



MCES Forest Lake Interceptor 7029 Rehabilitation Design

Facility Plan

MCES Forest Lake Interceptor 7029

Rehabilitation Design Facility Plan

I hereby certify that this report was prepared by me or under my direct supervision,
and that I am a duly Licensed Professional Engineer under the laws of the State of
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MCES Forest Lake Interceptor 7029

Rehabilitation Design

Facility Plan

Facility Plan Executive Summary

The Forest Lake Interceptor 7029 was constructed in the early 1970s. This Facility Plan encompasses the section of existing 36-inch Interceptor 7029 in Forest Lake, from MH 113 (Lift Station L01) south to MH 77 (Lift Station L02) on the border of the city of Forest Lake and Hugo. This section of the Interceptor 7029 is routed north-south in a rural area within existing prescribed MCES permanent easements. A portion of this project runs through Tanners Brook Golf Course. Temporary easements will be procured to allow for necessary construction staging and access activities.

This section of Interceptor 7029 is in fair to poor condition and needs rehabilitation to extend its service life.

This recommended solution consists of:

- Trenchless structural rehabilitation of over 11,000 feet of 36-inch interceptor
- Trenchless cleaning only of over 7,000 feet of 36-inch interceptor
- Structural lining of twenty (20) existing manholes (MHs)
- Partial reconstruction of six (6) MHs

Multiple pipe and MH rehabilitation technologies were evaluated based on project characteristics and MCES familiarity with the products and methods.

The recommended rehabilitation methods include:

- Cured in Place Pipe (CIPP) rehabilitation for 36-inch interceptor
- Fiber Reinforced Pipe (FRP) MH structural liner inserts
- Partial reconstruct for the existing Type 4 “doghouse” MHs where base structure is larger than riser sections

Temporary conveyance of existing wastewater flows will be provided in a phased manner from a MH north of Headwaters Parkway to south of the project extents to facilitate cleaning and rehabilitation activities.

The design phase will be completed in 2024 with construction anticipated for 2025 into 2026.

1.0 Facility Plan Introduction and Demand Projections

1.1 Problem Definition

The Metropolitan Council owns and operates the Forest Lake Interceptor from Lift Station L01 to L78 in White Bear Lake. A 2018 condition assessment revealed approximately 1,000 linear feet (LF) upstream of L02 to be condition 4.5 and the remaining 7,000 LF between manholes (MH) 81 and 94 to be condition rating four (4) as defined by the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP). This 11,000-foot section of 36-inch, single barrel, reinforced concrete pipe (RCP) was installed in the early 1970s and is in Fair to Poor condition. A 35-foot-wide permanent easement exists over the corridor.

Desktop and field analysis of the existing MHs in the 7029 corridor from MH 77A to MH 99 has been completed per Existing Conditions Tech Memo dated July 6, 2023, and Existing Conditions Tech Memo dated Feb 19, 2024. Both memorandums are found in Appendix A.

1.2 Flows and Organic Loads

The Metropolitan Council provided TKDA with 10 years of flow rate data from flow meters near lift stations L01 and L02 along with a capacity analysis of the interceptor conducted in 2023. This analysis is in Appendix B: MCES Capacity Analysis. The capacity analysis determined that the 10-year average dry weather flow was 1.5 million gallons per day, and that the 10-year peak wet weather flow was 2.9 million gallons per day.

MCES also provided hourly flow data for the past 10-years. Based on an analysis of this data, the peak hourly wet weather flow was 5.65 million gallons per day for lift station L01, and 6.01 million gallons per day for lift station L02. The capacity analysis concluded that the hydraulic capacity of this section of Interceptor 7029 is adequate through 2040.

1.3 Impact on Existing Wastewater Facilities

Interceptor 7029 flows to the south and discharges to MCES Interceptor 6901 which ultimately discharges to the MCES Metro WWTP. This project is not increasing the flow rates or organic loadings. This project will have minimal impact to downstream gravity interceptors, lift stations and wastewater treatment plant.

1.4 Project Description

The Metropolitan Council owns and operates the Forest Lake Interceptor 7029 from Lift Station L01 to L78 in White Bear Lake. This project will consist of the following:

- Trenchless structural rehabilitation of 11,000 feet of 36-inch gravity interceptor
- Trenchless cleaning only of over 7,000 feet of 36-inch gravity interceptor
- Structural rehabilitation of 20 MHs
- Partial reconstruction of four (4) doghouse type MHs

Temporary conveyance of existing wastewater flows will be provided in a phased manner from a MH north of Headwaters Parkway to south of the project extents to facilitate cleaning and rehabilitation activities. The temporary conveyance system will consist of suction pits with two (2) pumps and dual 14-inch temporary conveyance pipes.

