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2020 CENTRE REGION ACT 537 SEWAGE FACILITIES PLAN UPDATE: SPECIAL STUDY FOR THE SCOTT ROAD PUMP STATION AND BRISTOL INTERCEPTOR

UNIVERSITY AREA JOINT AUTHORITY
CENTRE COUNTY, PENNSYLVANIA

HRG Project No. R001178.0661

TABLE OF CONTENTS

The 2020 Act 537 Sewage Facilities Plan Update: Special Study for the Scott Road Pump Station and Bristol Interceptor, for the Centre Region Council of Governments is organized by the following:

EXECUTIVE SUMMARY

Recommended Alternative

It is recommended to pursue the implementation of Alternative 1-C, which generally involves the replacement of the existing wet well, installation of new submersible pumps, forcemain replacement, and construction of a gravity relief sewer. This alternative addresses both existing and projected hydraulic overload conditions at both the Scott Road Pump Station and the downstream gravity conveyance system. Although Alternative 1-C represents a higher capital cost, upgrading the pump station and forcemain will provide improved operability through the modified configuration of pumping and controls to cohere to the UAJA's standard specifications. The estimated present worth of the option is $2,191,000.

The UAJA will continue to own and operate the proposed pump station and its associated facilities. The UAJA will be responsible for complying with all applicable water quality standards and effluent limitations. The following table presents a general project implementation schedule.

Implementation Schedule

Milestone	Date
Submit Special Study to Municipalities/Planning Commissions (60-day Review)	June 2020
Begin Public Comment Period (30-day)	July 2020
Receive Municipal/Planning Comments, Conclude Public Comment Period	August 2020
Submit Revised Special Study to Municipalities/Planning Commission	September 2020
Present Special Study to CRCOG General Forum	September 2020
Adoption by Municipalities and CRCOG	October 2020
Submission of Special Study to PA DEP (120-day Review)	October 2020
Receive DEP Comments/Approval of Special Study	January 2021
Complete Preliminary Design	April 2021
Submit Permit Applications (WQM, NPDES)	May 2021
Complete Final Design	August 2021
Receive DEP Comments/Approval of Permits	August 2021
Begin Construction	September 2021
Project Completion	August 2022

Introduction

The Centre Region consists of six municipalities located in the south-central portion of Centre County, Pennsylvania: College, Ferguson, Halfmoon, Harris, and Patton Townships and State College Borough. The University Area Joint Authority (UAJA) owns and operates the Centre Region's primary wastewater treatment facility, the Spring Creek Pollution Control Facility (SCPCF). The UAJA works closely with the Centre Regional Planning Agency (CRPA) and local municipal officials on regional planning activities to manage and prepare its system to meet the future needs of the Centre Region.

The UAJA's SCPCF has a hydraulic capacity (annual average daily flow) of 9.0 million gallons per day (MGD) with a permitted effluent discharge to Spring Creek, a Class A natural trout reproduction stream.

Discharge from the SCPCF is limited to 6.0 MGD to protect the high quality and natural wildlife of Spring Creek. The Beneficial Reuse Project was implemented as a result of the *2000 Centre Region Act 537 Sewage Facilities Plan Revision* which identified and evaluated the disposal alternatives for the remaining 3.0 MGD of wastewater effluent that cannot be discharged to Spring Creek. The UAJA can effectively treat influent wastewater to a level that exceeds all current permit requirements (NPDES Permit No. PA0026239).

Special Study Goals

The UAJA owns and operates the Scott Road Pump Station, located in Ferguson Township, which provides sanitary sewer conveyance from the Pine Grove Mills area and a portion of users along S.R. 26 to the Bristol Interceptor in the Patton-Ferguson sewershed. A Task Activity Report (TAR) for this *2019 Act 537 Sewage Facilities Plan Update: Special Study for the Scott Road Pump Station and Bristol Interceptor* was submitted to the DEP on May 28, 2019, with subsequent approval received on June 11, 2019. This Special Study identifies and evaluates alternatives for safely handling both existing and future wastewater flows associated with the area(s) currently served by the Scott Road Pump Station.

The UAJA has historically experienced elevated peak flows at the Scott Road Pump Station from inflow and infiltration, and consequently has completed improvements including the replacement of over 1,000 linear feet (l.f.) of sanitary sewer line upstream of the pump station and numerous inspections in effort to reduce the impacts from stormwater. During peak events, influent flows exceed the capacity of the existing pump station, requiring the UAJA to pump wastewater from the wet well and transfer it by truck to the gravity connection point. The UAJA staff typically spends 6-8 hours performing bypass pumping during appreciable rain events. However, the staff has reported events requiring up to 28 hours of bypass pumping. New development in the area and increased sewage flows coupled with aging infrastructure is projected exacerbate overload conditions. Rehabilitation of deficiencies identified within the upstream collection system have, for the time, eliminated the need for bypass pumping during comparable rain events.

The UAJA staff has witnessed backwatering of wastewater flows in the Bristol/Westerly Parkway Interceptor when the Scott Road Pump Station is running. To address this issue and to ensure that the selected alternative for the Scott Road Pump Station will not cause hydraulic overload conditions in the downstream sewer system, the Bristol/Westerly Parkway Interceptor section of the conveyance system was also evaluated as part of this Special Study.

Existing Facilities

The Pine Grove Mills area has a population of approximately 1,500 people (2010 census). Wastewater generated from various residential and non-residential connections is collected through a series of service laterals and sanitary sewer lines. A small lift station known as the Piney Ridge Pump Station is located in the western-most section of the Pine Grove Mills sewershed. Wastewater from the Pine Grove Mills area then flows by gravity to the Scott Road Pump Station, located northeast of the community. The Scott Road Pump Station also receives wastewater flow from connections along S.R. 26 near the intersection with Whitehall Road.

The lift station was originally constructed in 2000 and consisted of duplex submersible pumps and approximately 6,300 l.f. of 6 inch diameter SDR 21 PVC forcemain. The pump station was upgraded in 2007 to a series pumping system comprised of submersible pumps and dry pit pumps with a combined design rating of 510 gallons per minute (gpm) at 316 feet total dynamic head (TDH). With the upgrade, only one set of pumps is operational at any given time (i.e. one submersible and one dry pit). The submersible pumps, located within the 8 foot diameter wet well and the dry pit pumps are started and stopped using variable frequency drives (VFDs); however, the pumps are operated at a constant speed. Subsequent to repeated failures, presumably due to over insertion during installation, a section of the forcemain (approximately 825 l.f.) was replaced with 8 inch diameter C900 DR 14 PVC in 2016.

The forcemain conveying wastewater flow from the Scott Road Pump Station discharges into manhole FT-FM located along Research Drive. Wastewater then flows by gravity through 8 inch PVC sanitary sewer lines within Research Drive to the intersection with Bristol Avenue. The subsequent section of wastewater conveyance consists of 12 inch PVC sanitary sewer line to the intersection of Bristol Avenue and Ferguson Crossing Drive; then 15 inch PVC sanitary sewer line continues until eventually intersecting the Struble Interceptor.

Current and Projected Wastewater Flows

The UAJA's *2018 Chapter 94 Report* indicated that the Scott Road Pump Station currently serves 1,129 EDUs. Influent flow and pumping rates at the Scott Road Pump Station were approximated during field visits on Wednesday June 19, 2019 (mid-day) and Monday February 2, 2020 (morning). Using wet well level fill and draw down observations, estimates of the average daily influent flow rate and the typical pump discharge rate were made (average influent flow during field visits: 291 gpm, average pumping rate during field visits: 748 gpm).

The number of future connections was projected based on available land development plans and on information presented in the Centre Region Planning Agency's (CRPA) *2017 Regional Development Capacity (REDCAP) Report*, which is an analysis of the potential development capacity within the Regional Growth Boundary/Sewer Service Area (RGB/SSA). An additional 602 EDUs are anticipated to contribute wastewater flow to the Scott Road Pump Station in the future. Utilizing the UAJA's planning value of 175 gpd/EDU, average wastewater flows are projected to be approximately 302,900 gpd. Applying a peaking factor of 3.95 (calculated based on flow meter data), the pump station will need to be able safely handle flows up to approximately 1.197 MGD.

Alternatives Considered

Several alternatives were developed and evaluated to provide for additional capacity and alleviate hydraulic overload conditions. **Alternative 1-C: Pump Station replacement with force main upgrade and gravity relief sewer is the recommended alternative**.

Alternative 1 generally involves the replacement of the existing wet well, installation of two new submersible pumps, and forcemain replacement. A design pumping rate of 830 gpm was selected for this alternative. In order to provide a holding period not to exceed 10 minutes for the maximum monthly average flow, the existing 8 foot diameter wet well will need to be replaced with a 12 foot diameter wet

well. In addition, in order to maintain velocities between 2 feet per second (fps) and 5 fps, the remaining section of 6-inch diameter forcemain would need to be upgraded to 8-inch diameter or the entire length upgraded to 10-inch diameter. In order to alleviate potential future overload conditions in the downstream gravity sewer segments of the Bristol/Westerly Parkway Interceptor, the following minor alternatives were evaluated in associated with Alternative 1:

- Alternative 1-A: PS and FM Upgrades with Increased Diameter Downstream
- Alternative 1-B: PS and FM Upgrades with Modified Slope Downstream
- **Alternative 1-C: PS and FM Upgrades with Gravity Relief Sewer (Recommended)**

Alternative 2 generally involves the construction of a 150,000 gallon equalization tank adjacent to the existing facilities on Scott Road, supplemental pump station, and control equipment. Mixing/aeration equipment would be required to alleviate the accumulation of sludge and grit, and to prevent malodors. This alternative would not include any modifications to the capacity and/or layout of the existing pump station. Flows exceeding the capacity of the Scott Road Pump Station would be pumped into the equalization tank by the supplemental pump station and then reintroduced back into the conveyance infrastructure when peak flows subside and capacity becomes available. In order to alleviate potential future overload conditions in the downstream gravity sewer segments of the Bristol/Westerly Parkway Interceptor, the following minor alternatives were evaluated in associated with Alternative 2:

- Alternative 2-A: EQ Tank with Increased Diameter Downstream
- Alternative 2-B: EQ Tank with Modified Slope Downstream

Alternatives 2-A and 2-B are not recommended because they continue to utilize the existing multi-stage pumping system and add a potential source of odors and an additional pump.

