CITY OF ASHLAND WATER POLLUTION CONTROL FACILITY

NO FEASIBLE ALTERNATIVE ANALYSIS REPORT FOR ELIMINATION OF WPCF EQUALIZATION BASIN OVERFLOWS

May 31, 2022

REVISED DECEMBER 20, 2022 (AFTER OEPA REVIEW)

Revised July 8, 2024 - Revised Implementation Plan and Schedule

BURGESS & NIPLE

Engineers ■ Planners ■ Environmental Scientists

July 8, 2024

Transmitted Electronically

Mayor and Council
City of Ashland
206 Claremont Ave.
Ashland, Ohio 44805

Re: Ashland WPCF
NPDES
Ashland County
Long Term Permit
2PD00010

Dear Mayor and City Council:

This letter is regarding the no feasible alternative (NFA) analysis report for the Ashland WPCF equalization basin overflow that bypasses secondary treatment. On December 15, 2023, the City of Ashland submitted a letter requesting a revision to the plan that was accepted on January 18, 2023. On January 4, 2024, the Ohio EPA provided comments to the proposed revisions and the City provided a response to Ohio EPA comments on June 4, 2024. The revision proposes to implement alternative number 2 of the plan with the installation of additional storage and flow equalization at the plant. The report was submitted on June 1, 2022, and was a requirement of Part 1 C item C of the NPDES permit compliance schedule. Ohio EPA submitted comments to the report on November 22, 2022, and revised report was submitted on December 20, 2022. The report was prepared and submitted by Joseph M. Starkey, P.E., Burgess & Niple, Akron, Ohio. A summary of the NFA proposal and response to comments is below.

The City proposes to install a 10 million gallon equalization basin, which is expected to provide adequate control for a 5 year storm event. The City has installed a flow meter on the influent piping to the existing equalization basin and plans to install rain gauges to collect data for evaluation of precipitation frequency. The City's response to comments also indicated that the City will not be moving forward with the short-term improvements at the wastewater treatment facility that were identified in the NFA. The City's implementation schedule proposes that a PTI will be submitted for the basin by September 1, 2025, and the construction would be completed by November 1, 2027. The schedule also proposed that inflow and infiltration reduction will continue in the collection system and point of sale requirements for clean water connections will be enforced and a sewer rate study will be completed.

The proposal to move forward with alternative 2 of the NFA with the construction of a 10 million gallon equalization basin is acceptable. If the system overflows more frequently than the design storm, then additional work may be needed to reduce the overflow frequencies based on an updated financial analysis. Ohio EPA proposes to include a 2-year post-construction monitoring period in the City's NPDES permit compliance schedule, during which the City must assess whether the level of control has been met.

To proceed, an updated permit modification application is required to be submitted. The current modification request has been marked incomplete and an updated application needs to be submitted.

If you have questions or concerns regarding this letter, please contact Mr. Ryan Gierhart at 419.373.3053 or email at ryan.gierhart@epa.ohio.gov.

Sincerely,

Alex A. Smaili, P.E.
Water Quality Engineer II/Unit Supervisor
Ohio EPA
Division of Surface Water

/cle

ec: Kevin Zebrowski, Wastewater Treatment Superintendent, City of Ashland
Michael Hunter, Director of Water and Wastewater Facilities, City of Ashland
Shane Kremser, City Engineer, City of Ashland
Joseph M Starkey, P.E., Burgess and Niple
Ashley Ward, Ohio EPA-DSW
Alex Smaili, Ohio EPA-DSW
John Takas, Ohio EPA-DSW
Ryan Gierhart, Ohio EPA-DSW
David Brumbaugh, Ohio EPA-DSW

SHANE KREMSER, PE, CBO
DIRECTOR OF ENGINEERING & BUILDING DEPARTMENT
206 CLAREMONT AVENUE
ASHLAND, OHIO 44805
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KREMSER.SHANE@ASHLAND-OHIO.COM

June 4, 2024

Mr. Ryan Gierhart
Ohio Environmental Protection Agency
Northwest District Office Surface Water
347 N. Dunbridge Road
Bowling Green, OH 43402

Re: No Feasible Alternative Report (NFA) – Implementation Plan Revision
NPDES Permit 2PD00010*QD

Mr. Gierhart:

This letter is being provided in response to the Ohio Environmental Protection Agency's letter dated January 4, 2024 pertaining to the City of Ashland's request to revise its NFA Analysis Report's implementation plan. Please find listed below responses to the comments provided therein.

1. The NFA indicated that to remove all overflows from the 5-year period of storms reviewed, a storage volume of 20.5 million gallons (MG) would be needed. Based on the construction limitations, the plan recommends a 10 MG basin be installed and that this size basin would reduce the number of overflow events from 22 to 3 over the 5-year period reviewed. Please identify the largest storm recurrence interval that will be fully controlled by installation of a 10 MG basin, to serve as a design level of control.

   Response: B&N reviewed the City of Ashland's available data (Monthly Operating Reports, as submitted to Ohio EPA and daily rain gauge totals). The two largest overflow events for the period of 2016 through 2021 occurred in June and July 2019. The June event was a longer duration event with substantial rainfall recorded for a 4-day period from June 15th through the 18th. The July event was shorter in duration, with rainfall recorded over a 2-day period (July 21st and July 22nd). The total overflow observed at the WWTP for the June event was 20.5 million gallons (MG). The total overflow observed for the July event was 13.8 MG. Without having hourly rain-gauge data, it is difficult to ascertain the exact frequency sizing of these events.

   A total of 2.65 inches of rain was observed on July 21st and 0.7 inches was observed on July 22nd. The City noted on their Monthly Operating Report the following note: "Ashland experienced a massive thunderstorm on July 21st that caused the worst flooding the city has seen in the past 20 years. The quantity of flow that the plant received in a short time frame caused the treatment facilities equalization basin to overflow a record amount on July 22nd and continued into the 23rd from station 2PD00010602." The City does not have hourly flow data, but the 2.65 inches of rain observed on July 21st, appeared to occur in the evening per plant flow data. Utilizing the Precipitation Frequency Table for the City of Ashland as developed by National

Oceanic and Atmospheric Administration (NOAA), a rainfall of 2.65 inches could be the equivalent of a 10- to 25-year average recurrence interval, depending upon if the rain occurred over 6 or 3 hours, respectively. The note on the monthly operating record indicated that the rainfall occurred in a short time frame.

It is difficult to assign an exact flow frequency interval to the July 21st and 22nd rain event but based on the information described above, assigning a frequency interval of a 10-year storm event seems reasonable.

Based on available flow and rain data, it would be impossible to assign a precise largest storm recurrence interval that will be fully controlled by the installation of the 10-MG basin. A sustained rain event and/or high groundwater conditions due to sustained wet conditions could impact I&I and thus flows to the WWTP and ultimately the volume of overflow. However, based on the July 2019 storm, it could be estimated - based on an overflow of 13.8 MG for an approximate 10-year event – that the 10-MG basin could be capable of providing adequate control for a 5-year storm event.

2. The proposed basin size indicates that overflows still will have the potential to occur after construction. If the system overflows more frequently than the design storm, then additional work may be needed to reduce the overflow frequencies based on an updated financial analysis. Ohio EPA proposes to include a 2-year post-construction monitoring period in the permit compliance schedule, during which the City must assess whether the level of control has been met.

   Response: The City has recently completed the installation of magnetic flow meters on the influent piping to the existing WWTP equalization basin. This new flow data combined with metering of the flow into the proposed Equalization Basin plus the City's existing WWTP influent flow measurement would provide instantaneous total flow measurement from the system.

   To confirm the magnitude of storm events being captured by the equalization basins, the City proposes the installation of new rain gauges within the City. The rain gauges would provide data needed to use the NOAA developed precipitation frequency tables to estimate the strength and frequency of storm events as they occur in the future. This data in conjunction with the monitored overflow volumes should provide adequate information for Ohio EPA to assess whether the desired level of control has been achieved.

3. Section 6 of the NFA and the proposed implementation plan in the original submittal proposed plant improvements including short term improvements with the installation of an EQ basin flow meter, upgrades to the influent pump station, primary treatment, trickling filters and UV disinfection. Is the City proposing to move forward with any of the recommended plant improvements?

   Response: The City has recently completed the installation of magnetic flow meters on the influent piping to the existing WWTP equalization basin. To facilitate the investment needed for the design and construction of the additional 10 MG flow equalization basin, the short-term improvements previously specified will have to be implemented in the long-term.

If you have any questions, please call my office at 419-289-8331.

Sincerely,

Shane Kremser

Shane Kremser, PE, CBO

CC: Mayor Matt Miller; Larry Paxton; Rick Wolfe II; Mike Hunter

January 4, 2024

Transmitted Electronically

Mayor and Council
City of Ashland
206 Claremont Avenue
Ashland, Ohio 44805

Re: Ashland WPCF
NPDES
Ashland County
Long Term Permit
2PD00010

Dear Mayor and City Council:

This letter is regarding the no feasible alternative (NFA) analysis report for the Ashland WPCF equalization basin overflow that bypasses secondary treatment. On December 15, 2023, the City of Ashland submitted a letter requesting a revision to the plan that was accepted on January 18, 2023.

The revision proposes to implement alternative number 2 of the plan with the installation of additional storage and flow equalization at the plant. The report was submitted on June 1, 2022, and was a requirement of Part 1 C item C of the NPDES permit compliance schedule. Ohio EPA submitted comments to the report on November 22, 2022, and revised report was submitted on December 20, 2022. The report was prepared and submitted by Joseph M. Starkey, P.E., Burgess & Niple, Akron, Ohio.

We have the following comments on the proposal to implement alternative number 2 of the NFA:

1. The NFA indicates that to remove all overflows from the 5 year period of storms reviewed a storage volume of 20.5 million gallons (MG) would be needed. Based on the construction limitations, the plan recommends a 10 MG basin be installed and that this size basin would reduce the number of overflow events from 22 to 3 over the 5 year period reviewed. Please identify the largest storm recurrence interval that will be fully controlled by installation of a 10-MG basin, to serve as a design level of control.

2. The proposed basin size indicates that overflows still will have the potential to occur after construction. If the system overflows more frequently than the design storm, then additional work may be needed to reduce the overflow frequencies based on an updated financial analysis. Ohio EPA proposes to include a 2-year post-construction monitoring period in the permit compliance schedule, during which the City must assess whether the level of control has been met.

3. Section 6 of the NFA and the proposed implementation plan in the original submittal proposed plant improvements including short term improvements with the installation of an EQ basin flow meter, upgrades to the influent pump station, primary treatment, trickling filters and UV disinfection. Is the City proposing to move forward with any of the recommended plant improvements?

If you have questions or concerns regarding this letter, please contact Mr. Ryan Gierhart at (419) 373-3053 or email at ryan.gierhart@epa.ohio.gov.

Sincerely,

Alex A. Smaili, P.E.
Water Quality Engineer II/Unit Supervisor
Ohio EPA
Division of Surface Water

/cle

ec: Kevin Zebrowski, Wastewater Treatment Superintendent, City of Ashland
Michael Hunter, Director of Water and Wastewater Facilities, City of Ashland
Shane Kremser, City Engineer, City of Ashland
Joseph M Starkey, P.E., Burgess and Niple
Ashley Ward, DSW-CO
Alex Smaili, DSW-NWDO
John Takas, DSW-NWDO
Ryan Gierhart, DSW-NWDO
David Brumbaugh, DSW-CO

MATT MILLER
MAYOR & DIRECTOR OF PUBLIC SERVICE AND SAFETY

PHONE: 419.289.8622
FAX: 419.289.9613
MAYOR@ASHLAND-OHIO.COM

city of
ASHLAND
MAYOR'S OFFICE

December 15, 2023

Mr. Ryan Gierhart
Ohio Environmental Protection Agency
Northwest District Office Surface Water
347 N. Dunbridge Road
Bowling Green, OH 43402

**Re: No Feasible Alternative Report (NFA) – Implementation Plan Revision
NPDES Permit 2PD00010*QD**

Mr. Gierhart,

The City of Ashland is requesting to revise the recently OEPA approved Implementation Plan and Schedule as it was originally presented in our No Feasible Analysis Report for the Elimination of WPCF Equalization Basin Overflows (NFA), dated December 20, 2022.

Our revised implementation plan would prioritize Alternative No. 2 to provide additional wastewater storage and flow equalization as described in the NFA. The budgetary cost for these improvements is $14.4 million.

Please find attached the revised Implementation Plan & Schedule for your review.

If you have any questions, please call my office at 419-289-8622.

Sincerely,

Matt Miller
Mayor, City of Ashland

Attachment: Amended NFA Section 9, Implementation Plan & Schedule

cc: Larry Paxton, Rick Wolf II, Mike Hunter, Shane

9.0 Implementation Plan & Schedule

9.1 Implementation Plan

The proposed implementation plan includes the following:

1. **Additional Wastewater Storage and Flow Equalization (Alternative No. 2)**
   a. As described herein

2. **I&I Reduction within the Collection System**
   a. Continue to inspect and clean the collection system
   b. Perform sewer rehabilitation projects (CIPP) as needed
   c. Institute a real estate point-of-sale (POS) requirement to remove private side cross connections

3. **Perform a Rate Study**
   a. Adjust sewer rates to the maximum extent practical to accommodate the proposed implementation plan and other future improvements at the WPCF.

9.2 Schedule

OEPA NFA Approval	February 2024
Rate Study	Ongoing – March 2024
Flow Equalization Basin Design	May 2024 – May 2025
Flow Equalization Basin PTI	June 2025 – September 2025
Flow Equalization Basin Construction	November2025 – November 2027
Collection System Maintenance	Ongoing
Sewer Rehabilitation Projects	Ongoing
POS Cross-Connection Removal	2025 Onwards

BURGESS & NIPLE

50 S. Main Street | Suite 600 | Akron, OH 44308 | 330-376-5778

Mr. Ryan Gierhart
Ohio Environmental Protection Agency
Northwest District Office Surface Water
347 N. Dunbridge Road
Bowling Green, OH 43402

Re: No Feasible Alternative Report REVISED
City of Ashland, OH
Ashland County
NPDES Permit 2PD00010*QD
Event Code 15099

December 22, 2022

Dear Mr. Gierhart:

On behalf of the City of Ashland and in accordance with the City's NPDES Permit 2PD00010*QD, Part I, C - Schedule of Compliance (C.1.c), Burgess & Niple submits the attached REVISED No Feasible Alternatives Analysis report that address your comments dated November 22, 2022 on the original report.

> **Comment 1:** Please provide a brief summary in the report of the current assets that the City of Ashland uses to operate and maintain the collection system. How many staff members oversee the collection system and what equipment does the City own for performing cleaning and maintenance of the system?
>
> ***Response 1:*** *This information has been provided. Please see section 5.1, Description of Existing System.*
>
> **Comment 2:** It is understood that plan proposes a rate evaluation study within 6 months of approval of the NFA. Please provide some discussion in the submitted report on the current financial capability of the City. What are current sewer rates and does the City have outstanding debt on the collection system and water pollution control facility? The US EPA has developed a draft financial capability assessment guidance that can help evaluate the financial capability of the City. The guidance can be found at the following link: https://www.regulantion s.gov/document/EPA-HQ-OW-2020-0426-0071.
>
> ***Response 2:*** *Additional discussion of the City's current financial capability has been provided. Please see section 8.4, Current Financial Overview.*
>
> **Comment 3:** Section 5.1 of the report indicates that during the sewer system evaluation survey from 1990-2004 there were 156 observed occurrences of dyed water in sanitary sewers where storm sewers crossed perpendicular, has any work been completed to eliminate the cross connections. Were these addressed through the City's inflow and infiltration reduction plan that was worked on in 2009-2013.
>
> ***Response 3:*** *Since the completion of the 1999-2004 SSES evaluation, the City attempted to address all 156 observed occurrences prior to 2009 with improvements to eliminate/reduce leakage from the storm sewer systems including repairs or replacement of catch basins, replacement of pip sections, etc. Please see section 5.1.*

Comment 4: Beside the root control program as indicated in Section 5 of the report, please provide a summary of improvements or repairs to the collection system that have been completed in the last two years.

Response 4: *Additional discussion regarding work completed in the past two years and upcoming capital improvement projects has been provided. Please see Section 5.1.*

Please note for your convenience, additions/revisions to the text within the attached report have been tracked via yellow highlighting. Please advise if there are any questions or comments.

Sincerely,

Mike Starkey

Joseph M. (Mike) Starkey, PE

JMS:jms
copy: Mr. Michael Hunter, Director of Water and Wastewater Facilities - City of Ashland
Mr. Shane Kremser, City Engineer – City of Ashland
Ms. Sherry Fair, Wastewater Treatment Superintendent – City of Ashland
Mr. Daniel R. Johnson, P.E. - B&N
File

CITY OF ASHLAND

NO FEASIBLE ALTERNATIVE ANALYSIS REPORT FOR ELIMINATION OF WPCF EQUALIZATION BASIN OVERFLOWS

May 31, 2022
REVISED December 20, 2022

Matt Miller Date
City of Ashland
Mayor and Director of
Public Service & Safety

Michael Hunter Date
City of Ashland
Director of Utilities

Daniel R. Johnson, PE Date
Burgess & Niple, Inc.
Project Director

Shane Kremser, PE Date
City of Ashland
City Engineer

Joseph M. Starkey, PE Date
Burgess & Niple, Inc.
Project Manager

This Report has been prepared by:

Burgess & Niple, Inc.
50 S. Main Street
Suite 600
Akron, Ohio 44308
330-376-5778

LIST OF ACRONYMS

10SS: Ten States Standards
@: at

A

A: Amps
ADA: American Disability Act
ADDF: Average daily design flow
ADF: Average daily flow
ADW: Average dry weather flow

B

B&N: Burgess & Niple Inc.
BFP: Belt filter press
BNR: Biological nutrient removal
BOD: Biological Oxygen Demand

C

CBOD: Carbonaceous biochemical oxygen demand
CCT: Chlorine contact tank
CCTV: Closed circuit television
CEPT: Chemically enhanced primary treatment
CF: Cubic feet
cfu: Colony forming units
CIP: Capital Improvement Plan
CIPP: Cured-in-place-pipe
CMMS: Computerized maintenance management system
CMOM: Capacity, Management, Operations and Maintenance
CP: Control panel
CSS: Cement stabilized soil
CWA: Clean Water Act
CY: cubic yard

D

DAF: Dissolved air flotation
DEFA: Division of Environmental and Financial Assistance
DIP: Ductile iron pipe
DO: Dissolved oxygen
DSL: Digital subscriber line

E

E.*coli*: Escherichia coli
EDI: Energy dissipating inlets
eDMR: Electronic discharge monitoring report
EPA: Environmental Protection Agencies
EPC: energy performance contract
ESCO: Energy service company
EQ: Equalization

F

FCC: Federal Communications Commission
F/M: Food-to-microorganism
FPA: Facility planning area
Ft: Feet
FTE: Full time employee

G

GIS: Geographic Information System
gpd: Gallon per day
GPR: Green Project Reserve
gpm: Gallon per minute

H

H2S: Hydrogen Sulfide
HMI: Human machine interface
HP: Horsepower
HSTS: Home sewage treatment systems
HVAC: Heating ventilation and air conditioning

I

IEEE: Institute of Electrical and Electronic Engineers
IFAS: Integrated fixed-film activated sludge
I&I: Inflow and Infiltration
IIJA: Infrastructure Investment and Jobs Act

J

K

KV: Kilovolt
KVA: Kilovolt-ampere
kW: Kilowatt
kWh: Kilowatt hour

L

LED: Light emitting diode
LEED: Leadership in Energy and Environmental Design
LP: Low pressure

M

M: Million
Mag: Magnetic
MBBR: Moving bed biofilm reactor
MBR: Membrane bioreactor
MCC: Motor control center
MG: Million Gallons
mgd: Million gallons per day
mg/L: Milligram per liter
MIN: Minimum
min: Minute
MLSS: Mixed liquor suspended solids
mm: millimeter
MOP8: Water Environment Federation's Manual of Practice – 8
MS: Mini systems
MTU: Maximum transmission unit

N

N/A: Not Applicable
NASSCO: National Association of Sewer Service Companies
NEWPCC: New England Water Pollution Control Commission
NEMA: National Electrical Manufacturers Association
NFA: No Feasible Alternative
NFPA: National Fire Protection Agency
NH3: Ammonia
NO3+NO2: Nitrate + Nitrite
NPDES: National Pollution Discharge Elimination System
NPW: Non-potable water
NRD: Nutrient Reduction Discount

O

OBC: Ohio Building Code
OE: Ohio Edison
OEPA: Ohio Environmental Protection Agency
OEPA-DEFA: Ohio Environmental Protection Agency, Division of Environmental and Financial Assistance
OIT: Operator interface terminal
O&M: Operation and maintenance
OPWC: Ohio Public Works Commission
ORC: Ohio Revised Code
OSHA: Occupational Safety and Health Administration
OWDA: Ohio Water Development Authority

P

PACP: Pipeline Assessment and Certification Program
PC: Personal computer
PCCP: Prestressed concrete cylinder pipe
PDDF: Peak daily design flow
PDF: Peak daily flow
PEL: Preliminary effluent limit
pH: Potential Hydrogen
PLC: Programmable logic controller
POTW: Publically Owned Treatment Works
PRV: Pressure relief valves
PS: Pump station
PSI: Pounds per square inch
PST/PSTs: Primary settling tank (s)

Q

R

RAS: Return activated sludge
RCP: Reinforced concrete pipe
RDP: RDP Technologies, RDP EnVessel Pasteurization System
RTU: Remote telemetry unit

S

SCADA: Supervisory control and data acquisition
scfm: Standard cubic feet per minute
SCIP: State Capital Improvement Program
SDWA: Safe Drinking Water Act
SF: Square feet

S (continued)

SHT: Sludge holding tank
SOR: Surface overflow rate
SSES: Sanitary Sewer Evaluation Survey
SSO: Sanitary sewer overflow
SST: Sludge storage tank
SWD: Side water depth

T

TDH: Total dynamic head
TDS: Total dissolved solids
TSS: Total suspended solids

U

Ug/L: Microgram per liter
U.S.: United States
UV: Ultraviolet

V

VFD: Variable frequency drive
VHF: Very high frequency
V: Volts

W

WAS: Waste activated sludge
WEFTEC: Water Environment Federation Technical Exhibition & Conference
WLR: Weir loading rate
WPC: Water pollution control
WPCC: Water Pollution Control Center
WPCF: Water Pollution Control Facility
WPCLF: Water Pollution Control Loan Fund
WRRSP: Water Resource Restoration Sponsor Program
WWTP: Wastewater treatment plant

X

Y

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APPENDICES

CITY OF ASHLAND, WATER POLLUTION CONTROL FACIILITY
NO FEASIBLE ALTERNATIVE (NFA) ANALYSIS REPORT FOR EQUALIZATION BASIN OVERFLOWS

1.0 Executive Summary

The City of Ashland Water Pollution Control Facility (WPCF) operates under an Ohio Environmental Protection Agency (OEPA) administered National Pollution Discharge System (NPDES) Permit No. 2PD00010*QD. The current permit became effective on June 1, 2020. Section C (Elimination of Bypasses) of Part I, C (Schedule Compliance) of the permit requires the City to conduct a comprehensive analysis of feasible alternatives to eliminate the bypasses at the EQ Basin. The City is required by their NPDES permit to submit the comprehensive analysis to the OEPA no later than 24 months from the effective date (June 1, 2022).

The following general alternatives were evaluated as part of this report:

- Alternative 1: Inflow/Infiltration Reduction within the Collection System
- Alternative 2: Additional Wastewater Storage and Flow Equalization
- Alternative 3: Expanded Secondary Treatment Capacity
- Alternative 4: Methods to Enhance Treatment of Bypassed Flows

During the 5-year period from January 1, 2017 through December 31, 2021the City of Ashland's WPCF had a total of 42 days with overflow occurrences. Of those 42 days with overflows, the largest single day overflow amount was 12.75 MG occurring July 22, 2019; and the largest total cumulative overflow being from an extended rain event was 20.5 MG which occurred over three days from June 16, 2019, through June 18, 2019.

For each of the four alternatives stated above, B&N worked with the City to identify applicable and implementable concepts to address the required overflow removal. These conceptual alternatives were refined and evaluated for both cost and feasibility .

The recommended implementation plan presented in this report was developed so that the City can reduce and ultimately eliminate overflow bypass events. The implementation plan is holistic in nature and includes recommended improvements not specifically driven by the NFA Study but recommended for completion by the City for improved operation and management of the City's collection and treatment systems.

The proposed implementation plan is a two-pronged approach:

1. **I&I Reduction within the Collection System (Alternative No.1)**
    - Conduct 5-year comprehensive sewer inspection and cleaning program
    - Complete annual Capital Improvement Plan (CIP) for sewer rehab projects to address highest priority repairs and rehab to address structural issues and to reduce I&I
    - Institute program for focused I&I reduction in areas of high I&I (including public and private side improvements)

2. **Phased Improvements at WPCF**
    - Install permanent flow meter to EQ Basin influent flow within first year
    - At end of year 2, start design of Short-Term Improvements for WWTP. Improvements to include:
        - Influent Pump Replacement (15 mgd)
        - Influent Grit Removal System Replacement (15 mgd)
        - Primary Treatment System Replacement (15 mgd)
        - Trickling Filter Repairs (media replacement and structural repairs) and Trickling Filter Lift Station Pump Replacement – 10 mgd
        - UV Disinfection Replacement – 10 mgd with ability to increase to 15 mgd in future
        - SCADA System Improvements

After 5 years of focused I&I reduction and repairs in collections system (Alternative No. 1), an evaluation will be completed to evaluate the most effective approach going forward related to continued focused I&I reduction in areas of high I&I (public and private side improvements) and/or the need for completion of WPCF expansion (Alternative No. 3).

Critical to the program and to be started upon receiving EPA approval of approach will be:

- Public education
- Ordinance Review and Modifications
- Rate and funding evaluations

Figure ES.1 is a preliminary schedule provided to illustrate the timing for completing the recommended tasks of the proposed implementation plan and provide anticipated budgetary annual expenditures. For simplicity and readability purposes only the first 8 years are presented within Figure ES.1. Year 8 is the year in which payment of the WPCF Short Term Improvement costs would come into full effect.

FIGURE ES.1. PRELIMINARY SCHEDULE AND BUDGETARY ANNUAL EXPENDITURES FOR RECOMMENDED APPROACH

[Inflation is not included in expenditures provided below. All costs are shown in 2022 dollars.]

STRATEGY AREA AND TASK	Duration (Months)	Budgetary Cost	2022 Year 0	2023 Year 1	2024 Year 2	2025 Year 3	2026 Year 4	2027 Year 5	2028 Year 6	2029 Year 7	2030 Year 8
GENERAL OR ADMINISTRATIVE ITEMS											
• Receive Approval from Ohio EPA	3	N/A	✓ N/A								
• Hire consultant to lead program	2	N/A	✓ N/A								
• Ordinance Review and Revisions	6	$25,000	✓ $12,500	✓ $12,500							
• Public Education Program	18	$40,000	✓ $20,000	✓ $20,000							
• Rate Evaluation Study	6	$20,000	✓ $20,000								
• Institute Rates	3	N/A		✓ N/A							
COLLECTIONSYSTEM - I&I REMOVAL PROGRAM											
5-Yr Inspection & Cleaning Program											
• Develop Bidding Documents	3	$165,000	✓ $50,000	✓ $115,000	✓ $165,000	✓ $165,000	✓ $165,000	✓ $165,000	✓ $80,000 [c]	✓ $80,000 [c]	✓ $80,000 [c]
• Complete Yearly Allotted Cleaning & CCTV Inspection	7	$950,000		✓ $950,000	✓ $950,000	✓ $950,000	✓ $950,000	✓ $950,000	✓ $450,000 [c]	✓ $450,000 [c]	✓ $450,000 [c]
• Analyze CCTV Data to Establish Priority Repairs and Rehab	2	$35,000		✓ $35,000	✓ $35,000	✓ $35,000	✓ $35,000	✓ $35,000	✓ $20,000 [c]	✓ $20,000 [c]	✓ $20,000 [c]
Annual CIP Rehab Projects to address highest priority repairs/rehab											
• Develop Bidding Documents (including inspections and field work)	3	$115,000		✓ $40,000	✓ $115,000	✓ $115,000	✓ $115,000	✓ $115,000	✓ $115,000	✓ $115,000	✓ $115,000
• Complete Yearly CIP Rehab Projects	7	$750,000			✓ $750,000	✓ $750,000	✓ $750,000	✓ $750,000	✓ $750,000	✓ $750,000	✓ $750,000
Focused I&I Reduction in Areas of high I/I (CIPP Lining Work)											
• Ordinance needs to be in place to allow lining work on private property.	-	N/A		✓ N/A	✓ N/A						
• Use micro-level detection and rain gauges for comprehensive I&I evaluation.	4	$60,000		✓ $60,000							
• Field investigations (i.e. dye/smoke testing) to evaluate areas with direct connections.	2	$40,000		✓ $40,000	✓ $40,000	✓ $40,000	✓ $40,000	✓ $40,000	✓ $40,000	✓ $40,000 [d]	✓ $40,000 [d]
• Develop Bidding Documents	4	$290,000		✓ $290,000	✓ $290,000	✓ $290,000	✓ $290,000	✓ $290,000	✓ $290,000	✓ $290,000 [d]	✓ $290,000 [d]
• Enforce disconnection of illegal direct connections in the target area (per ordinance).	7	$25,000		✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000 [d]	✓ $25,000 [d]
• Pre Rehab Flow Monitoring (3-month duration) (Assumes City Assistance)	3	$25,000		✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000 [d]	✓ $25,000 [d]
• Complete Yearly Allotted Rehab & Lining Improvements	7	$1,730,000			✓ $1,730,000	✓ $1,730,000	✓ $1,730,000	✓ $1,730,000	✓ $1,730,000	✓ $1,730,000 [d]	✓ $1,730,000 [d]
• Post Rehab Flow Monitoring (3-month period post rehab) (Assumes City Assistance)	3	$25,000				✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000 [d]	✓ $25,000 [d]
• Evaluate WWTP Expansion vs continued targeted I&I reduction & coordination w/ OEPA	3	$75,000							✓ $75,000		
PHASED IMPROVEMENTS AT WPCF											
Influent Flow Metering Improvements											
• Develop Bidding Documents	3	$20,000	✓ $20,000								
• Complete Improvements	6	$130,000		✓ $130,000							
Short-Term Improvements											
• Develop Bidding Documents (Assumed as 15% of Total Project Cost)	18	$2,500,000				✓ $1,670,000 [a]	✓ $830,000 [a]				
• Complete Improvements and Services During Construction	30	$14,600,000					✓ $2,920,000 [b]	✓ $5,840,000 [b]	✓ $5,840,000 [b]		
TOTAL BUDGETARY COSTS			**$122,500**	**$1,742,500**	**$4,125,000**	**$5,820,000**	**$7,900,000**	**$9,990,000**	**$9,465,000**	**$3,550,000**	**$3,550,000**
TOTAL BUDGETARY ANTICIPATED ANNUAL LOAN PAYMENTS AND NFA O&M COSTS			**$102,500**	**$1,282,500**	**$1,300,000**	**$1,494,000**	**$1,663,000**	**$1,832,000**	**$1,476,000**	**$1,570,000**	**$2,749,000** [e]

[a] Costs for development of construction and bidding documents assumes utilization of a WPCLF 0% Design Loan that would be rolled into Construction Loan at construction. Bi-annual payments would not start until 6-12 months after completion of construction project.

[b] Costs for construction of proposed short-term improvements assumed to be paid by WPCLF Loan (20 yr. @ 1.56% interest). Bi-annual payments would not start until 6-12 months after completion of construction project.

[c] Upon completion of proposed 5-yr CCTV Inspection and Cleaning Program, yearly maintenance cleaning & CCTV inspection should continue as a standard component of City CMOM program. A reduced yearly cost has been included to reflect the reduced yearly inspection performed as a maintenance item compared to the initial inspection work.

[d] Upon completing first 5 years of Focused I/I Reduction (CIPP Lining) Program and sewer rehab work from 5-year cleaning and inspection program, the City will evaluate I/I removal effectiveness and evalute need to continue collection system targeted I&I reduction versus plan expansion.

[e] Annual payments from Year 8 until Program Year 22 would increase approximately $173,000 annually to account for the annual loans required the CIP Rehab/Repair and Focused I&I (CIPP Lining) work (assuming the 5-year evaluation shows that focused I&I removal should continue). This table would need to be modified if expansion of the WPCF is required after the 5-year evaluation.

Budgetary Cost cells highlighted with this color are assumed as being financed with a 20-year WPCLF loan at 1.56% interest. The project cost is shown in the table, but the related yearly loan amount is included in the "Total Budgetary Anticipated Annual Loan Payment and NFA O&M Costs" line item based on when the loan pay-backs are expected to commence.

2.0 Introduction

The City of Ashland (City) WPCF includes a bypass/overflow from the facility's 5-million-gallon concrete equalization (EQ) basin (Internal Station 2PD00010602). Overflow from the EQ Basin combines with plant effluent flow (Internal Station 2PD00011001) downstream of UV disinfection and prior to step aeration and final discharge to Lang Creek (Internal Station 2PD00010003).

The City is required by the Ohio Environmental Protection Agency (OEPA) to conduct a comprehensive analysis of feasible alternatives to eliminate the bypasses at the EQ Basin. These requirements are described in the Schedule of Compliance (Part I, C) of the City's current wastewater treatment plant NPDES permit (Permit No. 2PD00010*QD).

3.0 General Alternatives

The general alternatives to be considered for the reduction of overflows from the City's existing equalization basin are listed in the compliance schedule in the NPDES Permit and are listed below. The first step in the development of a recommended "feasible" plan is to consider these "general alternatives" as they may apply to the City of Ashland's situation and incorporate these concepts into various alternative plans for development, cost analysis and evaluation.

Email correspondence from the Ohio EPA in response to the June 2021 NFA Status Report submittal indicated that facilities serving separate sanitary sewer systems must provide secondary treatment to all influent flows and the City's NPDES permit had inappropriately included a requirement to evaluate "…methods that will enhance the treatment of any bypassed flows" (Option 4) as part of the study requirements.

The US EPA's Proposed Peak Wet Weather Policy does not support diversion of bypass "…around secondary treatment units at POTW treatment plants when the peak flows are largely due to poor (or lack of) collection system maintenance or the lack of investment in or upgrades to treatment capacity." However, the US EPA does recognize and encourage the use and permitting of advanced technologies (i.e. membrane, tertiary) that can produce higher quality effluent than is required to meet secondary treatment based permit limits. The policy states "…the NPDES authority should take that improved baseline performance into consideration when determining whether peak flow diversion at a POTW treatment plant is approved and under what conditions." With this in mind and based upon the inclusion of Alternative 4 within the NPDES permit, the City chose to keep Alternative 4 as part of the analysis.

