



REGION 5

CHICAGO, IL 60604

Purpose: Compliance Monitoring Inspection

Facility: Lakewood Wastewater Treatment Plant (WWTP) and collection system
1699 Valley Pkwy
Lakewood, Ohio 44116

Date of Inspection: March 25, 2025

U.S. EPA Representatives: William Jones, Environmental Engineer, 312-886-6058
Jones.William@epa.gov
Megan Bobb, Life Scientist, 312-353-6057
Bobb.Megan@epa.gov

Ohio EPA Inspector(s): Erm Gomes, Ohio Environmental Protection Agency (OEPA) Northeast District Office; (330) 963-1196;
erm.gomes@epa.ohio.gov
Josh Herold, OEPA Northeast District Office; (330) 963-1224
joshua.herold@epa.ohio.gov
Samantha Thompson, OEPA Northeast District Office;
samantha.thompson@epa.ohio.gov
Tomas Parry, OEPA Northeast District Office;
tomas.parry@epa.ohio.gov

Facility Representatives: Mark Papke, City Engineer, (216) 529-6807;
mark.papke@lakewoodoh.gov
Mirko Kucinic, WWTP Manager, (216) 529-5939;
mirko.kucinic@lakewoodoh.net
Chris Gordon, Director of Public Works, (216) 529-6692
Josh Conrad, Geographic Information Systems Coordinator

Report Prepared by: Bill Jones, Environmental Engineer, 312-886-6058
Water Enforcement and Compliance Assurance Branch, Section 1
Jones.William@epa.gov

Inspector Signature: WILLIAM JONES Digitally signed by WILLIAM JONES
Date: 2025.04.23 12:05:06 -05'00'

Approver Name and Title: Molly Smith, Section 1 Supervisor, Water Enforcement and Compliance Assurance Branch

Approver Signature: MOLLY SMITH Digitally signed by MOLLY SMITH
Date: 2025.04.23 13:42:34 -05'00'

Purpose of Inspection:

The purpose of the inspection in which the U.S. EPA participated was to assist and observe the Ohio EPA in their inspection of the progress related to the Interim Consent Decree between Lakewood, OH, OEPA, and U.S. EPA.

INTRODUCTION

On March 25, 2025, U.S. EPA Inspectors Bill Jones and Megan Bobb participated in OEPA's routine compliance inspection of the City of Lakewood's Wastewater Treatment Plant, including their nine permitted combined sewer overflows (CSOs). Erm Gomes of the OEPA's Northeast District Office lead a planned inspection of the City's collection system and the Chemically Enhanced High-Rate Treatment Facility (CEHRT). Inspectors William Jones and Megan Bobb accompanied OEPA on an inspection of some of the city's permitted CSOs and a walkthrough of the WWTP and CEHRT.

EPA Inspectors and OEPA Inspectors arrived at the Lakewood City Hall at 8:00 am EST on March 25, 2025. The inspection began with a presentation from Mark Papke, of the City of Lakewood, on the current rehabilitation project on the City's Interceptor, Consent Decree Updates, and demonstration of the City's Geographic Information System (GIS) capabilities, which include a mapped sewer system utilized for maintenance ticketing, inspection planning, and electronic record-keeping. At approximately 10:50 am EST, the presentation was adjourned, and the group began the inspection of the collection system and WWTP.

Background:

The following information was shared by the City of Lakewood inspection participants during the opening conference:

The Lakewood Collection System and WWTP serves a population of approximately 50,000, draining both to Lake Erie to the north and Rocky River to the west. The system can also drain sewage to the east, to the North-East Ohio Regional Sewer District. The system was initially constructed in the early 1900s; the eastern and northern portions mainly drain into Lake Erie, while the southwest portion drains into Rocky River. Approximately 77% of combined sewer and stormwater flowing into Lake Erie drain to the Interceptor Sewer, which conveys combined sewage to the WWTP. The western 75% of Lakewood uses two pipes to collect dry and wet weather flow, with some single pipe combined sewers intermingled. The local sewers use an over/under configuration from the 1920s and 1930s, which utilize an invert plate to separate the stormwater from the sewage underneath. Overtime, the cement sealant on the plates has degraded (see Photo 2), along with the mortar joints on the interceptor, which has allowed for inflow and infiltration (I/I) into the sanitary sewer pipe underneath. This overall increase in flow has caused unpermitted discharges into Lake Erie and Rocky River.

On January 31, 2023, the City of Lakewood entered a Consent Decree with the U.S. EPA and the Ohio EPA to address violations of its National Pollutant Discharge Elimination System (NPDES) Permit #OH0026018 and unpermitted CSOs. As part of this Consent Decree, Lakewood, OH submitted an Integrated Wet Weather Improvement Plan (IWWIP), which included a “bundled,” approach to compliance, and where this interim Consent Decree would be revisited. The Bundle 1 Project Schedule included the construction and full operation of a CEHRT by December 2024. In their January 2025 Update Report, the City of Lakewood stated they had reached full operation of the CEHRT, as outlined in the Consent Decree. The City of Lakewood operator reported that 5 million gallons per day (MGD) was the most they have processed in one day since reaching full operation. The operator also stated that mostly the City is just running for a few hours, so the start up and shut down are important to keep the equipment from freezing in the wintertime.

Construction started on the City’s interceptor in April 2023 and will continue into September of 2025. The original sewer was brick and mortar, and as such has deteriorated and collapsed in certain areas and has allowed for increased I/I. AECOM was contracted to rehabilitate the sewer using Glass Reinforced Polymer (GRP) (See Photo 13) to line the newly cleaner sewer. Mark Papke suggested that they have already seen a 31% decrease in nightly flow attributed to decreased I/I. In conjunction with the interceptor rehabilitation, several combined sewers and over/under sewers have been separated and continue to be planned with yearly watermain replacements. The City uses a GIS overlay to show where and when manhole separations are planned.

Lakewood has completed the design for CSO 052 storage, which is set to start construction in June 2026, as part of their Consent Decree. Mark Papke reviewed the 6.1 million gallon storage facility design, which will be constructed next to the WWTP (see Photo 19). The design includes sewer construction from the CSO conveyance under Rocky River to the storage point. The City

reports overflows monthly to OEPA as part of the CD, and quarterly and annual reports to U.S. EPA and OEPA.

Process Description:

Lakewood reported achieving full operation in April 2024 for the new CEHRT at their WWTP. This facility is designed to handle 35 MGD of additional wastewater flow during wet weather events. A weir at the end of the east aerial sewer (see Photo 12) conveys additional water to the CEHRT, which goes through screening and degritting, then ballasted flocculation and Ultraviolet (UV) disinfection before discharging to Lake Erie. The entire process to treat flow as it enters is 15 min from influent to effluent. The sludge gets pumped to the WWTP and hauled off as waste.

Their WWTP averages a flow of 6 million gallons per day (MGD), but can take up to 50 MGD, and undergoes screening and degritting, primary settling, gravity sludge thickening (Recycled Activated Sludge (RAS)) is pumped back into tanks after final settling), aeration, phosphorus removal, final settling, disinfection (May-October), and discharges to Rocky River and Lake Erie.

FACILITY WALK-THROUGH OCCURRED:

Yes

Data Collected and Observations:

Collection System (See Photos 1-10)

At 12:08 p.m. EST, observed AECOM lining the interceptor at Webb and Edgewater Drive. Contractor explained that this project would line about 21,000 feet of interceptor, and take about 2.5 years to complete. The contractor will install Flo-Dar meters to monitor interceptor flow rates at the turn southward toward the WWTP, once electrical work complete.

At 12:31 p.m. EST, observed adjacent manholes for CSO 059, separated, as one for sampling and the other for access to sewer. The lot to the west of the manholes has been purchased for the proposed CSO 059 storage facility (1.5 MG), which is scheduled in the CD to begin construction June 2030.

CEHRT and WWTP (See Photos 11-25)

At 4:10 p.m. EST, observed high turbulence at the inflow site to the primary clarifiers, (see Photo 21). Flow meter read 4.18 MGD (see Photo 20), which the plant operator described as normal for the facility. The design structure of the conveyance is a Parshall flume and there are some irregularities in the channel just above it. Flow measurements are taken at the narrow point (see Photo 21).

At 4:53 p.m. EST, observed debris, scrap metal, and an uncovered dumpster with holes in the bottom near the stormwater drains (see photos 23-24). The plant operator explained that all storm drains are equipped with filtration systems (see photo 25).

Photos and/or Videos: were taken during the inspection.
See Appendix A.