Alternative 3 generally involves the construction of a large capacity community on-lot disposal system (COLDS) to handle the excess wastewater flows from the existing Scott Road Pump Station. This alternative would require a total septic volume of approximately 180,000 gallons, uniform dosing pump stations, and a soil absorption area of approximately 140,000 square feet. In order to alleviate potential future overload conditions in the downstream gravity sewer segments of the Bristol/Westerly Parkway Interceptor, the following minor alternatives were evaluated in associated with Alternative 3:

- Alternative 3-A: COLDS with Increased Diameter Downstream
- Alternative 3-B: COLDS with Modified Slope Downstream

Alternatives 3-A and 3-B are not recommended because of their higher cost, and because UAJA believes on-lot disposal systems in karst geology should be avoided where possible even though DEP regulations allow for them.

Alternative 4 generally involves the construction of approximately 19,300 l.f. of 12-inch diameter SDR-35 PVC sanitary sewer and associated manholes to convey wastewater flows from the collection system tributary to the existing Scott Road Pump Station to the existing Slab Cabin Interceptor. The existing pump station and forcemain facilities would then be abandoned, effectively transferring the Pine Grove Mills area wastewater flows from the Patton-Ferguson sub-basin to the College-Harris sub-basin.

As previously mentioned, the UAJA staff has witnessed wastewater backwatering in downstream gravity sections when the existing Scott Road Pump Station is running. Implementation of Alternative 4 would itself relieve the overload conditions currently experienced in the Bristol/Westerly Parkway Interceptor.

Alternative 4 is not recommended because of the significant cost and the long approval, permitting and construction time, which would place undue hardship on developers waiting for capacity to be made available.

The no action alternative represents a situation in which the UAJA does not upgrade or alter the existing facilities in any way. This was determined not to be a feasible alternative considering the existing issues experienced with the facilities which pose potential health and environmental dangers as well as limit the availability for growth and development in the area.

Evaluation of Alternatives

The technically feasible alternatives were evaluated for consistency with respect to the following:

- Clean Streams Law
- Clean Water Act
- Corrective Action Plans/Annual Reports
- Centre Region Comprehensive Plan
- Anti-degradation Requirements
- State Water Plans
- PA Prime Agricultural Land Policy
- County Stormwater Plans
- Wetland Protection
- Source Water Protection
- Protection of rare, endangered or threatened species
- Historical and archaeological resource protection

With the exception of Alternatives 3 and 4, implementation of each of the proposed alternatives would involve the disturbance of lands within the SSA that have been previously disturbed. Implementation of Alternative 4, only, would result in disturbance of lands designated as Agricultural Security Areas, and areas which contain highly productive drinking water wells.

Implementation of Alternative 4, only, would necessitate extensive wetland protection, as this alternative includes construction of a sewer alignment generally parallel to Slab Cabin Run. While the presence of wetlands alone does not eliminate the potential for the UAJA to implement Alternative 4, it would certainly increase the capital cost of construction.

In order to evaluate the economic impacts of the alternatives, conceptual-level cost estimates were prepared. These costs include estimated capital construction costs, project costs, and annual operation and maintenance (O&M) costs. No detailed field survey or investigations were conducted as part of this Special Study to confirm the accuracy of record drawings, to confirm the location of below grade utilities, or to confirm the site subsurface conditions. Table 6.1 presents a summary of the cost estimates developed for the Scott Road Pump Station alternatives.

Table 6.1: Summary of Pump Station Alternatives' Costs Estimates and Present Worth Analysis

Alternative	Capital Cost	Annual O&M Cost	Annual O&M Present Worth	Total Present Worth
1: Pump Station and Forcemain Upgrades	**$ 1,743,000**	**$ 28,710**	**$ 447,562**	**$ 2,191,000**
2: Equalization Tank	$ 1,111,000	$ 44,290	$ 690,439	$ 1,801,000
3: Community On-Lot Disposal System	$ 2,376,000	$ 31,261	$ 487,340	$ 2,863,000
4: Gravity Conveyance	$ 3,665,000	$ 640	$ 9,977	$ 3,675,000

The implementation of Alternatives 1, 2, or 3 would require the additional implementation of one of the Bristol/Westerly Parkway Interceptor alternatives. A summary of cost estimates developed for these minor alternatives is presented in Table 6.2.

Table 6.2: Summary of Bristol/Westerly Parkway Interceptor Costs Estimates

Alternative	Capital Cost
1-A: (PS & FM Upgrades) Increased Diameter Downstream	$ 775,000
1-B: (PS & FM Upgrades) Modified Slope Downstream	$ 690,000
1-C: (PS & FM Upgrades) Gravity Relief Sewer	**$ 342,000**
2-A: (EQ Tank) Increased Diameter Downstream	$ 93,000
2-B: (EQ Tank) Modified Slope Downstream	$ 319,000
3-A: (COLDS) Increased Diameter Downstream	$ 93,000
3-B: (COLDS) Modified Slope Downstream	$ 319,000

Table 6.3 presents the combined costs of each major alternative with its associated lowest estimated capital cost Bristol/Westerly Parkway Interceptor alternative.

Table 6.3: Total Costs Estimates of Paired Alternatives

Alternative	Total Cost
1-C: PS and FM Upgrades with Gravity Relief Sewer	**$ 2,533,000**
2-A: EQ Tank with Increased Diameter Downstream	$ 1,894,000
3-A: COLDS with Increased Diameter Downstream	$ 2,956,000
4: Gravity Conveyance	$ 3,675,000

Another component considered in evaluating the pump station alternatives was the effects of greenhouse gas (GHG) emissions, which are integral to the understanding of a project's impact and should be factored into the decision making process accordingly. The significance of GHG emissions from wastewater treatment plants has been increasingly acknowledged in recent years. The implementation of a gravity conveyance line to replace the Scott Road Pump Station could reduce greenhouse gas emissions by approximately 35% compared to Alternatives 1 and 2.

The final aspect to consider in evaluating the pump station alternatives is the overall operability of each conveyance option. An operability review insures quality and reliability from an O&M standpoint at this important early stage of a project. The gravity conveyance system (Alternative 4) plainly represents the least labor intensive alternative. Construction of a COLDS or equalization tank would add complexity to the existing system, which is undesirable from an operator's perspective. The addition of mechanical and electrical equipment to the existing system also introduces another point in which failure of such equipment could cause a disruption to sewage conveyance. Implementation of Alternative 1, would provide a decrease in labor required by the UAJA's collection system staff compared to both existing conditions and to Alternatives 2 and 3. The proposed pump station modifications would bring the Scott Road Pump Station into coherence with the UAJA's standard specifications for lift stations.

1 PREVIOUS WASTEWATER PLANNING

1.1 Summary of Previous Act 537 Plans and Related Documents

Over the past 30 years, a substantial amount of sewage facility planning work has been completed in the Centre Region; however, a comprehensive update has not been completed since 2006. In 1987, the UAJA and the Centre Region municipalities began working cooperatively with the PA Department of Environmental Resources (DER) to address concerns that the UAJA's SCPCF was approaching its (then) 3.84 MGD capacity.

In 1990, DER officially approved the *Centre Region Act 537 Sewage Facilities Plan*, which approved the expansion of the UAJA's SCPCF to 6.0 MGD, with condition that a study be completed to select the preferred alternative to provide sewage treatment capacity for the Centre Region's projected needs beyond 6.0 MGD. Additionally, in 1991, the PA Department of Environmental Protection (DEP) issued a National Pollutant Discharge Elimination System (NPDES) permit to the UAJA that imposed effluent temperature limits on the discharge to Spring Creek. While a 316(a) temperature study for Spring Creek was conducted, the UAJA and the Centre Region municipalities proceeded with efforts to complete the wastewater alternatives study.

The wastewater alternatives study was published in 1996, identifying and evaluating 13 alternatives to meet the future needs of the community, and was reviewed by the Centre Region's municipal planning commissions and elected officials. Then, in 1997, an additional report was published describing the beneficial reuse alternative, bringing the total number of alternatives evaluated by the Centre Region to 14. The 316(a) temperature study was completed in 1998, and concluded that a variance on temperature limits should be granted for discharge flows up to 6.0 MGD. Following the municipal review process, the Centre Region Council of Governments (COG) General Form endorsed the beneficial reuse alternative.