The general alternatives evaluated as part of this report are:

- **Alternative 1: Inflow/Infiltration Reduction within the Collection System**
- **Alternative 2: Additional Wastewater Storage and Flow Equalization**
- **Alternative 3: Expanded Secondary Treatment Capacity**
- **Alternative 4: Methods to Enhance Treatment of Bypassed Flows**

4.0 Existing & Future Flows

Table 4.1 presents the existing average daily flows for the Ashland WPCF. Data for 2017 through 2021 is included along with the current design capacity.

Table 4.1 – City of Ashland WPCF Existing Flows

Year	Average Flow	
	Outfall (001)	Combined Outfall (003)*
2017	4.39 mgd	4.41 mgd
2018	4.85 mgd	4.93 mgd
2019	4.77 mgd	4.91 mgd
2020	4.36 mgd	4.39 mgd
2021	3.86 mgd	3.90 mgd
Average 2017-2021	4.44 mgd	4.49 mgd
Total Design Capacity	5.0 mgd	N/A

*Outfall 003 includes plant effluent and EQ Basin overflows.

Table 4.2 presents the population for the City of Ashland from 1980 through 2020. The population of Ashland has shown a flat to downward trend over the past 20 years.

Table 4.2 – Historical Population

Year	Population	% Change
1980	20,252	
1990	20,628	1.86%
2000	21,245	2.99%
2010	20,362	-4.16%
2020	19,225	-5.58%

Conservatively assuming a population growth of 0.5% per year, the average combined outfall (003) flow rate of 4.49 mgd could be anticipated to grow to 4.96 mgd over the next 20 years.

Table 4.3 presents the additional flow information and effluent performance of the WPCF for the 5 years January 1, 2017 through December 31, 2021.

Table 4.3 –Flow & Effluent Quality for Years 2017 through 2021

		Outfall (001)	EQ Basin Overflow (602)	Combined Outfall (003)
Flow	Average Daily (mgd)	4.44	N/A	4.49
	Minimum Daily (mgd)	1.19	N/A	1.19
	Maximum Daily (mgd)	11.45	12.75	22.88
	Average Dry Weather Flow (mgd)[1]	2.53	N/A	N/A
Water Quality Parametrs	Average Total Suspended Solids, TSS (mg/L)	7.11	40.6	14.9
	Average Carbonaceous Biological Oxygen Demand, $CBOD_5$ (mg/L)	5.42	51.3	9.18
	Average Nitrogen, Ammonia, NH_3 (mg/L)	0.49	2.05	0.37

[1] Average Dry Weather Flow (ADW) is defined here as the daily average flow when the groundwater is at or normal and runoff is not occurring. Estimated by using the driest consecutive two (2) week period of flow. Used to estimate base sanitary flow.

Table 4.4 shows the number of overflow occurrences (days with an overflow), number of overflow events (related to the storm event, not calendar days) and the overflow volumes by year from 2017 through 2021. Over this 5-year period, the equalization basin has overflowed a total of 42 times with an average of 7.2 days of overflow occurrences per year. The largest single day overflow occurred on July 22, 2019 when the basin overflowed a total of 12.75 MG. Additionally, on June 16-18, 2019 there was a 3 day EQ Basin overflow event in which a total of 20.50 MG overflowed from the EQ Basin, with a peak single day overflow value of 8.21 MG. This overflow was driven by a large storm event when it rained consistently for three days and thus the plant was unable to empty the EQ Basin because of steady high flows.

Table 4.4. Historical Quantity and Overflow Volumes by Year

	Year				
	2017	2018	2019	2020	2021
# of Days with Overflow Occurrences	6	10	16	4	5
Avg. Day Overflow Volume (MG)	1.11	2.93	3.22	1.93	3.19
Max Day Overflow Volume (MG)	2.781	6.6	12.75	3.175	5.711
# of Storm Overflow Events	3	6	8	2	3
Avg. Event Overflow Volume (MG)	2.22	4.88	6.44	3.85	5.32
Max Event Overflow Volume (MG)	3.81	9.176	20.5	5.513	11.33
Total Yearly Overflow Volume (MG)	6.66	29.28	51.52	7.7	15.96

5.0 Existing Collection System Evaluation

5.1 Description of Existing System

The City's sanitary collection system is a separate sewer system which consists of approximately 125 miles of sanitary sewer and approximately 8,000 service connections, across 22 mini-systems (MS).

The City of Ashland collection system is maintained by a staff of six (6) Utility Line Maintenance Workers under the direction of Grant Ugerer, Ohio Class II W/W, Maintenance Supervisor. Maintenance equipment includes:

- 1 - mini excavator
- 1 - TV truck
- 1 - Aquatech Combination Jet/Vac truck
- 4 - Dump trucks
- 4 - Backhoes
- 7 – Work/utility trucks

SSES (1999-2000). The most recent evaluation information comes from a Sanitary Sewer System Evaluation Survey (SSES) which was conducted from 1999-2004. This survey divided the City's system into 22 mini-systems (MS) and provides a broad evaluation of the overall system utilizing a variety of data collection and field investigation methods. Many of the methods applied were chosen to demonstrate to the City the different methods available, often in a "pilot study" fashion.

The SSES information in conjunction with multiple workshop style meetings between B&N and City personnel was the focal point for obtaining information and historical knowledge of the collection system.

The following is a summary of the methods applied from 1999-2004.

- Flow monitoring
  - May 2000 – June 2000 (Phase 1)
  - June 2000 – August 2000 (Phase 2)
  - Only a single 1-2 year frequency rain event was recorded.
  - Significant lag time between rainfall and increased flow in sanitary sewers suggests significant contributions from private sources – footer drains, downspouts, indirect connections, leaking laterals.
  - See Table 5.1, Flow Monitoring Summary.

- Questionnaires to property owners
  - Select mini-systems
  - 2,250 sent; 750 responses (33%)

- Rainfall and dye testing of mainline sewers
  - Dyed water introduced to 800 storm sewer segments and various drainage ditches across all mini-systems.

- 156 observed (CCTV) occurrences of dyed water observed in sanitary sewers where storm sewers crossed perpendicular.
    - Since the completion of the 1999-2004 SSES evaluation, the City attempted to address all 156 observed occurrences prior to 2009 with improvements to eliminate/reduce leakage from the storm sewer systems including repairs or replacement of catch basins, replacement of pipe sections, etc.

Over the last two (2) years, most efforts in the collections system have been maintenance related and not repairs of a capital improvement nature. Recently, the City had installed a Cured-in-Place-Pipe (CIPP) liner for a 350 foot segment of sanitary sewer along Morgan Ave. Upcoming capital improvements include the replacement of approximately 1,060 linear feet of 12-inch Vitrified Clay Pipe (VCP) from Commerce Parkway to Wil Research LS) with 15-inch Poly-Vinyl Chloride (PVC) pipe along US Route 250 next year.

FIGURE 5.1
OVERALL MINI-SYSTEM MAP

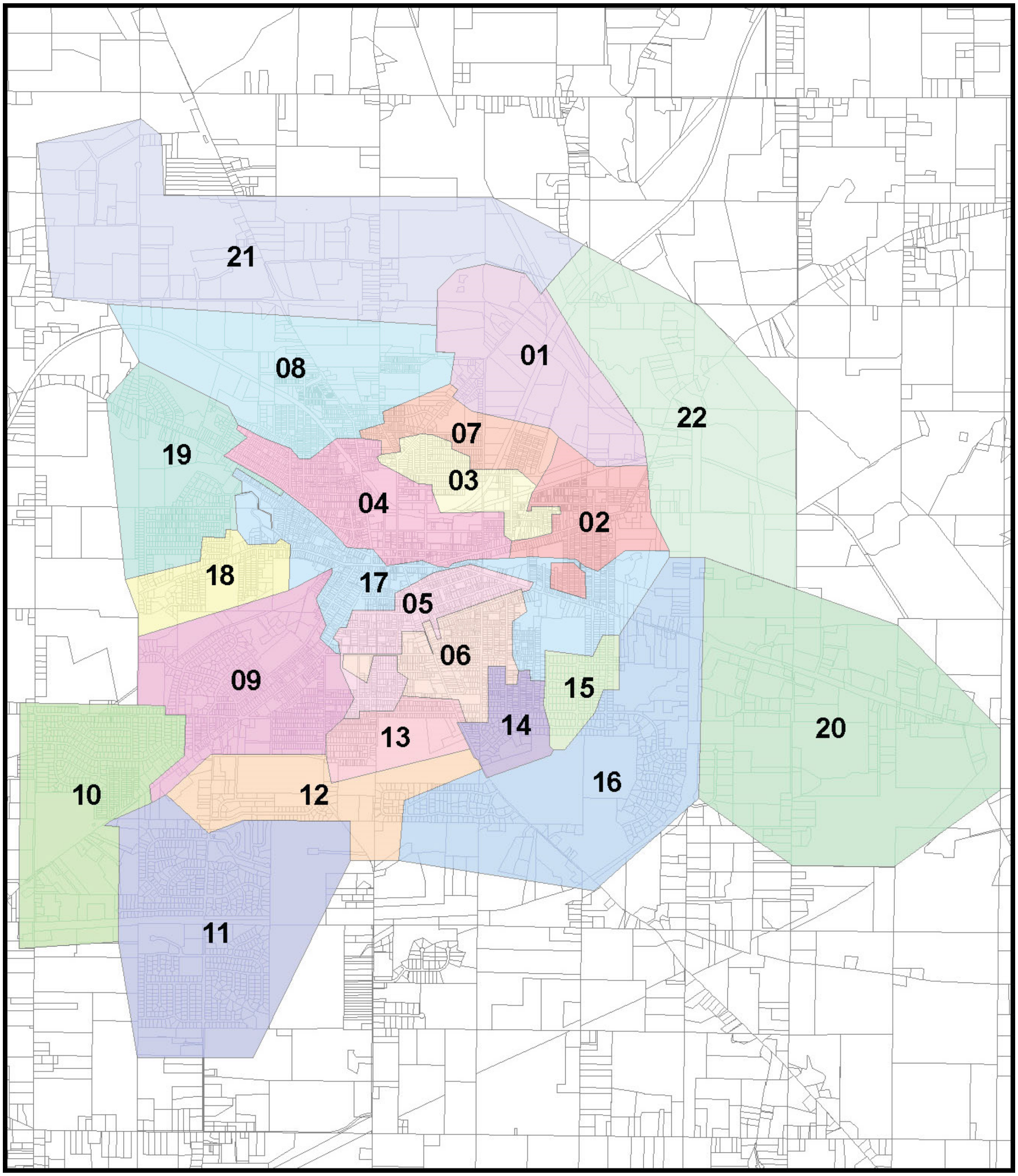


Table 5.1 – Flow Monitoring Summary

Manhole Location	Size of Main (Inches)	Avg. Flow (mgd)	Peak Flow (mgd)	Peak Level in Inches	Comment	Percent Increase in flow rate
1-1	12	0.03	0.05	5.935		66.7%
2-1	24	1.8	8.059	18.923		347.7%
3-1	10	0.08	0.592	15.161	Exceeds capacity	640.0%
4-1	12	0.62	1.239	7.613		99.8%
5-1	12	0.25	1.47	14.927	Exceeds capacity	488.0%
6-1	8	0.2	1.368	10.871		584.0%
7-1	15	0.13	1.087	27.89	Exceeds capacity	736.2%
8-1	10	0.19	1.315	22.866	Exceeds capacity	592.1%
9-1	15	0.45	2.304	19.541	Exceeds capacity	412.0%
10-1	12	0.2	1.508	5.449		654.0%
11-1	10	0.12	0.585	5.852		387.5%
12-1	10	0.3	1.174	52.174	Exceeds capacity	291.3%
13-1	8	0.09	0.884	5.402		882.2%
14-1	8	0.05	0.672	4.353		1244.0%
15-1	12	0.04	0.408	4.308		920.0%
16-1	21	0.8	3.012	12.438		276.5%
17-1	30	3	8.987	14.214		199.6%
18-1	12	0.09	0.621	2.705		590.0%
19-1	12	0.2	1.46	3.405		630.0%
20-1	12	0.055	0.127	2.184		130.9%

- Residential property dye testing
  - Dyed water introduced to downspouts on 593 residential properties across select mini-systems
  - Only mini-system 4 had observed occurrences (249) of dyed water in the sanitary lateral.

- Smoke testing
  - Select portions of mini-system 4 only; 14 positive observations

- Manhole inspections
  - 32 manholes across select mini-systems
  - Preference given to manholes with installed flow meters or which were part of previous sewer studies (1980; 1995)

- GIS
  - Mapping of City sanitary, water, and storm utilities completed
  - Database developed.

- Storm sewer capacity analysis
    - Preliminary desktop analysis performed for select “older” mini-systems.
    - Upsizing of storm sewer pipes recommended.

Root Control. The City has an annual (2018-present) root control program in which the services of a contractor is utilized for multiple applications of a root killing/inhibitor foam into select sanitary sewers in the following mini-systems:

- MS4
- MS6
- MS13
- MS16
- MS17

Review Summary and Findings. While the SSES covers a wide range of different data collection and investigation methods, it only provides very small sample sizes for certain mini-systems. The results of the different investigations suggest typical deficiencies that are common in older collection systems, but do not provide direction as to what mini-systems warrant highest priority. The 2000 flow monitoring likely is the best data as it was performed in all mini-systems. This data is not ideal as it appears that no significant storm events were experienced.

Mini-system 4, however, was included in more investigations than all others and was the only mini-system to have smoke testing performed and was the only mini-system to have positive observations during residential property dye testing and was repeatedly stated to be “old” and to have a history of known issues in the collection system. Therefore, mini-system 4 should be one of the highest priorities for future improvements.

Other mini-systems were identified to be given high priority for future improvements based upon a combination of the highest percent increase in flow observed during flow monitoring and positive observations of rainfall and dye testing in mainline sewers. These mini-systems are 3, 7, 14, and 17. Additional mini-systems could likely be identified to be given similar prioritization with more comprehensive efforts for data collection and field investigations, which is strongly recommended in order to confirm or revise the initial five mini-systems discussed herein for prioritization.

5.2 Recommended System Improvements

It is recommended that the City begin a 5-year program for the cleaning and NASSCO PACP CCTV inspection of all sanitary sewers, completing approximately 25 miles of sewer per year. This work would likely require contracting with a professional sewer contractor. Once the initial 5-year cycle is completed, the City can evaluate the cleaning and inspection cycle for subsequent years.

This program will provide a number of benefits:

- Cleaning & PACP CCTV Inspection (5-year program)
    - Restore sewer capacity due to build-up of sediment and debris
    - Identify critical pipe deficiencies requiring immediate repair
    - Identify sewers and manholes that exhibit signs of significant I&I and can be lined to reduce overall I&I
    - Identify developing pipe deficiencies that can be planned and budgeted for future improvements
    - Identify pipes and services that are no longer active and therefore can be abandoned
    - Collect mapping and data to populate and supplement the existing GIS
- Yearly Maintenance & Repair Improvements can be prioritized for improved system performance especially related to I&I reduction.

The Engineer's Budgetary Opinion for the Annual Project Costs for the 5-year Cleaning and Inspection Program suggested above is approximately $1,150,000. A detailed breakdown of this cost estimate is provided in Appendix A.

In conjunction with the 5-year cleaning and inspection program, an annual budget for sewer repairs and improvements projects should be established. This will allow for repairs of immediate critical needs to be addressed, and also allow for larger projects such as cured-in-place-pipe (CIPP) lining to be performed. The Engineer's preliminary Annual Budget for completion of yearly sewer repair and improvements projects is $860,000. A breakdown of this annual budgeted cost is provided in Appendix A.

Essentially what is being recommended are components of a CMOM program. The City may choose to stay within the parameters of the recommendations made herein or may perhaps decide to expand efforts to more closely resemble a comprehensive CMOM program, as the need and related budgets for such are realized. A CMOM Program provides proactive strategy for sewer maintenance and operation.

6.0 Existing Water Pollution Control Facility Evaluation

6.1 Description of Existing Facility

The Ashland WPCF has an average daily design flow capacity of 5.0 million gallons per day (mgd) with a peak treatment capacity of 10 mgd. The plant was originally constructed in 1930 and has been upgraded multiple times. The 5-million-gallon EQ Basin was installed in 2005. Ashland WPCF serves approximately 20,000 people. The plant's liquid treatment processes include:

- Coarse Screening
- Influent Pumping
- Flow Equalization (& Pumping)
- Medium Screening
- Grit Removal
- Micro-strainer Fine Screening (supplements Primary Treatment for flows above 4 mgd)
- Primary Sedimentation
- Trickling Filters
- Combined biological nitrification and BOD Removal aeration tanks
- Secondary Clarification
- Effluent Pumping
- Ultraviolet (UV) Disinfection

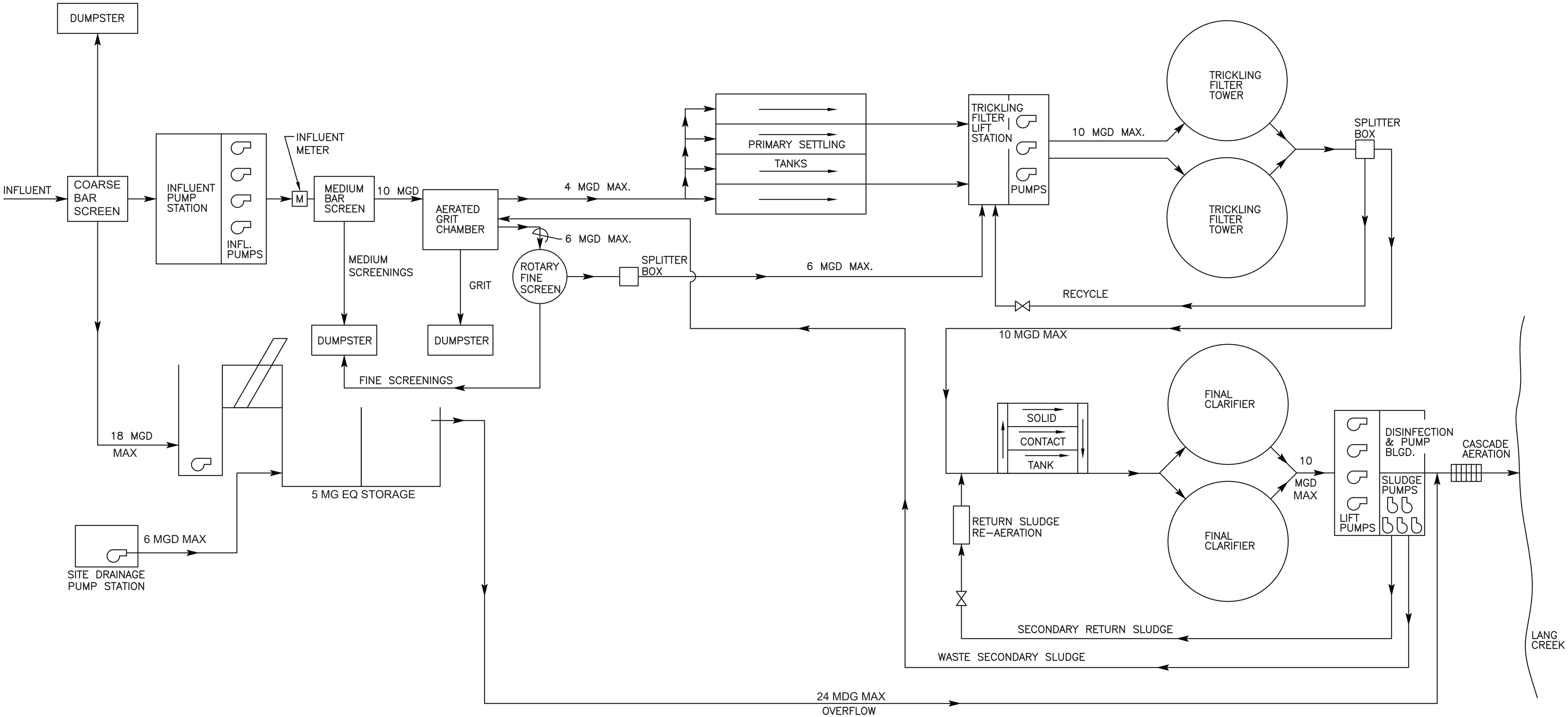
A flow schematic of the WPCF's existing liquid treatment process is provided in Figure 6.1.

6.2 Treatment Process Modeling

As part of the treatment plant capacity requirement of the NFA process, computer process modeling was incorporated into the NFA analysis. BioWin Wastewater Treatment Modeling software, from Envirosim Associates, Ltd. was utilized to create a representative wastewater treatment computer model of the existing plant. The model included process units defined to match the existing unit processes at the WPCF. The model was run and results compared to internal sampling results and MOR operations data to calibrate the model. The model was adjusted so that the steady state model results compared favorably to the real-life performance of the WPCF. Summary tables of the modeled influent and effluent parameters are provided in Appendix B for the calibrated existing conditions and the average Daily Design Flow (ADDF) of 5.0 mgd. The model was used as part of the evaluation of WPCF expansion as described below.

6.3 Existing Unit Process Evaluation

This portion of the NFA Report is a summary of the condition, capacity, and recommendations for the individual unit process systems at the WPCF. An evaluation



PLEASE NOTE:
FERRIC CHLORIDE THAT IS FED FOR PHOSPHORUS REMOVAL IS NOT SHOWN.

FIGURE 6.1

EXISTING LIQUID STREAM TREATMENT FLOW SCHEMATIC

was conducted with the City and recommendations, if needed, were made to improve the performance, reliability and/or capacity of each process area.

The results of this evaluation and the recommended renovations are improvements that should be considered by the City for completion at the WPCF in the near future and are not necessarily directly driven by the NFA study but are presented herein to help establish a holistic evaluation of the total improvements needed at the facility in addition to any I&I removal or expanded capacity improvements within the collection system or at the WPCF, respectively.

6.3.1 Raw Wastewater Pumping

6.3.1.1 Description

The Raw Wastewater Lift Station pumps coarse screened wastewater to the Influent Screening Building. Flows more than 10 mgd overflow a weir upstream of the coarse screen and flows by gravity to the EQ Basin Influent Wet Well where it is pumped into the EQ Basin.

<u>Salient Features</u>

Pump Protection Screening	
Type of Screen	Mechanical climbing bar screen
Quantity	1 (w/ manually cleaned bar screen bypass
Screen Opening Size	2-inch
Raw Influent Pumping	
Number of Pumps	4
Type	Pedestal Mounted Vertical Non-Clog Centrifugal Pumps
Design Capacity, each	3,500 gpm @ 31 ft TDH
Size	60 HP
Influent Metering	
Type of Meter	Magnetic Flow Meter
Quantity	1

6.3.1.2 Condition

- Reaching End of life cycle
- Cannot get parts for anymore
- Flow Metering utilizes chart recorder with no SCADA system

6.3.1.3 Performance / Capacity Limitations

- Firm capacity of 15 mgd but City cannot pump 15 mgd due to downstream capacity of system
- Flows in excess of 10 mgd overflow to EQ Basin

- Plugging and breakdowns of pumps have been an issue

6.3.1.4 Recommended Improvements

- Replace pumps

6.3.2 Preliminary Treatment (Medium Screen, Grit Removal & Micro-Strainer Fine Screen)

6.3.2.1 Description

The raw wastewater pumps pump wastewater to the Screening and Grit Building which houses the facilities medium screens, grit removal, and micro-strainer fine screen. The micro-strainer provides the equivalent of primary treatment for flows in excess of 4 mgd (capacity of traditional primary clarifiers).

<u>Salient Features</u>

Medium Screens	
Type of Screen	Step type mechanical screen
Quantity	1 (w/ overflow to bypass channel)
Screen Opening Size	6 mm clear spacing
Capacity	Greater than 15 mgd
Grit Removal	
Type	Aerated
Quantity	1 tank
Dimensions	32' x 18' x 12' SWD
Volume	51,840 gallons
PDF Capacity	15 mgd
Detention Time @ PDF	5 minutes
Micro-Strainer Fine Screen	
Type	Rotary Screen
Quantity	1
Opening Size	0.03-inches
Capacity	7,700 gpm (11.0 mgd)

6.3.2.2 Condition

- Structural issues with building
- Concrete of Grit structure is in very poor condition

6.3.2.3 Performance/Capacity Limitations

- Grit removal unit has issues with removal performance

6.3.2.4 Recommended Improvements

- Replace structure or abandon building and construct new screening & grit removal facility.

6.3.3 Flow Equalization Storage and Pumping

6.3.3.1 Description

In 2005 the City constructed a 2 cell, 5 million gallon EQ Basin. When influent flow to the WPCF exceeds 10 mgd, the flows above 10 mgd flow over a weir and flow by gravity from the Influent Screening and Pump Station to the EQ Basin Influent Pump Wet Well where the flow is pumped up into an influent channel where the wastewater is screened and allowed to discharge into Basin #1 (North Basin). Once Basin #1 is full, wastewater overflows to Basin #2. Upon completely filling both basins wastewater overflows from the EQ Basin via two (2) 10-ft long overflow weirs located at the eastern end of Basin #2. Flow leaving the basin is measured via an ultrasonic level sensor measuring the height of flow over the fixed overflow weir.

<u>Salient Features</u>

Influent Pumps	
Type	Submersible Non-Clog
Quantity	3
Capacity	4,200 gpm (6 mgd) each
EQ Basin	
Type	Concrete Above/Below Grade Tank
# of Basins	2
Dimensions (per basin)	80’ x 145’ x 25’-8” SWD
Total Volume	5.0 million gallons (nominal)
Cleaning System	
Type	Water Cannons
Quantity	6
Overflow Metering	
Type	Overflow Weir w/ Level Sensor
Quantity	Two (2), 10-ft each

6.3.3.2 Condition

- Good

6.3.3.3 Performance/Capacity Limitations

- Due to overflow being from two fixed 10-ft weirs, the velocity and height of overflow can allow for unrestricted flow of solids from EQ basin.

6.3.3.4 Recommended Improvements

- Install influent flow meters on discharge of each influent pump to measure instantaneous and peak flow rates into basin.

6.3.4 Primary Settling

6.3.4.1 Description

Wastewater flows by gravity from the Aerated Grit Chamber to the Primary Tanks. The existing primary settling tanks were constructed in 1930 and are capable of handling up to 4 mgd of flow. When flow to the plant is greater than 4 mgd, flows above 4 mgd overflow a weir at the Aerated Grit tank and are diverted to the rotary fine screen that provides equivalent primary treatment.

<u>Salient Features</u>

Primary Settling Tanks	
Type	Rectangular (Concrete)
Quantity	4
Dimensions	72’-4” x 12’ x 8’-4” SWD, each
Total Volume	216,900 gallons
Total Surface Area	3,472 SF
Surface Overflow Rate	1,150 gpd/sf @ 4.0 mgd
Detention Time	1.3 hours @ 4.0 mgd

6.3.4.2 Condition

- Units have outlived their useful life.
- Failures of sludge collector mechanism
- Require concrete repairs

6.3.4.3 Performance/Capacity Limitations

- 4 mgd capacity which is less than average daily flow
- Maintenance issues related to sludge rake collectors

6.3.4.4 Recommended Improvements

- Abandon or replace units in their entirety. Preferred replacement technology would be primary settling tanks; however space is very limited. Replacement with fine screens could allow for increase to 15 mgd capacity in existing footprint.

6.3.5 Trickling Filters

6.3.5.1 Description

Effluent from the primary tanks and the micro-strainer fine screen (if in operation) combine and flows to the Trickling Filter Pump Station wet well where the combined flow is pumped via dry well Trickling Filter pumps to the plant's trickling filters. During low flow days, effluent from the tower is recycled back to the Trickling Filter Pump Station and recycled back through the filters to ensure the media is kept wet and the lower portions of the filter operates effectively.

<u>Salient Features</u>

Trickling Filter Lift Station	
Number of Pumps	3
Type	Pedestal Mounted Vertical Non-Clog Centrifugal Pumps
Design Capacity, each	3,470 gpm @ 62 ft TDH
Size	77 HP
Trickling Filter Towers	
Design Avg. BOD_5	135 mg/L
Design Avg. Ammonia	15.0 mg/L
Quantity	2
Dimensions, each	83.9-ft diameter, 30-ft height
Media Type	60-degree cross flow plastic
Media Surface Area	30 SF/CF
Total Volume	331,710 CF
Total Unit Surface Area	9.95×10^6 SF
Design Avg. BOD_5 Loading	17 lbs. per 1,000 CF/day

6.3.5.2 Condition

- Trickling filter Lift Station pumps are reaching end of life cycle
- Cannot get parts for lift station pumps anymore
- Filter media needs replaced
- Structural degradation of concrete bases at inlet louvers and elsewhere

6.3.5.3 Performance/Capacity Limitations

- None

6.3.5.4 Recommended Improvements

- Replace lift station pumps
- Replace media
- Refurbish or replace distribution arms
- Complete structural repairs of concrete foundation wall
- Inspect interior of tank and make repairs while unit is offline

6.3.6 Sludge Re-Aeration and Solids Contact Unit

6.3.6.1 Description

Effluent from the Trickling Filters flows by gravity to the Solids Contact Units where remaining biological BOD removal and nitrification occurs.

Salient Features

Solids Contact Chambers	
Number of Chambers	3 in parallel
Type	Aerated; Plug Flow
Chamber Dimensions, each	16’ x 36’ x 11.75’ SWD
Total Volume	20,300 CF
Detention Time @ Design ADF + 50% Return Sludge	30 minutes
Max Day Flow (PDF + Return Sludge)	12.5 mgd
Detention Time @ Max Day Flow	17.5 minutes
Aeration System Type	Fine bubble
Required Max Air Supply	15 scfm per 1,000 CF
Return Sludge Aeration Tank	
Capacity	20,000 gallons
Air Supply Rate	30 scfm per 1,000 CF
Required Air Supply	80.2 scfm

6.3.6.2 Condition

- Air piping and diffusers need replaced

6.3.6.3 Performance/Capacity Limitations

- None (10 mgd capacity)

6.3.6.4 Recommended Improvements

- Replace diffusers and above grade air piping

6.3.7 Final Settling

Effluent from the Solids Contact Units flows by gravity to the Final Settling Tanks where activated sludge is allowed to settle and be removed via the tank collector mechanism. Pumps located in the basement of the Disinfection and Pump Building pump waste sludge to sludge holding tanks and return sludge back to the re-aeration tanks.

6.3.7.1 Description

<u>Salient Features</u>

Secondary Clarifiers	
Quantity	2
Type	Circular, center feed with flocculation well
Dimensions, each	80-ft diameter x 14' SWD
Volume, each	0.53 MG
Surface Overflow Rate @ Design ADF (5 mgd)	500 gpd/sf
Surface Overflow Rate @ Design PDF (10 mgd)	1,000 gpd/sf
Type Sludge Collection	Suction Header
Weir Length, total	502 lineal feet (lf)
Weir Overflow Rate @ Design ADF	9,960 gpd/lf

6.3.7.2 Condition

- Good

6.3.7.3 Performance/Capacity Limitations

- None (10 mgd capacity)

6.3.7.4 Recommended Improvements

- None

6.3.8 Effluent Pumping

6.3.8.1 Description

Effluent pumping is required to pump the effluent from the Final Settling Tanks up into the UV Disinfection Influent Channel during disinfection season or to the final outfall during non-disinfection season. Effluent pumping is located on the northern side of the Disinfection and Pump Building.

<u>Salient Features</u>

Effluent Pumping	
Quantity	4
Type	Axial-flow
Drive	VFD
Capacity	10 mgd w/ largest off-line

6.3.8.2 Condition

- Good

6.3.8.3 Performance/Capacity Limitations

- None

6.3.8.4 Recommended Improvements

- None

6.3.9 Disinfection

The existing ultraviolet disinfection system is an in-channel system manufactured by Trojan Technologies installed in 2001. The system uses two channels with two empty channels provided for off-season bypass around the units. Effluent level on the downstream side of the UV units is maintained via a weighted flap gate that insures a maximum submergence of the light bulbs. Effluent from disinfection is metered and discharges to Lang Creek after flowing over cascade aeration to provide increased dissolved oxygen in the final effluent.