RECORDS REVIEW

List of Records Reviewed Onsite:

1. *Lakewood Collection System Update Presentation, dated March 25. 2025;*
2. *Chemically Enhanced High Rate Treatment Facility Guide, dated December 2022; and*
3. *WWTP Facility Guide, dated October 2022*

Facility Name: Lakewood Collection System

Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116

Date of Inspection: March 25, 2025

APPENDICES AND ATTACHMENTS

1. Appendix A: Digital Image Log
2. Appendix B: Lakewood Collection System Presentation
3. Appendix C: Lakewood CEHRT Guide
4. Appendix D: Lakewood WWTP Guide

Facility Name: Lakewood Collection System and WWTP
Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116
Date of Inspection: March 25, 2025

APPENDIX A: DIGITAL IMAGE LOG

**Lakewood Collection System
EPA Inspection March 25, 2025
All photos taken by Megan Bobb, Life Scientist, U.S. EPA
Camera: Pentax Optio WG-1 GPS**



1: IMGP0001

Description: Manhole showing weir structure to CSO 057 to the North, flow circles around and drops into Interceptor. At high flow, outfalls to CSO 057.

Location: CSO 057 and Edgewater Dr in Lakewood Park.

Date/Time: March 25, 2025/11:28 a.m.

Facility Name: Lakewood Collection System and WWTP
Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116
Date of Inspection: March 25, 2025



2: IMG0002

Description: CSO 056, Over-under sewer showing plate removed and sanitary flow from bottom pipe.

Sampler will collect 4000 mL every significant event

Location: CSO 056 and Edgewater Dr.

Date/Time: March 25, 2025/ 11:46 a.m.



3: IMG0003

Description: Manhole showing weir structure to CSO 055 to the North.

Location: CSO 055, Edgewater Dr.

Date/Time: March 25, 2025/ 11:58 a.m.

Facility Name: Lakewood Collection System and WWTP
Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116
Date of Inspection: March 25, 2025



4: IMG0004

Description: Construction of Interceptor Replacement at Webb St.

Location: Webb and Edgewater Dr.

Camera Direction: West

Date/Time: March 25, 2025 / 12:08 p.m.



5: IMG0005

Description: Construction of Interceptor Replacement at Webb St. Interceptor turns south toward WWTP.

Location: Webb and Edgewater Dr.

Date/Time: March 25, 2025 / 12:09 p.m.

Facility Name: Lakewood Collection System and WWTP
Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116
Date of Inspection: March 25, 2025



6: IMGP0006

Description: Reinforced manhole to CSO 059.

Location: CSO 059

Date/Time: March 25, 2025 / 12:31 p.m..



7: IMGP0007

Description: City acquired lot for CSO 059 Storage Facility

Location: CSO 059

Camera Direction: Southwest

Date/Time: March 25, 2025 / 12:31 p.m.

Facility Name: Lakewood Collection System and WWTP
Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116
Date of Inspection: March 25, 2025



8: IMG008

Description: Sampling Device and Flow Monitor

Location: CSO 059

Date/Time: March 25, 2025 / 12:32 p.m.

Facility Name: Lakewood Collection System and WWTP
Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116
Date of Inspection: March 25, 2025



9. IMGP009

Description: Monitoring and Sampling point at two different locations due to access issues

Location: CSO 059

Camera Direction: Northeast

Date/Time: March 25, 2025 / 12:32 p.m

Facility Name: Lakewood Collection System and WWTP
Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116
Date of Inspection: March 25, 2025



10: IMG00010

Description: Over-under sewer towards CSO 052

Location: Madison Ave. E. of Rocky River

Date/Time: March 25, 2025 / 12:52 p.m.



11: IMG00011

Description: CSO 052 Outfall at the end of the road into Rocky River, inaccessible on foot

Location: Madison Ave. E. of Rocky River

Camera Direction: West

Date/Time: March 25, 2025 / 12:53 p.m.

Facility Name: Lakewood Collection System and WWTP
Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116
Date of Inspection: March 25, 2025



12: IMG0012

Description: East End Aerial Sewer, Pipe to the right sends to CEHRT once flow reaches WWTP Capacity

Location: Headworks WWTP and CEHRT

Camera Direction: Northeast

Date/Time: March 25, 2025 / 3:13 p.m.



13: IMG0013

Description: Glass Reinforced Polymer (GRP) Lining for Interceptor Rehabilitation

Location: Stored outside the CEHRT Facility

Camera Direction: Northeast

Facility Name: Lakewood Collection System and WWTP
Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116
Date of Inspection: March 25, 2025

Date/Time: March 25, 2025 / 3:17 p.m.



14: IMGP0014

Description: Controls for Screening System

Location: CEHRT Entry Room

Date/Time: March 25, 2025 / 3:20 p.m.



15: IMGP0015

Description: Automated SCADA System for CEHRT Screening Pumps

Location: CEHRT Entry Room

Date/Time: March 25, 2025 / 3:24 p.m.

Facility Name: Lakewood Collection System and WWTP
Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116
Date of Inspection: March 25, 2025



16: IMGP0016

Description: Aqua Guards Rotating Screens, 35 MGD Design Flow

Location: CEHRT Screening Chamber

Date/Time: March 25, 2025 / 3:25 p.m.



17: IMGP0017

Description: Screening Conveyance to Waste Dumpsters, hauled out with WWTP waste

Location: CEHRT Screening Chamber

Date/Time: March 25, 2025 / 3:25 p.m.

Facility Name: Lakewood Collection System and WWTP
Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116
Date of Inspection: March 25, 2025



18: IMG0018

Description: Automated Grit Separation System. When the Grit Tank is less than 12 ft., the coagulation tank blades turn off to prevent damage. Currently have Raw Water in tank to flush system before anticipated flow (level at time of record 12.83 ft.)

Location: CEHRT

Date/Time: March 25, 2025 / 3:30 p.m.



19: IMG0019

Description: Location of proposed CSO 052 Storage Facility (to initiate construction in June 2026)

Location: South of CEHRT

Camera Direction: Southeast; Date/Time: March 25, 2025 / 3:58 p.m.

Facility Name: Lakewood Collection System and WWTP
Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116
Date of Inspection: March 25, 2025



20: IMGP0020

Description: Flow monitoring at Clarifier inflow, observed flow rate of 4.18 MGD; WWTP Operator stated this was normal but could reach as high as 50 MGD. Structure could be causing higher numbers (see Photo 21).

Location: WWTP Primary Clarifiers; Date/Time: March 25, 2025 / 4:08 p.m.



21: IMGP0021

Description: Primary Clarifier Inflow from Grit/Screening; observed high turbidity due to Parshall flume at inflow.

Location: WWTP Primary Clarifiers; Camera Direction: North; Date/Time: March 25, 2025 / 4:10 p.m.

Facility Name: Lakewood Collection System and WWTP
Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116
Date of Inspection: March 25, 2025



22: IMG0022

Description: Sampling monitor room for WWTP Effluent Flow.

Location: WWTP

Date/Time: March 25, 2025 / 4:31 p.m.



23: IMG0023

Description: Scrap metal on ground and open dumpster with holes for drainage near storm drain

Location: West Parking Lot of WWTP

Camera Direction: North

Date/Time: March 25, 2025 / 4:53 p.m.

Facility Name: Lakewood Collection System and WWTP
Facility Location: 1699 Valley Pkwy, Rocky River, OH 44116
Date of Inspection: March 25, 2025



24: IMG0024

Description: Sediment and dirt piled up around the storm drain

Location: West Parking Lot of WWTP

Camera Direction: North

Date/Time: March 25, 2025 / 4:53 p.m.



25: IMG0025

Description: Stormwater filtration system in all storm drains in WWTP

Location: West Parking Lot of WWTP

Date/Time: March 25, 2025 / 4:55 p.m.

Ohio EPA Collection System Inspection Updates



City of Lakewood
Department of Engineering & Construction

Mark K. Papke, PE, CPESC
City Engineer

A t t e n d e e s

Mark Papke – Lakewood City Engineer

Chris Gordon – Lakewood Public Works Director

Josh Conrad – GIS Coordinator (GIS demonstration portion)

Erm Gomes – Ohio EPA NE District Office

Joshua Herold – Ohio EPA NE District Office

Samantha Thompson – Ohio EPA NE District Office

Tomas Parry – Ohio EPA NE District Office

Megan Bobb – US EPA Region 5

William Jones – US EPA Region 5



AGENDA

Interceptor

Interim Partial
Consent
Decree

Overflow
Monitoring &
DCS

CMOM

GIS & Field
Apps

Questions

Interceptor - History

Installed in 1918 incrementally and completed in 1940s after street sewers were built

20,128' in length

20' deep at east end to 94' deep at west end

Carries +/- 77% of sanitary and combined sewer to WWTP

Consists of Segmental tile Cleveland Egg-Shaped Sewer (56.5" high by 42.5" wide)