A 2018 condition assessment revealed approximately 1,000 linear feet (LF) upstream of L02 to be condition 4.5 and the remaining 7,000 LF between manholes (MH) 81 and 94 to be condition rating four (4) as defined by the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP). The 36-inch, single barrel, reinforced concrete pipe (RCP) was installed in 1970. A 35-foot-wide permanent easement exists over the corridor.

As part of the initial work authorization for this project, TKDA completed desktop and field analysis of the existing MHs in the 7029 corridor from MH 77A to MH 99. As seen in the Existing Conditions Tech Memo dated July 6, 2023. The section of interceptor between MH 99 and MH 113 was the subject of a desktop and field analysis that can be seen in Existing Conditions Tech Memo dated Feb 19, 2024.

This report reflects a preliminary design stage of the rehabilitation project which will include lining of the interceptor pipe and MH's south of MH 99. Several MH's and a short portion of interceptor pipe at the downstream (southern) boundary of the site are proposed for replacement.

1.5 Location Drawings

The location of Interceptor 7029 is shown in Appendix C: Location Drawings.

1.6 Engineering Criteria

This section of interceptor is being rehabilitated and will not have increased function or capacity to existing conditions.

Engineering criteria to be used in design of the project shall be included.

1.7 Site Information

Interceptor 7029 in the project area passes through mostly undeveloped rural agricultural area. The topography is mostly flat. Wetlands and other aquatic resources were identified and delineated by Anderson Engineering in October of 2023. A total of 28 wetlands, or portions thereof, were identified and delineated along this project corridor. The wetland delineations are captured in a Wetland Investigation report prepared by Anderson Engineering (this report is within Appendix A). The project alignment is outside of the 100-year flood plain.

According to the Geologic Atlas of Washington County (2016), bedrock geology of the area consists of Jordan Sandstone, St. Lawrence Formation, and Tunnel City Group. Jordan Sandstone is characterized by dominantly white to yellow, very fine- to coarse-grained, friable quartz sandstone. St. Lawrence Formation is principally light gray to yellowish-gray and pale yellowish-green, dolomitic, feldspathic siltstone with interbedded, very fine-grained sandstone and shale. Tunnel City Group is divided into two formations: the Mazomanie and Lone Rock Formations. The Mazomanie Formation is dominantly white to yellowish-gray, fine- to medium-grained, cross-stratified, generally friable, quartz sandstone. The Lone Rock Formation underlies the Mazomanie Formation and consists of pale yellowish green, very fine- to fine-grained glauconitic, feldspathic sandstone and siltstone, with thin, greenish-gray shale partings.

Elevation of the bedrock surface throughout the study area varies from approximately 651 to 850 feet above mean sea level. Depth from the land surface to the bedrock surface throughout the study area varies from approximately 101 to 300 feet. According to the

Minnesota Department of Natural Resources (DNR) Karst Feature Inventory, no sinkholes or karst conditions were identified in the project area.

According to the Natural Resources Conservation Service (NRCS) Web Soil Survey, there are ten soil types within the study area. The erosion hazard rating included in Table 1.7 indicates the hazard of soil loss from off-road areas after disturbance activities that expose the soil surface. Due to the location of the site and the classification of the soil, the soil types are not rated for an erosion hazard rating, meaning that there is not enough information to make a determination regarding soil erodibility. The soils information is included in Table 1. Project soils do not present any situations that will require unique soil stabilization methods, soil correction, or other measures.

Table 1: Soil Types, per the NRCS Web Soil Survey

Map Unit Symbol	Map Unit Name	Erosion Hazard	Acres within Study area	Percent of Study area
75	Bluffton loam	Not rated	99.4	22.0%
113	Webster loam	Not rated	33.4	7.4%
123	Dundas fine sandy loam	Not rated	227.1	50.2%
132C	Hayden fine sandy loam, 6 to 12 percent slopes	Not rated	0.3	0.1%
169B	Braham loamy fine sand, 1 to 6 percent slopes	Not rated	1.5	0.3%
170	Blomford loamy fine sand	Not rated	27.7	6.1%
225	Nessel fine sandy loam, 1 to 4 percent slopes	Not rated	26.1	5.8%
481	Kratka fine sandy loam	Not rated	4.4	1.0%
544	Cathro muck	Not rated	26.2	5.8%
1055	Aquolls and Histosols, ponded	Not rated	6.0	1.3%

1.8 Alternative Selection

1.8.1 Pipe Rehabilitation Alternatives

TKDA conducted an alternatives analysis for four (4) potential interceptor rehabilitation alternatives; Do Nothing Alternative, Cured in Place Pipe (CIPP) lining, Spiral Wound lining, Slip Lining. Each alternative was analyzed for capacity reduction, constructability, cost, and its effect on the environment. Fold and Form pipe lining is another technology available on the market. Based on limited local experience with the technology, and it likely requiring the same amount of excavation as slip-lining, the technology was not considered in detail for this project.