6.3.9.1 Description

<u>Salient Features</u>

Disinfection	
Type	Ultraviolet; medium pressure
Quantity	2 banks, 1 per channel
No. of Modules per Bank	9
No. of Lamps per Module	8
Dosage @ Peak Flow	30,000 $\mu Ws/cm^2$
Peak Capacity, total	11 mgd

6.3.9.2 Condition

- Reaching end of life
- Replacement parts becoming difficult/costly to find and maintenance more troublesome

6.3.9.3 Performance/Capacity Limitations

- Peak treatment capacity is 11 mgd, but flow through capacity is limited to 10 mgd +/-

6.3.9.4 Recommended Improvements

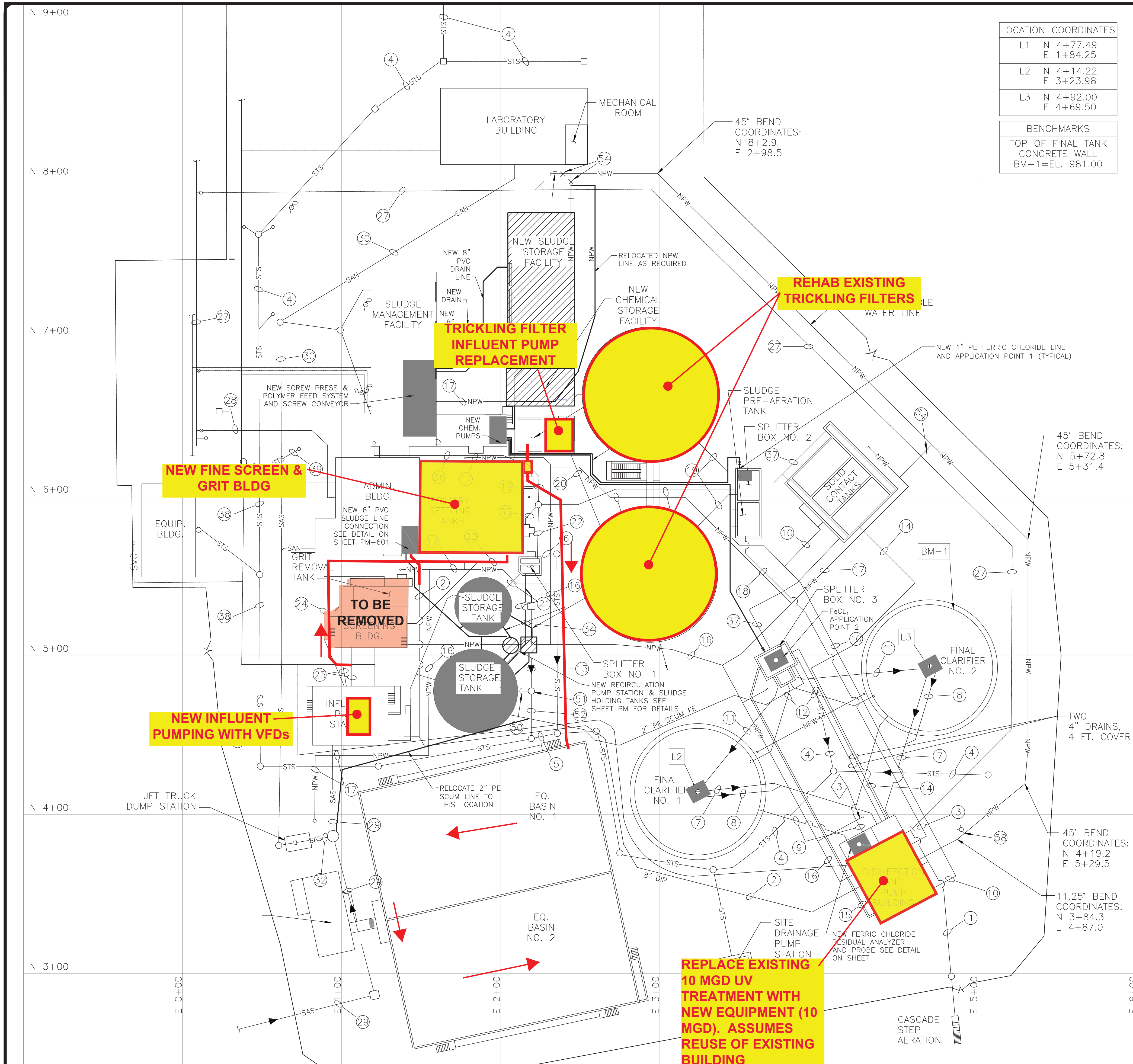
- Replace with newer unit
- Optimize hydraulic capacity of system

6.4 Recommended Short-Term WPCF Improvements

The recommended improvements described above and summarized below are project(s) that will be needed in the near future to allow for continued proper treatment of existing wastewater flows. These improvements are primarily driven by the age, operational restrictions, poor performance (with grit equipment) and limited ability to service outdated equipment associated with the existing facilities. Although not specifically driven by the NFA Study, these projects do need to be recognized as needing to be completed in the near future and should be considered in conjunction with the proposed NFA driven recommendations to allow the City the ability to develop the most cost-effective long-term plan moving forward.

6.4.1 Summary of Improvements

A list of the recommended Short-Term WPCF Improvements Projects is provided below. An exhibit illustrating the location and overall site plan of the proposed improvements in provided in Figure 6.2.



EXISTING PIPING SCHEDULE

①	DESCRIPTION
1	30" D.I.P. EFFLUENT LINE
2	8" D.I.P. WASTE SLUDGE LINE
3	10" D.I.P. RETURN SLUDGE
4	12" R.C.P. STORM
5	24" R.C.P. STORM
6	18" R.C.P. STORM
7	8" D.I.P. SLUDGE LINE
8	6" D.I.P. DRAIN LINE
9	24" D.I.P. EFFLUENT LINE
10	8" D.I.P. AIR LINE
11	30" D.I.P. INFLUENT LINE
12	6" D.I.P.
13	24" V.S.P. STORM
14	6" D.I.P. DRAIN
15	2- 1/2" POLYMER FEED LINES
16	2" P.V.C. NON-POTABLE WATERLINE
17	2" P.V.C. NON-POTABLE WATERLINE
18	3" GALV. STL. NON-POTABLE WATERLINE
19	24" D.I.P.
20	20" D.I.P.
21	16" C.I.P. (TO BE ABANDONED)
22	24" D.I.P.
23	30" D.I.P.
24	3" D.I.P. AIR LINE
25	20" D.I.P. PIPE
26	14" D.I.P. STORM
27	4" D.I.P. POTABLE WATERLINE
28	6" D.I.P. POTABLE WATERLINE
29	54" INTERCEPTOR SEWER
30	6" D.I.P. SANITARY SEWER
31	8" D.I.P. EQ. TANK DRAIN (TO BE ABANDONED)
32	12" R.C.P.
33	24" C.I.P.
34	24" R.C.P. (TO BE ABANDONED)
35	16" PIPE
36	8" V.S.P.
37	36" D.I.P.
38	15" R.C.P. STORM
39	8" R.C.P. STORM
50	24" D.I.P. (TO BE ABANDONED)
51	MH T/C=979.25 24"FL=971.0 (N,S) 24"FL=971.0 (W)
52	24" R.C.P.
53	MH T/C=979.25 24"FL=970.9 (N,S)

FIGURE 6.2

SUMMARY OF SHORT-TERM IMPROVEMENTS AT THE WPCF

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- Headworks and Preliminary Treatment Improvements
  - replace the existing influent pumps including VFD drives;
  - provide influent flow metering to existing EQ Basin (budget costs are based on installing three (3) magnetic flow meters on the discharge piping of the three influent pumps (1 meter per pump));
  - Replace Primary Treatment System. Budget costs are based on the following:
    - Abandon and demolish existing Medium Screen and Grit Removal Building and associated equipment;
    - Abandon and demolish the existing primary clarifiers;
    - Construct a new Fine screen and Grit Removal Building in current location of the existing primary clarifiers (possibly utilizing the existing primary clarifier structure as the lower level / basement of the proposed building). A plan view of the proposed new Fine Screen and Grit Removal Building is provided in Figure 6.3; and
    - Provide piping modifications to allow influent flow up to 15 mgd to receive primary treatment. Flows above 10 mgd would flow from primary treatment effluent to EQ Tanks.

- Trickling Filter Rehabilitation
  - replace existing Trickling Filter Lift Station pumps;
  - remove existing media and install new media;
  - refurbish and replace (if needed) existing distribution arms; and
  - perform detailed structural evaluations and complete necessary structural repairs to concrete foundation slab, concrete support/footer ring, and outer metal walls of tower.

- Supervisory Control and Data Acquisition (SCADA) System Improvements
  - Provide SCADA system backbone for existing equipment and to allow monitoring of PLCs for new equipment to provide for improved monitoring and control capabilities. Budgetary cost stated below for SCADA Improvements is for the "backbone" work needed to equip the existing plant to monitor existing equipment and expand to include PLCs for new equipment. Instrumentation and controls costs for each new facility is included within that facility's estimated cost.

- Disinfection Improvements
  - Install new UV Disinfection System to replace outdated existing system that has reached the end of its useful life.

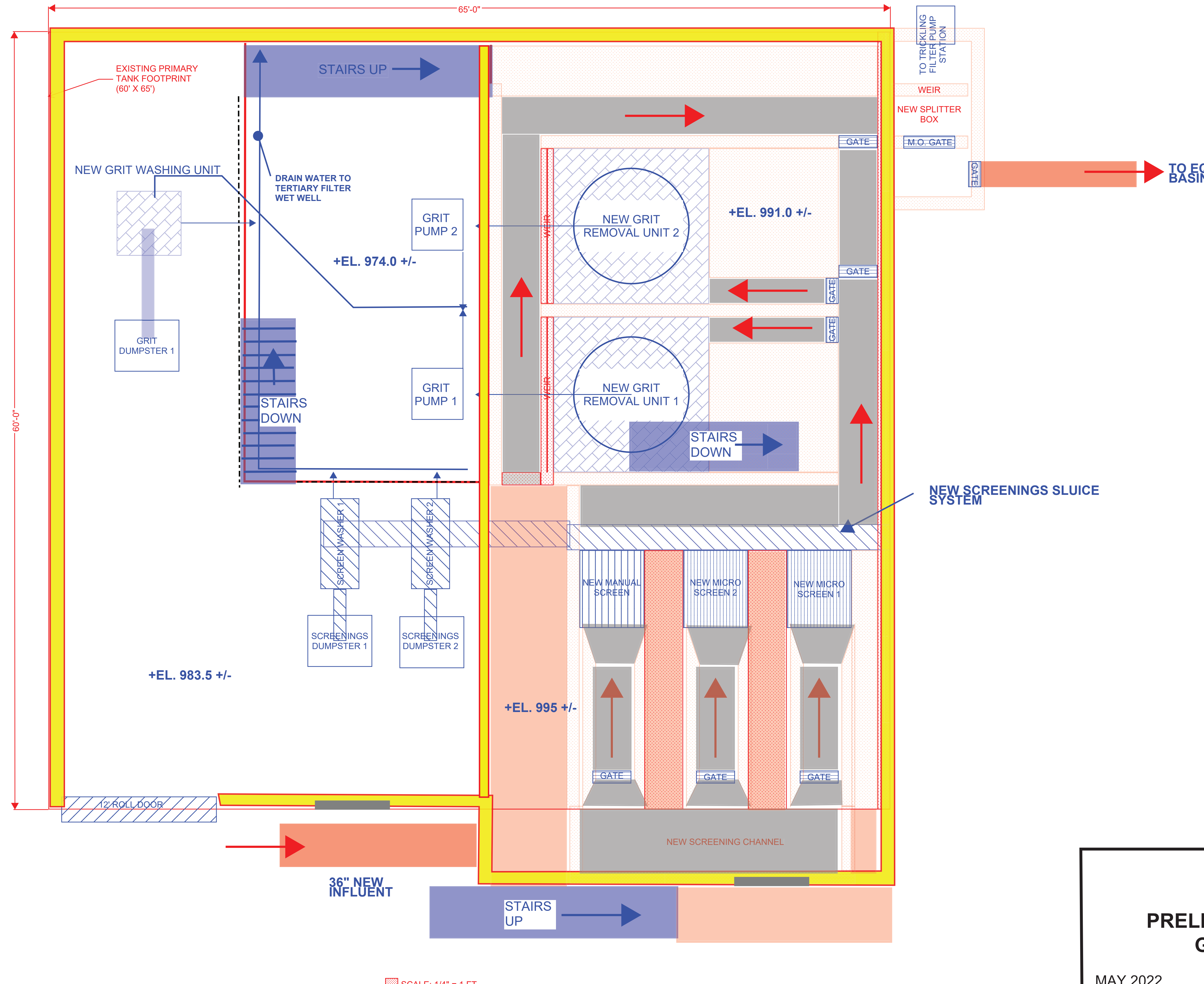

FIGURE 6.3

PRELIMINARY FINE SCREENING & GRIT BUILDING LAYOUT

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6.4.2 Budgetary Costs

A summary of the Engineer's Opinion of Probable Project Costs for completion of the Short-Term WPCF Improvements is provided in Table 6.1.

Table 6.1. Engineer's Budgetary Opinion of Probable Project Costs

ITEM	DESCRIPTION	BUDGETARY COST
A	INFLUENT PUMPING STATION IMPROVEMENTS	$640,000
B	INFLUENT METERING IMPROVEMENTS AT EXISTING EQ BASIN	$90,000
C	NEW FINE SCREEN AND GRIT REMOVAL BUILDING	$4,510,000
D	DEMOLITION OF EXISTING EQUIPMENT AND STRUCTURES	$470,000
E	TRICKLING FILTER REHABILITATION (INCLUDING NEW LIFT STATION PUMPS)	$3,460,000
F	SCADA IMPROVEMENTS	$520,000
G	DISINFECTION IMPROVEMENTS	$870,000
	SUBTOTAL	**$10,560,000**
	CONTINGENCY (@ 30%)	$3,170,000
	TOTAL ESTIMATED CONSTRUCTION COST	**$13,730,000**
	ENGINEERING, LEGAL, AND ADMINISTRATIVE COSTS (@ 25%)	$3,430,000
	TOTAL ESTIMATED BUDGETARY PROJECT COSTS	**$17,160,000**

7.0 Alternative Plans

The current NPDES permit requires the preparation of a "comprehensive analysis of feasible alternatives necessary to eliminate the bypasses at the treatment plant." The evaluation includes the following four (4) evaluation alternatives (Alternative 4 is included based on the rationale explained in Chapter 3 above):

- Alternative 1: Inflow/Infiltration Reduction in the Collection System.
- Alternative 2: Additional Wastewater Storage and Flow Equalization.
- Alternative 3: Additional Secondary Treatment Capacity, including both constructing additional secondary capacity and enhancing existing secondary capacity.
- Alternative 4: Evaluation of Methods to Enhance Treatment of Bypass Flows.

This section of the NFA report presents the alternative plans, project cost estimates and additional or new O&M costs due to the described plans; and shows the results of an evaluation of the monetary and non-monetary factors associated with those plans.

7.1 Alternative 1: Inflow/Infiltration Removal within the Collection System

7.1.1 Description

As supported by the 2000 SSES report and the City's historical knowledge of the collection system, the collection system is impacted significantly by both public and private side I&I. Upon B&N's review of available data and consultation with City, the recommended approach for removal of I&I is a targeted reduction program consisting of focused CIPP lining program in areas of high I&I within the system.

The CIPP lining program would include:

- lining of City sewers, manholes, and private laterals to within approximately 5-feet of the house;
- disconnection of illegal direct connections; and
- redirection of roof drains away from the house, where feasible.

Based on the limited storm size (1-2 year storm) observed during the 2000 SSES and to help better identify the highest I&I areas across the whole collection system, B&N recommends the City complete a supplemental Mini-System I&I Microdetection Study as part of this alternative. The proposed Microdetection Study utilizes level sensors installed at strategic manholes within the collection system. Rain gauges would be installed at strategic accessible locations in the collection system. Although not specifically capable of measuring each gallon of I&I, this study monitors wastewater levels within the system in order to identify areas within the collection system network which are likely responsible for contributing significant I&I. This study information combined with the City's historical knowledge and the knowledge gained from the 5-year cleaning and CCTV program (see Chapter 5) should be used to help in the establishment of each specific year's CIPP lining project boundaries.

Ancillary tasks that would be required to properly institute the CIPP lining program include:

- a review of the City's existing Sewer Use Ordinance and ordinance modifications to:
  - allow City (with contractor assistance) to complete lateral lining work on private property and to redirect downspouts (but not cause problems for adjacent properties)
  - provide clear direction for private property owners that need to eliminate illegal direct connections
  - create agreement forms to work on private property
  - include legal review of any proposed modifications
- implementation of a public education program
- pre-and post-flow monitoring (3-month duration each) of each rehabilitated area to determine impact of completed work
- targeted dye/smoke testing to identify potential direct connections
- field (dashboard) surveys regarding roof drains to locate possible direct connections and evaluate need and viability of roof drain redirects

7.1.2 Analysis Completed

As presented in Chapter 4, over the past 5-year period (2017 – 2021), the largest single day overflow event occurred on July 22, 2019 in the amount 12.75 MG. This overflow occurred due to a very large and intense storm, estimated by the City to be a greater than a 20 year storm event. No rain data exists for the City, but evaluation of a nearby rain gauge at the Mansfield Airport does indicate a large storm that produced 2.45 inches of rain between late July 21 into the early morning of July 22nd. The second largest daily overflow event occurred on June 16, 2019 in the amount of 8.21 MG and was part of a three-day overflow event.

Based upon this historical event data, a volume of 8.5 MG was chosen as the desired basis of design volume of required I&I removal. Removal of this volume of flow would remove 98% of the total daily overflow occurrences in the past 5-year period.

B&N's experience from working with multiple communities in Ohio is that institution of a focused CIPP Lining program as being suggested for this alternative has the potential to remove anywhere from 1 to 5 gpm per lateral plus I&I removals from leaking public sewers and manholes. A recommended planning number is 2.5 gpm/lateral. Assuming 2.5 gpm per lateral, approximately 2,400 laterals, and corresponding main line sewer and manholes, would need to be lined to remove 8.5 MG of flow over a one-day wet weather period. Additionally, the identification and mitigation of significant sewer defects during the initial 5-year cleaning and inspection cycle will be critical to achieving the 8.5 MG reduction goal.

Five mini-systems (3, 4, 7, 14, and 17) identified from the 2000 SSES Study were selected by B&N as leading districts for focused I&I removal and to serve as a representative sample in developing a multi-year CIPP lining program. These five mini-systems have a total of 176,554 LF (33.4 miles) of sanitary sewer and approximately 2,700 laterals. This equates to approximately 81 laterals per mile. Based on a density rate of 81 laterals per mile, the total approximate mileage of sewer area requiring lining to achieve 2,400 laterals would be approximately 29.6 miles.

For a community the size of Ashland, B&N's experience has shown that a CIPP lining program of approximately 1 - 1.5 miles per year is achievable. This is based on investigative field work; preparation of bid documents; pre- and post-improvement flow testing; bidding and construction of the CIPP lining work; and other associated work including lab and field testing of lining improvements. A 20-year CIPP lining program was assumed with the approximate length of sewer to be lined each year to be 1.48 miles to achieve the goal of 29.6 miles of lined sewer including lined laterals and other work in project area (lining of leaky manholes, roof drain redirects, and elimination of illegal direct connections).

7.1.3 Budgetary Costs

A budgetary cost estimate for targeted CIPP Lining of the entire 5 mini-systems (including lateral lining and other miscellaneous work) identified from the 2000 SSES was developed and is presented in Appendix C. Using this cost, an average cost per mile for CIPP Lining is estimated to be $1.37 million. Based on the need to complete approximately 1.48 miles of CIPP Lining per year to achieve the desired 8.5 MG of total I&I removal over the 20-year program, the average yearly cost would be $2.02 million.

7.1.4 Pros and Cons of Proposed Alternative

Major Pros	Major Cons
• Removes problem at source and reduces total volume of clean water treated at the WPCF thereby reducing energy, chemical and other ancillary costs associated with treatment. • Reduces clean water in collection system and occurrences of water-in-basements. • Provides additional capacity in sewer system as I&I is removed • Provides repairs in sewer system as needed to maintain remaining useful life of system.	• Highest cost alternative.

7.2 Alternative 2: Additional Wastewater Storage and Flow Equalization

7.2.1 Description

As discussed in Chapter 4, during the 5-year period from January 1, 2017 through December 31, 2021 the City of Ashland's WPCF had a total of 42 days with overflow occurrences. Of those 42 days with overflows, the largest single day overflow amount was 12.75 MG occurring July 22, 2019 and the largest total combined overflow from an extended rain event was 20.5 MG occurring on the three days of June 16, 2019 through June 18, 2019. To remove all overflows from that 5-year period would have required additional storage of 20. 5 MG. Availability of viable sites for a storage basin of this size is not feasible. Additionally, construction of a basin of this size would cause operational and negative treatment impacts to the existing treatment facility due to extended return times of the stored flow to the system.

B&N worked with the City of Ashland to identify possible locations for construction of additional equalization storage volume. To minimize cost and to maximize storage capacity, an earthen basin with clay liner was assumed. A concrete lined settling cell with push walls was assumed to be built at the influent entrance to the basin. This settling cell would capture most solids and be periodically cleaned by the City with a front end loader or similar type unit.

Two possible properties were identified for consideration as presented in Figure 7.1. The first property was a 31.3 acre field located directly west of the existing WPCF and across Lang Creek. This property is currently owned by the City. The second property was a 18.1 acre field located directly south of the WPCF again across Lang Creek. This property is not owned by the City and is currently an active farm field. Both properties

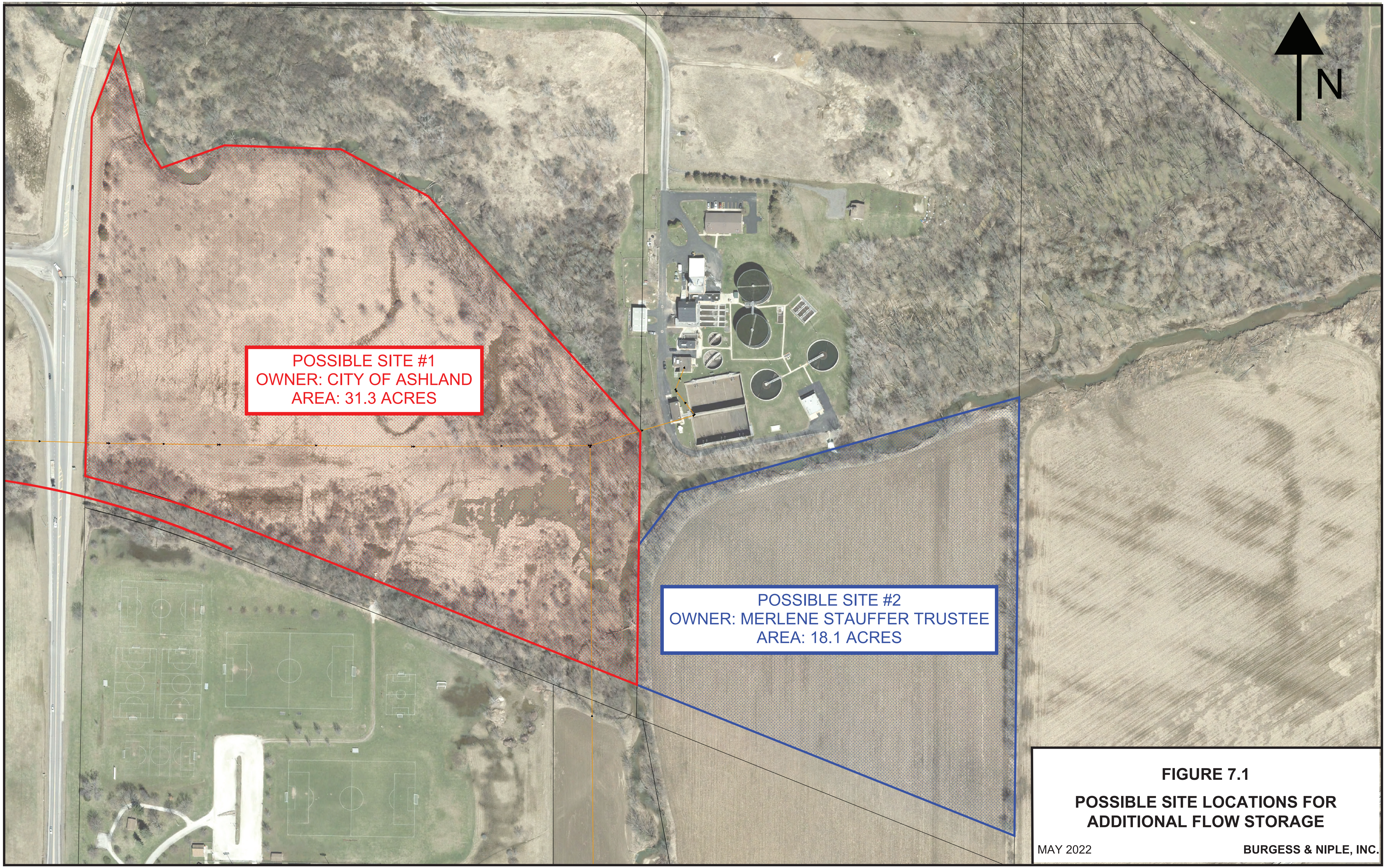

FIGURE 7.1

POSSIBLE SITE LOCATIONS FOR ADDITIONAL FLOW STORAGE

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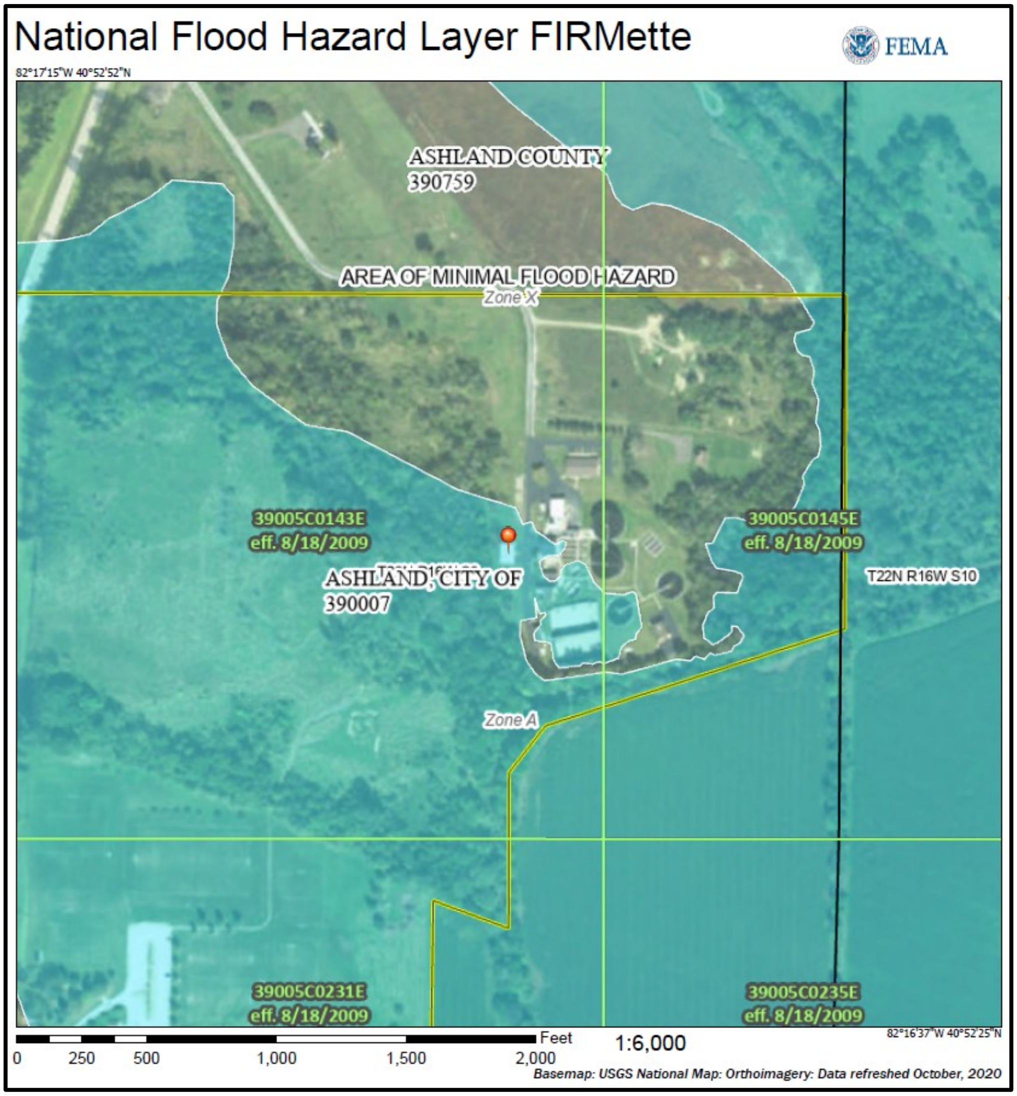
lie within the flood plain as shown in Figure 7.2. The property to the west of the WPCF, which is owned by the City, was selected as the preferred location for detailed evaluation of additional storage due to the site's proximity to the incoming trunk sewers that transport flow to the WPCF.

Figure 7.2. Floodplain Location Map



7.2.2 Analysis Completed

7.2.2.1 Wetlands

The U.S. Fish and Wildlife Service's National Wetlands Inventory was utilized to tentatively identify expected wetlands within the proposed property. The location of the EQ Basin and ancillary structures was placed to avoid the anticipated wetlands. A complete wetland delineation study would be needed ahead of detailed design if this Alternative is acted upon for implementation by the City. The location of the anticipated wetlands within the project area is provided in Figure 7.3.

Figure 7.3. Anticipated Wetlands Near Project Area

7.2.2.2 Soil Evaluation

Soil borings were completed at the possible basin site. A copy of the Geotechnical Exploration Report is provided in Appendix D. A principal concern for this alternative is the high groundwater table and poor soil that were observed from the soil borings. These poor soil conditions would make construction difficult. Based on the findings of the soils report, the following assumptions were made and used to estimate the final preliminary layout and budgetary cost of the basin:

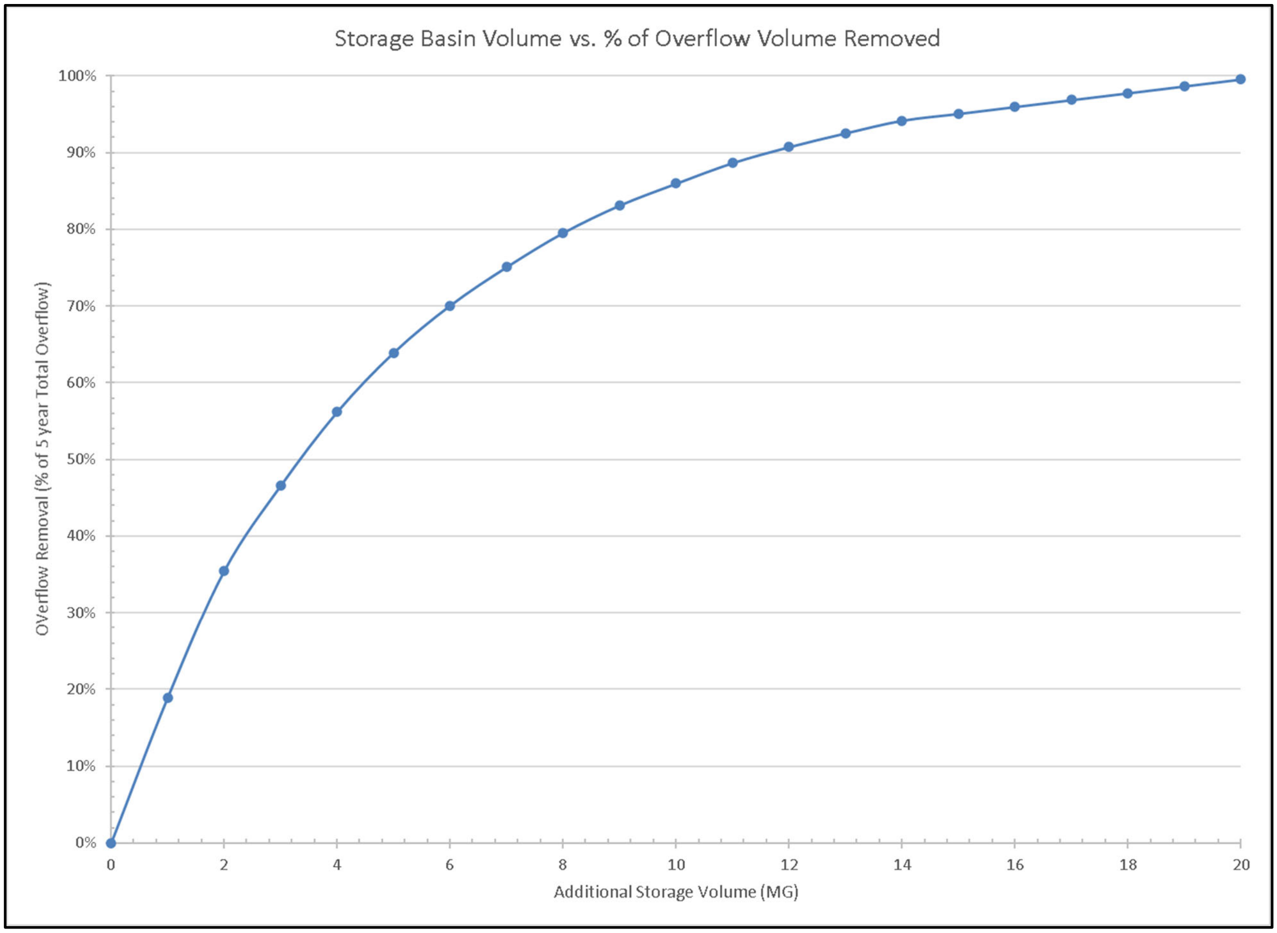
- Due to the high groundwater and poor soil conditions, no excavation of soils onsite was assumed with construction of the basin on top of the existing surface. This will require importing of soils for the berm and clay liner.
- To get the heavy equipment onsite and to work on-top of the existing soils as required to place the liner and berm, a Cement Stabilized Soil (CSS) platform from which the construction Contractor can work would be required.
- Since settlement of the soil would occur at the embankments, staged construction would be required with the berms. It is assumed that 6-9 months of time would be needed to allow settlement of berms prior to making final improvements and connections (i.e. piping, liner install, etc.).

7.2.2.3 Sizing of the Basin

Reviewing the overflow data from the EQ Basin at the WPCF for 2017 through 2021, there were a total of 42 overflow occurrences (days with overflow) equating to a total of 22 overflow events.   An overflow occurrence is defined as any calendar day with an overflow from the basin. An overflow event represents a rain event that fills the basin and causes an overflow to occur and is defined by the wet weather event not the overflow. A single overflow event could represent multiple daily overflow occurrences all related to the same wet weather event. A summary of the overflow occurrences and events and the impact of varying volumes of storage is provided in Appendix E. A chart showing the percentage of the total overflow volume from the WPCF that would have been removed based on volume of additional storage volume over the 5-year period of 2017 to 2021 is provided in Figure 7.4.

Reviewing the construction limitations of the proposed basin site in conjunction with the expected number of overflow events and overflow volume to be removed, a 10 MG basin was selected as the largest feasible basin size. A 10 MG basin would have reduced the number of overflow events from 22 to 3 and removed approximately 86% of the total 5-year overflow volume. A larger basin would not be feasible at this site.

Figure7. 4. Removal of Overflow Volume as a Function of Additional Storage Volume Provided



7.2.2.4 Summary of Proposed Improvements

A list of the proposed improvements included with this alternative is provided below. An exhibit illustrating the location and overall site plan of the proposed improvements in provided in Figure 7.5.

- Diversion Structure
  - Diversion structure would have an automated bypass gate with the ability to divert flow to proposed EQ Basin when existing EQ Basin at WPCF is full.
  - Coarse screening would be provided of the diverted wastewater flow to keep screenings within sanitary sewer.
- Influent Pump Station
  - Pump Station would include four (4) submersible non-clog pumps rated for 2,350 gpm capable of providing a firm pumping capacity of 18 mgd.
  - Below grade valve vault would be provided opposite of wet well
  - Building would be installed for Electrical systems and controls
  - Monorail and hoist would be provided for removal of pumps.
- 10 MG earthen basin would include:
  - clay liner
  - concrete settling cell with push wall for collection of settled solids
  - entrance ramp access to settling cell
  - outlet structure to allow controlled return of flow to sanitary sewer
- Miscellaneous sitework including access road and security fence.
- Due to the remote location of the proposed EQ Basin to the WPCF, the completion of the SCADA System Improvements proposed as part of the Short-Term WPCF Improvements would be required to be completed at the same time as these improvements to allow monitoring/control of the facility.