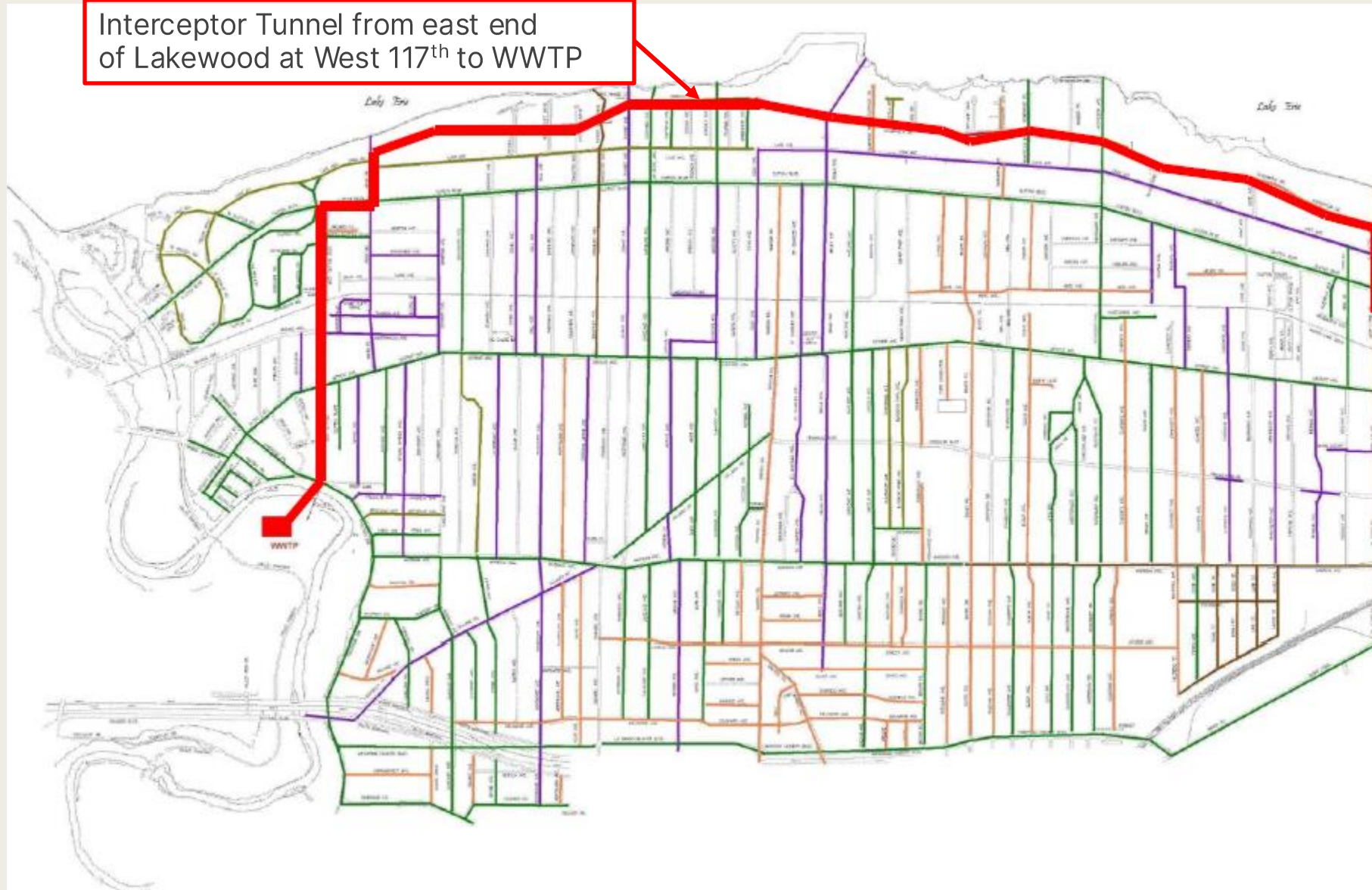
33 manholes

Located primarily through residential areas and a portion of the Gold Coast



Interceptor - Location

Interceptor Tunnel from east end
of Lakewood at West 117th to WWTP



Interceptor Issues

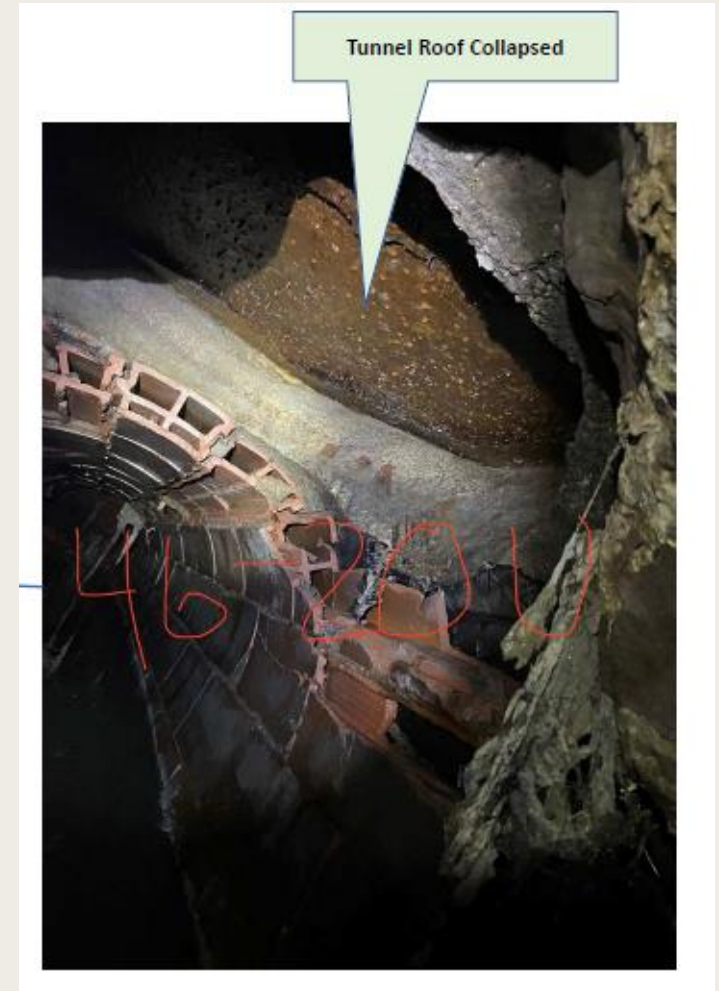


Typical Tunnel
Mortar deteriorated
from microbial
induced corrosion

Through overflow monitoring program, discovered increase in volume of CSO water discharge in 2021 model versus actual flow meter. Investigation found several areas where interceptor roof collapsed causing dams. Hired emergency contractor to repair areas.

The hydrogen sulfide within the sanitary sewage is creating sulfuric acid that is rapidly deteriorating the mortar joints of the segmented tile joints. Once the mortar joints fail the segmented tiles come apart and elevated water further erodes the next sections of segmented tile.

In 2022, contracted AECOM to design Rehabilitation.



Interceptor Rehabilitation Design 2022

Cleaned entire interceptor

Multi-sensor platform equipped with high-definition CCTV and time-of-flight LIDAR profiling above flow line and SONAR profiling below flow line.

Evaluated multiple rehabilitation techniques

Selected segmental Glass Reinforced Polymer (GRP) composites due to ability to match wide array of subtle cross section changes, overall constructability, ability to install without bypassing sewer flows, less number of shafts, and life cycle cost considerations.

Determined locations of shafts and met with all impacted property owners. All work within Right of Way with exception to 3 that required Right of Entries.

Adding 3 permanent real-time flow meters for monitoring flows and assisting with CD requirements



Interceptor Construction

Design in 2022

Bid & Award in March 2023

Construction April 2023 to September 2025

Cost = \$25.4 million

Funding ARPA and OPWC

Established project specific website and public education and outreach.

<https://www.lakewoodoh.gov/lakewood-interceptor/>



Interceptor Before & After



Interceptor progress

Cleaned & Inspected – 88%

Lined & Grouted – 77%

13 Shafts Total

- 10 Completed & Restored

- 2 Installed being prepared for slip lining

- Last Shaft to begin this week

16 of 25 manholes rehabilitated

Project on track to meet completion September of 2025



Chemically Enhanced High-Rate Treatment Facility - \$23.5 million

Construction completed in September 2022

Achievement of Full Operation December 2024

Wet Weather Operation Plan Submitted July 2024

Semi-Annual Reporting submitted to Erm April and October

CSO-052 Storage Facility (6.1 MG) - \$39.1 million

Complete Design and Permitting June 1, 2025

PTI submitted and under review

NOI obtained 3GC15692*AG

USACE NWP 58 obtained

401 waived and 404 permit obtained

CSO-059 - \$25 million

Summer 2025 beginning Data Collection & Analysis



Interim Partial Consent Decree Update

2022 Watermain Replacement – Completed - \$7.4 million

Gladys – CIPP lined under sewer, all ROW laterals replaced & manholes rehabbed

*Andrews – CIPP lined under sewer, manhole separations, & all ROW laterals replaced

Added storm water detention system to reduce potential for basement backups

2023 Watermain Replacement – Completed - \$6.9 million

Elmwood & Reveley – CIPP lined under sewer & manholes rehabbed

*Parkwood – CIPP lined under sewer, manhole separations, & all ROW laterals replaced

2024 Watermain Replacement – Completed - \$4.9 million

Glenbury, Mars & Marlowe Avenues – CIPP lined Under Sewer & manholes rehabbed

Lewis Drive Sewer Improvements – Completed - \$6 million

**Relief Sewer Constructed, CIPP lined under sewer, manhole separations, & all ROW laterals replaced

*Pre-construction flow monitoring & sampling collected in design.

