required, scfm	2,800
Aerobic (1311 Thru 1314) Air Required, scfm	5,190
Aerobic (1311 Thru 1314) Air Provided, scfm	5,200
Aerobic (1401 Thru 1404) Air Required, scfm	3,242
Aerobic (1401 Thru 1404) Air Provided, scfm	3,250
Sludge Age, days	15.0
F/M Ratio	0.088

Performance

The existing system is performing very well. The City has not had any BOD_5 violations related to performance of the biological process since the system was placed into operation in 2019. The City did experience one violation of their effluent ammonia daily maximum limit in October of 2022, but otherwise the system has performed extremely well.

Deficiencies

The City has noticed a build-up of grit in the anoxic zones near the baffle walls. This can lead to blockage of the flow under the baffle walls and potentially creating a large hydraulic differential when draining the basins (if only one mud valve is being utilized, for example).

MCC-1300 in the Blower Building is from 2004 and should be replaced. The 16” RAS isolation valve was installed in 2004 and should be replaced.

Recommendations

It is recommended that the City begin budgeting for the replacement of MCC-1300. It is also recommended that the City replace the 16” RAS isolation valve.

5.5.8 Process Control Building / Chemical Phosphorus Removal

Process Description

This building was constructed in 2019 and controls the internal recycle pumps for the biological process, the phosphorus monitoring system, and the storage and feed systems for chemical phosphorus removal using ferric chloride. The internal recycle pumps promote denitrification by sending nitrate-rich MLSS back to the anoxic zone. Four recycle pumps are located in a wet well adjacent to the Process Control Building with room for two additional pumps to be installed when the biological process expands. The wet well is fed MLSS from two locations; The pipe that connects the upper 1300 basins to the lower 1400 basins, and from Basin 1403. This allows the internal recycle to be taken from midway through the aerobic zone or from near the end of the aerobic zone. The City may select either location by the use of two sluice gates at the wet well.

The phosphorus monitoring system samples and filters MLSS from the internal recycle wet well and indicates to the City's SCADA what the levels of ortho-phosphate are being sent to the final clarifiers. The City uses this information to predict the amount of ferric chloride they need to feed to the effluent channel of the upper 1300 basins to meet their effluent TP limit. The City also has the option to send ferric chloride to the digested sludge storage tank to chemically-bind the soluble phosphorus prior to dewatering.

The ferric chloride storage system consists of two 6,550-gallon tanks with insulation and heat tracing to maintain the low viscosity of the chemical during the winter months. The system is paired with three peristaltic chemical feed pumps, each with the capacity of 40 gallons per hour.

Design Data

Number of Tanks	2
Volume, gal/tank.	6,650
Number of Pumps	3
Capacity, gph	40

Performance

There are no issues with the chemical phosphorus removal system at this time; however, the City has noted that they no longer utilize the option to send ferric chloride to the digested sludge storage tank to chemically-bind the soluble phosphorus prior to dewatering.

Deficiencies

Since the City no longer sends ferric chloride to the digested sludge storage tank, it is likely that the total phosphorus in the recycle increases when ortho-phosphate is sent to the head of the WWTF in centrate.

It also was noted during the site visit that the Process Control and Chemical Phosphorus Removal building needs to be updated with low temperature and heat alarms added.

Recommendations

The City should add low temperature and heat alarms.

5.5.9 Final Clarifiers

IEPA Regulatory Requirements

Following is an excerpt from Title 35: Subtitle C: Chapter II: Part 370.710 Illinois Recommended Standards for Sewage Works.

Surface Settling Rates (Overflow Rates)

The hydraulic loadings shall not exceed 1000 gallons per day per square foot based on design peak hourly flow, and 800 gallons per day per square foot based on peak hourly flow for separate activated sludge nitrification stage. Refer to Section 370.1210(c)(4).

Solids Loading Rate

The solids loading shall not exceed 50 pounds solids per day per square foot at the design peak hourly rate.

Weir Loading

Weir loadings shall not exceed 20,000 gallons per day per lineal foot based on design peak hourly flows for plants having design average flows of 1.0 mgd or less. Overflow rates shall not exceed 30,000 gallons per day per lineal foot based on design peak hourly flow for plants having design average flow of greater than 1.0 mgd. Higher weir overflow rates may be allowed for bypass settling tanks. If pumping is required, weir loadings should be related to pump delivery rates to avoid short circuiting. Refer to Section 370.410(c)(8).

Design Data

Number	2
Design	Hydraulic Differential
Average Flow, MGD	9.00
Peak Hourly Flow, MGD	18.35
Diameter, ft.	120
Sidewater Depth, ft.	12.75
Surface Area – Each, sf	11,310
Surface Area – Total, sf	22,620
Weir Length – Each, lin. ft.	343
Weir Length – Total, lin. ft.	686
Surface Loading Rate at PHF, gpd/sf	811
Solids Loading Rate at PHF, lbs./day/sf	31.9
Weir Loading Rate, gpd/lf	26,749

The two 120-foot diameter clarifiers were constructed in 1987. The existing design includes peripheral feed and take-off. The existing mechanism is an Envirex To-Bro and operates on a hydraulic differential principle. The existing To-Bro header is designed to remove sludge from the entire clarifier floor evenly, instead of raking the bio-solids to a center hopper. The design capacity of the units is within the Illinois EPA guidelines and should continue to serve the City well.

Performance

The removal of TSS has been very effective, with a range of 95% to 99% removal.

Deficiencies

Flow splitting between the two clarifiers is controlled by inverted slide gates at the flow diversion structure to the north. This method of flow splitting is difficult to control, and one clarifier typically sees the majority of flow from the aeration basins. Consideration should be given for removing this structure and replacing it with a Tee and two gate valves.

When algae build up on the effluent weirs, they must be washed down with a hose. The non-potable water piping around the clarifiers that was installed as a part of the 2002 Nitrification Improvements was unintentionally left filled during the winter months, which froze and caused the pipes to burst. Therefore, City staff must haul a 1.5” hose to around the final clarifiers and utilize the non-potable water yard hydrant for wash down and cleaning of the equipment. Options to address this build-up include lining of the effluent weirs with fiberglass, installing covers over the weirs, and installing a method to flood the outer trough with large quantities of non-potable water at one time.

The To-Bro headers are from the original installation and were stripped and painted in 1995. The walls of these headers may be rusted through and drawing unevenly from the bottom of the clarifiers. The existing units have sufficient capacity to serve the future design loadings but may need to be replaced in kind.

City staff requested that the effluent weirs be checked for level. This was completed and confirmed that they were properly installed. The grout on the bottom of the clarifiers is coming up in several places and needs to be replaced.

Recommendations

The 120-foot diameter final clarifiers were constructed in 1987 and have been rehabilitated on a routine basis. The service life of the clarifiers should be 25 to 30 years. The City will be rehabilitating these clarifiers in 2024/2025, including rehabilitation of the clarifier mechanisms, To-Bro headers, and drive unit, as well as replacement of wear items. The clarifier draining sluice gates on the south side of the clarifiers will also be replaced with this project.

It is recommended that the City consider replacing the flow diversion structure with inverted weirs in a future project. Also, the effluent weir should be protected from algae buildup by the installation of covers around the perimeter launders of the clarifiers.

5.5.10 UV Disinfection System

Process Description

During the Nitrification Improvements, the plant upgrades included installation of an Ultraviolet Disinfection system. The system was designed to handle the peak hourly flow through the treatment facility. In addition, a second channel was constructed for installation of a parallel system in the future if the facility was upgraded to utilize UV disinfection on excess flow. Finally, a non-potable water system was installed just downstream of the UV disinfection channels to provide wash water from the treated effluent.

Design Data

Peak Design Flow, MGD	20
UV Transmission, % (Field measured transmissivity = 80%)	65
TSS, mg/L	25
Disinfection Limit, fecal count	400
Design Intensity, mW	40,125
Number of Channels	1
Number of Reactors per channel	1
Number of Banks/ Reactor	2
Number of Modules per Bank	4
Total Number of UV Lamps	8
Type of level control	Fixed Weir
Automatic Mechanical Cleaning	Yes

Performance

The existing system is performing very well. The City has not had any violation related to the performance of the system since it was placed into operation in 2005.

Deficiencies

The UV System provides water to the non-potable water (NPW) system, which is used for several purposes around the wastewater treatment plant site. The non-potable water system includes three vertical turbine pumps and a filtration system. The UV system tends to generate a significant amount of algae, due to the combination of high intensity light and nutrients (phosphorus and nitrogen) being available in the effluent. The algae enters the NPW system and plugs pumps and the filter system. The exposure of this system to weather year-round has taken its toll on the system components. The controllers for this system, as well as hydraulic lines and pumps, should be replaced. Finally, the power distribution for the UV structure is still housed within the existing Chlorine Building. This building is structurally failing, and it is recommended that the components that are powered through this building be strategically re-fed from another source. The UV system is to be rehabilitated as part of a separate capital project that is ongoing in conjunction with the final clarifier rehabilitation and scheduled to be in construction in 2025.

Recommendations

There are several alternative solutions to the algae issue including removal of the nutrients, installation of a different UV system or modification of the NPW system. The plant will need to be upgraded to remove total nitrogen and phosphorus, both of which are discussed at length in Section 6 of this report. UV disinfection technology has advanced over the last ten years, and it is recommended that the existing Trojan 4000 system be replaced simultaneously with the installation of the newer Trojan Sigma system in the open channel. It is recommended that a structure be built around the equipment to extend its service life. These recommendations are included in a separate project plan and a separate overall project. The project includes rehabilitation of the final clarifiers and is currently in design.

The current power distribution system includes one utility transformer feeding two switchboards: MSB-1100 in the Main & Sludge Handling Building does not have adequate capacity to feed the new UV structure. While the new UV system would be able to be fed power through SB-1600 in the Chlorine Building, it would require temporary power to maintain disinfection processes throughout construction. Therefore, a third switchboard, SB-1601, will be installed within the proposed UV Building. This switchboard will have capacity to power the southern end of the WWTF, including the proposed UV Building, the future Tertiary Building, the final clarifiers, and the RAS/WAS pump station. The new UV Building will have space for SB-1601, as well as future VFDs for the RAS/WAS pump station.

5.5.11 WAS Holding Tanks (exterior)

Process Description

During the Sewage Treatment Plan Additions in 1966, two rectangular final clarifiers were constructed. These tanks were rehabilitated in 1972 and converted to first flush tanks in the 1985 Excess Flow Facilities project. The tanks were converted again in the 1990s to WAS holding tanks. The existing system includes a pinch valve within the Recycle Pump Station of the excess flow clarifiers which draws waste sludge from the RAS force main and sends it to the east end of the WAS holding tanks. The tanks are aerated with fine bubble diffusers that receive air from the 1400 blowers, which also provide air to the 1400 biological process basins. A telescoping valve in each tank is used for decanting to the sanitary sewer. WAS is drawn from the launders at the west end of the tanks by the WAS progressive cavity pumps in the Main & Sludge Handling Building for thickening prior to digestion.

Design Data

WAS Storage Tank	
Number	2
Volume Each, gal.	184,726
Volume Total, gal.	369,452
Storage, days	2.8

Performance

The existing tanks provide adequate storage for City operations.

Deficiencies

The City struggles with wasting operations as the existing pinch valve struggles to maintain the low wasting flow rate desired by the City. This may be remedied by installing a smaller pinch valve for normal operations and maintaining the existing valve for peak flows. The telescoping valves are aging and need to be replaced with valves that provide more travel to allow the City to decant more than the existing valves allow. The diffusers are in poor condition and should be considered for replacement. The concrete tanks are structurally failing and should be rehabilitated or replaced.

Recommendations

The WAS holding tanks should be replaced. The cost estimate for this work is included in Section 6.

5.5.12 Anaerobic Digestion

IEPA Regulatory Requirements

Following is an excerpt from Title 35: Subtitle C: Chapter II: Part 370.830 Illinois Recommended Standards for Sewage Works.

Tank Capacity

1) Rational Design

The total digestion tank capacity shall be determined by rational calculations based upon such factors as volume of sludge added, its percent solids, and character, the temperature to be maintained in the digesters, the degree or extent of mixing to be obtained, the degree of volatile solids reduction required, method of sludge disposal, and the size of the installation with appropriate allowances for gas, scum, supernatant and digested sludge storage. Secondary digesters of two-stage series digestion systems that are used for digested sludge storage and concentration shall not be credited in the calculations for volumes required for sludge digestion. Calculations should be submitted to justify the basis of design.

2) Empirical Design

When such calculations are not submitted to justify the design based on the above factors, the minimum combined digestion tank capacity outlined below will be required. Such requirements assume that the raw sludge is derived from ordinary domestic wastewater, a digestion temperature is to be maintained in the range of 85 to 95 F (29 to 35 C), 40 to 50 percent volatile matter in the digested sludge, and that the digested sludge will be removed frequently from the process. (See also subsection (a)(1) above and Section 370.860(a)(1).)

A) Completely Mixed Systems

For digestion systems providing for intimate and effective mixing of the digester contents, the system may be loaded up to 80 pounds of volatile solids per 1000 cubic feet of volume per day in the active digestion units.

B) Moderately Mixed Systems

For digestion systems where mixing is accomplished only by circulating sludge through an external heat exchanger, the system may be loaded up to 40 pounds of volatile solids per 1000 cubic feet of volume per day in the active digestion units. This loading may be modified upward or downward depending upon the degree of mixing provided.

Design Data

Number	2
Design	Egg-Shaped
Volume, cf each	64,171
Total Volume, cf	128,342
Total Volume, gal	924,000
TWAS VSS, lbs/day	5,857
Primary VSS, lbs/day	11,818
Volatile Solids Loading Rate, lbs VSS/day	14,706
Loading Rate, lbs VSS/1000 cf	96
Loading Rate, gpd	40,838
Detention Time, days	22.6

Performance

The anaerobic digesters were constructed as part of the 1991 Sludge Handling Improvements. The egg-shaped digesters were the second system of its kind constructed in the United States. When in operation, the digesters have continuously met the volatile solids reduction requirements for Class B land application. The major components have adequate detention time and capacity to effectively treat the bio-solids produced by the 9.0 MGD treatment facility.

Deficiencies

The digested sludge storage tank was constructed in 2017 and includes a gas-holding, spiral-guided cover. The gas from the cover is conveyed to the digester gas piping system in the anaerobic digestion facility through a 6” flexible hose. This hose is made of a braided stainless-steel exterior, and the installation will be modified in 2024 to prevent constrictions in the hose. The eastern door to the upper level of the Anaerobic Digester Control Building needs to have a threshold installed to prevent rain from entering the room below the door. It was also noted during the site visit that the Anaerobic Digestor Building needs to be updated with low temperature and heat alarms added.

Recommendations

The City should install a threshold on the eastern door on the upper level of the Anaerobic Digester Control Building. Additionally, the City should add low temperature and heat alarms to the rooms in the digestion complex.

5.5.13 Sludge Handling Building

Process Description

This building was constructed in two phases during the 2012 Main and Sludge Handling Building Improvements. The first phase included electrical/ control, sludge thickening and dewatering facilities. The sludge thickening facilities include WAS holding, sludge feed pumps, polymer unit, gravity belt thickener, TWAS holding and TWAS pumping systems. The sludge dewatering facilities include digested sludge feed pumps, polymer units, two centrifuges and a conveyor in a loading dock. The second phase included an operations building that contains an office, break room, locker room, inventory and maintenance garage.

For the sludge thickening process, waste activated sludge (WAS) is drawn from either the existing WAS holding tanks or the WAS holding tank within the new Sludge Handling Building by progressive cavity pumps and conveyed to the gravity belt thickener (GBT). The process utilizes the polymer feed system to assist in thickening the sludge. Thickened sludge (TWAS) from the GBT is received by the TWAS holding tank within the new Sludge Handling Building, then conveyed to the egg-shaped anaerobic digesters by another set of progressive-cavity pumps.

The sludge dewatering process utilizes digested sludge pumping systems, two centrifuges and a conveyor in a loading dock. Sludge is drawn from the digested sludge storage tank and sent to the centrifuges via progressive cavity pumps. The centrifuges dewater the sludge from about 2.5% solids to approximately 22%, which greatly reduces the volume of the sludge for disposal. Dewatered sludge is sent to trucks by a shaftless screw conveyor through one of five different locations in the new truck dock, and then hauled away for land application.

Design Data – Sludge Thickening

Gravity Belt Thickeners	
Number of Gravity Belt Thickeners	1
Belt Width, meters	2
Solids Loading, lbs. DS/day	7,905
Solids Loading, gallons/day	135,399
Maximum Loading Rate, lbs. DS/hr.	2,000
Operation, hrs./week	32
Thickened Sludge Volume at 4% TS, gpd	22,510
WAS Storage Tank	
Number	1
Volume, gal.	83,711
Storage, days	0.9
TWAS Storage Tank	
Number	1
Volume, gal.	73,462
Storage, days	5.4

Design Data – Sludge Dewatering

Centrifuges

Number of units	2
Hydraulic Loading, gpm	150
Solids Loading, lbs. TS/hr.	1,875
Operation, hrs./centrifuge/week	16

Deficiencies

City staff has reported that the TWAS mixing system, which utilizes the TWAS pumps to recycle the tank contents through two nozzles above the high water level in the tank, is not effective. As a result, the TWAS settles out into three layers: water on the bottom, saturated TWAS in the middle, and a mat of dried TWAS on top. This dried mat of sludge is not broken up by flow from the mixing system or from the GBT discharge, which compounds the issue. The building contains a hot water heater which needs to be replaced. Polymer unit PU-1102 needs to be replaced within the next 5 years. The City has also reported issues with filtrate from the GBT causing an overflow of foam in the receiving sanitary sewer. When thickening capacity is increased, the sewer line capacity should also be increased. It was noted during the site visit that the Sludge Handling Building needs to be updated with low temperature and heat alarms added.

Recommendations

The City should consider implementation of a different TWAS mixing system, including:

- Air pulse pump(s) within the TWAS tank
- Microbiology addition to TWAS tank

If the tank is utilized for TWAS storage, consideration should be given for adding microbiology to the tank to prevent the sludge mat from forming. This may be implemented from within the Sludge Thickening Room with a small mixing tank and feed pump. If the City wishes to repurpose TWAS tank for side stream filtrate treatment, the GBT discharge may be piped directly to a TWAS pump, which may be relocated to the Sludge Thickening Room. It is recommended that the water heater and polymer unit be replaced.

The centrifuges were put into service in 2014. With a service life of roughly 20 years, the City should budget for centrifuge replacement in roughly 10 years. A cost estimate for this project is included below.

Table 5-3: Dewatering Equipment Replacement – Probable Costs

GENERAL CONDITIONS	$769,000
DEWATERING EQUIPMENT REPLACEMENT	$1,319,700
CONSTRUCTION SUB-TOTAL	**$2,088,700**
CONTINGENCY @ 10%	**$209,000**
ESTIMATED CONSTRUCTION COST	**$2,297,700**
ENGINEERING (15%)	**$345,000**
TOTAL PROJECT COST	**$2,642,700**

5.5.14 Consolidated Design Calculations of the Existing Main Wastewater Treatment Facility

Population Equivalent

Existing Population Equivalent, PE	49,016
Build-out of Service Area, PE	15,021
Total Service Area, PE	64,037

(49,016 PE x 93.58 gal/day/PE) +(15,021 x 100 gal/day/PE) = 6,092,000 gallons/day

Design Flows

Design Average Flow, MGD	9.00
Peak Hourly (Dry Weather) Flow, MGD	18.35
Peak Wet Weather Flow, MGD	35.70
PWWF through WWTF, MGD	18.35
PWWF through Excess Flow, MGD	17.35

Dry Weather Wastewater Characteristics

BOD5 = 9.0 MGD x 181 mg/l x 8.34 lb./gal. = 13,588 lb./day
TSS = 9.0 MGD x 207 mg/l x 8.34 lb./gal = 15,537 lb./day
NH3-N = 9.0 MGD x 21 mg/l x 8.34 lbs./gal. =1,576 lb./day

East Side Lift Station

Screens	Perforated Plate Mechanical
Number of Units	1
Opening Size, mm	3
Max flow through screen: MGD	14
Channel width: ft.	3.50
Channel depth: ft.	13.00
Discharge height: ft.	5.00
Perforation size: mm	3
Water level downstream: ft.	1.105
Screen Headloss: ft.	1.410
Max water level upstream: ft.	2.515

Screenings Washer/ Compactor	
Number of Units	1
Grinder, HP	5
Auger, HP	3

Pumps	Submersible
Number of Units	3
Horsepower, HP	100
Design Condition 1 – 100% One Pump	
Flow, GPM	4,345
TDH, Ft	62
Speed, RPM	1,200
Design Condition 2 – 100% Three Pumps	
Flow, GPM (each)	3,240
TDH, Ft	80.6
Speed, RPM	1,200
Design Condition 3 – 60% One Pump	
Flow, GPM (each)	700
TDH, Ft	33.2
Speed, RPM	700

Riverside Lift Station

Bar Screens	
Number of Units	2
Opening Size, in	0.25
Max flow per screen: MGD (BS-0201/ BS-0202)	35.0/35.0
Channel width: ft.	5.50/ 5.50
Channel depth: ft.	6.0/ 6.0
Discharge height: ft.	5.0 / 5.0
Water level downstream: ft.	4.07 / 4.07
Screen Headloss: ft.	0.30 / 0.30
Max water level upstream: ft.	4.37 / 4.37

Screenings Washer/ Compactor	
Number of Units	2

Pumps	Submersible
Number of Units	8
Pump P-0201 through P-0204 (4 pumps)	
Horsepower, HP (w/ VFD)	140
Flow, GPM/Pump	5,000
Force main, in.	24
Pump P-0205 through P-0208 (4 pumps)	
Horsepower, HP	110
Flow, GPM/Pump	2,327
Force main, in.	16

Process/Excess Flow Diversion:

Fixed Weir Flow Splitting:	
Weir Length, feet	40
Head over Weir @ 17.35 MGD, feet	0.146

Excess Flow Facilities:

Excess Flow Clarifier:	
Number of Units	2
Peak Wet Weather Flow, MGD	17.35
BOD5 Influent (estimated), mg/l	181
BOD5 Influent (est.), lb./day	26,234
TSS Influent (est.), mg/l	211
TSS Influent (est.), lb./day	30,508
NH3-N Influent (est.), mg/l	21
NH3-N Influent (est.), lb./day	3,039
Length, ft.	110
Width, ft.	44
Depth (average), ft.	9.43
Volume, $ft.^3$	91,282
Volume, gallons	682,800
Surface Area, $ft.^2$	9,680
Weir Length, ft.	640
Surface Loading Rate, gal/day/$ft.^2$	1,792
Solids Loading Rate, lb./day/$ft.^2$	3.2
Weir Overflow Rate, gal/day/ft.	27,110
Detention Time, minutes	57
BOD5 Removal (efficiency)	25.6%
BOD5 Effluent, mg/l	135
BOD5 Effluent (est.), lb./day	19,517
TSS Removal (est.)	45.6%
TSS Effluent (est.), mg/l	115
TSS Effluent (est.), lb./day	16,603
NH3-N Removal (est.)	0%
NH3-N Effluent (est.), mg/l	21
NH3-N Effluent (est.), lb./day	3,039
Fecal Count	1 x 107

Excess Flow Facilities: (Cont.)

Chlorine Contact Tank:

Number of Units	2
Length, feet	96
Width, feet	21
Depth, feet	7
Volume (total), cu. ft.	28,224
Volume (total), gallons	211,116
Detention Time, minutes	17

Preliminary Treatment

Grit Tank

Number of Units	2
Design	Aerated
Design Average Flow (DAF), MGD	9.00
Peak Wet Weather Flow (PHF), MGD	18.35
Length, ft.	22
Width, ft.	20
Sidewater Depth, ft.	18
Total Volume, gallons	99,858
Total Volume, cu. ft.	13,350
Detention Time at DAF, min	16.0
Detention Time at PHF, min	7.8

Primary Treatment

Primary Settling Tanks	
Number	4
Length, ft.	100
Width, ft.	20
Surface Area, sf/clarifier	2,000
Total Surface Area, sf	8,000
Overflow Rate at DAF, gpd/sf	1,125
Weir Loading Rate, gpd/ft.	15,000
Primary Influent BOD, lbs./day	13,834
Primary Influent TSS, lbs./day	16,088
Primary Influent NH_3-N, lbs./day	1,602
Removal Efficiency - BOD, %	29
Removal Efficiency - SS, %	50
BOD Removed, lbs./day	4,012
Suspended Solids Removed, lbs./day	8,044
Primary Effluent BOD, lbs./day	9,822
Primary Effluent TSS, lbs./day	6,836
Sludge Volume at 1%, gpd	96,454

Primary Sludge Fermenter	
Number	1
Diameter, ft.	28
Surface Area – Each	616
Overflow Rate at DAF	127
Solids Loading at DAF, gpd/sf	13.1
Thickened Primary Sludge Volume at 5%, gpd	18,326
Supernatant Volume	78,127
VSS Solids to Digestion (78%), lbs./day	5,961

Primary Sludge Pumps

Number	3
Run Time, hr./day	24
Capacity, gpm(each)	33

Secondary Treatment

Aeration Basins	
Number of Tanks	18
Sidewater Depth, ft.	16
Anaerobic Basin 1301 & 1302, total cu. ft.	24,640
Anaerobic Basin 1303A Thru 1306A, total cu. ft.	57,344
Anoxic Basin 1303B Thru 1306B, total cu. ft	122,880
Aerobic Basin 1307 Thru 1310, total cu. ft.	184,320
Aerobic Basin 1401 Thru 1404, total cu. ft.	109,760
Total Volume, cu. ft.	498,944
Total Volume, gal.	3,732,101
Detention Time at 9.00 MGD, hrs.	10.0
Organic Loading, lbs./day BOD	10,411
Organic Loading, mg/l BOD	136
Organic Loading Rate, lbs./day BOD/1,000 cu. ft.	20.9
MLSS, mg/l	3,800
Solids Inventory, lbs.	118,278
RAS Return Rate, MGD	10.5
WAS, lbs./day	7,905
WAS Volume at 0.76% TS, gpd	135,399
Anoxic Air Required, sfm	2,131
Anoxic Air Required, scfm	2,800
Aerobic (1311 Thru 1314) Air Required, scfm	5,190
Aerobic (1311 Thru 1314) Air Provided, scfm	5,200
Aerobic (1401 Thru 1404) Air Required, scfm	3,242
Aerobic (1401 Thru 1404) Air Provided, scfm	3,250
Sludge Age, days	15.0
F/M Ratio	0.088

Process Control Building	
Number of Tanks	2
Volume, gal/tank.	6,650
Number of Pumps	3
Capacity, gph	40

Internal Recycle Pump Station	
Design	Submersible
Number of Pumps	4
Capacity, gpm	12,500

<u>Final Clarifiers</u>

Number	2
Design	Hydraulic Differential
Average Flow, MGD	9.00
Peak Hourly Flow, MGD	18.35
Diameter, ft.	120
Sidewater Depth, ft.	12.75
Surface Area – Each, sf	11,310
Surface Area – Total, sf	22,620
Weir Length – Each, lin. ft.	343
Weir Length – Total, lin. ft.	686
Surface Loading Rate at PHF, gpd/sf	811
Solids Loading Rate at PHF, lbs./day/sf	31.9
Weir Loading Rate, gpd/lf	26,749

<u>RAS Pump Station</u>

Design	Submersible
Number of Pumps	4
RAS Pump Capacity	2,666 gpm @ 68.3 ft. TDH
RAS Force Main Size	16”

Ultraviolet Disinfection

Peak Design Flow, MGD	20
UV Transmission, %(Field measured transmissivity = 80%)	*65*
TSS, mg/L	25
Disinfection Limit, fecal count	400
Design Intensity, mW	40,125
Number of Channels	1
Number of Reactors per channel	1
Number of Banks/ Reactor	2
Number of Modules per Bank	4
Total Number of UV Lamps	80
Type of level control	Fixed Weir
Automatic Mechanical Cleaning	Yes

Sludge Handling Facility

<u>Sludge Thickening - Gravity Belt Thickeners</u>

Number of GBT’s	1
Belt Width, meters	2

Solids Loading, lbs. DS/day	7,905
Solids Loading, gallons/day	135,399
Maximum Loading Rate, lbs. DS/hr.	2,000
Operation, hrs./week	32
Thickened Sludge Volume at 4% TS, gpd	22,510

<u>TWAS Storage Tank</u>

Number	1
Volume, gal.	73,462
Storage, days	3.26

<u>Sludge Handling Facility (Cont.)</u>

<u>Anaerobic Digestion</u>

Number	2
Design	Egg-Shaped
Volume, cu. ft. each	64,171
Total Volume, cu. ft.	128,342
Total Volume, gpd	924,000
TWAS VSS, lbs./day	5,857
Primary VSS, lbs./day	5,961
Volatile Solids Loading Rate, lbs. VSS/day	11,818
Loading Rate, lbs. VSS/1000 cu. ft.	96
Loading Rate, gpd	40,838
Detention Time, days	22.6

Gas Production

Actual Gas Production:	
Low End Gas Production, cu. ft./day	87,408
High end Gas Production, cu. ft./day	131,112
Minimum Per EPA	
VSS Reduction, %	38
VSS Reduction, lbs.	4,491
Low End Gas Production, cu. ft./day	53,893
High End Gas Production, cu. ft./day	80,840
Low End Heating Range, btu/day	32,335,825
High End Heating Range, btu/day	48,503,738

WAS Storage Tank	
Number	1
Diameter, ft.	45
Sidewater Depth, ft.	7.0
Volume, cf	11,133
Volume, gal.	83,711
Storage, days	0.9

Sludge Storage Tank	
Number	1
Diameter, ft.	40
Sidewater Depth, ft.	18
Sludge Volume, cf	16,336
Sludge Volume, gal.	122,195
Storage, days	3
Dig. Gas Volume, cf	5,000

Centrifuges	
Number of units	2
Hydraulic Loading, gpm	150
Solids Loading, lbs. TS/hr.	1,875
Operation, hrs./centrifuge/week	16.0

5.6 WEST SIDE WRF NPDES PERMIT LIMITS

The following information is derived from the existing NPDES permit for the City of St. Charles West Side WRF. This permit was last issued on August 18, 2023 and expires on August 31, 2028. The NPDES permit has been, and continues to be, written in such a way that it anticipated expansion of this facility from 0.7 MGD to 1.05 MGD. The current NPDES permit is included as Appendix B:

Phase III (Expanded WWTF)

Flow	
Design Average Flow, MGD	1.05
Design Maximum Flow, MGD	2.63
$CBOD_5$	
Monthly Average, mg/L	10
Monthly Average, lbs.	88
Daily Maximum, mg/L	20
Daily Maximum, lbs.	175
Suspended Solids	
Monthly Average, mg/L	12
Monthly Average, lbs.	105
Daily Maximum, mg/L	24
Daily Maximum, lbs.	210
Fecal Coliform	
Monthly Maximum (May-Oct. Geometric Mean)	200 per 100 ml
pH	
Range	6 - 9
Chlorine Residual	
Daily Maximum, mg/L	0.05
Total Phosphorus	
Monthly Average, mg/L	1.0

Ammonia Nitrogen

March

Monthly Average, mg/L	1.5
Monthly Average, lbs.	13
Weekly Average, mg/L	3.8
Weekly Average, lbs.	33
Daily Maximum, mg/L	4.9
Daily Maximum, lbs.	43

April through October

Monthly Average, mg/L	1.2
Monthly Average, lbs.	11
Daily Maximum, mg/L	3.0
Daily Maximum, lbs.	26

November through February

Monthly Average, mg/L	2.5
Monthly Average, lbs.	22
Daily Maximum, mg/L	6.6
Daily Maximum, lbs.	58

Dissolved Oxygen

March through July

Weekly Average (not less than), mg/L	6
Daily Minimum, mg/L	5

August through February

Monthly Average (not less than), mg/L	5.5
Weekly Average (not less than), mg/L	4
Daily Minimum, mg/L	3.5

5.7 WEST SIDE WRF PROCESS SUMMARY

Raw wastewater contains a variety of contaminants including nutrients, organic, and inorganic material that must be removed prior to discharging to a receiving stream. The raw wastewater is transported from the institutions, businesses and residences to the facility through a 24-inch interceptor sewer along Illinois Route 38. The wastewater is received by an influent pump station and conveyed to the headworks where inorganic material such a plastics and rags are screened from the wastewater.

The screened wastewater is then blended with return activated sludge (RAS), which contains beneficial micro-organisms. The resulting thinner sludge is commonly referred to as mixed liquor suspended solids (MLSS). The MLSS is then introduced to the biological process.

The West Side WRF utilizes a biological nutrient removal process known as a 5-stage Bardenpho. This process uses aeration uses a series of anaerobic, anoxic, and aerobic zones to remove phosphorus and total nitrogen through denitrification, as well as utilizes micro-organisms for the conversion of contaminants including dissolved organic material and ammonia-nitrogen. The micro-organisms or bio-mass utilize dissolved oxygen for respiration, which is supplied by compressed ambient air through fine bubble diffusers. Within the biological process, the total volume of bio-mass increases as it consumes the contaminants.

Following the biological process, solids are separated from the water through settling in final clarifiers. Most of the settled solids are returned to the beginning of the biological process in the form of return activated sludge or RAS. A portion of the sludge must be wasted to maintain a proper balance. This waste activated sludge (WAS) is transferred to the aerobic digestion process for further stabilization prior to ultimate disposal. The clear water flows over the weirs of the clarifiers to the disc filters where solids are further reduced prior to disinfection.