7.2.3 Budgetary Costs

A summary of the Engineer's Budgetary Opinion of Probable Project Costs for completion of Alternative 2 improvements is provided in Table 7.1.

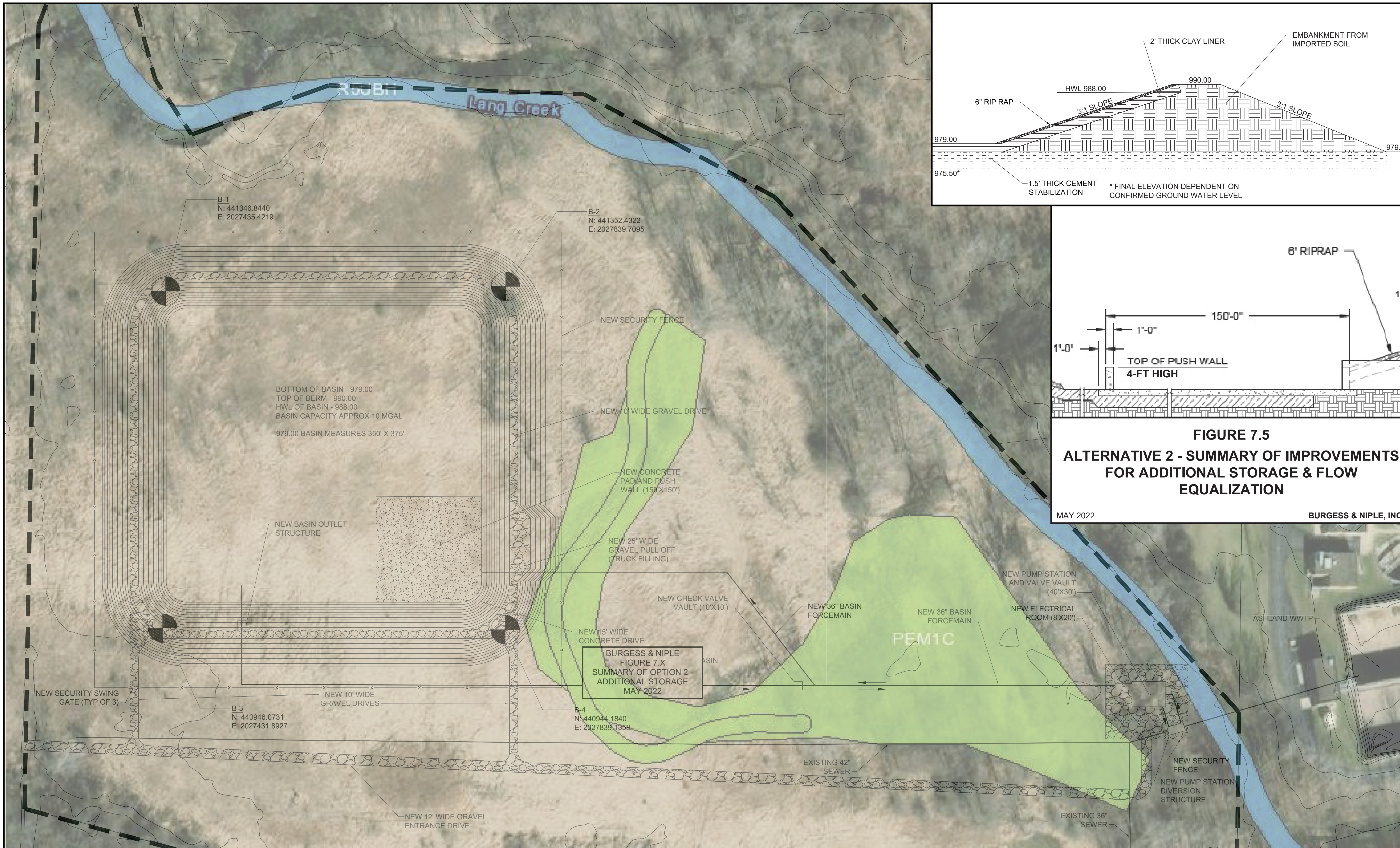


FIGURE 7.5

ALTERNATIVE 2 - SUMMARY OF IMPROVEMENTS FOR ADDITIONAL STORAGE & FLOW EQUALIZATION

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BURGESS & NIPLE, INC.

Table 7.1. Engineer's Budgetary Opinion of Probable Project Costs for Alternative No. 2

ITEM	DESCRIPTION	ANTICIPATED COST
A	MOBILIZATION	$240,000
B	SITE PIPING & SITE WORK	$1,0140,000
C	EQ BASIN AND SOLIDS COLLECTION AREA	$3,340,000
D	DIVERSION STRUCTURE	$510,000
E	PUMP STATION AND ELECTRICAL BUILDING	$2,050,000
F	OUTLET STRUCTURE	$120,000
G	SCADA BACKBONE AT WPCF	$520,000
H	ELECTRICAL, INSTRUMENTATION & CONTROLS	$1,060,000
	SUBTOTAL	**$8,880,000**
	CONTINGENCY (@ 30%)	$2,660,000
	TOTAL ESTIMATED CONSTRUCTION COST	**$11,540,000**
	ENGINEERING, LEGAL, AND ADMINISTRATIVE COSTS (@ 25%)	$2,890,000
	TOTAL ESTIMATED BUDGETARY PROJECT COSTS	**$14,430,000**

7.2.4 Pros and Cons of Proposed Alternative

Major Pros	Major Cons
• Second Lowest Project Cost • Would have removed 86% of recorded overflows from the last 5 years (2017 through 2021).	• Basin would be used only a handful of times per year. • Site is separated from WPCF and would require remote monitoring & operation. • Construction is in a flood plain & will require wetland delineation. • Potential for odors. • Poor soil conditions and high groundwater conditions make for a difficult and higher risk construction. • Would likely require staged construction to allow time (i.e. 6-9 months) for embankments to fully settle prior to finishing of construction (i.e. piping, clay liner, etc.).

7.3 Alternative 3: Expanded Secondary Treatment

7.3.1 Description

As presented in Chapter 6, the peak secondary treatment capacity is 10 mgd as limited by Final Clarifiers, effluent pumping, and disinfection. An expansion of secondary treatment peak design flow from 10 mgd to 15 mgd was evaluated. Due to the limited footprint available for expansion of the plant, BioWIN modeling was utilized to evaluate the optimal operation and expansion required. The developed alternative includes the construction of headworks, primary treatment, and trickling filter improvements presented as part of the "Short-Term" Improvements (as presented in Chapter 6). Additionally, it would include the construction of an expanded trickling filter influent pump station, one additional final clarifier, solids contact tank expansion, and new UV disinfection structure, expanded effluent pumping and other ancillary improvements.

We do not anticipate requiring an expansion of average design capacity as part of these improvements and thus an anti-degradation evaluation is not anticipated. There would be no anticipated increase loading to the stream. In fact, as EQ overflows are significantly reduced loadings to the stream will decrease.

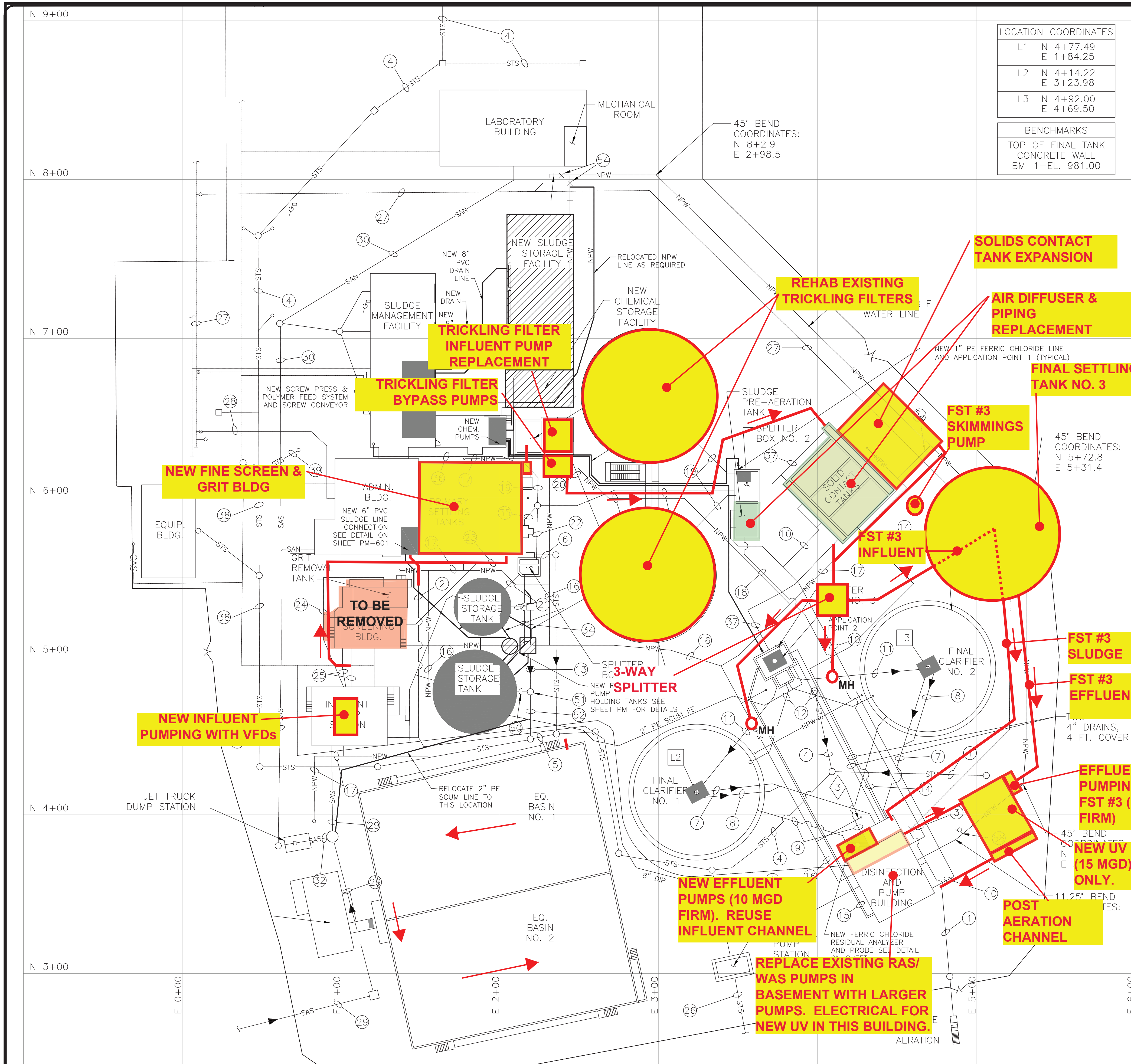
7.3.2 Analysis Completed

7.3.2.1 BioWIN Modeling

B&N utilized the calibrated BioWin model to evaluate required improvements for satisfactory secondary treatment of an expanded peak flow of 15 mgd. A key finding was that a third trickling filter is not required. The trickling filter lift station would need to be expanded to allow bypass of flows greater than 10 mgd around the trickling filters to an expanded solids contact unit. Summary tables of the modeled influent and effluent parameters is provided in Appendix B for the ADDF of 5.0 mgd and the peak hourly/daily flow of 15 mgd through the plant.

7.3.2.2 Summary of Preliminary Improvements

A list of the preliminary improvements included with this alternative and used for budgetary cost evaluation is provided below. An exhibit illustrating the location and overall site plan of the proposed improvements in provided in Figure 7.6.



LOCATION	COORDINATES
L1	N 4+77.49 E 1+84.25
L2	N 4+14.22 E 3+23.98
L3	N 4+92.00 E 4+69.50

BENCHMARKS
TOP OF FINAL TANK CONCRETE WALL BM−1=EL. 981.00

EXISTING PIPING SCHEDULE

①	DESCRIPTION
1	30" D.I.P. EFFLUENT LINE
2	8" D.I.P. WASTE SLUDGE LINE
3	10" D.I.P. RETURN SLUDGE
4	12" R.C.P. STORM
5	24" R.C.P. STORM
6	18" R.C.P. STORM
7	8" D.I.P. SLUDGE LINE
8	6" D.I.P. DRAIN LINE
9	24" D.I.P. EFFLUENT LINE
10	8" D.I.P. AIR LINE
11	30" D.I.P. INFLUENT LINE
12	6" D.I.P.
13	24" V.S.P. STORM
14	6" D.I.P. DRAIN
15	2− 1/2" POLYMER FEED LINES
16	2" P.V.C. NON−POTABLE WATERLINE
17	2" P.V.C. NON−POTABLE WATERLINE
18	3" GALV. STL. NON−POTABLE WATERLINE
19	24" D.I.P.
20	20" D.I.P.
21	16" C.I.P. (TO BE ABANDONED)
22	24" D.I.P.
23	30" D.I.P.
24	3" D.I.P. AIR LINE
25	20" D.I.P. PIPE
26	14" D.I.P. STORM
27	4" D.I.P. POTABLE WATERLINE
28	6" D.I.P. POTABLE WATERLINE
29	54" INTERCEPTOR SEWER
30	6" D.I.P. SANITARY SEWER
31	8" D.I.P. EQ. TANK DRAIN (TO BE ABANDONED)
32	12" R.C.P.
33	24" C.I.P.
34	24" R.C.P. (TO BE ABANDONED)
35	16" PIPE
36	8" V.S.P.
37	36" D.I.P.
38	15" R.C.P. STORM
[illegible]	R.C.P. STORM
[illegible]	" D.I.P. (TO BE ABANDONED)
51	T/C=979.25 24"FL=971.0 (N,S) =971.0 (W)
[illegible]	C.P.
53	MH T/C=979.25 24"FL=970.9 (N,S)

FIGURE 7.6

ALTERNATIVE 3: EXPANSION OF PLANT TO 15 MGD PEAK DAILY FLOW

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- Headworks and Preliminary Treatment Improvements (as presented in Chapter 6)
    - Replace the existing influent pumps including VFD drives;
    - Provide influent flow metering to existing EQ Basin (budget costs are based on installing three (3) magnetic flow meters on the discharge piping of the three influent pumps (1 meter per pump));
    - Replace Primary Treatment System. Budget costs are based on the following:
        - Abandon and demolish existing Medium Screen and Grit Removal Building and associated equipment;
        - Abandon and demolish the existing primary clarifiers;
        - Construct a new Fine screen and Grit Removal Building in current location of the existing primary clarifiers (possibly utilizing the existing primary clarifier structure as the lower level / basement of the proposed building). A plan view of the proposed new Fine Screen and Grit Removal Building was provided in Figure 6.3, previously.
        - Provide piping modifications to allow influent flow up to 15 mgd to receive primary treatment. Flows above 10 mgd would flow from primary treatment effluent to EQ Tanks.
- Trickling Filter Rehabilitation (as presented in Chapter 6)
    - replace existing lift station pumps
    - remove existing media and install new media
    - refurbish and replaced (if needed) existing distribution arms; and
    - perform detailed structural evaluations and complete necessary structural repairs to concrete foundation slab, concrete support/footer ring, and outer metal walls of tower.
- Trickling Filter Pump Station Expansion
    - Expansion of existing pump station structure
    - Installation of two 3,500 gpm submersible non-clog centrifugal pumps (dry well installation) capable of providing 5 mgd of firm pumping capacity to expanded solids contact unit
    - Process piping and valving (16” interior and 20” within yard)

- Solids Contact Tank Expansion
    - New tank same size of existing unit (mirror image) including air piping and air diffusers
    - Replacement of existing air piping and diffusers within existing tank
- 3rd Final Clarifier
    - New 3-way flow splitter structure and influent piping to existing and new clarifiers
    - 3rd Final Clarifier same size as existing units
    - New skimmings pump stations to handle skimmings from 3rd clarifier
    - Ancillary yard piping (influent, effluent, skimmings, and sludge)
    - New RAS and WAS pumps in the basement of the existing Disinfection and Pumping Building as required to handle additional sludge flow.
- Expanded Effluent Pump Station & New UV Disinfection Structure
    - New axial-flow, can type effluent pumps (quantity of 4) at the existing effluent pump station capable of pumping the flow from the existing two final clarifiers (10 mgd firm) to new UV Disinfection Structure
    - New UV Disinfection Structure (Below is basis of budgetary costs but would be evaluated further in design phase)
        - Two channels
        - Trojan UV Signa (Basis of Design Manufacturer)
        - Firm capacity of 15 mgd
        - Roof only over structure
        - Post aeration channel provided to supplement step aeration at final outfall
    - New axial-flow, can type effluent pumps (quantity of 2) to handle flow from 3rd clarifier (firm capacity of 5 mgd)
    - Ancillary piping, valving and other items (i.e. handrail, grating, access hatches, etc.) as required
- Supervisory Control and Data Acquisition (SCADA) System Improvements
    - Provide SCADA system backbone for existing facility to allow expansion and connection to PLCs for new equipment to provide for improved monitoring and control capabilities.

7.3.3 Budgetary Costs

A summary of the Engineer's Budgetary Opinion of Probable Project Costs for completion of Alternative 3 improvements is provided in Table 7.2.

Table 7.2. Engineer's Budgetary Opinion of Probable Project Costs for Alternative 3

ITEM	DESCRIPTION	BUDGETARY COST
A	INFLUENT PUMPING STATION IMPROVEMENTS	$640,000
B	INFLUENT METERING IMPROVEMETNS AT EXISTING EQ BASIN	$90,000
C	NEW FINE SCREEN AND GRIT REMOVAL BUILDING	$4,510,000
D	DEMOLITIONOF EXISTING EQUIPMENT AND STRUCTURES	$470,000
E	TRICKLING FILTER REHABILITATION (INCLUDING REPLACEMENT OF LIFT STATION PUMPS)	$3,120,000
F	TRICKLING FILTER PUMP STATION MODIFICATIONS	$1,320,000
G	SOLIDS CONTACT TANK EXPANSION	$1,230,000
H	3RD FINAL CLARIFIER	$3,940,000
I	EXPANDED EFFLUENT PUMP STATION & NEW UV DISINFECTION STRUCTURE	$3,090,000
J	SCADA BACKBONE IMPROVEMENTS	$520,000
	SUBTOTAL	**$18,930,000**
	CONTINGENCY (@ 30%)	$5,680,000
	TOTAL ESTIMATED CONSTRUCTION COST	**$24,610,000**
	ENGINEERING, LEGAL, AND ADMINISTRATIVE COSTS (@ 25%)	$6,150,000
	TOTAL ESTIMATED BUDGETARY PROJECT COSTS	**$30,760,000**

7.3.4 Pros and Cons of Alternative

Major Pros	Major Cons
• Plant peak flow expansion would provide additional peak flow capacity and provide the basis for future expansion of the ADF design capacity based on need for City Growth. • New equipment and system would provide increased reliability and energy efficiency.	• Higher cost than Alternative 2 (Additional EQ Storage) • Tight footprint. • Unless combined with collection system improvements, does not remove I&I from collection system.

7.4 Alternative 4: Methods to Enhance Treatment of Bypass Flows

As discussed in Chapter 3, email correspondence from the Ohio EPA indicated that facilities serving separate sanitary sewer systems must provide secondary treatment to all influent flows and the City's NPDES permit had inappropriately included a requirement to evaluate this alternative as part of the study requirements.

As discussed in Chapter 3, the City has chosen to keep this alternative as part of the final analysis to ensure all reasonable alternatives are considered.

7.4.1 Description

Two enhanced treatment options were considered for this alternative:

- The first (Alternative 4a) was the implementation of tertiary filtration downstream of the EQ Basin overflow to filter normal flows and peak flows and include disinfection of both secondary effluent and the enhanced treated EQ basin overflow.
- The second (Alternative 4b) was the implementation of Chemically Enhanced Primary Treatment (CEPT) to the EQ basin influent flow prior to overflow. CEPT enhancement would help reduce the effluent TSS and BOD concentrations of the overflow. Like Alternative 4a, all overflow from the EQ basin would receive disinfection.

7.4.1.1 Alternative 4a – Tertiary Filtration

Influent to the WPCF in excess of 10 mgd is diverted to the existing EQ basin and pumped into the EQ basin via three (3) 6 mgd influent pumps. Therefore, the peak raw influent flow that could be diverted to the EQ basin is 18 mgd. An in-plant stormwater pump station handling local stormwater also can pump up to 6 mgd of flow to the EQ basin. Therefore, the maximum overflow rate from the basin is 24 mgd.

The basis of design for this alternative was to provide 20 mgd of tertiary filtration treatment of the combined secondary plant effluent and EQ basin overflow as this would treat almost all overflow conditions based on historical data. This would provide tertiary treatment of all secondary effluent (10 mgd) and up to 10 mgd of EQ basin overflow. When overflow from the existing EQ basin exceeds 10 mgd, secondary plant effluent would be diverted around the tertiary filters and up to 20 mgd of EQ basin overflow would receive tertiary treatment. Any overflow flows in excess of the 20 mgd tertiary filter capacity would be bypassed around tertiary treatment and disinfected prior to discharge. Disinfection would be sized to provide treatment of all 34 mgd (10 mgd secondary effluent + 24 mgd EQ basin overflow) of flow.

7.4.1.2 Alternative 4b – Chemically Enhanced Primary Treatment (CEPT) of EQ Flow

CEPT was chosen for evaluation based on its long, established history as a proven high-rate treatment technology that can substantially aid in the removal of solids from wet weather flows. A reduction of the effluent BOD can be expected as well based on effective removal of the biological solids from the effluent.

This alternative includes the addition of CEPT treatment to Tank #2 of the existing EQ Basin with improved effluent v-notch launders to provide a reduced overflow velocity from the basin. Treated overflow from the basin would be disinfected and then combined with the traditional plant effluent prior to discharge to the outfall.

Proposed improvements would likely require construction of a new chemical storage and feed facility to house the coagulant and polymer utilized to provide the enhanced settling and is included in the budgetary opinion of probable project costs.

7.4.2 Analysis Completed – Alternative 4a (Tertiary Treatment)

7.4.2.1 Tertiary Filter Sizing and Operational Plan

Due to required footprint size of the 20 mgd tertiary filter and 34 mgd disinfection facility, construction of the proposed facility is shown to the south of the existing WPCF on the south side of Lang Creek.

The new tertiary treatment and disinfection facility would replace the existing disinfection facility and existing outfall. Flow to the facility would require an access bridge and crossing of Lang Creek with secondary effluent and EQ overflow force mains and ancillary piping.

The tertiary treatment technology used to estimate budgetary costs was compressible media filters due to this type of filters ability to handle widely variable flows.

Disinfection budgetary costs were based on UV Disinfection.

7.4.2.2 Summary of Required Improvements

A list of the proposed improvements included with this alternative is provide below. This alternative would be predominantly located to the south of Lang Creek built on existing farmland that would need to be purchased by the City. An exhibit illustrating the proposed improvements on the property to south of Lang Creek is provided in Figure 7.7. An exhibit illustrating the proposed improvements required

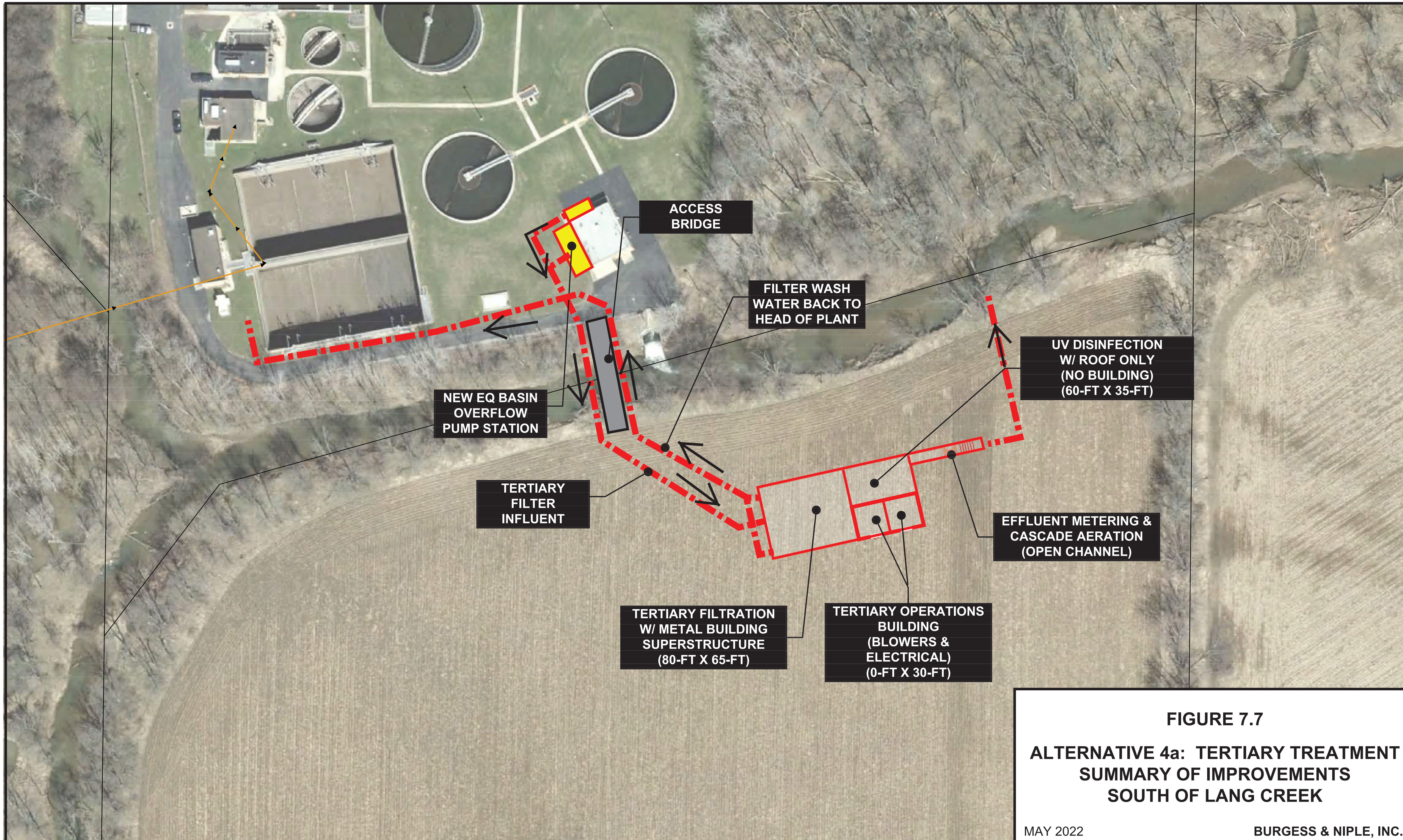

FIGURE 7.7

ALTERNATIVE 4a: TERTIARY TREATMENT SUMMARY OF IMPROVEMENTS SOUTH OF LANG CREEK

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at the existing WPCF property is provided in Figure 7.8. Improvements used to establish budgetary cost are listed below:

- Existing Effluent Pumps Station Modifications
  - Convert existing axial-flow effluent pump station to a submersible non-clog centrifugal pump station with new force main to pump plant effluent to the Tertiary/Disinfection Facility south side of Lang Creek.
  - Pump Station would include four (4) 2,350 gpm submersible non-clog pumps with a firm 10 mgd total pumping capacity.
  - 30-inch force main from pump station to Tertiary Filtration/Disinfection Facility
- EQ Basin Overflow Pump Station
  - Construct new EQ Basin Overflow Pump Station to send EQ basin overflow to the Tertiary Filtration/Disinfection Facility on the south side of Lang Creek.
  - The new pump station would utilize four (5) submersible non-clog centrifugal pumps (4,200 gpm) sized to provide a firm 24 mgd total pumping capacity.
  - 36-inch force main from EQ Basin Overflow Pump Station to Tertiary Filtration/Disinfection Facility
- Tertiary Filters (Compressible Media Filter – Fuzzy Filter by Parkson was used as Basis of Evaluation)
  - Twelve (12) 8-ft x 8-ft Fuzzy Filter Cells installed in below grade concrete structure with metal pre-engineering building constructed to protect the cells from freezing.
  - Two (2) duty and one (1) standby air wash blowers inside separate room
  - Filter backwash water pump station and force main back to head of plant (sanitary sewer manhole upstream of influent pumping station)
  - Electrical room with Automated controls
- New UV Disinfection
  - Two channels
  - Trojan UV Signa (Basis of Evaluation Manufacturer)
  - Firm capacity of 34 mgd
  - Roof only over structure
  - Share common electrical room with Tertiary Filters
- Effluent Metering & Post Aeration
  - Parshall flume
  - Cascade aeration provided downstream of effluent metering

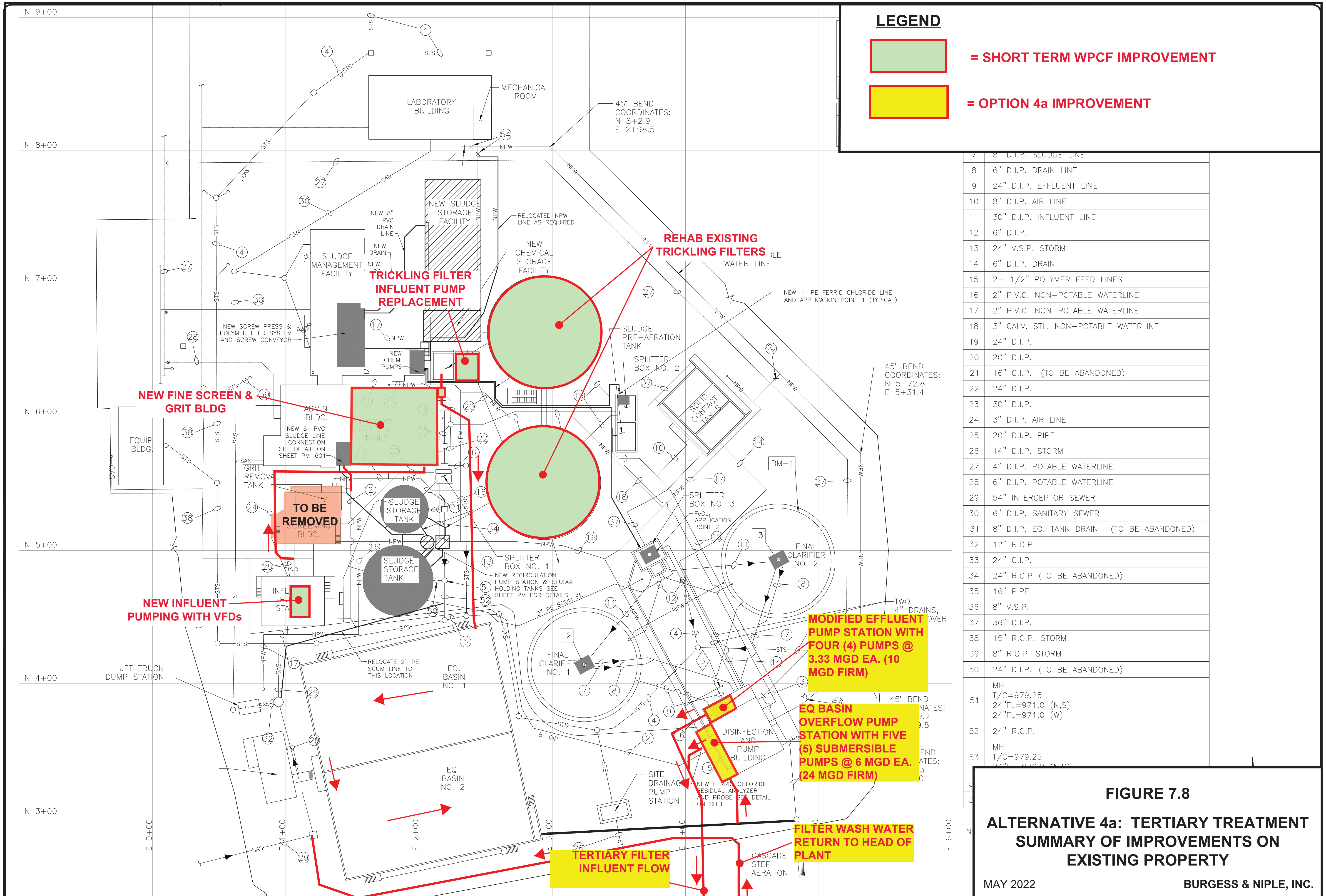

FIGURE 7.8

ALTERNATIVE 4a: TERTIARY TREATMENT SUMMARY OF IMPROVEMENTS ON EXISTING PROPERTY

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- Sitework and Ancillary Improvements
  - Vehicle access bridge across Lang Creek
  - Security fencing
  - Access road and parking.
- the completion of the SCADA System Backbone Improvements proposed as part of the Short-Term WPCF Improvements would be required to be completed at the same time as these improvements to allow monitoring/control of the facility. The costs for this improvement is included in the Budgetary Costs presented in the follow section.

7.4.3 Analysis Completed – Alternative 4b (CEPT)

7.4.3.1 Operational Plan

Inlet to the existing basin would be moved to the northeast corner of Tank #1 with Tank 1 used for storage. Upon filling of Tank #1 flow would enter Tank #2 via an influent channel where coagulant would be fed and activated via a high-rate induction mixer. Polymer would be fed as the influent flow enters Tank #2 to allow the pin floc created from the added coagulant to congregate further into larger “particles” that settle prior to overflowing from the tank via the effluent v-notch launders.

The peak surface overflow rate (SOR) for the Tank #2 would be approximately 2,100 gpd/sf (@ 24 mgd overflow rate). SORs of 3,000 – 5,000 gpd/sf for CEPT facilities are typical. A low SOR indicates a lower upflow velocity which would provide effective treatment.

Possible coagulants include: Ferric Chloride ($FeCl_3$), Polyaluminum Chloride (PAC), Aluminum Sulfate, Aluminum Chorhydrate, and Sodium Aluminate. It is recommended that jar testing would need to be completed on the primary influent to determine preferred chemicals for treatment and cost effectiveness. The WPCF currently utilized Ferric Chloride for the removal of phosphorus.

A separate chemical storage and feed facility has been assumed for this alternative.

7.4.3.2 Summary of Required Improvements

A list of the preliminary improvements included with this alternative is provide below. An exhibit illustrating the preliminary improvements required (and used for budgetary cost estimate) is provided in Figure 7.9.