** Pre-Construction flow monitoring collected in design.



Future Collection System work planned

2025 Watermain Replacement – Bidding in April - \$10 million

Northland (Delaware to Hilliard) & Norton – Plan to CIPP line under Sewer & rehab manholes

*Northland (Madison to Detroit) - Plan to CIPP line under sewer,
Manhole separations, replace all ROW laterals, & rehab manholes

CUY-Bunt Rd Rehabilitation – Construction 2026 to 2028 - \$22.4 million

Lakewood Hts to Madison – Plan to CIPP line Combo Sewer & rehab manholes

*Madison to Clifton - Plan to CIPP line under sewer, Manhole separations, replace all ROW laterals, & rehab manholes

*Pre-construction flow monitoring & sampling collected in design.



City has Clean Water Lakewood website

<https://www.lakewoodoh.gov/cleanwaterlakewood/>



The site contains Interim Partial Consent Decree,
Semi-Annual Reports, All CD projects, IWWIP Phases I & II, CSO
information, and Lead Service Line Information

Semi-Annual reporting January and July every year per Interim Partial
CD

Overflow Monitoring

54 monitoring locations

38 area-velocity meters

16 ultrasonic meters

3 Rain Gauges

City Hall (East), Fire Station #1 (Middle), & WWTP (West)

Monthly reporting to Erm Gomes

CSO Alerts and Status

<https://cso.lakewoodoh.gov/>



2024 City Cleaning

Sanitary – 92,452'

Combination – 58,258'

Interceptor – 13,585'

Storm – 97,180'

Catch basins - 493

2024 Cuyahoga County Contracted

Sanitary – 40,521'

City owns & operates 2 lift stations monthly routine maintenance performed by WWTP personnel

Both equipped with natural gas backup generators & alarms



Personnel - 16

Water/Wastewater Collection Division Manager - 1

Project Manager - 1

Group Leader - 1

Dig Crew – 3

CCTV Camera Operators – 2

Sewer Jet Operators – 2

Sewer Maintenance Crew – 6 (1 currently vacant)

Major Equipment

Vactors – 2 (new one coming in June old one converting to hydro excavating only)

Hydro excavator - 1

Vactor Truck #815 for catch basin cleaning - 1

Camera Truck CCTV Envirosight with Lateral Launch -1

Push cameras -2

Backhoe - 1

Front End Loader – 1

Rigid Snakes 1.25” and Vivax Metrotech Vloc3 Utility Locator



NPDES

CSWCD – MCM #1 and #2

CCBH – MCM #3

One current illicit discharge held administrative hearing on 3/12/2025.
Owner entered agreement completion by 6/10/2025

CSWCD – MCM #4 and #5

City Staff – MCM #6

Annual training CCBH

Quarterly inspections and Annual Inspection

Note: WWTP personnel perform separate routine inspections and sampling from WWTP outfalls per facility plan



Demonstration (As Requested)

- GIS System Mapped System
- Sewer OUPS Work Order Field App
- Dye Test App
- Sewer Call App
- CMOM Field Suite to track CMOM maintenance/requirements
 - Sewer Cleaning Maintenance
 - Catch basin Cleaning
 - Weir Checks & Hot Spots
- MCM#6 Facility Inspections and WWTP
- Manhole Clever Scan App

March 25, 2025

Questions



March 25, 2025

Thank you!

City of Lakewood Contacts:

Mark Papke, PE, CPESC

City Engineer

(216) 529-6807

Mark.papke@lakewoodoh.gov





WASTE WATER TREATMENT PLANT

Revised: October 2022

SCREENING / DEGRITTING

The screening/degritting building has two (2) influent channels, each containing an automatic bar screen. The bar screens are used to remove debris (screenings) out of the wastewater. The purpose of removing the screenings is to prevent clogging and damage to downstream process equipment. The screenings are deposited onto a conveyor system where they then pass thru a washing/compaction unit. The washing and compaction of the screenings allows for the pollutants (nutrients) bound up in the screenings to be removed and returned to the process waste stream for further treatment. The washed and compacted screenings are deposited into a dumpster for disposal at an approved landfill site.

After screening the wastewater flow enters one (1) of two (2) vortex tanks. The purpose of the vortex tanks is to allow heavy inert objects (grit) such as stones and sand to settle out. The grit slurry is then pumped out of the vortex tank and passes thru a degritting cyclone where excess moisture is removed from the slurry after which the dewatered grit is deposited into a dumpster for disposal at an approved landfill site.

PRIMARY SETTLING

The screened and degrittied wastewater then flows to the primary settling process. Here the flow enters a division well from which it is evenly distributed to the four (4) primary settling tanks. The average detention time in these tanks is two (2) hours. During this detention period settleable solids are gravitationally removed and floatable solids (grease) are skimmed off the tank surfaces. The settled solids are pumped to gravity sludge thickening tanks and the floatable skimmings are pumped to the primary digester tanks.

GRAVITY SLUDGE THICKENING

The gravity thickener process is where sludge settled out in the primary tanks is concentrated from one half percent (1/2%) to approximately five percent (5%). Once concentrated in the thickened sludge tanks the thickened sludge is pumped to the primary digester tanks.

Waste Activated Sludge (WAS) can also be decanted to the gravity thickened sludge tanks so that it also can be concentrated before being pumped to the primary digester tanks.

AERATION SYSTEM

The wastewater (primary effluent) flows from the primary settling tanks to the aeration tanks. The aeration system consists of eight (8) tanks which are divided into two (2) banks of four (4) tanks per bank. The primary effluent is evenly distributed into the two (2) banks of aeration tanks. Return Activated Sludge (RAS) which settles out in the final settling tanks is pumped into

the #1 - #2 - #5 and #6 aeration tanks. The RAS contains microorganisms that are needed to carry out the assimilation (reduction) of non-settleable pollutants (nutrients) that are found in the primary effluent. Since the sludge mass in the RAS is constantly increasing, a small percentage of the RAS flow must be disposed of, this is accomplished by wasting a given amount of RAS, known as Waste Activated Sludge (WAS), to the gravity thickened sludge tanks on a continuous basis.

A fine bubble diffuser system is used to distribute air throughout the aeration tanks. Each tank contains six hundred sixty (660) ceramic diffusers, not unlike the material used to make aeration stones for aquariums. Air is pumped into each aeration tank in order to keep the aerobic microorganisms alive.

PHOSPHORUS REMOVAL

Sodium aluminate is used to precipitate out phosphorus. It is added to the flow leaving the aeration tanks before it enters the final settling process. The removal of phosphorus helps in the reduction of algae blooms experienced in Lake Erie each summer.

FINAL SETTLING

The final settling process consists of six (6) settling tanks. The flow leaving the aeration tanks, known as Mix Liquor Suspended Solids (MLSS), is evenly distributed to the final settling tanks in service. Typically only two (2) final settling tanks are in service during normal flows (4 – 5 million gallons per day). When higher wet weather flows are experienced (up to 40 million gallons per day) the other reserve final settling tanks are placed into service. MLSS is a combination of aerobic microorganisms and primary settled effluent. The MLSS solids rapidly settle out in the final tanks leaving a clean clear effluent. The settled MLSS solids are now referred to as Return Activated Sludge (RAS) and are pumped back to the aeration tanks. The clean final effluent then is ready for discharge.

DISINFECTION

During the months of May – October the final effluent must be disinfected before being discharged. This is accomplished by using Ultra-Violet (UV) light. The UV light alters the DNA of E. coli bacteria so that they cannot replicate and thus the quantity in the final effluent is reduced.

SLUDGE DIGESTION/DISPOSAL SYSTEM

The digestion system consists of two (2) primary and two (2) secondary digestion tanks. The gravity thickened sludge is pumped to the primary anaerobic digestion tanks. The anaerobic digestion process further breaks down the pollutants found in the sludge by using microorganisms that live in the absence of oxygen. The digestion process requires holding the sludge for an extended period of time at a temperature in the range of 95 – 105 degrees F. A

by-product of the anaerobic digestion process is methane gas. The gas is collected and burnt in boilers in order to keep the sludge temperature in the acceptable range. Another benefit of the methane gas is that it is also used to heat a majority of the facility's buildings during the colder months.