In 1999, the Centre Region municipalities prepared a revision to the *Centre Region Act 537 Sewage Facilities Plan* recommending the abandonment of the Ferguson Township Authority Plant. The plan revision recommended that the flow from the Pine Grove Mills area be piped to the UAJA system for treatment. To ensure consistency with the *Centre Region Comprehensive Plan*, the line conveying the flow from the Pine Grove Mills area to the UAJA line along West College Avenue was designated as a conveyance line, and it was indicated at that time that no connections would be permitted to this conveyance line. The plan revision was subsequently adopted by all six Centre Region municipalities, and the Ferguson Township Authority Plant was abandoned and demolished, transferring the wastewater from the Pine Grove Mills area to the UAJA SCPCF for treatment.

The *2000 Centre Region Act 537 Sewage Facilities Plan Revision* identified the disposal alternatives for up to 3.0 MGD of wastewater effluent from the SCPCF that could not be discharged to Spring Creek. The majority of the alternatives proposed to dispose of the effluent water outside the Spring Creek Watershed. However, one alternative, the Beneficial Reuse Project, was identified that utilizes the effluent water for watershed management rather than strictly disposal. In addition to providing a valuable resource to businesses and industries in the area, this alternative also reduces nitrogen concentrations to help meet

Chesapeake Bay preservation requirements, and offsets environmental impacts of water withdrawal wells within the area.

In 2001, the hydraulic and organic capacity of the SCPCF was increased to 9.0 MGD and 22,500 lbs. BOD/day, respectively. Additionally, construction was initiated for the advanced water treatment facilities (microfiltration and reverse osmosis) and distribution line for the Beneficial Reuse Project (Phase 1).

A revision was made to the Sewer Service Area (SSA) near Pine Grove Mills in 2003. One area was added to the SSA, while another was removed to ensure that no increase in wastewater flow was generated by the plan revision. All six Centre Region municipalities adopted this revision.

The UAJA completed construction of Phase 1 for the Beneficial Reuse Project in 2005, with Phase 1A planned to begin the following year. Meanwhile, a draft update of the *Centre Region Act 537 Sewage Facilities Plan* was presented to the Centre Region COG.

The *2006 Centre Region Act 537 Sewage Facilities Plan Update* established an updated Regional Growth Boundary (RGB) and Sewer Service Area (SSA). The RGB and SSA are used to identify areas of the community where public sewer service will be provided in the future by the UAJA. The *2006 Plan Update* evaluated 26 areas requested for expansion, and ultimately identified five properties for addition to the RGB/SSA. A hydraulic model was created to evaluate the UAJA's collection and conveyance system and to identify interceptors or segments of interceptors having flow limitations. The adopted and approved *2006 Plan Update* identified deficiencies within the UAJA's sewage collection and conveyance system and presented a schedule and estimated costs for upgrading overloaded segments.

The *2006 Plan Update* also defined the reuse water distribution system to be implemented in three phases that were initially identified when the Beneficial Reuse Project was adopted in 2000. The *2006 Plan Update* states that the water produced from the Beneficial Reuse Project will be reused in the community for industrial, agricultural, and irrigation purposes and that the ultimate goal is to move the water back to the headwaters of the community where it can be used to replenish headwater streams, springs, and groundwater resources.

Additionally, the *2006 Plan Update* evaluated various topics such as the agreement between the UAJA and State College Borough for flow diversion, the proposal of a volumetric billing program, and the relative health of on-lot disposal systems in the Centre Region. A comprehensive, region-wide Sewage Management Plan, providing for regular pumping and routine inspection of all on-lot disposal systems in the community was implemented.

The *2009 Centre Region Act 537 Sewage Facilities Plan Amendment* further defined the appropriate structural solutions for the previously identified sewage collection and conveyance deficiencies in order to address the implementation of vital interceptor projects. The hydraulic model that was generated as part of the *2006 Plan Update* was recalculated using data collected through extensive field surveying during 2007. Through hydraulic modeling, it was determined that the majority of the Big Hollow Interceptor

could not safely convey predicted future peak flows. The adopted and approved *2009 Plan Amendment* ultimately recommended the construction of a diversion forcemain to the Big Hollow Interceptor.

Since the conclusion and adoption of the *2006 Plan Update* and the *2009 Plan Amendment*, the Centre Region has authorized several special studies in order to maintain a coordinated plan to guide future sewage facility decisions in the community.

The *2016 Special Study for the Pennsylvania State University (PSU) Water Reuse System* addressed the PSU's reclaimed water system, including the location of existing lines as well as future demand.

The *2017 Update for the Extension of Beneficial Reuse Water (UAJA) Lines to Harris Township* evaluated extending the UAJA's existing beneficial reuse water system into Harris Township to serve specific customers.

The *2018 Special Study to Upgrade the PSU University Park Wastewater Treatment Plant (WWTP*) identified the need to upgrade the existing WWTP in order to renovate and replace aged infrastructure, improve onsite safety and improve the treatment and energy efficiency of the facility. The six Centre Region municipalities adopted the 2018 Special Study following a public hearing in March 2018 at the COG General Forum meeting.

A Task Activity Report (TAR) for this *2020 Act 537 Sewage Facilities Plan Update: Special Study for the Scott Road Pump Station and Bristol Interceptor* was submitted to the DEP on May 28, 2019, with subsequent approval received on June 11, 2019.

A Task Activity Report (TAR) for the *2019 Act 537 Sewage Facilities Plan Update: Special Study for the Meeks Lane Pump Station Project* was authorized for submission to the DEP through the Centre Region Approval Process for Act 537 Plan Special Study Task Activity Reports. The TAR was submitted to the DEP on October 8, 2019 and was approved on October 16, 2019. The special study is being prepared.

2 PHYSICAL AND DEMOGRAPHIC ANALYSIS

2.1 Description of Current Sewer Service Areas

Since the mid-1970s, the Centre Region has implemented a series of policies that direct growth to areas where infrastructure exists in order to preserve prime agricultural lands, natural areas, and other sensitive environmental resources in the community. These growth management policies were used to establish the Regional Growth Boundary (RGB). In the early 1990s, the *Centre Region Act 537 Sewage Facilities Plan* was approved, which established the Centre Region's Sewer Service Area (SSA).

As part of the *2006 Plan Update*, the RGB and the SSA were brought into alignment and currently represent a cohesive boundary. Five of the Centre Region's six municipalities have land area within the RGB/SSA, with the exception being Halfmoon Township. The RGB/SSA has had a significant influence on the location of development in the Centre Region because it is used to direct growth to where it is believed to be most appropriate, while preserving the rural character of areas outside of the boundary.

Exhibit 2.A in Appendix A shows the current overall RGB/SSA in reference to the municipal boundaries of the Centre Region.

2.2 Identification of Planning Areas

The UAJA owns and operates the Scott Road Pump Station, located in Ferguson Township, which provides sanitary sewer conveyance from the Pine Grove Mills area as well as portions along SR 26 south of Whitehall Road. This Special Study identifies and evaluates alternatives for safely handling both existing and future wastewater flows associated with the area(s) currently served by the Scott Road Pump Station.

Therefore, the planning area generally consists of the Pine Grove Mills area (Ferguson Township) and portions of College and Harris Townships between the existing Scott Road Pump Station and the UAJA's existing collection system, as shown on Exhibit 2.B in Appendix A. The area(s) served by the Scott Road Pump Station is highlighted, which includes vacant lands within the SSA that could be developed in the future, which can be expected to contribute flow to the station.

Exhibit 2.C in Appendix A provides soils information including farmland classifications and Agricultural Security Areas within the project area. The major soil types in the area include Hagerstown silt loam (approximately 43%) and Opequon-Hagerstown complex (approximately 28%). Appendix E includes a detailed soils report for the project area.

Exhibit 2.D in Appendix A shows the geologic formations while Exhibit 2.E in Appendix A shows the topography of the project area. The Pine Grove Mills area is physically separated from the more urbanized areas in the Centre Region by an expanse of agricultural lands to the west, north, and east. Tussey Mountain provides a physical barrier south of the area.

The State College Borough Water Authority (SCBWA) serves the project area utilizing the following raw water sources:

- Slab Cabin Run: 7.3 MGD (All Sources Filtered)
  - Shingletown Gap Reservoir – 2.00 MGD, Peak
  - Harter Well Field – 2.50 MGD, Peak
  - Thomas Well Field – 3.37 MGD, Peak
- Nixon Well Field: 3.00 MGD
- Kocher Well Field: Not to Exceed 25% of Total Demand
- Chestnut Ridge Well Field: 1.01 MGD
- Alexander Well Field: 4.70 MGD
- Grays Woods Well Field: 3.88 MGD

The SCBWA water service area is shown on Exhibit 2.F in Appendix A, as well as the protection area for the relevant raw water sources in the project area. The data regarding water service areas (most recently updated October 12, 2019) and source water protection areas (most recently updated June 6, 2017) was accessed through Centre County's GIS Department.

Waterways within the project area include Slab Cabin Run and Roaring Run, as well as various ponds and wetlands, as shown on Exhibit 2.G in Appendix A. The data regarding locations of wetlands within the project area was accessed through the U.S. Fish and Wildlife Service National Wetlands Inventory.

3 EXISTING SEWAGE FACILITIES

3.1 Description of Current Wastewater Collection and Conveyance Facilities

The UAJA owns and maintains a wastewater collection and conveyance system which is comprised of two major drainage basins, the Patton-Ferguson Township sub-basin which is lifted via the Big Hollow Pump Station located on Fox Hollow Road, and the College-Harris Township sub-basin which is lifted via the Main Pump Station located on Trout Road. Flows from State College Borough that are treated at the SCPCF are conveyed through the College-Harris drainage area.