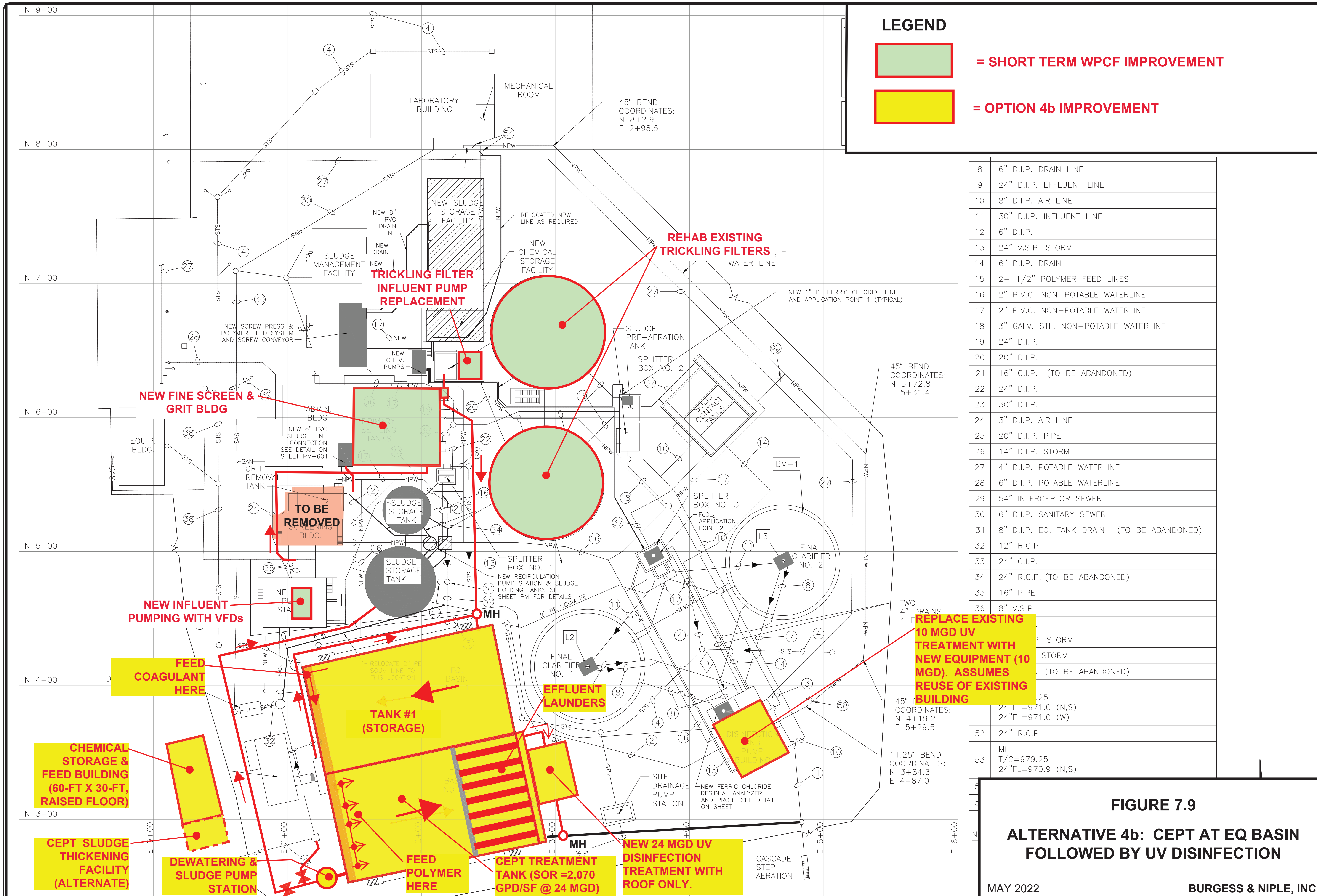

FIGURE 7.9

ALTERNATIVE 4b: CEPT AT EQ BASIN FOLLOWED BY UV DISINFECTION

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- EQ Basin Modifications
  - Piping modifications to relocate existing inlet to northeast corner of Tank #1.
  - Sludge removal improvements including water cannons and the addition of fill concrete to slope tanks to the west to a common channel that drains to the southwest corner of Tank #2 where the sludge is removed via a new dewatering and sludge pump station.
  - Cross-connection, coagulant mixing channel where coagulant is introduced to flow from Tank #1 prior to discharge to Tank #2.
  - Polymer piping and feed diffusers to feed polymer to the coagulant treated flow as it enters Tank#2.
  - V-notch effluent launders and effluent channel.
- New Dewatering and Solids Pumps Station that includes two (2) submersible non-clog centrifugal pumps that can both dewater supernatant from the tank and pump out settled solids flushed to the pump station via water cannons. The cleaner upper level or supernatant water would be pumped to the head of the plant for treatment. The settled solids would be pumped to the existing sludge storage tank for sludge treatment.
- New UV Disinfection
  - Two channels
  - Trojan UV Signa (Basis of Design Manufacturer)
  - Firm capacity of 24 mgd
  - Roof only over structure
- Chemical Storage and Feed Building
  - Two (2) 6,000 gallon bulk coagulant storage tanks with level sensors. The coagulant feed pumps would be hose type pumps.
  - Two (2) liquid emulsion polymer feed systems (1 online, 1 back-up) with two (2) 275-gallon polymer feed totes with weigh scales for monitoring volume used/available.
  - Spill containment for each stored chemical.
  - Chemical piping.
  - Dilution water system.
  - HVAC.
  - Electrical Room.
  - Operator control room.
- The completion of the SCADA System Backbone Improvements proposed as part of the Short-Term WPCF Improvements would be required to be completed at the same time as these improvements to allow connection of new monitoring/control of the new equipment to the existing facility. The costs for this improvement is included in the Budgetary Costs presented in the follow section.

7.4.4 Budgetary Costs – Alternative 4a

A summary of the Engineer's Budgetary Opinion of Probable Project Costs for completion of Alternative 4a improvements is provided in Table 7.3.

Table 7.3. Engineer's Budgetary Opinion of Probable Project Costs for Alternative 4a

ITEM	DESCRIPTION	BUDGETARY COST
A	EXISTING TRADITIONAL PLANT EFFLUENT PUMP STATION MODIFICATIONS	$580,000
B	NEW EQ BASIN OVERFLOW PUMP STATION	$1,590,000
C	TERTIARY FILTER / DISINFECTION FACILITY	$12,500,000
D	EFFLUENT METERING AND POST AERATION	$840,000
E	SITEWORK AND ANCILLARY IMPROVEMENTS	$1,380,000
F	SCADA BACKBONE IMPROVEMENTS	$520,000
	SUBTOTAL	**$17,410,000**
	CONTINGENCY (@ 30%)	$5,220,000
	TOTAL ESTIMATED CONSTRUCTION COST	**$22,630,000**
	ENGINEERING, LEGAL, AND ADMINISTRATIVE COSTS (@ 25%)	$5,660,000
	TOTAL ESTIMATED BUDGETARY PROJECT COSTS	**$28,290,000**

7.4.5 Budgetary Costs – Alternative 4b

A summary of the Engineer's Budgetary Opinion of Probable Project Costs for completion of Alternative 4b improvements is provided in Table 7.4.

Table 7.4. Engineer's Budgetary Opinion of Probable Project Costs for Alternative 4b

ITEM	DESCRIPTION	BUDGETARY COST
A	EXISTING EQ BASIN MODIFICATIONS	$3,200,000
B	NEW DEWATERING AND SOLIDS PUMP STATION	$550,000
C	UV DISINFECTION TREATMENT STRUCTURE	$2,140,000
D	CHEMICAL STORAGE AND FEED BUILDING	$1,040,000
E	SCADA BACKBONE IMPROVEMENTS	$520,000
	SUBTOTAL	**$7,450,000**
	CONTINGENCY (@ 30%)	$2,240,000
	TOTAL ESTIMATED CONSTRUCTION COST	**$9,690,000**
	ENGINEERING, LEGAL, AND ADMINISTRATIVE COSTS (@ 25%)	$2,420,000
	TOTAL ESTIMATED BUDGETARY PROJECT COSTS	**$12,110,000**

7.4.6 Pros and Cons of Proposed Alternative 4a

Major Pros	Major Cons
• This alternative improves effluent quality during all flow situations (most drastic reduction of loads to stream of any alternative).	• Second highest project cost • Construction would be in a flood plain. • No reduction of overflows. • Final acceptance by Ohio EPA unknown. • Required purchase of private property

7.4.7 Pros and Cons of Proposed Alternative 4b

Major Pros	Major Cons
• This alternative improves water quality of overflow from existing EQ Basin. • Lowest project cost	• No reduction of overflows • Final acceptance by Ohio EPA unknown. • Requires additional operational costs and handling issues associated with captured solids.

7.5 Alternative Plan Evaluation: Cost and Other Non-Monetary Factors

Table 7.5 below presents the Engineer's Budgetary Opinion of the City's Capital and O&M Costs for the above alternatives. In addition to the project costs presented above as part of our evaluation for each alternative, Table 7.5 includes costs for the recommended base-line improvements or additional maintenance identified as needed in the short-term at the WPCF (Chapter 6) and within the collection system (Chapter 5).

The capital costs associated with the short-term WPCF work including the focused I&I removal work and the capital costs associated with Alternatives 2 through 4b are assumed as being funded by 20-yr WPCLF loans at the current 1.56% interest rate. However, these projects may have other funding options such as OPWC funding, principal forgiveness loans through DEFA, etc. as described in Chapter 8.

Any operational & maintenance costs associated with any of the evaluated alternatives is handled as a yearly operational cost paid for by the City's operational revenue.

A weighted comparison table of the evaluated options is presented in Table 7.6.

Table 7.5 Engineer's Budgetary Opinion of Capital and O&M Costs (Alternatives 1 - 4b)

	Description	**Alternative 1** I&I Reduction w/in Collection System	**Alternative 2** Additional Flow Storage	**Alternative 3** Expansion of the WPCF Capacity	**Alternative 4a** Tertiary Treatment of Overflow	**Alternative 4b** CEPT of EQ Basin Flow
CAPITAL COST FINANCABEL BY LOAN	Engineer's Budgetary OPPC for Evaluated Alternative	N/A	$14,430,000	$30,760,000	$28,290,000	$12,110,000
	Engineer's Budgetary OPPC of Collection System Maintenance Repair and Rehabilitation Projects (20-year plan @ $860,000/year)	$17,200,000	$17,200,000	$17,200,000	$17,200,000	$17,200,000
	Focused I&I Removal (CIPP Lining) within Collection System, Engineers Budgetary OPPC (20-year plan @ $1.67 M/year)	$40,400,000	N/A	N/A	N/A	N/A
	Engineer's Budgetary OPPC for Short-Term WPCF Capital Costs	$17,160,000	$16,310,000[1]	N/A	$14,900,000[2]	$16,310,000[1]
	Total Capital Costs	**$74,760,000**	**$47,940,000**	**$47,960,000**	**$60,390,000**	**$45,620,000**
	① Yearly WPCLF Loan Cost (20-year @ 1.56%)	$4,380,000	$2,810,000	$2,810,000	$3,540,000	$2,670,000
ANNUAL COSTS	Engineer's Budgetary OPPC of 5-year Cleaning & CCTV Program, Annual	$1,150,000	$1,150,000	$1,150,000	$1,150,000	$1,150,000
	Budgetary Additional Operation & Maintenance Costs	N/A	$50,000[3]	N/A	N/A	$100,000[4]
	② Total Annual Sewer System O&M Costs	$1,150,000	$1,200,000	$1,150,000	$1,150,000	$1,250,000
	① + ② **Estimated Annual Capital and O&M Costs**	$5,530,000	$4,010,000	$3,960,000	$4,690,000	$3,920,000

[1] SCADA Backbone Costs included in Alternative Cost.
[2] SCADA Backbone and Disinfection Costs included in Alternative Cost.
[3] For solids removal at EQ Basin.
[4] Chemical costs and additional solids handling costs.

Table 7.6. Weighted Factor Evaluation of Proposed Alternatives

Worst = 1	Good = 2	Best = 3

Criteria	Weighting Factor	Option 1 (CIPP Lining)	Option 2 (10 MG EQ Basin)	Option 3 (Expand Plant Peak Capacity to 15 MGD)	Option 4A (Tertiary for EQ overflow)	Option 4B (CEPT for EQ overflow)
Reduction of overflow volume	1.50	2	3	3	1	1
Provides repairs & positive impact on overall longevity & life of collection & treatment system.	1.50	3	1	3	2	1
Overall Cost	1.50	1	3	3	2	3
Simplicity of operation	1.25	3	2	2	1	1
Reduction of pollutant load	1.25	1	2	2	3	2
Provides for growth	1.25	3	1	2 [(a)]	1	1
Energy Requirements / Low Carbon Footprint	1.25	3	2	1	1	1
Potential for Phasing of Project(s)	1.00	3	3	1	1	1
Impact on Operational Reliability of WPCF	1.00	1	3	3	3	3
Impact on solids treatment process	1.00	3	2	2	2	1
Total Weighted Score		28.5	27.25	28.25	21	18.75

[(a)] Deemed a "Good" rating instead of "Best" based on proposed improvements only providing a peak flow expanions not a design average daily flow expansion.

8.0 Financing Options

Funding assistance for this project may be provided through one or more of the following governmental agencies/programs.

8.1 Ohio Water Development Authority (OWDA) Loans

OWDA provides low interest loans to local governments and agencies in the State of Ohio for planning and/or construction to improve wastewater and drinking water infrastructure. Projects are eligible to receive OWDA financing provided that detailed plans are approved by Ohio EPA and local rate legislation is enacted to ensure that system revenues will adequately meet annual loan payments.

The OWDA application period is open throughout the year. Loan applications are due the 1st of each month, except for November (no meeting) and December (deadline is in mid-November).

Loans can be repaid over a 5- to 30-year term.

As of this writing, the OWDA Market Rate is:

- Term 5-20 years 2.81%
- Term 21-30 years 2.96%

OWDA charges a one-time fee of 0.35 percent of the total loan amount for a Loan Administration Fee. This fee can be included in the total loan amount and is due when the loan agreement is executed.

(Source: https://www.owda.org/default.aspx)

8.2 Ohio Environmental Protection Agency, Division of Environmental and Financial Assistance Water Pollution Control Loan Fund

The Ohio Environmental Protection Agency, Division of Environmental and Financial Assistance (OEPA-DEFA) Water Pollution Control Loan Fund (WPCLF) is a revolving loan program administrated through the Ohio Water Development Authority (OWDA). As of this writing, the standard terms and interest rates for loans through the WPCLF are as follows:

- Term 5-20 years: 1.56%
- Term 21-30 years: 1.66%
- Term 31-45 years: 1.81%

OWDA charges a one-time fee of 0.35 percent of the total loan amount, and OEPA charges a one-time fee of 1.0 percent of the total loan amount. These Loan Administration Fees can be included in the total loan amount.

The OEPA-DEFA revolving loan program also offers both planning/design and/or construction loans. All planning/design loans are 0% interest for a five-year term, in order to encourage project planning through the WPCLF program. A WPCLF design loan can be rolled into the construction loan, at the lower, discounted interest rate. This effectively postpones any payments on the design loan until after construction has commenced.

WPCLF offers programmatic discounts and principal forgiveness. The Federal Infrastructure Investment and Jobs Act (IIJA) signed into law November 15, 2021 provides for increased opportunities for Principal Forgiveness. Principal forgiveness is generally restricted to "disadvantaged communities" (SDWA) or those meeting "affordability criteria" (CWA) and priority will be given to disadvantaged communities that are ready to proceed.

Annually, WPCLF funds are available to eligible applicants that submit a complete nomination package for each project by August 31 for the next program year.

(Source: https://www.owda.org/default.aspx)

8.3 Ohio Public Works Committee (OPWC) Loans

Funding for infrastructure projects (including sewer repair projects) is provided through grants, loans, and loan assistance, or local debt support. Grants are available for up to 90% of the total project costs for repair/replacement, and up to 50% for new/expansion. Loans can be provided for up to 100% of the project costs. Grant/loan combinations are also available. There is no minimum or maximum loan amount with terms of one to thirty years, not exceeding the useful life of the project. The interest rate is 0%. Once the project is completed a final amortization schedule is provided requiring payments every January and July until the term of the loan expires. Loans may be paid in full, with no penalty. Projects must be nominated for funding through the municipality's OPWC District Committee. Awards are based on a competitive scoring system established by each district.

Annually, applications can be submitted to the local Integrating Committee for scoring. The applications are typically due in June or July. Awards are announced in September or October.

(Source: https://www.pwc.ohio.gov/Programs/Infrastructure-Programs/Loans)

8.4 Current Financial Overview

The *2019 Ohio EPA Sewer and Water Rate Survey* standardized sewer comparisons on a consumption of 7,756 gallons per month (1,037 cubic feet per month). Using this assumed consumption volume, the average monthly residential sewer charge in the

City of Ashland would be $58.71, or $705 per year. By comparison, of the 408 Ohio community sewer systems surveyed in the 2019 report, the average annual residential sewer rate in Ohio was $749

Existing debt carried by the Sewer Department is related to the 2005 Equalization Basin Project at the wastewater treatment plant and the more recent US-250/I-71 Sewer extension. The table below shows the amount of remaining debt and associated annual debt service.

Project	**Remaining Debt**	**Annual Payments**	**Approximate Payoff**
EQ Basin	$2,825,000	$324,850	12/1/2032
US250/I71 Sewer Extension	$1,245,000	$107,000	12/1/2038
TOTAL	$4,070,000	$431,850	

The USEPA published the *2022 Proposed Financial Capability Assessment Guidance* document which is intended to standardize what EPA considers when evaluating a community's financial capability to implement control measures needed to meet Clean Water Act (CWA) obligations. It incorporates EPA's 1997 Financial Capability Assessment (FCA) Guidance, which uses a two-phased approach for evaluating a NPDES permitee's financial capability to fund CWA control measures. In the first phase, the Residential Indicator (RI) calculates the cost per household as a percentage of median household income (MHI) for the service area using data collected by the U.S. Census Bureau. In the second phase, the Financial Capability Indicator (FCI) evaluates the municipality's overall fiscal health and local demographics relative to national norms. The RI and FCI results are brought together in a matrix that evaluates the impact ("high," "medium," or "low") a proposed CWA program imposes on the municipality or utility. This two-phased approach is referred to as the Financial Capability Assessment (FCA).

The City of Ashland will perform a detailed Rate Evaluation as discussed in Section 9.2.D. A preliminary calculation of the current Residential Indicator (RI) for the City of Ashland (based on the above listed debt service only with no new improvements included) indicates a result less than 1.0 percent. The guidance suggests that this would be characterized as "low" financial impact at the present, unless there is significant weakness in Ashland's financial and socioeconomic conditions, as determined by the second phase FCI evaluation.

9.0 Implementation Plan & Schedule

9.1 Implementation Plan

The proposed implementation plan is a two-pronged approach:

- Collection System
  - 5-year inspection and cleaning program
  - Annual Capital Improvement Plan (CIP) for sewer rehab projects to address highest priority repairs and reduce I&I
  - Focused I&I reduction in areas of high I&I (public and private side improvements)
- Phased improvements at the WPCF

After 5 years of focused I&I reduction and repairs in collections system, an evaluation will be completed to evaluate WPCF expansion and need for continued focused I&I reduction in areas of high I&I (public and private side improvements).

Critical to the program and to be started upon receiving EPA approval of approach will be:

- Public education
- Ordinance Review and Modifications
- Rate and funding evaluations

9.2 Specific Strategy

A. Hire consultant(s) to help lead program (as needed)

B. Focus on I&I Reduction in Collection System
- 5-year comprehensive sanitary sewer cleaning and inspection program
  - 125 miles of sanitary sewer total, approximately 25 miles/year
  - Work to be done by contractors
  - CCTV inspections using NASSCO PACP Coding by asset number
  - MH inspections to be completed at same time (identify structural and I&I issues)
  - Cleaning of sewers as required
  - Prioritize inspections in areas of known historical I&I issues
  - CCTV to be reviewed by experienced PACP certified personnel to identify priority structural repairs and repairs needed to reduce I&I.
  - Based on similar programs in other City's we anticipate project costs to be approximately $1,150,000 for contractors to inspect and clean sewers (this includes costs for preparation of bid documents). This is based on a 5-year program (25 miles per year).

- Annual repairs to collection system to be completed starting in year 2 of 5-year cleaning and inspection program and thereafter as identified through the 5-year cleaning and inspection program.
  - Bid documents for sewer system CIP repairs to be prepared annually based on previous year's inspections. Preparation of bid documents is anticipated to take approximately 3 months (for additional field work, preparation of plans, construction details, specifications, and engineer's opinion of probable construction costs).
  - Sewer repair work to be completed in annual projects (approximately 7-month duration).
  - Based on similar programs in other City's we anticipate project costs to be approximately $865,000 per year for sewer rehabilitation (this includes costs for preparation of bid documents).
- 5-year program of targeted I&I reduction [Phase 1 of 20-year Lining Program]
  - Program will include lining of City sewers, MHs, and private laterals (to within 5 feet of the house); disconnection of illegal direct connections; and roof drain redirects – where feasible. This program will be in areas of high I&I.
  - Public education process will be started as soon as consultant is on-board and will be critical for this program.
  - City ordinances need to be modified:
    - Ordinances need to allow City to complete lateral lining work on private property.
    - Ordinances need to allow contractor to redirect downspouts away from foundations -but not cause problem for adjacent properties.
    - Ordinances need to provide clear direction for private property owners that need to eliminate illegal direct connections.
    - Agreement forms will need to be developed for work on private property.
    - Legal review will be required.
  - First area (approximately 1.48 mile of public sewer and connecting private laterals) to be identified based on previous flow monitoring and City's historical knowledge.
  - Use level sensors (micro I&I detection strategy) to evaluate entire system to identify areas of high I&I- for years 2-5.
  - In first targeted I&I reduction area, prepare bidding documents (for CIPP lining of system and other improvements).
    - Conduct pre- and post-flow monitoring (3-month duration for each).
    - CCTV sewers (coordinate with CMOM investigations).
    - Conduct targeted dye/smoke testing to identify potential direct connections, as needed.

        - Conduct field (dashboard) surveys regarding roof drains (locate possible direct connections and evaluate need and viability of roof drain redirects).
        - Evaluate need and location for private sewer lateral cleanouts with City. B&N recommendation is to install cleanout at house.
            - Contractor will then <u>not</u> have to enter the house.
            - Allows for air testing of lateral to confirm that lining is watertight.
            - Gives homeowner access point to lateral for future cleaning/inspection.
        - Recommend lateral inspections of representative connections during bid preparation for first area (may not need to be done for every area). Contractor must inspect every lateral and allowance can be included in bid for any necessary point repairs or lateral replacement.
        - Evaluate roof drain redirect strategy and include recommended strategy on bid documents.
        - Enforce disconnection of illegal direct connections.
    - Anticipated cost is approximately $2,135,000 per year (including preparation of bid documents).
    - Continue annual program for at least 5 years and then conduct evaluation described in next item.
- After 5-years of targeted I&I reduction and sewer rehab work from 5-year cleaning and inspection program, evaluate I&I removal effectiveness and evaluate need for further collection system targeted I&I reduction versus plant expansion.

C. Phased Improvements at WWTP

- Install permanent flow meter to EQ Basin influent flow and telemetry to allow for continual monitoring of total influent flows to WWTP. This is to be done as soon as possible after consultant selection. Bid documents will need to be prepared, bid received, bids evaluated, and meters installed.
- At end of year 2, start design of Short-Term Improvements for WWTP. Confirm capacities from 5-year total influent flow metering.
    - Influent Pump Replacement (15 mgd)
    - Influent Grit Removal System Replacement (15 mgd)
    - Primary Treatment System Replacement (15 mgd)
    - Trickling Filter Repairs (media replacement and structural repairs) and Trickling Filter Lift Station Pump Replacement – 10 mgd
    - UV Disinfection Replacement – 10 mgd with ability to increase to 15 mgd in future
    - SCADA System Improvements

- After 5-years of targeted I&I reduction, an evaluation will be conducted to confirm additional WWTP improvements and treatment plant expansion requirements.

D. Rate Evaluation and Funding
   - Conduct rate evaluation based on planned projects and evaluate possible funding sources. Present funding evaluation to Council within 6 months from receiving approval of NFA Study and proposed approach.
   - Develop plan for funding the 5-year collection system work and initial WWTP improvements. Rate evaluation will need to be re-evaluated after 5-year period.

9.3 Schedule

Figure 9.1 is a preliminary schedule provided to illustrate the timing for completing the recommended tasks of the proposed implementation plan and provide anticipated budgetary annual expenditures. For simplicity and readability purposes only the first 8 years are presented within Figure 9.1. Year 8 is the year in which payment of the WPCF Short Term Improvement costs would come into full effect.

Upon completing 5-years of the targeted I&I reduction and sewer rehab work from the 5-year cleaning and inspection program, the City will evaluate I&I removal effectiveness and evaluate the need to continue with collection system targeted I&I reduction program versus plant expansion.

FIGURE 9.1. PRELIMINARY SCHEDULE AND BUDGETARY ANNUAL EXPENDITURES FOR RECOMMENDED APPROACH

[Inflation is not included in expenditures provided below. All costs are shown in 2022 dollars.]

STRATEGY AREA AND TASK	Duration (Months)	Budgetary Cost	2022 Year 0	2023 Year 1	2024 Year 2	2025 Year 3	2026 Year 4	2027 Year 5	2028 Year 6	2029 Year 7	2030 Year 8
GENERAL OR ADMINISTRATIVE ITEMS											
• Receive Approval from Ohio EPA	3	N/A	✓ N/A								
• Hire consultant to lead program	2	N/A	✓ N/A								
• Ordinance Review and Revisions	6	$25,000	✓ $12,500	✓ $12,500							
• Public Education Program	18	$40,000	✓ $20,000	✓ $20,000							
• Rate Evaluation Study	6	$20,000	✓ $20,000								
• Institute Rates	3	N/A		✓ N/A							
COLLECTIONSYSTEM - I&I REMOVAL PROGRAM											
5-Yr Inspection & Cleaning Program											
• Develop Bidding Documents	3	$165,000	✓ $50,000	✓ $115,000	✓ $165,000	✓ $165,000	✓ $165,000	✓ $165,000	✓ $80,000 [c]	✓ $80,000 [c]	✓ $80,000 [c]
• Complete Yearly Allotted Cleaning & CCTV Inspection	7	$950,000		✓ $950,000	✓ $950,000	✓ $950,000	✓ $950,000	✓ $950,000	✓ $450,000 [c]	✓ $450,000 [c]	✓ $450,000 [c]
• Analyze CCTV Data to Establish Priority Repairs and Rehab	2	$35,000		✓ $35,000	✓ $35,000	✓ $35,000	✓ $35,000	✓ $35,000	✓ $20,000 [c]	✓ $20,000 [c]	✓ $20,000 [c]
Annual CIP Rehab Projects to address highest priority repairs/rehab											
• Develop Bidding Documents (including inspections and field work)	3	$115,000		✓ $40,000	✓ $115,000	✓ $115,000	✓ $115,000	✓ $115,000	✓ $115,000	✓ $115,000	✓ $115,000
• Complete Yearly CIP Rehab Projects	7	$750,000			✓ $750,000	✓ $750,000	✓ $750,000	✓ $750,000	✓ $750,000	✓ $750,000	✓ $750,000
Focused I&I Reduction in Areas of high I/I (CIPP Lining Work)											
• Ordinance needs to be in place to allow lining work on private property.	-	N/A		✓ N/A	✓ N/A						
• Use micro-level detection and rain gauges for comprehensive I&I evaluation.	4	$60,000		✓ $60,000							
• Field investigations (i.e. dye/smoke testing) to evaluate areas with direct connections.	2	$40,000		✓ $40,000	✓ $40,000	✓ $40,000	✓ $40,000	✓ $40,000	✓ $40,000	✓ $40,000 [d]	✓ $40,000 [d]
• Develop Bidding Documents	4	$290,000		✓ $290,000	✓ $290,000	✓ $290,000	✓ $290,000	✓ $290,000	✓ $290,000	✓ $290,000 [d]	✓ $290,000 [d]
• Enforce disconnection of illegal direct connections in the target area (per ordinance).	7	$25,000		✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000 [d]	✓ $25,000 [d]
• Pre Rehab Flow Monitoring (3-month duration) (Assumes City Assistance)	3	$25,000		✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000 [d]	✓ $25,000 [d]
• Complete Yearly Allotted Rehab & Lining Improvements	7	$1,730,000			✓ $1,730,000	✓ $1,730,000	✓ $1,730,000	✓ $1,730,000	✓ $1,730,000	✓ $1,730,000 [d]	✓ $1,730,000 [d]
• Post Rehab Flow Monitoring (3-month period post rehab) (Assumes City Assistance)	3	$25,000				✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000	✓ $25,000 [d]	✓ $25,000 [d]
• Evaluate WWTP Expansion vs continued targeted I&I reduction & coordination w/ OEPA	3	$75,000							✓ $75,000		
PHASED IMPROVEMENTS AT WPCF											
Influent Flow Metering Improvements											
• Develop Bidding Documents	3	$20,000	✓ $20,000								
• Complete Improvements	6	$130,000		✓ $130,000							
Short-Term Improvements											
• Develop Bidding Documents (Assumed as 15% of Total Project Cost)	18	$2,500,000				✓ $1,670,000 [a]	✓ $830,000 [a]				
• Complete Improvements and Services During Construction	30	$14,600,000					✓ $2,920,000 [b]	✓ $5,840,000 [b]	✓ $5,840,000 [b]		
TOTAL BUDGETARY COSTS			**$122,500**	**$1,742,500**	**$4,125,000**	**$5,820,000**	**$7,900,000**	**$9,990,000**	**$9,465,000**	**$3,550,000**	**$3,550,000**
TOTAL BUDGETARY ANTICIPATED ANNUAL LOAN PAYMENTS AND NFA O&M COSTS			**$102,500**	**$1,282,500**	**$1,300,000**	**$1,494,000**	**$1,663,000**	**$1,832,000**	**$1,476,000**	**$1,570,000**	**$2,749,000** [e]

[a] Costs for development of construction and bidding documents assumes utilization of a WPCLF 0% Design Loan that would be rolled into Construction Loan at construction. Bi-annual payments would not start until 6-12 months after completion of construction project.

[b] Costs for construction of proposed short-term improvements assumed to be paid by WPCLF Loan (20 yr. @ 1.56% interest). Bi-annual payments would not start until 6-12 months after completion of construction project.

[c] Upon completion of proposed 5-yr CCTV Inspection and Cleaning Program, yearly maintenance cleaning & CCTV inspection should continue as a standard component of City CMOM program. A reduced yearly cost has been included to reflect the reduced yearly inspection performed as a maintenance item compared to the initial inspection work.

[d] Upon completing first 5 years of Focused I/I Reduction (CIPP Lining) Program and sewer rehab work from 5-year cleaning and inspection program, the City will evaluate I/I removal effectiveness and evalute need to continue collection system targeted I&I reduction versus plan expansion.

[e] Annual payments from Year 8 until Program Year 22 would increase approximately $173,000 annually to account for the annual loans required the CIP Rehab/Repair and Focused I&I (CIPP Lining) work (assuming the 5-year evaluation shows that focused I&I removal should continue). This table would need to be modified if expansion of the WPCF is required after the 5-year evaluation.

Budgetary Cost cells highlighted with this color are assumed as being financed with a 20-year WPCLF loan at 1.56% interest. The project cost is shown in the table, but the related yearly loan amount is included in the "Total Budgetary Anticipated Annual Loan Payment and NFA O&M Costs" line item based on when the loan pay-backs are expected to commence.