Once digested the stabilized sludge is dewatered on filter presses. The digested sludge is approximately five percent (5%) solids and the dewatered sludge cake averages approximately twenty percent (20%) solids. The dewatered sludge (biosolids) is hauled to EPA approved land application; surface application and land fill sites. Approximately five thousand (5000) wet tons of biosolids are produced annually.

Process Description for Tours

DEFINITION of TERMS

AEROBIC – Requiring, or not destroyed by, the presence of free or dissolved oxygen in an aqueous environment.

ACIDITY – The capacity of an aqueous solutions to neutralize a base, raise the pH.

ALKALINITY – The capacity of an aqueous solution to neutralize an acid, lower the pH.

AMMONIA NITROGEN – The quantity of elemental nitrogen present in the form of ammonia (NH₃).

ANAEROBIC – A condition in which free and dissolved oxygen is unavailable. Requiring and not destroyed by the absence of free or dissolved oxygen.

BIOCHEMICAL OXYGEN DEMAND (BOD) – A measure of the quantity of oxygen used in the biochemical oxidation of organic matter in a specific time, at a specific temperature and under specific conditions.

CARBONACEOUS BIOCHEMICAL OXYGEN DEMAND (CBOD) – The depletion of dissolved oxygen by biological organisms in a body of water in which the contribution from nitrogenous bacteria has been suppressed.

CHEMICAL OXYGEN DEMAND (COD) – A measurement of the amount of organic compounds in water. Most applications of COD determine the amount of organic pollutants found in surface water (e.g. lakes and rivers) or wastewater.

DISSOLVED OXYGEN (DO) – The amount of oxygen that is carried in a given medium. It can be measured with a dissolved oxygen probe such as an oxygen sensor in liquid media, usually water/wastewater.

ESCHERICHIA COLI (E. COLI) – One of the species of bacteria in the fecal coliform group. It is found in large numbers in the gastrointestinal tract and feces of warm-blooded animals. Its presence is considered indicative of fresh fecal contamination, and is used as an indicator organism for the presence of less easily detected pathogenic bacteria.

EFFLUENT – Wastewater flow out of a treatment process or wastewater facility.

INFLUENT – Wastewater flow into a wastewater facility or treatment process.

mgd – Million Gallons per Day. A measurement of flow.

mg/L – Milligrams per liter, a measurement of concentration equal to parts per million.

NITROGEN – An essential nutrient that is often present in wastewater as ammonia, nitrate, nitrite and organic nitrogen.

NUTRIENT – Any substance that is assimilated by organisms and promotes growth.

pH – A measure of hydrogen-ion concentration in a solution. Using a scale of (0 – 14 S.U.). With 7 being neutral the lower the value goes the greater the acidity and the higher the value goes the greater the alkalinity of the substance.

PHOSPHORUS – An essential chemical element and nutrient for all life forms.

SETTLED – Wastewater flow after primary treatment.

TOTAL SUSPENDED SOLIDS (TSS) – The amount of insoluble solids floating and in suspension in wastewater. The dry-weight of particles trapped by a filter, typically of a specified pore size.

Digester Improvement Project, 2019 – 2021 noticeable changes:

- Two Primary Digesters Operation was reduced to one Primary Digester operation
- Secondary Digesters Tanks are converted into Sludge Storage Tanks
- Primary Digester #2 Dual Membrane Cover installed to increase methane gas pressure and storage capacity
- New methane and natural gas piping to the ERB (Energy Recovery Building)
- New Pump & Nozzle Mixing System installed in the Primary Digester #2
- New Hot Water Pumps and Piping
- New BRB (Energy Recovery Building)
- Two (2) New boilers, 1.5 million BTU's each
- New Digester Sludge Recirculating Pumps and Heat Exchangers
- Methane Gas Condition System
- New PLC (Programmable Logic Controller) and Controls
- 100 KW CHP (Combined Heat & Power) Generator. The CHP uses methane gas as a fuel, and when running produces around 30% of the plant's electrical demand
- ERB PLC incorporated into the Lakewood SCADA (Supervisory Control and Data Acquisition) System
- Two (2) new Thickened Sludge Grinders

Disinfection Chamber

Number of Tanks	1
Size (each)	80' l x 22.5 w 10.7' swd
Type	Ultraviolet

Primary Anaerobic Digester Tanks

Number of Tanks	2
Size (each)	75' dia x 22.5' swd
Volume (each)	745,523 gal - 99,403 cu ft
Total Volume	1.49 million gal - 198,806 cu ft

Secondary Anaerobic Digester Tanks

Number of Tanks	2
Size (each)	60' dia x 22.5' swd
Volume (each)	477,128 gal - 63,617 cu ft
Total Volume	954,256 gal - 127,234 cu ft

Sludge Storage Tank

Number of Tanks	1
Size (each)	75' dia x 21.5' swd
Volume (each)	712,380 gal

DESIGN DATA

Degritting Vortexes

Number of Tanks	2
Size (each)	16' Diameter
Volume (each)	20 mgd

Primary Settling Tanks

Number of Tanks	4
Size (each)	65' dia x 8.17' swd
Volume (each)	203,333 gal - 27,111 cu ft
Total Volume	813,332 gal - 108,444 cu ft

Sludge Thickening Tanks

Number of Tanks	2
Size (each)	35' dia x 10' swd
Volume (each)	72,159 gal - 9,621 cu ft
Total Volume	144,318 gal - 19,242 cu ft

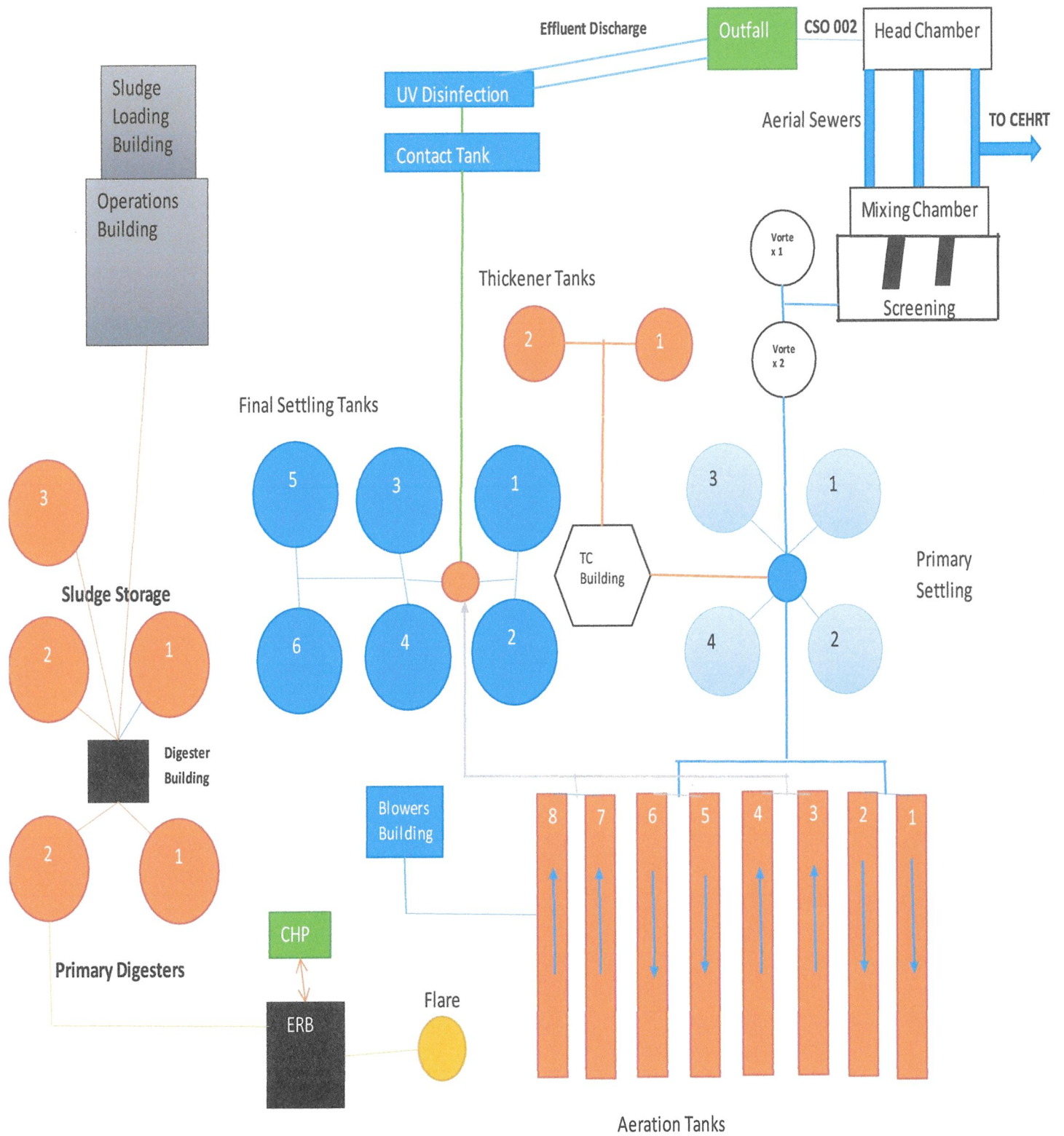
Aeration Tanks

Number of Tanks	8
Size (each)	153' l x 30' w x 13' swd
Volume (each)	447,525 gal - 59,670 cu ft
Total Volume	3.58 million gal - 477,360 cu ft