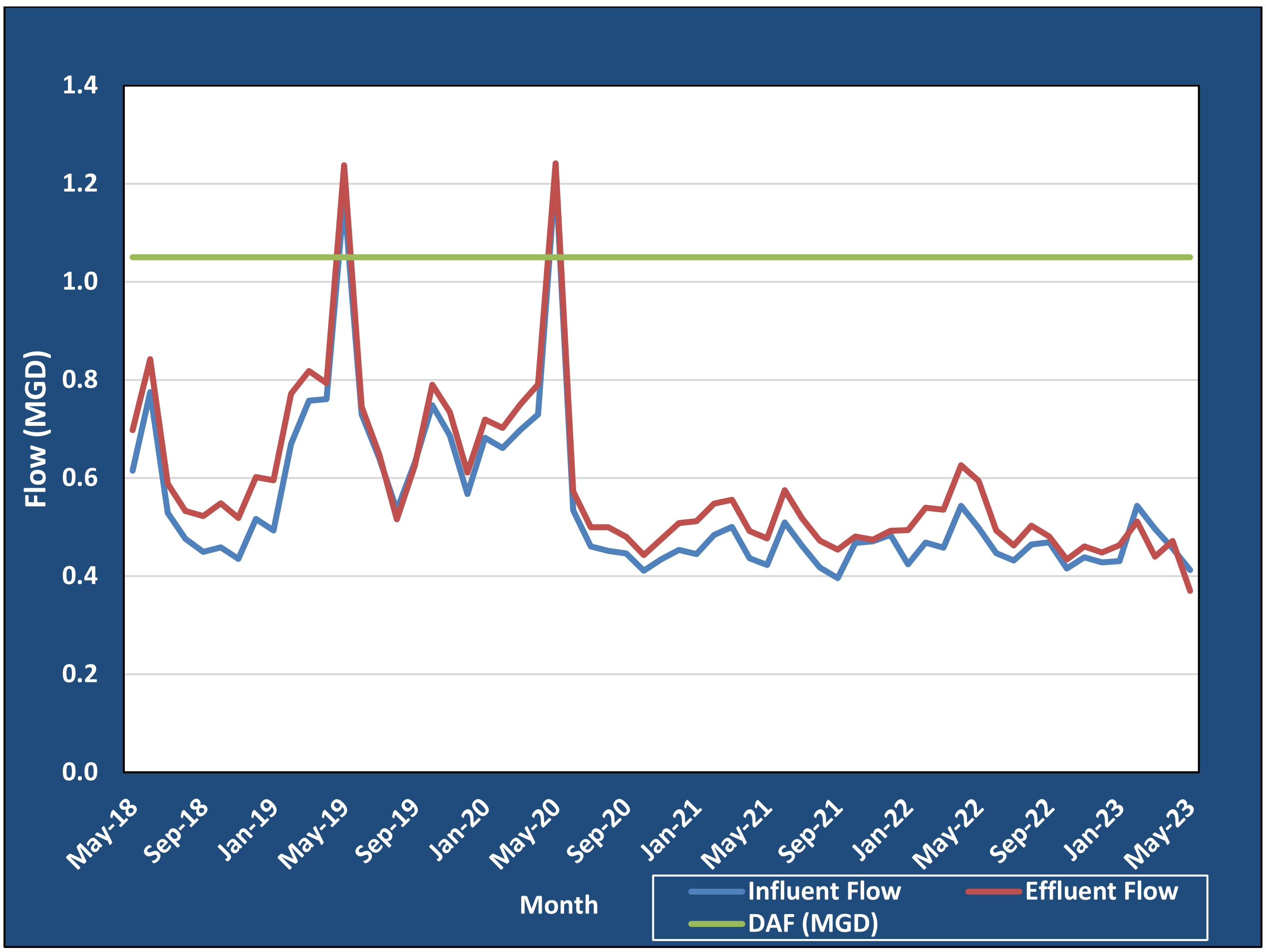
The West Side WRF disinfects the effluent with ultraviolet radiation. The U.V. light disrupts the remaining organisms' ability to reproduce or accomplish cell division. The effluent is then conveyed through an outfall sewer to Mill Creek where it is discharged.

5.8 West Side WRF Plant Performance

5.8.1 Influent Flow

The Design Average Flow for the West Side WRF is 1.05 MGD. The Illinois EPA reviews the three low flows months for any twelve-month period. The average of the three low flow months is compared to the design average flow to determine the remaining capacity for connecting additional load and sewer extensions. Figure 5-1 below shows the Design Average Flow and the monthly influent and effluent flows from 2018 through 2023.

Figure 5-6: West Side WRF – Influent and Effluent Flows



The monthly average flow from 2018 through 2023 ranged from 0.38 MGD to 0.79 MGD. The table below shows the annual average flow and three low flow months for 2018 through 2023.

Table 5-4: West Side WRF – Average and Low Flow Data

	3 Month Low Flow Average	Months	Annual Average	Peak Month Flow
Influent Flow Meter				
2018	0.448 MGD	Nov / Sept / Oct	0.53 MGD	0.78 MGD
2019	0.532 MGD	Jan / Aug / Dec	0.70 MGD	1.17 MGD
2020	0.431 MGD	Oct / Nov / Sept	0.60 MGD	1.22 MGD
2021	0.412 MGD	Sept / Aug / May	0.46 MGD	0.51 MGD
2022	0.423 MGD	Oct / Jan / Dec	0.46 MGD	0.54 MGD
2023	0.433 MGD	May / Jan / Apr	0.47 MGD	0.54 MGD
Effluent Flow Meter				
2018	0.525 MGD	Nov / Sept / Aug	0.61 MGD	0.84 MGD
2019	0.574 MGD	Aug / Jan / Dec	0.74 MGD	1.24 MGD
2020	0.466 MGD	Oct / Nov / Sept	0.64 MGD	1.24 MGD
2021	0.467 MGD	Sept / Aug / Nov	0.50 MGD	0.58 MGD
2022	0.448 MGD	Oct / Dec / Nov	0.51 MGD	0.63 MGD
2023	0.424 MGD	May / Mar / Jan	0.45 MGD	0.51 MGD

As discussed in Section 2, the property within the West Side Service Area continues to be developed. The capacity of the West Side WRF has recently been expanded from a capacity of 700,000 gallons per day (0.7 MGD) to 1.05 MGD. Considering metered influent from 2018 through 2023, the West Side WRF treated an average flow of 540,000 gallons per day or 0.54 MGD. There is also development that is currently ongoing. Section 2 provides an estimate of 1.28 MGD for Build-out conditions of the service area.

5.8.2 Carbonaceous Oxygen Demand $CBOD_5$

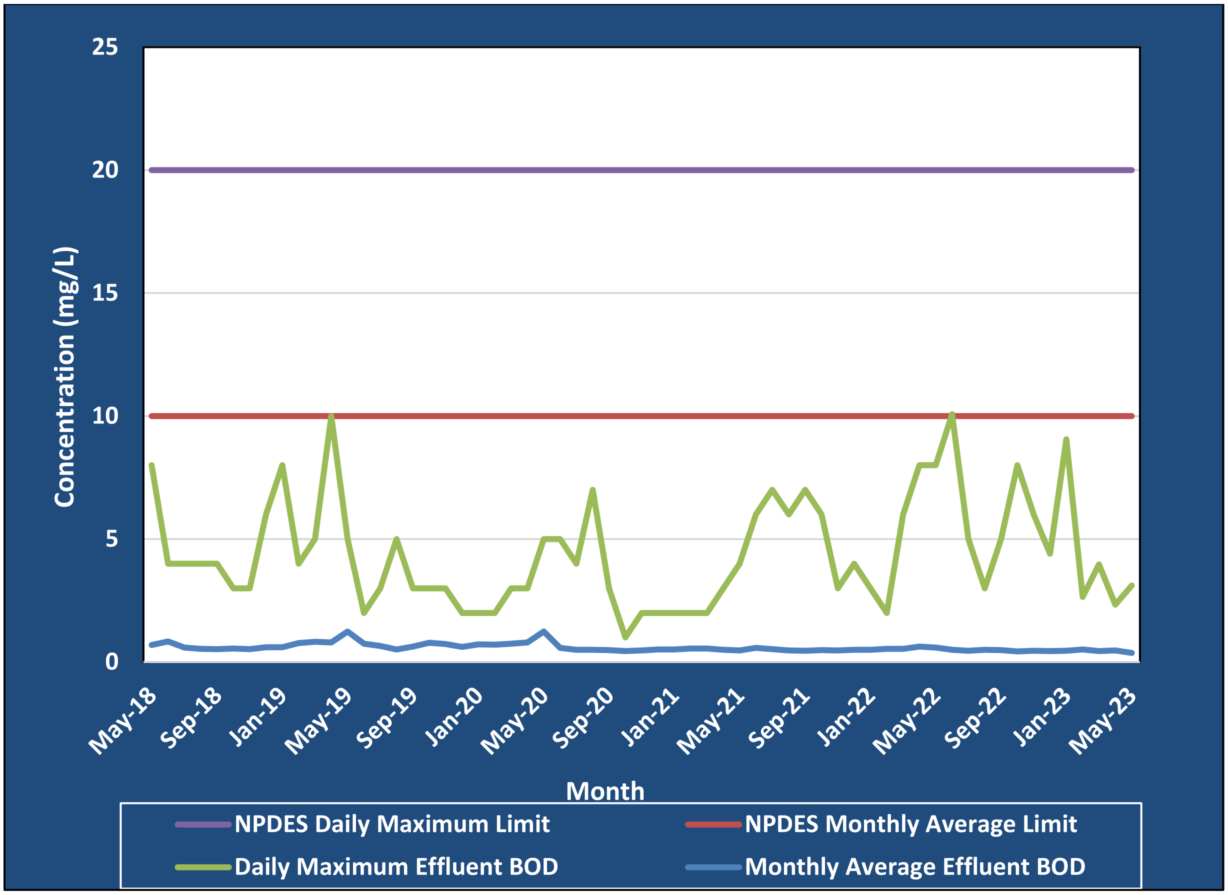
To determine the proper $CBOD_5$ design loading, the monthly average was reviewed for the 2018-2023 time period.

Year	*Annual Average*	*Maximum Monthly Average*	*Daily Maximum*
2018	178 mg/L	217 mg/L	336 mg/L
2019	150 mg/L	205 mg/L	300 mg/L
2020	175 mg/L	228 mg/L	660 mg/L
2021	202 mg/L	241 mg/L	484 mg/L
2022	194 mg/L	244 mg/L	407 mg/L
2023	175 mg/L	195 mg/L	352 mg/L
Average	179 mg/L	222 mg/L	423 mg/L

The facility should be designed with adequate biological reduction capacity to meet the effluent limits on a continuous basis. The influent concentrations should be evaluated based on 2018-2023 data. The original design was based around the Illinois EPA design standard of 0.17 lbs./ PE/ day or 204 mg/L. This is more conservative than with the current monthly average and was utilized for the design of the biological process.

The Daily Monitoring Reports were reviewed to document the efficiency of the existing process. The average influent and effluent $CBOD_5$ for the period were 179 mg/L and 2.33 mg/L, respectively. This reflects an efficiency of 98.70%.

Figure 5-7: West Side WRF – $CBOD_5$ Performance



5.8.3 Total Suspended Solids

Total Suspended Solids (TSS) loadings were analyzed by comparing the monthly average, the maximum monthly average, and the daily maximum for 2018-2023 DMR data.

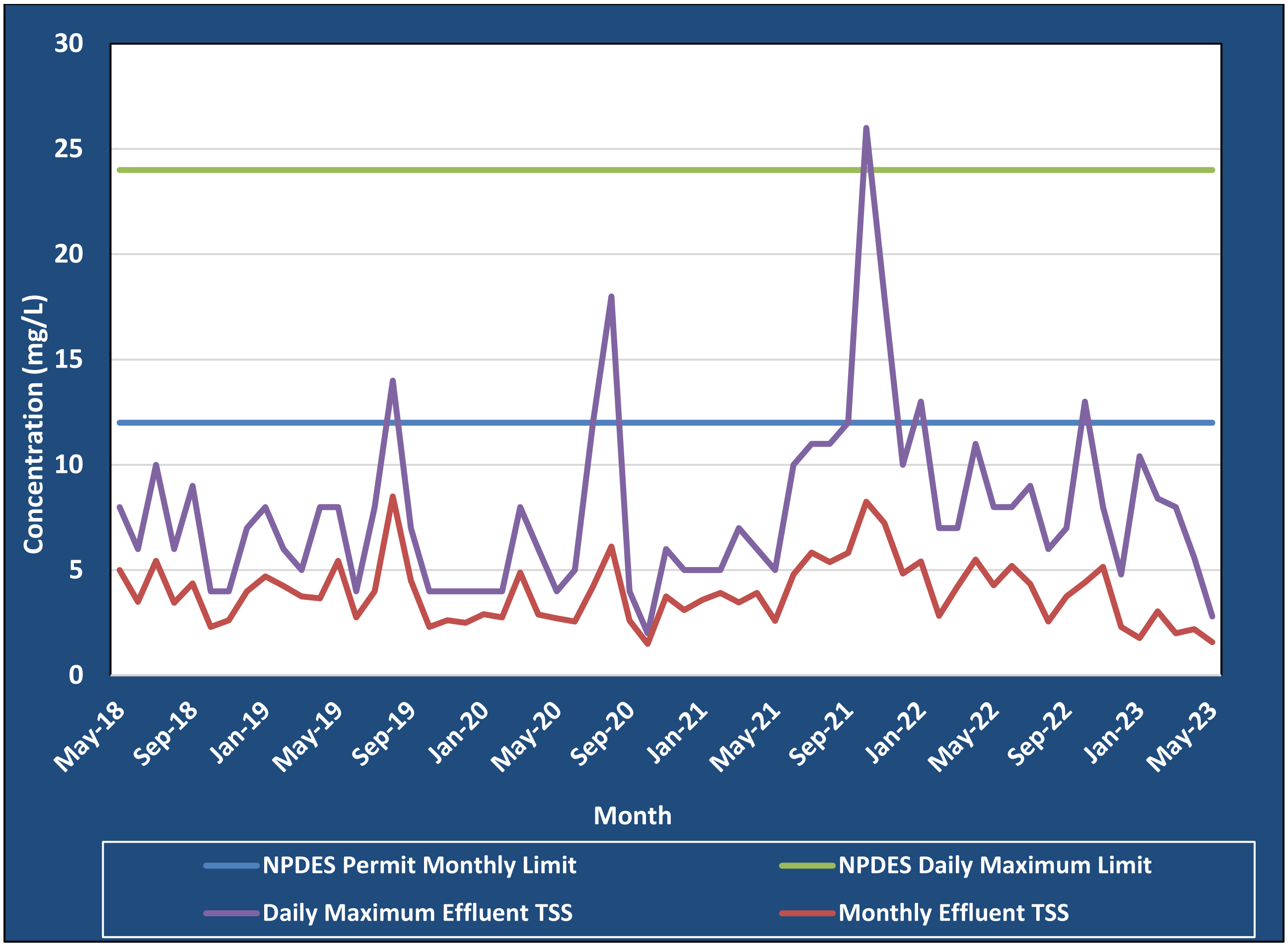
Year	*Annual Average*	*Maximum Monthly Average*	*Daily Maximum*
2018	188 mg/L	219 mg/L	413 mg/L
2019	168 mg/L	232 mg/L	400 mg/L
2020	190 mg/L	355 mg/L	1,678 mg/L
2021	212 mg/L	266 mg/L	440 mg/L
2022	241 mg/L	378 mg/L	950 mg/L
2023	173 mg/L	229 mg/L	370 mg/L
Average	195 mg/L	280 mg/L	709 mg/L

The facility should be designed with adequate solids handling capacity to meet the bio-solids reduction needs on a continuous basis. However, solids reduction is a continuous process in excess of 24 days detention time. Therefore, it is not adversely affected by increased solids loading from a single day. City staff have agreed that using 240 mg/L would provide a conservative design. This is the IEPA standard.

TSS = 1.05 MGD x 240 mg/L x 8.34 lbs./gal = 2,102 lbs./day

The NPDES Permit Limit for TSS is 12 mg/L monthly average and 24 mg/L daily maximum. A similar analysis of the DMR data for CBOD was completed for the TSS limit. The plant's overall performance from 2018 through 2023 was 98.08% effective with an average effluent concentration of 3.75 mg/L. The plant has been able to meet its permit limits on a continuous basis over the past six years. The high daily maximum reported on October 20, 2021 was an excursion with a concentration reported of 26mg/L, which is greater than the daily maximum permit limit of 24 mg/L.

Figure 5-8: West Side WRF – TSS Performance



5.8.4 Ammonia Nitrogen

The monthly influent average ammonia concentrations for the last five years of DMR data are listed below.

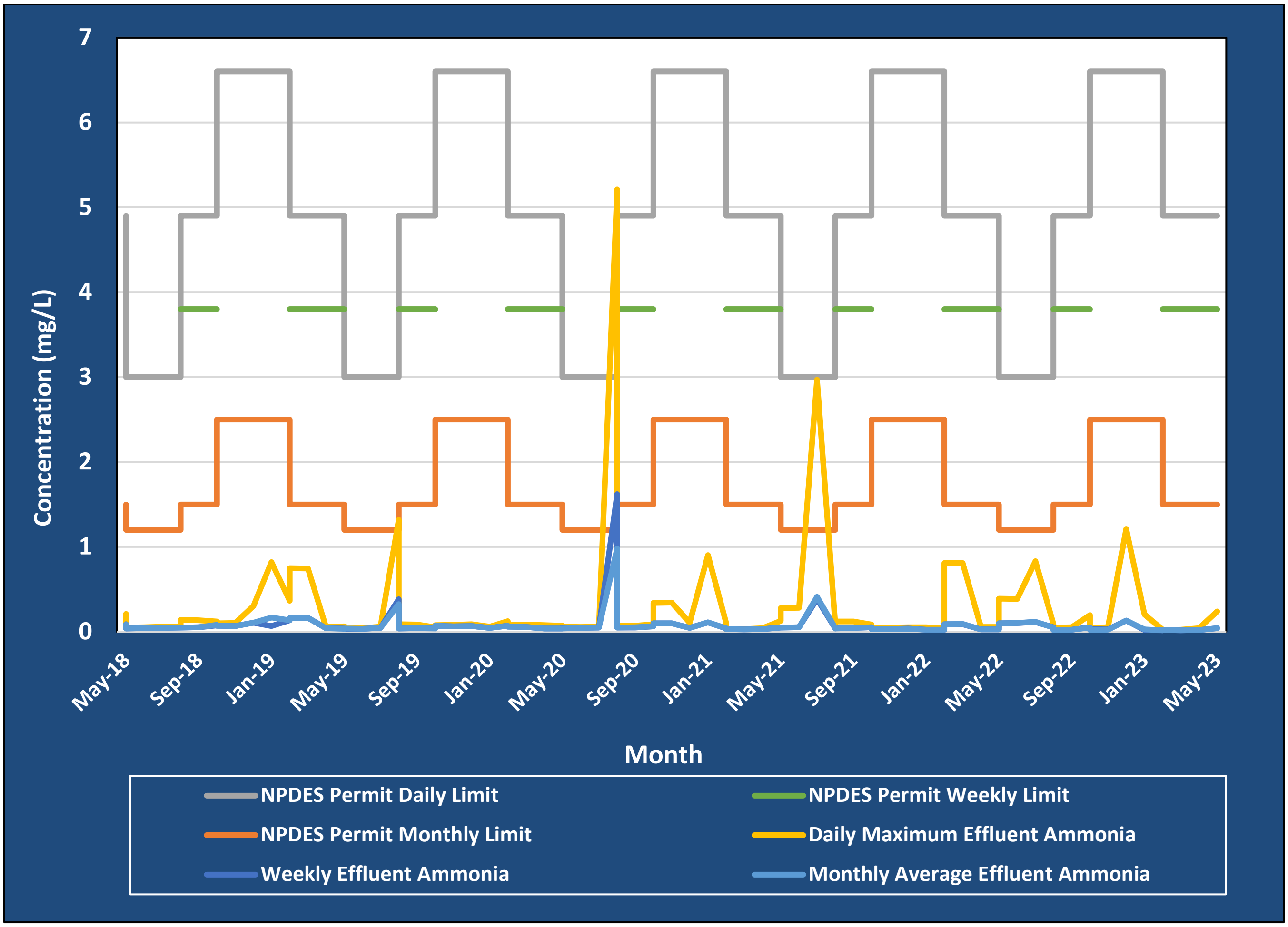
Year	*Annual Average*	*Maximum Monthly Average*	*Daily Maximum*
2018	22 mg/L	26 mg/L	30 mg/L
2019	18 mg/L	23 mg/L	31 mg/L
2020	22 mg/L	29 mg/L	34 mg/L
2021	25 mg/L	28 mg/L	37 mg/L
2022	23 mg/L	30 mg/L	43 mg/L
2023	19 mg/L	22 mg/L	25 mg/L
Average	22 mg/L	26 mg/L	33 mg/L

The facility should be designed with adequate nutrient removal capacity to meet the effluent limits needs on a continuous basis. However, designing around the highest monthly max for each year seems too conservative. Therefore, it is recommended that the design is based around the maximum monthly average.

NH_3-N = 1.05 MGD x 26 mg/L x 8.34 lb./gal. = 228 lb./day

The effluent ammonia concentrations were compared to the current monthly effluent limits. The plant's overall efficiency from 2018 through 2023 was 99.65% effective with an average effluent concentration of 0.08 mg/L. The plant has been able to meet its permit limits on a continuous basis over the period analyzed, with the exception of an excursion on August 25, 2020. This excursion occurred when the contractor was dewatering the aerobic digester, and included a Daily Maximum Effluent of 5.21 mg/L, which is higher than the daily maximum permit limit of 3 mg/L. Since the City installed their own dewatering facilities in the Phase III Expansion, no further excursions have occurred.

Figure 5-9: West Side WRF – Ammonia Performance

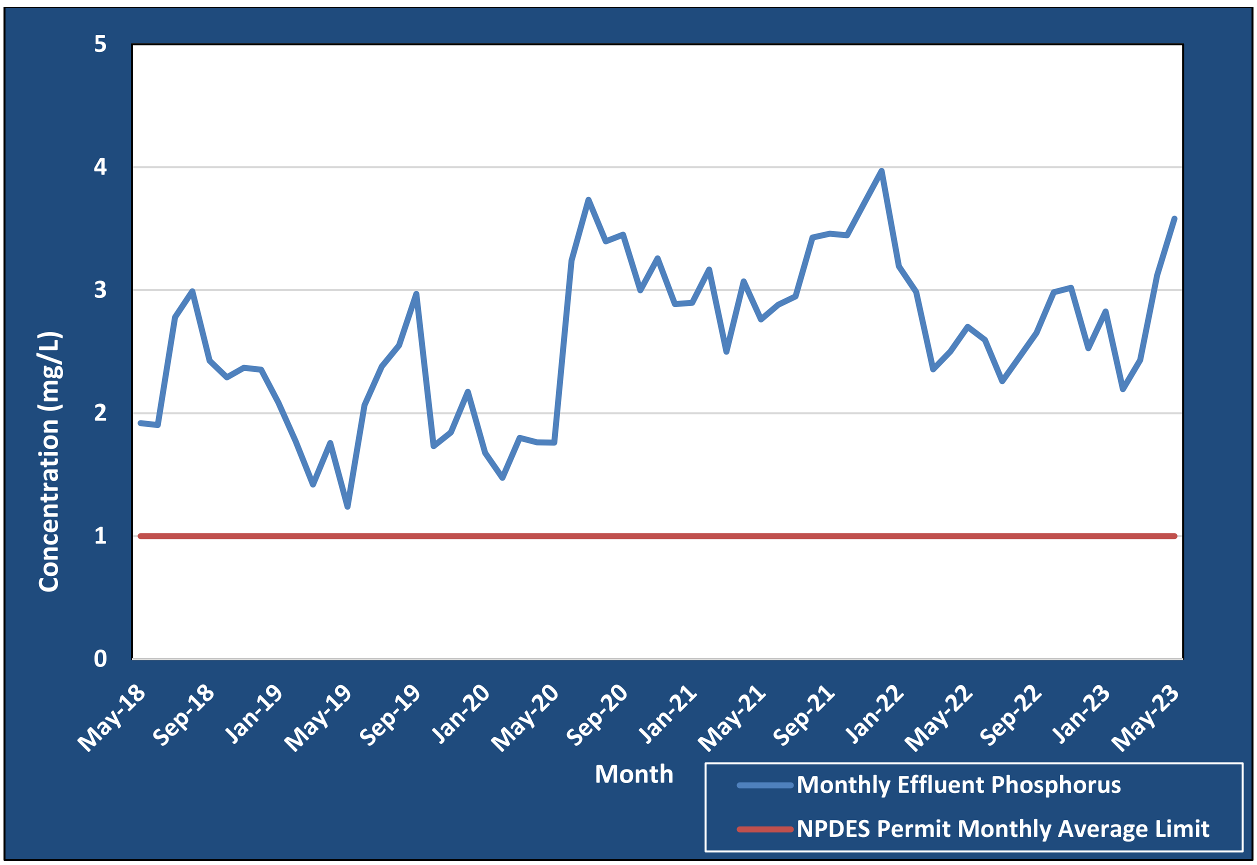


5.8.5Total Phosphorus

Since the plant was expanded to 1.05 MGD, its new issued NPDES permit will include an effluent total phosphorus limit of 1.0 mg/L. Figure 5-5 below shows the phosphorus performance of the WRF.

The facility began monitoring phosphorus in 2017. The plant's overall efficiency for phosphorus removal from 2018 through 2023 was 46.67% effective with an average effluent concentration of 2.22 mg/L. However, the City did not have capabilities for phosphorus removal until the 2020 Phase III improvements were put into operation 2023. Currently, the Bardenpho process is in the process of optimization to finalize the project and biologically meet the 1.05 MGD permit limits.

Figure 5-10: West Side WRF – Phosphorus Performance



5.9 EXISTING WEST SIDE WATER RECLAMATION FACILITY

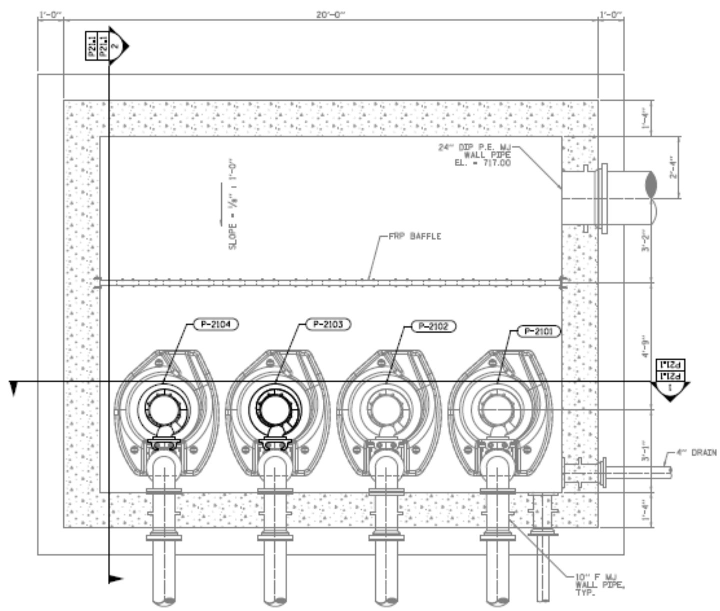
5.9.1 Operations Building

Process Description
The Operations Building contains a laboratory, locker room, operator control room, raw sewage screening room, blower room, and electrical room. The structure is located between the Raw Sewage Pump station and the Biological Process basins.

Performance & Deficiencies
The electrical room gets hot during all seasons.

Recommendations
The electrical room needs to be provided with a cooling system.

5.9.2 Raw Sewage Pumping



Raw Sewage Pump Station - Lower Level Process Plan
SCALE: 3/8" = 1'-0"

Process Description

The raw sewage pump station was constructed during the Phase II Expansion and expanded as part of the Phase III Expansion. The pump station includes a four-pump system, with one pump providing back-up capacity. The system is designed with flow matching capabilities using two speed motors and pre-rotation basins. In 2017, two of the Meyer pumps were replaced with Hidrostal pumps and VFDs. The pre-rotation operation was abandoned due to issues with slug loading of rags. In 2021, the remaining two-speed pump was replaced with a Hidrostal Pump with a VFD, and a fourth pump was also installed.

IEPA Regulatory Requirements

Raw Sewage Pump Stations are regulated under the provisions of Title 35: Subtitle C: Chapter II: Part 370.400 Illinois Recommended Standards for Sewage Works. The following are excerpts from the applicable sections.

Section 370.410 Design

c) Pumps and Pneumatic Ejectors

1) Multiple Units

Multiple pumps or ejector units shall be provided …… Units shall have a capacity such that, with any unit out of service, the remaining units will have capacity to handle the design peak flow.

g) Ventilation

6) Dry Wells

Dry well ventilation may either be continuous or intermittent. Ventilation, if continuous, should provide at least 6 complete air changes per hour; if intermittent, at least 30 complete air changes per hour.

h) Flow measurement

Suitable devices for measuring sewage flow shall be provided at all pumping stations. Indicating, totalizing and recording flow measurement shall be provided at pumping stations with a 1200 gpm or greater design peak flow.

Section 370.550 Essential Facilities

a) Emergency Power or pumping facilities

1) All plants shall be provided with an alternate source of electric power or pumping capability to allow continuity of operation during power failures. Methods of providing power or pumping capability include:

A) The connection to at least two independent public utility sources …

B) Portable or in-place internal combustion engine equipment which will generate electrical or mechanical energy.

C) Portable pumping equipment when only emergency pumping is required.

Design Data

Number of pumps	4
Type	4 Wemco-Hidrostal with VFDs, 2 VFDs with Bypass Contactors
Capacity, each	1,745 gpm at 37 ft. TDH
Force Main Dia., inches	14
Firm Capacity of P.S.	5,235 gpm (one pump out of service)

Performance & Deficiencies

The IEPA Design Standards require the pump station to be capable of pumping the Peak Hourly Flow of 2.63 MGD (1,514 gpm) with one pump out of service. However, due to infiltration and inflow issues on the IYC Campus, the expected Peak Wet Weather Flow was 2,312 gpm. The pump station was designed to meet the long-term Peak Wet Weather Flow of 3,680 gpm with 3 pumps in operation. Therefore, each pump is capable of producing a minimum of 1,745 gpm, and a combined flow of 3,490 gpm. The pump station will be capable of producing more than 3,700 gpm with three pumps running. Therefore, the pump station meets all regulatory requirements at this time.

In 2015, the City staff modified its operations. The City elected to no longer utilize the pre-rotation system of the pump station and began operating with start and stop water levels similar to float back-up controls in a standard lift station. According to the City, the low speed on a single pump emptied the wet well too quickly and causing an excess number of starts and stops. Both start and stop water levels that have been in place over the last several years are above the pre-rotation channels, and debris has been allowed to build up in this wet well.

Since that time, the City has replaced two of the original Wemco 2-speed pre-rotation raw sewage pumps with Meyers pumps and replaced the 2-speed starters with variable frequency drives. The Meyers pumps do not have suction bells and therefore do not effectively utilize the pre-rotation basins.

Recommendations

Without the pre-rotation system being utilized or the wet well getting cleaned out, the higher water level in the wet well has developed a build-up of grit in the dead zones north of the baffle wall. This has created operational issues with the submersible level sensor, which is located north of the baffle wall.

It is recommended that this wet well be cleaned out. If any work is done within the wet well in the future, it is recommended that fillets be installed in the northwest and northeast corners to prevent material build-up. An alternate control system could be incorporated that would allow for either operational mode to be utilized. For example, the pre-rotation could be used on a weekly basis but the VFDs would normally be used to maintain a liquid level in the wet well.

Table 5-5: Raw Sewage Pump Station Condition Assessment

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
P-2101	Raw Sewage Pump	Raw Sewage Pump Station	Good	2017	15	2032		$90,000
P-2102	Raw Sewage Pump	Raw Sewage Pump Station	Good	2017	15	2032		$90,000
P-2103	Raw Sewage Pump	Raw Sewage Pump Station	Excellent	2022	15	2037		$90,000
P-2104	Raw Sewage Pump	Raw Sewage Pump Station	Excellent	2022	15	2037		$90,000
LE/LIT-2101	Radar Level Transmitter	Raw Sewage Pump Station	Excellent	2022	15	2037		$6,000
LS-2101 – LS-2107	Level Switches	Raw Sewage Pump Station	Excellent	2022	15	2037		$2,100
						TOTAL		***$368,100***

5.9.3 Headworks – Screens

Process Description

The headworks provide a variety of functions, including mechanical screening, RAS blending and flow measurement. The facilities are located in the center of the Operations Building. Flow is received from the raw sewage pump station, passes through a magnetic flow meter, and passes through the mechanical fine screen. RAS is also conveyed to the screening channel, but passes through a perforated-plate drum screen. Screened influent blends with RAS to form Mixed-Liquor Suspended Solids (MLSS) before it is conveyed to the extended aeration basins.

IEPA Regulatory Requirements

The Following are excerpts from Title 35 Subtitle C: Chapter II Part 370.610 Illinois Recommended Standards for Sewage Works

Where Required: *Screening of raw sewage shall be provided at all mechanical treatment works*

Mechanical Screens: *Clear openings for mechanically cleaned screens may be as small as practical to assure the proper operation and maintenance of treatment facilities. Mechanical screens shall be located so as to be protected from freezing and facilitate maintenance.*

Velocities through Screens: *For manual and mechanically racked bar screens the maximum velocity during peak flow periods should not exceed 2.5 feet per second. The velocity shall be calculated from a vertical projection of the screen opening on the cross-sectional area between the invert of the channel and the flow line. Excessive headloss through the screen, which may affect upstream flow measurement or by-passing taken be taken into account.*

Design Data

Number of channels	2
Number of Mech. Fine Screens	1
Capacity	6.0 MGD
Number of Drum Screens	1
Capacity	3.5 MGD
Number of Manually Cleaned Screens	1
Maximum Clear Water Headloss, inches	11.0
Bar Spacing, inches	3/16
Nominal Screening Basket Diameter, inches	47

Performance and Deficiencies

The existing fine screen and drum screen were installed in the Phase III Expansion. The expected service life for mechanical bar screens is fifteen years. Currently, the fine screen is performing very well with no lapses in service. The drum screen does not function properly, and does not remove any debris from RAS (or even MLSS flow when the fine screen is isolated). The drum screen is set to operate on a timer.