APPENDIX A

Engineer's Budgetary Costs for 5-Year Cleaning and Inspection Program & Annual Budget for Sewer Repair and Improvements Projects

CITY OF ASHLAND, OHIO
SANITARY SEWER CLEANING AND INSPECTION PROGRAM
5-YEAR CYCLE
COMPLETE GRAVITY SANITARY SEWER SYSTEM

BURGESS & NIPLE
Engineers ■ Architects ■ Planners

MAY 2022

Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	6-inch Sanitary Sewer Cleaning and CCTV	99,869	LF	$6.00	$599,214
2	8-inch Sanitary Sewer Cleaning and CCTV	371,480	LF	$5.00	$1,857,400
3	10-inch Sanitary Sewer Cleaning and CCTV	58,544	LF	$5.00	$292,720
4	12-inch Sanitary Sewer Cleaning and CCTV	57,145	LF	$5.00	$285,725
5	15-inch Sanitary Sewer Cleaning and CCTV	34,898	LF	$7.00	$244,286
6	18-inch Sanitary Sewer Cleaning and CCTV	1,653	LF	$7.00	$11,571
7	21-inch Sanitary Sewer Cleaning and CCTV	16,219	LF	$7.00	$113,533
8	24-inch Sanitary Sewer Cleaning and CCTV	6,255	LF	$9.00	$56,295
9	27-inch Sanitary Sewer Cleaning and CCTV	2,974	LF	$9.00	$26,766
10	30-inch Sanitary Sewer Cleaning and CCTV	6,014	LF	$12.00	$72,168
11	36-inch Sanitary Sewer Cleaning and CCTV	4,050	LF	$12.00	$48,600
12	42-inch Sanitary Sewer Cleaning and CCTV	2,331	LF	$15.00	$34,965
13	CONTINGENCY	30	%		$1,092,973
	Gravity Sanitary Sewer Totals:	**661,432**	LF		
	PRELIMINARY CONSTRUCTION COST SUBTOTAL				**$4,736,216**
	ENGINEERING SERVICES (CMOM PROGRAM) (Est. @ $200K/YEAR)				$1,000,000
	PRELIMINARY PROJECT COST TOTAL				**$5,736,216**
	PRELIMINARY PROJECT COST PER YEAR FOR 5-YEAR CYCLE*	5	YR		**$1,147,243**

*Assumes approximately 95,000 feet (18 miles) of sewer per year — ***SAY*** **$1,150,000**

CITY OF ASHLAND, OHIO
SANITARY SEWER SYSTEM
REPAIR AND REPLACEMENT
ANNUAL PROGRAM*

BURGESS & NIPLE
Engineers ■ Architects ■ Planners

MAY 2022

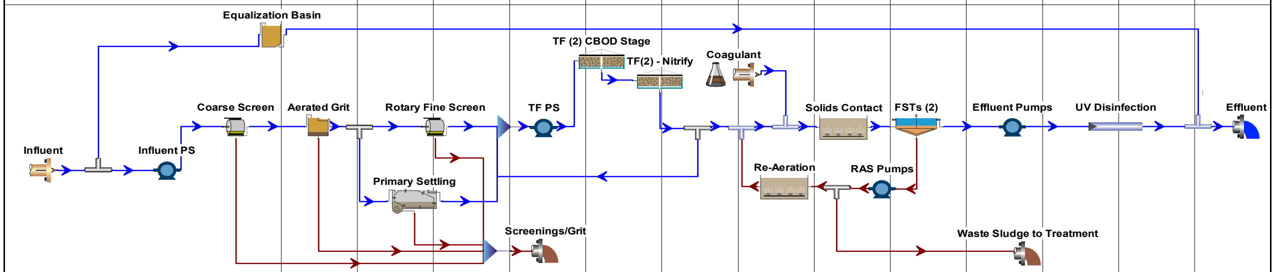
Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	Sanitary Sewer Repair and Replacement*	1	LS	$750,000	$750,000
	PRELIMINARY CONSTRUCTION COST SUBTOTAL				**$750,000**
	ENGINEERING SERVICES	15	%		$112,500.00
	PRELIMINARY PROJECT COST TOTAL				**$862,500**
	PRELIMINARY PROJECT COST PER YEAR FOR 1-YEAR CYCLE	1	YR		**$862,500**
	*Repair and replacement work will be selected based on deficiencies identified during annual cleaning and inspection			***SAY***	**$860,000**

APPENDIX B

BioWin Wastewater Treatment Modeling
Input Data & Model Results

CITY OF ASHLAND, OHIO WWTP
BIOWIN MODELING SUMMARIES

EXISTING WWTP MODEL SCHEMATIC:



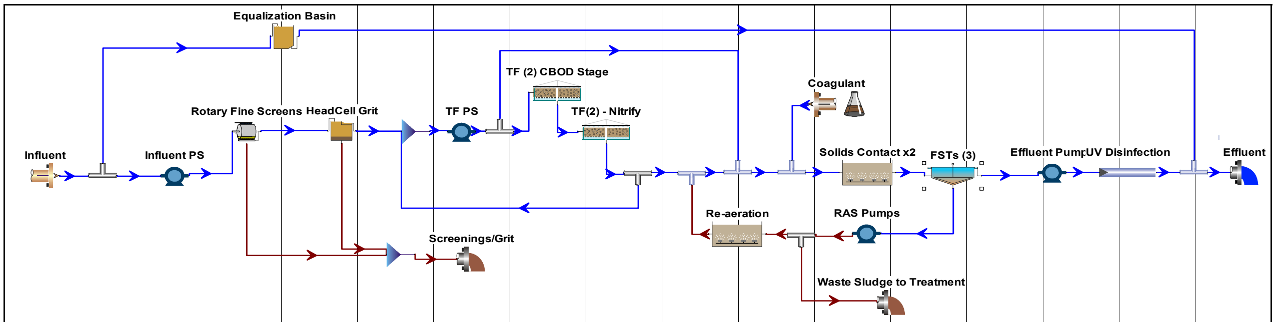
RECENT ANNUAL AVERAGE (2016-2021)

Elements	Flow [mgd]	Total suspended solids [mg/L]	Volatile suspended solids [mg/L]	BOD - Total Carbonaceous [mg/L]	BOD - Filtered Carbonaceous [mg/L]	N - Total Kjeldahl Nitrogen [mgN/L]	N - Nitrite + Nitrate [mgN/L]	P - Soluble PO4-P [mgP/L]	P - Total P [mgP/L]	N - Ammonia [mgN/L]	pH []	Alkalinity [mmol/L]	Gas - Dissolved oxygen [mg/L]
Influent	4.44	205	196	199.98	51.14	30	0	3.1	6.2	19.8	7.3	6	0
Influent (Actual 2017-2021)	**4.44**	**202**		**197**									
Influent PS	4.44	205	196	199.98	51.14	30	0	3.1	6.2	19.8	7.29	6	0
Coarse Screen	4.44	192.91	184.12	196.35	51.14	29.48	0	3.1	6.01	19.8	7.29	6	0
Aerated Grit	4.44	189.39	184.12	196.35	51.14	29.48	0	3.1	6.01	19.8	7.29	6	0
Rotary Fine Screen	3.24	131.69	127.72	160.6	51.14	27.55	0	3.1	5.11	19.8	7.29	6	0
Primary Settling	1.17	85.81	83.42	116.93	51.14	26.47	0	3.1	4.42	19.8	7.29	6	0
TF PS	4.41	119.47	115.92	148.97	51.14	27.26	0	3.1	4.93	19.8	7.29	6	0
TF (2) CBOD Stage	4.41	109.8	100.39	71.65	1.36	8.9	1.8	2.39	4.93	0.49	6.69	4.52	1.51
TF(2) - Nitrify	4.41	74.37	66.04	34.56	0.78	6.98	3.18	3.07	4.93	0.07	6.8	4.39	5.02
TF Recycle Splitter	4.41	74.37	66.04	34.56	0.78	6.98	3.18	3.07	4.93	0.07	6.8	4.39	5.02
RAS Mixer	6.58	2047.47	1512.99	661.45	0.73	138.61	3.3	2.78	71.74	0.1	6.83	4.3	4.12
TF Recycle Splitter (U)	0	74.37	66.04	34.56	0.78	6.98	3.18	3.07	4.93	0.07	6.8	4.39	5.02
Solids Contact	6.58	2051.69	1508.97	657.17	0.66	138.39	3.39	2.26	71.74	0.14	6.82	4.13	5
FSTs (2)	4.36	7.74	5.69	3.13	0.66	1.78	3.39	2.26	2.53	0.14	6.82	4.13	5
Effluent Pumps	4.36	7.74	5.69	3.13	0.66	1.78	3.39	2.26	2.53	0.14	6.82	4.13	5
UV Disinfection	4.36	7.75	5.69	3.13	0.66	1.78	3.39	2.26	2.53	0.14	6.87	4.13	5
Effluent	4.36	7.75	5.69	3.13	0.66	1.78	3.39	2.26	2.53	0.14	6.87	4.13	5
Effluent (Actual Average 2017-2021)	**4.44**	**7.11**		**5.42**					**3.25**	**0.49**			
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Coarse Screen (U)	0	18092.39	17759.39	5558.27	51.14	796.07	0	3.1	290.4	19.8	7.29	6	0
Aerated Grit (U)	0	15775.29	184.12	196.35	51.14	29.48	0	3.1	6.01	19.8	7.29	6	0
Rotary Fine Screen (U)	0.02	11672.01	11408.6	7312.07	51.14	414.41	0	3.1	184.67	19.8	7.29	6	0
Primary Settling (U)	0.01	15402.9	14974.44	11861.43	51.14	471.81	0	3.1	239.59	19.8	7.29	6	0
FSTs (2) (U)	2.22	6066.2	4461.54	1941.77	0.66	406.71	3.39	2.26	207.67	0.14	6.82	4.13	2
Screenings/Grit	0.03	13554.59	12694.8	8161.79	51.14	457.55	0	3.1	205.11	19.8	7.29	6	0
Waste Sludge to Treatment	0.05	6066.2	4461.54	1941.77	0.66	406.71	3.39	2.26	207.67	0.14	6.82	4.13	2

ADDF - 5.0 MGD

Elements	Flow [mgd]	Total suspended solids [mg/L]	Volatile suspended solids [mg/L]	BOD - Total Carbonaceous [mg/L]	BOD - Filtered Carbonaceous [mg/L]	N - Total Kjeldahl Nitrogen [mgN/L]	N - Nitrite + Nitrate [mgN/L]	P - Soluble PO4-P [mgP/L]	P - Total P [mgP/L]	N - Ammonia [mgN/L]	pH []	Alkalinity [mmol/L]	Gas - Dissolved oxygen [mg/L]
Influent	5	240	196	224.97	80.37	30	0	3.1	6.2	19.8	7.3	6	0
Influent PS	5	240	196	224.97	80.37	30	0	3.1	6.2	19.8	7.29	6	0
Coarse Screen	5	226.15	183.22	221.44	80.37	29.43	0	3.1	5.99	19.8	7.29	6	0
Aerated Grit	5	205.59	183.22	221.44	80.37	29.43	0	3.1	5.99	19.8	7.29	6	0
Rotary Fine Screen	3.65	142.52	125.66	186.71	80.37	27.4	0	3.1	5.08	19.8	7.29	6	0
Primary Settling	1.32	93.08	82.95	144.24	80.37	26.36	0	3.1	4.41	19.8	7.29	6	0
TF PS	4.97	129.34	114.28	175.39	80.37	27.12	0	3.1	4.9	19.8	7.29	6	0
TF (2) CBOD Stage	4.97	149.87	127.71	95.58	2	10.39	0.97	1.82	4.9	0.48	6.66	4.59	1.64
TF(2) - Nitrify	4.97	110.39	88.76	52.46	0.89	8.78	1.86	2.45	4.9	0.07	6.74	4.49	4.46
TF Recycle Splitter	4.97	110.39	88.76	52.46	0.89	8.78	1.86	2.45	4.9	0.07	6.74	4.49	4.46
RAS Mixer	7.42	3273.95	2293.67	1141.45	0.82	211.76	1.75	2.25	94.18	0.11	6.78	4.43	3.19
TF Recycle Splitter (U)	0	110.39	88.76	52.46	0.89	8.78	1.86	2.45	4.9	0.07	6.74	4.49	4.46
Solids Contact	7.42	3274.6	2287.08	1134.35	0.74	211.49	1.8	1.85	94.18	0.14	6.83	4.29	5
FSTs (2)	4.92	7.41	5.17	3.3	0.74	1.75	1.8	1.85	2.06	0.14	6.83	4.29	5
Effluent Pumps	4.92	7.41	5.17	3.3	0.74	1.75	1.8	1.85	2.06	0.14	6.83	4.29	5
UV Disinfection	4.92	7.41	5.17	3.3	0.74	1.75	1.8	1.85	2.06	0.14	6.88	4.29	5
Effluent	4.92	7.41	5.17	3.3	0.74	1.75	1.8	1.85	2.06	0.14	6.88	4.29	5
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Coarse Screen (U)	0	23311.73	21478.4	6105.38	80.37	976.98	0	3.1	350.93	19.8	7.29	6	0
Aerated Grit (U)	0	102922.9	183.22	221.44	80.37	29.43	0	3.1	5.99	19.8	7.29	6	0
Rotary Fine Screen (U)	0.02	12757.11	11638.61	7133.87	80.37	433.77	0	3.1	188.45	19.8	7.29	6	0
Primary Settling (U)	0.01	18831.17	16782.2	13001.59	80.37	537.58	0	3.1	268.09	19.8	7.29	6	0
FSTs (2) (U)	2.5	9702.11	6776.25	3359.44	0.74	624.11	1.8	1.85	275.39	0.14	6.83	4.29	2
Screenings/Grit	0.03	18378.16	13591.63	8352.39	80.37	501.57	0	3.1	219.52	19.8	7.29	6	0
Waste Sludge to Treatment	0.05	9702.11	6776.25	3359.44	0.74	624.11	1.8	1.85	275.39	0.14	6.83	4.29	2

EXPANDED PEAK FLOW WWTP MODEL SCHEMATIC:



ADDF - 5.0 MGD

Elements	Flow [mgd]	Total suspended solids [mg/L]	Volatile suspended solids [mg/L]	BOD - Total Carbonaceous [mg/L]	BOD - Filtered Carbonaceous [mg/L]	N - Total Kjeldahl Nitrogen [mgN/L]	N - Nitrite + Nitrate [mgN/L]	P - Soluble PO4-P [mgP/L]	P - Total P [mgP/L]	N - Ammonia [mgN/L]	pH []	Alkalinity [mmol/L]	Gas - Dissolved oxygen [mg/L]
Influent	5	240	196	224.97	80.37	30	0	3.1	6.2	19.8	7.3	6	0
Influent PS	5	240	196	224.97	80.37	30	0	3.1	6.2	19.8	7.29	6	0
HeadCell Grit	4.97	148.97	131.68	189.37	80.37	27.64	0	3.1	5.17	19.8	7.29	6	0
Rotary Fine Screens	4.97	164.85	131.68	189.37	80.37	27.64	0	3.1	5.17	19.8	7.29	6	0
TF PS	5.97	144.63	126.17	167.37	67.08	24.6	0.38	3	5.17	16.5	7.16	5.74	0.87
TF (2) CBOD Stage	5.97	155.29	130.66	93.36	1.84	10.48	1.72	1.99	5.17	0.16	6.62	4.51	2.53
TF(2) - Nitrify	5.97	123.05	98.73	57.93	0.94	9.5	2.28	2.48	5.17	0.07	6.72	4.46	5.18
TF Recycle Splitter	4.97	123.05	98.73	57.93	0.94	9.5	2.28	2.48	5.17	0.07	6.72	4.46	5.18
RAS Mixer	7.42	3699.42	2416.37	1090.65	0.84	220.3	2.61	2.21	111	0.11	6.77	4.32	4.01
TF Recycle Splitter (U)	1	123.05	98.73	57.93	0.94	9.5	2.28	2.48	5.17	0.07	6.72	4.46	5.18
Solids Contact x2	7.42	3699.1	2404.39	1077.9	0.67	219.65	3.1	1.64	111	0.15	6.91	4.05	5
Effluent Pumps	4.92	5.99	3.9	2.42	0.67	1.64	3.1	1.64	1.82	0.15	6.91	4.05	5
UV Disinfection	4.92	6	3.9	2.42	0.67	1.64	3.1	1.64	1.82	0.15	6.95	4.05	5
Effluent	4.92	6	3.9	2.42	0.67	1.64	3.1	1.64	1.82	0.15	6.95	4.05	5
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HeadCell Grit (U)	0	79162.24	131.68	189.37	80.37	27.64	0	3.1	5.17	19.8	7.29	6	0
Rotary Fine Screens (U)	0.02	15194.82	12994.82	7310.39	80.37	499.69	0	3.1	210.58	19.8	7.29	6	0
Screenings/Grit	0.03	17655.1	12500.08	7036.5	80.37	481.53	0	3.1	202.68	19.8	7.29	6	0
Waste Sludge to Treatment	0.05	10971.23	7131.24	3195.65	0.67	648.95	3.1	1.64	325.99	0.15	6.91	4.05	5

EXPANDED PEAK FLOW TO PHF - 15 MGD THROUGH PLANT

Elements	Flow [mgd]	Total suspended solids [mg/L]	Volatile suspended solids [mg/L]	BOD - Total Carbonaceous [mg/L]	BOD - Filtered Carbonaceous [mg/L]	N - Total Kjeldahl Nitrogen [mgN/L]	N - Nitrite + Nitrate [mgN/L]	P - Soluble PO4-P [mgP/L]	P - Total P [mgP/L]	N - Ammonia [mgN/L]	pH []	Alkalinity [mmol/L]	Gas - Dissolved oxygen [mg/L]
Influent	15	80	65	74.99	27.1	10	0	1.05	2.1	6.6	7.3	6	0
Influent PS	15	80	65	74.99	27.1	10	0	1.05	2.1	6.6	7.29	6	0
HeadCell Grit	14.92	49.53	43.64	63.2	27.1	9.21	0	1.05	1.75	6.6	7.29	6	0
Rotary Fine Screens	14.92	54.95	43.64	63.2	27.1	9.21	0	1.05	1.75	6.6	7.29	6	0
TF PS	15.92	48.78	42.77	60.26	25.45	8.84	0.28	1.04	1.75	6.19	7.26	5.95	0.47
TF (2) CBOD Stage	10	47.51	39.41	27.68	1.72	3.63	4.22	0.78	1.75	0.09	6.84	5.25	5.14
TF(2) - Nitrify	10	37.67	29.75	16.33	0.86	3.29	4.48	0.95	1.75	0.09	6.95	5.23	7.42
TF Recycle Splitter	9	37.67	29.75	16.33	0.86	3.29	4.48	0.95	1.75	0.09	6.95	5.23	7.42
RAS Mixer	11.45	2286.01	1606.58	933.15	1.02	141.22	3.6	0.83	59.66	0.19	6.96	5.27	5.88
TF Recycle Splitter (U)	1	37.67	29.75	16.33	0.86	3.29	4.48	0.95	1.75	0.09	6.95	5.23	7.42
Solids Contact x2	17.37	1528.87	1073.3	628.23	3.67	95.81	2.64	0.53	39.91	1.38	7.06	5.32	5
Effluent Pumps	14.87	10.93	7.68	8.14	3.67	2.91	2.64	0.53	0.82	1.38	7.06	5.32	5
UV Disinfection	14.87	10.94	7.68	8.14	3.67	2.91	2.64	0.53	0.82	1.38	7.07	5.32	5
Effluent	14.87	10.94	7.68	8.14	3.67	2.91	2.64	0.53	0.82	1.38	7.07	5.32	5
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
HeadCell Grit (U)	0	80961.38	43.64	63.2	27.1	9.21	0	1.05	1.75	6.6	7.29	6	0
Rotary Fine Screens (U)	0.07	5064.94	4314.94	2421.56	27.1	166.56	0	1.05	71.04	6.6	7.29	6	0
Screenings/Grit	0.08	6063.58	4258.74	2390.53	27.1	164.49	0	1.05	70.13	6.6	7.29	6	0
Waste Sludge to Treatment	0.05	10559.21	7412.78	4317.22	3.67	648.49	2.64	0.53	272.5	1.38	7.06	5.32	5

APPENDIX C

Engineer's Budgetary Cost Estimate for Typical Cost per Mile for Targeted I&I Reduction (CIPP Lining)

CITY OF ASHLAND, OHIO
SANITARY SEWER REHABILITATION
25-YEAR PROGRAM
FIVE MINI DISTRICTS (3, 4, 7, 14, 17)**

BURGESS & NIPLE
Engineers ■ Architects ■ Planners

MAY 2022

Item	Description	Quantity	Unit	Unit Cost	Total Cost
1	6-inch Sanitary Sewer - CIPP Lining	38,220	LF	$46	$1,758,120
2	8-inch Sanitary Sewer - CIPP Lining	97,240	LF	$46	$4,473,040
3	10-inch Sanitary Sewer - CIPP Lining	16,455	LF	$53	$872,115
4	12-inch Sanitary Sewer - CIPP Lining	3,554	LF	$57	$202,578
5	15-inch Sanitary Sewer - CIPP Lining	11,040	LF	$65	$717,600
6	18-inch Sanitary Sewer - CIPP Lining	933	LF	$80	$74,640
7	21-inch Sanitary Sewer - CIPP Lining	5,404	LF	$100	$540,400
8	30-inch Sanitary Sewer - CIPP Lining	3,708	LF	$175	$648,900
9	Manhole Lining (Assume 10 VF per MH for 512 MHs)	5,120	VF	$350	$1,792,000
10	SAS Service Lateral CIPP Lining (Assume 2,700 Laterals at 30 Feet - From SAS to House)	2,700	EA	$7,000	$18,900,000
11	CONTINGENCY	30	%		$8,993,818
	Mini District 3, 4, 7, 14, 17 Totals:**	**176,554**	LF		
	PRELIMINARY CONSTRUCTION COST SUBTOTAL				**$38,973,211**
	ENGINEERING SERVICES	17	%		$6,625,446
	PRELIMINARY PROJECT COST TOTAL				**$45,598,657**
	PRELIMINARY PROJECT COST PER MILE*	33.4	MILE		**$1,365,229**

*Annual numbers do not include anticipated % increases for labor, materials, inflation
**Mini districts selected based upon small data samples

APPENDIX D

Alternative No. 2 (Additional Storage) Geotechnical Exploration Report

DRILLING | MATERIAL TESTING | ENGINEERING

GEOTECHNICAL EXPLORATION REPORT

FOR THE

ASHLAND EQ BASIN PRELIMINARY INVESTIGATION
US ROUTE 42
CITY OF ASHLAND, OHIO
WGE #20221042

PREPARED FOR

BURGESS & NIPLE
50 SOUTH MAIN STREET, SUITE 600
AKRON, OHIO 44308

BY

WERTZ GEOTECHNICAL ENGINEERING, INC.
400 COLLIER DRIVE
DOYLESTOWN, OHIO 44230

April 7, 2022

Burgess & Niple
50 South Main Street, Suite 600
Akron, Ohio 44308

ATTN: **Mr. Mike Starkey, P.E.**

RE: **Geotechnical Exploration Report for the Ashland EQ Basin Preliminary Investigation, City of Ashland, Ohio; WGE #20221042**

Mr. Starkey:

Wertz Geotechnical Engineering has completed the requested subsurface investigation for the 10 million gallon equalization basin preliminary investigation project near the Ashland Wastewater Treatment Plan on Route 42 in the City of Ashland, Ohio. The purposes of this investigation were to define the general subsurface conditions at the field, and make recommendations relative to site preparation, earthwork, and construction of a clay basin liner. This report was prepared by an experienced engineering and geological staff. These professional services have been performed, the findings obtained, and the recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices.

If you have any questions or concerns regarding the information presented in this submittal, or have need of additional services, please contact our office at (330) 991-0041.

Sincerely,

Leroy Wertz

Leroy Wertz, P.E.
Senior Project Engineer

Kelly Luecke

Kelly Luecke, P.E.
Project Engineer

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LIST OF FIGURES:

LIST OF ATTACHMENTS:

PROJECT DESCRIPTION

SITE DESCRIPTION

The proposed 10 million gallon equalization (EQ) basin preliminary site location is between US Route 42 and the Ashland Wastewater Treatment Plant (WWTP) at 865 US Route 42 in the City of Ashland, Ohio. The boring locations are located approximately 200 to 600 feet east of the US Route 42 pavement, and south of Lang Creek. The project area is currently grassed with areas of brush and trees, and may be within a special flood hazard area.

In addition to the primary location under investigation, one exploratory boring was performed in the wooded area east of the WWTP.

According to the preliminary plan accompanying the Request for Proposal, the proposed EQ basin is roughly 420 feet square, as measured at the top of the embankment. The proposed bottom of excavation is elevation 970± feet, the bottom of basin is 972 feet, top of berm elevation is 986 feet, and the high water elevation is 984 feet. A basin outlet structure is proposed on the south side of the basin. Construction of the berm will require approximately 11 feet of fill placement, and will be constructed with spoils from the basin excavation. The proposed top of the berm is a 10 foot wide gravel drive. Wertz Geotechnical Engineering, Inc. (WGE) understands that upper clayey soils may be reused as the EQ basin clay liner.

If our project understanding or any of our project assumptions are incorrect, we should be contacted in order to determine if our recommendations remain valid.

DESCRIPTION OF REGIONAL GEOLOGICAL SETTING

The project site in Ashland, Ashland County, Ohio is situated in the Killbuck-Glaciated Pittsburgh Plateau Physiographic Region, which is defined by ridges and flat uplands covered with thin drift and dissected by steep valleys. The valley segments alternate between broad drift-filled and narrow rock-walled reaches (Ohio Department of Natural Resources Division of Geological Survey, 1998).

According to the USDA Web Soil Survey, the site area is mapped by the local soil and water conservation district as Shoals silt loam, a material consisting of loamy alluvium, deposited on flood plains and river valleys. Algiers silt loam, a material consisting of alluvium deposited on floodplains is also present. Also present in the site area is the Bogart gravelly loam, a material consisting of outwash deposited on terraces. Finally, the site area also contains Luray silty clay loam, a material consisting of glaciolacustrine deposits, deposited on terraces on valleys (USDA, 2020). A USDA Web Soil Survey site map is presented in Figure 2.

According to publicly available mine data from ODNR, no active or inactive surface or underground sand and gravel, limestone, or coal mining activities are present within the site footprint or surrounding areas.

According to 24k Ohio Division of Geological Survey (ODNR-DGS) Bedrock Geology Maps, bedrock within the site area primarily consists of the Logan and Cuyahoga Formations

Undivided, of which major lithologies consist of consist of shale, siltstone, and sandstone; and minor lithologies consist of conglomerate and limestone. (Ohio Department of Natural Resources Division of Geological Survey, 1991). Bedrock is reported by ODNR-DGS around 900 to 725 feet MSL in elevation, which is approximately 100 to 225 feet below existing site grades. A Geologic Map is presented in Figure 3.

FIELD INVESTIGATION & LABORATORY TESTING

Five (5) borings were advanced to depths of 25 feet below the existing site grades on March 11th and 14th, 2022. Borings were drilled using the CME 550 all-terrain rotary drilling rig with 3.25-inch hollow stem augers, operated by Wertz Geotechnical Engineering, Inc. (WGE) drilling staff. The boring locations were selected by Burgess & Niple, and field marked utilizing handheld GPS units by WGE personnel at the approximate locations as shown on the attached Figure 1, Geotechnical Boring Location Map.

Standard penetration testing and sampling was performed at the depth intervals shown on the attached Boring Logs utilizing a 140-lb automatic hammer falling 30 inches to drive a 2-inch outer-diameter split spoon sampler over three, six-inch intervals.

Collected samples were examined and visually identified by our personnel in the field based on the visual-manual procedure (ASTM D-2488). Representative samples were retained and transported to our office, for further examination and the assignment of laboratory testing, by one of our geotechnical engineers. The results are included in Attachment A, Geotechnical Soil Boring Logs.

Moisture content testing (ASTM D-2216) was performed on selected representative samples per the referenced ASTM standards. Forty-eight (48) moisture content tests were conducted on the retained samples. Plasticity Index testing (Atterberg Limits) was performed on six (6) retained samples of clay soil per ASTM D-4318. The moisture content and Atterberg Limit test results are included on the Boring Logs in Attachment A.

In addition, nine (9) sieve and hydrometer tests (ASTM D7928) were performed. The test results are included in Attachment B

Where possible, static groundwater level observations and hole depth soundings were made upon completion of each boring. This was followed by backfilling the holes. Groundwater level observations, made during the drilling of each boring, are indicated on the attached Boring Logs. It should be noted that groundwater levels and zones of saturation should be expected to fluctuate seasonally based on variations in amounts of rainfall, evapotranspiration, runoff from impervious areas, and several other factors.

SUBSURFACE CONDITIONS

Soil boring data collected at the site generally indicated the presence of shallow clayey fill underlain by stratifications of clay and sandy soils. The boring logs can be described for engineering purposes as the following:

- The topsoil thickness was found to be 18 inches or less at the test locations.

Subsurface Conditions in B-1 through B-4, West of WWTP:

- Underlying the topsoil, a shallow layer of clayey fill material was encountered to 3 feet below grade in Borings B-1, B-2, and B-4. In Boring B-3, the fill material was a clayey sand material and extended to 5.5 feet below grade. In all the borings, the clayey fill was moist with a medium stiff to stiff consistency.

- In Borings B-1 and B-2, native (non-fill), moist, soft to medium stiff clay soils were encountered beneath the upper fill, extending to 5.5 feet and 10 feet below grade, respectively. In addition, moist, very loose silt soil was encountered in B-1.

- Wet to saturated, very loose to medium dense sand and sand/gravel layers were encountered in all four borings. Saturated, medium dense sand was predominant. The sandy layer was encountered as follows: in B-1 from 8 to 15.5 feet depth; in B-2 from 13 feet depth to the boring termination at 25 feet depth; in B-3 from 5.5 to 15.5 feet depth; and in B-4 from 3 to 20 feet depth.

- Groundwater was encountered within the sand and sand/gravel layer of Borings B-1, B-2 and B-4. In Boring B-3, the groundwater was encountered within the upper layer of sandy clay fill. A summary of groundwater depths are as follows:

Boring ID	Groundwater Encounter Depth*/Elevation**	Groundwater Depth after Drilling Completion
B-1	8 feet / 971± feet	4 feet/975 ±feet
B-2	14 feet / 964± feet	4 feet/974 ± feet
B-3	3 feet / 976± feet	1 foot/978 ±feet
B-4	3 feet / 975± feet	1.5 feet/976.5±feet

* As measured from the existing ground surface.
** Approx. elevations provided for comparison to basin excavation elevation 970± feet.

- The Atterberg Limits testing results are summarized as follows:

Boring ID, Sampling Interval	Liquid Limit, Plasticity Index	Note
B-1, 3.5' - 5.0'	LL 44%, PI 22%	Lean Clay
B-1, 8.5' - 10.0'	LL 24%, PI 5%	Silty Sand w/ Minor Clay
B-2, 3.5' - 5.0'	LL 38%, PI 16%	Lean Clay
B-2, 8.5' - 10.0'	LL 44%, PI 21%	Lean Clay
B-2, 11.0' – 12.5'	LL 34%, PI 19%	Lean Clay
B-4, 1.0' – 2.5'	LL 35%, PI 13%	Lean Clay Fill

- Please refer to the attached boring logs for specific information related to the types, textures and stratification of materials encountered.

Subsurface Conditions in B-5, East of WWTP:

- Subsurface conditions in Boring B-5 were found to be similar to the western borings, with the variation of a deeper silty layer beneath the clayey fill.

- Underlying the topsoil, a layer of clayey fill material was encountered to 5.5 feet below grade. The fill was a moist, medium stiff to stiff clayey material with minor gravel and silt.

- Underlying the fill, native (non-fill), damp, stiff clayey silt and moist, loose silt soils were encountered.

- Wet, very loose to medium dense, sand and sand/gravel soils were found from 13 feet below grade to the boring termination depth of 25 feet., with a thin layer of moist, soft clay from 15.5 feet to 18 feet depth.

- Groundwater was encountered within the wet sand and sand/gravel layer below 13 feet depth. After completion of drilling, groundwater was measure at 12.5 feet below grade in the bore hole.

GEOTECHNICAL RECOMMENDATIONS

We offer the following for your consideration based on our analysis of the subsurface conditions encountered at the locations indicated; and the assumption that conditions between and away from the borings are similar to those that are known:

GENERAL CONSIDERATIONS

It is WGE's engineering opinion that control of groundwater during basin excavations into the saturated sandy soils will be difficult. Control of construction phase groundwater may require sheeting be placed in addition to standard dewatering from well points.

Groundwater was encountered during drilling of Borings B-1, B-3 and B-4 at elevations which are higher than proposed basin excavation elevation of 970 feet. The basin clay liner will be subject to uplift forces from the high groundwater. Surrounding grades may prevent perimeter drains around the basin from discharging into the waterways to the north and south of the basin.

The preliminary plan proposes up to 11 feet of embankment fill be placed for construction of the berm. The preliminary plan proposes a top-of-berm elevation of 986.00 feet, with a 3:1 (horizontal:vertical) slope on either side of the 10 foot wide berm top. Construction of the earth embankment will be difficult due to soft foundation subgrades and wet conditions. Significant drying of the onsite soils should be anticipated. During the warmer summer months, the clay can be dried and compacted to specifications, though significant time and effort should be anticipated for this effort. During wet weather, the onsite soils would need to be treated with lime or cement chemicals.

The total volume of fill soil placed to achieve the design top of bank elevation should take into account the settlement which will occur due to the weight of the proposed fill placement. Based on the estimated soil parameters, the total anticipated settlement is less than 4 inches below the center of the embankment. An initial settlement of ¾ inches is anticipated from the sandy soils with the remaining 3.25 inches of settlement from long-term consolidation of the clay soils. The settlement analysis is based on the soil profile of B-2, which would produce the maximum settlement of the four (4) test borings performed.

The basin embankment side slope will be unstable due to groundwater seepage. Soft and wet granular soils are present in the subsoils. The excavated sidewalls of the basin will be partially below the groundwater. Placing a standard 2 foot clay liner along the sidewalls below the groundwater table will be unstable. A sheet pile wall will need to be created to cut off the groundwater flow and provide stability to the sidewalls of the basin if the bottom of basin is set at 972 feet.

In our engineering opinion, both the fill material and native soil spoils from the basin excavation would be suitable for reuse in the berm embankment beneath the proposed 2 foot clay liner. The onsite soils material will require significant drying prior to reuse.

The preliminary plan proposes placement of a 2 foot clay liner as a part of the EQ basin construction. Based on Borings B-1 through B-4, the following is a summary of clayey soils anticipated within the excavation (assumed to terminate at elevation 970± feet):

Boring ID	Approximate Elevation of Clay Layer	Approximate Depth of Clay Layer	Description
B-1	977.3 – 976 feet	3.8 feet	Clay fill w/minor silt and fine sand
B-1	976 – 973.5 feet		Lean Clay w/ minor silt
B-2	977.5 – 975 feet	7.5 feet	Clay fill w/minor silt
B-2	975 – 970± feet		Lean Clay w/ minor silt
B-3	No Clay Spoils above elevation 970± feet		
B-4	977.5 – 975 feet	2.5 feet	Lean Clay Fill

The clayey soils summarized above were all in a moist condition with moisture contents ranging from 24% to 42%. Clay would require significant drying prior to reuse. Sitework for the project would be difficult to construct the earthwork embankment for the basin, due to the wet and soft conditions. Based on the encountered clay soils and the specified compaction, the estimated coefficient of permeability “K” of the properly compacted clay is 10^-6 inches per second.

Boring B-5 encountered similar subsurface conditions as those found at the western borings, with the exception that no soft soils were encountered, and the presumed basin excavation would terminate within the moist, loose silt soils. Groundwater was encountered below 12.5 feet.

All embankment fill placement should be continuously monitored by our geotechnical engineer or their assigned soil technician. The fill material should be placed in controlled lifts not exceeding 8 inch depth. Care should be taken to perform proctor testing upon any change to fill material to ensure that lifts are compacted to the proper density and at the optimum moisture content. Field density tests should be performed on at least every lift, and every 500 cubic yards of fill material placed.

EARTHWORK GUIDELINES

- Prior to construction, all topsoil and vegetation should be removed from within the proposed basin limits and embankments.

- The exposed basin subgrade should be proof rolled under the direction of an on-site geotechnical engineer. Any areas of yielding (pumping/rutting) soils, or obviously contaminated zones, should be scarified, dried and recompacted. The subgrade should be sealed prior to inclement weather.

- Any required engineered fill placed should consist of clean, inert soil which should be approved by the geotechnical engineer. The engineered fill should have a dry density greater than 100 pcf, a liquid limit less than 50%, and an organic content less than 3%.

- Engineered fill material should be placed on a stable, approved subgrade in controlled lifts. Each lift of engineered fill should be compacted to a stable condition and to at least 95% of its maximum dry density as determined by a standard proctor (ASTM D-698), with a moisture content between 2% under to 3% over optimum moisture. All filling operations should by monitored by WGE's geotechnical engineer or their representative. Field density tests should be made by WGE to ensure compaction to specification. The clay liner should be compacted to 0 to 3% over optimum and 95% of a standard proctor.

- All surfaces should be sealed and sloped after each day, and prior to inclement weather, to promote positive drainage of water offsite.

- Construction traffic should be kept off any wet and/or yielding subgrades.