The UAJA's collection and conveyance system currently consists of 18 lift stations ranging in capacity from 0.1 MGD up to 22.3 MGD, approximately 5,400 manholes, and approximately 250 miles of mainline sewer ranging in size from 8 inch diameter up to 36 inch diameter with various materials. The UAJA maintains a sewer-cleaning machine, portable flow meters, and TV inspection equipment. As a result, the collection and conveyance system is monitored, cleaned and repaired on a regular basis. In addition, the UAJA staff regularly performs manhole inspections, TV inspections and smoke/dye tests to identify problem sources. Consequently, the sewage facilities are in good condition.

Pine Grove Mills Collection

The Pine Grove Mills area has a population of approximately 1,500 people (2010 census). Wastewater generated from various residential and non-residential connections is collected through a series of service laterals and sanitary sewer lines. A small lift station known as the Piney Ridge Pump Station is located in the western-most section of the Pine Grove Mills sewershed. Wastewater from the Pine Grove Mills area then flows by gravity to the Scott Road Pump Station, located northeast of the community.

The Scott Road Pump Station also receives wastewater flow from connections along S.R. 26 near the intersection with Whitehall Road. The UAJA's *2018 Chapter 94 Report* indicated that the Scott Road Pump Station currently serves 1,129 EDUs.

The UAJA has historically experienced elevated peak flows at the Scott Road Pump Station from inflow and infiltration, and consequently has completed improvements including the replacement of over 10,000 linear feet (l.f.) of sanitary sewer line upstream of the pump station and numerous inspections and repairs in effort to reduce the impacts from stormwater. More specific line replacement and collection system repair information is included in Appendix B.

Scott Road Pump Station

The lift station was originally constructed in 2000 and consisted of duplex submersible pumps rated for 236 gallons per minute (gpm) at 175 feet total dynamic head (TDH). This pumping arrangement experienced recurring failures, and at times was not hydraulically sufficient. Consequently, the pump station was upgraded in 2007 to a series pumping system comprised of submersible pumps and dry pit pumps with a combined design rating of 510 gpm at 316 feet TDH. Each submersible pump conveys flow to a dry pit pump. With the upgrade, only one set of a pump combination is capable of operation at any given time (i.e. one submersible and one dry pit). The submersible pumps, located within the 8 foot diameter wet well and the dry pit pumps, located inside the building, are started and stopped with variable frequency drives; however, when operating, the pumps run at a constant speed.

Figure 3-1: Existing Wet Well and Valve Vault at the Scott Road Pump Station

Figure 3-2: Interior of the Existing 8 foot Diameter Wet Well

Figure 3-3: Exterior of Existing Scott Road Pump Station Building Structure

Figure 3-4: Interior of Existing Scott Road Pump Station, Dry-Pit Pumps

Figure 3-5: Interior of Existing Scott Road Pump Station, Control Equipment

Pump failure and high wetwell levels are called out through visual and audible alarms on the control panel, and the system has the capability to send alarm messages directly to the UAJA personnel. During times of power failure, the pumps run off of an emergency generator located outside of the building structure.

The existing pump station currently experiences hydraulic overload conditions during wet weather events. During peak events, influent flows exceed the capacity of the existing pump station, requiring the UAJA to pump wastewater from the wet well and transfer it by truck to the gravity connection point. The UAJA staff typically spends 6-8 hours performing bypass pumping during appreciable rain events. However, the

staff has reported events requiring up to 28 hours of bypass pumping. New development in the area and increased sewage flows coupled with aging infrastructure is projected exacerbate overload conditions. Rehabilitation of deficiencies identified within the upstream collection system have, for the time, eliminated the need for bypass pumping during comparable rain events.

Scott Road Pump Station – Forcemain

Approximately 6,300 l.f. of 6 inch diameter SDR 21 PVC forcemain was also constructed in 2000. From the time of the pump station upgrade in 2007 to mid-2015, the UAJA experienced multiple failures of the forcemain. An evaluation was conducted to determine if hydraulic conditions could be linked to the failures, the results of which indicated that under normal operating conditions, pressure surges were not evident. Moreover, surge calculations did not yield total pipe pressures considerably in excess of pipe pressure ratings. Circumferential cracking around the bell area suggested over insertion or over inflection during construction. Therefore, it was recommended that the portion of failing forcemain be replaced with 8 inch diameter C900 DR 14 PVC pipe. Approximately 825 l.f. of forcemain replacement was completed in 2016. Exhibit 3.A shows the existing forcemain alignment.

Bristol/Westerly Parkway Interceptor

The forcemain conveying wastewater flow from the Scott Road Pump Station discharges into manhole FT-FM located along Research Drive. Exhibit 3.B in Appendix A shows the existing downstream conveyance system. Wastewater then flows by gravity through an 8 inch PVC sanitary sewer line to manhole CA-6 located within the intersection of Research Drive and Cato Avenue. Wastewater continues to flow by gravity through the 8 inch PVC sanitary sewer lines following the alignment of Research Drive to manhole CA-1, then north to manhole WPI-23 located within Bristol Avenue. The subsequent section of wastewater conveyance consists of 12 inch PVC sanitary sewer line from manhole WPI-23 to manhole WPI-18, which is located within the intersection of Bristol Avenue and Ferguson Crossing Drive. From manhole WPI-18, 15 inch PVC sanitary sewer line continues eastward along Bristol Avenue to manhole WPI-17, then the alignment turns north behind S&A Homes Park and Haymarket Park, crossing Blue Course Drive, to manhole WPI-7 located within Westerly Parkway. The 15 inch conveyance line alignment then follows Westerly Parkway northeast to manhole WPI-4, where it then runs northwest to intersect the Struble Interceptor at manhole SIR-5-35.1.

The UAJA staff has witnessed backwatering of wastewater flows in manhole CA-1 when the Scott Road Pump Station is running. To address this issue and to ensure that the selected alternative for the Scott Road Pump Station will not cause hydraulic overload conditions in the downstream sewer system, a detailed evaluation of the Bristol/Westerly Parkway Interceptor section of the conveyance system was included as part of this Special Study.

A table outlining the estimated reserve capacity of the Bristol/Westerly Parkway Interceptor is included in Appendix B. Each sewer segment currently meets the minimum slopes for its associated pipe diameter as outlined in the PA DEP's *Domestic Wastewater Facilities Manual*. Additional flows from the 274 'future' EDUs associated with The Yards at Old State development, which is currently under construction along Whitehall Road, were considered to be existing flows for the purpose of this evaluation. Therefore, the

remaining capacity shown in Appendix B represent the available capacity for upgrades to the pump station and other future connections.

Exhibit 3.C in Appendix A shows the overall gravity conveyance flow path from the Scott Road Pump Station to the UAJA's wastewater treatment plant. An evaluation of the Radio Park and Big Hollow Interceptors was performed in 2012, identifying the Big Hollow Trunk South as the most limiting downstream section. The reserve capacity was estimated to be approximately 1.3 million gallons per day (MGD) at the time. Assuming an addition of 200 EDUs per year, the UAJA's planning flow rate of 175 gpd per EDU, and a peaking factor of 2.5 (estimated through the 2012 flow study), the current reserve capacity in the Big Hollow Trunk South is approximately 0.68 MGD. The Yards at Old State development is currently under construction near Whitehall Road, and when complete, an additional 274 EDUs will contribute wastewater to the interceptor. Therefore, for this Special Study, the most limiting downstream segment is considered to have a reserve capacity of approximately 0.56 MGD. This is a conservative estimate in that the UAJA's 5-year annual average flow is 126 gpd per EDU, as reported in the *2018 Chapter 94 Report*.

For this Special Study, the UAJA performed CCTV inspection of the conveyance system from manhole WPI-23 to manhole SIR-5-35.1 (downstream of the Scott Road Pump Station). The reports for each sewer segment inspection are included in Appendix C. No observations of major defects were recorded during the inspection.

3.2 Description of Current Wastewater Treatment Facilities

The UAJA owns and operates the Centre Region's primary wastewater treatment facility, the Spring Creek Pollution Control Facility (SCPCF), located partially in Benner Township and partially in College Township, Centre County, PA. Wastewater generated in five municipalities (Patton Township, Ferguson Township, College Township, Harris Township, and State College Borough) and a portion from the Pennsylvania State University is conveyed to the SCPCF through the collection and conveyance system consisting of gravity lines and pumping stations as previously described. In addition to wastewater, the facility accepts waste activated sludge from nearby treatment plants as well as septage.