The recommended alternative for this project is Alternative 2 - CIPP lining due to its minimal hydraulic capacity reduction (1.5-3" interceptor diameter reduction), its wide adoption within the local construction industry, MCES's familiarity with the method, and its moderate cost and environmental impact compared to the other alternatives.

1.8.1.1 Alternative 1 - Do Nothing

Alternative 1 would utilize the existing interceptor without rehabilitation. This section of interceptor has a NASSCO rating ranging from 4 to 4.5 (poor condition). Not rehabilitating this interceptor at this time would allow this RCP interceptor to deteriorate further thus potentially posing a risk to public health and the environment.

1.8.1.2 Alternative 2 - CIPP

Cured in place pipe (CIPP) is a trenchless pipe rehabilitation method involving a resin impregnated felt or fiberglass liner inserted into a pipe via a MH. The liner is then pressurized to cause the liner to form a tight fit with the existing pipe. The resin is set via heat or ultraviolet (UV) light. Heat can come from heated water or steam used to pressurize the pipe, this requires the pipe be pressurized and heated over a set duration of time based on the chemical nature of the resin. UV curing of CIPP can be completed in less time, yet is more expensive, but may be a desirable alternative if water to use in curing the pipe proves difficult to source economically. CIPP Liners are watertight and corrosion resistant replacement pipe. This method requires 100% of the flow of the host pipe be diverted.

1.8.1.3 Alternative 3 - Spiral Wound

Spiral wound lining is a trenchless pipe rehabilitation method involving a continuous PVC or HDPE strip wound around the walls overlapping itself and forming a watertight seal creating the walls of a new pipe. The annular space between the new and old pipe must then be grouted. Spiral wound lining can be installed in an active pipe with minimal to no diversion of the flow via temporary conveyance. The method would require removing the cone from existing MHs to fit the lining machine setup. Spiral wound pipe varies in the amount of flow that can be handled during construction, with 25% pipe capacity being the typical maximum allowable during construction.

1.8.1.4 Alternative 4 - Slip Lining

Slip Lining is a pipe rehabilitation method involving inserting a smaller carrier pipe into an existing damaged pipe. Typically, in gravity sanitary sewer applications, this carrier pipe is made of HDPE, PVC, or FRP material. The carrier pipe is assembled in small sections of pipe that are inserted sequentially, each new section pushing the prior section deeper into the pipe. The annular space left between the host pipe, and the carrier pipe must be grouted. This method requires either digging insertion and receiving pits at each end of a repaired section or by inserting very small segments of pipe into the damaged pipe that are small enough to fit through the existing MH structures. This method requires 100% of the flow of the host pipe be diverted.

1.9 Environmental Review

As noted in Section 1.7, 28 wetlands were identified in the site. The Local Government Unit, or LGU, responsible for implementing the state Wetland Conservation Act in this situation is the Rice Creek Watershed District. Any impacts due to construction would be temporary. No permanent impacts to wetlands are proposed as part of the project, so compensatory wetland mitigation will not be required. Any impacts to a wetland would be reviewed and permitted by the Rice Creek Watershed District.

The DNR Public Water Inventory does not show or identify any public waters within the site. The site is also not within any shoreland, floodplain, wild and scenic river, critical corridor, or agricultural preserve.

According to the DNR County Geologic Atlas Program, depth to groundwater within the site area is approximately 0-10 feet below surface. The site is not within any wellhead protection areas or any drinking water supply management areas. The 2024 EAW shows that there are eight wells near the project site.

Within a mile of the project site is Clear Lake and Hardwood Creek. Both are on the MPCA 303d Impaired Waters List. Nine unnamed DNR public water basins and 45 wetlands are within a mile of the site.

The MPCA's *What's in My Neighborhood* (WIMN) database identified two properties within the project site that are or may be contaminated. These were the Tanner's Brook Golf Course, and the intersection of Headwaters Parkway and Fenway Avenue.