Table 5-6: Operations Building Condition Assessment Table

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
FS-2201	Fine Screen	Operations Building/ Screening Room	Excellent	2022	15	2037		$200,000
FS-2202	Drum Screen	Operations Building/ Screening Room	Good	2022	15	2037		$210,000
G-2201	36"x50" Gate (Stop Log)	Operations Building	Good	2001	25	2026	$30,000	
G-2202	36"x50" Gate (Stop Log)	Operations Building	Good	2001	25	2026	$30,000	
G-2203	36"x50" Gate (Stop Log)	Operations Building	Good	2001	25	2026	$30,000	
HT-2201	Hydro Pneumatic Tank	Operations Building	Excellent	2022	15	2037		$16,000
HT-2202	Hydro Pneumatic Tank	Operations Building	Excellent	2022	15	2037		$16,000
LE-2201	Radar Level Sensor	Operations Building	Excellent	2022	10	2032		$6,000
LE-2202	Radar Level Sensor	Operations Building	Excellent	2022	10	2032		$6,000
LS-2201	High Level Switch	Operations Building	Excellent	2022	15	2037		$300
LS-2202	High Level Switch	Operations Building	Excellent	2022	15	2037		$300
FE/FIT-2201	Flow Meter (Influent Flow)	Operations Building	Good	2001	15	2016	$7,000	
AE/AIT-2201	Gas Detection	Operations Building	Excellent	2022	10	2032		$3,000
FU-1	Gas Fired Furnace	Operations Building/ Mechanical Room	Good	2001	20	2021	$15,000	
UH-1	Gas Fired Unit Heater	Operations Building/ Electrical Room	Good	2001	20	2021	$7,500	
UH-2	Gas Fired Unit Heater	Operations Building/Blower Room	Good	2001	20	2021	$7,500	

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
UH-3	Electric Unit Heater	Operations Building/ Screening Room	Good	2001	20	2021	$1,000	
UH-4	Electric Unit Heater	Operations Building/ Screening Room	Good	2017	20	2037		$1,000
EF-1	Cabinet Fans	Operations Building/Toilet & Shower	Good	2001	20	2021	$1,000	
EF-2	Centrifugal Exhaust Fans	Operations Building/ Screening Room	Good	2001	20	2021	$2,500	
EF-3	Centrifugal Exhaust Fans	Operations Building/ Screening Room	Good	2001	20	2021	$2,500	
EF-4	Centrifugal Exhaust Fans	Operations Building/Blower Room	Good	2001	20	2021	$2,500	
SF-1	Cabinet Fans	Operations Building/Electric Room	Good	2001	20	2021	$1,000	
SF-2	Cabinet Fans	Operations Building	Good	2001	20	2021	$1,000	
ACCU-1	Air Cooled Condensing Unit	Operations Building	Poor	2001	15	2016	$15,000	
L-1	External Louver	Operations Building/ Mechanical Room	Good	2001	20	2021	$1,500	
L-2	External Louver	Operations Building/ Mechanical Room	Good	2001	20	2021	$1,500	
L-3	External Louver	Operations Building/ Screening Room	Good	2001	20	2021	$1,500	
L-4	External Louver	Operations Building/Blower Room	Good	2001	20	2021	$1,500	
WHR-1	Water Heater	Operations Building/ Mechanical Room	Poor	2001	10	2011	$1,200	

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
WS-1	Water Softener	Operations Building/ Mechanical Room	Poor	2001	10	2011	$2,000	
S-2201	Sampler	Operations Building	Good	2001	15	2016	$25,000	
MCC-2201	MCC	Operations Building/ Electrical Room	Good	2001	25	2026	$216,000	
MCC-2202	MCC	Operations Building/ Electrical Room	Excellent	2022	25	2044		$160,000
T-1	Transformer	Operations Building/ Electrical Room	Good	2001	25	2026	$4,000	
T-2	Transformer	Operations Building/ Electrical Room	Good	2001	25	2026	$4,000	
CP-2201	Control Panel	Operations Building/ Electrical Room	Fair	2001	15	2016	$25,000	
CP-2202	Control Panel	Operations Building/ Electrical Room	Fair	2001	15	2016	$25,000	
V-2201	10" Plug Valve	Operations Building/Room 2209	Good	2001	25	2026	$7,000	
V-2202	10" Check Valve	Operations Building/Room 2209	Good	2001	25	2026	$8,500	
V-2203	10" Plug Valve	Operations Building/Room 2209	Good	2001	25	2026	$7,000	
V-2204	10" Check Valve	Operations Building/Room 2209	Good	2001	25	2026	$8,500	
V-2205	10" Plug Valve	Operations Building/Room 2209	Good	2001	25	2026	$7,000	
V-2206	10" Check Valve	Operations Building/Room 2209	Good	2001	25	2026	$8,500	
V-2207	10" Plug Valve	Operations Building/Room 2209	Good	2001	25	2026	$7,000	
V-2208	10" Check Valve	Operations Building/Room 2209	Good	2001	25	2026	$8,500	

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
V-2209	14" Plug Valve	Operations Building/Room 2208	Good	2001	25	2026	$8,500	
V-2210	14" Plug Valve	Operations Building/Room 2208	Good	2001	25	2026	$8,500	
V-2211	14" Plug Valve	Operations Building/Room 2208	Good	2001	25	2026	$8,500	
V-2212	2" Air Release	Operations Building/Room 2209	Good	2001	25	2026	$5,000	
V-2213	8" Plug Valve	Operations Building/Room 2208	Good	2001	25	2026	$3,000	
V-2214	8" Plug Valve	Operations Building/Room 2208	Good	2001	25	2026	$3,000	
V-2215 (Future)	6" Butterly Valve	Operations Building/Room 2209	Good	2001	25	2026	$4,000	
V-2216	6" Butterly Valve	Operations Building/Room 2209	Good	2001	25	2026	$4,000	
V-2217	6" Butterly Valve	Operations Building/Room 2209	Good	2001	25	2026	$4,000	
V-2218	6" Butterly Valve	Operations Building/Room 2209	Good	2001	25	2026	$4,000	
V-2226	4" Gate Valve	Operations Building/Room 2209	Good	2001	25	2026	$2,500	
V-2227	4" Gate Valve	Operations Building/Room 2209	Good	2001	25	2026	$2,500	
						TOTAL	**$581,200**	***$618,600***

5.9.4 Biological Process

Process Description

The aeration basins are a plug flow design with 24 hours detention time. The process consists of three parallel basins, each with a 350,000-gallon volume. The basin design has a 15-foot side-water depth and common wall construction to minimize expansion costs and maximize diffuser efficiency. Each basin is divided into five separate zones, A through E, by FRP baffle walls. The St. Charles West Side WRF utilizes this five-stage process, which is called a Bardenpho. This series of anaerobic, anoxic, and aerobic stages is used for nitrification, denitrification, BOD/carbon removal, and enhanced biological phosphorus removal.

Raw influent is mixed with recycle flows (tertiary filter backwash and filtrate) and RAS prior to entering the Stage 1 anaerobic basins (Basins 2301-3A). These zones have large diameter submersible mixers (M-2301-3A) that are equipped with VFDs to allow operator control of the mixing energy. There is no aeration capacity within the anaerobic zone. Flow from this zone goes under the baffle walls to the Anoxic Zone (2301-3B).

The Stage 1 Anoxic basins 2301-3B are designed for denitrification. Nitrified MLSS is sent via a submerged pipe and mixing pump from the end of the Aerobic Zone (2301-3C) to the anoxic zone. M-2301-3Bs are adjusted to the minimum speed required to maintain a fully mixed basin, similar to the anaerobic zone. These mixers are smaller blade submersible mixers that spin at a faster rate.

Effluent from the Stage 1 Anoxic Basins flows to Aerobic basins 2301-3C to complete the biological oxidation and nitrification process under the baffle wall. The blowers are controlled by the dissolved oxygen probe that is selected by the operator to maximize efficiency. Flow from the aerobic basins is split between recycle flow (to the head of the Stage 1 Anoxic Basins) and the Stage 2 Anoxic Basins.

The Stage 2 Anoxic Basins 2301-3D can be operated as swing basins. The design includes both diffusers and mechanical mixers M-2301-3D. This zone is aerated if necessary to meet effluent ammonia concentration requirements. This stage is a polishing step. When the basin is not aerated, a portion of the remaining nitrogen will be denitrified and released as nitrogen gas. After this, flow passes to the Stage 2 Aerobic Stage basins 2301-3E. The Stage 2 Aerobic Zone is used for final ammonia polishing and increasing the D.O. prior to clarification, filtration, and disinfection.

IEPA Regulatory Requirements

Following is an excerpt from Title 35: Subtitle C: Chapter II: Part and 370.920 and 370.1210 Illinois Recommended Standards for Sewage Works.

Aeration Tank Organic Loading
Extended Aeration 15 lbs. BOD_5/day/1000 CF

Hydraulic Retention Time
The hydraulic detention time shall be a minimum of 24 hours based on the plant design average flow as determined by Section 370.920.

Design Data

Design	5-Stage BNR
Design Average Flow	1.05 MGD (729 gpm)
Peak Wet Weather Flow Rate	6 MGD (4,167 gpm)
Number of Trains	3 Existing (1 Future)
BOD5	1,786 lbs./day
TSS	2,102 lbs./day
NH3-N	219 lbs./day
Surface Area	9,360 square feet
Side Water Depth	15 feet
Total Volume	187,200 cu. ft (1,050,192 gal)
Biological Loading	12.7 lbs./day/1,000 cf
Detention Time	24.00 hours
MLSS conc.	2,790 mg/L
Solids Inventory	32,575 lbs.
Sludge Age	9.0 days
Oxygen Required	122 lbs./hr.
Oxygen Supplied	122 lbs./hr.

Performance & Deficiencies

The Aeration basins design is adequate to treat the maximum monthly average for both BOD_5 and ammonia. The process has performed exceptionally well and has been removing 98% of each contaminant, despite the fact that the effluent weirs have corroded away. The diffuser system is a fine bubble diffuser which is low maintenance, but is subject to fouling and requires routine membrane maintenance and the membranes should be replaced every 7 years.

In 2022, the effluent weirs in all of the basins were replaced. The Blowers for the air supply were installed in 2022 during the Phase III Expansion. The blowers and electrical components have been operating in an acceptable manner and are adequately sized to meet the existing conditions. The flow meter that currently controls the blower speeds is nearing the end of its useful life and has experienced operational issues. This flow meter should be replaced.

Table 5-7: Aeration Basins Condition Assessment Table

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
G-2301	42"x24" Gate (D.O. Weir)	Aeration Basin 2301	Excellent	2022	25	2047		$30,000
G-2302	18"x18" Gate (Sluice)	Aeration Basin 2301	Excellent	2022	25	2047		$15,000
G-2303	18"x18" Gate (Sluice)	Aeration Basin 2301	Excellent	2022	25	2047		$15,000
G-2304	42"x24" Gate (D.O. Weir)	Aeration Basin 2302	Good	2001	25	2026	$30,000	
G-2305	18"x18" Gate (Sluice)	Aeration Basin 2302	Good	2001	25	2026	$15,000	
G-2306	18"x18" Gate (Sluice)	Aeration Basin 2302	Good	2001	25	2026	$15,000	
G-2307	18"x18" Gate (Sluice)	Aeration Basin 2303	Good	2001	25	2026	$15,000	
G-2308	18"x18" Gate (Sluice)	Aeration Basin 2303	Good	2001	25	2026	$15,000	
G-2309	48"x24" Gate (D.O. Weir)	Aeration Basin 2303	Good	2001	25	2026	$30,000	
G-2313	42"x60" Gate (D.O. Weir)	Aeration Basin/Diversion Structure	Good	2001	25	2026	$36,000	
G-2314	42"x60" Gate (D.O. Weir)	Aeration Basin/Diversion Structure	Good	2001	25	2026	$36,000	
AE-2301A ORP	ORP Probe	Aeration Basin 2301	Excellent	2022	10	2032		$4,500
AE-2301B ORP	ORP Probe	Aeration Basin 2301	Excellent	2022	10	2032		$4,500
AE-2301C1 DO	DO Probe	Aeration Basin 2301	Excellent	2022	10	2032		$4,500
AE-2301C2 DO	DO Probe	Aeration Basin 2301	Excellent	2022	10	2032		$4,500

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
AE-2301D ORP	ORP Probe	Aeration Basin 2301	Excellent	2022	10	2032		$4,500
AE-2301E DO	DO Probe	Aeration Basin 2301	Excellent	2022	10	2032		$4,500
AE-2302A ORP	ORP Probe	Aeration Basin 2301	Excellent	2022	10	2032		$4,500
AE-2302A NOx	Nitrate/Nitrite Probe	Aeration Basin 2302	Excellent	2022	10	2032		$4,500
AE-2302B ORP	ORP Probe	Aeration Basin 2302	Excellent	2022	10	2032		$4,500
AE-2302B NOx	Nitrate/Nitrite Probe	Aeration Basin 2302	Excellent	2022	10	2032		$4,500
AE-2302C1 DO	DO Probe	Aeration Basin 2302	Excellent	2022	10	2032		$4,500
AE-2302C2 DO	DO Probe	Aeration Basin 2302	Excellent	2022	10	2032		$4,500
AE-2302D ORP	ORP Probe	Aeration Basin 2302	Excellent	2022	10	2032		$4,500
AE-2302E DO	DO Probe	Aeration Basin 2302	Excellent	2022	10	2032		$4,500
AE-2301A ORP	ORP Probe	Aeration Basin 2301	Excellent	2022	10	2032		$4,500
AE-2301B ORP	ORP Probe	Aeration Basin 2301	Excellent	2022	10	2032		$4,500
AE-2301C1 DO	DO Probe	Aeration Basin 2301	Excellent	2022	10	2032		$4,500
AE-2301C2 DO	DO Probe	Aeration Basin 2301	Excellent	2022	10	2032		$4,500
AE-2301D ORP	ORP Probe	Aeration Basin 2301	Excellent	2022	10	2032		$4,500
AE-2301E DO	DO Probe	Aeration Basin 2301	Excellent	2022	10	2032		$4,500
B-2301	Blower	Operations Building/Blower Room	Excellent	2022	15	2037		$35,000
B-2302	Blower	Operations Building/Blower Room	Excellent	2022	15	2037		$35,000
B-2303	Blower	Operations Building/Blower Room	Excellent	2022	15	2037		$35,000
FE/FIT-2301	Flow Meter (Blower Air)	Operations Building/Blower Room	Needs replacement	2001	15	2016	$8,000	

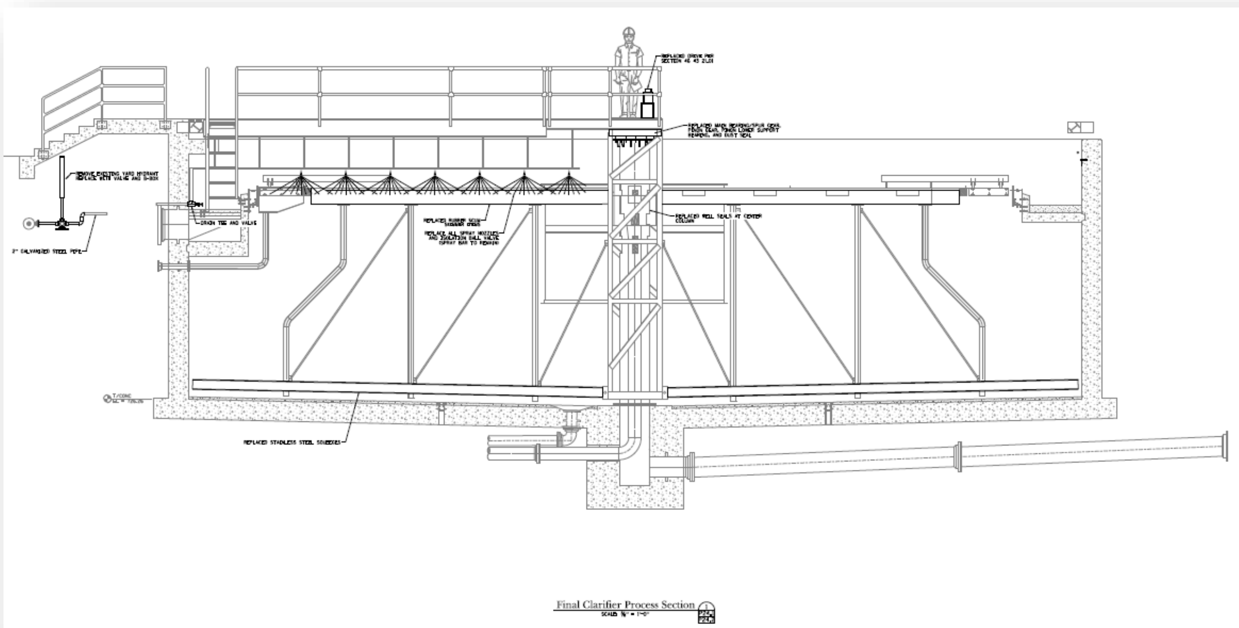
Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
V-2301	8" Mud Valve	Aeration Basin 2301B	Excellent	2022	15	2037		$5,500
V-2302	8" Mud Valve	Aeration Basin 2301C	Excellent	2022	15	2037		$5,500
V-2303	8" Mud Valve	Aeration Basin 2301D	Excellent	2022	15	2037		$5,500
V-2304	8" Mud Valve	Aeration Basin 2302B	Excellent	2022	15	2037		$5,500
V-2305	8" Mud Valve	Aeration Basin 2302C	Excellent	2022	15	2037		$5,500
V-2306	8" Mud Valve	Aeration Basin 2302D	Excellent	2022	15	2037		$5,500
V-2307	8" Mud Valve	Aeration Basin 2303B	Excellent	2022	15	2037		$5,500
V-2308	8" Mud Valve	Aeration Basin 2303C	Excellent	2022	15	2037		$5,500
V-2309	8" Mud Valve	Aeration Basin 2303D	Excellent	2022	15	2037		$5,500
V-2313	12" Butterfly Valve	Aeration Basin 2301	Needs replacement	2001	15	2016	$6,000	
V-2314	12" Butterfly Valve	Aeration Basin 2304	Needs replacement	2001	15	2016	$6,000	
V-2315	4" Butterfly Valve	Aeration Basin 2301	Excellent	2022	25	2047		$3,000
V-2316	4" Butterfly Valve	Aeration Basin 2301	Excellent	2022	25	2047		$3,000
V-2317	6" Butterfly Valve	Aeration Basin 2301	Excellent	2022	25	2047		$4,000
V-2318	4" Butterfly Valve	Aeration Basin 2301	Excellent	2022	25	2047		$3,000
V-2319	4" Butterfly Valve	Aeration Basin 2301	Excellent	2022	25	2047		$3,000
V-2320	4" Butterfly Valve	Aeration Basin 2302	Excellent	2022	25	2047		$3,000
V-2321	4" Butterfly Valve	Aeration Basin 2302	Excellent	2022	25	2047		$3,000
V-2322	6" Butterfly Valve	Aeration Basin 2302	Excellent	2022	25	2047		$4,000
V-2323	4" Butterfly Valve	Aeration Basin 2302	Excellent	2022	25	2047		$3,000
V-2324	4" Butterfly Valve	Aeration Basin 2302	Excellent	2022	25	2047		$3,000
V-2325	4" Butterfly Valve	Aeration Basin 2303	Excellent	2022	25	2047		$3,000
V-2326	4" Butterfly Valve	Aeration Basin 2303	Excellent	2022	25	2047		$3,000
V-2327	6" Butterfly Valve	Aeration Basin 2303	Excellent	2022	25	2047		$4,000

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
V-2328	4" Butterfly Valve	Aeration Basin 2303	Excellent	2022	25	2047		$3,000
V-2329	4" Butterfly Valve	Aeration Basin 2303	Excellent	2022	25	2047		$3,000
M-2301A	Mechanical Mixer	Aeration Basin 2301	Excellent	2022	15	2037		$37,000
M-2301B	Mechanical Mixer	Aeration Basin 2301	Excellent	2022	15	2037		$23,000
M-2301D	Mechanical Mixer	Aeration Basin 2301	Excellent	2022	15	2037		$23,000
M-2302A	Mechanical Mixer	Aeration Basin 2302	Excellent	2022	15	2037		$37,000
M-2302B	Mechanical Mixer	Aeration Basin 2302	Excellent	2022	15	2037		$23,000
M-2302D	Mechanical Mixer	Aeration Basin 2302	Excellent	2022	15	2037		$23,000
M-2303A	Mechanical Mixer	Aeration Basin 2303	Excellent	2022	15	2037		$37,000
M-2303B	Mechanical Mixer	Aeration Basin 2303	Excellent	2022	15	2037		$23,000
M-2303D	Mechanical Mixer	Aeration Basin 2303	Excellent	2022	15	2037		$23,000
MP-2301	Internal Recycle Pump	Aeration Basin 2301	Excellent	2022	15	2037		$23,000
MP-2302	Internal Recycle Pump	Aeration Basin 2302	Excellent	2022	15	2037		$23,000
MP-2303	Internal Recycle Pump	Aeration Basin 2303	Excellent	2022	15	2037		$23,000
						TOTAL	**$212,000**	**$670,500**

5.9.5 Final Clarifiers & RAS Pump Station

Process Description

The West Side Water Reclamation Facility includes two hydraulic differential clarifiers. The clarifiers were constructed during Phase II Expansion project and design to meet tertiary treatment standards. In the Phase III Expansion, the clarifiers were downgraded to meet final clarifier standards, and tertiary disc filters were installed to maintain tertiary treatment standards. RAS from the final clarifiers is controlled with telescoping valves that are tributary to dedicated Parshal flumes prior to entering the RAS wet well. There are three Hydrostal submersible pumps in this wet well, which conveys RAS up to the influent screening channel.



IEPA Regulatory Requirements

Following is an excerpt from Title 35: Subtitle C: Chapter II: Part 370.710 Illinois Recommended Standards for Sewage Works.

> *Surface Settling Rates (Overflow Rates)*
> *The hydraulic loadings shall not exceed 1000 gallons per day per square foot based on design peak hourly flow, and 800 gallons per day per square foot based on peak hourly flow for separate activated sludge nitrification stage. Refer to Section 370.1210(c)(4).*
>
> *Solids Loading Rate*
> *The solids loading shall not exceed 50 pounds solids per day per square foot at the design peak hourly rate.*
>
> *Weir Loading*
> *Weir loadings shall not exceed 20,000 gallons per day per lineal foot based on design peak hourly flows for plants having design average flows of 1.0 mgd or less. Overflow rates shall not exceed 30,000 gallons per day per lineal foot based on design peak hourly flow for plants having design average flow of greater than 1.0 mgd. Higher weir overflow rates may be allowed for bypass settling tanks. If pumping is required, weir loadings should be related to pump delivery rates to avoid short-circuiting. Refer to Section 370.410(c)(8).*

Pump stations are regulated under the provisions of Title 35: Subtitle C: Chapter II: Part 370.400 Illinois Recommended Standards for Sewage Works.

Design Data

Final Clarifiers

Number of Units	2
Clarifier Diameter	60 feet
Side Water Depth	14' 0”
Surface Area	2,827 sf/clarifier
Peak Hourly Flow + TFR + RAS	5.65 MGD
Solids Loading Rate	17.6 lbs./sf/day
Surface Loading Rate	999 gal/sf/day
Weir Overflow Rate	14,987 gal/lf/day @ PHF

<u>RAS Pump Station</u>

Number of pumps	3
Type	3 Wemco-Hidrostal with 2-speed starters
Capacity, each from original construction	730 gpm
Capacity, each from Phase III	1,460 gpm
Force Main Dia., inches	8
Firm Capacity of P.S.	1,460 gpm (one pump out of service)

Performance & Deficiencies

The clarifiers were designed with a 14-foot side-water depth to allow the City to carry a sludge blanket within the clarifier. This blanket assists in developing a higher return sludge concentration. The clarifiers are covered with low-maintenance aluminum covers. The covers prevent algal growth and freezing during winter operation. In addition, the mechanism is constructed of 304 series stainless steel, which prevents corrosion and extends the expected service life of the clarifier.

The clarifiers were rehabilitated during the Phase III Expansion, including replacement of wear items, installation of handrail for safe access along the effluent launder, replacement of the control panels, and rehabilitation of the gear drive assembly. The exhaust fans are original construction, and need to be replaced.

The RAS pump station was provided a third pump during the Phase III Expansion. All pumps operate well.

Table 5-8: Final Clarifiers & RAS Pump Station Condition Assessment

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
AE/AIT-2401	Explosive Gas Detector	Final Clarifier 2401	Excellent	2022	10	2032		$5,000
AE/AIT-2401	Explosive Gas Detector	Final Clarifier 2402	Excellent	2022	10	2032		$5,000
EF-2401 a	Exhaust Fans	Final Clarifier 2401	Good	2019	15	2034		$5,000
EF-2401 b	Exhaust Fans	Final Clarifier 2401	Good	2019	15	2034		$5,000
EF-2401 c	Exhaust Fans	Final Clarifier 2401	Good	2019	15	2034		$5,000
EF-2401 d	Exhaust Fans	Final Clarifier 2401	Good	2019	15	2034		$5,000
EF-2402 a	Exhaust Fans	Final Clarifier 2402	Good	2019	15	2034		$5,000
EF-2402 b	Exhaust Fans	Final Clarifier 2402	Good	2019	15	2034		$5,000
EF-2402 c	Exhaust Fans	Final Clarifier 2402	Good	2019	15	2034		$5,000
EF-2402 d	Exhaust Fans	Final Clarifier 2402	Good	2019	15	2034		$5,000
FC-2401	Final Clarifier	Final Clarifier 2401	Excellent	2022	25	2047		$150,000
FC-2402	Final Clarifier	Final Clarifier 2402	Excellent	2022	25	2047		$150,000
CP-2401	Control Panel	Outside of Final Clarifier 2401	Excellent	2022	25	2047		$15,000
CP-2402	Control Panel	Outside of Final Clarifier 2402	Excellent	2022	25	2047		$15,000
V-2401	8" Plug Valve	Outside of Final Clarifier 2401	Good	2001	25	2026	$8,000	
V-2402	8" Plug Valve	Outside of Final Clarifier 2402	Good	2001	25	2026	$8,000	
P-2701	RAS Pump	RAS/WAS Pump Station	Excellent	2018	15	2033		$40,000
P-2702	RAS Pump	RAS/WAS Pump Station	Excellent	2019	15	2034		$40,000
P-2703	RAS Pump	RAS/WAS Pump Station	Excellent	2022	15	2037		$40,000
P-2705	Sump Pump	RAS/WAS Pump Station	Excellent	2018	10	2028		$1,200
FE/FIT-2701	Ultrasonic Flow Transmitter (FC 2401 RAS)	Parshall Flume	Needs Replacement	2001	15	2016	$6,000	

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
FE/FIT-2702	Ultrasonic Flow Transmitter (FC 2402 RAS)	Parshall Flume	Needs Replacement	2001	15	2016	$6,000	
LE/LIT-2703	Ultrasonic Level Transmitter	RAS/WAS Pump Station	Needs Replacement	2001	15	2016	$6,000	
LSL-2704	Low Level Switch	RAS/WAS Pump Station	Needs Replacement	2001	15	2016	$250	
LSH-2704	High Level Switch	RAS/WAS Pump Station	Needs Replacement	2001	15	2016	$250	
UH-2701	Unit Heater	RAS/WAS Pump Station	Fair	2001	20	2021	$2,500	
EF-2701	Exhaust Fan	RAS/WAS Pump Station	Fair	2001	20	2021	$3,000	
MCC-2701	MCC	RAS/WAS Pump Station	Good	2001	25	2026	$96,000	
CP-2701	Control Panel	RAS/WAS Pump Station	Needs Replacement	2001	15	2016	$25,000	
LCP-2701	Lighting Control Panel	RAS/WAS Pump Station	Fair	2001	25	2026	$5,000	
V-2701	Telescoping Valve	RAS/WAS Inlet	Good	2001	25	2026	$15,000	
V-2702	Telescoping Valve	RAS/WAS Inlet	Good	2001	25	2026	$15,000	
V-2703	Plug Valve	RAS/WAS Pump Station	Good	2001	25	2026	$3,000	
V-2704	Check Valve	RAS/WAS Pump Station	Good	2019	25	2044		$3,500
V-2705	Plug Valve	RAS/WAS Pump Station	Good	2001	25	2026	$3,000	
V-2706	Check Valve	RAS/WAS Pump Station	Good	2019	25	2044		$3,500
V-2707	Plug Valve	RAS/WAS Pump Station	Good	2001	25	2026	$3,000	
V-2708	Check Valve	RAS/WAS Pump Station	Good	2018	25	2043		$3,500
V-2709	Plug Valve	RAS/WAS Pump Station	Good	2001	25	2026	$3,000	
V-2710	Check Valve	RAS/WAS Pump Station	Good	2018	25	2043		$3,500
						TOTAL	***$208,000***	***$515,200***

5.9.6 Chemical Phosphorus Removal

Process Description

The City's biological phosphorus removal process requires chemical backup. At the West Side WRF, the City utilizes Aluminum Sulfate for chemical backup. A chemical storage tank and feed system are contained in the Tertiary Building.

The Alum Sulfate storage system consists of a 6,150-gallon tank. The system is paired with three peristaltic chemical feed pumps, each with the capacity of 15.6 gallons per hour. The City has the option of dosing the MLSS at the diversion structure upstream of the Final Clarifiers and/or dosing the channel upstream of the tertiary filters.

IEPA Regulatory Requirements

Following is an excerpt from Title 35: Subtitle C: Chapter II: Part 370.1200 Illinois Recommended Standards for Sewage Works.

> *Storage Facilities*
> *Storage facilities shall be sufficient to ensure that an adequate supply of the chemical is available at all times. Exact size required will depend on size of shipment, length of delivery time, and process requirements. Storage for a minimum of a 10-day supply should be provided.*
>
> *Feed Systems (Liquid Chemical Feed Pumps)*
> *Liquid chemical feed pumps should be of the positive displacement type with variable feed rate. Pumps shall be selected to feed the full range of chemical quantities required for the phosphorus mass loading conditions anticipated with the largest unit out of service.*

Design Data

Number of Storage Tanks	1
Volume, Each	6,150 gallons
Number of Feed Pumps	3
Capacity, Each	15.6 gph

Performance & Deficiencies

The chemical storage and feed facilities were installed in 2022 and are in excellent condition.

5.9.7 Tertiary Filters

Process Description

The City's tertiary treatment process utilizes disc filters in order to ensure compliance with its NPDES permit suspended solids concentration limits. Effluent from the final clarifiers flows via gravity to the Tertiary Building. Disc filters contain polyester elements that strain flow in an inside-out pattern. With this technology, influent wastewater is filtered by passing from the inside of two filter panels on a disk segment into the collection tank. Solids are contained on the inside of the disk filter while filtrate remains in the tank. Disc filter systems are contained in concrete tanks and are Kruger Hydrotech units. These filters remove suspended solids as small as 10 microns in size. Each filter contains 22 discs, and each filter element is partially submerged and backwashed through counter-current spray. Typically, less than 1% of total flow is required for backwash.

IEPA Regulatory Requirements

Following is an excerpt from Title 35: Subtitle C: Chapter II: Part 370.1120 Illinois Recommended Standards for Sewage Works.

> *The peak hourly flow rate applied to the filter shall not exceed 5 gpm/sq.ft. of filter area, computed with one unit out of service.*

Design Data

Number of Units	2
Capacity, Each	6 MGD
Filter Discs per Unit	22
Filter Submerged Surface Area, Each	949 SF
Hydraulic Loading @ PWWF (one unit out of service)	4.4 gpm/SF

Performance & Deficiencies

The tertiary disc filters were installed in 2022 and are in excellent condition.

5.9.8 Ultraviolet Disinfection

Process Description

Ultraviolet Disinfection is an environmentally friendly method of disinfecting wastewater. Microorganisms, including viruses, are inactivated when exposed to UV-C light in a controlled environment and dosage. The UV-C light with a frequency of 254 nanometers causes a physical reaction with the organisms' DNA. This reaction prevents cell division and reproduction of potentially dangerous organisms and viruses.

The UV Disinfection system was replaced during the Phase III Expansion. The design included a two-bank system with 6 modules and 12 lamps per module. The system was installed with adequate capacity to serve the build-out conditions.

Design Parameters

Number of Units	1 Proposed
Design	Horizontal (Trojan UV3000+™)
Design Average Flow	2.60 MGD (1,805 gpm)
Peak Wet Weather Flow	5.02 MGD (3,486 gpm)
TSS	< 15 mg/L
UV Transmission	65%

Performance & Deficiencies

The system was installed in 2022 and has operated successfully since it was started-up.