The SCPCF has a design flow of 9.0 MGD and a 5-year annual average flow of approximately 5.3 MGD. The facility was originally built in 1969 and has been upgraded and expanded several times since then. The UAJA is permitted to discharge 6.0 MGD of treated wastewater effluent to Spring Creek. The Beneficial Reuse Project was implemented as a result of the *2000 Centre Region Act 537 Sewage Facilities Plan Revision* which identified and evaluated the disposal alternatives for the remaining 3.0 MGD of wastewater effluent that cannot be discharged to Spring Creek. The UAJA can effectively treat influent wastewater to a level that exceeds all current permit requirements (NPDES Permit No. PA0026239). The SCPCF contains the following liquid and solids unit processes:

Liquid Process Train	
Headworks	Fine Screening, Flow Measurement and Grit Removal
Primary Clarification	Rectangular Chain and Flight Clarifiers
Biological Treatment	Biological Nutrient Removal with Aerobic and Anoxic Reactors

Secondary Clarification	Circular Rim-Feed Hydraulic Sludge Removal Clarifiers
Flow Conveyance	Intermediate Submerged Flow Pump Station
Tertiary Treatment	Denitrification Filters and Chemical Addition
Disinfection	Ultraviolet Light Disinfection

Solids Process Train

Primary Sludge Conveyance	Air Operated Diaphragm Pumps
Waste Sludge Conveyance	Vertical Close-Coupled Centrifugal Pumps
Septage Receiving	Screening and Sampling
Sludge Conditioning	Sludge Holding and Polymer Addition
Sludge Dewatering	Centrifugation
Sludge Treatment	In-Vessel Composting

Beneficial Reuse Process Train

Source Water	Secondary Clarifier Effluent
Prescreening	Wedge Wire Strainers
Water Conveyance	Centrifugal Pumps
First Stage Filtration	Microfiltration
Advanced Oxidation	Ozone
Second Stage Filtration	Reverse Osmosis
Chemical Treatment	pH and Alkalinity Stabilization
Primary Disinfection	Ultraviolet Light Disinfection
Secondary Disinfection	Sodium Hypochlorite Disinfection

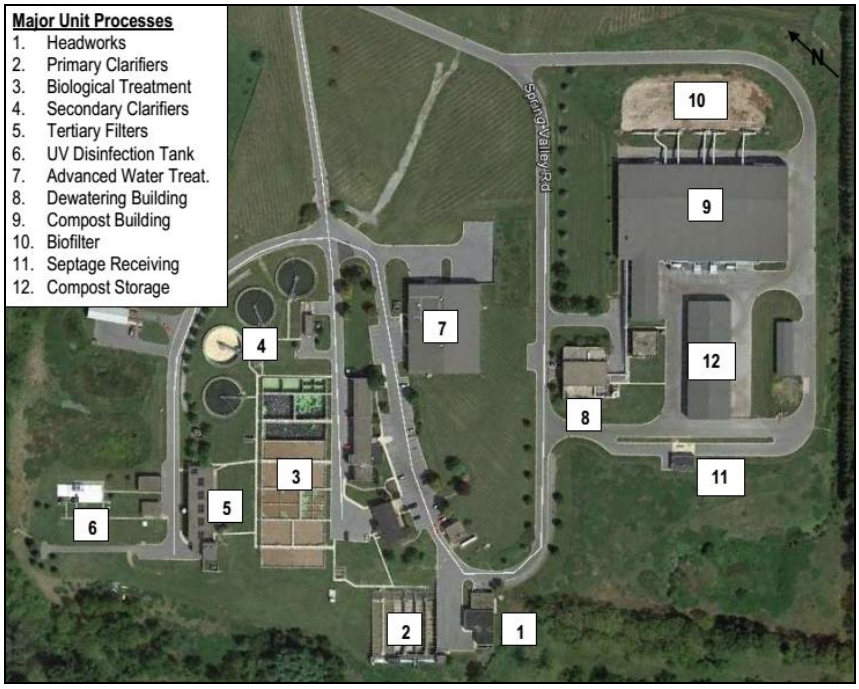

Figure 3-6: Aerial View of the SCPCF Illustrating the Facility Layout and Identification of Unit Processes (Image Source: Google earth)

3.3 Estimates of Wastewater Flows from Existing Customers

The Scott Road Pump Station serves existing customers in the Pine Grove Mills area and connections along S.R. 26 near the intersection with Whitehall Road, which includes a combination of residential and commercial users within the Centre Region's RGB/SSA.

Influent flow and pumping rates at the Scott Road Pump Station were approximated during field visits on Wednesday June 19, 2019 (mid-day) and Monday February 2, 2020 (morning). Using wet well level fill and draw down observations, estimates of the average daily influent flow rate and the typical pump discharge rate were made (average influent flow during field visits: 291 gpm, average pumping rate during field visits: 748 gpm).

Flow meters were installed at four locations during the second half of 2019. Two meters were placed upstream of the Scott Road Pump Station and an additional two meters were placed downstream. The dates for which data was collected at these meter locations are listed in the following table.

Table 3.1: Collection System Flow Meter Locations and Deployment Dates

Meter Location	Measurement Periods
Manhole FT-23 (upstream, near College Ave, Slab Cabin Run)	11/27/2019 – 12/3/2019, 12/7/2019 – 12/17/2019
Manhole FT-19 (upstream, near Scott Rd, College Ave)	11/27/2019 – 12/17/2019, 12/24/2019 – 01/07/2020
Manhole WPI-14 (downstream, behind Haymarket Park)	06/28/2019 – 07/27/2019, 08/01/2019 – 09/09/2019
Manhole WPI-2 (downstream, near Madison St backlot)	06/28/2019 – 12/31/2019

Daily precipitation data, available through the National Oceanic and Atmospheric Administration (NOAA), at Station USC00368449: State College, PA US was evaluated to determine the severity of I/I in these segments of the collection system. Precipitation events that resulted in greater than one tenth of an inch of rainfall are listed in the following table.

Table 3.2: Notable Precipitation Events during Flow Meter Measurement Periods

Date	Inches	Date	Inches	Date	Inches	Date	Inches
July 3rd	0.12	Aug 16th	0.11	Oct 4th	0.14	Dec 10th	0.52
July 7th	0.32	Aug 19th	0.60	Oct 17th	0.35	Dec 11th	0.14
July 8th	0.50	Aug 23rd	0.15	Oct 23rd	1.00	Dec 14th	0.24
July 18th	0.81	Aug 29th	0.37	Oct 27th	1.34	Dec 15th	0.49
July 22nd	0.36	Sep 2nd	0.95	Oct 31st	0.35	Dec 17th	0.26
July 23rd	0.11	Sep 12th	0.51	Nov 1st	1.28	Dec 30th	0.40
July 31st	0.23	Sep 15th	0.13	Nov 8th	0.23	Jan 4th	0.28
Aug 6th	0.33	Sep 27th	0.19	Nov 24th	0.85		
Aug 7th	0.46	Oct 1st	0.26	Nov 28th	0.13		
Aug 8th	0.31	Oct 3rd	0.21	Dec 2nd	0.58		

Upstream Flows, FT-23

The flow meter installed in manhole FT-23, upstream of the Scott Road Pump Station, near the College Avenue crossing of Slab Cabin Run, collected both depth and velocity data at 15 minute intervals. The

two values were then used to calculate the wastewater flow at each time interval. Hydrographs showing the daily flow at this location are included in Appendix C.

Wastewater flows measured at this meter location represent influent flows to the Scott Road Pump Station from the Pine Grove Mills area. The average flow during this period (November 27th to December 3rd and December 7th to December 17th) was approximately 90,700 gpd. A maximum flow of approximately 358,000 gpd occurred on December 14th at around 2:30 pm.

Upstream Flows, FT-19

The flow meter installed in manhole FT-19, upstream of the Scott Road Pump Station, near the intersection of College Avenue and Scott Road, collected both depth and velocity data at 1 minute intervals from November 27th to December 17th and at 15 minute intervals from December 24th to January 7th. The two values were then used to calculate the wastewater flow at each time interval. Hydrographs showing the daily flow at this location are included in Appendix C.

Wastewater flows measured at this meter location represent influent flows to the Scott Road Pump Station from the connections along S.R. 26 near the intersection with Whitehall Road. The average flow during the periods measured was approximately 870 gpd. A maximum flow of approximately 29,600 gpd occurred on December 14th at around 10:20 am.

Downstream Flows, WPI-14

The flow meter installed in manhole WPI-14, downstream of the Scott Road Pump Station, behind Haymarket Park, collected both depth and velocity data at 5 minute intervals. The depth and velocity values were then used to calculate the wastewater flow at each time interval. Hydrographs showing the daily flow at this location are included in Appendix C.

Wastewater flows measured at this meter location represent flows from the Scott Road Pump Station as well as from additional connections that contribute wastewater to the gravity conveyance system between the forcemain discharge and manhole WPI-14. The average flow during this period (June 28th to July 27th and August 1st to September 9th) was approximately 164,000 gpd. A maximum flow of approximately 1.02 MGD occurred on August 18th at around 5:30 pm.

Peaks in flow can be clearly observed, indicating the times at which the Scott Road Pump Station was discharging wastewater flow to the conveyance system. The influence of I/I was especially apparent on July 18th and September 2nd, during which the State College area received approximately 0.81 inches and 0.95 inches of rain, respectively. The total number of peaks (i.e. number of pump station starts) on these two days were 91 and 107, respectively. In comparison, an average total number of peaks of 73 was observed on dry days.

Between manhole FT-FM (forcemain discharge location) and WPI-14 (flow meter location), an additional 1086.5 EDUs currently contribute wastewater flow to the gravity conveyance system. An estimated flow per EDU was calculated by dividing the base flow values by the number of contributing EDUs. The overall average flow per EDU from June 28th to September 9th was 112 gpd/EDU. For reference, the

average flow per EDU on July 18th and September 2nd (two rainiest days) was 128 gpd/EDU and 153 gpd/EDU, respectively.

Downstream Flows, WPI-2

The flow meter installed in manhole WPI-2, downstream of the Scott Road Pump Station, near the Madison Street backlot, collected only depth data throughout its deployment (June 28th to December 31st). A reading was collected every minute until the morning of July 1st, when from then on a depth reading was collected every 10 minutes. Since this meter did not collect velocity data, Manning's equation was used to calculate the approximate wastewater flow at each time interval based on the depth data collected and the slope of the upstream sewer segment.