Two state listed species (endangered, threatened, or special concern) may be found within the vicinity of the project site, the Blanding's Turtle, and Wilson's Phalarope. There are six species under the Federal Endangered Species Act expected or known to be in or near the project site: Northern Long-eared Bat, Tricolored Bat, Whooping Crane, Salamander Mussel, Monarch Butterfly, and the Rusty Patched Bumble Bee. An avoidance plan for the Blanding's Turtle will be adhered to, if needed. Disturbances to suitable nesting habitats for the Wilson's Phalarope will be avoided during construction in mid-May through July. Any disturbed soils will be reseeded with native seed grasses. No adverse effects to fish, wildlife, plant communities, or sensitive ecological resources are anticipated as a result of the project. Additionally, the project will not result in land cover changes and all land disturbance will be temporary in nature.

Per a search of the Minnesota State Historic Preservation Office's (SHPO) Statewide Inventory conducted in September 2023, there are no archaeological sites identified within the project site. If cultural materials are encountered, a qualified Professional Archaeologist will be contacted to assess the discovery and provide guidance. Due to the site being previously disturbed during the placement of the existing wastewater conveyance pipe, it is anticipated that no archaeological sites will be uncovered during the construction of the project.

2.0 Facility Planning

2.1 Problem Evaluation and Existing Facility Review

- a. As noted in Sections 1.1 and 1.4, a 2018 condition assessment revealed an approximately 8,000 linear foot section of 36-inch, single barrel, reinforced concrete pipe (RCP) to be in Poor to Very Poor condition. This section was installed in the early 1970s. Additionally, it was discovered that there is significant corrosion between Manhole (MH) 99 and Lift Station L02.
- b. Section VII of the city of Forest Lake's 2040 Comprehensive Plan, adopted in 2020, identifies the existing sanitary sewer system for the city. Forest Lake's 2040 Plan estimates that approximately 75% of the city's residents were served by sewer in 2020. The wastewater flow into Interceptor 7029 was 1.60 million gallons per day (MGD) in 2018, and 1.80 MGD in 2020. The city of Forest Lake's 2040 Plan estimates that flows would increase to 1.98 MGD in 2030, and 2.17 MGD by 2040. Further expansion of the Metropolitan Urban Service Area (MUSA) within the city of Forest Lake is identified in Figures 2-4 and 7-4 in the 2040 Plan.
- c. The southeast portion of the city of Columbus is also served by sewer; an intercommunity agreement between Columbus and Forest Lake was signed in 2001. The agreement requires a minimum available capacity from Forest Lake of 1.13 million gallons per day for flows from Columbus. As of 2020, the current quarterly unmetered data available from the Metropolitan Council was approximately 29,000 gal/day for the sewered areas of Columbus. Portions of Columbus within the Metropolitan Urban Services Area (MUSA) are primarily east of Rice Creek and south of Howard and Mud Lakes. The rest of Columbus is unsewered. The connection from Columbus to the regional sewer system is located near the intersection of 202nd Street and Fenway Avenue in Forest Lake. The city of Columbus' 2040 Comprehensive Plan (adopted in 2019) identifies the current and future sewer service areas in Figures 6.1 – 6.3. Table 6.3 in their 2040 Plan showed wastewater flow of 0.02 MGD in 2010, and estimated flows of 0.06 MGD in 2020, 0.07 in 2030, and 0.08 MGD in 2040. Other areas of the city of Columbus would have to be served by connections from elsewhere; the 2040 Plan for Columbus noted discussions with the cities of Lino Lakes and East Bethel and the Metropolitan Council regarding options for future service connections.
- d. The Metropolitan Council's 2040 Water Resources Plan (adopted in 2015 and amended in 2018) balances the demands of growth identified in Thrive 2040 (the Council's development framework for the seven-county metropolitan region) with the protection and management of lakes, rivers, streams, wetlands, and groundwater. The community forecasts of sewered populations are found in Table A-3, which are consistent with the forecasts in the 2040 comprehensive plans for Forest Lake and Columbus. Table A-4 includes wastewater flow projections, which are also consistent the projections in the 2040 comprehensive plans for Forest Lake and Columbus. Appendix F in the 2040 Water Resources Plan identifies the long-term service areas of the regional wastewater system within the metropolitan region; these are consistent with the future service areas identified in the 2040 comprehensive plans for Forest Lake and Columbus.