- The need for additional repairs and stabilization of the subgrade may be substantially reduced if site work is performed during times of drier weather. Therefore, it is recommended that site work and pavement operations be performed during these times.

- The estimated coefficient of permeability "K" of the properly compacted onsite clay is 10^-6 inches per second. Most of the subsoils consisted of pervious sandy soils with an estimated permeability rate of 0.1 inches per second. These estimates are based on the Casagrande permeability chart based on soil texture.

EXCAVATIONS & CONSTRUCTION GROUNDWATER CONSIDERATIONS

Groundwater was encountered during drilling of Borings B-1, B-3 and B-4 at elevations which are higher than proposed basin excavation elevation of 970 feet. The basin clay liner will be subject to uplift forces from the high groundwater. Surrounding grades may prevent perimeter drains around the basin from discharging into the waterways to the north and south of the basin.

Groundwater levels can fluctuate with seasonal variations. Control of groundwater is expected to present challenges during excavations. Control of construction phase groundwater may require sheeting be placed in addition to standard dewatering from well points to allow for the groundwater level to be lowered below the basin excavation elevation during construction.

Excavations should either be sloped back or shored in accordance with Occupational Safety & Health Administration (OSHA) regulations and any other applicable local codes. Parameters for design of temporary shoring are included in those regulations. With respect to excavation side slopes, the site soils should be classified as Type "C" per OSHA. Therefore, excavations should be cut back to a slope no steeper than a 1.5:1 (horizontal:vertical).

The existing soils encountered onsite can likely be excavated with a standard-sized hydraulic excavator equipped with a standard earth bucket.

The total anticipated settlement with the estimated soil parameters is less than 4 inches below the center of the embankment. An initial settlement of ¾ inches is anticipated from the sand with remaining 3.25 inches from long-term consolidation of the clay soils. The settlement analysis is based on the soil profile of B-2, which would produce the maximum settlement from the four (4) test borings performed.

The basin side embankment slope will be unstable due to groundwater seepage. Soft and wet granular soils are present in the subsoils. The excavated sidewalls of the basin will be partially below the groundwater. A sheet pile wall will need to be created to cut off the groundwater flow and provide stability to the sidewalls of the basin if the bottom of basin is set at 972 feet.

The embankment slope on the outside face will depend on the quality of earthwork operations. The existing subsoils are wet soft or very loose. The subgrade soils can be disturbed by construction traffic. Unstable subgrades and/or fill material will require drying and recompacting to project specifications to provide a stable embankment.

STANDARD OF CARE AND LIMITATIONS

Our recommendations for this project were developed utilizing the soil information obtained from the test borings that were made at the proposed site. The soil borings only depict the soil conditions at the specified locations and time at which they were made. The soil conditions at other locations on the site may differ from those occurring at the boring locations. Additionally, the conclusions and recommendations have been based upon the available soil information and the design details furnished to us. We should be immediately notified, if during construction, any conditions different from those found in this investigation are evident or our project assumptions are incorrect. We will advise you of any modifications to our conclusions and recommendations deemed necessary, after observing the exposed conditions and/or changes to the project scope. The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. Wertz Geotechnical Engineering, Inc. is not responsible for the conclusions, opinions, or recommendation made by others based upon the data included herein. We hope you will find this report satisfactory.

Please contact our office at (330) 991-0041 if we may be of further service or you have questions regarding this submittal.

Respectfully submitted,

Kelly Luecke, P.E.
Project Engineer

Leroy Wertz, P.E.
Senior Geotechnical Engineer

FIGURE 1

Geotechnical Boring Location Map

WERTZ

GEOTECHNICAL ENGINEERING

400 Collier Drive, Doylestown, Ohio 44230

330-991-0041

OFFICE@WERTZGEO.COM

GEOTECHNICAL BORING LOCATION MAP

CLIENT

BURGESS & NIPLE
50 SOUTH MAIN STREET
SUITE 600
AKRON, OHIO 44308

SITE

US ROUTE 42
ASHLAND, OHIO

PROJECT NAME

ASHLAND WWTP
10 MG EQ BASIN

LAYOUT BY **CD**

DRAWN BY **CD**

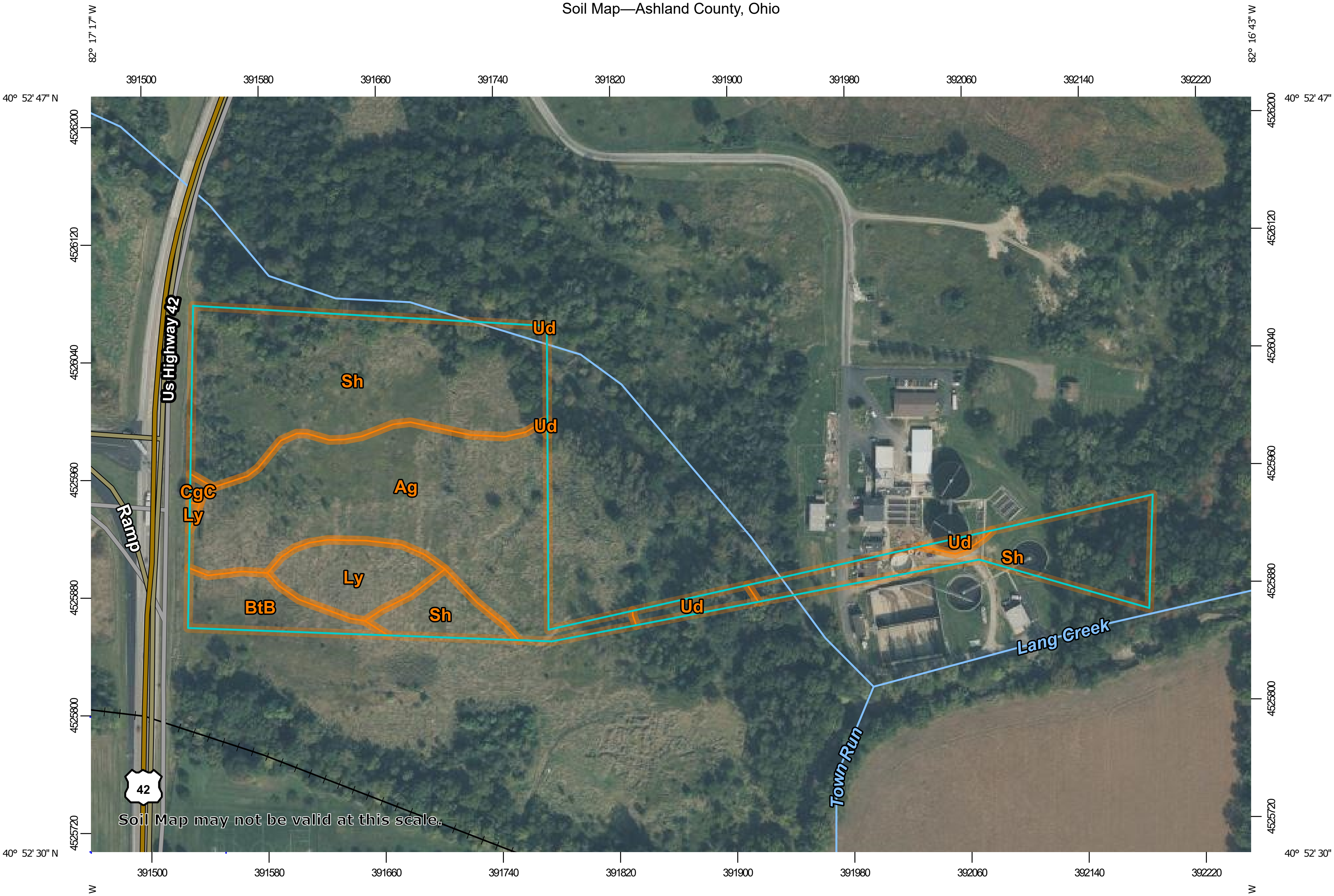
CHECKED BY **KL**

DATE: 4/05/2022

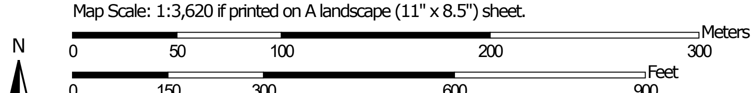
FIGURE NO. **1**

FIGURE 2

USDA Web Soil Survey Map



Map Scale: 1:3,620 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Ashland County, Ohio
Survey Area Data: Version 19, Aug 31, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 1, 2020—Oct 1, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Ag	Algiers silt loam	5.4	35.1%
BtB	Bogart gravelly loam, 2 to 6 percent slopes	0.9	5.6%
CgC	Chili loam, 6 to 12 percent slopes	0.0	0.3%
Ly	Luray silty clay loam, 0 to 2 percent slopes	1.1	7.1%
Sh	Shoals silt loam, 0 to 2 percent slopes, occasionally flooded	7.7	49.9%
Ud	Udorthents	0.3	2.0%
Totals for Area of Interest		**15.5**	**100.0%**

FIGURE 3

ODNR Bedrock Geology Map

ASHLAND EQ BASIN PROJECT GEOLOGIC MAP

Bedrock Topography of Ohio 24K (ODNR-DGS) -Bedrock Topography 24K - Contours

Bedrock Topography Contour (50-ft Interval), data from ODNR-DGS)

Water well, data from Ohio Division of Water

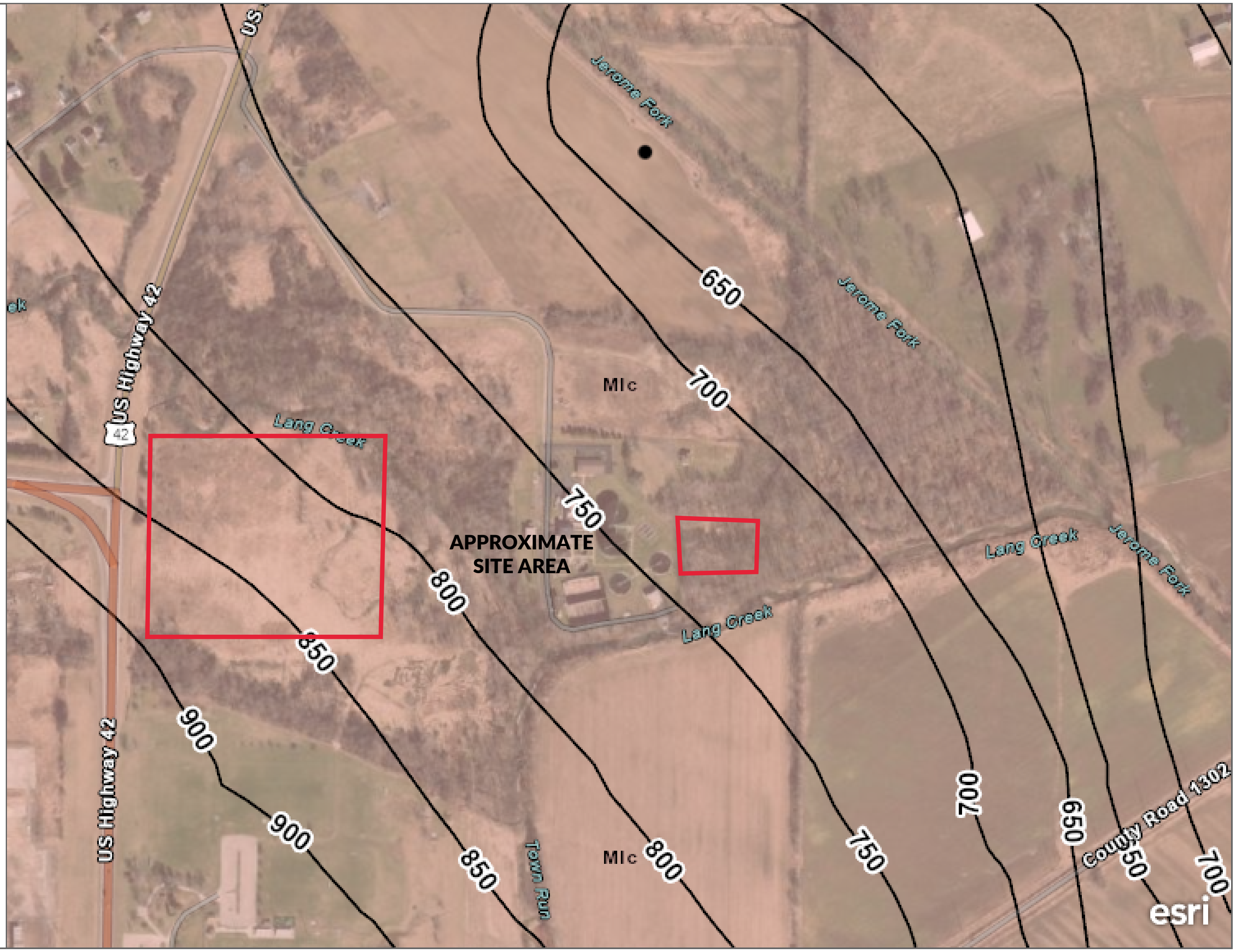
Bedrock exposure

ODOT boring

-Bedrock Geology 24K
-Data Bedrock Geology of Ohio 24K (ODNR-DGS)

Mlc - *Logan and Cuyahoga Formations, Undivided*
Major: Shale, Siltstone, Sandstone
Minor: Conglomerate, Limestone

Bedrock Contours are interpolated by ODNR-DGS based on data from local water wells and oil and gas wells.



Bedrock is estimated to be approximately 100 to 225 feet below existing grade.

600ft

Ohio Department of Natural Resources-Division of Geological Survey | Maxar | Esri Community Maps Contributors, BuildingFootprintUSA, Esri, HERE, Garmin, SafeGraph, INCREMENT P, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

ATTACHMENT A

Geotechnical Boring Logs

WERTZ GEOTECHNICAL ENGINEERING, INC.
DRILLING | MATERIAL TESTING | ENGINEERING

400 COLLIER DRIVE
DOYLESTOWN, OHIO, 44230
(330) 991-0041

PROJECT:	Ashland EQ Basin	PROJECT NO.: 20221042	DRILL RIG:	CME 550	BORING ID:	B-1	**Page 1 of 1**
LOCATION:	Ashland, Ohio		METHOD:	Hollow Stem	DATE STARTED:	3/15/2022	
LOGGED BY:	CN		AUGER SIZE:	3.25 inches	DATE COMPLETED:	3/15/2022	
DRILL CREW:	JK & DM & CN		HAMMER:	Automatic SPT	ELEVATION:	979 feet MSL	
GROUNDWATER ENCOUNTER DEPTH	8'	GROUNDWATER AT COMPLETION: 4'	TOTAL DEPTH:	25'	CAVE DEPTH:		

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE DEPTH	BLOW COUNTS (BLOWS/FOOT)	RECOVERY (INCHES)	POCKET PEN (TSF)	GRAPHIC LOG	LITHOLOGY
0–1.7		AS	--	--	--		20" TOPSOIL.
1.7–3	1	1.0-2.5	0-1-4	12	1.0		FILL: Moist, medium stiff, brown, CLAY, minor silt and fine sand. Wn%: 24.2
3–5.5	2	3.5-5.0	1-2-2	18	1.0		Moist, soft, brown and gray CLAY, minor silt, trace sand. LL: 44 PI: 22 Wn%: 22.9
5.5–8	3	6.0-7.5	0-0-2	18			Moist, very loose, gray, SILT, minor clay, trace sand. Wn%: 18.8
8–15.5	4	8.5-10.0	0-1-1	18			Wet, very loose, gray, silty, fine to coarse SAND, trace clay. LL: 24 PI: 5 Wn%: 14.3
	5	11.0-12.5	6-8-8	12			WET, medium dense, gray, fine to coarse SAND AND GRAVEL, trace silt. Wn%: 15.1
	6	13.5-15.0	3-7-7	8			Wet, medium dense, brown, fine to coarse SAND AND GRAVEL. Wn%: 24.7
15.5–25	7	16.0-17.5	5-6-8	12			Moist, stiff, brown, CLAY, some silt, trace gravel. Wn%: 16.2
	8	18.5-20.0	6-6-8	15	3.5		Moist, stiff, gray, CLAY, minor silt, trace sand. Wn%: 21.8
	9	21.0-22.5	6-6-8	18	4.0		Moist, stiff, gray, CLAY, minor silt, trace sand. Wn%: 32.5
	10	23.5-25.0	8-8-12	6	4.5		Moist, very stiff, gray, CLAY, some silt, minor fine to coarse sand. Wn%: 19.2

Note: *Ground surface elevations at boring locations estimated using data provided by Google Earth Pro.*

WERTZ GEOTECHNICAL ENGINEERING, INC.
DRILLING | MATERIAL TESTING | ENGINEERING

400 COLLIER DRIVE
DOYLESTOWN, OHIO, 44230
(330) 991-0041

PROJECT:	Ashland EQ Basin	PROJECT NO.: 20221042	DRILL RIG: CME 550	BORING ID:	B-2
LOCATION:	Ashland, Ohio		METHOD: Hollow Stem	DATE STARTED:	3/15/2022
LOGGED BY:	CN		AUGER SIZE: 3.25 inches	DATE COMPLETED:	3/15/2022
DRILL CREW:	JK & DM & CN		HAMMER: Automatic SPT	ELEVATION:	978 feet MSL
GROUNDWATER ENCOUNTER DEPTH	14'	GROUNDWATER AT COMPLETION: 4'	TOTAL DEPTH: 25'	CAVE DEPTH:	

DEPTH (FEET)	SAMPLE NUMBER	SAMPLE DEPTH	BLOW COUNTS (BLOWS/FOOT)	RECOVERY (INCHES)	POCKET PEN (TSF)	GRAPHIC LOG	LITHOLOGY
0		AS	--	--	--		6" TOPSOIL.
1-2	1	1.0-2.5	3-4-5	8	2.0		FILL: Moist, stiff, brown, CLAY, minor silt, trace sand. Wn%: 30.7
4-5	2	3.5-5.0	2-3-3	14	1.5		Moist, medium stiff, brown and gray, CLAY, some silt, trace sand. LL: 38 PI: 16 Wn%: 27.8
6-7	3	6.0-7.5	0-0-2	8	0.5		Moist, soft, gray, CLAY, some silt. Wn%: 35.2
9-10	4	8.5-10.0	0-0-3	12	0.5		Moist, soft, gray, CLAY, some silt, trace sand. LL: 44 PI: 21 Wn%: 31.9
11-12	5	11.0-12.5	1-2-4	8	1.0		Moist, medium stiff, gray, CLAY, minor silt, trace sand. LL: 34 PI: 19 Wn%: 19.2
14-15	6	13.5-15.0	5-5-5	10			Wet, medium dense, brown, silty, fine to coarse SAND AND GRAVEL. Wn%: 21.9
16-17	7	16.0-17.5	4-5-5	13			Saturated, medium dense, brown, fine to coarse SAND AND GRAVEL, trace silt. Wn%: 18.4
19-20	8	18.5-20.0	3-4-4	12			Saturated, loose, gray, fine to coarse SAND, trace silt. Wn%: 37.6
21-22	9	21.0-22.5	3-3-5	13			Saturated, loose, gray, fine to coarse SAND, trace silt. Wn%: 27.5
24-25	10	23.5-25.0	5-7-8				Saturated, medium dense, brown, fine to coarse SAND, minor gravel, trace silt. Wn%: 26.2

Note: *Ground surface elevations at boring locations estimated using data provided by Google Earth Pro.*

WERTZ GEOTECHNICAL ENGINEERING, INC.
DRILLING | MATERIAL TESTING | ENGINEERING

400 COLLIER DRIVE
DOYLESTOWN, OHIO, 44230
(330) 991-0041

PROJECT:	Ashland EQ Basin	PROJECT NO.: 20221042	DRILL RIG: CME 550	BORING ID: B-3	**Page 1 of 1**
LOCATION:	Ashland, Ohio		METHOD: Hollow Stem	DATE STARTED: 3/11/2022	
LOGGED BY:	CD		AUGER SIZE: 3.25 inches	DATE COMPLETED: 3/14/2022	
DRILL CREW:	JK & JR & DM & CD		HAMMER: Automatic SPT	ELEVATION: 979 feet MSL	
GROUNDWATER ENCOUNTER DEPTH	3'	GROUNDWATER AT COMPLETION: 1'	TOTAL DEPTH: 25'	CAVE DEPTH: 4'	

SAMPLE NUMBER	SAMPLE DEPTH	BLOW COUNTS (BLOWS/FOOT)	RECOVERY (INCHES)	POCKET PEN (TSF)	GRAPHIC LOG	LITHOLOGY
	AS	--	--	--		6" TOPSOIL.
1	1.0-2.5	3-4-3	12			FILL: Moist, medium stiff, brown, clayey fine to coarse SAND, minor gravel. ***NOTE:*** *No SPT sampling. Sample taken from auger-cuttings.* Wn%: 13.2
2	3.5-5.0	3-5-6	14			
3	6.0-7.5	7-5-5	14			Wet, medium dense, brown, fine SAND AND GRAVEL.
4	8.5-10.0	6-6-4	16			Saturated, medium dense, brown, silty, fine to coarse SAND AND GRAVEL. Wn%: 20.5
5	11.0-12.5	4-6-9	12			Saturated, medium dense, gray, fine to coarse SAND AND GRAVEL, minor silt. Wn%: 18.6
6	13.5-15.0	7-5-8	13			Saturated, medium dense, brown, fine to coarse SAND, minor gravel and silt. Wn%: 16.9
7	16.0-17.5	6-5-7	11	3.5		Moist, stiff, gray, CLAY, some silt, trace gravel. Wn%: 14.0
8	18.5-20.0	3-5-7	18	1.0		Moist, stiff, brown and gray, silty CLAY, trace sand and gravel. Wn%: 17.3
9	21.0-22.5	2-2-4	16	1.5		Moist, medium stiff, gray, CLAY, minor fine to coarse sand and silt, trace gravel. Wn%: 18.7
10	23.5-25.0	2-3-5	10	1.5		Moist, medium stiff, gray, CLAY, minor fine to coarse sand and silt, trace gravel. Wn%: 14.5

Note: *Ground surface elevations at boring locations estimated using data provided by Google Earth Pro.*

WERTZ GEOTECHNICAL ENGINEERING, INC.
DRILLING | MATERIAL TESTING | ENGINEERING

400 COLLIER DRIVE
DOYLESTOWN, OHIO, 44230
(330) 991-0041

PROJECT:	Ashland EQ Basin	PROJECT NO.: 20221042	DRILL RIG: CME 550	BORING ID:	B-4
LOCATION:	Ashland, Ohio		METHOD: Hollow Stem	DATE STARTED:	3/15/2022
LOGGED BY:	CN		AUGER SIZE: 3.25 inches	DATE COMPLETED:	3/15/2022
DRILL CREW:	JK & DM & CN		HAMMER: Automatic SPT	ELEVATION:	978 feet MSL
GROUNDWATER ENCOUNTER DEPTH	3'	GROUNDWATER AT COMPLETION: 1.5'	TOTAL DEPTH: 25'	CAVE DEPTH:	

SAMPLE NUMBER	SAMPLE DEPTH	BLOW COUNTS (BLOWS/FOOT)	RECOVERY (INCHES)	POCKET PEN (TSF)	LITHOLOGY
	AS	--	--	--	6" TOPSOIL.
1	1.0-2.5	1-3-3	6	1.0	FILL: Moist, medium stiff, brown CLAY, some silt and fine to coarse sand, trace gravel. LL: 35 PI: 13 Wn%: 41.8
2	3.5-5.0	2-3-5	12		Wet, loose, brown, silty, fine to coarse SAND, minor gravel. Wn%: 26.7
3	6.0-7.5	6-7-6	13		Saturated, medium dense, brown, fine to coarse SAND, minor silt, trace gravel. Wn%: 23.4
4	8.5-10.0	5-7-7	13		Saturated, medium dense, brown, silty, fine to coarse SAND, minor gravel. Wn%: 35.9
5	11.0-12.5	5-6-7	13		Saturated, medium dense, brown, fine to coarse SAND, minor silt, trace gravel. Wn%: 13.6
6	13.5-15.0	4-4-6	13		Saturated, medium dense, brown, fine to medium SAND, trace silt. Wn%: 12.5
7	16.0-17.5	5-7-6	14		Saturated, medium dense, brown, fine to coarse SAND, trace gravel. Wn%: 24.2
8	18.5-20.0	3-4-4	17		Saturated, loose, brown and gray, fine to coarse SAND, minor silt. Wn%: 18.0
9	21.0-22.5	2-2-3	18		Moist, medium stiff, gray, silty CLAY, trace sand. Wn%: 12.9
10	23.5-25.0	3-4-6	17		Moist, stiff, gray, silty CLAY, trace sand. Wn%: 16.4

***Note** : Ground surface elevations at boring locations estimated using data provided by Google Earth Pro.*

DEPTH (FEET): 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

GRAPHIC LOG

WERTZ GEOTECHNICAL ENGINEERING, INC.
DRILLING | MATERIAL TESTING | ENGINEERING

400 COLLIER DRIVE
DOYLESTOWN, OHIO, 44230
(330) 991-0041

PROJECT:	Ashland EQ Basin	PROJECT NO.: 20221042	DRILL RIG: CME 550	BORING ID:	B-5
LOCATION:	Ashland, Ohio		METHOD: Hollow Stem	DATE STARTED:	3/15/2022
LOGGED BY:	CN		AUGER SIZE: 3.25 inches	DATE COMPLETED:	3/15/2022
DRILL CREW:	JK & DM & CN		HAMMER: Automatic SPT	ELEVATION:	976 feet MSL
GROUNDWATER ENCOUNTER DEPTH	13'	GROUNDWATER AT COMPLETION: 12.5'	TOTAL DEPTH: 25'	CAVE DEPTH:	20'

SAMPLE NUMBER	SAMPLE DEPTH	BLOW COUNTS (BLOWS/FOOT)	RECOVERY (INCHES)	POCKET PEN (TSF)	LITHOLOGY
	AS	--	--	--	8" TOPSOIL.
1	1.0-2.5	4-3-4	18	2.0	FILL: Moist, medium stiff, gray, silty CLAY, minor gravel. Wn%: 20.1
2	3.5-5.0	4-6-9	18	2.5	FILL: Moist, stiff, gray, CLAY, some silt, minor gravel. Wn%: 21.6
3	6.0-7.5	6-6-7	18	2.5	Damp, stiff, brown, clayey SILT, trace sand. Wn%: 23.7
4	8.5-10.0	2-2-2	18		Moist, loose, brown, SILT, minor clay, trace sand. Wn%: 30.9
5	11.0-12.5	2-2-3	18		Moist, loose, brown, very fine sandy SILT, trace clay. Wn%: 32.7
6	13.5-15.0	1-1-2	18		Wet, very loose, gray, fine to coarse SAND, minor silt. Wn%: 57.3
7	16.0-17.5	1-1-2	18	1.0	Moist, soft, gray, CLAY, minor silt. Wn%: 28.1
8	18.5-20.0	2-2-3	18		Moist to wet, loose, brown and gray, silty fine to coarse SAND, trace clay. Wn%: 16.6
9	21.0-22.5	3-5-5	16		Wet, medium dense, gray, fine to coarse SAND AND GRAVEL. Wn%: 14.4
10	23.5-25.0	3-1-2	9		Wet, loose, gray, fine to coarse SAND AND GRAVEL, trace silt. Wn%: 11.8

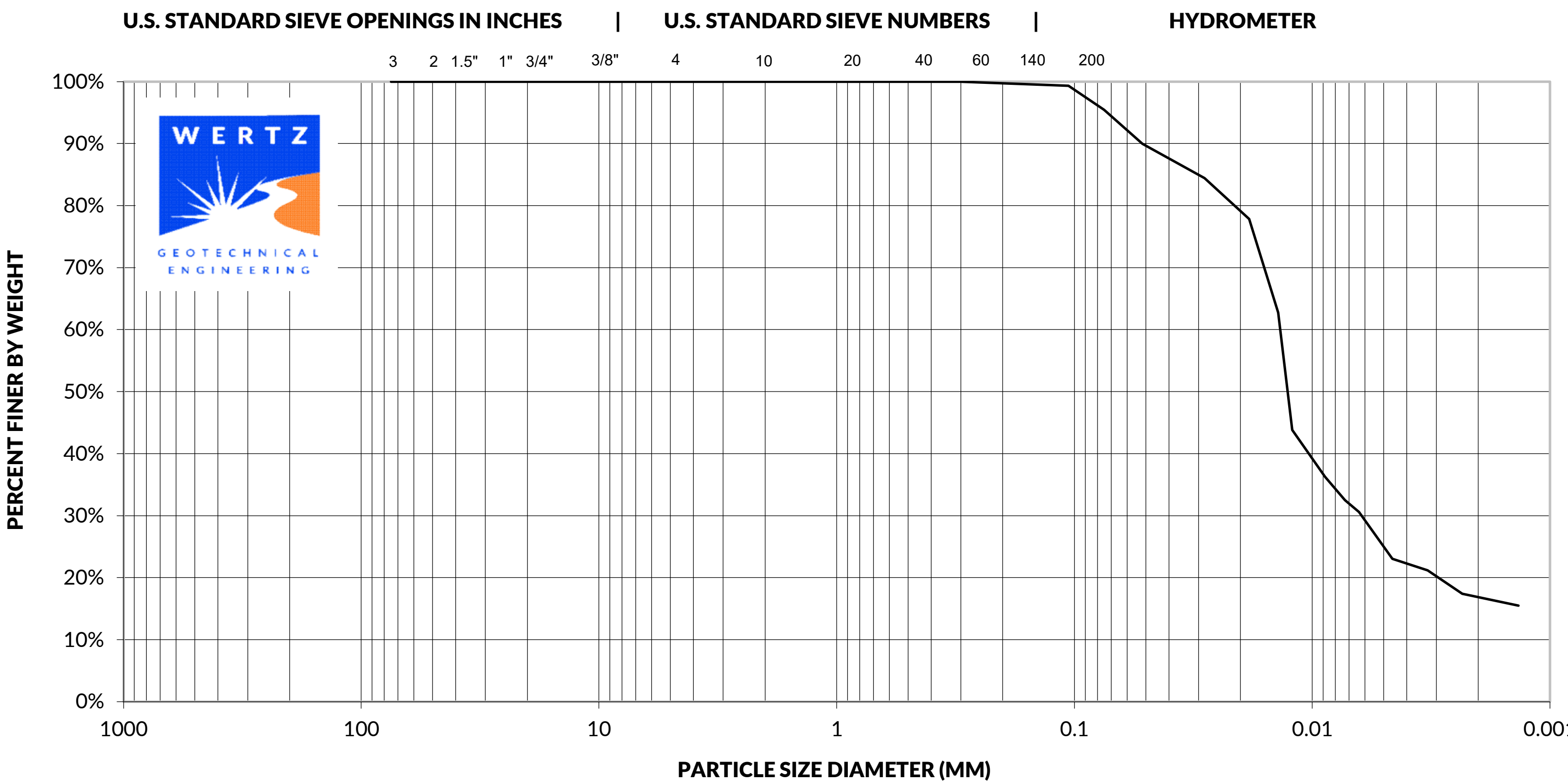
DEPTH (FEET): 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

GRAPHIC LOG

Note: *Ground surface elevations at boring locations estimated using data provided by Google Earth Pro.*

ATTACHMENT B

Sieve & Hydrometer Analysis Results

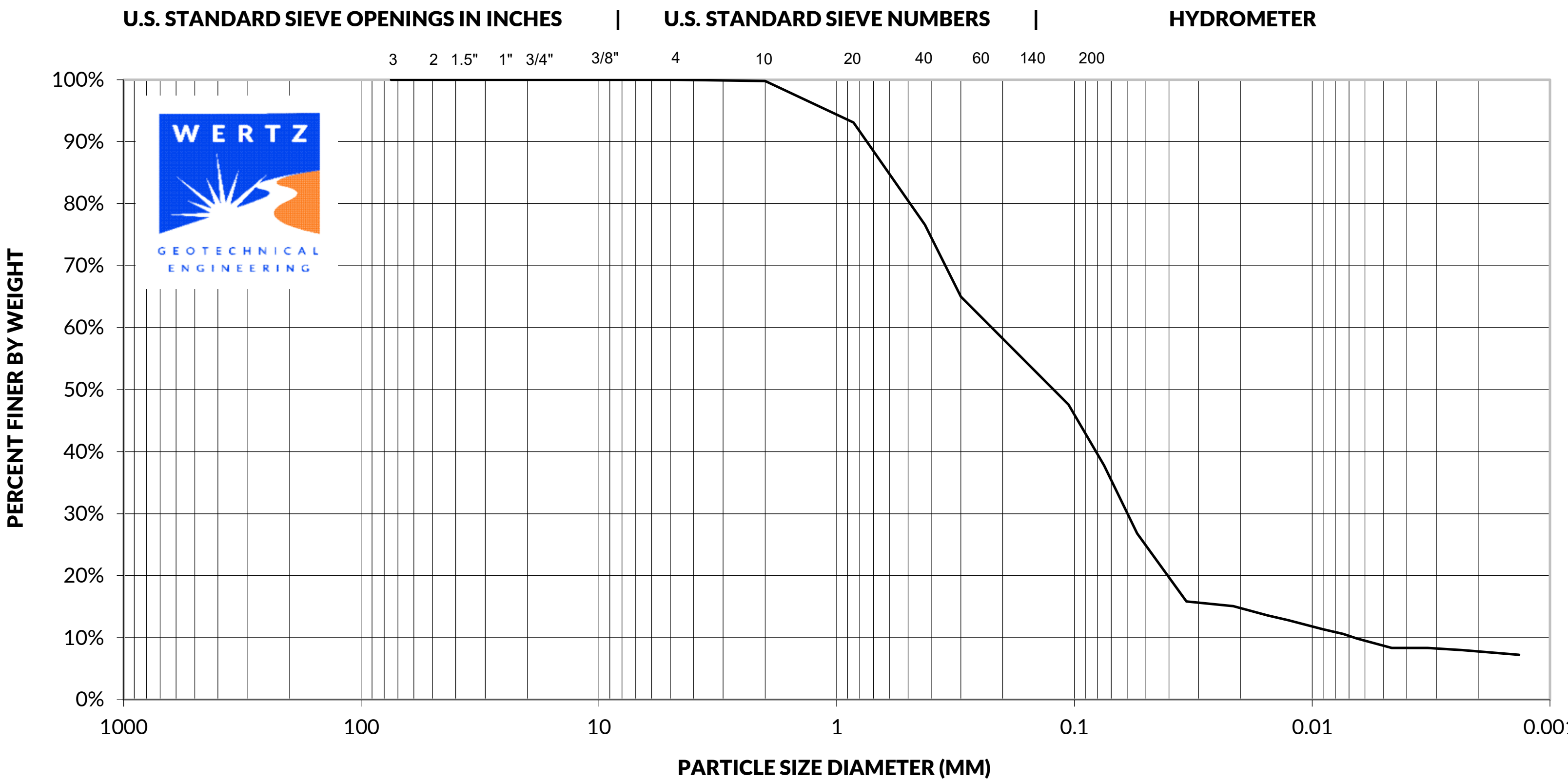


COBBLE	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Boring No.	Sample No.	Depth	Classification	Wn%	LL	PL	PI	Project		
B-1	S-2	3.5-5	Lean Clay (CL)	N/A	44	22	22	Ashland EQ Basin		
Cu	**Cc**	**Max Particle Size (Sieve Opening)**		**D_{60}**	**D_{30}**	**D_{10}**	**% ≥ 3"**	**% Gravel**	**% Sand**	**% Fines**
N/A	N/A	2.00 mm		0.6685	0.2823	0.0917	0.0%	0.0%	4.6%	95.4%