This estimated flow data was analyzed to check for any hydraulic overloads in the furthest downstream section of the Westerly Parkway Interceptor – no overloads were observed. Hydrographs showing the estimated daily flow at manhole WPI-2 are included in Appendix C. The average flow during this period (June 28th to December 31st) was approximately 440,000 gpd. A maximum flow of approximately 1.46 MGD occurred on November 28th at around 12:20 pm.

4 FUTURE GROWTH AND DEVELOPMENT

4.1 Summary of Municipal and County Planning Documents

Zoning Districts and Land Use Plans

Exhibit 4.A in Appendix A shows the various zoning districts within the project area.

The Ferguson Township zoning map, included in Appendix A, was updated and signed on January 21, 2019. The existing Scott Road Pump Station is located within the Rural Agricultural District. The existing forcemain alignment traverses the Rural Agricultural, General Commercial, and the Light Industry, Research and Development Districts. The existing Bristol/Westerly Parkway Interceptor alignment traverses the Planned Residential, Two Family Residential, and Single Family Residential Districts.

College Township's zoning map, included in Appendix A, was last amended on February 15, 2018. The project area for which alternatives identified as part of this Special Study may traverse include lands located in the Agricultural and Single Family Residential Districts.

Harris Township's zoning map, included in Appendix A, was adopted on March 14, 2016. The project area for which alternatives identified as part of this Special Study may traverse include lands located in the Agricultural and Single Family Residential Districts.

Exhibit 4.B in Appendix A shows the existing county level land use classifications within the project area.

Floodplain and Stormwater Management

§27-801 of the Ferguson Township Municipal Code, §200-30 of the College Township Municipal Code, and §12-7.1 of the Harris Township Municipal Code provide standards for development and land uses within floodplains. Structures within floodplains are generally prohibited, however essential services which includes water and wastewater infrastructure are permitted within floodplain areas, provided such facilities are designed and built to minimize and eliminate flood damage and infiltration.

§26 of the Ferguson Township Municipal Code, §175 of the College Township Municipal Code, and §13 of the Harris Township Municipal Code provide standards for stormwater management. Disturbance within the project area will need to comply with the Townships' stormwater management requirements.

County and Regional Plans

Long range comprehensive land use planning for Ferguson, College, and Harris Townships is provided in the *Centre Region Comprehensive Plan*, which is a multi-municipal plan as defined by Section 107 of the Pennsylvania Municipalities Planning Code. This plan was most recently updated and adopted by the six Centre Region municipalities in November 2013. Future planned land use classifications within the project area are generally equivalent to that of existing land use.

The *Centre Region Comprehensive Plan* provides an overview of long range planning goals for the Centre Region's municipalities, including where the majority of future growth should be provided for. The plan includes a regional growth boundary (RGB), which identifies where urban densities will be

supported through appropriate zoning, infrastructure, and public services, including public sewer. The RGB is coterminous with the Centre Region Act 537 Plan's Sewer Service Area (SSA). Future growth in areas of the Centre Region located outside of the RGB/SSA are planned to develop at densities that utilize on-lot disposal methods. There are no current plans to expand the RGB/SSA at this time.

The *Centre Region Comprehensive Plan* includes numerous policies to ensure the logical provision and extension of public sewer service, and to ensure that adequate wastewater conveyance and treatment is available for future growth within the RGB/SSA.

The *Centre County Comprehensive Plan* is a guiding document for land use and development regulations. Phase 1 was completed in 2003, although the County is continuously identifying implementation strategies which are published as updates. The *Centre County Comprehensive Plan* is generally consistent with the policies contained in the *Centre Region Comprehensive Plan*.

4.2 Evaluation of Potential Future Connections

The alternatives outlined in this Special Study pertaining to the Scott Road Pump Station will need to ultimately provide wastewater conveyance for both existing and future customers, which will be a combination of residential and commercial users within the RGB/SSA. As previously discussed in Chapter 3, the Scott Road Pump Station currently serves 1,129 EDUs, located in the Pine Grove Mills area and along S.R. 26 near the intersection with Whitehall Road.

The number of future connections was projected based on available land development plans and on information presented in the Centre Region Planning Agency's (CRPA) *2017 Regional Development Capacity (REDCAP) Report*, which is an analysis of the potential development capacity within the RGB/SSA.

The CRPA utilized the most recent tax parcel data for the Centre Region in order to develop an updated list of vacant and underutilized properties. Some properties were assumed unlikely to ever be developed and therefore were removed from the list; these included:

- Parks, open space, or other areas specifically designated for recreational use
- Stormwater basins
- Cemeteries
- Undeveloped lots adjacent to developed lots under the same ownership that are actively maintained – these lots are often being utilized as lawn areas for the adjacent property, and overall do not substantially influence dwelling unit counts of sewage flows
- Parcels mostly or entirely within wetlands, floodplains, or containing steep slopes of 25% or greater

The CRPA then classified each property from the vacant land inventory into one of three categories: properties with approved development plans, properties with proposed development plans, and properties with no development plans. Exhibit 4.C in Appendix A shows the properties within the project area, which were included in the *REDCAP Report*'s vacant land inventory, and can be anticipated to contribute wastewater flow to the Scott Road Pump Station based on topography and the layout of existing facilities.

The entirety of the vacant lands within the Pine Grove Mills area are currently zoned for Single Family Residential development. For the REDCAP Report, the potential development capacity for residential parcels was based on the existing zoning regulations. To account for the potential full buildout of each property, the maximum permitted dwelling unit density of the zoning district was applied to the buildable area of each residential parcel. Based on this methodology, an additional 299 EDUs could be developed on vacant parcels within the SSA in the Pine Grove Mills area.

The identified vacant lands located along S.R. 26 (Harner Farm properties) were zoned for Rural Agricultural development when the REDCAP Report was completed in 2017, as is shown on Exhibit 4.A. However, two of the frontage properties were re-zoned in June 2018 to General Commercial and Single Family Residential, as is shown on the updated Ferguson Township Zoning Map. For the REDCAP Report, the potential development capacity for non-residential parcels was estimated based on the maximum lot coverage, building height, and/or floor area ratio of the zoning district. The UAJA assumes that the average commercial structure produces one EDU per 3,000 square feet; this value was then applied to the buildable area of each non-residential parcel. For this Special Study, the CRPA estimated updated numbers for these properties utilizing proposed and conceptual land development plans (Whitehall Road Sheetz, Harner Farm Subdivision, and Orchard View) and the REDCAP Report methodology for non-residential parcels without current development proposals; an additional 207 EDUs could be developed on vacant lands within the SSA along S.R. 26.

Residences in the Corl Acres neighborhood located in the southwest corner of the SSA in Ferguson Township are currently served by on-lot sewage disposal systems. If the UAJA's collection system is extended to serve this neighborhood in the future, it is anticipated that the properties would then contribute wastewater flow to the Scott Road Pump Station. No sanitary surveys of the on-lot systems were completed as part of this Special Study. The REDCAP Report identified seven vacant parcels in this area. Based on the number of existing homes in the neighborhood and the REDCAP Report methodology for residential parcels, an additional 96 EDUs could be developed within the SSA in the Corl Acres area. There was no evaluation of structural alternatives to provide public sewer service to these EDUs for this Special Study.

Therefore, a total of 602 EDUs could be developed in the future which can be reasonably expected to contribute wastewater flow to the Scott Road Pump Station.

Vacant lands along and near the Bristol/Westerly Parkway Interceptor on which future connections to the system would likely contribute wastewater flow to the immediate downstream gravity conveyance sewer were identified based on the CRPA's REDCAP Report. Improved properties developed on these vacant lands are expected to connect to the system downstream of the Bristol/Westerly Parkway Interceptor's most limiting segments (reserve capacities outlined in Appendix B). Additional flows from the 274 'future' EDUs associated with The Yards at Old State development, which is currently under construction along Whitehall Road, were considered to be existing flows for the purpose of this evaluation.

5 ALTERNATIVES FOR WASTEWATER CONVEYANCE

5.1 Summary of Conveyance Alternatives Considered

As discussed in Chapter 3, the existing facilities currently experience hydraulic overload conditions. These issues, coupled with the anticipated growth within the SSA that was evaluated in Chapter 4, necessitate thoughtful planning in order to provide adequate sewage disposal needs for the area. The major goal of this Special Study is to provide a recommended alternative for safely conveying both existing and projected wastewater flows contributed by connections tributary to the existing Scott Road Pump Station.

The major alternatives for the Scott Road Pump Station include the following:

1: Increase the capacity of the pump station and forcemain.
2: Construct a wet weather and peak flow equalization tank.
3: Construct a community on-lot disposal system.
4: Construct a gravity conveyance system and eliminate the pump station.

The downstream section of conveyance, namely the Bristol/Westerly Parkway Interceptor, was also evaluated in order to prevent any hydraulic overload conditions as a result of the recommended pump station alternative. These minor alternatives generally include increasing the capacity of the overloaded sewer segments by increasing the diameter or by modifying the slope, and constructing a gravity relief sewer. The minor alternatives for the Bristol/Westerly Parkway Interceptor differ based on the resultant flows from each of the major pump station alternatives.