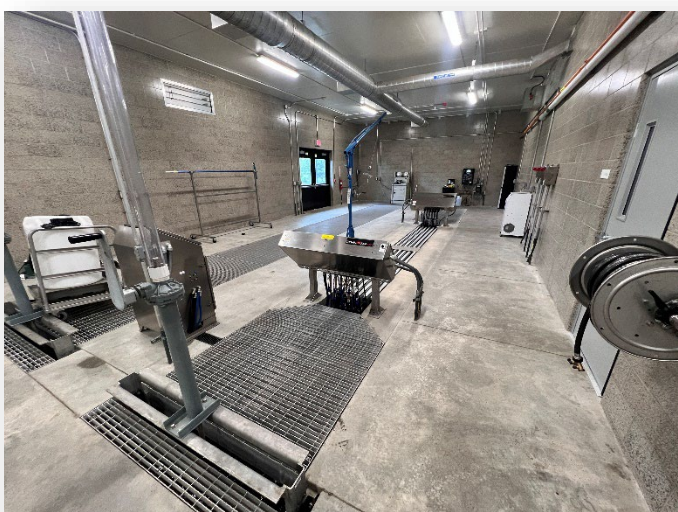


Table 5-9: Tertiary Building Condition Assessment

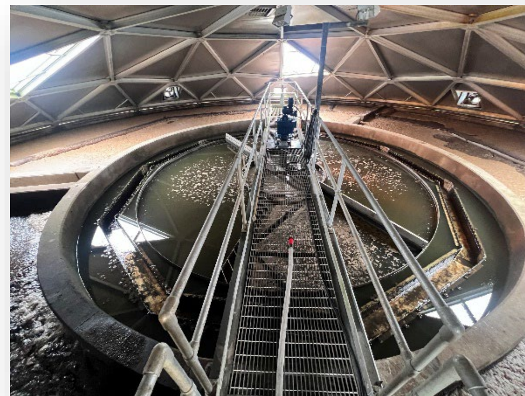
Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
F-2501	Disc Filter	UV/Filter Room	Excellent	2022	20	2042		$315,000
F-2502	Disc Filter	UV/Filter Room	Excellent	2022	20	2042		$315,000
G-2501	Slide Gate	UV/Filter Room	Excellent	2022	25	2047		$35,000
G-2502	Slide Gate	UV/Filter Room	Excellent	2022	25	2047		$35,000
G-2503	Slide Gate	UV/Filter Room	Excellent	2022	25	2047		$28,000
G-2504	Slide Gate	UV/Filter Room	Excellent	2022	25	2047		$28,000
G-2505	Slide Gate	UV/Filter Room	Excellent	2022	25	2047		$28,000
G-2506	Slide Gate	UV/Filter Room	Excellent	2022	25	2047		$28,000
G-2507	Slide Gate	UV/Filter Room	Excellent	2022	25	2047		$28,000
UV-2501	UV Disinfection Equipment	UV/Filter Room	Excellent	2022	20	2042		$265,000
P-2501-3	NPW Pump System	NPW Room	Excellent	2022	15	2037		$150,000
CST-2501	Alum Storage Tank	Chemical Room	Excellent	2022	25	2047		$25,000
CMP-2501 - CMP-2503	Alum Feed System	Chemical Room	Excellent	2022	15	2037		$55,000
V-2501	4" Ball Valve	Chemical Room	Excellent	2022	15	2037		$350
V-2502	4" Check Valve	Chemical Room	Excellent	2022	15	2037		$500
V-2503	6" Plug Valve	NPW Room	Excellent	2022	15	2037		$3,000
V-2504	6" Pinch Valve	NPW Room	Excellent	2022	15	2037		$6,000
V-2505	6" Plug Valve	NPW Room	Excellent	2022	15	2037		$3,000
V-2506	6" Mud Valve	UV/Filter Room	Excellent	2022	15	2037		$4,500
V-2507	6" Mud Valve	UV/Filter Room	Excellent	2022	15	2037		$4,500
V-2508	6" Mud Valve	UV/Filter Room	Excellent	2022	15	2037		$4,500
V-2509	6" Mud Valve	UV/Filter Room	Excellent	2022	15	2037		$4,500
FE/FIT-2501	6" Magnetic Flow Meter	NPW Room	Excellent	2022	20	2042		$4,000

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
FE/FIT-2502	24" Magnetic Flow Meter	MH West of Tertiary Building	Excellent	2022	20	2042		$12,000
MAU-2501	Make-Up Air Unit	S of Tertiary Building	Excellent	2022	15	2037		$15,000
EUH-2501	Electric Unit Heater	Electrical Room	Excellent	2022	15	2037		$5,000
ACCU-1	Air Cooled Condensing Unit	N of Tertiary Building	Excellent	2022	15	2037		$5,000
CRAC-2501	Conditioning Unit	Electrical Room	Excellent	2022	15	2037		$5,000
EF-2501	Exhaust Fan	Chemical Room	Excellent	2022	15	2037		$8,000
EF-2502	Exhaust Fan	Chemical Room	Excellent	2022	15	2037		$5,000
PPU-2501	Positive Pressurization Unit	Electrical Room	Excellent	2022	15	2037		$15,000
D-2501	Dehumidifier	NPW Room	Excellent	2022	15	2037		$4,000
D-2502	Dehumidifier	UV/Filter Room	Excellent	2022	15	2037		$4,000
EWH-2501	Electric Water Heater	UV/Filter Room	Excellent	2022	15	2037		$5,000
EWH-2502	Electric Water Heater	NPW Room	Excellent	2022	15	2037		$5,000
						TOTAL	***$0***	***$1,457,850***

5.9.9 Sludge Stabilization

Process Description

The existing 0.35 MGD package plant was converted to aerobic digestion during the Phase II Expansion. The package plant included a concentric circular design with basins on the exterior and a clarifier in the center. The conversion included replacement of the clarifier with a gravity thickener, installation of air-lift pumps for basin-to-basin transfer, installation of sludge transfer pumps to disposal and replacement of the aeration system. The air-lift pumps were replaced during the Phase III Expansion, which also included the replacement of the blowers, aeration header, and gravity thickener rotating assembly.



Design Parameters

Sludge Thickening:

Design	Gravity Thickening
Diameter	32.5 ft
Side Water Depth	13.5 ft
Volume	83,770 gal
Surface Area	829 square feet
Peak Loading Rate	400 gal/sf/day
	(160 gpm WAS & 70 gpm from Digester)
Influent Flow @ 0.75%	25,200 gpd
Waste to Digester @ 2.5%	7,559 gpd

Aerobic Digestion:

Number of Units	3
Total Volume	26,985 CF
Detention Time	47 days

Performance & Deficiencies

The aerobic digester was rehabilitated during the Phase III Expansion within the existing structure. The systems have performed well since they were started-up.

5.9.10 Sludge Handling Building

Process Description

The Sludge Handling Building was constructed during the Phase III Expansion, which included the digested sludge storage tank, sludge storage tank mixer, filtrate pump station, sludge feed pumps, polymer feed system, protected water system, sludge dewatering belt filter press, sludge belt conveyor, and the blowers for the aerobic digesters. Belt filter press feed pumps normally draw sludge from the digested sludge storage tank, but can also draw from any of the three digesters directly. The building contains a dewatering room, restroom, operator room, electrical room, and a janitor's/mechanical room. The building was designed to easily accommodate an additional belt filter press and associated sludge feed, polymer feed, and filtrate pumps. The belt conveyor transports dewatered sludge from the belt filter press to the Sludge Storage Building roughly 30 feet to the west within an enclosed chase. The Sludge Storage Building includes a 3-walled superstructure of 8'-tall concrete walls and a pre-engineered metal building. The structure is designed to provide a year's worth of dewatered sludge storage for the City from both the West Side WRF and the Main WWTF.

Design Parameters

Digested Sludge Storage:

Number of Units	1
Total Volume	8,620 CF
Detention Time	5 days

Sludge Dewatering Belt Filter Press:

Number of Units	1
Hydraulic Capacity	140 gpm
Solids Capacity	7,005 lbs./day
Dewatered Solids Concentration	17%
Operation	10.8 hrs./week

Table 5-10: Aerobic Digester & Sludge Handling Facility Condition Assessment

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
P-2801	Airlift Pump Sludge	Basin 2801	Excellent	2022	15	2037		$6,000
P-2802	Airlift Pump Scum	Basin 2801	Excellent	2022	15	2037		$8,000
P-2803	Airlift Pump Sludge	Basin 2802	Excellent	2022	15	2037		$8,000
GT-2801	Gravity Thickener	Center of Digester	Excellent	2022	25	2047		$335,000
EF-2801	Exhaust Fan	Digester	Good	2001	15	2016		$5,000
EF-2802	Exhaust Fan	Digester	Good	2001	15	2016		$5,000
EF-2803	Exhaust Fan	Digester	Good	2001	15	2016		$5,000
EF-2804	Exhaust Fan	Digester	Good	2001	15	2016		$5,000
V-2801	6" Plug Valve	Outside Basin 2802	Good	2001	25	2026	$3,500	
V-2802	8" Plug Valve	Between Basin 2801 and Basin 2802	Good	2001	25	2026	$4,500	
V-2803	6" Plug Valve	Outside Basin 2801	Excellent	2022	25	2047		$3,500
V-2804	6" Plug Valve	East Side of Digester	Excellent	2022	25	2047		$3,500
V-2805	6" Plug Valve	East Side of Digester	Excellent	2022	25	2047		$3,500
V-2806	6" Plug Valve	East Side of Digester	Excellent	2022	25	2047		$3,500
V-2807	8" Plug Valve	Overflow Isolation from Basin 2803	Excellent	2022	25	2047		$4,500
V-2808	8" Plug Valve	Between Basin 2801 and Basin 2802	Good	2001	25	2026	$4,500	
V-2809	8" Plug Valve	Overflow Isolation from Basin 2802	Excellent	2022	25	2047		$4,500
V-2810	8" Butterfly Valve	Basin 2802	Excellent	2022	25	2047		$4,500
V-2811	8" Butterfly Valve	Basin 2801	Excellent	2022	25	2047		$4,500
V-2812	8" Butterfly Valve	Basin 2803	Excellent	2022	25	2047		$4,500
V-2828	8" Telescoping Valve	Basin 2803	Good	2001	25	2026	$5,000	

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
AE/AIT-2801	Explosive Gas Detector	Digester	Good	2020	10	2030		$5,000
B-2901	Digester Blower	N of Sludge Handling Building	Excellent	2022	15	2037		$35,000
B-2902	Digester Blower	N of Sludge Handling Building	Excellent	2022	15	2037		$35,000
B-2903	Digester Blower	N of Sludge Handling Building	Excellent	2022	15	2037		$35,000
M-2901	Mechanical Mixer	Digested Sludge Storage Tank	Excellent	2022	15	2037		$23,000
P-2901	Submersible Pump	Recycle Pump Station	Excellent	2022	15	2037		$20,000
P-2902	Submersible Pump	Recycle Pump Station	Excellent	2022	15	2037		$20,000
P-2904	Progressive Cavity Pump	Dewatering Room	Excellent	2022	15	2037		$30,000
P-2905	Progressive Cavity Pump	Dewatering Room	Excellent	2022	15	2037		$30,000
P-2907	Water Booster Pump	Dewatering Room	Excellent	2022	15	2037		$5,000
PWS-2901	Protected Water System	Dewatering Room	Excellent	2022	15	2037		$60,000
HT-2901	Hydro Pneumatic Tank	Dewatering Room	Excellent	2022	15	2037		$16,000
PU-2901	Polymer Unit	Dewatering Room	Excellent	2022	15	2037		$50,000
BFP-2901	Belt Filter Press	Dewatering Room	Excellent	2022	20	2042		$360,000
SC-2901	Belt Conveyor	Dewatering Room to Sludge Storage Bldg.	Excellent	2022	20	2042		$180,000
LE-2901	Radar Level Transmitter	Recycle Pump Station	Excellent	2022	15	2037		$6,000
LE-2902	Radar Level Transmitter	Digested Sludge Storage Tank	Excellent	2022	15	2037		$6,000
LS-2901 – LS-2905	Level Switches	Raw Sewage Pump Station	Excellent	2022	15	2037		$1,500
LS-2906	Level Switch	Digested Sludge Storage Tank	Excellent	2022	15	2037		$300
FE/FIT-2901	4" Magnetic Flow Meter	Valve Vault	Excellent	2022	20	2042		$3,000

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
FE/FIT-2902	6" Magnetic Flow Meter	Dewatering Room	Excellent	2022	20	2042		$4,000
FE/FIT-2903	6" Magnetic Flow Meter	Dewatering Room	Excellent	2022	20	2042		$4,000
V-2901	4" Plug Valve	Valve Vault	Excellent	2022	25	2047		$2,500
V-2902	4" Check Valve	Valve Vault	Excellent	2022	25	2047		$3,000
V-2903	4" Plug Valve	Valve Vault	Excellent	2022	25	2047		$2,500
V-2904	4" Check Valve	Valve Vault	Excellent	2022	25	2047		$3,000
V-2905	4" Plug Valve	Valve Vault	Excellent	2022	25	2047		$2,500
V-2906	4" Check Valve	Valve Vault	Excellent	2022	25	2047		$3,000
V-2907	6" Butterfly Valve	N of Sludge Handling Building	Excellent	2022	25	2047		$4,000
V-2908	6" Butterfly Valve	N of Sludge Handling Building	Excellent	2022	25	2047		$4,000
V-2909	6" Butterfly Valve	N of Sludge Handling Building	Excellent	2022	25	2047		$4,000
V-2911	8" Plug Valve	Dewatering Room	Excellent	2022	25	2047		$4,000
V-2912	8" Plug Valve	Dewatering Room	Excellent	2022	25	2047		$4,000
V-2913	8" Plug Valve	Dewatering Room	Excellent	2022	25	2047		$4,000
V-2914	8" Plug Valve	Dewatering Room	Excellent	2022	25	2047		$4,000
V-2915	8" Plug Valve	Dewatering Room	Excellent	2022	25	2047		$4,000
V-2916	8" Plug Valve	Dewatering Room	Excellent	2022	25	2047		$4,000
V-2917	6" Plug Valve	Dewatering Room	Excellent	2022	25	2047		$3,000
V-2918	6" Check Valve	Dewatering Room	Excellent	2022	25	2047		$4,000
V-2919	6" Plug Valve	Dewatering Room	Excellent	2022	25	2047		$3,000
V-2920	6" Check Valve	Dewatering Room	Excellent	2022	25	2047		$4,000
V-2921	6" Plug Valve	Dewatering Room	Excellent	2022	25	2047		$3,000
V-2922	6" Check Valve	Dewatering Room	Excellent	2022	25	2047		$4,000

Tag	Description	Location	Condition	Date Installed (Year)	Estimated Life (Years)	Expected Replacement	Replacement Need	Future Replacement Need
V-2923	6" Check Valve	Dewatering Room	Excellent	2022	25	2047		$4,000
V-2924	6" Plug Valve	Dewatering Room	Excellent	2022	25	2047		$3,000
V-2925	6" Plug Valve	Dewatering Room	Excellent	2022	25	2047		$3,000
V-2926	6" Check Valve	Dewatering Room	Excellent	2022	25	2047		$4,000
V-2927	4" Plug Valve	Valve Vault	Excellent	2022	25	2047		$2,500
V-2928	6" Plug Valve	Dewatering Room	Excellent	2022	25	2047		$3,000
V-2929	6" Plug Valve	Dewatering Room	Excellent	2022	25	2047		$3,000
V-2930	4" Plug Valve	Valve Vault	Excellent	2022	25	2047		$2,500
MAU-2901	Make-Up Air Unit	N of Sludge Handling Building	Excellent	2022	15	2037		$15,000
EUH-2901	Electric Unit Heater	Electrical Room	Excellent	2022	15	2037		$5,000
ACCU-2901	Air Cooled Condensing Unit	W of Sludge Handling Building	Excellent	2022	15	2037		$5,000
CRAC-2901	Conditioning Unit	Electrical Room	Excellent	2022	15	2037		$5,000
D-2901	Dehumidifier	Dewatering Room	Excellent	2022	15	2037		$4,000
EF-2901	Exhaust Fan	Janitor Room	Excellent	2022	15	2037		$3,000
EWH-2901	Electric Water Heater	Janitor Room	Excellent	2022	15	2037		$5,000
EWH-2902	Electric Water Heater	Operator Room	Excellent	2022	15	2037		$5,000
EWH-2903	Electric Water Heater	Restroom	Excellent	2022	15	2037		$2,000
MCC-2901	MCC	Electrical Room	Excellent	2022	25	2047		$240,000
						TOTAL	***$17,500***	***$1,729,800***

5.9.11 Vactor Receiving Station

Process Description

The City owns and operates a vactor receiving station on the West Side WRF property. The structure includes a concrete foundation and inclined slab with a trench drain to contain material from the City's vactor trucks. The City may utilize either the main unloading location on the east face of the building or the elevated unloading location on the north side. The building is located just north of the aerobic digester facility. The trench drain is tributary to the Recycle Pump Station at the Sludge Handling Building, which conveys decanted water to the head of the Water Reclamation Facility.

Performance & Deficiencies

The structure was constructed in 2022 and is in excellent condition.

5.9.12 Consolidated Design Calculations of the Existing West Side Water Reclamation Facility

Population Equivalent

Total 2022 PE	7,351	PE
Additional PE at Build-Out of Service Area	8,165	PE
Total Future PE	15,516	PE

Design Flows:

Design Average Flow	=	1.05	MGD (729 gpm)
Design Maximum Flow	=	2.63	MGD (1,826 gpm)
Peak Hourly Flow Rate	=	3.06	MGD (2,139 gpm)
PHF + Tertiary Filter Return (TFR)	=	3.15	MGD (2,389 gpm)
Peak Wet Weather Flow (PWWF)	=	4.15	MGD (2,847 gpm)
PWWF + TFR	=	4.24	MGD (3,097 gpm)

Waste Characteristics:

Influent BOD5	=	1,786 lbs./day =	204 mg/L
Influent rbCOD	=	583 lbs./day =	67 mg/L
Influent TSS	=	2,102 lbs./day =	240 mg/L
Influent NH_3-N	=	219 lbs./day =	25 mg/L
Influent TKN	=	333 lbs./ day =	38 mg/L
Influent P	=	53 lbs./day =	6 mg/L

Raw Sewage Pump Station:

Number of pumps	4
Type	Pre-Rotation
Capacity, gpm each	1,640
Force Main Dia., in.	14
Maximum Capacity of P.S., gpm	3,620

Screens:

Number of Screens	1
Type	Lakeside Rotomat/Rotating Drum Screen
Capacity, MGD Each	6.5
Number of Screens	1
Type	Lakeside Raptor/ Fine Screen
Capacity, MGD Each	6.5

Biological Process:

Design	5-Stage BNR
Design Average Flow	1.05 MGD
Number of Trains	3
SWD, ft	15
Tank Width, ft	32.5
Tank Length, ft	96
Volume, 1st stage Anaerobic cu. ft.	27,300
Volume, 1st stage Anoxic cu. ft.	23,400
Volume, 1st stage Aerobic cu. ft.	93,600
Volume, 2nd stage Anoxic cu. ft.	23,400
Volume, 2nd stage Aerobic cu. ft.	19,500
Volume, total cu. ft.	187,200
Volume, total, gal.	1,400,256
Detention Time at 1.05 MGD, hrs.	24.5
Organic Loading, lbs. /day BOD_5	1,786
Organic Loading Rate, lbs. /day BOD_5/1,000 cu. ft.	12.7
MLSS, mg/L	2790
Solids Inventory, TSS, lbs.	32,575
WAS, lbs. /day	2,036
WAS Volume at 0.75% TS, gpd	38,900
Air Required Reduction , scfm	1,692
Air Provided, scfm	5,308
Sludge Age, days	9.0
F/M Ratio, TSS	0.07
PD Blowers (3), scfm each	986 @ 7.97 psi

MLSS Diversion Structure:

Number of Units	1
Design Average Flow (at Phase IV) + RAS + TFR	2.17 MGD
PHF + TFR + RAS (Phase IV)	4.7 MGD
PWWF + TFR+ RAS (Phase IV)	5.82 MGD

Final Clarifiers:

Number of Units	2 Existing
Design	Center Feed
Design Average Flow, MGD each	0.7
Design Average Flow, gpm each	(486)
Peak Hourly Flow Rate, MGD each	1.97
Peak Hourly Flow Rate, gpm each	(1,365)
PWWF + TFR, MGD	2.59

PWWF + TFR, gpm	(1,795)
Clarifier Diameter, ft.	60
Side Water Depth, Average	14'- 0”
Surface Area, sq. ft. /clarifier	2,827
Solids Loading, lb. / sq. ft. /day, PWWF, 20°C	12
Surface Loading, gal / sq. ft. /day, PWWF, 20°C	893
Weir Loading, gal / lin. ft. / day, Average Daily Flow	3,714
Influent Dia.	16"
Effluent Dia.	24"
Return Sludge Dia.	8"
Waste Sludge Dia.	4"

Tertiary Filters:

Number of Units	2 (3 future)
Design	Disc Filters
Future Peak Wet Weather Rate	6 MGD
Area, sq. ft. each:	1,460
Total Area, sq. ft.	2,920
Backwash Rate, gpm each:	183
Total Recycle, gpm	366
Headloss, ft.	0.51

Ultra-Violet Disinfection:

Number of Units	1 Existing
Design	Horizontal
Design Average Flow, MGD	1.05
Peak Hourly Flow, MGD	3.08
Peak Hourly Flow, gpm	2,139
PWWF, MGD	4.10
PWWF, gpm	2,847
TSS, mg/L	15
UV Transmission	65%

RAS/WAS Pumping:

Design	Pre-rotations
Number of Pumps	4
RAS Pump Capacity each, gpm	800
RAS Force Main Dia.	8"

Sludge Handling – Aerobic Digestion:

Sludge Thickening:

Design	Gravity Thickening
Diameter, ft.	32.5
Side Water Depth, ft.	13.5
Volume, gal	83,770
Surface Area, sq. ft.	829
Peak Loading Rate, gal/ sq. ft. / day	400
	(160 gpm WAS & 70 gpm from Digester)
Influent Flow @ 0.75%, gallons / day	25,200
Waste to Digester @ 2.5%, gallons / day	7,559

Aerobic Digestion:

Number of Units	3
Side Water Depth, ft.	15
Digester 801, cu. ft.	9,810
Digester 802, cu. ft.	17,175
Digester 803 (sludge storage), cu. ft.	16,455
Total Volume, cu. ft.	26,985
Loading Rate, cu. ft. / PE	3.2
VSS Reduction, %	46
Detention Time, days	47

Sludge Dewatering

Design	Belt Filter Press
Number of Units	1
Capacity, gpm	140
Capacity, lbs. / day.	1,419

Proposed Digested Sludge Storage:

Number of Units	2
Total Volume (West Side WRF + Main WWTP), cu. ft.	162,000+
Dimensions, sq. ft.	27,000+

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SECTION 6

FACILITY UPGRADE AND EXPANSION PLANS

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6. FACILITY UPGRADE AND EXPANSION PLANS

6.1 MAIN WASTEWATER TREATMENT FACILITY UPGRADES

6.1.1 Project Background

The City of St. Charles' Main Wastewater Treatment Facility (MWWTF) discharges to the Fox River. According to the Illinois EPA Clean Water Act Section 303(d) List, the Fox River does not meet water quality standards for its intended use in the majority of the segments, including the segments immediately downstream of the St. Charles MWWTF. The impairment on the river for aquatic life is based on a low dissolved oxygen concentration. This low dissolved oxygen content is due to algal growth and exacerbated by the presence of pools upstream of the low head dams along the river.

In 2001, the Illinois EPA was contemplating performing a Total Maximum Daily Load (TMDL) study on the Fox River in an attempt to address the impairment. At that time, there was insufficient data available to support a TMDL and therefore would simply be a modeling exercise which would not reflect actual environmental conditions. Many of the communities along the Fox River (including St. Charles) joined forces with other stakeholders, including Friends of the Fox and Sierra Club, to form the Fox River Study Group (FRSG). The FRSG determined that it was in the best interest of all the stakeholders if a comprehensive solution was developed and that solution was based on comprehensive river-monitoring data and modeling. The FRSG, in concert with the POTWs along the river, have monitored the river for numerous constituents including phosphorus, nitrogen, fecal coliform and chlorophyll a. This water quality data provided the basis for development of QUAL2K and HSPF models.

In 2004, the Illinois EPA implemented statewide nutrient removal criteria for wastewater treatment facilities that were proposing expansion of their hydraulic capacity. Two nutrients of concern were total nitrogen and phosphorus. The NPDES Permits issued for these facilities typically contained an interim 1 mg/L annual average phosphorus limit and requirement to monitor total nitrogen.

In 2011, the Illinois EPA was receiving increased pressure by the USEPA and environmental stakeholders to address nutrient criteria on all POTWs, not only treatment plants undergoing expansion. Several NPDES permits along the Fox River had expired and were due to be reissued by the Illinois EPA. However, the Illinois EPA elected to delay reissuance so the NPDES permits could incorporate language agreed upon in ongoing discussions on nutrient criteria.

In January 2012, in an attempt to build consensus among all stakeholders, the Illinois EPA presented the FRSG with special conditions in draft form for nutrient criteria. The FRSG had not yet completed the low flow monitoring required to calibrate the HSPF and QUAL2K models. Therefore, determination of a water quality based phosphorus limit could not be determined at that time. The FRSG in conjunction with the Illinois EPA worked to develop a schedule for completion of the modeling effort and determination of water quality based phosphorus standards. During the drought in the summer of 2012, the FRSG was able to obtain low flow monitoring for the Fox River and further calibrate the model.

In January 2013, the Illinois EPA and FRSG were able to agree on special conditions for all dischargers greater than 1 MGD. These conditions included a 1 mg/L interim phosphorus standard and a schedule for completion of the water quality modeling for the development of permanent phosphorus criteria. The permit language requires the FRSG to complete analysis of the alternatives and provide recommendations by December 2015. The permit also requires the POTWs to perform a study and determine the cost for compliance of phosphorus removal for a 1 mg/L standard as well as a 0.5 mg/L standard. In their 2018 NPDES permit, the IEPA included a requirement to study and determine the cost for compliance of phosphorus removal for a 0.1 mg/L standard. It is the intent of the special conditions that all dischargers along the Fox River will meet the recommended standards by 2030.

The St. Charles MWWTF must comply with a 1 mg/L annual average phosphorus limit. It is likely that the Facility will need to achieve lower phosphorus effluent limits prior to 2030. Phosphorous removal in wastewater treatment plants was common in the 1970's. The most widespread method of phosphorous removal used at that time was the addition of chemical coagulants that cause phosphate compounds to settle out of solution. Phosphorous removal is also possible through biological processes, but the amount of phosphorous that can be removed through such processes is limited. Both biological and chemical phosphorus removal options were evaluated in the 2015 Facility Plan.

The City of St. Charles utilized a decision matrix to determine the best alternative for the Main WWTF. Economic and non-economic factors were listed and weighted. The alternative that was in the best interest of the City for each factor was awarded those points, and a total score was tallied. In some instances, the factor was found to be approximately the same for both alternatives. In these cases, points were awarded to both alternatives.

The City elected to pursue biological phosphorus removal to comply with its annual average NPDES permit limit of 1.0 mg/L. The City began construction on these improvements, coupled with upgrades to the anaerobic digestion complex, in 2017. Construction was completed in 2019. The City achieved the effluent limit for total phosphorus by the scheduled milestone in the NPDES permit.

6.1.2 Biological Nutrient Removal

Overview

All life forms utilize a food source and a source of oxidative potential, usually oxygen or nitrite, to absorb phosphates into their bodies as the molecule adenosine tri-phosphate (ATP). This process is known as metabolism. Phosphorous is released from ATP to provide energy for cellular growth and activities. When activated sludge is produced and collected, phosphates absorbed within the cells of microorganisms as ATP and other cellular components are removed from the wastewater flow. This is the basis for biological phosphorous removal, a small amount of which occurs in all activated sludge processes in which activated sludge is wasted.

Greater amounts of phosphorous can be removed through biological methods by creating an anaerobic zone, in which no oxygen or nitrate is available, within a facility's suspended biological processes. Most microorganisms are not capable of storing large amounts of ATP and rely on a constant rate of metabolism to maintain cellular activity. Certain microorganisms known as Phosphorus Accumulating Organisms (PAOs) can store significantly more phosphorous than other heterotrophic bacteria. PAOs are capable of survival in an anaerobic environment absent of nitrate and oxygen. As such, the percentage of PAOs within the microbiological community increases when the process includes an anaerobic zone. The larger PAO population ensures a higher concentration of phosphorus within the sludge wasted from the process.

Biological Phosphorus Removal (BPR) requires rigid operational control in order to maximize the efficiency of the process. The process is sensitive to changes in temperature, flow and feed concentration. BPR may not be able to continuously meet the 1 mg/L effluent standard set by the IEPA. Therefore, chemical polishing capabilities are incorporated into the biological phosphorus removal design.

It is important to note that the phosphorus captured in the BPR process is simply stored in the bodies of microorganisms and can easily be returned to solution. The high phosphorus sludge is wasted from the biological process to a sludge stabilization process. Once stabilized, the sludge is then dewatered and disposed of through land application or land filling operations.

Consideration was also given for the biological reduction of nitrogen for possible future limits. This approach to wastewater treatment is called Biological Nutrient Removal (BNR). For the consideration of a BNR alternative, the overall system was modeled to identify potential operational issues and boundary conditions. The use of these models has become standard industry practice for evaluation and design of biological treatment plant processes, especially in phosphorus removal applications. The model was developed utilizing existing dimensions of the biological process basins, and was calibrated by data obtained during an intensive sampling and lab testing process.

It has been documented that anaerobic zones are needed to provide an environment where the PAOs are allowed to metabolize influent organic material with limited competition from other organisms. In this environment, the PAOs release phosphorus and metabolize the readily biodegradable Chemical Oxygen Demand (rbCOD). In downstream aerobic zones, the PAOs enter an endogenous state and perform luxury uptake of phosphorus. The following excerpt from the 4th Edition of Wastewater Engineering: Treatment and Reuse (Metcalf and Eddy) further explains the zones within a typical Biological Phosphorus Removal (BPR) system:

> *"Wastewater characterization, including rbCOD measurements, is essential to evaluate fully the design and performance of BPR systems. Biological phosphorus removal is initiated in the anaerobic zone where acetate (and propionate) is taken up by phosphorus-storing bacteria and converted to carbon storage products that provide energy and growth in the subsequent anoxic and aerobic zones. The rbCOD is the primary source of volatile fatty acids (VFAs) for the phosphorus-storing bacteria … The more acetate, the more cell growth, and, thus, more phosphorus removal."*

Most BNR processes also address nitrogen removal. Raw wastewater is anaerobic and therefore the majority of nitrogen is in the form of ammonia. The nitrogen cycle includes four forms; ammonia → nitrite → nitrate → nitrogen gas. Ammonia, nitrite and nitrate are all soluble, whereas nitrogen gas is released to the atmosphere. Therefore, removal of nitrogen from wastewater requires a process which produces nitrogen gas. Nitrification is an aerobic process where organisms oxidize ammonia to nitrite and nitrate. Nitrosomonas and similar microorganisms oxidize ammonia (NH_3) to nitrite (NO_2). Nitrite is oxidized to nitrate (NO_3) by nitrobacter and similar microorganisms. Denitrification is an anoxic process where organisms reduce nitrate to nitrogen gas (N_2). The driving mechanism for denitrification is the microorganisms need to obtain the oxygen molecule for respiration. This process is more efficient when microorganisms have a readily available carbon source.

The alternation between anaerobic, anoxic, and aerobic zones have been utilized in several different configurations. The City of St. Charles' Main WWTF utilizes an A^2/O Process, enhanced with a primary sludge fermenter for carbon augmentation to the anaerobic zone. The head of the process is an anaerobic zone, followed by an anoxic and an aerobic zone. An internal recycle of approximately 2 times the design flow from the end of the aerobic zones is conveyed to the head of the anoxic zones. This internal recycle denitrifies approximately 66% of the flow. The plant may either draw the internal recycle flow from between the 1300 basins and the 1400 basins, or near the end of the 1400 basins through the operation of sluice gates at the IR pump station.

Ammonia Reducing Side-Stream Treatment

The Main WWTF currently is recycling 20-30% of their ammonia load in their centrate. Reducing ammonia loading to the head of the plant through the centrate would improve the BNR processes. If this loading is eliminated, chemical may not be needed to polish the process flow to meet limits.

Traditional Nitrification/Denitrification

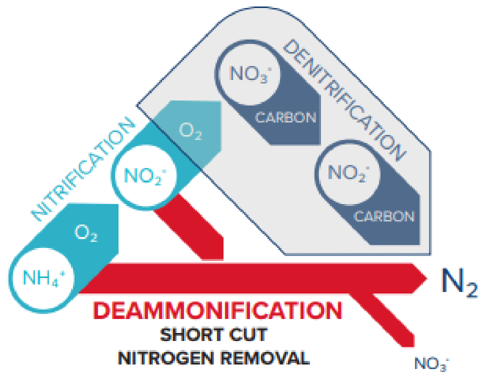
Centrate can be treated with traditional nitrification/denitrification processes. These biological processes are relatively simple and stable, however they are energy intensive as oxygen is required to be supplied throughout the nitrification process. During nitrification, alkalinity as $CaCO_3$ is utilized in the conversion of ammonia nitrogen to nitrate. Approximately 7.14 mg of alkalinity are used to convert each milligram of ammonia. Therefore, it is necessary to monitor the alkalinity available to the nitrification process to ensure that low pH does not inhibit the growth of bacteria. In side-stream processes where high ammonia levels are treated, there is a potential for low alkalinity (and therefore low pH) to limit the amount of ammonia converted.

Further evaluation would be required to determine if an additional source of alkalinity would be required to maintain a pH balance in the side-stream process. This alkalinity source can be additional waste activated sludge or a dosed chemical such as lime or sodium hydroxide. To implement nitrification/denitrification, a small amount of RAS or WAS would be mixed with centrate to provide the required mass of nitrifying bacteria. This would require installation of new tanks, one anaerobic and one aerobic. A recycle pump station would be required, in addition to aerators, blowers, and WAS or RAS pumping to maintain the required MLSS concentration.

Anaerobic ammonium oxidation or "Anammox" is a process which short-circuits the conventional nitrification/denitrification process. Nitrosomas microbes first convert ammonia to nitrite under aerobic conditions, which requires a constant supply of low-pressure air. After a short detention period, the air supply is turned off and the process enters an anaerobic state. During this period, anammox bacteria perform deammonification converting nitrite directly to nitrogen gas without requiring an air supply. Several proprietary forms of the Anammox process exist within the domestic wastewater market.

Anammox-Based Nitrification - DEMON ™

Figure 6-1: Deammonification Process (Credit World Water Works)



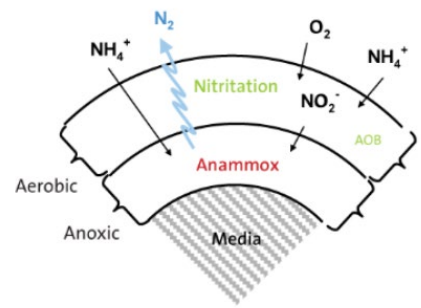
One such process is the DEMON® process (an acronym for DEamMONification) manufactured by World Water Works. The DEMON® system was the first Anammox process constructed in North America after being utilized throughout Europe. Through shunting the nitrification progression at nitrite, oxygen requirements are reduced by approximately 60%, sludge generation is reduced by more than 80%, and no external carbon or alkalinity source is required. World Water Works advertises an ammonia removal efficiency of 85-92% based on existing installations.

The DEMON® process would operate in eight-hour cycles, three times each day. The first phase is a six-hour centrate fill with alternating aeration and mixing. During the aerated portion of the phase, ammonia is converted to nitrite. Aeration is then stopped and anammox bacteria convert the nitrite to nitrogen gas. Operational control is provided through maintaining pH fluctuations during the fill phase. Acid is formed during nitrification, lowering the pH. After a drop of 0.01 units, aeration is stopped, and the process enters an anaerobic phase performing deammonification. The pH subsequently rises, and the sequence is repeated. Sludge is wasted through a cyclone system which separates and retains the heavier anammox bacteria while wasting the lighter ammonia oxidizing bacteria (A/OBs). This allows a decoupling of the SRT to provide approximately 50 days SRT for anammox bacteria and 3 days SRT for A/OB's. Due to the cyclical nature of the DEMON® process, an upstream equalization basin is required to provide detention during non-fill phases of the process. This equalization basin would also serve to provide a consistent flow throughout the day and over days when sludge dewatering is not performed. The process would require seed sludge from an existing installation for startup. The estimated capital costs associated with installing a DEMON® process at the MWWTF are roughly $5.5 Million.

Anammox-Based Nitrification – AnitaMOX™

The ANITA™ Mox process, manufactured by Kruger, Inc., is another Anammox process for side-stream ammonia removal. This system utilizes a moving bed biofilm reactor (MBBR) technology to provide nitrification and deammonification of high strength wastes. Two different layers of bacteria grow on polyethylene carriers, allowing for simultaneous aerobic nitration and anoxic ammonia oxidation reactions to take place. The outer layout of biofilm consists of Nitrosomas which convert ammonia to nitrite under aerobic conditions. The inner layer of biofilm is comprised of anammox bacteria which utilize the converted nitrite and remaining ammonia, producing nitrogen gas.