REPORT OF PARTICLE SIZE ANALYSIS

Lab No. L22-010

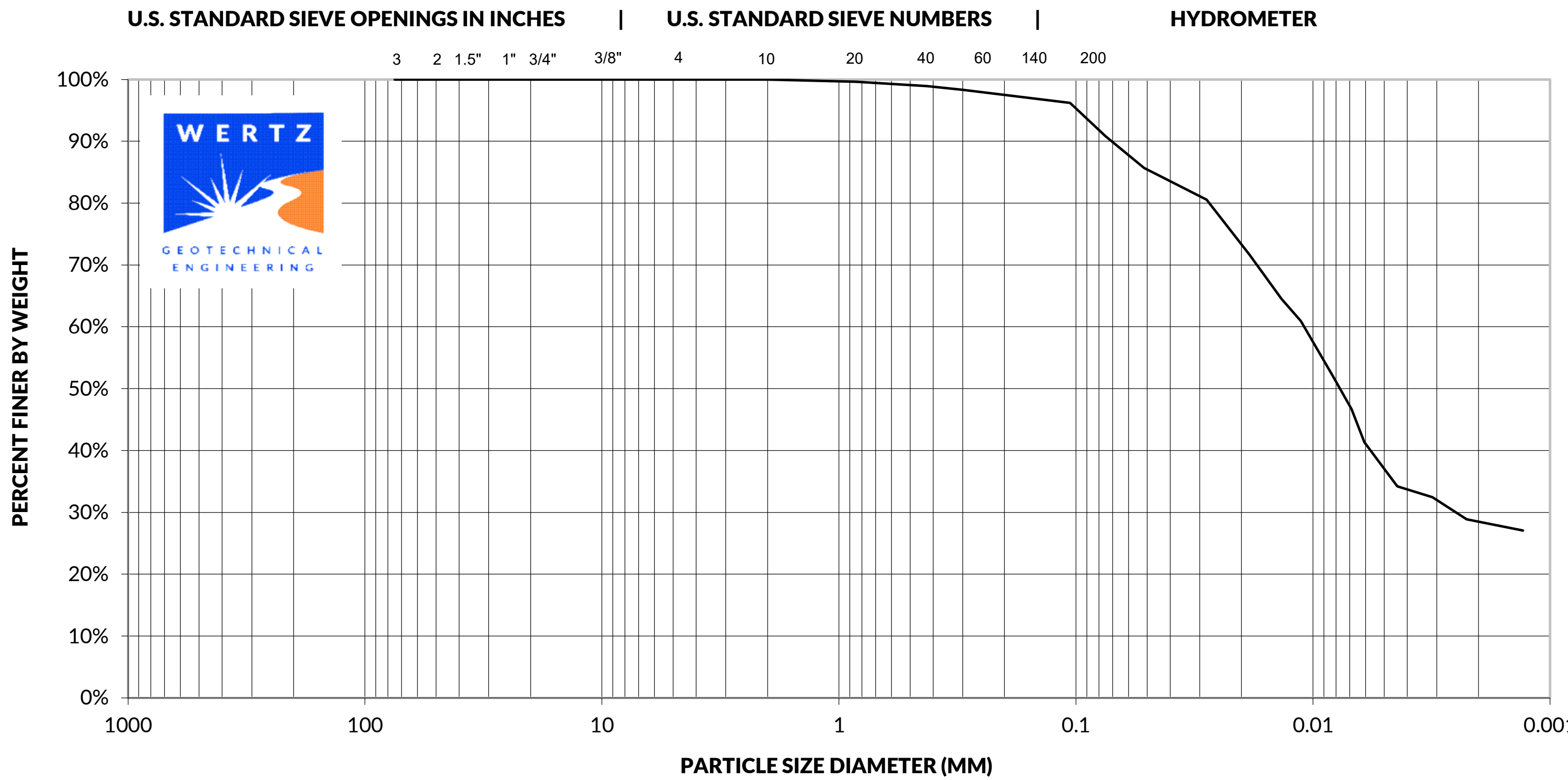


COBBLE	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Boring No.	Sample No.	Depth	Classification	Wn%	LL	PL	PI	Project		
B-1	S-4	8.5-10	Silty Sand (SM)	N/A	24	19	5	Ashland EQ Basin		
Cu	**Cc**	**Max Particle Size (Sieve Opening)**		**D_{60}**	**D_{30}**	**D_{10}**	**% ≥ 3"**	**% Gravel**	**% Sand**	**% Fines**
N/A	N/A	2.00 mm		0.2441	0.0604	0.0067	0.0%	0.0%	62.2%	37.8%

REPORT OF PARTICLE SIZE ANALYSIS

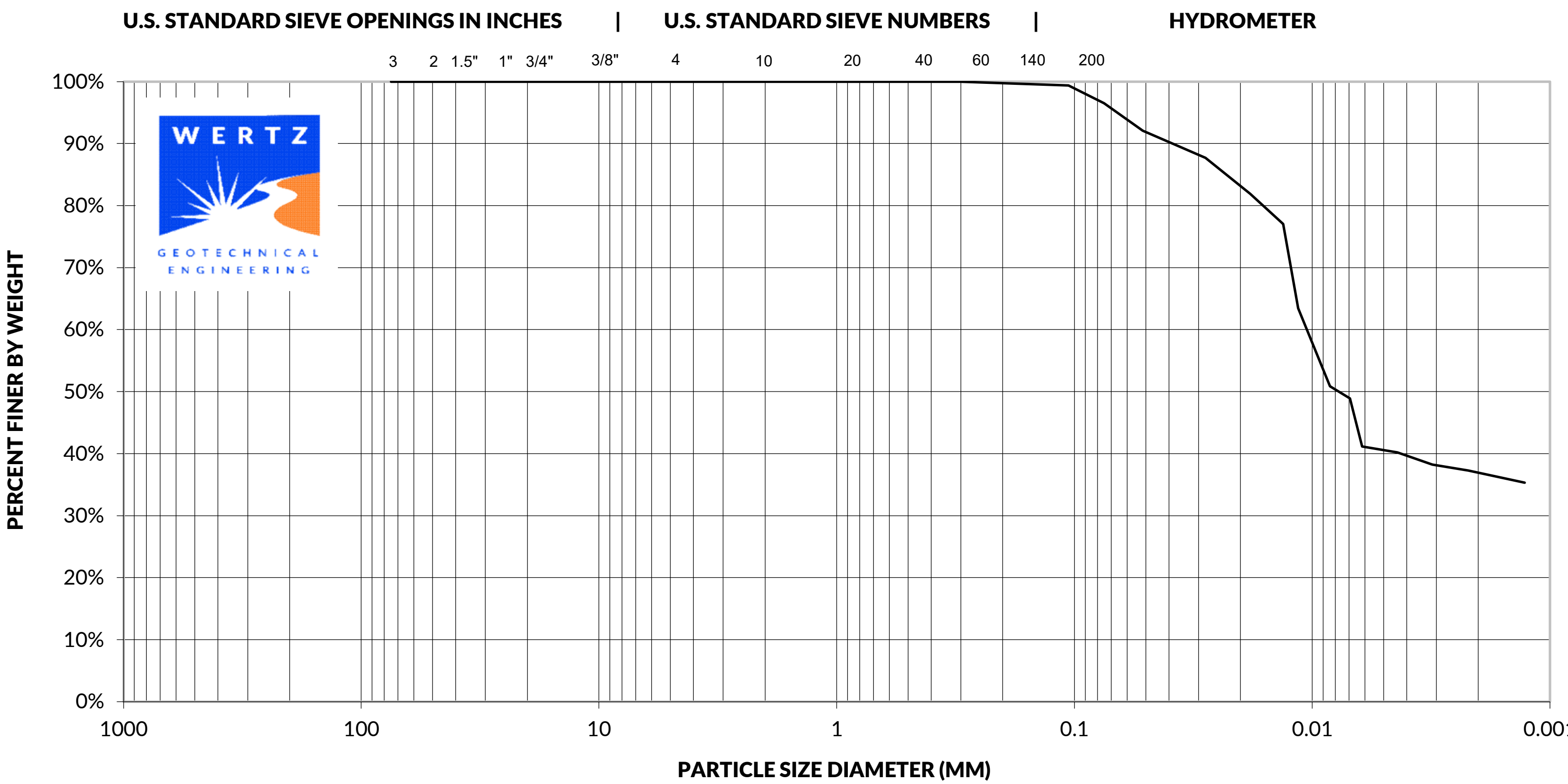
Lab No. L22-010



COBBLE	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Boring No.	Sample No.	Depth	Classification	Wn%	LL	PL	PI	Project		
B-2	S-2	3.5-5	Lean Clay (CL)	N/A	38	22	16	Ashland EQ Basin		
Cu	**Cc**	**Max Particle Size (Sieve Opening)**		**D_{60}**	**D_{30}**	**D_{10}**	**% ≥ 3"**	**% Gravel**	**% Sand**	**% Fines**
N/A	N/A	850 um		0.2441	0.0604	0.0067	0.0%	0.0%	9.2%	90.8%

REPORT OF PARTICLE SIZE ANALYSIS	Lab No.	L22-010



COBBLE	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Boring No.	Sample No.	Depth	Classification	Wn%	LL	PL	PI	Project
B-2	S-4	8.5-10	Lean Clay (CL)	N/A	44	23	21	Ashland EQ Basin

Cu	Cc	Max Particle Size (Sieve Opening)	D_{60}	D_{30}	D_{10}	% ≥ 3"	% Gravel	% Sand	% Fines
N/A	N/A	2.00 mm	0.2441	0.0604	0.0067	0.0%	0.0%	3.5%	96.5%

REPORT OF PARTICLE SIZE ANALYSIS

Lab No. L22-010

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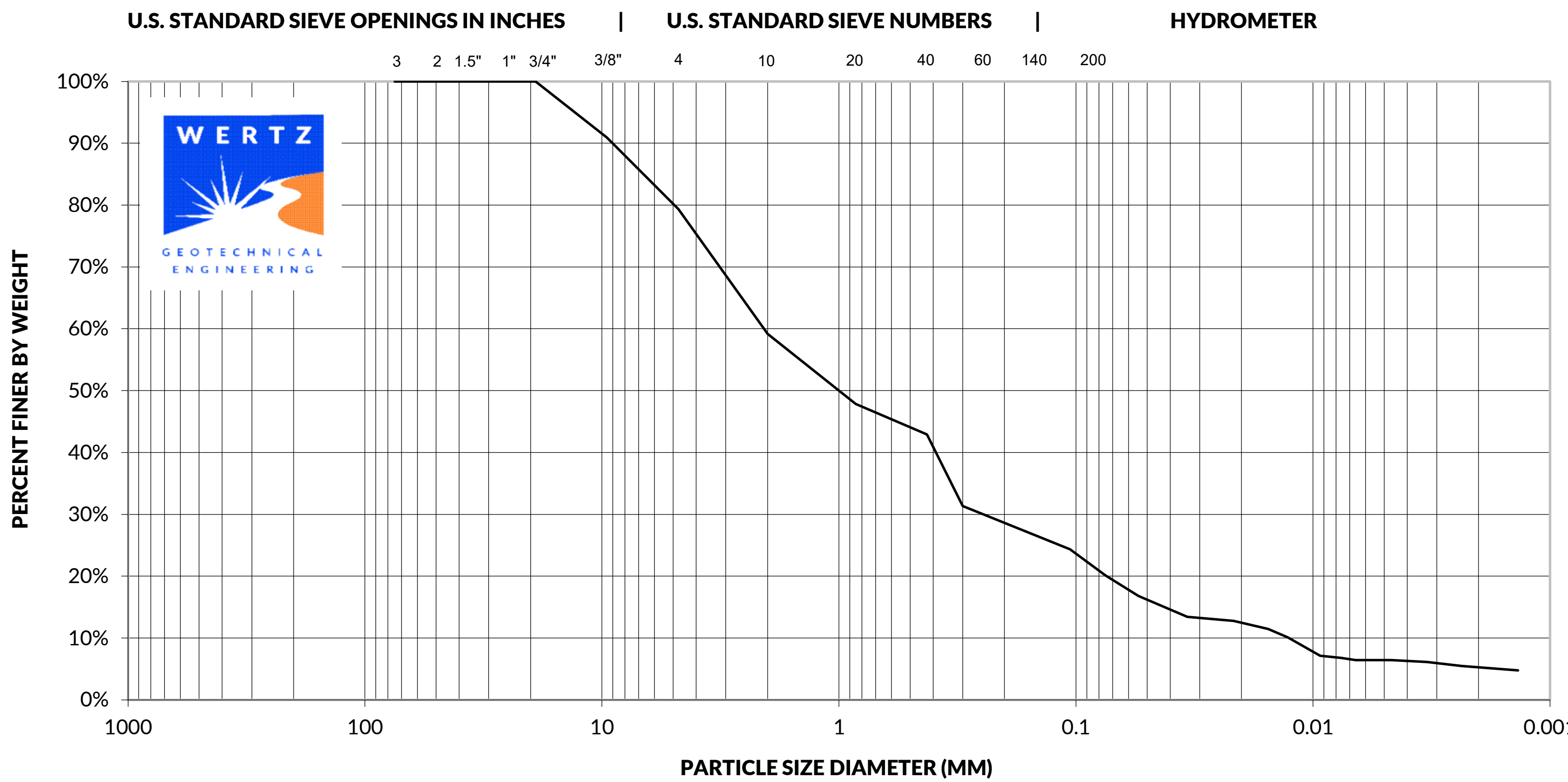

COBBLE	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Boring No.	Sample No.	Depth	Classification	Wn%	LL	PL	PI	Project		
B-2	S-5	13.5-15	Silty Sand with Gravel (SM)	N/A	N/A	N/A	N/A	Ashland EQ Basin		
Cu	**Cc**	**Max Particle Size (Sieve Opening)**		**D_{60}**	**D_{30}**	**D_{10}**	**% ≥ 3"**	**% Gravel**	**% Sand**	**% Fines**
N/A	N/A	9.5 mm		2.1126	0.2631	0.0126	0.0%	20.6%	59.2%	20.1%

REPORT OF PARTICLE SIZE ANALYSIS

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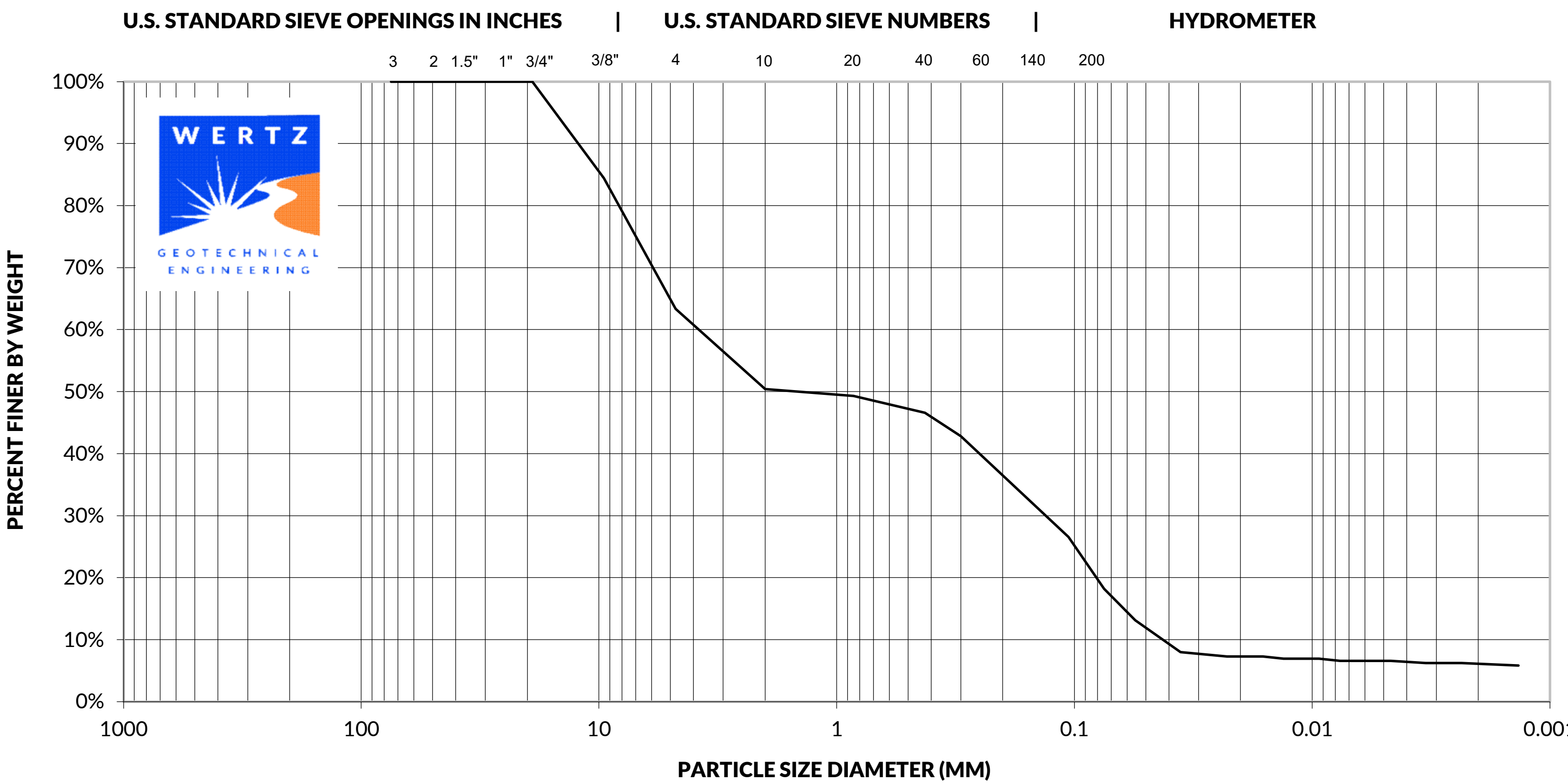

COBBLE	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Boring No.	Sample No.	Depth	Classification	Wn%	LL	PL	PI	Project
B-3	S-4	8.5-10	Silty Sand with Gravel (SM)	N/A	N/A	N/A	N/A	Ashland EQ Basin

Cu	Cc	Max Particle Size (Sieve Opening)	D_{60}	D_{30}	D_{10}	% ≥ 3"	% Gravel	% Sand	% Fines
N/A	N/A	9.5 mm	4.0422	0.147	0.0451	0.0%	36.7%	45.1%	18.2%

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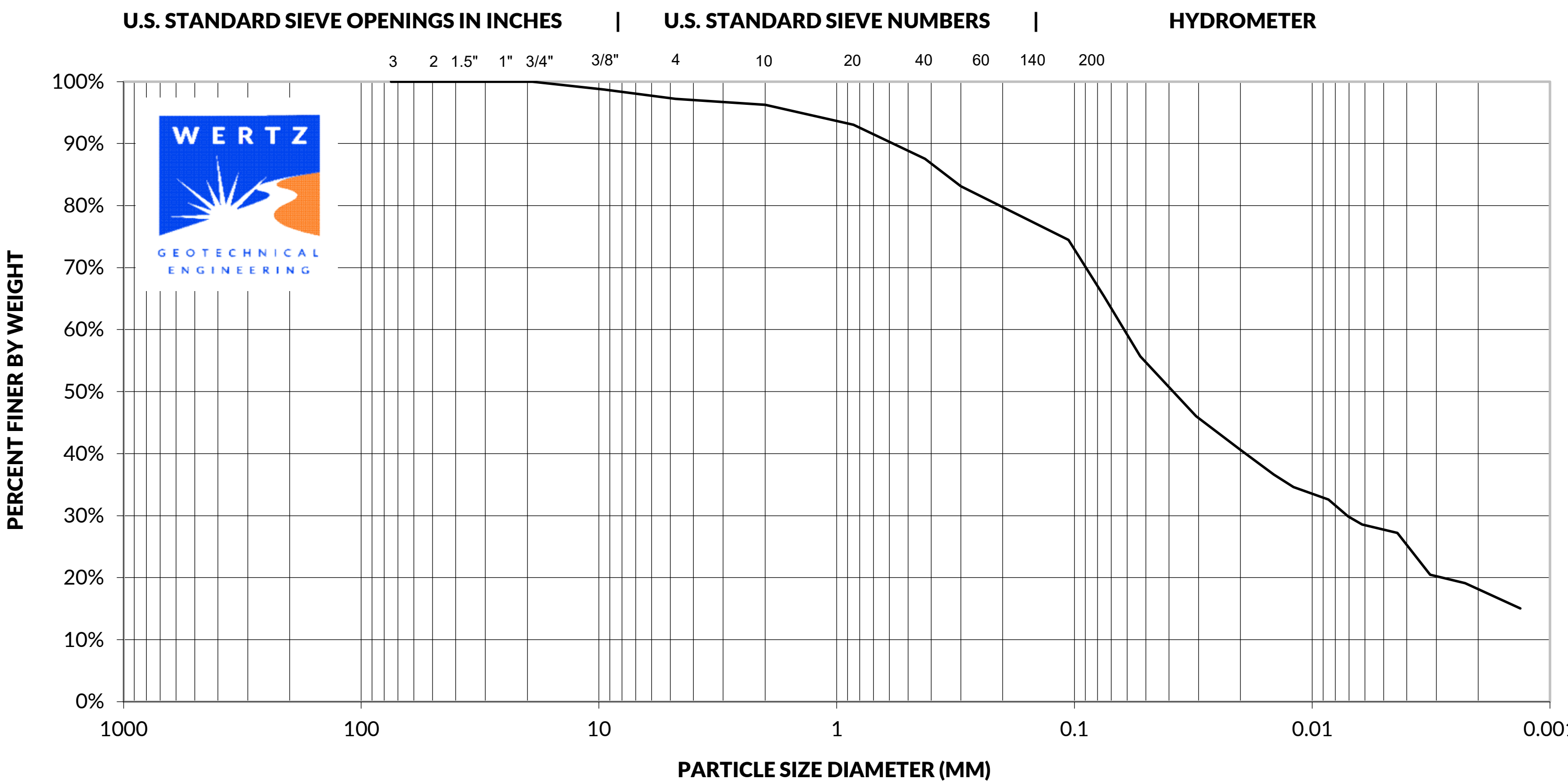
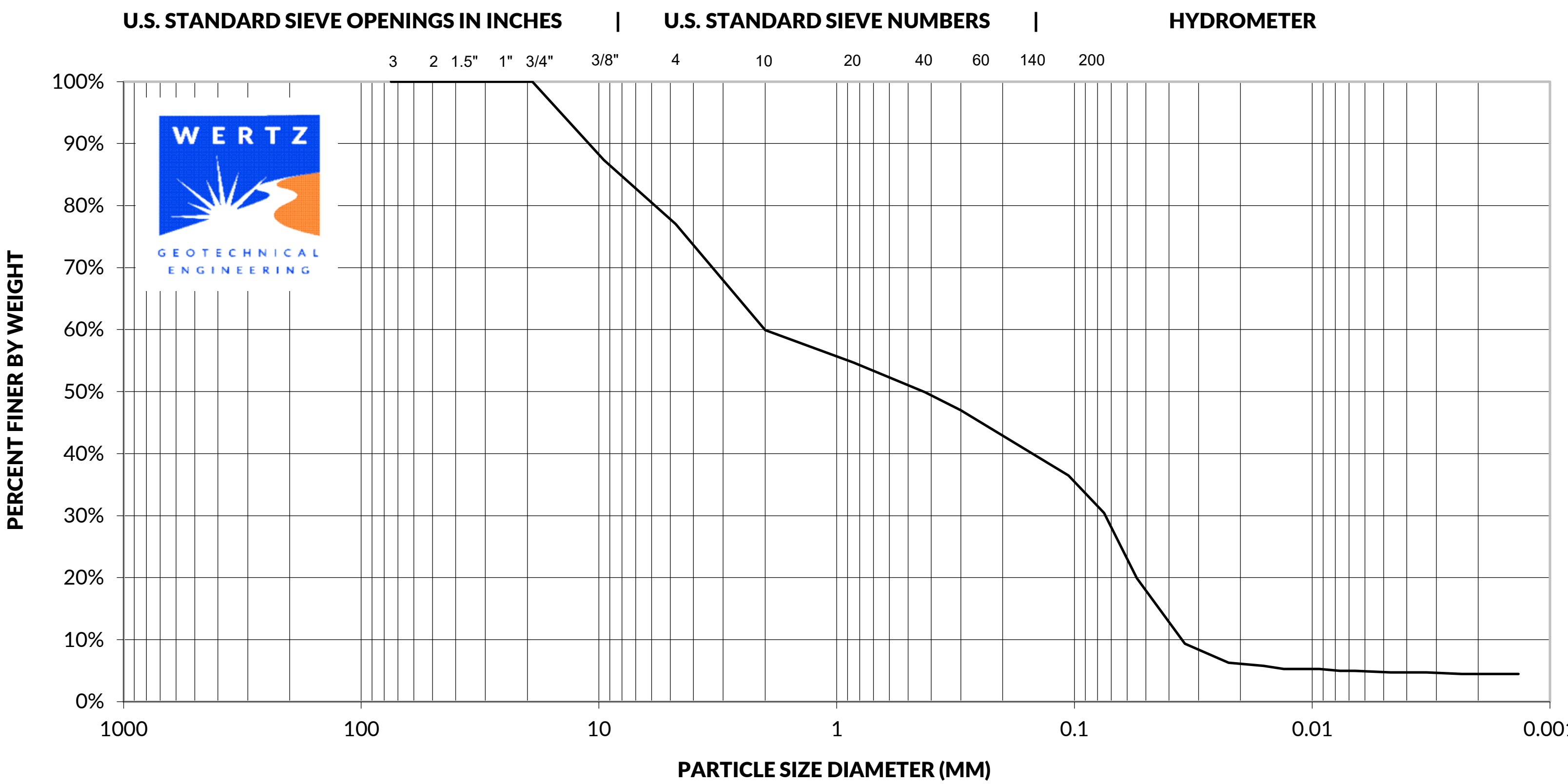


COBBLE	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Boring No.	Sample No.	Depth	Classification	Wn%	LL	PL	PI	Project		
B-4	S-1	1-2.5	Lean Clay with Sand (CL)	N/A	35	22	13	Ashland EQ Basin		
Cu	**Cc**	**Max Particle Size (Sieve Opening)**		**D_{60}**	**D_{30}**	**D_{10}**	**% ≥ 3"**	**% Gravel**	**% Sand**	**% Fines**
N/A	N/A	9.5 mm		4.0422	0.147	0.0451	0.0%	2.8%	31.8%	65.3%

REPORT OF PARTICLE SIZE ANALYSIS	Lab No.	L22-010



COBBLE	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Boring No.	Sample No.	Depth	Classification	Wn%	LL	PL	PI	Project		
B-4	S-2	3.5-5	Silty Sand with Gravel (SM)	N/A	N/A	N/A	N/A	Ashland EQ Basin		
Cu	**Cc**	**Max Particle Size (Sieve Opening)**		**D_{60}**	**D_{30}**	**D_{10}**	**% ≥ 3"**	**% Gravel**	**% Sand**	**% Fines**
N/A	N/A	9.5 mm		2.012	0.0741	0.0355	0.0%	23.0%	46.6%	30.4%

REPORT OF PARTICLE SIZE ANALYSIS

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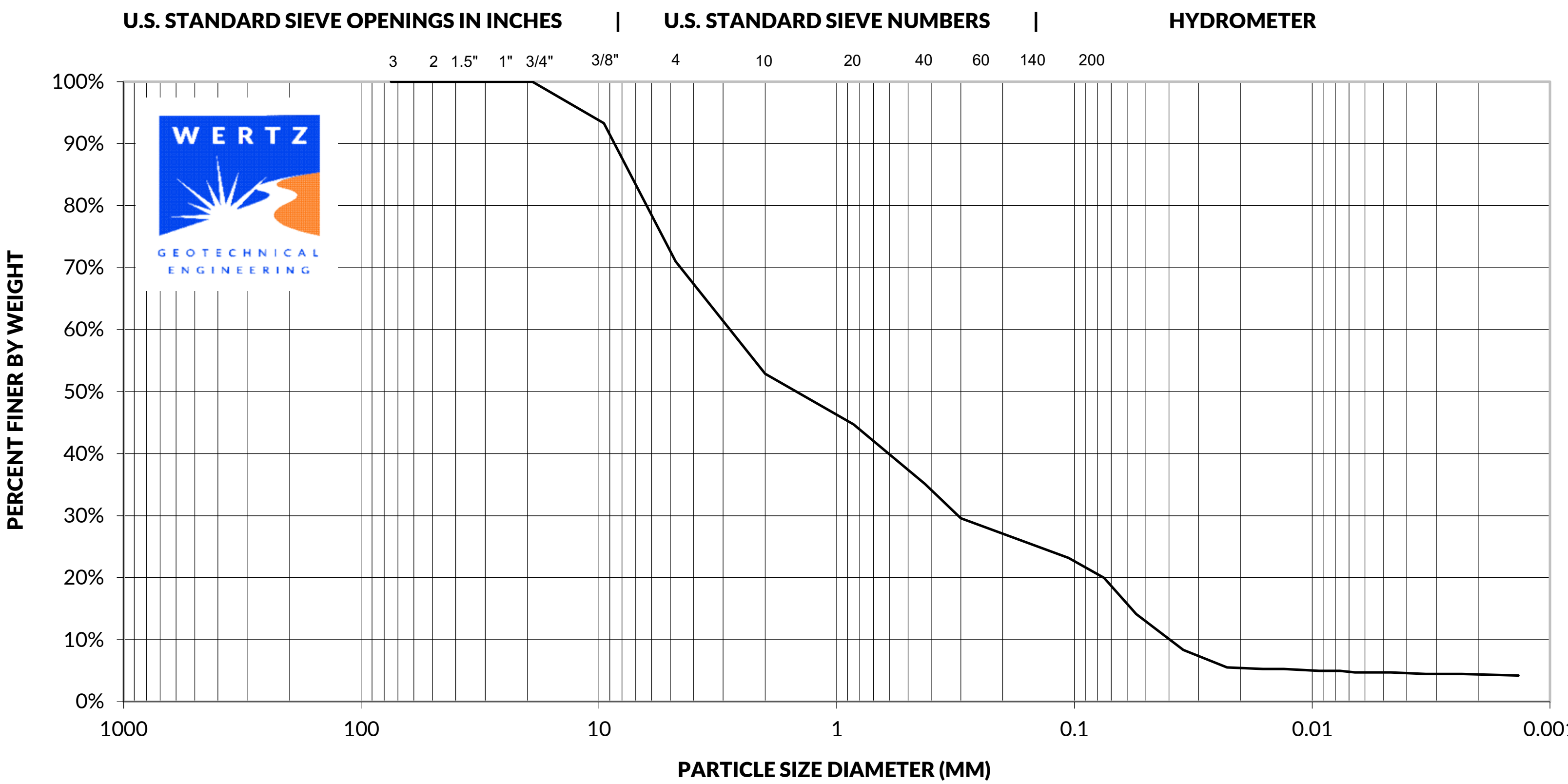

COBBLE	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Boring No.	Sample No.	Depth	Classification	Wn%	LL	PL	PI	Project		
B-4	S-4	8.5-10	Silty Sand with Gravel (SM)	N/A	N/A	N/A	N/A	Ashland EQ Basin		
Cu	**Cc**	**Max Particle Size (Sieve Opening)**		**D_{60}**	**D_{30}**	**D_{10}**	**% ≥ 3"**	**% Gravel**	**% Sand**	**% Fines**
N/A	N/A	9.5 mm		3.0855	0.3094	0.0406	0.0%	29.0%	51.0%	20.0%

REPORT OF PARTICLE SIZE ANALYSIS

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APPENDIX E

Alternative No. 2 (Additional Storage) Summary of Overflow Occurrences and Overflow Volume based on Varying Volumes of Storage

EVALUATION OF ADDITIONAL STORAGE VOLUMES ON PAST OVERFLOW OCCURRENCES (2017 TO PRESENT)

Storage Volume (MG)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
# of Occurrences (days w/ Overflow)	42	32	19	13	12	7	4	3	2	1	1	1	1	0	0	0	0	0	0	0	0
# of Rain Events w/ Overflow	22	21	15	11	9	8	6	5	4	4	3	3	2	2	1	1	1	1	1	1	1
Total Overflow Volume (MG)	111.1	90.1	72.022	59.6	48.9	40.3	33.4	27.8	22.8	18.8	15.7	12.7	10.3	8.34	6.50	5.50	4.50	3.50	2.50	1.50	0.50
Net # of Occurrences Removed	0	10	23	29	30	35	38	39	40	41	41	41	41	42	42	42	42	42	42	42	42
Net # of Events Removed	0	1	7	11	13	14	16	17	18	18	19	19	20	20	21	21	21	21	21	21	21
Net Overflow Volume Removed (MG)	0	21.0	39.0	51.4	62.2	70.8	77.7	83.3	88.2	92.2	95.4	98.4	100.7	102.7	104.6	105.6	106.6	107.6	108.6	109.6	110.6
% of Occurrences Removed	0%	24%	55%	69%	71%	83%	90%	93%	95%	98%	98%	98%	98%	100%	100%	100%	100%	100%	100%	100%	100%
% of Events Removed	0%	5%	32%	50%	59%	64%	73%	77%	82%	82%	86%	86%	91%	91%	95%	95%	95%	95%	95%	95%	95%
% of Overflow Removed	0%	19%	35%	47%	56%	64%	70%	75%	80%	83%	86%	89%	91%	93%	94%	95%	96%	97%	98%	99%	100%