5.2 Development of Pump Station, Equalization, and Piping Alternatives

As part of the *2006 Plan Update*, a hydraulic model was created to evaluate the UAJA's collection and conveyance system. A separate hydraulic model was later developed and updated for the beneficial reuse water system. The sanitary sewer system model was partially updated for the *2009 Plan Amendment* to evaluate the Big Hollow Interceptor. The reuse water system model was partially updated for the *2017 Update* to evaluate extending the system into Harris Township. For this Special Study, the hydraulic model was partially updated, focusing solely on the Scott Road Pump Station, forcemain, and the Bristol/Westerly Parkway Interceptor, and used to develop and evaluate potential alternatives.

Specific modeling results are discussed in the following sections and are included in Appendix D. Sewer segments that were identified to have flows of 80% or greater of their full flow capacity are shown in red text with grey shading. The base sewer model is comprised of the existing downstream gravity conveyance section from manhole FT-FM (current forcemain discharge location) to manhole SIR-5-34 (Struble Interceptor). Flow results from the base model are shown in Table D.1 in Appendix D; the backwatering of wastewater in manhole CA-1 that the UAJA has reported is further reinforced by the results of the base model.

Alternative 1: Pump Station (PS) and Forcemain (FM) Upgrades

The first major alternative is to upgrade the Scott Road Pump Station to have the capacity to serve both existing and future connections. Existing wastewater flows were discussed in Chapter 3, and potential

future connections were discussed in Chapter 4. Based on these estimations, the Scott Road Pump Station will ultimately serve approximately 1,731 EDUs. Utilizing the UAJA's planning value of 175 gpd/EDU, average wastewater flows are projected to be approximately 0.303 MGD. Applying a peaking factor of 3.95 (calculated based on flow meter data), the pump station will need to be able to safely handle flows up to approximately 1.197 MGD.

Therefore, a design pumping rate of 830 gpm was selected for this alternative. This alternative includes the abandonment of the current submersible to dry-pit series pumping layout. The new pump station would be designed following the UAJA's updated Standard Specifications, which generally consists of duplex submersible pumps within a wet well, followed by a valve vault, then forcemain discharge. In order to provide a holding period not to exceed 10 minutes for the maximum monthly average flow, the UAJA will need to replace the existing 8 foot diameter wet well with a 12 foot diameter wet well. In addition, in order to maintain velocities between 2 feet per second (fps) and 5 fps, the UAJA would also need to increase the size of the entire forcemain to 10 inch diameter.

Table D.2 in Appendix D shows modeled flow results in the existing downstream gravity sewer segments when the design pumping rate of 830 gpm is discharged to manhole FT-FM. This design rate represents the flow rate of the pump station with one submersible pump running. While the UAJA typically prefers a pump station to operate in lead/lag configuration, the ability to run both pumps simultaneously is necessary for emergency situations. Modeled flow results in the existing downstream gravity sewer segments when an estimated dual pump rate of 1100 gpm is discharged to manhole FT-FM are presented in Table D.3 in Appendix D.

With the dual pump flow representing the worst-case scenario for this major alternative, the sewer model was calculated with various modifications to the downstream gravity sewer segments, as shown in Tables D.4 through D.7 in Appendix D. Three technically feasible alternatives were generated based on the sewer model results. All three of these alternatives generally involves the replacement of the existing wet well, installation of two new submersible pumps, and forcemain replacement, as shown in Exhibit 5.A in Appendix A. The existing dry-pit pumps inside the pump house would be removed and site piping would be re-routed. It was assumed that new control equipment and emergency generator would be purchased and installed for the proposed pump station upgrades, and that the UAJA would purchase a third submersible pump to keep on hand as a spare.

Alternative 1-A: PS and FM Upgrades with Increased Diameter Downstream

Based on results from the sewer model, increasing the capacity of the downstream gravity sewer segments within Research Drive and Bristol Avenue by increasing the diameter of the pipes (Table D.5) would alleviate potential future overload conditions. Alternative 1-A includes the previously described pump station and forcemain upgrades, along with the replacement of approximately 2,900 l.f. of sanitary sewer within Research Drive and Bristol Avenue, as shown in Exhibit 5.B in Appendix A.

Alternative 1-B: PS and FM Upgrades with Modified Slope Downstream

Another way to increase the capacity of the downstream gravity sewer segments is to increase the slope.

In this minor alternative, the existing sections of 8 inch and 12 inch PVC piping would be removed and replaced with new PVC piping of the same size, at a modified slope.

Based on contour data available through the Pennsylvania Spatial Data Access (PASDA) for existing topography and the UAJA's GIS records for existing invert elevations, the depth of ground cover appears adequate to allow for adjustment of the slope of the sewer segments from manhole FT-FM to manhole CA-4. However, the ground cover upstream of manhole CA-2 is near the minimum to prevent freezing, and so in order to increase capacity of the sewer segments from manhole CA-2 to manhole WPI-21 by increasing the slope of the alignment, sewer depths would need to be increased downstream, as far as manhole WPI-18 (sewer model results in Table D.6).

Alternative 1-B includes the previously described pump station and forcemain upgrades, along with the replacement of twelve sections of sanitary sewer (approximately 2,600 l.f.) within Research Drive and Bristol Avenue, as shown in Exhibit 5.C in Appendix A.

Alternative 1-C: PS and FM Upgrades with Forcemain Extension

In this alternative, the forcemain would be extended such that flows from the Scott Road Pump Station, which currently discharge at manhole FT-FM, would be pumped further downstream to a new discharge point, thus alleviating surcharge events and hydraulic overload situations (sewer model results in Table D.7 in Appendix D).

Alternative 1-C includes the previously described pump station and forcemain upgrades, along with construction of approximately 3,300 linear feet of 10 inch diameter forcemain. A preliminary layout was defined based on utility location data in the area gathered from a PA One Call. The alignment of the forcemain would generally extend from the current forcemain discharge point, continue parallel to Research Drive to the northern side of Bristol Avenue, then turn east until finally connecting to the existing 15 inch sanitary sewer segment between manholes WPI-17 and WPI-16 (behind S&A Homes Park), as shown in Exhibit 5.D in Appendix A.

Alternative 2: Equalization Tank

Flow equalization is a method used to dissipate peak hydraulic loadings by temporarily diverting wastewater flows to a storage tank. This major alternative would not include any modifications to the capacity and/or layout of the existing pump station. The tank would receive wastewater from the collection system tributary to the existing Scott Road Pump Station during peak flow periods and store the material until it can be pumped to the gravity connection point.

The UAJA staff typically spends 6-8 hours performing bypass pumping during appreciable rain events. However, the staff has reported events requiring up to 28 hours of bypass pumping. At the estimated future peak flow of 1.197 MGD, excess flows to the storage tank are estimated to be approximately 83 gpm (existing pump station flow subtracted from future peak flow). For the worst-case scenario, a necessary retention time in the equalization tank was assumed to be 30 hours, requiring a storage volume of approximately 150,000 gallons. Mixing/aeration equipment would be required to alleviate the accumulation of sludge and grit, and to minimize malodors. A supplemental pump station would also be

required on site in order to convey the excess flows from the existing wet well to the equalization tank. It was assumed that new control equipment would be purchased and installed for the supplemental pump station, and that the UAJA would purchase a third submersible pump to keep on hand as a spare. Exhibit 5.E in Appendix A shows a general site layout for Alternative 2.

Alternative 2-A: Equalization Tank with Increased Diameter Downstream

Flow results from the base model, Table D.1 in Appendix D, indicate that at the existing flow from the Scott Road Pump Station, hydraulic overload conditions occur in the 8 inch sewer segments from manhole CA-2 to WPI-23. The capacity of these segments can be increased by replacing the segments with larger diameter pipes (sewer model results in Table D.8). Alternative 2-A involves the previously described equalization tank and supplemental pump station construction, as well as the replacement of approximately 320 l.f. of sanitary sewer within Research Drive and Bristol Avenue, as shown in Exhibit 5.F in Appendix A.

Alternative 2-B: Equalization Tank with Modified Slope Downstream

Based on contour data available through the PASDA for existing topography and the UAJA's GIS records for existing invert elevations, the ground cover upstream of manhole CA-2 is near the minimum to prevent freezing, and so in order to increase capacity of the sewer segments from manhole CA-2 to manhole WPI-23 by increasing the slope of the alignment, sewer depths would need to be increased downstream, as far as manhole WPI-20 (sewer model results in Table D.9). Alternative 2-B involves the previously described equalization tank and supplemental pump station construction, as well as the replacement of approximately 1,220 l.f. of sanitary sewer within Research Drive and Bristol Avenue, as shown in Exhibit 5.G in Appendix A.

Alternative 3: Community On-Lot Disposal System

This alternative represents the diversion of wastewater flows in excess of the existing Scott Road Pump Station capacity to a community on-lot sewage disposal system (COLDS). The Ferguson Township Municipal Code defines COLDSs as any sanitary sewage treatment and disposal systems which treats and disposes of sewage generated from two or more EDUs by utilizing a subsurface absorption bed or land application. The preliminary design of this alternative was based on Chapter 73 of PA Code Title 25.