Final Settling Tanks

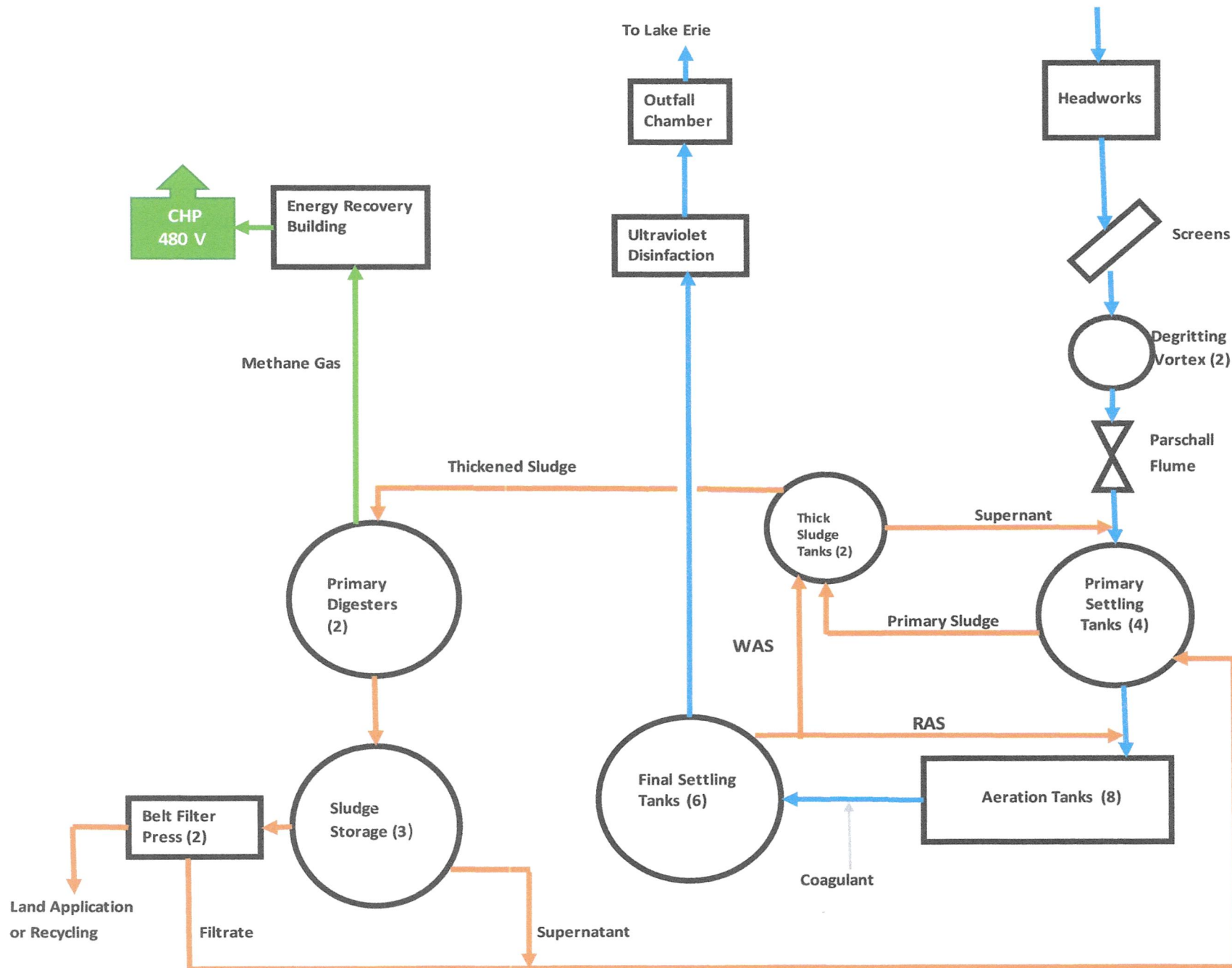
Number of Tanks	6
Size (each)	75' dia x 10.25' swd
Volume (each)	339,623 gal - 45,283 cu ft
Total Volume	2.04 million gal - 271,698 cu ft

LAKEWOOD WASTEWATER TREATMENT PLANT DIAGRAM



LAKEWOOD WWTP - PROCESS FLOW DIAGRAM

6



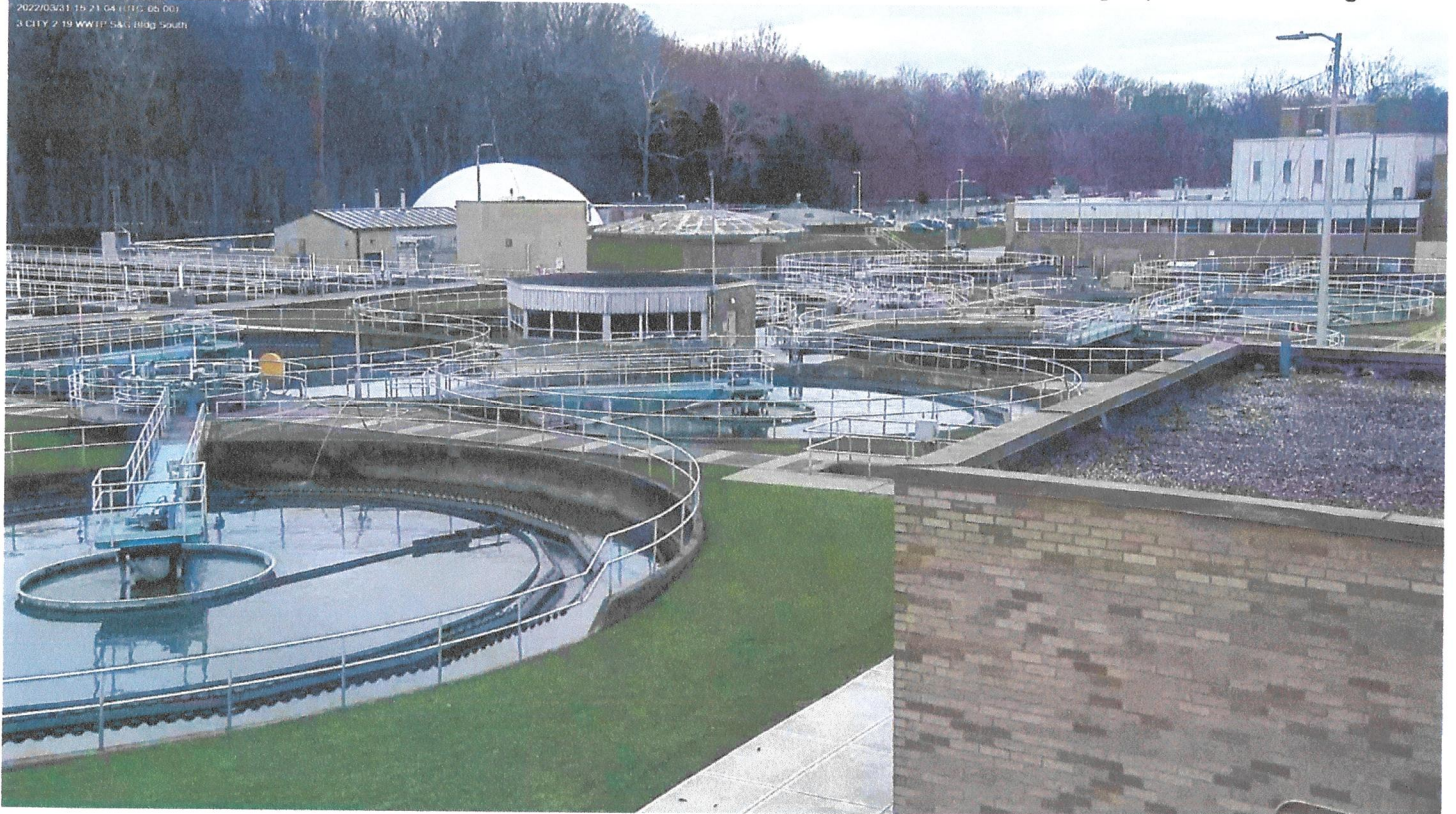
CHP (Combined Heat & Power) Generator and ERB (Energy Recovery Building)



Blowers Building, Energy Recovery Building, and Primary Digesters



Primary Settling Tank #1, Tunnel Control Building, Blower Building, Energy Recovery Building, Operations Building



WWTP Effluent, Final Clarifiers #3 and #5



Final Clarifiers, S&G Building, CEHRT Facility



Lakewood WWTP and CEHRT (Chemically Enhanced High Rate Treatment) Plant Aerial View





CEHRT FACILITY

December 2022

CEHRT AERIAL VIEW



Lakewood WWTP and CEHRT Overview

The Lakewood WWTP is designed to effectively treat 18 MGD (Millions of Gallons a Day) of sewage. The sustained wet-weather treatment capacity of the biological process is 30 MGD, with the maximum hydraulic flow capacity of 40 MGD. During dry weather, the average daily flow into the WWTP is 7 MGD.