Figure 6-2: AnitaMox™ Process (Credit Kruger)



The ANITA™ Mox system can remove up to 90% of ammonia and 85% of total nitrogen. Like the DEMON process, the ANITA™ Mox requires approximately 40% of the oxygen demand of conventional nitrification and requires no external carbon source. This system utilizes medium bubble diffusers and submersible mixers. Two positive displacement blowers (one duty and one standby) are typically recommended. The entire biomass is grown on the carriers and is retained in the system by media screens which prevent it from wasting. The growth rate of the individual bacteria species determines the SRT; since the anammox bacteria has a very slow growth rate it is imperative that this bacteria is not routinely wasted. Typical scope of supply for the ANITA™ Mox system includes the polyethylene media, media screens, aeration system, mixers, blowers, instrumentation, and control equipment. Similar to the DEMON process, the ANITA™ Mox system requires upstream equalization if centrate is not supplied to the process at a constant rate. The estimated capital costs associated with installing an ANITA™ Mox process at the MWWTF are roughly $5.4 Million.

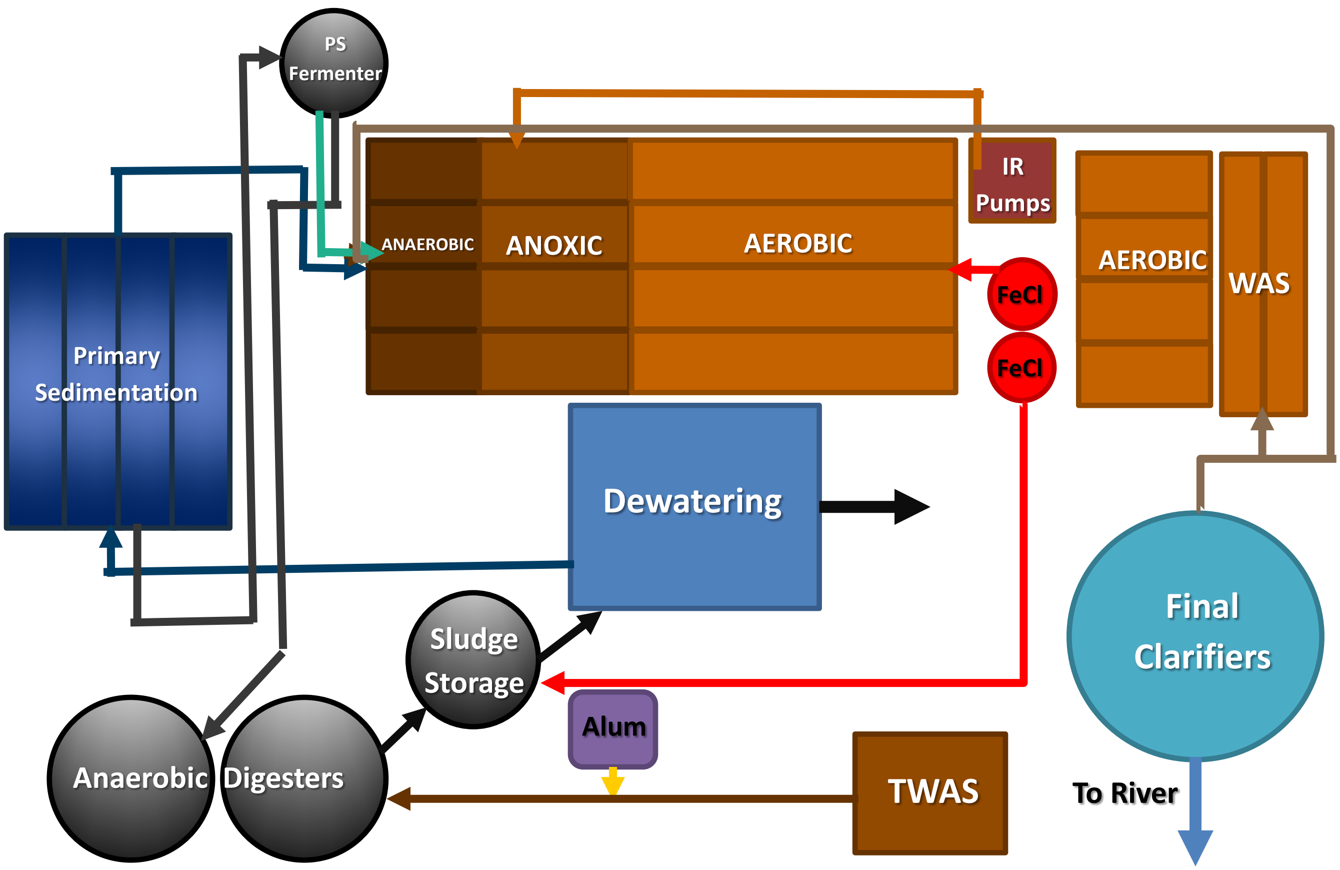
Biological Phosphorus Removal Impacts

The sludge stabilization process at the Main WWTF is anaerobic digestion. Orthophosphate tied up in PAOs from the BNR process is released under anaerobic conditions, increasing the potential for struvite formation. Struvite is a compound made up of magnesium, ammonium, and phosphorus. Alkaline conditions increase the potential for struvite crystallization, which can attach to the mixing systems, heat exchangers, sludge recirculation pumps and sludge transfer pipes. Struvite may be controlled by minimizing the concentrations of the three main soluble ions or chemical addition to reduce the pH level. The City utilizes a chemical buffering system and chemical storage facility to dose the anaerobic digesters with aluminum sulfate with the TWAS feed to the digesters to combat struvite formation.

Biological Process Limitations

The analysis for the service area to the Main WWTF provided in Section 2 indicates that at build-out, the facility will serve 64, 037 PE. The average flow is 93.64 gcd, which converts to an average daily flow of 6.09 MGD rather than 9 MGD. Using the modeled conditions (MLSS at 9°C, 239 mg/L $CBOD_5$, 26 mg/L ammonia and 40 mg/L TKN), the existing Main WWTF is able to meet effluent standards at 6.09 MGD. The Facility is also able to meet current (1.0 mg/L) and future (0.5 mg/L) effluent total phosphorus limits at design flow by utilizing more chemicals for polishing. However, the existing Main WWTF must utilize several structures that are beyond their useful life to achieve this. The Main WWTF biological process is indicated in Figure 6-6-3 below.

Figure 6-3: Existing Biological and Solids Handling Process



The aerobic zone is split into two sets of basins: The "upper" 1300 series basins were constructed in 2002; The "lower" 1400 basins were constructed in 1966, along with the WAS storage tanks which were constructed with a common wall. The 1400 basins were modified during several projects over the years. In 1973, rectangular final clarifiers were constructed adjacent to the WAS storage tanks. These final clarifiers were converted to excess flow clarifiers in 1985. In 2002, a diversion structure was constructed near the NE corner of the 1400 basins and the west wall was penetrated for a new 36" DI MLSS pipe. In 2017, the 1400 basins were incorporated into the BNR as the final aerobic zone of the process. This included a second penetration in the west wall for a new 36" DI MLSS pipe.

The existing basins used for the A^2/O process have a limited hydraulic retention time (HRT). The system performs very well at current flows of 6.5 MGD because HRT is roughly 14 hours in the existing basins. However, at design average flows of 9 MGD, the HRT is reduced to roughly 10 hours. To compensate for the reduced HRT, the basis of design utilized a MLSS concentration of 3,800 mg/L. This concentration is achievable, and the City will be able to maintain effluent concentrations below *current* permit limits for ammonia and total phosphorus. However, from an operations standpoint this will be very difficult to manage. Any reduction in the effluent total phosphorus limit or the addition of a total nitrogen limit to the NPDES permit will make operations exceedingly more difficult. Therefore, before the WWTF receives a 0.5 mg/L effluent TP limit and potentially a limit on total nitrogen, it is recommended that the City consider improvements to their biological process.

Under average loading conditions, the existing process can meet effluent standards at and above 50^o F (10^o C). Under maximum day demand loading, the existing process is only able to meet effluent standards with wastewater at and above 57^o F (14^o C) by utilizing a MLSS concentration of 3,800 mg/L. Additional detention time is necessary under high loading and low temperature conditions.

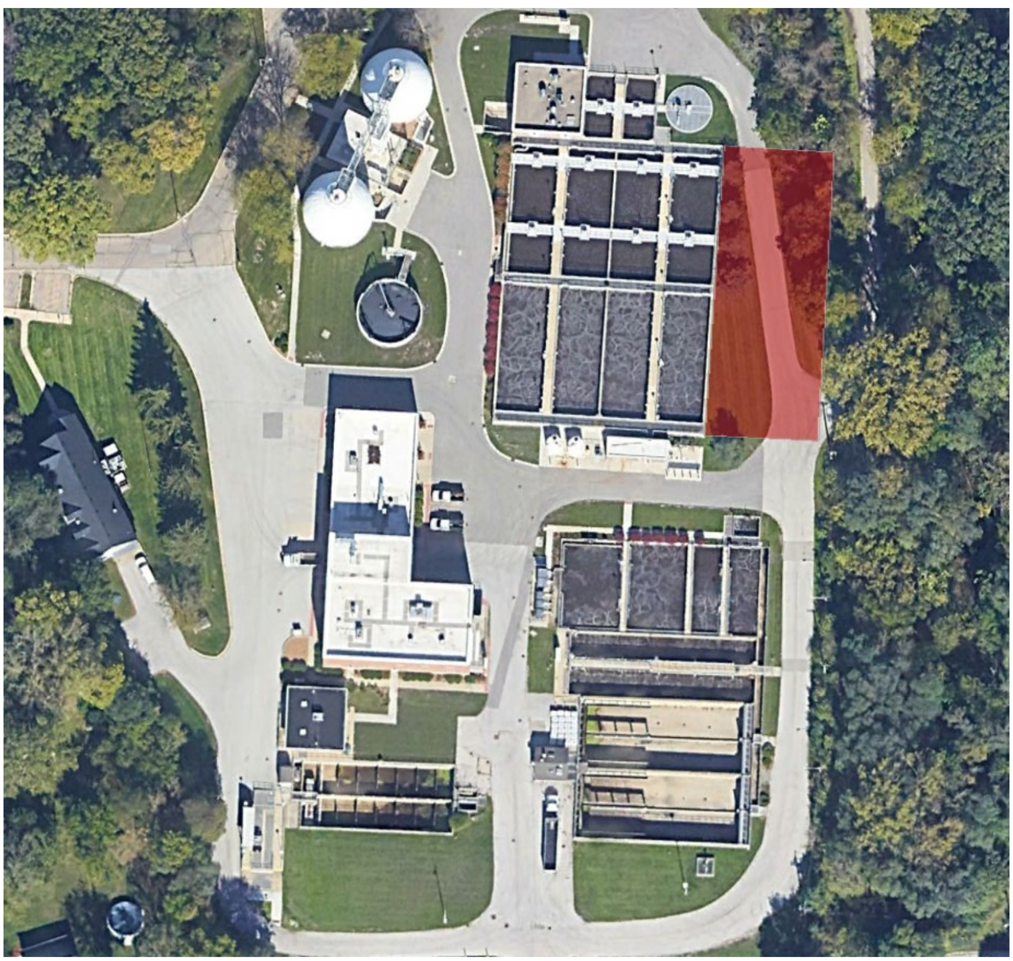
To address this issue, the biological process could revert to single-stage nitrification under these loadings and temperatures. In this mode, the City would perform chemical phosphorus removal to achieve the proposed NPDES permit limits. This is the City's current approach to the treatment of high flows or loads.

A second option would be to extend the biological process from 10 hours detention time to 12 hours with additional tankage to achieve nitrification, denitrification, and biological phosphorus removal. The biological process expansion would allow it to function over the entire range of operational conditions at a more reasonable MLSS concentration of 3,200 mg/L. This alternative would include construction of approximately 1.6 million gallons of detention time within the biological process.

6.1.3 Biological Process Expansion

To provide greater HRT for the biological process at design flow, several alternatives were considered. Two alternatives to reduce the amount of HRT required would include membrane reactors in the anaerobic zone and an IFAS process. These alternatives were both removed from consideration as they have previously proven to be too costly to implement and maintain at this facility.

The 1300 basins could be expanded to the east. This would require construction of two trains of BNR basins (similar to the four trains currently in the 1300 basins), the potential removal of the East Side Lift Station and associated revisions to the collection system to convey flows to the Riverside Lift Station, and installation of two IR pumps in the existing IR Pump Station wet well. This alternative would require realignment of the existing 24" Excess Flow, 16" RAS, and 6" NPW lines as well as revisions to City Electric Utility OH power lines.



The 1400 basins and WAS holding tanks were constructed in the 1966 Sewage Treatment Plant Improvements and have been rehabilitated and repurposed several times as discussed in Section 5. The 1400 basins could be reconstructed within the current footprint of the 1400 basins and WAS holding tanks. The 1400 basins are roughly 5 feet deeper than the WAS tanks that share a common wall. As such, the 1400 basins themselves cannot be removed without consideration of replacing the WAS tanks. The design would include 20'-deep side water depth basins for the extended BNR, an overflow structure to convey flow from the end of the 1400 basins to the internal recycle pump station wet well, and construction of WAS storage. The new WAS storage tank would provide roughly 340,000 gallons, which is equivalent to existing exterior tanks.

RAS denitrification has been shown to reduce excess DO impacts on the anaerobic zone. The RAS denitrification tank would need to be approximately the same volume as the new WAS storage to achieve the 1.5 hours HRT required to achieve anoxic conditions at design flow. The construction of the WAS storage and RAS denitrification tanks could be a single structure located east of the existing primary clarifiers, which is not ideal but appears to be the best available area onsite. Obvious issues with this concept include the distance from this tank to the WAS handling equipment in the Main & Sludge Handling Building, required removal of the East Side Lift Station, and construction of a dedicated interceptor sewer from the existing East Side Lift Station to the Riverside Lift Station. This option is not practical or feasible and is not recommended due to the complexity of the construction and the loss of the East Side Lift Station.

The WAS storage tank could therefore be located between the east ring road of the MWWTF and the access road to the East Side Lift Station and would require the replacement of the electrical service feed duct bank to this lift station. This option still has the new WAS storage tanks several hundred feet away from the WAS thickening operations and was removed from consideration.

Yet another alternative is to construct the new BNR basins *and* WAS storage tanks within their current footprint. This structure would be divided into four basins; Three would be for the BNR and one would be for WAS storage. These tanks would have a side water depth of 26 feet, which would provide approximately 1.6 Million gallons for the BNR. The resulting process would have an HRT of 12 hours with an MLSS concentration of 3,200 mg/L. The tank dedicated to WAS storage would be split into two tanks for redundancy, providing a total of 395,000 gallons. This equates to roughly three days WAS storage at design conditions, which is similar to the existing WAS tanks that provide roughly 370,000 gallons. The construction would allow the connection point for the suction piping from the existing GBT Feed Pumps in the Sludge Handling Building to remain in generally the same location. This alternative would also include an overflow structure to convey flow from the end of the 1400 basins to the internal recycle pump station wet well.

The additional volume in the new 1400 basins will increase the overall HRT in the biological process. Consideration was given to modifying the existing baffle walls to maintain the same percentage of the overall volume within each zone. This would include shifting the anaerobic/anoxic baffle walls, relocating four of the eight internal recycle force main discharges, and modifying the aeration system piping within Basins 1303-1306. The bridges and mixers within basins 1303-1306 would remain in their current location. It would also require the addition of bridges, mixers, and baffle walls to basins 1307-1310 to create additional anoxic zones. However, by adding to the aerobic zone with the new 1400 basins and reducing the design MLSS concentration from 3,800 mg/L to 3200 mg/L, accordingly, the original design minimum HRT and SRT in each zone is still achieved. Modification to the 1300 basins is therefore not recommended. Swing zones and chemical phosphorus removal should still be considered at temperatures below 14 degrees C as originally designed to maintain nitrification. A future study is recommended to evaluate implementation of tertiary filtration (See Section 5) to offset chemical costs required to achieve 0.5 mg/L effluent TP with the expanded biological process.

Table 6-1: Existing vs. Proposed HRT and SRT

	HRT at DAF, hours			SRT at DAF, days		
	Anaerobic	Anoxic	Aerobic	Anaerobic	Anoxic	Aerobic
Existing	1.64	2.45	5.87	2.46	3.68	8.82
Proposed	1.64	2.45	8.06	2.07	3.10	10.20
Minimum per original B.O.D.	0.5 - 2.0	2.4	6.58	1.00	3.68	8.70

6.1.4 Construction Considerations

The deep basin design was modeled to confirm constructability, as the 1400 basins would be out of operation for at least a year. During construction, the City would activate all swing zones in the 1300 basins to fully nitrify. With a very small remaining anerobic zone and with RAS NO_x interference consuming the available carbon source in this zone, the PAO population will diminish. Therefore, the City will need to implement chemical phosphorus removal to meet effluent TP limits. During construction of the 1400 basins and assuming the City treats an average of 7 MGD during this period, it is estimated that the City will need to utilize approximately 600 gallons of ferric chloride per day to meet their monthly limit of 1.0 mg/L. This is easily achievable with the existing chemical feed system, but the City should budget for these higher-than-normal chemical costs (see Table 6-2 below). The existing RAS pumps are also adequately sized for the required flow of 10.5 MGD with the largest pump out of service (11.6 MGD capacity).

Construction will require tight control of wasting and thickening operations utilizing the existing interior WAS storage tank to maintain the biomass in the process. WAS production at 7 MGD for the chemical phosphorus removal facility during construction compared to the existing biological phosphorus removal process is estimated to increase by roughly 4%, so the GBT will need to run slightly more hours per week during construction. Dewatering operations are anticipated to *decrease* by roughly 7% due to sludge from the chemical phosphorus removal process being easier to dewater than sludge from biological phosphorus removal. The project will cost roughly $14.5 Million.

Table 6-2: Main WWTF Biological Process Expansion Cost Estimate

SUMMARY	
Description	**Total Cost**
GENERAL CONDITIONS	$2,691,000
SITE WORK	$1,821,104
WAS STORAGE & 1400 BASINS	$6,936,415
Construction Sub-total	**$11,448,519**
Contingency @ 10%	$1,144,900
Design Engineering @ 7.5%	$944,600
Construction Engineering @ 7.5%	$944,600
PROBABLE PROJECT COST:	**$14,490,000**

NOTE: Chemical costs during construction are forecasted to be roughly $49,000/month at 7 MGD.

6.1.5 Biosolids Handling

Wasting and Thickening Operations

The wasting and thickening operations would need to be considered as the City grows. At 9 MGD, it is estimated that the City will need to waste roughly 130,000 gallons per day at a concentration of 7,000 mg/L. The existing gravity belt thickener is limited to a maximum feed of 500 gallons per hour and to 2,000 pounds per hour of solids. This indicates that the existing gravity belt thickener will be volume-limited, requiring over 30 hours of operation per week to keep up with the gallons wasted from the biological process. As the facility approaches design flows, the City should consider installation of the second GBT (provisions for this equipment were made in the 2012 Main and Sludge Handling Building Improvements).

Table 6-3 below indicates the number of days per week that the gravity belt thickener(s) will need to be in operation. The City's average influent from 2018-2022 was 4.94 MGD. It is recommended that an additional gravity belt thickener, polymer feed unit, and WAS pump be installed once the average annual influent exceeds 8 MGD.

Table 6-3: Gravity Belt Thickener Operations

Design Average Flow, MGD	9	8	7	9	8	7
WAS, Gallons per Day	130000	115600	101200	130000	115600	101200
WAS, Pounds per Day	7560	6800	5900	7560	6800	5900
GBTs In Operation	**1**	**1**	**1**	**2**	**2**	**2**
Volume-Limited Operation, Hr./Wk.	31	27	24	16	14	12
Solids-Limited Operation, Hr./Wk.	27	24	21	14	12	11
Days of GBT Operation*	5	5	4	3	3	2

* Limited daily operations to 6.5 hours to allow time for startup and cleanup

Digested Sludge Dewatering Operations

The sludge dewatering operations would also need to be considered as the City grows. At 9 MGD, it is estimated that the City will need to dewater roughly 40,000 gallons per day at a concentration of 23,000 mg/L. The existing centrifuges are limited to a maximum feed of 150 gallons per minute and to 1,875 pounds per hour of solids. This indicates that the existing centrifuges will be volume-limited, requiring over 30 hours of operation per week to keep up with the gallons of sludge from the anaerobic digesters. As the facility approaches design flows, the City should consider installation of the third centrifuge (provisions for this equipment were made in the 2012 Main and Sludge Handling Building Improvements).

Table 6-4 below indicates the number of days per week that the centrifuge(s) will need to be in operation. It is recommended that the City consult with the centrifuge manufacturer to determine if the existing equipment can be reconfigured to provide a shallower beach slope, as the existing steep beach tends to build up grit and cause vibration issues. This has been an issue for plant operations, which has caused them to be without one of their centrifuges for an extended period of time. The steep beaches also have the potential for the formation of vivianite within the centrifuges, which causes operational issues. If the existing equipment cannot be modified to rectify this issue, it is recommended that an additional centrifuge, polymer feed unit, and centrifuge feed pump be installed once the influent exceeds 8 MGD.

Table 6-4: Centrifuge Operations

Design Average Flow, MGD	9	8	7	9	8	7
Digested Sludge, Gallons per Day	40000	35600	31200	40000	35600	31200
Digested Sludge, Pounds per Day	7650	6800	6000	7650	6800	6000
CTs In Operation, All In Service	**2**	**2**	**2**	**3**	**3**	**3**
Volume-Limited Operation, Hr./Wk.	16	14	13	11	10	9
Solids-Limited Operation, Hr./Wk.	15	13	12	10	9	8
Days of CT Operation*	3	3	2	2	2	2

* Limited daily operations to 6.5 hours to allow time for startup and cleanup

6.1.1 Excess Flow Treatment

Flow is received at the head of the influent channel from three active force mains. Flow measurement is obtained through a Parshall flume. Prior to flow measurement, flow in excess of 18.35 MGD is considered to be Excess Flow. The Excess Flow Clarifiers provide primary treatment (settling) in accordance with IEPA regulations. The efficiency of the Excess Flow Clarifiers are dependent on the hydraulic loading rate. Under the current design conditions, the excess flow clarifier could be expected to achieve roughly 26% BOD5 removal and 46% suspended solids removal.

Once the Excess Flow Clarifiers begin to overflow, the flow is conveyed to Excess Flow Chlorine Contact Tanks mixing chamber, where chlorine gas is introduced, and a mechanical mixer ensures proper distribution. Flow then is disinfected as it flows through the contact tanks, under scum troughs, over an effluent weir trough, through a Parshall flume for flow measurement, then blended with treated process effluent from the UV disinfection system. Once combined, the flows are discharged together to the Fox River. This is allowed per the City of St. Charles' NPDES Permit, which contains wet weather limits allowing the treatment facility to discharge higher concentrations of BOD_5 and suspended solids during extreme events than under normal flow conditions.

The City should consider replacement of the excess flow disinfection system. It is recommended that the Chlorine Contact Tank and Chlorine Building be demolished a Tertiary Building be constructed adjacent to the Contact Tank. This building would normally treat process flow which would first pass through a rapid mix/coagulation/flocculation system with polymer and alum directly upstream of the filters. This system would bind up remaining phosphorus in the effluent prior to filtration more efficiently than chemical precipitation alone, and could be located generally in the area occupied by the Contact Tank. After the rapid mix system, flow would enter a low-head pump station before entering the tertiary disc filters. During an excess flow event, process flow would bypass the rapid mix/coagulation/flocculation system. Process flow and excess flow clarifier effluent would blend within the low-head pump station wet well prior to filtration. Blended flow would then be conveyed to the UV Building for disinfection.

Table 6-5: Tertiary Treatment Building – Probable Costs

Description	Total Cost
GENERAL CONDITIONS	$3,404,500
SITEWORK	$1,870,620
FILTER BUILDING	$11,557,180
Construction Sub-total	**$16,832,300**
Contingency @ 10%	$1,683,300
Design Engineering @ 7.5%	$1,388,700
Construction Engineering @ 7.5%	$1,388,700
PROBABLE PROJECT COST:	**$21,300,000**
IEPA Contingency (3%)	$555,468
Construction Period Interest (1.5%)	$327,832
TOTAL LOAN AMOUNT (nearest half $M)	**$22,500,000**

6.2 West Side Water Reclamation Facility Expansion

6.2.1. Project Background

Section 5 provided an analysis of the current West Side WRF infrastructure condition, biological and hydraulic loading. The existing facility is in good condition, with most equipment being replaced in 2020-2022 during the Phase 3 Expansion. The analysis within Section 5 also demonstrated that the strength of the wastewater is consistent with the original design parameters. In addition, the influent flows are approximately 62 gcd which is similar to the 62 gcd billed to users. Therefore infiltration and inflow are minimal.

The service area continues to be developed in accordance with the City's Comprehensive Plan. The analysis presented in Section 5 demonstrated that the West Side WRF is operating at approximately 51% of its design capacity (0.54 MGD out of 1.05 MGD Design). Based on the loads, current development, and committed flow, the City has begun planning for the Phase 4 Improvements to expand the facility to 1.40 MGD.

The Northeastern Illinois Planning Commission (now CMAP) and Illinois EPA approved the Phase 2 and Phase 3 Expansions in their review of the 1998 Facility Plan Update. The Illinois EPA requested that a Facility Plan Update be provided prior to approval of the originally recommended Phase 4 – 1.40 MGD expansion. The analysis provided in Section 2 demonstrates that the existing 1.05 MGD has capacity to serve approved development. The IEPA recommends expansion when the forecasted hydraulic loading from the additional property, pending development or redevelopment, would result in an average daily flow of 80% of the design capacity (0.84 MGD). To prevent being placed on critical review status with the IEPA, expansion should be considered if the capacity is expected to exceed 80% of the facility's capacity in the next 5 years. This process will include permitting for Phase 4, which could take over a year to complete. The design of the Phase 4 project would take roughly 18 months to complete, and roughly 2 years to construct. Therefore, it is recommended that the City begin planning for the Phase 4 expansion.

6.2.2. Regulatory Issues

In 2004, the Illinois EPA implemented additional nutrient removal criteria for wastewater treatment facilities that were proposing expansion of hydraulic capacity. Two nutrients of concern are total nitrogen (TN) and total phosphorus (TP). At this time, the anticipated limits are 8 mg/L and 1 mg/L for TN and TP, respectively. The IEPA has begun issuing permits lowering the TP limit for major POTWs to 0.5 mg/L by 2030.

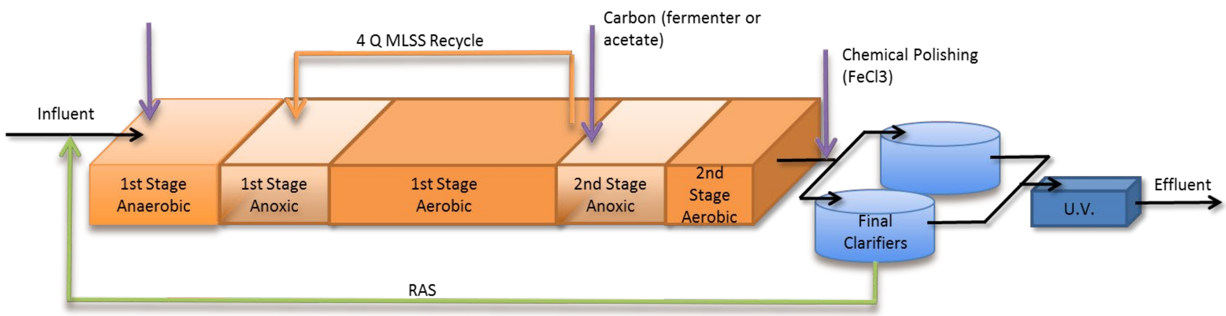
Expansion of the treatment facility will require upgrade of the biological process to address recently promulgated and pending environmental regulations including anti-degradation limits. The regulatory issues that should be addressed within this section include nutrient removal, suspended solids effluent requirements, and bio-solids stabilization. Other issues include anti-degradation requirements, and copper and radium concentrations in the effluent.

6.2.3. Biological Nutrient Removal

As described in 6.1.2, the alternation from anaerobic, anoxic and aerobic zones have been modified, enhanced and utilized in several different configurations. As the influent to each wastewater treatment facility and the desired effluent quality is different, the configuration of BPR or BNR processes must be carefully evaluated. Commonly implemented BNR processes include simultaneous nitrification/denitrification, A/O, A^2/O, Bardenpho, UCT, MLE, and the Modified Johannesburg. TAI evaluated the potential for each of these processes during planning for the Phase III expansion and implemented a 5-stage Bardenpho process.

Successful implementation of this process is highly dependent on the availability of readily available bio-degradable COD and the formation of volatile fatty acids (VFAs). VFAs are naturally formed by the anaerobic degradation of raw wastewater. This process commonly occurs in the collection system. However, the West Service Area is a relatively small basin, and anaerobic degradation of the raw wastewater may be limited. Furthermore, the level of degradation will be seasonal due to changes in temperature of the raw wastewater. Two recommended methods to address this issue include implementation of a fermenting process or the addition of an auxiliary carbon source such as acetate.

Figure 6-4: West Side WRF – Five-Stage Bardenpho Process



Originally developed by Dr. James Barnard, the Five-Stage Bardenpho configuration provides denitrification and phosphorus removal, which is the basis for the name of the process (Bar-den-pho). The head of the process is an anaerobic zone, followed by the first set of anoxic and aerobic zones. An internal recycle of approximately 4 times the design flow from the end of the first aerobic zones is conveyed to the head of the first anoxic zones. This internal recycle will denitrify approximately 80% of the flow and will require implementation of an additional carbon source to denitrify the remaining 20%.

The configuration ends with a second set of anoxic and aerobic zones. The second anoxic zones provide additional denitrification by utilizing nitrate from the first aerobic zones in combination with the added carbon to create nitrogen gas, which is stripped from the water in the final aerobic zone. The zones would be split by the construction of baffle walls within the existing basins. The typical Five-Stage Bardenpho process requires approximately 14 hours of hydraulic retention time. The existing basins provide approximately 24 hours retention at design flow and should be able to achieve the effluent nutrient limits consistently within the biological process. Even with this enhanced BNR process, some chemical addition for polishing may be required to continuously meet an effluent TP limit of 0.5 mg/L.

With a Bardenpho, additional carbon is normally required to supplement the second anoxic zone for additional denitrification. Various methods are carbon supplementation were evaluated including RAS and MLSS fermentation. The volume of tankage required for these methods would require significant investment that was not accounted for in the previous planning documents. It was determined that the original Bardenpho without supplemental carbon would serve the City without the need to spend additional capital. This was constructed Phase 3 expansion and will be expanded with the Phase 4 and Phase 5 projects to maintain the HRT within each zone of the process at the increased flow rates.

As mentioned previously, the process is sensitive to changes in temperature, flow and feed concentration. BPR may not be able to continuously meet the anticipated future 0.5 mg/L effluent standard. Therefore, chemical polishing capabilities should be incorporated into the biological phosphorus removal design.

6.2.4. Chemical Phosphorus Removal

The chemical precipitation required for phosphorus removal with alum is estimated to be anywhere between one mole of alum to 2 moles of alum (Al) for one mole phosphorus (P) to get down to 0.5 mg/L effluent TP. This range of molar ratio is required to satisfy competing reactions, as well as colloidal reactions, and this ratio will vary depending on the target effluent TP. It is estimated that sludge production from chemical precipitation in the process will yield four times the influent pounds of phosphorus removed, which would increase the overall sludge production by 25 – 40% based on the effluent P required.

Chemical precipitation in the secondary process increases the settling ability of the flocculation within the clarifiers and potentially improves effluent TSS entering the tertiary disc filters. Additionally, dosing chemical later in the process has proven to be more efficient due to the availability of soluble P and the increased exposure time and mixing energy. The City's existing chemical feed system for phosphorus removal has two dosing locations: in the diversion structure upstream of the final clarifiers and in the influent box upstream of the tertiary disc filters. If needed for further polishing of TP, the City can also dose the final clarifier effluent prior to the tertiary disc filters.

Due to the pending TN limits, chem-P alone is not recommended. The biological process at the West Side WRF will need to be expanded to maintain nitrification, denitrification, and phosphorus removal abilities. Chemical polishing equipment is recommended for any BNR system to ensure effluent nutrient limits are met consistently. The chemical demand was calculated stoichiometrically with an estimated molar ratio of 1.75:1 to remove down to 0.5 mg/L. A safety factor of 1.25 was used to account for additional competing reactions and flow variations.

Determine Parameters of Al_2SO_4

Molecular Weight of Al_2SO_4 = 594 g /mole
Moles / Pound of Al_2SO_4 = 455 g/lb. / 594 g/mole = 0.77 moles of Al_2SO_4/ pound
Weight of Al_2SO_4per gal of solution = 11.13 lb. /gal x 49% = 5.45 lb. of Al_2SO_4/ gal
5.45 lb. of Al_2SO_4/ gal x .77 moles / pound = 4.2 moles of Al_2SO_4 per gallon x 2 mole Al/mole Al_2SO_4
4.2 moles of Al_2SO_4 per gallon x 2 mole Al/mole Al_2SO_4 = 8.4 mole Al/gal

Determine Parameters of PO_4

Molecular Weight of PO_4 = 95 g /mole
Molecular Weight of P = 31 g /mole

Existing:

1.05 MGD x 6 mg/L TP x 8.34 lbs/gal = 53 lbs. PO_4 as P
53 lbs. P x 455 g/lb. / 31 g/mol = 770 moles P
Effluent P: 1.05 MGD x 0.4 mg/L x 8.34 lbs/gal = 3.5 lbs. P (51 moles)
Reduce 46.5 lbs. (682 moles) P to reach 0.4 mg/L effluent PO_4

Determine Al_2SO_4 dosage for Final Clarifiers (use 1.75 moles Al / per mole P)

8.4 moles/gal Al/ 1.75 mole Al/mole P = 4.80 mole P removed/gal Al_2SO_4
4.80 mole P * 31 g/mole / 455 g/lb. = 0.33 lbs. P removed/gal Al_2SO_4
Use 3 gallons of Al_2SO_4 per pound PO_4

Determine Required Volume of Al_2SO_4

3 gallons * 46.5 lbs./day = 140 gal/day
Safety factor = 1.25 x 140 = 174 gal/day

Determine Required Dosage Rate of Al_2SO_4

(174 gallons Al_2SO_4 /day x 11.13 lbs. /gal) x 49% = 951 lbs. Al_2SO_4/day
951 lbs. / (8.34 lbs. /gal x 1.05 MGD) = 81.4 mg/L

The calculated dosing requirements for secondary treatment to attain an effluent TP of 0.5 mg/L equate to a daily usage of approximately 174 gallons for the existing 1.05 MGD capacity. This is approximately 7.25 gallons per hour, which may vary throughout the day due to the extremely low influent flows overnight. The City's 6,150-gallon chemical storage tank would therefore provide roughly 35 days storage for chemical phosphorus removal (BNR is not effective).