2.2 Planning and Service Area

Existing land uses around the interceptor includes agricultural, farmsteads and farmland, single family detached, golf course, and undeveloped land. Adjacent existing land uses are similar but include multifamily and retail/other commercial to the north, and the city of Hugo to the south. There are no parks, cemeteries, or trails within the vicinity of the study area; however, the study area runs through Tanners Brook Golf Course and Hardwood Creek Trail is located approximately one half-mile west of the study area.

The city of Forest Lake's 2040 Comprehensive Plan identifies future land uses for land within the city. Future land use designations of the land around the interceptor are identified in Figure 2-3 in their Plan. The designations include *Highway Business*, *Low-Medium Density Residential*, *Park and Recreation*, and *Mixed Use*. *Highway Business* is intended for businesses that require proximity to the regional transportation infrastructure. *Low-Medium Density Residential* is intended to provide one-family detached and attached homes as well as two-family homes. *Park and Recreation* is primarily intended for public active recreation activities. *Mixed Use* is intended to provide areas for compact, walkable, mixed-use development along key community corridors.

The 2040 Plan for Forest Lake also identifies staging areas for future development and expansion of the MUSA within the city limits on Figures 2-4 and 7-4 in their Plan. Development Stage 2 (areas to be developed by 2030) includes land near Interstate 35 and US Highway 61. Development Stage 3 (areas to be developed by 2040) identify development occurring in the southwest quadrant of the city near the Forest Lake Interceptor. This includes areas near Tanners Brook Golf Course, and on land near County Road 50 and Harrow Avenue North. Areas within the city south of County Road 50 and east of US Highway 61 are identified as being developed and served with sewer post-2040.

2.3 Population Projection and Planning Period

The 2020 decennial census reported the city of Forest Lakes's population at 20,611. The Metropolitan Council's annual population estimates for 2023 estimated the city's population at 21,502.

As part of the 2040 comprehensive planning cycle (Thrive 2040), the Metropolitan Council forecasted that the city of Forest Lake will have a population of 25,200 in 2030, and a population of 28,900 in 2040. The forecasts for 2030 also included a total population of 20,730 being sewered, while 4,470 would be unsewered. 2040 was forecasted to have 24,430 sewered, with 4,470 again being unsewered.

The Metropolitan Council's preliminary forecasts for the 2050 comprehensive planning cycle (Imagine 2050) estimate that population growth will continue in Forest Lake but will occur at a slower rate than previously thought, as shown in Table 2 below.

Table 2: Population forecasts for Forest Lake

Forecast Year	Thrive 2040	Imagine 2050
2030	25,200	23,832
2040	28,900	26,127
2050	N/A	29,601

The 2020 decennial census showed Columbus with a population of 4,159. The Metropolitan Council's annual population estimates for 2023 estimated the city's population at 4,151.

As part of the 2040 comprehensive planning cycle (Thrive 2040), the Metropolitan Council forecasted that the city of Columbus will have a population of 4,950 in 2030, and a population of 5,500 in 2040. The forecasts for 2030 estimated a total population of 680 being sewerred, while 4,270 would be unsewerred. 2040 was forecasted to have 830 residents sewerred, with 4,670 being unsewerred.

Similar to the preliminary forecast for Forest Lake, the Metropolitan Council's preliminary forecasts for the 2050 comprehensive planning cycle (Imagine 2050) estimate that population growth will continue in Columbus but will occur at a slower rate than previously thought, as shown in Table 3 below.

Table 3: Population forecasts for Columbus

Forecast Year	Thrive 2040	Imagine 2050
2030	4,950	4,636
2040	5,500	5,113
2050	N/A	5,670

2.4 Hydraulic Capacity

Flow definitions and identification, hydraulic capacity to serve existing or new collection systems, and consideration of combined sewer interceptors does not apply to this project. The proposed project involves the replacement and rehabilitation of an existing interceptor. Lift Stations and WWTPs are not a part of this project.

2.4.1 Flow Definitions and Identification

The following flows for the design year shall be identified and used as a basis of design for sewers, lift stations, wastewater treatment plants, treatment units, and other wastewater handling facilities. Where any of the terms defined in this Paragraph are used in these design standards, the definition contained in this Paragraph applies.

- a. Design Average Flow
The design average flow is the average of the daily volumes to be received for a continuous 12-month period expressed as a volume per unit time. However, the design average flow for facilities having critical seasonal high hydraulic loading periods (e.g., recreational areas, campuses, industrial facilities) shall be based on the average of the daily volumes to be received during the seasonal period.
- b. Design Maximum Day Flow
The design maximum day flow is the largest volume of flow to be received during a continuous 24-hour period expressed as a volume per unit time.
- c. Design Peak Hourly Flow
The design peak hourly flow is the largest volume of flow to be received during a one-hour period expressed as a volume per unit time.