In the event of greater than ¼ inch of rain, the WWTP flow usually jumps up to 40 MGD in half an hour or less. Prior to the construction of the CEHRT, any flow over 40 MGD was discharged at CSO 002 (Combined Sewer Overflow 002) directly into Lake Erie without any treatment.

Most of the sewage flow (around 90%) into the WWTP flows through 3 aerial sewer pipes, 48-inch diameter each, running across the Rocky River. The remaining 10% of the flow is coming from Lakewood's West End through a 30-inch aerial sewer pipe, installed in 2015, and from the City of Rocky River (around 100 households).

To eliminate/minimize CSO 002 flow, the City of Lakewood built the Chemically Enhanced High-Rate Treatment (CEHRT) Plant. The construction of the CEHRT was completed in 2021.

The CEHRT Plant is designed to treat the sewage that used to be discharged at CSO 002 into the Lake Erie without any treatment.

The Conventional Wastewater Treatment Plant includes:

1. Screening
2. De-gritting
3. Primary Settling
4. Gravity Sludge Thickening
5. Biological Treatment (Aeration System)
6. Coagulant addition for phosphorus removal
7. Final Settling
8. Disinfection (Ultra-Violet Lights), between May 1st and November 1st
9. Sludge Digestion & Sludge Disposal

The CEHRT Plant includes:

- a. Screening
- b. De-gritting
- c. Coagulation – Aluminate Sulfate addition
- d. Maturation – Polymer and Sand addition
- e. Final Settling
- f. Disinfection (Ultra-Violet Lights)

CEHRT (Chemically Enhanced High-Rate Treatment)

CEHRT Facility Pictures

Southwest/West Facility Entrance



Northwest/North Facility Entrance



North Side

Actual HRT Actiflo Portion Canopy and Emergency Backup Generator



CEHRT Treatment Facility consists of the following:

1. Aerial Sewer Sewage Feed Pipe
2. Screening
3. De-Gritting
4. Conveyor System
5. Actiflo Process
 - a. Coagulation
 - b. Maturation
 - c. Final Settling
6. Disinfection, UV (Ultra-Violet) System

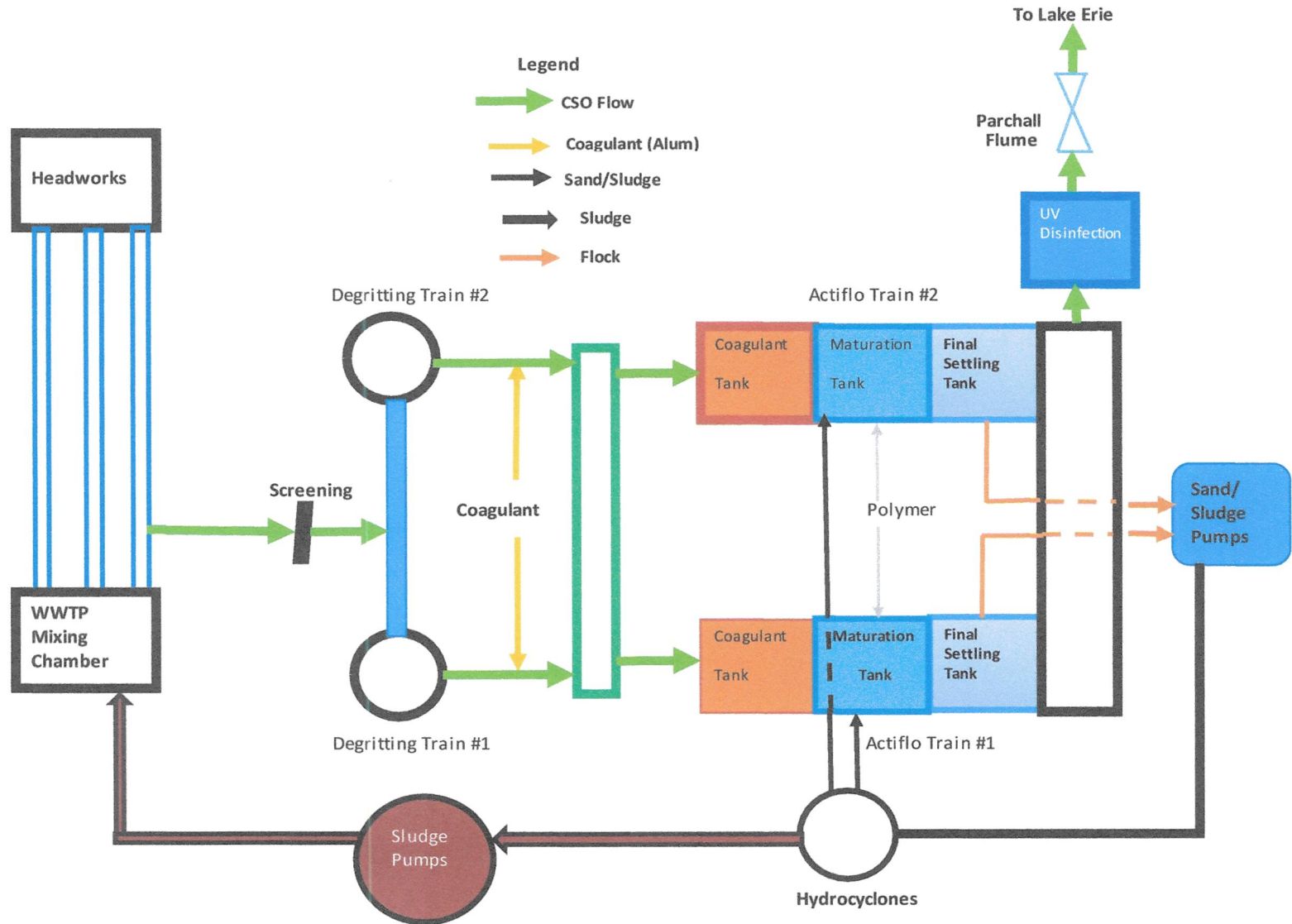
Aerial Sewer Sewage Feed Pipe

There are three (3) 48-inch diameter aerial sewer pipes running across the Rocky River. The aerial sewer pipes #1 and #2 are dedicated to feed the Lakewood existing WWTP. The aerial sewer pipe #3 is connected to the CEHRT facility.

Aerial Sewer Pipe #3 – Dedicated for CEHRT



LAKEWOOD CEHRT - PROCESS FLOW DIAGRAM



The CEHRT activates when the flow to the WWTP reaches 40 MGD (Millions of Gallons a Day) and Head Chamber Level reaches 87 inches. The Head Chamber level is located on the north side of Rocky River. The CEHRT capacity is 35 MGD.

Screening

There are two (2) Aqua Guards Rotating Screens, each design for 35 MGD flow. The screening openings are 5 mm (3/16"), so any solids larger than 3/16" get removed during this process.

The screenings collected at the Aqua Guards run thru the screening compactors. The Screening Compactors removes the water and volatile solids from the screening material and reduces the volume of the screenings. The screenings from here get conveyed to the waste dumpsters, and eventually get disposed to the landfill.

Aqua Guards Rotating Screens



Screening Compactors



De-Gritting

During the De-Gritting process, the heavy materials, such as gravel, asphalt, rocks, stones, mortar, and the other heavy settable materials get separated from the sewage. There are two (2) grit settling tanks, located downstream of the screening process. The grit pumps pump the grit slurry to the grit separators. After the grit gets separated from the water and washed down it is conveyed to the waste dumpsters and eventually gets disposed to the landfill.