Design for 1.4 MGD:

1.4 MGD x 6 mg/L TP x 8.34 lbs./gal = 70 lbs. PO_4 as P
70 lbs. P x 455 g/lb. / 31 g/mol = 1,028 moles P
Effluent P: 1.4 MGD x 0.4 mg/L x 8.34 lbs./gal = 4.7 lbs. P (69 moles)
Reduce 65.3 lbs. (959 moles) P to reach 0.4 mg/L effluent PO_4

Determine Al_2SO_4 dosage for Final Clarifiers (use 1.75 moles Al / per mole P)

8.4 moles/gal Al/ 1.75 mole Al/mole P = 4.80 mole P removed/gal Al_2SO_4
4.80 mole P x 31 g/mole / 455 g/lb. = 0.33 lbs. P removed/gal Al_2SO_4
Use 3 gallons of Al_2SO_4 per pound PO_4

Determine Required Volume of Al_2SO_4

3 gallons x 65.3 lbs./day = 196 gal/day

Safety factor = 1.25 x 196 = 245 gal/day

Determine Required Dosage Rate of Al_2SO_4

(245 gallons Al_2SO_4/day x 11.13 lbs. /gal) x 49% = 1,336 lbs. Al_2SO_4/day

1,336 lbs. / (8.34 lbs. /gal x 1.4 MGD) = 114.44 mg/L

The calculated dosing requirements for secondary treatment to attain an effluent TP of 0.5 mg/L equate to a daily usage of approximately 245 gallons for Phase 4 – 1.4 MGD capacity. This is approximately 10.2 gallons per hour, which may vary throughout the day due to the extremely low influent flows overnight. The City's chemical storage tank provides roughly 25 days storage for chemical phosphorus removal (BNR is not effective).

The calculated dosage requirements for secondary treatment to attain an effluent TP of 0.5 mg/L for the Phase 5 – 2.8 MGD capacity would be double the dosage of Phase 4, or roughly 490 gallons per day. This would provide 12.5 days of chemical storage, which is close to the IEPA design standard of 10 days. Prior to the Phase 5 expansion, it is recommended that the true molar ratio be verified to confirm if the existing chemical storage tank is adequately sized to meet IEPA design standards. The following table summarizes the calculations below and utilizes 2023 chemical costs.

Table 6-6: Chemical Cost Analysis for TP = 0.5 mg/L

DAF (MGD)	Phosphorus (Lbs./Day)	Phosphorus (Lbs./Year)	Al_2SO_4 (Gallons/Year)	Estimated Annual Cost
1.05	46.5	17,000	63,510	$132,860
1.40	65.3	23,850	89,425	$187,080

6.2.5. Summary of Nutrient Removal Recommendations

An analysis was completed as part of the 2015 Facility Plan to determine the costs associated with meeting future TP and TN limits. A Five-Stage Bardenpho was recommended for BNR West Side WRF. The Five-Stage Bardenpho provides flexibility of operation and reduced TN. The anticipated effluent TN limit is 8 mg/L. The TN limit could be 5 mg/L in the future, and the Bardenpho will then be the more applicable process. Additionally, the Bardenpho should be able to meet 1.0 mg/L effluent TP with minimal chemical polishing.

These recommendations were reiterated in the 2019 Facility Plan update and then implemented in the Phase 3 Improvements Project, which was completed in 2023. As previously described, this project included implementation of a 5-stage Bardenpho process with chemical polishing and tertiary filtration. The City is currently operating the process as a 3-stage A2O to maximize phosphorus removal.

The City expects to have a TP limit of 0.5 mg/L by 2030. The existing process can easily be scaled up to reach the future 0.5 mg/L limit. By utilizing the Bardenpho the chemical cost should stay low and nutrient removal upgrades will not be required when limits change. The tertiary filters adequately reduce solids, and the chemical feed and storage system is appropriately sized to polish the effluent to less than 0.5 mg/L TP.

To reach an effluent level of 0.5 mg/L TP, the chemical requirements increase significantly due to competing reactions and reduced reaction rates at lower PO_4 concentrations. Currently effluent solids are around 2 mg/L. With a BNR process, it is anticipated that approximately 6% of these solids are phosphorus, meaning 0.12 mg/L. There is additionally approximately 0.1 mg/L soluble non-reactive phosphorus (SNRP). Therefore, the ortho-P would have to be reduced to approximately 0.25 mg/L (not including the SNRP). The chemical precipitation required for phosphorus removal for secondary treatment to reach 0.5 mg/L is based on an estimation of 1.75 moles aluminum per mole of phosphorus.

It is recommended that the City complete a full-scale pilot utilizing the existing system to determine the actual molar ratio of aluminum required to reduce effluent TP to < 0.5 mg/L prior to preliminary design of any improvements. Improvements to the tertiary filters could be implemented to facilitate improved chemical precipitation by expanding the Tertiary Building and installing a rapid mix/coagulation/flocculation system with polymer and alum directly upstream of the filters. This system would bind up remaining phosphorus in the effluent prior to filtration more efficiently than chemical precipitation alone. The capital cost of this system is approximately $800,000 plus the building extension and modifications. Though chemical use would be reduced, the payback on this system should be evaluated once the chemical demands are verified.

With a Bardenpho, additional carbon is required to supplement the second anoxic zone for additional denitrification for an effluent TN limit of < 8-10 mg/L. Various methods are carbon supplementation were evaluated including RAS and MLSS fermentation. The volume of tankage required for these methods would require significant investment. When the facility is expanded, anti-degradation limits will likely be implemented which would include a TN limit. It was determined that the original Bardenpho with supplemental carbon should be utilized to meet future TN limits. Based on the performance of the existing system, a supplemental carbon storage and feed system may be required and should be considered during future designs.

6.2.6. Bio-Solids Stabilization

Bio-solids stabilization is the process of reducing the amount of volatile matter in the sludge produced by the wastewater treatment process. There are numerous stabilization processes that are commonly used including aerobic digestion, anaerobic digestion, and composting. Other technologies that have been recently introduced to the industry include thermophilic aerobic digestion, lime stabilization, heat pasteurization, and others.

The USEPA and the Illinois EPA govern the reuse and disposal of bio-solids. The USEPA document governing the land application of sewage sludge is commonly referred to as 40 CFR Part 503 and was promulgated in February of 1993. Under the Section 503 regulations there are three classifications of stabilized bio-solids; Class B, Class A and Class A-EQ (exceptional quality). The Illinois EPA guidelines for application of bio-solids are provided in Title 35, Subtitle C, Chapter II, Part 391.

The USEPA standards for Class B bio-solids include requirements for fecal and vector attraction reduction. Class B sludge can be land applied under a site-specific Sludge Disposal Permit (SDP). The property, which receives Class B sludge, cannot be used for growing crops for direct human consumption and must have limited public access. The City currently uses the aerobic digestion process to produce Class B bio-solids and land applies on open land adjacent to the site. However, while some contaminants are regulated at agronomic uptake rates, others such as heavy metals do not degrade over time. Repeated applications of these contaminants will therefore be cumulative, limiting the number of applications for a particular site.

The basis of design for the Phase 3 project demonstrated that thickening to 2.5% TSS with a minimum temperature of 15°C in the digester would provide roughly 530 days-°C (43% reduction in VSS) in the existing digesters, which exceeds the minimum destruction of 38% per IEPA. The IEPA design standard for aerobic digestion at a facility without primary clarifiers is 4.5 CF aerobic digester volume per PE. When the Facility is expanded to serve 14,000 PE in Phase 4, 63,000 CF of digester volume will be required to meet this IEPA design standard. The existing digester provides roughly 43,500 CF, and therefore will not meet IEPA design standards. The existing aerobic digester was built in the 1960's and converted from the original package plant in 1999. It has been rehabilitated multiple times and the concrete structure will have reached its useful life by the time the facility is expanded in Phase 4. Expanded digestion capacity will therefore be required as part of the Phase 4 expansion project. Anaerobic digestion was considered due to a smaller footprint. However, this is not recommended due to increased phosphorus re-release during digestion, as well as safety concerns due to digester gas production. The existing Sludge Handling Building was designed for aerobically digested sludge and would require improvements to handle anaerobically digested sludge. Therefore, it is recommended that the City continue to utilize the aerobic digestion process.

6.2.7. Expansion Requirements

Section 2 reviewed the current and committed capacity remaining at the West Side WRF. The total capacity is 51% of design (0.54 MGD). However, the total flow *including constructed development* is 64% of design. The Illinois EPA places facilities over 80% of design flow or load on Critical Review to ensure that permitting does not exceed design capacity. There is capacity for approximately an additional 1,624 PE prior to being placed on Critical Review. Once the influent flow and outstanding permits reach 100% of the design capacity, the facility is placed on Restricted Status and additional connections will not be permitted until the facility has been expanded.

6.2.8. Phase 4 Improvements

The West Side Water Reclamation Facility's current capacity is 1,050,000 gallons per day, or 1.05 MGD. The facility was designed to be expanded in 350,000 gallon per day increments. Phase 4 will increase the facility's capacity from 1.05 MGD to 1.4 MGD. When development requires further expansion, the West Side WRF design allows for this capacity to double to 2.8 MGD with the Phase 5 expansion.

General Description

The 2021 Phase 3 Improvements and Expansion project generally rehabilitated and upgraded the facility in its entirety. This project was completed in 2023. This project generally laid the pathway for the Phase 4 expansion when the time comes. Most of the equipment was installed to accommodate the increased hydraulic demand when the facility is expanded to 1.4 MGD. Expansion of the biological process is recommended to maintain the 24-hour Hydraulic Retention Time (HRT).

The preliminary treatment screening structure was designed to handle 6.5 MGD, which equates to the peak wet weather flow expected through Phase 4 (1.4 MGD). Therefore, no additional improvements should be required for the preliminary treatment prior to 2037 for Phase 4 flows.

The existing Bardenpho process is sized for 1.05 MGD and was designed to be increased in 0.35 MGD increments. A fourth process basin will be constructed in Phase 4 including baffle walls, mixers, diffusers, and process monitoring equipment. An additional process blower to meet increased oxygen demand with the expanded process is not required until Phase V.

Considerations were made for the Phase 4 expansion to 1.4 MGD during design and construction of the Phase 3 expansion. The existing clarifiers are sized appropriately for the expanded facility. The drives and mechanisms were rehabilitated as part of the Phase 3 expansion and should not require improvements prior to approximately 2037 for Phase 4 flows.

The RAS/WAS Pump station was originally designed for expansion. Two pumps were installed as part of the Phase 2 Project. An additional pump was installed as part of the Phase 3 Project. It is recommended that the fourth pump is installed during the Phase 4 project. Additionally, the two original pumps should be considered for replacement.

The Phase 3 project included installation of a new Tertiary Building which includes tertiary filters and a UV system, with space for a third filter and second UV system. All systems are adequately sized for the Phase 4 PWWF and should not require expansion to adequately treat the next expansion flows and loads.

The aerobic digestion facility capacity is limited and will require expansion to adequately digest sludge under Phase 4 design conditions. It is recommended that four new aerobic digesters are constructed on the south side of the site. A WAS Thickening Building using a rotary drum thickener or similar technology is also recommended. It is recommended that the digesters are covered to help maintain temperature and reduce odors. The Sludge Handling Building was also constructed in the Phase 3 improvements and currently has adequate capacity to handle Phase 4 loads.

Phase 4 Design Loading

Influent Flows:

Design Average Flow	=	1.40	MGD (972 gpm)
Peaking Factor	=	2.92	
Peak Hourly Flow Rate	=	4.10	MGD (2,847 gpm)
PHF + Tertiary Filter Return (TFR)	=	4.14	MGD (2,876 gpm)
Peak Wet Weather Flow (PWWF)	=	5.20	MGD (3,611 gpm)
PWWF + TFR	=	5.26	MGD (3,647 gpm)

Waste Characteristics:

Influent BOD_5 =	2,283 lbs./day	204 mg/L
Influent rbCOD =	777 lbs./day	67 mg/L
Influent TSS =	2,802 lbs./day	240 mg/L
Influent NH_3-N =	292 lbs./day	25 mg/L
Influent TKN =	444 lbs./ day	38 mg/L
Influent P =	70 lbs./day	6 mg/L

Figure 6-5: West Side WRF Phase 4 Expansion Conceptual Layout

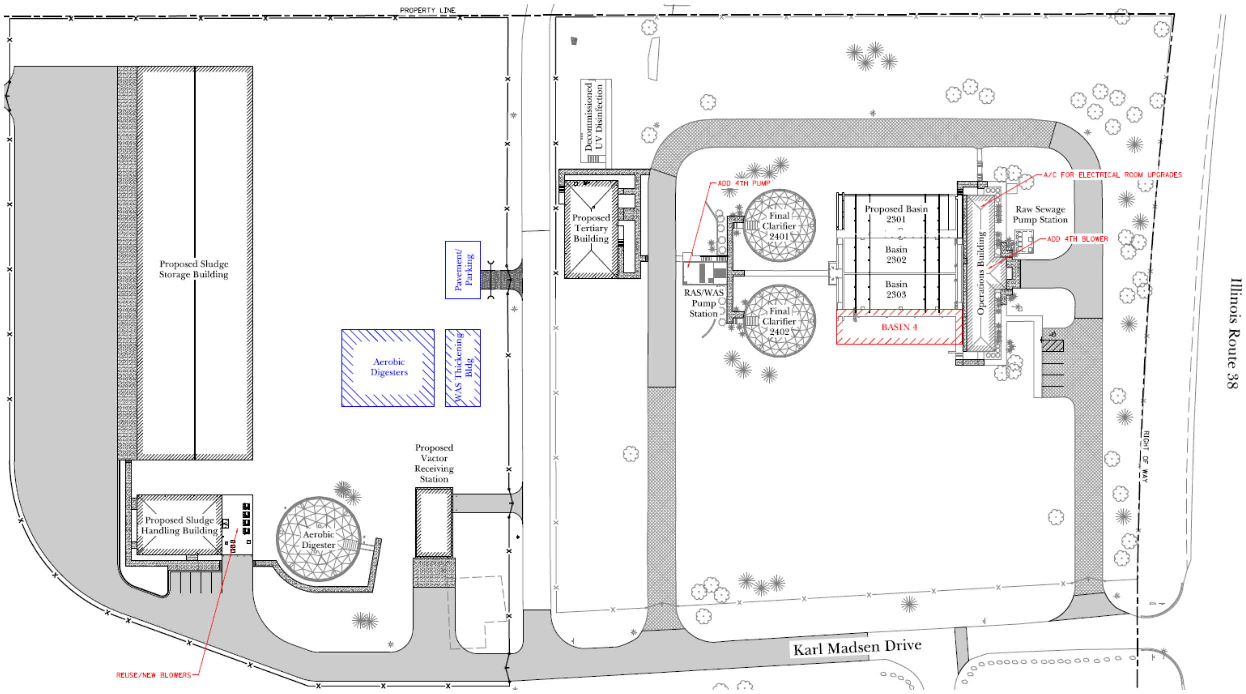
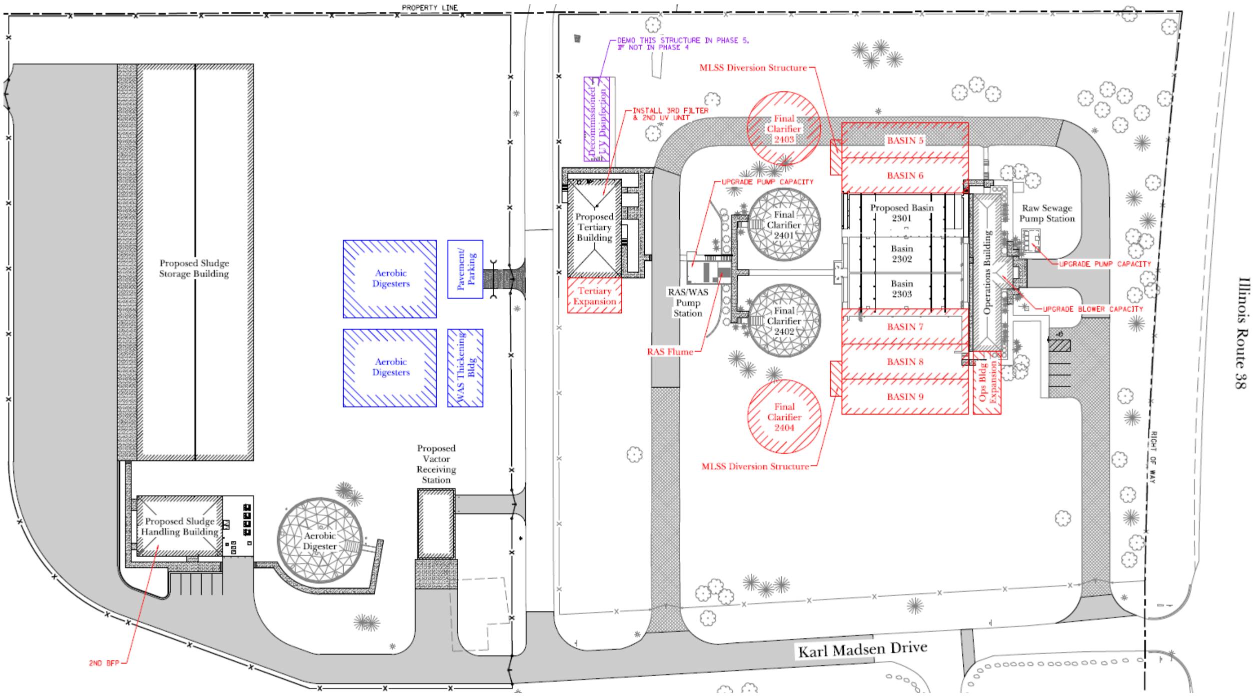


Figure 6-6: West Side WRF Phase 5 Expansion Conceptual Layout



Anticipated NPDES Permit Limits

Flow	
Design Average Flow, MGD	1.40
Design Maximum Flow, MGD	5.20
CBOD5	
Monthly Average, mg/L	10
Monthly Average, lbs.	88
Daily Maximum, mg/L	20
Daily Maximum, lbs.	175
Suspended Solids	
Monthly Average, mg/L	12
Monthly Average, lbs.	105
Daily Maximum, mg/L	24
Daily Maximum, lbs.	210
Fecal Coliform	
Monthly Maximum (May-Oct. Geometric Mean)	200 per 100 ml
pH	
Range	6 - 9
Chlorine Residual	
Daily Maximum, mg/L	0.05
Total Phosphorus	
Monthly Average, mg/L	1.0
Total Nitrogen	
Annual Geometric Mean, mg/L	10.0

Ammonia Nitrogen

March

Monthly Average, mg/L	1.5
Monthly Average, lbs.	18
Weekly Average, mg/L	3.8
Weekly Average, lbs.	44
Daily Maximum, mg/L	4.9
Daily Maximum, lbs.	57

April through October

Monthly Average, mg/L	1.2
Monthly Average, lbs.	14
Daily Maximum, mg/L	3.0
Daily Maximum, lbs.	35

November through February

Monthly Average, mg/L	2.5
Monthly Average, lbs.	29
Daily Maximum, mg/L	6.6
Daily Maximum, lbs.	77

Dissolved Oxygen

March through July

Weekly Average (not less than), mg/L	6
Daily Minimum, mg/L	5

August through February

Monthly Average (not less than), mg/L	5.5
Weekly Average (not less than), mg/L	4
Daily Minimum, mg/L	3.5

Process Summary

The Phase 4 process shall include a raw sewage pump station, screening, a Bardenpho process, clarification, tertiary filters, ultra-violet disinfection, sludge thickening, aerobic digestion, and sludge dewatering and storage. The following is a listing of existing and proposed process components and their associated sizes.

Raw Sewage Pump Station:

Number of pumps	4
Type	Pre-Rotation
Capacity, gpm each	1,550
Force Main Dia., in.	14
Maximum Capacity of P.S., gpm	4,200

Screens:

Number of Screens	2
Type	Lakeside Rotomat
Capacity, MGD Each	6.0

Biological Process:

Design	5-Stage BNR
Design Average Flow	1.40 MGD
Number of Trains	1 proposed, 4 total
Volume, 1st stage Anaerobic cu. ft.	27,300
Volume, 1st stage Anoxic cu. ft.	23,400
Volume, 1st stage Aerobic cu. ft.	93,600
Volume, 2nd stage Anoxic cu. ft.	23,400
Volume, 2nd stage Aerobic cu. ft.	19,500
Volume, total cu. ft.	187,200
Volume, total, gal.	1,400,000
Detention Time at 1.40 MGD, hrs.	24.0
Organic Loading, lbs. /day BOD_5	2,382
Organic Loading Rate, lbs. /day BOD_5/1,000 cu. ft.	13
MLSS, mg/L	2,000
Solids Inventory, lbs.	23,352
WAS, lbs. /day	1,667
WAS Volume at 0.75% TS, gpd	26,657
Air Required Reduction , scfm	2,628
Air Provided, scfm	3,956
Sludge Age, days	14
F/M Ratio	0.07
PD Blowers (1 proposed, 4 total), scfm each	987

MLSS Diversion Structure:

Number of Units	1
Design Average Flow + RAS + TFR	1.87 MGD
PHF + Tertiary Filter Return (TFR) + RAS	5.48 MGD
Peak Wet Weather Flow (PWWF) + TFR+ RAS	6.95 MGD

Final Clarifiers:

Number of Units	2 Existing
Design	Center Feed
Design Average Flow, MGD each	0.7
Design Average Flow, gpm each	(243)
Peak Hourly Flow Rate, MGD each	2.05
Peak Hourly Flow Rate, gpm each	(711)
PWWF + TFR, MGD each	2.6
PWWF + TFR, gpm each	(902)
Clarifier Diameter, ft.	60
Side Water Depth	14' 9"
Surface Area, sq. ft. /clarifier	2,827
Solids Loading, @ PWWF lb. / sq. ft. /day	17
Surface Loading @ PWWF, gal / sq. ft. /day	924
Weir Loading, @ PWWF gal / lin. ft. / day	13,854
Influent Dia.	16"
Effluent Dia.	14"
Return Sludge Force Main Dia.	8"
Waste Sludge Force Main Dia.	6"

Tertiary Filters:

Number of Units	2
Design	Inside-Out Disc Filters
Peak Wet Weather Rate	5.2 MGD
Area, sq. ft. each	1,460
Total Area, sq. ft.	2,920
Backwash Rate, gpm each	36
Total Recycle, gpm	72

Ultra-Violet Disinfection:

Number of Units	1 Existing
Design	Horizontal
Design Average Flow, MGD	1.40
Peak Hourly Flow, MGD	4.10
Peak Hourly Flow, gpm	2,847
PWWF, MGD	5.20
PWWF, gpm	3,600
TSS, mg/L	10
UV Transmission	65%

RAS Pumping:

Design	Pre-rotation, 2-Speed
Number of Pumps	1 proposed, 4 total
RAS Pump Capacity each, gpm	1,100 gpm / 520 gpm
RAS Force Main Dia.	8"

Sludge Handling – Aerobic Digestion:

<u>Sludge Thickening:</u>

Design	Rotary Drum Thickener
Number of RDT's	1
RDT Capacity, gpm/unit	125
Capture Efficiency, %	95
Influent Flow @ 0.70%, gallons / day	38,889
TWAS to Digester @ 2.0%, gallons / day	13,516

<u>Aerobic Digestion:</u>

Number of Units	4
Length, Each, ft.	40
Width, Each, ft.	30
Side Water Depth, ft.	16
Digester Volume, Each, cu. ft.	22,500
Total Digester Volume, cu. ft.	67,500
Loading Rate, cu. ft. / PE	4.82
Detention Time, days	42
Temperature, degrees-C	15
VSS Reduction, %	42

Dewatering

Design	Belt Filter Press
Number of Units	1
Capacity, gpm	140
Capacity, lbs. / day.	7,005

Dewatered Sludge Storage:

Number of Units	1
Total Volume (West Side WRF + Main WWTP), cu. ft.	92,091
Dimensions, sq. ft.	31,000

Basis of Design – Phase 4 Digester Expansion

In Phase IV the digestion capacity will be expanded to meet requirements per Illinois Code. The expanded capacity was determined per the following:

Required Volume: 4.5 CF/PE per Section 370.840 for facilities without primary clarifiers
4.5 CF/PE * 14,000 PE = 63,000 CF Required

Recommended Sizing: 4 digesters in series, each 45'W x 30'L x 16' SWD
= 19,200 CF each, 76,800 CF total

WAS thickening is recommended to 2% solids
WAS feed @ 2% = 13,516 gal/day
76,800 CF * 7.48 gal/CF = 574,464 gallons
574,464 gallons / 13,516 gal/day = 42 days @ 15°C = 638 days-°C
= 42% Destruction

Cost Estimate for Phase 4

Table 6-7: West Side WRF Phase 4 Expansion

Description	Total Cost
GENERAL CONDITIONS	$3,358,000
SITE WORK	$2,644,200
RSPS AND OPERATIONS BUILDING	$333,700
BIOLOGICAL PROCESS	$2,003,228
RAS/WAS PUMP STATION	$112,500
AEROBIC DIGESTERS	$3,758,710
WAS THICKENING BUILDING	$2,519,626
Construction Sub-total	**$14,729,964**
Contingency @ 10%	$1,473,000
Design Engineering @ 7.5%	$1,215,300
Construction Engineering @ 7.5%	$1,215,300
PROBABLE PROJECT COST:	**$18,640,000**

SECTION 7

IMPLEMENTATION PLAN

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7. IMPLEMENTATION PLAN

7.1 SELECTED ALTERNATIVE

Main Service Area

After careful consideration of the alternatives for biological process expansion at the Main WWTF, the City has elected to pursue replacement of the 1400 biological process basins and WAS holding tanks with four new, 26'-deep basins. The City is also electing to replace the excess flow disinfection system and construct a Tertiary Building. The City of St. Charles intends on funding both projects through the Water Pollution Control Loan Program administered by the Illinois EPA with the intention of servicing the debt through user fees.

West Side Service Area

The alternatives for the Phase 4 expansion of the West Side WRF are analyzed in Section 6 of this report. The City of St. Charles intends on funding the project through the Water Pollution Control Loan Program administered by the Illinois EPA with the intention of servicing the debt through user fees.

7.2 RECOMMENDATIONS

The City currently has an operations and maintenance budget of approximately $8.46 Million, which is shown in Table 7-1 to increase 3% annually. The lift station O&M costs in Table 7-1 have been updated to the recommended levels from Section 4 for the Main and West Facility Plan Updates. The O&M costs for the Main WWTF and West Side WRF consume the majority of the remaining budget. The costs of the CMOM program as recommended in Section 3 are also included, but are in addition to the other (existing) budget items.

Table 7-1: Operation and Maintenance for Phased Implementation Plan

Description	'23-'24	'24-'25	'25-'26	'26-'27	'27-'28	'28-'29 to '38-'39
COLLECTION SYSTEM – CMOM	$0.50	$0.50	$0.50	$0.50	$0.50	$5.00
LIFT STATIONS	$0.07	$0.07	$0.07	$0.07	$0.07	$0.72
WEST SIDE WRF O&M	$0.72	$0.74	$0.76	$0.78	$0.81	$9.57
MAIN WWTF O&M	$7.17	$7.39	$7.61	$7.88	$8.12	$95.84
TOTAL PROPOSED O&M	$8.46	$8.70	$8.94	$9.24	$9.50	$111.13
CURRENT O&M BUDGET (3% increase)	$8.46	$8.72	$8.98	$9.25	$9.52	$112.46

Projected costs are in millions of dollars

The complete list of all capital improvements recommended in this report is provided below.

Table 7-2: Capital Improvements Summary

EAST SIDE LIFT STATION REHABILITATION	$970,000
TERTIARY TREATMENT BUILDING	$21,293,000
PRIMARY CLARIFIER REHABILITATION	$599,600
DEWATERING EQUIPMENT REPLACEMENT	$2,642,700
MAIN WWTF BIOLOGICAL PROCESS EXPANSION	$14,490,000
WEST SIDE WRF PHASE 4 EXPANSION	$18,640,000
TOTAL CAPITAL IMPROVEMENTS	$58,635,300

The City currently has a capital improvements budget of approximately $3.52 Million. This cost represents the existing debt service on previously completed improvements that were funded through the Illinois SRF, and are labeled in Table 7-3 as "Existing Debt Service". The additional costs of the recommended capital improvements recommended in Sections 3 – 6 are included in Table 7-3 as "Proposed Debt Service". These projects were discussed with City staff to gain concurrence on the desired start and completion dates for each recommended improvement. A detailed user rate study is recommended to assess how the City should cover the recommended capital improvements.

Table 7-3: Debt Service for Capital Improvements – Implementation Plan

	'23-'24	'24-'25	'25-'26	'26-'27	'27-'28	'28-'29 to '37-'38
EXISTING DEBT SERVICE						
2002 NITRIFICATION IMPROVEMENTS	$0.65	$0.65	$0.29			
EAST SIDE AND RIVERSIDE LIFT STATIONS	$0.10	$0.10	$0.10	$0.10	$0.10	$0.29
2012 MAIN AND SLUDGE HANDLING BUILDING	$0.61	$0.61	$0.61	$0.61	$0.61	$4.30
2017 P-REMOVAL & DIG. IMPR.	$1.03	$1.03	$1.03	$1.03	$1.03	$10.32
WEST SIDE WRF PH. III EXPANSION	$1.12	$1.12	$1.12	$1.12	$1.12	$11.23
RIVERSIDE LIFT STATION REPLACEMENT		$0.19	$0.95	$0.95	$0.95	$9.51
PROPOSED DEBT SERVICE						
COLLECTION SYSTEM REPLACEMENT	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
EAST SIDE LIFT STATION REHABILITATION						$0.44
TERTIARY TREATMENT BUILDING						$2.77
PRIMARY CLARIFIER REHABILITATION				$0.60		
DEWATERING EQUIPMENT REPLACEMENT						$0.34
MAIN WWTF BNR EXPANSION						$7.12
WEST SIDE WRF PHASE 4 EXPANSION						$10.05
TOTAL CAPITAL IMPROVEMENTS	$3.52	$3.71	$4.11	$4.42	$3.82	$56.38

Projected costs are in millions of dollars

SECTION 8
ENVIRONMENTAL IMPACTS

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8. Anti-Degradation and Environmental Impact Analysis

8.1 General Discussion

The City of St. Charles is responsible for providing sanitary service and treatment for the communities within the Facility Planning Area (FPA). Sections 1 through 6 describe the basins of the FPA that are tributary to the Main WWTF (a.k.a. the Main Service Area), the basins of the FPA that are tributary to the West Side WRF (a.k.a. the West Service Area), the anticipated development, collection system, and treatment facility improvement needs in detail. As the designated management agency, the City is also responsible for meeting the long-range goals of the Clean Water Act and to minimize the environmental impacts of pollution from the sanitary waste generated within the West Service Area, the Facility Planning Area, and specifically within the Main Service Area.

The City has and continues to work with each of the affected communities by providing sanitary service, encouraging responsible development practices, and working with state and local agencies to protect the Fox River and Mill Creek from pollutants.

In addition to actively pursuing solutions to the communities wastewater collection needs, the City has invested in upgrading the Main WWTF with newer technologies to meet the needs of the Fox River Watershed. Some of the improvements to protect the environment incorporated into the recent projects include:

- Expansion of the biological process to include phosphorus and nitrogen removal
- Upgrade of the sludge stabilization facilities

The City has invested in upgrading the West Side WRF with newer technologies to meet the needs of the Mill Creek Watershed. Some of the improvements to protect the environment incorporated into the recent projects include:

- Expansion of the biological process to include phosphorus and nitrogen removal
- Upgrade of the sludge stabilization facilities
- Construction of a Sludge Dewatering Building and Sludge Storage Building
- Construction of a Tertiary Building for tertiary treatment and UV disinfection

As shown in Section 5, the performance of the Main WWTF has been outstanding. The BOD_5, suspended solids, ammonia, and total phosphorus loadings are continuously well below the NPDES Permit Limits. The performance of the West Side WRF has also been outstanding. The BOD5, suspended solids, and ammonia loadings are continuously well below the NPDES Permit Limits.

The City is committed to upgrading the wastewater treatment facilities in a manner that will be a benefit to both the communities served and the ecosystem surrounding the Fox River and Mill Creek. For the West Side WRF, the purpose of this environmental analysis is to identify the parameters of concern with an increase in discharge, as well as to minimize the impact of expansion and improve the existing conditions.

8.2 Main Service Area Environmental Areas of Concern

Areas of environmental concern include not only the Fox River, but the wetlands and nature preserves within the area. The wildlife habitat and open space represent a significant portion of the Facility Planning Area. The comprehensive plan prepared by the City within the FPA recognizes the importance of preserving open space and incorporating responsible development. Ordinances and development practices to minimize urban run-off from impacting the environment is encouraged.

The most significant concern for the Main WWTF includes the quality of the final effluent. The facility's current effluent quality is exceptional. However, concerns over impacts on the surrounding environment including wetlands, wildlife habitat, and endangered species must be considered.

8.2.1. Water Quality Concerns

The Clean Water Act was established to protect and revive the lakes, rivers, and streams throughout the United States. Restoring their quality is crucial in maintaining a healthy environment and ensuring the sustainability of these waters for all to use and enjoy.

Title 35, Section 302 of the Illinois Administrative Code establishes the method for determining, implementing, and regulating Water Quality Standards. Section 302.105 – Antidegradation has been added to protect existing uses of all water, maintain the quality of waters, and prevent unnecessary deterioration of the waterways.

The Clean Water Act also established the NPDES Permitting program managed by the individual state agencies. The program establishes effluent limits that the Publically Owned Treatment Works (POTWs) must meet. The Main WWTF has consistently been in accordance with its NPDES permit limits.

There are two methods of determining effluent limits. The first is Water Quality Based Effluent Limits (WQBEL's). WQBEL's have historically been used throughout Illinois to establish the NPDES Permit Limits for POTW Discharges.