- d. Design Peak Instantaneous Flow

The design peak instantaneous flow is the instantaneous maximum flow rate to be received.

2.4.2 *Hydraulic Capacity for Wastewater Facilities to Serve Existing and New Collection Systems*

- a. Not Applicable.

2.4.3 *Combined Sewer Interceptors*

Interceptor 7029 is not a combined interceptor.

2.5 Organic Capacity

This project is for the rehabilitation of an existing gravity interceptor with no treatment component. The waste stream consists of domestic and commercial wastewater with no industrial loading. Waste stream characteristics are not anticipated to change. Organic loadings were not evaluated.

2.6 Wastewater Treatment Facility Design Capacity

This project is for the rehabilitation of an existing gravity interceptor with no treatment component.

2.7 Initial Alternative Development

As noted in the Preliminary Design Report, the possibility of realigning this section of interceptor was considered at a conceptual level upon request of the city of Forest Lake. Said concept would involve building a new interceptor along Fenway Avenue North. Relocation would provide an expected lifespan of 80 years, while a rehabilitation of the existing interceptor would have a lifespan of 50 years. The predicted cost of relocation was approximately \$22 million, compared to an estimated cost of rehabilitation of approximately \$11 million. Due to costs, rehabilitation was determined to be the route to pursue.

Three potential interceptor rehabilitations were analyzed: cured in place pipe (CIPP) lining, spiral wound lining, and slip lining. The fourth alternative reviewed in Section 2.8 is to maintain status quo (do nothing). Fold and Form pipe lining, while an available technology on the market, was not considered in detail for this project due to limited local experience with this technology, and similar excavation requirements to slip lining.

CIPP lining, due to its minimal hydraulic capacity reduction (1.5-3" interceptor diameter reduction), its wide adoption within the local construction industry, MCES's familiarity with the method, and its moderate cost and environmental impact compared to the other alternatives, was then determined to be the best alternative for this project.

2.8 Detailed Alternative Evaluation

The following shall be included for the alternatives to be evaluated in detail.

- a. Sewer System Revisions – Proposed revisions to the existing sewer system including adequacy of portions not being changed by the project shall be evaluated.
- b. Wet Weather Flows – Facilities to transport and treat wet weather flows in a manner that complies with federal, state, and local regulations shall be provided.
- c. Wet Weather Flow Equalization – If the ratio of design peak hourly flow to design average flow is 3:1 or more, flow equalization shall be considered. This may be

accomplished by either building a wet weather retention basin and gradually returning the excess flow to the treatment plant during off-peak periods or by providing a plant large enough to handle all flows.

- d. Site Evaluation – Site evaluation shall consider the following criteria. When a site must be used which is critical with respect to the following items, appropriate measures shall be taken to minimize adverse impacts.
 - 1. Compatibility of the treatment process with the present and planned future land use, including noise, potential odors, air quality, and anticipated sludge processing and disposal techniques, shall be considered. Non-aerated lagoons should not be used if excessive sulfate is present in the wastewater. Wastewater treatment facilities should be separate from habitation or any area likely to be built up within a reasonable future period and shall be separated in accordance with state and local requirements.
 - 2. Zoning and other land use restrictions shall be identified.
 - 3. The accessibility and topography of the site shall be evaluated.
 - 4. Area for future plant expansion shall be identified.
 - 5. Direction of prevailing wind shall be identified.
 - 6. Flood considerations, including the 25- and 100-year flood levels, impact on floodplain and floodway, and compliance with applicable regulations regarding construction in flood-prone areas, shall be evaluated. Paragraph 51.2 contains requirements for protection from flooding.
 - 7. Geologic information, depth to bedrock, karst features, or other geologic considerations of significance to the project shall be included. Lagoons shall not be in karst areas unless the specific geologic and construction details are acceptable.
 - 8. Protection of groundwater including public and private wells is of utmost importance. Demonstration that protection will be provided shall be included. The regulatory agency shall be contacted for required separation.
 - 9. Soil type and suitability for construction and depth to normal and seasonal high groundwater shall be determined.
 - 10. The location, depth, and discharge point of any field tile in the immediate area of the proposed site shall be identified. Present and known future effluent quality requirements as determined by the regulatory agency shall be included. Access to receiving stream for the outfall line shall be discussed and displayed.
 - 11. A preliminary assessment of site availability shall be included.
- e. Unit Sizing – Unit operation and unit process sizing and basis shall be provided.
- f. Flow Diagram – Flow diagram of treatment facilities including all recycle flows shall be included.
- g. Flexibility – Compliance with requirements of Paragraph 5.3.6 Arrangement of Units shall be assured.
- h. Removal Efficiencies – Loadings to and removal efficiencies through each unit operation shall be provided in addition to total removal efficiency and effluent quality (both concentrations and mass).