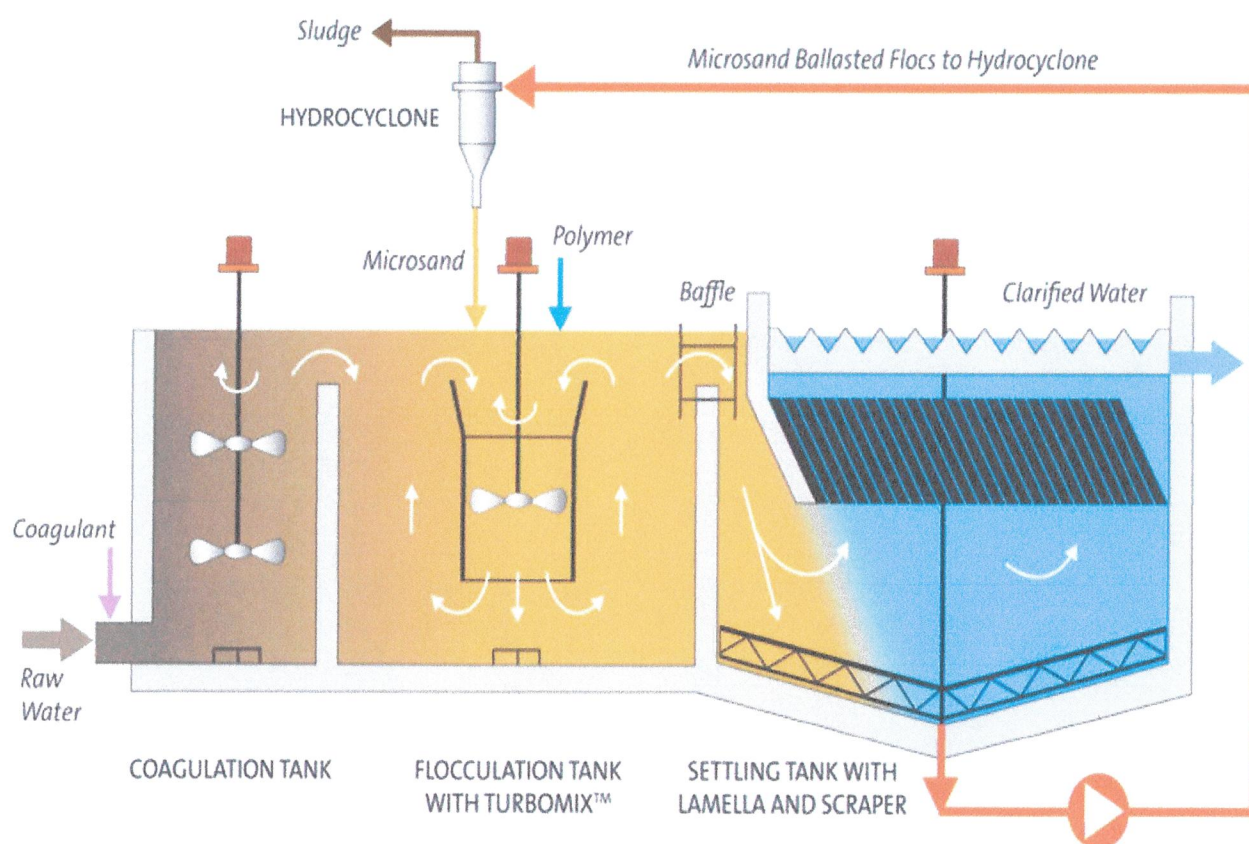
Grit Separators



Actiflo

Actiflo is a compact clarification process using micro-sand enhanced flocculation and settling. A coagulant is added to the raw CSO water in a separate coagulation tank, as shown below. The coagulated water is conveyed to an Injection Tank (Maturation Tank) where micro-sand (NSF approved inert pure silica sand) and polymer are added. The micro-sand provides a large contact area and acts as particle ballast (attracting the solids), thereby accelerating the settling rate of particle flocs. Polymer bridging binds destabilized suspended solids to the micro-sand particles. In the maturation tank, the particles agglomerate and grow into high-density flocs, which settle to the bottom of the settling tank. Lamella tubes are used in the settling tank. Clarified water is collected at the top of the settling tank. Sludge is collected at the bottom of the settling tank and is sent to a hydrocyclone. The hydrocyclone separates the sludge from the water, and the water is recycled back to the injection tank. The sludge is sent to a sludge storage tank.

Actiflo process schematic is shown below



The Actiflo has a much smaller footprint, and much shorter detention time than traditional WWTP process.

The traditional WWTP is designed to effectively remove large materials from the sewage, grit, suspended solids, BOD (Biochemical Oxygen Demand), phosphorus, ammonia, metals, and oil & grease. Traditional WWT is a complete wastewater treatment process. It takes up to 24 hours (and more during the dry weather) from the start of the treatment to the final discharge of the clean water. The average daily flow to Lakewood WWTP is around 7 MGD (Millions of Gallons per Day).

The Lakewood CEHRT is mainly designed to effectively remove large materials from the sewage, grit, and suspended solids. During the process, some of the BOD, metals, and phosphorus are removed as well, but not as much as in the traditional WWT process. It takes between 15 minutes and 45 minutes (Depending on the flow) from the start of the treatment to the final discharge of the clean water

There are two (2) Actiflo trains, each designed to treat 17.5 MGD. So, the total capacity of the CEHRT is 35 MGD.

Actiflo Hydro Cyclones (Sand Separators) and Sludge Return System/Piping



Coagulation

The Lakewood CEHRT utilizes Aluminum Sulfate (Alum) as a coagulant. The projected dosage is between 50 mg/L and 100 mg/L (milli grams per liter). The Coagulation System includes a 6,000 gallons Alum Storage Tank, three (3) Alum Pumps, Alum Piping, Discharge Nozzles, Stationary Mixers, and Mechanical Mixers.

Alum Storage Tank and Alum Pumping System



Maturation Tank

The CEHRT utilizes polymer and Micro-Sand as a ballast to create heavier floc that rapidly settles in the Final Settling Tank. The Maturation Process includes Polymer Storage Totes, two (2) Polymer Feed Pumps & Piping, Sand, and Turbo Mixer. The projected dosage for polymer feed is between 0.5 mg/L and 4 mg/L.

Polymer Storage Totes and Pumping System



Final Settling

The water from Maturation Tank flows into the Final Settling Tank. In the Final Settling Tank, the floc (Mixture of alum, polymer, sand and sludge) settles rapidly, and clean water rises thru lamella plates to the top of the tank, and spills into effluent troughs. From the troughs the clean water flows into CEHRT effluent channel.

The settled floc at the bottom of the Final Settling Tank is pushed to the center of tank by a rotating scraper. From there, the floc is pumped back to the top of Maturation Tank, where the sand is separated from the sludge. The sludge is pumped to the WWTP Mixing Chamber for further processing, and the sand returns to the Maturation Tank.

The Final Settling Process includes scrapers (sweeps) located on the bottom of the tanks, effluent troughs, pH probes, turbidity meters, six (6) sand/sludge pumps and piping, sand separators, sampling ports, sampler, sludge return wet well, and three (3) sludge return submersible pumps.

Disinfection, UV (Ultra-Violet) System

The clean effluent water from the final settling tanks flows into the effluent channel. The UV System is in the final effluent channel. The UV System is used for final disinfection before the water is discharged into Lake Erie. Based on Lakewood NPDES Permit, UV disinfection is required between May 1st and November 1st.

UV Disinfection System Canopy



The UV System includes two (2) banks. Each bank has twenty (20) modules. Each module has eight (8) high intensity UV bulbs, so there are 320 UV bulbs.

After the UV disinfection system, the water flows through the Parshall Flume. The Parshall Flume controller displays and records the flow amounts (in MGD) and flow totalizers (in MG).

Laboratory Testing

During the operation of the CEHRT, the composite and grab samples are collected and analyzed for Suspended Solids, pH, E.coli, Ammonia and CBOD5.

HRT TRAIN VOLUMES/DETENTION TIMES

	GRIT TANK VOLUME FT ³	COAG. TANK VOLUME FT ³	MATURATATION TANK VOLUME FT ³	SETTLING TANK VOLUME FT ³	TOTAL VOLUME FT ³	TRAIN TOTAL VOLUME GALLONS	DETENTION TIME AT 5 MGD MINUTES	DETENTION TIME AT 8.75 MGD MINUTES	DETENTION TIME AT 17.5 MGD MINUTES
ONE TRAIN	4184.36	3990	6964.2	6661.25	21799.81	163062.6	46.96	26.84	13.42
TWO TRAINS	8368.72	7980	13928.4	13322.5	43599.62	326125.2			26.83

HRT TANKS SIZES

GRIT TANK	COAGULATION TANK	MATURATION TANK	SETTLING TANK
16' L x 14.33' W x 18.25 D	14.25' L x 14' W x 20' D	19.08' L x 18.25' W x 20' D	18.25' L x 18.25' W x 20' D

NOTE: ONE TRAIN IS SERVICE FOR FLOW UP TO 17.5 MGD, TWO TRAINS IN SERVICE FOR FLOW OVER 17.5 MGD