The second method is to study a particular body of water and establish Total Maximum Daily Loads (TMDL's) based on the ecosystem's ability to receive pollutants without having an adverse effect on the streams ability to support its designated uses. By taking a watershed approach, a TMDL considers all potential sources of pollutants, both point and non-point sources. It also takes into account a margin of safety, which reflects scientific uncertainty and future growth. The effects of seasonal variation are also included.

In short, a TMDL is calculated using the following equation:

TMDL = WLA + MOS + SV

Such that:

WLA = Waste Load Allocation (point sources)
LA = Load Allocation (non-point sources)
MOS = Margin of Safety
SV = Seasonal Variation

Section 303(d) of the Clean Water Act requires each state to prepare a list of waters of the state that are considered to be impaired for their intended uses. In 2022, the Illinois EPA issued a revised Integrated Water Quality report and Section 303(d) List. Portions of the Fox River have been placed on this list.

The City's Main WWTF discharges to segment DT-58, which includes 3.76 miles of the Fox River. This segment has been identified as impaired at a medium priority. The assessment was based on site-specific data and concluded that segment DT-58 was not supporting aquatic life, fish consumption, or primary contact recreation. A summary of these impairments and their causes are shown below:

Table 8-1: Excerpt from Illinois' 2022 303(d) List and Prioritization: IL_DT-58

Priority	Hydrologic Unit Code	Water Name	Water Size	Designated Use	Cause
Medium	**0712000701**	**Fox River**	**3.76**	**Aquatic Life**	**Dissolved Oxygen**
Medium	**0712000701**	**Fox River**	**3.76**	**Fish Consumption**	**Mercury, PCBs**
Medium	**0712000701**	**Fox River**	**3.76**	**Primary Contact Recreation**	**Fecal Coliform**

In the 2018 303(d) list, neither "municipal point source discharges" nor "on-site treatment systems" were listed as sources of impairment. As such, it can be concluded that the City's Main WWTF does not contribute any substantial harmful pollutants to segment DT-58 of the Fox

River. However, it is still important to address any at-risk species in the vicinity that could be affected by future pollutant loadings.

8.2.2. Threatened and Endangered Species

The Illinois Department of Natural Resources offers an Ecological Compliance Assessment Tool (EcoCAT) that analyzes a given area and provides a list of protected resources in the vicinity of the project location. An EcoCAT was conducted for the areas surrounding the treatment facility and determined that the Illinois Natural Heritage Database contains no record of State-listed threatened or endangered species, Illinois Natural Area Inventory sites, dedicated Illinois Nature Preserves, or registered Land and Water Reserves in the vicinity of the project location. This report is included as Appendix E.

8.2.3. Input from Stakeholders

The USEPA, along with the IEPA, is currently considering alternatives to limit nutrient concentrations in an effort to reduce or eliminate local water quality impairments as well as hypoxia in the Gulf of Mexico. As discussed in Section 6, the Illinois EPA is focused on statewide nutrient removal criteria for wastewater treatment facilities. The Illinois EPA, along with the Fox River Study Group and other stakeholders, are developing solutions to address the impairments found along the Fox River.

For many years, the IEPA has enforced nutrient removal criteria for treatment facilities seeking to expand their hydraulic capacity. The IEPA revised the water quality standards in Illinois which resulted in lower treatment plant effluent limits for ammonia-nitrogen and phosphorus at Illinois POTWs. The City's NPDES permit includes a 1.0 mg/L monthly average phosphorus limit, as well as lower ammonia nitrogen levels. Their current permit is included as Appendix A.

8.3 WEST SIDE SERVICE AREA ENVIRONMENTAL AREAS OF CONCERN

Areas of environmental concern include not only Mill Creek, but the wetlands and nature preserves within the area. The wildlife habitat and open space represent a significant portion of the West Service Area. The comprehensive plan prepared by the City recognizes the importance of preserving open space and incorporating responsible development. Ordinances and development practices to minimize urban run-off from impacting the environment is encouraged.

In 1999, the City contracted with Huff and Huff, Inc. Environmental Consultants to perform a Non-Degradation Analysis for the West Side WRF's proposed expansions. This report found that the West Side WRF's effluent has not had, and is not expected to have, a negative impact on the Mill Creek environment. The Summary of this report states:

> *"In summary, no impact on the beneficial uses of Mill Creek (and Mooseheart Lake) are anticipated from the proposed change in the design average flow. In fact, the resultant higher stream flows under low flow conditions can be expected to benefit both Mill Creek and Mooseheart Lake"*

The City is planning to develop a stream characterization report to confirm the results of the 1999 analysis.

The most significant concern for the West Side WRF includes the quality of the final effluent. The facility's current effluent quality is exceptional. However, growth within the Facility Planning Area will lead to higher pollutant loading from other sources. Concerns over impacts on the surrounding environment including wetlands, wildlife habitat, and endangered species must be considered in anticipation of potential development.

8.3.1 Water Quality Concerns

The Clean Water Act was established to protect and revive the lakes, rivers, and streams throughout the United States. Restoring their quality is crucial in maintaining a healthy environment and ensuring the sustainability of these waters for all to use and enjoy.

Title 35, Section 302 of the Illinois Administrative Code establishes the method for determining, implementing, and regulating Water Quality Standards. Section 302.105 – Anti-degradation protects existing uses of all water, maintain the quality of waters, and prevent unnecessary deterioration of the waterways.

The Clean Water Act also established the NPDES Permitting program managed by the individual state agencies. The program establishes effluent limits that the Publicly Owned Treatment Works (POTWs) must meet. The West Side WRF has consistently been in accordance with its NPDES permit limits.

There are two methods of determining effluent limits. The first is Water Quality Based Effluent Limits (WQBEL's). WQBEL's have historically been used throughout Illinois to establish the NPDES Permit Limits for POTW Discharges.

The second method is to study a particular body of water and establish Total Maximum Daily Loads (TMDL's) based on the ecosystem's ability to receive pollutants without having an adverse effect on the streams ability to support its designated uses. By taking a watershed approach, a TMDL considers all potential sources of pollutants, both point and non-point sources. It also takes into account a margin of safety, which reflects scientific uncertainty and future growth. The effects of seasonal variation are also included. In short, a TMDL is calculated using the following equation:

TMDL = WLA + MOS + SV

Such that:

WLA = Waste Load Allocation (point sources)
LA = Load Allocation (non-point sources)
MOS = Margin of Safety
SV = Seasonal Variation

Section 303(d) of the Clean Water Act requires each state to prepare a list of waters of the state that are considered to be impaired for their intended uses. In 2014, the Illinois EPA issued a revised Integrated Water Quality report and Section 303(d) List. Portions of Mill Creek have been placed on this list.

The City's West Side WRF discharges to segment DTZL-02, which includes 11.1 miles of Mill Creek. This segment has not been identified as impaired on the 303(d) List. Downstream of this is segment DTZL-01, which has been identified as impaired at a medium priority. The assessment was based on site-specific data and concluded that segment DTZL-01 was not supporting aquatic life or primary contact recreation. A summary of these impairments and their causes are shown below:

Table 8-2: Excerpt 1 from Illinois' 2022 303(d) List and Prioritization: IL_DTZL-01

Priority	Hydrologic Unit Code	Water Name	Water Size	Designated Use	Cause
Medium	0712000701	Mill Creek - North	3.34	Aquatic Life	Cause Unknown
Medium	0712000701	Mill Creek - North	3.34	Primary Contact Recreation	Fecal Coliform

The downstream of segment DTZL-01 is segment DT-38 of the Fox River. This segment has been identified as impaired at a medium priority. The assessment was based on site-specific data and concluded that segment DT-38 was not supporting aesthetic quality, aquatic life, fish consumption or primary contact recreation. A summary of these impairments and their causes are shown below:

Table 8-3: Excerpt 2 from Illinois' 2022 303(d) List and Prioritization: IL_DT-38

Priority	Hydrologic Unit Code	Water Name	Water Size	Designated Use	Cause
Medium	0712000701	Fox River	10.83	Aquatic Life	TP, TSS
Medium	0712000701	Fox River	10.83	Fish Consumption	Mirex, Dieldrin, Toxaphene, Heptachlor, Aldrin, PCBs, Endrin
Medium	0712000701	Fox River	10.83	Primary Contact Recreation	Fecal Coliform

In the 2022 303(d) list, causes of impairment due to Mercury (Fish Consumption), pH (Aquatic Life), and Total Phosphorus (Aesthetic Quality) were removed from the list issued in 2018 for segment DT-38.

In the 2018 issuance of the 303(d) list, neither "municipal point source discharges" nor "on-site treatment systems" were listed as sources of impairment for segments DTZL-02 or DTZL-01. As such, it can be concluded that the City's West Side WRF does not contribute any substantial harmful pollutants to Mill Creek. However, the future expansion must not cause any noteworthy impairment to segment DT-38 of the Fox River. It is also important to address any at-risk species in the vicinity that could be affected by future pollutant loadings.

8.3.2 Threatened and Endangered Species

The Illinois Department of Natural Resources offers an Ecological Compliance Assessment Tool (EcoCAT) that analyzes a given area and provides a list of protected resources in the vicinity of the West Side WRF. An EcoCAT was conducted for the areas surrounding the facility (this report is included as Appendix F) and determined that the Illinois Natural Heritage Database shows the following protected resources may be in the vicinity of the project location:

Illinois Natural Area Inventory Sites

The Illinois Natural Areas Inventory (INAI) provides a set of information about high quality natural areas, habitats of endangered species, and other significant natural features. Information from the INAI is used to guide and support land acquisition and protection programs by all levels of government as well as by private landowners and conservation organizations. The original INAI was carried out in 1975–78, and it has been maintained by the Illinois Department of Natural Resources since then. Although the INAI has been updated to a certain extent, it no longer fully meets the needs of conservation-minded landowners, land managers, and regulatory agencies.

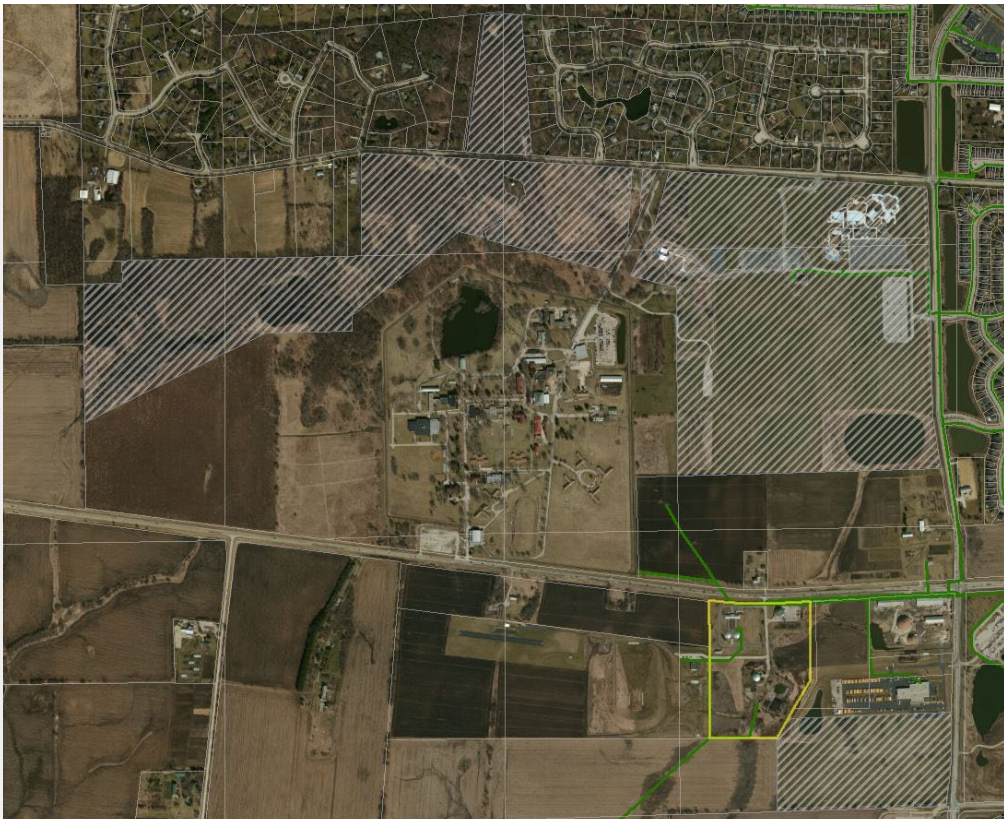
The new INAI process will allow the entire state to be thoroughly and systematically screened in order to find, describe, evaluate, classify, and map natural areas. New technologies and criteria will potentially identify perhaps twice as many natural areas of statewide significance as are currently known.

The Campton Hills Park INAI Site (INAI #1690, Categories II and III) contains just over 115 acres, and is located northwest of the West Side WRF. Prior to expansion, the Illinois Natural History Survey should be contacted to confirm that they will not be negatively impacted by this work.

Registered Land and Water Reserves

The Campton Hills Land and Water Reserve may also be in the vicinity of the project location. An exhibit showing the two protected resources and their location in relation to the West Side WRF is shown in Exhibit 8-1.

Exhibit 8-1: INAI and Dedicated Nature Preserves near WSWRF (yellow)



8.3.3 Input from Stakeholders

The USEPA, along with the IEPA, is currently considering alternatives to limit nutrient concentrations in an effort to reduce or eliminate local water quality impairments as well as hypoxia in the Gulf of Mexico. As discussed in Section 6, the Illinois EPA is focused on statewide nutrient removal criteria for wastewater treatment facilities. To address the water quality concerns with expansion of the West Side WRF, the City intends to meet with the Illinois EPA, Illinois DNR, Friends of the Fox, the Fox River Study Group and Sierra Club.

Sierra Club is America's oldest and largest grassroots environmental organization. The Sierra Club has national, state, and local chapters, which highlight issues of concern on the environment. The Illinois Sierra Club is very active in the study and protection of waterways throughout the state including the Fox River. Similarly, Friends of the Fox is a non-profit organization established for the purpose of protecting and maintaining the quality of the Fox River and its tributaries. Both organizations are attempting to work closely with communities to promote responsible development.

The Fox River Study Group (FRSG) is a coalition formed to address sustainable growth and water quality issues in the Fox River Watershed. The coalition members include Sierra Club, Friends of the Fox, Fox River Ecosystem Partnership, local municipalities, state agencies, and other interested parties. The FRSG scope has expanded its scope to the development of a comprehensive model of the Fox River Watershed. This project has been broken into four phases.

Phase I of this initiative is to compile current water quality and land use information in the watershed. Phase I work is being conducted by the Illinois State Water Survey and funded by the IEPA. Part of the Phase II work began in April 2002 when the FRSG water quality monitoring program started collecting samples at seven sites along the Fox River. This program, an all-volunteer effort organized by the Fox River and Fox Metro Water Reclamation Districts (FRWRD and FMWRD), was carefully designed to satisfy rigorous data quality requirements of the IEPA. Results from this program will be combined with results from Phase I to identify times and locations where additional information is needed.

The overall data, especially information describing how the watershed responds to storm events, will be used in Phase III to calibrate a model of the Fox River watershed. The fourth and final phase is to implement and maintain the watershed model as a management tool. The model will be used for the following purposes:

- Ensure efficient use of taxpayer and private moneys on watershed projects
- Assess the effect of various development options throughout the watershed
- Educate stakeholders
- Evaluate management priorities
- Identify sensitive regions within the watershed
- Develop effective continuing monitoring programs

For many years, the IEPA has enforced nutrient removal criteria for treatment facilities seeking to expand their hydraulic capacity. The IEPA revised the water quality standards in Illinois which resulted in lower treatment plant effluent limits for ammonia-nitrogen and phosphorus at Illinois POTWs. The City received a new NPDES permit for the West Side WRF which was effective on September 1st, 2023 and expires on August 31st, 2028. This permit includes limits for the West Side WRF both before and after the Phase 3 expansion to 1.05 MGD. Once the Phase 3 permit limits go into affect, they will include a 1.0 mg/L monthly average phosphorus limit. The City is pursuing the addition of permit limits for the Phase 4 expansion to 1.40 MGD.

8.4 West Side Service Area Impacts of Expansion

The most significant impact of expansion on the environment will be from an increased discharge to the Fox River. The 7-day, 10-year low flow for the Fox River at this point is 124 cubic feet per second.

To assess the impacts of the treatment facility expansion each of the listed potential causes for impairment identified in the 303(d) listing of the segment should be addressed to develop solutions for minimizing or eliminating the impact to the Fox River. Additionally, any additional Water Quality Standards that may be impacted due to an increase in discharge, in accordance with the Section 302.105 *Antidegradation* should also be addressed.

As stated previously, the Illinois EPA has not identified this section of Mill Creek as impaired and there are therefore no specific causes for impairment to address. However, typical causes for impairment from municipal wastewater effluents include BOD_5 , Total Suspended Solids (TSS), ammonia nitrogen, and phosphorus. As indicated in Section 5, the existing process consistently provides adequate treatment to meet the proposed BOD_5, TSS, and Ammonia effluent limits. The Facility is optimizing phosphorus removal systems constructed during the Phase 3 Expansion to meet the NPDES permit limit, and as a major discharger this facility will be required to comply with a lower limit of 0.5 mg/L in 2030. The Phase 4 expansion will ensure that these standards will continue to be met.

8.5 West Side Service Area Reducing Impacts of Expansion

8.5.1 Reducing Construction Impacts on Wetlands

While the City has no authority to impact or dictate development practices, the City's responsibility is to improve the environment within its jurisdiction through providing superior collection and treatment solutions. The City has developed a collection system plan that minimizes the impact on the existing wetlands and open space. Additionally, the use of trenchless technologies such as directional drilling will be utilized when necessary in order to minimize the impact of construction projects. The City is committed to providing any system expansion in a way that minimizes the impact on the existing wetlands and open space.

8.5.2 Water Reuse

One of the methods for reducing the impact from the plant expansion would be to incorporate a water reuse program into the project. Reviewing the Land Use Plan and the Facility Planning Area Boundary, conservation areas, and golf courses are the most eligible recipients for reuse water. Through discussions with the stakeholders, it is intended to investigate potential uses for reclaimed water such as irrigation of the plant site or golf courses.

8.5.3 Biological Nutrient Removal

One approach to mitigating the impacts of the increased discharge quantity is to reduce the concentration of nutrients discharged from the treatment facility. As described in Section 5, the current biological process is a 5-Stage Biological Nutrient Removal process. The performance of the process has been exceptional and has continuously produced effluent results well below the current NPDES Permit Limits, including ammonia. This process does also addresses concerns over total nitrogen and phosphorus, which can be contributing factors to algae blooms.

8.5.4 NPDES Permitting

The current NPDES Permit has limits on $CBOD_5$, TSS, Ammonia Nitrogen, and Total Phosphorus. Based on the historical performance of the facility, it is projected that the expanded West Side WRF will not exceed the current annual permitted pounds contribution for $CBOD_5$, TSS, Ammonia, or Total Phosphorus. In addition, effluent total nitrogen will be significantly reduced. These improvements will result in a net benefit to the Fox River.

Therefore, it is recommended that the future NPDES Permit increases the design average flow to 1.40 MGD and maintain the design maximum flow at 2.63 MGD when development necessitates it. The permit could maintain the same weekly and monthly effluent concentration limits but incorporate annual limits for BOD_5, TSS, and ammonia to represent the allotted discharge pounds of pollutants in the existing NPDES Permit. The 1.0 mg/L limit for Total Phosphorus will be in effect once the City finalizes their expansion, and this limit will be reduced to 0.5 mg/L by 2030. The permit's current monitoring requirement for Total Nitrogen in the final effluent can be maintained. The recommended NPDES permit limits are indicated in Table 8-2

Table 8-4: Recommended NPDES Permit Limits

		Existing		Proposed	
		DAF	DMF	DAF	DMF
Flow	Design Average Flow, MGD	1.05	2.63	1.4	3.93
Effluent BOD_5	Monthly Average, mg/L	10		10	
	Monthly Average, lbs.	88	219	117	328
	Daily Maximum, mg/L	20		20	
	Daily Maximum, lbs.	175	439	234	656
Effluent Suspended Solids	Monthly Average, mg/L	12		12	
	Monthly Average, lbs.	105	263	140	393
	Weekly Average, mg/L	24		24	
	Weekly Average, lbs.	210	526	280	787
Effluent pH	Range	6 – 9		6 – 9	
Effluent Fecal Coliform	Monthly Geometric Mean	200 per 100 ml		200 per 100 ml	
Effluent Chlorine Residual	Daily Maximum, mg/L	0.038		N/A	
Effluent Ammonia Nitrogen	*March-May / September-October*				
	Daily Maximum, mg/L	4.9		4.9	
	Daily Maximum, lbs.	43	107	57	161
	Weekly Average, mg/L	3.8		3.8	
	Weekly Average, lbs.	33	83	44	125
	Monthly Average, mg/L	1.5		1.5	
	Monthly Average, lbs.	13	33	18	49
	June-August				
	Daily Maximum, mg/L	3		3	
	Daily Maximum, lbs.	26	66	35	98
	Monthly Average, mg/L	1.2		1.2	
	Monthly Average, lbs.	11	26	14	39
	November through February				
	Daily Maximum, mg/L	6.6		6.6	
	Daily Maximum, lbs.	58	145	77	216
	Monthly Average, mg/L	2.5		2.5	
	Monthly Average, lbs.	22	55	29	82
Total Phosphorus	Monthly Average, mg/L	1		0.5	
	Monthly Average, lbs.	8.8	22	5.8	16
Total Nitrogen	Monthly Average	Monitor Only		Monitor Only	
Dissolved Phosphorus	Monthly Average	Monitor Only		Monitor Only	

Nitrate/Nitrite	Monthly Average	Monitor Only	Monitor Only
Total Kjeldahl Nitrogen (TKN)	Monthly Average	Monitor Only	Monitor Only
Alkalinity	Monthly Average	Monitor Only	Monitor Only
Temperature	Monthly Average	Monitor Only	Monitor Only
Dissolved Oxygen	*March through July*		
	Weekly Average not less than, mg/L	6.0	6.0
	Daily Minimum, mg/L	5.0	5.0
	August through February		
	Monthly Average not less than, mg/L	5.5	5.5
	Weekly Average not less than, mg/L	4.0	4.0
	Daily Minimum, mg/L	3.5	3.5

APPENDIX A
MAIN WASTEWATER TREATMENT FACILITY
NPDES PERMIT

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ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 North Grand Avenue East, P.O. Box 19276, Springfield, Illinois 62794-9276 • (217) 782-3397
Bruce Rauner, Governor **Alec Messina**, Director

217/782-0610

September 26, 2018

City of St. Charles
Two East Main Street
St. Charles, Illinois 60174

Re: City of St. Charles Eastside WWTF
NPDES Permit No. IL0022705
Bureau ID W0894830004
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.

Due to comments from the USEPA, special condition 23 was revised.

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, http://epa.state.il.us/water/net-dmr/index.html. 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 Jaime Rabins at 217/782-0610.

Sincerely,

Amy L. Dragovich

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

ALD:JAR:18011101

Attachments: Final Permit

cc: Records Unit
Des Plaines FOS
Compliance Assurance Section
Billing
CMAP
DRSCW/The Conservation Foundation
USEPA (via e-mail)

NPDES Permit No. IL0022705

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: September 30, 2023

Issue Date: September 26, 2018
Effective Date: October 1, 2018

Name and Address of Permittee:

City of St. Charles
Two East Main Street
St. Charles, Illinois 60174

Facility Name and Address:

City of St. Charles Eastside WWTF
East End of Devereaux Way
St. Charles, Illinois 60174
(Kane County)

Receiving Waters: Fox 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

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

ALD:JAR: 18011101

NPDES Permit No. IL0022705

Effluent Limitations, Monitoring, and Reporting

FINAL

Discharge Number(s) and Name(s): B01 STP Internal Outfall

Load limits computed based on a design average flow (DAF) of 9.0 MGD (design maximum flow (DMF) of 18.35 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	
$CBOD_5$** ***	1501 (3061)	3002 (6122)		20	40		2 Days/Week	Composite
Suspended Solids***	1877 (3826)	3378 (6887)		25	45		2 Days/Week	Composite
pH	Shall be in the range of 6 to 9 Standard Units						2 Days/Week	Grab
Fecal Coliform****	The monthly geometric mean shall not exceed 200 per 100 mL (May through October)						5 Days/Week	Grab
Chlorine Residual						0.05	****	Grab
Ammonia Nitrogen: (as N) March-May/Sept.-Oct.	113 (230)	--	135 (275)	1.5	--	1.8	2 Days/Week	Composite
June-August	98 (199)	--	105 (214)	1.3	--	1.4	2 Days/Week	Composite
November-February	--	--	255 (520)	--	--	3.4	2 Days/Week	Composite
Total Nitrogen*****	Monitor Only						1 Day/Month	Composite
Dissolved Phosphorus	Monitor Only						1 Day/Month	Composite
Nitrate/Nitrite	Monitor Only						1 Day/Month	Grab
Total Kjeldahl Nitrogen (TKN)	Monitor Only						1 Day/Month	Grab
Alkalinity	Monitor Only						1 Day/Month	Grab
Temperature	Monitor Only						1 Day/Month	Grab
		Annual Average			Annual Average			
Total Phosphorus (as P)		75 (153)			1.0		1 Day/Week	Composite
				Monthly Average not less than	Weekly Average not less than	Daily Minimum		
Dissolved Oxygen March-July				N/A	6.0	5.0	2 Days/Week	Grab
August-February				5.5	4.0	3.5	2 Days/Week	Grab

*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.
***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

NPDES Permit No. IL0022705

Effluent Limitations, Monitoring, and Reporting

FINAL

Discharge Number(s) and Name(s): B01 STP Internal Outfall (continued)

concentrations for a given time period.
****See Special Condition 10. During the weeks of Memorial Day, July Fourth, and Labor Day, the sampling frequency shall be 3 Days/Week.
*****See Special Condition 15. Total nitrogen shall be reported on the Discharge Monitoring Report (DMR) as a daily maximum.
Flow shall be reported on the DMR as monthly average and daily maximum.
pH shall be reported on the DMR as minimum and maximum value.
Fecal Coliform shall be reported on the DMR as a monthly geometric mean. No more than 10% of the samples during the month shall exceed 400 per 100 ml.
Chlorine residual shall be reported on the DMR as a daily maximum value.

The Annual Average, 12 month rolling average (calculated monthly), phosphorus limit shall be computed monthly. The annual average shall be calculated by adding the sum of the total phosphorus monitoring values from the previous 12 months of data expressed in milligrams/liter and divided by the number of samples collected. The annual average value for total phosphorus shall be reported on the DMR.

Dissolved oxygen shall be reported on the DMR as a minimum value.

NPDES Permit No. IL0022705

Effluent Limitations, Monitoring, and Reporting

FINAL

Discharge Number(s) and Name(s): A01 Excess Flow Outfall (flows in excess of 12,743 gpm)

These flow facilities shall not be utilized until the main treatment facility is receiving its design maximum flow (DMF)* (flow in excess of 12,743 gpm).

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:

Parameter	CONCENTRATION LIMITS (mg/L) Daily Maximum	Sample Frequency	Sample Type
Total Flow (MG)		Daily When Discharging	Continuous
BOD_5	Monitor Only	Daily When Discharging	Grab
Suspended Solids	Monitor Only	Daily When Discharging	Grab
Ammonia Nitrogen (as N)	Monitor Only	Daily When Discharging	Grab
Total Phosphorus (as P)	Monitor Only	Daily When Discharging	Grab

*An explanation shall be provided in comments section of the DMR should these facilities be used when the main treatment facility is not receiving Design Maximum Flow (DMF). The explanation shall identify the reasons the main facility is at a diminished treatment capacity. Additionally, the Permittee shall comply with the provisions of Special Condition 7.

The duration of each A01 discharge and rainfall event (i.e., start and ending time) including rainfall intensity shall be provided in the comment section of the DMR.

Total flow in million gallons shall be reported on the Discharge Monitoring Report (DMR) in the quantity maximum column.

BOD_5 and Suspended Solids shall be reported on the DMR as a daily maximum value.

Ammonia Nitrogen shall be reported on the DMR as a daily maximum value.

Total Phosphorus shall be reported on the DMR as a daily maximum value.

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Effluent Limitations, Monitoring, and Reporting

FINAL

Discharge Number(s) and Names(s): 001 Combined Discharge from A01 and B01 Outfall*

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 time as follows:

Parameter	CONCENTRATION LIMITS (mg/L) Monthly Average	Weekly Average	Sample Frequency	Sample Type
Total Flow (MG)			Daily When A01 is Discharging	Continuous
BOD_5**	30	45	Daily When A01 is Discharging	Grab
Suspended Solids**	30	45	Daily When A01 is Discharging	Grab
pH	Shall be in the range of 6 to 9 Standard Units		Daily When A01 is Discharging	Grab
Fecal Coliform	The monthly geometric mean shall not exceed 200 per 100 mL		Daily When A01 is Discharging	Grab
Chlorine Residual	0.75		Daily When A01 is Discharging	Grab
Ammonia Nitrogen (as N)***	Monitor only		Daily When A01 is Discharging	Grab
Total Phosphorus (as P)	Monitor only		Daily When A01 is Discharging	Grab
Dissolved Oxygen	Monitor only		Daily When A01 is Discharging	Grab

*An explanation shall be provided in the comment section of the DMR should these facilities be used when the main treatment facility is not receiving Design Maximum Flow (DMF). The explanation shall identify the reasons the main facility is at a diminished treatment capacity. Additionally, the Permittee shall comply with the provisions of Special Condition 7.

** 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.

***See Special Condition 19.

Total flow in million gallons shall be reported on the Discharge Monitoring Report (DMR) in the quantity maximum column. Report the number of days of discharge in the comments section of the DMR.

Fecal Coliform shall be reported on the DMR as a monthly geometric mean. No more than 10% of the samples during the month shall exceed 400 per 100 ml.

Chlorine Residual shall be reported on the DMR as monthly average value.

pH shall be reported on the DMR as a minimum and a maximum value.

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

A monthly average value for ammonia shall be computed for each month that A01 discharges beginning one month after the effective date of the permit. A monthly average concentration shall be determined by combining data collected from 001 and B01 (only B01 data from days when A01 is not discharging) for the reporting period. These monitoring results shall be submitted to the Agency on the DMR. Ammonia Nitrogen shall also be reported on the DMR as a maximum value.

A monthly and weekly average value for Dissolved Oxygen (DO) shall be computed for each month that A01 discharges beginning one month after the effective date of the permit. The monthly and weekly average concentrations for 001 shall be determined by combining data collected from 001 and B01 (only B01 data from days when A01 is not discharging) for the reporting period. These monitoring results shall be submitted to the Agency on the DMR. DO shall also be reported on the DMR as a minimum value.

Total Phosphorus shall be reported on the DMR as a maximum value.

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Influent Monitoring, and Reporting

The influent to the plant shall be monitored as follows:

Parameter	Sample Frequency	Sample Type
Flow (MGD)	Continuous	
BOD_5	2 Days/Week and Daily When Outfall A01 is Discharging	Composite
Suspended Solids	2 Days/Week and Daily When Outfall A01 is Discharging	Composite
Total Phosphorus (as P)	1 Day/Month	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.

Total Phosphorus shall be reported on the DMR as a daily maximum value.

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, http://www.epa.state.il.us/water/net-dmr/index.html.

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:

A. For Outfall Number B01 shall be taken at a point:
   1. Representative of the discharge of fully treated wastewater effluent, and
   2. When discharges are occurring from Outfall Number A01, prior to admixture with discharges from Outfall Number A01.
B. For Outfall Number A01 shall be taken at a point:
   1. Representative of the discharge from the excess flow treatment unit(s) to Outfall Number 001, and
   2. Prior to admixture with discharges from Outfall Number B01.
C. For Outfall Number 001 shall be taken at a point:
   1. Representative of the discharge from Outfall Number 001 but prior to entry into the receiving water, and
   2. Representative of the admixture of all flow from Outfall Numbers A01 and B01.
      a. On days when there are no discharges through Outfall Number A01 samples for all effluent limitations and monitoring parameters applicable to Outfall Number 001 can be taken at the location of sampling for Outfall Number B01. When this occurs, sample results for Outfall Number B01 must be reported on the DMRs for Outfall Number B01 and Outfall Number 001.
      b. On days when there are discharges through Outfall A01, samples for all effluent limitations and monitoring parameters applicable to Outfall 001 shall be representative of the discharge through Outfall 001 to the receiving water; and shall be taken at a point representative of the admixture of flows from Outfall Numbers A01 and B01.

SPECIAL CONDITION 9. 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 10. Fecal Coliform limits for Discharge Number B01 are effective May thru October. Sampling of Fecal Coliform is only required during this time period.

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Any use of chlorine to control slime growths, odors or as an operational control, etc. shall not exceed the limit of 0.05 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.

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 September 18, 1985 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.

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. Unless already completed, the Permittee shall 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 Federal revisions to the general pretreatment regulations. The proposal shall include all changes to the approved program and the sewer use ordinance which are necessary to incorporate the revisions of the Pretreatment Streamlining Rule (which became effective on November 14, 2005), which are considered required changes, as described in the Pretreatment Streamlining Rule Fact Sheet 2.0: Required

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changes, available at: http://cfpub.epa.gov/npdes/whatsnew.cfm?program_id=3. This includes any necessary revisions to the Permittee's Enforcement Response Plan (ERP).

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 http://www.epa.gov/region5/water/npdestek/Locallmt.xlx. 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

The Permittee's Pretreatment Program has been modified to incorporate a Pretreatment Program Amendment approved by U.S. EPA on October 1, 1996. The amendment became effective on the date of approval and is a fully enforceable provision of your Pretreatment Program.

Modifications of your Pretreatment Program shall be submitted in accordance with 40 CFR § 403.18, which established conditions for substantial and nonsubstantial modifications. All requests should be sent in electronic format to r5npdes@epa.gov, attention: NPDES Program Branch.

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 28th 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,

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along with brief explanations for deletions. The list shall specify which categorical Pretreatment standards, if any, are applicable to each Industrial User. The list must also identify Industrial Users subject to categorical Pretreatment Standards that are subject to reduced reporting requirements under 40 CFR § 403.12(e)(3), and identify which Industrial Users are Non-Significant Categorical Industrial Users.

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 monitoring report forms provided 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.

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 µg/L
00722	Cyanide (grab)*(available ***** or amenable to chlorination)****	5.0 µg/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

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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.

Minimum reporting limits are defined as: (1) The minimum value below which data are documented as non-detects. (2) Three to ten times the method detection limit. (3) The minimum value of the calibration range.