- i. Emergency Operation – Emergency operation requirements as outlined in Section 47 and Paragraph 56.1 shall be provided. MPCA and local agencies may have more stringent requirements.
- j. Technology Not Included In Ten States Standards – Paragraph 5.3.2 outlines procedures for introducing and obtaining approval to use technology not included in these standards. Proposals to use technology not included in these standards shall address the requirements of Paragraph 5.3.2. A contingency plan, in the event that such new technology fails to meet the expected performance, may be required by the reviewing authority in the absence of three separate and representative full-scale installations successfully using the same technology. Each representative full-scale installation should have sufficient monitoring and appropriate testing results that demonstrate reliable and effective compliance with the design performance criteria and have been operated for not less than three years at or near design capacity without major failure of either the process or equipment. Sludge
- k. The solids disposal options considered, and method selected shall be included. This is critical to completion of a successful project. Compliance with requirements of Chapter 80, Sludge Processing, Storage, and Disposal shall be assured.
- l. Treatment During Construction – A plan for the method and level of treatment (including sludge processing, storage, and disposal) to be achieved during construction shall be developed and included in the Facility Plan submitted to the regulatory agency for review and approval. This approved treatment plan shall be implemented by inclusion in the plans and specifications to be bid for the project. Refer to Paragraph 20.15 and Section 2.1.
- m. Operation and Maintenance – Portions of the project which involve complex operation or maintenance requirements shall be identified including laboratory requirements for operation, industrial sampling, and self-monitoring.
- n. Cost Estimates for capital, operation, and maintenance (including basis), shall be included.
- o. Environmental Review – Consideration shall be given to minimizing any potential adverse environmental effects of the proposed project. Compliance with planning requirements of federal, provincial, state, and local regulatory agencies shall be documented.

Table 4: Alternative Criteria Review

Criteria to Review	Alternative #1 <i>Do Nothing/Status Quo</i>	Alternative #2 <i>Cured in place pipe (CIPP)</i>	Alternative #3 <i>Spiral Wound</i>	Alternative #4 <i>Slip Lining</i>
<i>Sewer System Revisions</i>	N/A. Under this alternative, no revisions would be made to the existing interceptor.	Sewer cleaning would occur as a preparatory step prior to rehabilitation work. CIPP would involve either a steam/hot water curing, or a UV curing process to rehab the existing pipe.	Sewer cleaning would occur as a preparatory step prior to rehabilitation work. This would involve a continuous PVC or HDPE strip wound around the walls of the existing pipe.	Sewer cleaning would occur as a preparatory step prior to rehabilitation work. This would involve inserting a smaller carrier pipe into the existing pipe sequentially.
<i>Wet Weather Flows</i>	Peak hourly: L1 – 5.65 MGD L2 – 6.01 MGD	N/A	N/A	N/A
<i>Wet Weather Flow Equalization</i>	N/A	N/A	N/A	N/A
<i>Site Evaluation</i>	Under this alternative, no revisions would be made to the existing interceptor.	A minimal construction footprint would be required for this alternative. UV-cured CIPP is advantageous for reaching MHs with limited access to water.	A minimal construction footprint would be required for this alternative. This would require less water than other alternatives and would not require 100% conveyance during construction.	This alternative would require significant excavation for insertion pits compared to other alternatives.
<i>Unit Sizing</i>	Inside Diameter: 36" Manning's N: 0.015 Flow Capacity: 10.33 MGD	Inside Diameter: 34.5" – 35.5" Manning's N: 0.010 Flow Capacity: 13.8 MGD (Steam/Hot Water), 14.4 MGD (UV)	Inside Diameter: 30" Manning's N: 0.010 Flow Capacity: 9.53 MGD	Inside Diameter: 29.5" Manning's N: 0.010 Flow Capacity: 7.6 MGD
<i>Flow Diagram</i>	N/A	N/A	N/A	N/A
<i>Flexibility</i>	N/A. Under this alternative, no revisions would be made to the existing interceptor.	N/A	N/A	N/A
<i>Removal Efficiencies</i>	N/A. Under this alternative, no revisions would be made to the existing interceptor.	N/A	N/A	N/A
<i>Emergency Operation</i>	N/A. Under this alternative, no revisions would be	N/A	N/A	N/A