All samples containers, preservatives, holding times, analyses, method detection limit determinations and quality assurance/quality control requirements shall be in accordance with 40 CFR 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.

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

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 CONDITION 13. 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.

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 14. This Permit may be modified to include alternative or additional final effluent limitations pursuant to an approved Total Maximum Daily Load (TMDL) Study, an approved Implementation Plan, or an approved trading program.

SPECIAL CONDITION 15. The Permittee shall notify the IEPA in writing of any operational deficiencies and corrective measures to be taken if the treatment plant exceeds the concentration values of 10 mg/l of Total Nitrogen in the effluent. Correspondence shall be directed to:

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

Illinois Environmental Protection Agency
Bureau of Water
Springfield Field Office, Mail Code #10
1021 North Grand Avenue East
Post Office Box 19276
Springfield, Illinois 62794-9276

SPECIAL CONDITION 16. The Permittee shall conduct biomonitoring of the effluent from Discharge Number(s) B01.

Biomonitoring

1. 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:

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

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

2. Testing Frequency - The above tests shall be conducted using 24-hour composite samples unless otherwise authorized by the IEPA. Samples must be collected in the 18th, 15th, 12th, and 9th month prior to the expiration date of this Permit.

3. Reporting - Results shall be reported according to EPA/821-R-02-012, Section 12, Report Preparation, and shall be submitted to IEPA, Bureau of Water, Compliance Assurance Section 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.

4. Toxicity - Should a bioassay result in toxicity to >20% of organisms test 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 (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 shall immediately notify IEPA in writing of the test results.

5. Toxicity Reduction Evaluation and Identification - Should the biomonitoring program identify toxicity and result in notification by IEPA, the permittee shall develop a plan for toxicity reduction evaluation and identification. This plan shall be developed and implemented in accordance with Toxicity Reduction Evaluation Guidance for Municipal Wastewater Treatment Plants, EPA/833B-99/002, and 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 within ninety (90) days following notification by the IEPA. The Permittee shall implement the plan within ninety (90) days of notification date of the permittee above or other such date as is received by letter from 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 and toxicity reduction evaluation, the IEPA may modify this Permit to include numerical limitations for specific toxic pollutants and additional whole effluent toxicity monitoring to confirm the results of the evaluation. Modifications under this condition shall follow public notice and opportunity for hearing.

SPECIAL CONDITION 17. The Permittee shall monitor the wastewater effluent for Total Phosphorus, Dissolved Phosphorus, Nitrate/Nitrite, Total Kjeldahl Nitrogen (TKN), Ammonia, Total Nitrogen (calculated), Alkalinity and Temperature at least once a month beginning on the effective date of this permit. The Permittee shall monitor the wastewater influent for Total Phosphorus at least once a month. The results shall be submitted on electronic Discharge Monitoring Report Forms (NetDMRs) to IEPA unless otherwise specified by the IEPA.

SPECIAL CONDITION 18. The Permittee shall participate in the Fox River Study Group (FRSG) throughout the duration of this permit cycle. The Permittee shall work with other watershed members of the FRSG to determine the most cost effective means to remove dissolved oxygen (DO) impairment and offensive condition impairments in the Fox River to the extent feasible. The Permittee shall participate in the FRSG for the completion of the following tasks set out in the 2015 Fox River Implementation Plan (either by the permittee or through the FRSG) by the schedule dates set forth below:

A. The Permittee shall implement the recommendations of the 2015 Fox River Implementation Plan that are applicable to said Permittee during the term of this Permit.
B. The FRSG will conduct these activities during the term of the permit:
   1. Work with the Army Corps of Engineers and Illinois Department of Natural Resources to restart the Fox River Habitat & Connectivity Study.
   2. Collect continuous dissolved oxygen data and other water quality parameters at the Algonquin Bike Bridge from May through September 2018 to update the FRSG's water quality model.
   3. Analyze Fox River and Major Tributary Water Quality Data and Trends, for the period 1998-2016 by December 31, 2018.
   4. Update the Fox River DB database with newly collected data, by July 31, 2019.
   5. Amend the modelling and use the modified model to reevaluate water quality improvement scenarios, by August 31, 2019.

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6. Amend the Implementation Plan by December 31, 2022 based on the improved modelling and which will include proposed watershed improvement projects.

C. The Permittee shall submit an annual progress report on the activities identified in Item B above to the Agency by March 31 of each year. The Permittee may work cooperatively with the FRSG to prepare a single annual progress report that is common among FRSG permittees.

D. In its application for renewal of this permit, the Permittee shall consider and incorporate recommended FRSG activities listed in the Implementation Plan that the Permittee will implement during the next permit term.

SPECIAL CONDITION 19. The Agency shall consider all monitoring data submitted by the discharger in accordance with the monitoring requirements of this permit for all parameters, including but not limited to data pertaining to ammonia and dissolved oxygen for discharges from Discharge Number 001, to determine whether the discharges are at levels which cause, have the reasonable potential to cause or contribute to exceedances of water quality standards; and, if so, to develop appropriate water quality based effluent limitations. If the discharger wants the Agency to consider mixing when determining the need for and establishment of water quality based effluent limitations, the discharger shall submit a study plan on mixing to the Agency for the Agency's review and comment within two (2) months of the effective date of this Permit.

SPECIAL CONDITION 20. The Permittee shall work towards the goals of achieving no discharges from sanitary sewer overflows or basement back-ups and ensuring that overflows or back-ups, when they do occur do not cause or contribute to violations of applicable standards or cause impairment in any adjacent receiving water. Overflows from sanitary sewers are expressly prohibited by this permit and by Ill. Adm. Code 306.304. As part of the process to ultimately achieve compliance through the elimination of and mitigating the adverse impacts of any such overflows if they do occur, the Permittee shall (A) identify and report to IEPA all SSOs that do occur, and (B) update the existing Capacity, Management, Operations, and Maintenance (CMOM) plan at least annually and maintain it at the facility for review during Agency Field Operations Section inspections. The Permittee shall submit copies of the CMOM to the IEPA upon written request. The Permittee shall modify the Plan to incorporate any comments that it receives from IEPA and shall implement the modified plan as soon as possible. The Permittee should work as appropriate, in consultation with affected authorities at the local, county, and/or state level to develop the plan components involving third party notification of overflow events. The Permittee may be required to construct additional sewage transport and/or treatment facilities in future permits or other enforceable documents should the implemented CMOM plan indicate that the Permittee's facilities are not capable of conveying and treating the flow for which they are designed.

The CMOM plan shall include the following elements:

A. Measures and Activities:

1. A complete map and system inventory for the collection system owned and operated by the Permittee;
2. Organizational structure; budgeting; training of personnel; legal authorities; schedules for maintenance, sewer system cleaning, and preventative rehabilitation; checklists, and mechanisms to ensure that preventative maintenance is performed on equipment owned and operated by the Permittee;
3. Documentation of unplanned maintenance;
4. An assessment of the capacity of the collection and treatment system owned and operated by the Permittee at critical junctions and immediately upstream of locations where overflows and backups occur or are likely to occur; use flow monitoring and/or sewer hydraulic modeling, as necessary;
5. Identification and prioritization of structural deficiencies in the system owned and operated by the Permittee. Include preventative maintenance programs to prevent and/or eliminate collection system blockages from roots or grease, and prevent corrosion or negative effects of hydrogen sulfide which may be generated within collection system;
6. Operational control, including documented system control procedures, scheduled inspections and testing, list of scheduled frequency of cleaning (and televising as necessary) of sewers;
7. The Permittee shall develop and implement an Asset Management strategy to ensure the long-term sustainability of the collection system. Asset Management shall be used to assist the Permittee in making decisions on when it is most appropriate to repair, replace or rehabilitate particular assets and develop long-term funding strategies; and
8. Asset Management shall include but is not limited to the following elements:
   a. Asset Inventory and State of the Asset;
   b. Level of Service;
   c. Critical Asset Identification;
   d. Life Cycle Cost; and
   e. Long-Term Funding Strategy.

B. Design and Performance Provisions:

1. Monitor the effectiveness of CMOM;
2. Upgrade the elements of the CMOM plan as necessary; and
3. Maintain a summary of CMOM activities.

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C. Overflow Response Plan:

1. Know where overflows and back-ups within the facilities owned and operated by the Permittee occur;
2. Respond to each overflow or back-up to determine additional actions such as clean up; and
3. Locations where basement back-ups and/or sanitary sewer overflows occur shall be evaluated as soon as practicable for excessive inflow/infiltration, obstructions or other causes of overflows or back-ups as set forth in the System Evaluation Plan.
4. Identify the root cause of the overflow or basement backup, and document to files;
5. Identify actions or remediation efforts to reduce risk of reoccurrence of these overflows or basement backups in the future, and document to files.

D. System Evaluation Plan:

1. Summary of existing SSO and Excessive I/I areas in the system and sources of contribution;
2. Evaluate plans to reduce I/I and eliminate SSOs;
3. Evaluate the effectiveness and performance in efforts to reduce excessive I/I in the collection system;
4. Special provisions for Pump Stations and force mains and other unique system components; and
5. Construction plans and schedules for correction.

E. Reporting and Monitoring Requirements:

1. Program for SSO detection and reporting; and
2. Program for tracking and reporting basement back-ups, including general public complaints.

F. Third Party Notice Plan:

1. Describes how, under various overflow scenarios, the public, as well as other entities, would be notified of overflows within the Permittee's system that may endanger public health, safety or welfare;
2. Identifies overflows within the Permittee's system that would be reported, giving consideration to various types of events including events with potential widespread impacts;
3. Identifies who shall receive the notification;
4. Identifies the specific information that would be reported including actions that will be taken to respond to the overflow;
5. Includes a description of the lines of communication; and
6. Includes the identities and contact information of responsible POTW officials and local, county, and/or state level officials.

For additional information concerning USEPA CMOM guidance and Asset Management please refer to the following web site addresses. http://www.epa.gov/npdes/pubs/cmom_guide_for_collection_systems.pdf and http://water.epa.gov/type/watersheds/wastewater/upload/guide_smallsystems_assetmanagement_bestpratices.pdf

SPECIAL CONDITION 21. The Permittee may collect data in support of developing site-specific effluent limitations for ammonia nitrogen. In-stream monitoring for pH and temperature would be required. Samples should be taken downstream at a point representative of substantial mixing with the receiving stream and below the surface. A monitoring plan must be submitted to the Agency for approval which indicates the location, sample frequency and the duration of the monitoring program.

SPECIAL CONDITION 22. The Permittee shall, within 18 months of the effective date of this permit, prepare and submit to the Agency a Phosphorus Removal Feasibility Study (PRFS) 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 0.1 mg/L. The study shall evaluate the construction and O & M costs of the application of this limit on a monthly, seasonal and annual average basis. The feasibility report shall also be shared with the Fox River Study Group. Previously submitted feasibility studies may be updated with supplemental treatment technologies necessary to achieve 0.1 mg/L.

SPECIAL CONDITION 23. An effluent limit of 0.5 mg/L Total Phosphorus 12-month rolling geometric mean (calculated monthly) (hereinafter Limit) will be applicable to the Permittee beginning January 1, 2030. The Agency may modify the permit if:

A. The Permittee demonstrates that the Limit is not technologically feasible; or
B. The Permittee demonstrates 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:
   1. Interim Economic Guidance for Water Quality Standards, March 1995, EPA-823-95-002;
   2. Combined Sewer Overflows – Guidance for Financial Capability Assessment and Schedule Development, February 1997, EPA-832—97-004;
   3. Financial Capability Assessment Framework for Municipal Clean Water Act Requirements, November 24, 2014; or
C. If the Implementation Plan determines that a greater phosphorus reduction is necessary and achievable before January 1, 2030, then the Permittee shall meet the phosphorus limit identified in the Implementation Plan in accordance with the schedule set out therein; or
D. If the Limit is demonstrated not to be technologically or economically feasible by January 1, 2030, but is feasible within a longer

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timeline, then the Limit shall be met as soon as feasible; or

E. If the Limit is demonstrated not to be technologically or economically achievable by the Permittee, then an effluent limit that is achievable by the Permittee must be met as soon as feasible and shall not exceed 0.6 mg/L Total Phosphorus 12-month rolling geometric mean (calculated monthly).

The Agency will modify or reissue the NPDES permit as necessary. Any permit modification or renewal will be public noticed and made available for public review and comment prior to issuance of any permit modification or renewal. No date deadline extension or effluent limitation modification will be effective until it is included in a modified or reissued NPDES permit.

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.

(Rev. 7-9-2010 bah)

APPENDIX B
WESTSIDE WATER RECLAMATION FACILITY
NPDES PERMIT

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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 18, 2023

City of St. Charles
Two East Main Street
St. Charles, Illinois 60174

Re: City of St. Charles
City of St. Charles Westside WWTF
NPDES Permit No. IL0026808
Bureau ID W0894830005
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.

The following changes have been made to the permit since the public notice period.

1) Special Condition 10 has been updated to read "40 CFR, Part 122, Appendix J, Table 2."

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 Corey Branson at 217/782-0610.

Sincerely,

Darin E. LeCrone, P.E.
Manager, Permit Section
Division of Water Pollution Control

BDF:CWB:22112101.cwb

Attachments: Final Permit

cc: Records Unit
Des Plaines FOS
Compliance Assurance Section
Billing
CMAP
DRSCW/The Conservation Foundation

NPDES Permit No. IL0026808

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, 2028

Issue Date: August 18, 2023
Effective Date: September 01, 2023

Name and Address of Permittee:

City of St. Charles
Two East Main Street
St. Charles, Illinois 60174

Facility Name and Address:

City of St. Charles Westside WWTF
3803 Illinois Route 38
St. Charles, Illinois 60174
(Kane County)

Receiving Waters: Mill Creek

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.

Darin E. LeCrone, P.E.
Manager, Permit Section
Division of Water Pollution Control

BDF:CWB.22112101.cwb

NPDES Permit No. IL0026808

Effluent Limitations, Monitoring, and Reporting

FINAL

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

Load limits computed based on a design average flow (DAF) of 0.7 MGD (design maximum flow (DMF) of 1.75 MGD).

From the effective date of this Permit until the completion and start of operation of the expanded WWTF or the expiration date whichever comes first, 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	
$CBOD_5$**,****	58(146)		117(292)	10		20	2 Days/Week	Composite
Suspended Solids****	70(175)		140(350)	12		24	2 Days/Week	Composite
pH	Shall be in the range of 6 to 9 Standard Units						2 Days/Week	Grab
Fecal Coliform***	The monthly geometric mean shall not exceed 200 per 100 mL and no more than 10% of the samples in any month shall exceed 400 per 100mL. (May through October)						2 Days/Week	Grab
Chlorine Residual						0.05	***	Grab
Ammonia Nitrogen: As (N)								
March-May/Sept.-Oct.	8.8(22)	22(55)	29(72)	1.5	3.8	4.9	2 Days/Week	Composite
June-August	7.0(18)		18(44)	1.2		3.0	2 Days/Week	Composite
Nov.-Feb.	15(36)		39(96)	2.5		6.6	2 Days/Week	Composite
Total Phosphorus (as P)						Monitor Only	1 Day/Month	Composite
				Monthly Average not less than	Weekly Average not less than	Daily Minimum		
Dissolved Oxygen								
March-July				N.A.	6.0	5.0	2 Days/Week	Grab
August-February				5.5	4.0	3.5	2 Days/Week	Grab

*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 9.
****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.

NPDES Permit No. IL0026808

Effluent Limitations, Monitoring, and Reporting

FINAL

Discharge Number(s) and Name(s): 001 STP Outfall (Existing WWTF) (continued)

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 monthly geometric mean and as a percentage of the samples exceeding 400 per 100 mL.

pH shall be reported on the DMR as minimum and maximum value.

Ammonia Nitrogen shall be reported on the DMR as a 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 daily maximum value.

NPDES Permit No. IL0026808

Effluent Limitations, Monitoring, and Reporting

FINAL

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

Load limits computed based on a design average flow (DAF) of 1.05 MGD (design maximum flow (DMF) of 2.63 MGD).

From the completion and start of operation of the Expanded WWTF 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	
$CBOD_5$**,*****	88(219)		175(439)	10		20	3 Days/Week	Composite
Suspended Solids****	105(263)		210(526)	12		24	3 Days/Week	Composite
pH	Shall be in the range of 6 to 9 Standard Units						3 Days/Week	Grab
Fecal Coliform***	The monthly geometric mean shall not exceed 200 per 100 mL and no more than 10% of the samples in any month shall exceed 400 per 100mL. (May through October)						3 Days/Week	Grab
Chlorine Residual						0.05	***	Grab
Ammonia Nitrogen: As (N)								
March-May/Sept.-Oct.	13(33)	33(83)	43(107)	1.5	3.8	4.9	3 Days/Week	Composite
June-August	11(26)		26(66)	1.2		3.0	3 Days/Week	Composite
Nov.-Feb.	22(55)		58(145)	2.5		6.6	3 Days/Week	Composite
Total Phosphorus (as P)	8.8(22)			1.0			3 Days/Week	Composite
Total Nitrogen (as N)*****						Monitor Only	1 Day/Month	Composite
Dissolved Phosphorus						Monitor Only	1 Day/Month	Composite
Nitrate/Nitrite						Monitor Only	1 Day/Month	Composite
Total Kjeldahl Nitrogen (TKN)						Monitor Only	1 Day/Month	Composite
Alkalinity						Monitor Only	1 Day/Month	Grab
Temperature						Monitor Only	1 Day/Month	Grab
				Monthly Average not less than	Weekly Average not less than	Daily Minimum		
Dissolved Oxygen								
March-July				N.A.	6.0	5.0	3 Days/Week	Grab
August-February				5.5	4.0	3.5	3 Days/Week	Grab

*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 9.

NPDES Permit No. IL0026808

Effluent Limitations, Monitoring, and Reporting

FINAL

Discharge Number(s) and Name(s): 001 STP Outfall (Expanded WWTF) (continued)

****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.
*****See Special Condition 14.

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 monthly geometric mean and as a percentage of the samples exceeding 400 per 100 mL.

pH shall be reported on the DMR as minimum and maximum value.

Dissolved oxygen shall be reported on the DMR as a minimum value.

Total Phosphorus shall be reported on the DMR as a daily maximum value.

Total Nitrogen shall be reported on the DMR as a daily maximum value. Total Nitrogen is the sum total of Total Kjeldahl Nitrogen, Nitrate and Nitrite.

NPDES Permit No. IL0026808

Influent Monitoring, and Reporting

The influent to the plant shall be monitored as follows:

Parameter	Sample Frequency*	Sample Type
Flow (MGD)	Continuous	
BOD_5	2 Days/Week	Composite
Suspended Solids	2 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.

*The sample frequency for the Expanded WWTF shall be 3 Days/Week.

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 the existing facility shall be by or under the supervision of a Certified Class 2 operator. The expanded WWTF shall be operated by a 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. Fecal Coliform limits for Discharge Number 001 are effective May thru October. Sampling of Fecal Coliform is only required during this time period.

Any use of chlorine to control slime growths, odors or as an operational control, etc. shall not exceed the limit of 0.05 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 10. For the Expanded WWTF, the Permittee shall conduct semi-annual monitoring of the effluent and report concentrations (in mg/L) of the following listed parameters. Monitoring shall begin three (3) months from the effective date of this permit. The sample shall be a 24-hour effluent composite except as otherwise provided below and the results shall be submitted on Discharge Monitoring Report (DMR) electronic forms, unless otherwise specified by the IEPA. The parameters to be sampled and the minimum reporting limits to be attained are as follows:

STORET CODE	PARAMETER	Minimum reporting limit
01002	Arsenic	0.05 mg/L
01007	Barium	0.5 mg/L
01027	Cadmium	0.001 mg/L

Special Conditions

01032	Chromium (hexavalent) (grab)	0.01 mg/L
01034	Chromium (total)	0.05 mg/L
01042	Copper	0.005 mg/L
00720	Cyanide (total) (grab)***	5.0 µg/L
00722	Cyanide (grab) (available**** or amenable to chlorination)***	5.0 µg/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 (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
01092	Zinc	0.025 mg/L

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.

*1.0 ng/L = 1 part per trillion.
**Utilize USEPA Method 1631E and the digestion procedure described in Section 11.1.1.2 of 1631E.
***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 Permittee shall sample and analyze the effluent for the pollutants identified in 40 CFR, Part 122, Appendix J, Table 2. Provide data from a minimum of 3 samples taken within four and one-half years prior to the expiration of this Permit. Samples must be representative of the seasonal variation in the discharge. All samples must be collected and analyzed in accordance with analytical methods approved under 40 CFR Part 136. Sample results shall be submitted with the application for renewal of this Permit.

The Permittee must provide notice of any new introduction of pollutants from an indirect discharger which would be subject to Section 301 or 306 of the Clean Water Act as if it were directly discharging these pollutants and any substantial change in the volume or character of pollutants being introduced by a source introducing pollutants at the time of issuance of this Permit. The notice must include information on the quality and quantity of effluent introduced and any anticipated impact of the change on the quantity or quality of the effluent to be discharged.

The Permittee shall provide a report briefly describing the permittee's pretreatment activities and an updated listing of the Permittee's significant industrial users. The list should specify which categorical pretreatment standards, if any, are applicable to each Industrial User. Permittees who operate multiple plants may provide a single report. Such report shall be submitted within six (6) months of the effective date of this Permit to the following addresses:

U.S. Environmental Protection Agency
Region 5
77 West Jackson Blvd.
Chicago, Illinois 60604
Attention: Water Assurance Branch Enforcement and Compliance

Special Conditions

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 11. 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 CONDITION 12. 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.

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 13. 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 14. For the Expanded WWTF, the Permittee shall design and operate a biological nutrient removal (BNR) treatment process. Monitoring for Total Nitrogen is required to document the actual total nitrogen effluent concentration. The Permittee shall monitor the effluent for total nitrogen once per month. The monitoring shall be a composite sample and the results reported as a daily maximum on the Permittee's Discharge Monitoring Forms.

SPECIAL CONDITION 15. For the Expanded WWTF, 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 Edition) EPA/821-R-02-012, October 2002, and Whole Effluent Toxicity Methods Errata Sheet EPA/821-R-02-012-ES, December 2016. 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 emailed to EPA.PrmtSpecCondtns@Illinois.gov with "IL0026808 Special Condition 15" as the subject of the email 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 16. The Permittee shall notify the IEPA in writing once the treatment plant expansion has been completed. A letter stating the date that the expansion was completed shall be sent to the following address within fourteen (14) days of the expansion becoming operational:

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 17. The Permittee shall develop and submit to the Agency a Phosphorus Discharge Optimization Plan within 24 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. In developing the plan, the Permittee shall evaluate a range of measures for reducing phosphorus discharges from the treatment plant,

Special Conditions

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 18. The Permittee shall monitor the wastewater effluent for Total Phosphorus, Dissolved Phosphorus, Nitrate/Nitrite, Total Kjeldahl Nitrogen (TKN), Ammonia, Total Nitrogen (calculated), Alkalinity and Temperature at least once a month once the new plant is operational. The results shall be submitted on Discharge Monitoring Report (DMR) Forms or NetDMRs to IEPA unless otherwise specified by the IEPA.

SPECIAL CONDITION 19. The Permittee shall participate in the Fox River Study Group (FRSG) throughout the duration of this permit cycle. The Permittee shall work with other watershed members of the FRSG to determine the most cost effective means to remove dissolved oxygen (DO) impairment and offensive condition impairments in the Fox River to the extent feasible. The Permittee shall participate in the FRSG for the completion of the following tasks set out in the 2015 Fox River Implementation Plan (either by the permittee or through the FRSG) by the schedule dates set forth below:

A. The Permittee shall implement the recommendations of the 2015 Fox River Implementation Plan that are applicable to said Permittee during the term of this Permit.
B. The FRSG will conduct these activities during the term of the permit:
1. Work with the Army Corps of Engineers and Illinois Department of Natural Resources to restart the Fox River Habitat & Connectivity Study.
2. Collect continuous dissolved oxygen data and other water quality parameters at the Stratton Dam from April through September 2019, 2020, and 2021 to update the FRSG's water quality model.
3. Analyze Fox River and Major Tributary Water Quality Data and Trends, for the period 1998-2016 by December 31, 2018.
4. Update the Fox River DB database with newly collected data, by July 31, 2019.
5. Amend the modelling and use the modified model to reevaluate water quality improvement scenarios, by August 31, 2019.
6. Amend the Implementation Plan by December 31, 2022 based on the improved modelling and which will include proposed watershed improvement projects.
C. The Permittee shall submit electronically to EPA.PrmtSpecCondtns@illinois.gov with "IL0026808 Special Condition 19" as the subject of the email and posted to the permittees website an annual progress report on the activities identified in Item B above to the Agency by March 31 of each year. The Permittee may work cooperatively with the FRSG to prepare a single annual progress report that is common among FRSG permittees.
D. In its application for renewal of this permit, the Permittee shall consider and incorporate recommended FRSG activities listed in the Implementation Plan that the Permittee will implement during the next permit term.

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.

(Rev. 7-9-2010 bah)

APPENDIX C
STC MAIN DEVELOPMENT TABLES

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Table 1: Eastern 1 Drainage Basin Future Development Summary

Description	PE	Wastewater (GPD)
Total Residential	0	0
Total Non-Residential	25	2,500
Total Constructed PE	**0**	**0**
Total Future Development PE	**25**	**2,500**
Total Buildout PE	**0**	**0**
Total Future PE	**25**	**2,500**

Table 2: Eastern 2 Drainage Basin Future Development Summary

Description	PE	Wastewater (GPD)
Total Residential	4,361	436,100
Total Non-Residential	4,399	439,852
Total Constructed PE	**2,865**	**286,460**
Total Future Development PE	**5,210**	**520,992**
Total Buildout PE	**685**	**68,500**
Total Future PE	**8,760**	**875,952**

Table 3: Eastern 3 Drainage Basin Future Development Summary

Description	PE	Wastewater (GPD)
Total Residential	175	17,500
Total Non-Residential	573	57,340
Total Constructed PE	**536**	**53,640**
Total Future Development PE	**212**	**21,200**
Total Buildout PE	**0**	**0**
Total Future PE	**748**	**74,840**

Table 4: SC02 Drainage Basin Future Development Summary

Description	PE	Wastewater (GPD)
Total Residential	1,948	194,800
Total Non-Residential	548	54,800
Total Constructed PE	**1,204**	**120,400**
Total Future Development PE	**1,292**	**129,200**
Total Buildout PE	**0**	**0**
Total Future PE	**2,496**	**249,600**

Table 5: SC05_R3 Drainage Basin Future Development Summary

Description	PE	Wastewater (GPD)
Total Residential	308	30,800
Total Non-Residential	0	0
Total Constructed PE	**0**	**0**
Total Future Development PE	**0**	**0**
Total Buildout PE	**308**	**30,800**
Total Future PE	**308**	**30,800**

Table 6: SC05_T2 and SC05_C1 Drainage Basin Future Development Summary

Description	PE	Wastewater (GPD)
Total Residential	468	46,800
Total Non-Residential	30	3,000
Total Constructed PE	0	0
Total Future Development PE	498	49,800
Total Buildout PE	**0**	**0**
Total Future PE	**498**	**49,800**

Table 7: Southeast Central 2 Drainage Basin Future Development Summary

Description	PE	Wastewater (GPD)
Total Residential	28	23,400
Total Non-Residential	0	
Total Constructed PE	**0**	**0**
Total Future Development PE	**28**	**2,800**
Total Buildout PE	**0**	**0**
Total Future PE	**28**	**2,800**

Table 8: Southeast Central and Main Drainage Basin Future Development Summary

Description	PE	Wastewater (GPD)
Total Residential	507	50,700
Total Non-Residential	385	38,500
Total Constructed PE	**14**	**1,400**
Total Future Development PE	**878**	**87,800**
Total Buildout PE	**0**	**0**
Total Future PE	**892**	**89,200**

Table 9: WOR East Drainage Basin Future Development Summary

Description	PE	Wastewater (GPD)
Total Residential	466.9	46,690
Total Non-Residential	691.1	69,110
Total Constructed PE	**543.5**	**54,350**
Total Future Development PE	**614.5**	**61,450**
Total Buildout PE	**0**	**0**
Total Future PE	**1,158.0**	**115,800**

Table 10: WOR West Drainage Basin Future Development Summary

Description	PE	Wastewater (GPD)
Total Residential	40	4,000
Total Non-Residential	68	6,800
Total Constructed PE	**68**	**6,800**
Total Future Development PE	**40**	**4,000**
Total Buildout PE	**0**	**0**
Total Future PE	**108**	**10,800**

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Appendix D
STC Westside Development Tables

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Table 1: Renaux Manor Future Development Summary

Description	PE	Wastewater (GPD)
Total Residential	2,189	218,900
Total Non-Residential	88	8,800
Total Constructed PE	**331**	**33,100**
Total Future Development PE	**30**	**3,000**
Total Buildout PE	**1,916**	**191,600**
Total Future PE	**2,277**	**227,700**

Table 2: Zylstra Subbasin Future Development Summary

Description	PE	Wastewater (GPD)
Total Residential	0	0
Total Non-Residential	153.8	15,380
Total Constructed PE	**108.8**	**10,880**
Total Future Development PE	**45**	**4,500**
Total Buildout PE	**0**	**0**
Total Future PE	**153.8**	**15,380**

Table 3: Gravity WWTF Subbasin Future Development Summary

Description	PE	Wastewater (GPD)
Total Residential	2,036	203,600
Total Non-Residential	3,426	337,600
Total Constructed PE	**864**	**86,400**
Total Future Development PE	**2,451**	**245,100**
Total Buildout PE	**2,147**	**214,700**
Total Future PE	**5,462**	**546,200**

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APPENDIX E
ECOCAT REPORT FOR MAIN WWTF

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Ecological Compliance Assessment Tool

Applicant: Trotter and Associates, Inc. on behalf of the City of St. Charles, IL

IDNR Project Number: 2413449

Contact: Irena Hix

Date: 04/19/2024

Address: 40W201 Wasco Road, Suite D
St. Charles, IL 60175

Project: St. Charles Main WWTF Biological Process Upgrades
Address: 1405 S. 7th Avenue, St. Charles

Description: Upgrades to the biological process and holding basins.

Natural Resource Review Results

Consultation for Endangered Species Protection and Natural Areas Preservation (Part 1075)

The Illinois Natural Heritage Database contains no record of State-listed threatened or endangered species, Illinois Natural Area Inventory sites, dedicated Illinois Nature Preserves, or registered Land and Water Reserves in the vicinity of the project location.

Wetland Review (Part 1090)

The Illinois Wetlands Inventory shows wetlands within 250 feet of the project location.

An IDNR staff member will evaluate this information and contact you to request additional information or to terminate consultation if adverse effects are unlikely.

Location

The applicant is responsible for the accuracy of the location submitted for the project.

County: Kane

Township, Range, Section:
40N, 8E, 34
40N, 8E, 35

IL Department of Natural Resources Contact
Adam Rawe
217-785-5500
Division of Ecosystems & Environment

Government Jurisdiction
IL Environmental Protection Agency
Irena Hix on behalf of the City of St. Charles
40W201 Wasco Road, Suite D
St. Charles, Illinois 60175

Disclaimer

The Illinois Natural Heritage Database cannot provide a conclusive statement on the presence, absence, or condition of natural resources in Illinois. This review reflects the information existing in the Database at the time of this inquiry, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project's implementation, compliance with applicable statutes and regulations is required.

Terms of Use

By using this website, you acknowledge that you have read and agree to these terms. These terms may be revised by IDNR as necessary. If you continue to use the EcoCAT application after we post changes to these terms, it will mean that you accept such changes. If at any time you do not accept the Terms of Use, you may not continue to use the website.

1. The IDNR EcoCAT website was developed so that units of local government, state agencies and the public could request information or begin natural resource consultations on-line for the Illinois Endangered Species Protection Act, Illinois Natural Areas Preservation Act, and Illinois Interagency Wetland Policy Act. EcoCAT uses databases, Geographic Information System mapping, and a set of programmed decision rules to determine if proposed actions are in the vicinity of protected natural resources. By indicating your agreement to the Terms of Use for this application, you warrant that you will not use this web site for any other purpose.

2. Unauthorized attempts to upload, download, or change information on this website are strictly prohibited and may be punishable under the Computer Fraud and Abuse Act of 1986 and/or the National Information Infrastructure Protection Act.

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EcoCAT operates on a state of Illinois computer system. We may use software to monitor traffic and to identify unauthorized attempts to upload, download, or change information, to cause harm or otherwise to damage this site. Unauthorized attempts to upload, download, or change information on this server is strictly prohibited by law.

Unauthorized use, tampering with or modification of this system, including supporting hardware or software, may subject the violator to criminal and civil penalties. In the event of unauthorized intrusion, all relevant information regarding possible violation of law may be provided to law enforcement officials.

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EcoCAT generates a public record subject to disclosure under the Freedom of Information Act. Otherwise, IDNR uses the information submitted to EcoCAT solely for internal tracking purposes.

Illinois Department of
Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
http://dnr.state.il.us

JB Pritzker, Governor
Natalie Phelps Finnie, Director

April 19, 2024

Irena Hix
Trotter and Associates, Inc. on behalf of the City of St. Charles, IL
40W201 Wasco Road, Suite D
St. Charles, IL 60175

RE: St. Charles Main WWTF Biological Process Upgrades
Project Number(s): 2413449
County: Kane

Dear Applicant:

This letter is in reference to the project you recently submitted for consultation. The natural resource review provided by EcoCAT identified protected resources that may be in the vicinity of the proposed action. The Department has evaluated this information and concluded that adverse effects are unlikely. Therefore, consultation under 17 Ill. Adm. Code Part 1075 and 1090 is terminated.

Consultation for Part 1075 is valid for two years unless new information becomes available that was not previously considered; the proposed action is modified; or additional species, essential habitat, or Natural Areas are identified in the vicinity. If the project has not been implemented within two years of the date of this letter, or any of the above listed conditions develop, a new consultation is necessary. Consultation for Part 1090 (Interagency Wetland Policy Act) is valid for three years.

The natural resource review reflects the information existing in the Illinois Natural Heritage Database and the Illinois Wetlands Inventory at the time of the project submittal, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project's implementation, you must comply with the applicable statutes and regulations. Also, note that termination does not imply IDNR's authorization or endorsement of the proposed action.

Please contact me if you have questions regarding this review.

Adam Rawe
Division of Ecosystems and Environment
217-785-5500

APPENDIX F
ECOCAT REPORT FOR WEST SIDE WRF

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City of St. Charles

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