	made to the existing interceptor.			
<i>'Tech not included in ten states' standards</i>	N/A. Under this alternative, no revisions would be made to the existing interceptor.	N/A	N/A	N/A
<i>Solids Disposal Options</i>	N/A. Under this alternative, no revisions would be made to the existing interceptor.	N/A	N/A	N/A
<i>Treatment During Construction</i>	N/A. Under this alternative, no revisions would be made to the existing interceptor.	Temporary conveyance pipes will be sized to provide the greater of 1.5 times the daily maximum flow or one half of the maximum system design capacity. Multiple alignment options for temporary conveyance routes are available to pursue.	Temporary conveyance pipes will be sized to provide the greater of 1.5 times the daily maximum flow or one half of the maximum system design capacity. Multiple alignment options for temporary conveyance routes are available to pursue.	Temporary conveyance pipes will be sized to provide the greater of 1.5 times the daily maximum flow or one half of the maximum system design capacity. Multiple alignment options for temporary conveyance routes are available to pursue.
<i>Operation & Maintenance</i>	N/A	N/A	N/A	N/A
<i>Cost Estimates</i>	\$0/foot. The possibility of relocation of this section of interceptor was considered at a conceptual level. The predicted cost of relocation was approximately \$22 million.	\$275/foot (Steam/Hot Water) \$225/foot (UV)	\$400/foot	\$200/foot
<i>Environmental Review</i>	Maintaining status quo could allow the interceptor to deteriorate further, thus posing a potential risk to public health and the environment.	Minimal impact is anticipated for this alternative, beyond accessing MHs. Use of UV-cured CIPP could reduce water needs and transportation of water.	Minimal impact is anticipated for this alternative, beyond accessing MHs. This would require less water than other alternatives and would not require 100% conveyance during construction.	This alternative would be anticipated to create more ground disturbance and wetland impacts than other alternatives

2.9 Final Project Selection

Based on initial alternative development, and the detailed alternative evaluation, the recommendation is to pursue UV cured CIPP lining due to its increase in capacity compared to water or steam cured CIPP (Due to the thinner wall thickness of UV cured CIPP) and lower cost. The primary cost difference between these methods is the cost of removing and replacing MH cones, with quotes given by contractors making UV CIPP approximately \$50/linear foot cheaper than steam or water cured CIPP due to the ability for it to be installed through a smaller MH opening. Steam cured CIPP may be included in bidding documents as an alternative method.

Additionally, due to the need to move water to the project site the cost of moving water is a notable concern. While hot water cured CIPP allows for longer inversions, of up to 1,000 feet or more compared to 500 feet for UV and Steam cured. However, runs of up to 1,000 feet may be possible so long as a MH exists within 700 ft of the start and end MH, liner material could be inserted from either end of a 1,000-foot run, with a winch pulling from a central MH in each direction.

Water cured CIPP would potentially reduce the amount of site restoration required for this project. Based on analysis of a typical section of the project, it is assumed that costs saved due to not using water with UV curing outweighs the added restoration costs, making UV cured CIPP likely to be the most economical method for this project. This is demonstrated in the table below comparing the cost for each method between MH 90 and MH 94.

Table 5: CIPP Curing Methods Cost Sample Area, MH 90-94

Curing Method	UV	Steam	Hot Water
Length of Sample Area, in linear feet (LF)	1,650	1,650	1,650
Cost of Liner	\$365,000	\$450,000	\$450,000
Water Volume Required (gallons)	0	16,000	84,000
Water Cost	\$0	\$250	\$1,400
Water Trucking Cost	\$0	\$19,000	\$56,000
Restoration Cost	\$28,000	\$28,000	\$14,000
Estimated Cost	\$393,000	\$497,250	\$605,400

**Values are initial estimates used for comparison purposes, and may not be accurate for this project*

3.0 List of Report Tables and Appendices

Table 1 – Soil Types – *Section 1.7*

Table 2 – Population Forecasts for Forest Lake – *Section 2.3*

Table 3 – Population Forecasts for Columbus – *Section 2.3*

Table 4 – Alternative Criteria Review – *Section 2.8*

Table 5 – CIPP Curing Methods – *Section 2.9*

Appendix A – Existing Conditions Memorandums

Appendix B – MCES Capacity Analysis

Appendix C – Location Drawing