For design flows greater than 10,000 gpd, a safety factor of 1.5 is required. Therefore, the septic tank capacity required for this major alternative would be approximately 180,000 gallons (existing pump station flow subtracted from future peak flow, multiplied by 1.5), providing a retention time of 36 hours. The PA DEP considers a COLDS with a design capacity to discharge subsurface sewage flows which are in excess of 10,000 gpd to be a large volume on-lot sewage system, and thus requires Part II Permitting. At this stage, it was assumed that multiple baffled precast concrete tanks would be purchased and installed underground to make up the total septic tank volume. For example, an individual precast tank volume of 9,400 gallons would require approximately 19 units. Effluent from the septic tank(s) would flow by gravity to pump station(s), for uniform dosing of the drain field(s). A soil percolation rate of 6-15 minutes per inch was assumed, and therefore an absorption area of 140,000 square feet would be required. The drain field would likely be divided into two or more smaller areas, each requiring its own dosing pump station. A general layout for Alternative 3 is shown in Exhibit 5.H in Appendix A.

With this major alternative, the existing Scott Road Pump Station would continue to operate under its existing conditions. Alternatives 3.A and 3.B are similar to Alternatives 2.A and 2.B, respectively, for the modifications to the downstream conveyance segments within Research Drive and Bristol Avenue. The major difference between Alternative 2 and Alternative 3 is the method in which excess flows from the existing pump station will be handled.

Alternative 3-A: COLDS with Increased Diameter Downstream

Flow results from the base model, Table D.1 in Appendix D, indicate that at the existing flow from the Scott Road Pump Station, hydraulic overload conditions occur in the 8 inch sewer segments from manhole CA-2 to WPI-23. The capacity of these segments can be increased by replacing the segments with larger diameter pipes (sewer model results in Table D.8). Alternative 3-A involves the previously described large volume septic system construction, as well as the replacement of approximately 320 l.f. of sanitary sewer within Research Drive and Bristol Avenue, as shown in Exhibit 5.I in Appendix A.

Alternative 3-B: COLDS with Modified Slope Downstream

Based on contour data available through the PASDA for existing topography and the UAJA's GIS records for existing invert elevations, the ground cover upstream of manhole CA-2 is near the minimum to prevent freezing, and so in order to increase capacity of the sewer segments from manhole CA-2 to manhole WPI-23 by increasing the slope of the alignment, sewer depths would need to be increased downstream, as far as manhole WPI-20 (sewer model results in Table D.9). Alternative 3-B involves the previously described large volume septic system construction, as well as the replacement of approximately 1,220 l.f. of sanitary sewer within Research Drive and Bristol Avenue, as shown in Exhibit 5.J in Appendix A.

Alternative 4: Gravity Conveyance

The UAJA's collection and conveyance system is comprised of two major drainage basins, the Patton-Ferguson Township service area and the College-Harris Township service area. Currently, wastewater from the Pine Grove Mills area and from connections along S.R. 26 is conveyed by use of the Scott Road Pump Station to the Bristol/Westerly Parkway Interceptor; in the Patton-Ferguson sub-basin.

The Slab Cabin Interceptor serves portions of College and Harris Townships and transfers flow to the Puddintown Interceptor near the Millbrook Marsh. Alternative 4 generally involves the construction of a gravity based sanitary sewer to convey wastewater flows from the collection system tributary to the existing Scott Road Pump Station to the existing Slab Cabin Interceptor. The existing pump station and forcemain facilities would then be abandoned, effectively transferring the wastewater flows from the Pine Grove Mills area from the Patton-Ferguson sub-basin to the College-Harris sub-basin. With this major alternative, the potential for hydraulic overload in the Bristol/Westerly Parkway Interceptor would be eliminated.

The alignment of the gravity system would generally be parallel to Slab Cabin Run from manhole FT-24 (upstream from the existing Scott Road Pump Station, east of S.R. 26) to manhole ICS-5C-20 (south of Atherton St, near CVS), as shown in Exhibit 5.K in Appendix A. Based on the UAJA's GIS data, these two manholes are set at invert elevations of 1105.37 and 1026.83, respectively. The length of gravity

sewer based on a preliminary alignment would be approximately 19,300 feet, corresponding to an overall slope of 0.41%. Manholes would be installed at all changes in alignment, in slopes and at distances no greater than 400 ft. Therefore, in order to maintain a minimum velocity of 2 fps and to convey the estimated future peak flows, the gravity conveyance alternative would require a diameter of 12 inches.

5.3 No Action Alternative

The no action alternative represents a situation in which the UAJA does not upgrade or alter the existing facilities in any way. This was determined not to be a feasible alternative considering the existing issues experienced with the facilities which pose potential health and environmental dangers as well as limit the growth and development in the area.

The UAJA maintains multiple crews dedicated to the operation, maintenance, and rehabilitation of the collection and conveyance system. These crews routinely monitor the system for evidence of I/I and make repairs as needed. Regardless of the alternative selected, the UAJA crews will endeavor to remove and prevent I/I within the service area.

6 EVALUATION OF ALTERNATIVES

6.1 Consistency Evaluation

The technically feasible alternatives identified in Chapter 5 were evaluated for consistency with respect to the following:

- Clean Streams Law
- Clean Water Act
- Corrective Action Plans/Annual Reports
- Comprehensive Plans
- Anti-degradation Requirements
- State Water Plans
- PA Prime Agricultural Land Policy
- County Stormwater Plans
- Wetland Protection
- Source Water Protection
- Protection of rare, endangered or threatened species
- Historical and archaeological resource protection

Clean Streams Law

The Pennsylvania Clean Streams Law, enacted in 1937, is the main law designed to preserve and improve the purity of the waters of the Commonwealth. The implementation of any alternative resulting from the recommendations of this Special Study would involve detailed engineering design as well as proper permit authorizations prior to construction and as such, would not conflict with the Clean Streams Law.

Clean Water Act

The Clean Water Act is a U.S. federal law that regulates the discharge of pollutants into the nation's surface waters. The implementation of any alternative resulting from the recommendations of this Special Study would involve detailed engineering design as well as proper permit authorizations prior to construction and as such, would not conflict with the Clean Water Act.

Corrective Action Plans or Annual Reports

The UAJA is not currently involved with any Corrective Action Plans relevant to this Special Study. The UAJA completes an annual report under PA Code Chapter 94, Municipal Wasteload Management. The purpose of these regulations is to provide adequate conveyance and treatment for future needs and to prevent sewage facilities from becoming overloaded, etc. The UAJA's *2018 Chapter 94 Report* was used in the development of the alternatives.

Comprehensive Plans

Subsequent to the DEP approval of the Task Activity Report for this Special Study, the CRPA specifically requested that the UAJA not consider a gravity conveyance system (Alternative 4), on the basis that the alternative conflicts with the *Centre Region Comprehensive Plan*, which identifies a number of land use, environmental, public services, and sustainability goals, objectives, and policies that guide development in the Centre Region.

One example of a potential conflict with Alternative 4 and the *Centre Region Comprehensive Plan* is Policy 2.1.5: Locate future growth areas to avoid adverse impacts on identified source water protection areas for public water suppliers. Another example is Policy 7.1.2: Support the efforts of public, private,

and nonprofit organizations to preserve agricultural areas in the Region through dedicated conservation easements.

The gravity sewer would traverse an area that contains many large tracts that are preserved in perpetuity from development, contains highly productive State College Borough Water Authority drinking water wells, and is not expected to see development to the extent that would ever warrant public sewer.

Note that implementation of Alternative 4 would include the construction of a conveyance line only, and not the proposition of any future growth and development located along its alignment. The UAJA, the State College Borough Water Authority, the College Township Water Authority, and the Centre Region Council of Governments have each signed the Source Water Protection Agreement, expressing joint commitment to protecting source waters. There are many conventional on-lot systems in the Slab Cabin Run Basin through which the conveyance line would likely traverse. Research has demonstrated that conventional on-lot sewage management systems are not very effective at treating certain contaminants commonly found in residential wastewater, such as pharmaceutical compounds and endocrine disruptors. If the conveyance line (Alternative 4) were to be selected as the preferred option, the existing on-lot systems could be eliminated by connection to the gravity sewer, thus reducing potential contamination to the area's water supply sources.

The CRPA's request letter dated June 26, 2019 and the UAJA's response letter dated July 2, 2019 are included in Appendix H.

Anti-degradation Requirements

Anti-degradation requirements as contained in Chapters 93, 95 and 102 of the PA Code (relating to water quality standards, wastewater treatment requirements; and erosion and sediment control) will be considered during the detailed engineering design and best management practices will be implemented throughout construction of the recommended alternative(s).

State Water Plans

The Pennsylvania State Water Plan provides planning tools and guidance for those who make decisions that affect the Commonwealth's water resources. Centre County is located within the Lower Susquehanna Planning Region. Any conflicts with the State Water Plan would be alleviated through detailed engineering design of the recommended alternative(s).

PA Prime Agricultural Land Policy

With the exception of Alternatives 3 and 4, implementation of each of the proposed alternatives would involve the disturbance of lands within the SSA that have been previously disturbed. Implementation of Alternative 4, only, would result in disturbance of lands designated as Agricultural Security Areas. All disturbed areas will be restored, and best management practices will be used during construction of the recommended alternative(s).

County Stormwater Plans

The implementation of the proposed alternatives would not cause a significant increase in stormwater runoff. Disturbance related to the project construction will comply with the Townships' stormwater management requirements. NPDES permits are required for construction sites equal or larger than one acre. The UAJA would acquire all applicable permits before earthwork begins.

Wetland Protection

Implementation of Alternative 4, only, would necessitate extensive wetland protection, as this alternative includes construction of a sewer alignment generally parallel to Slab Cabin Run. While the presence of wetlands alone does not eliminate the potential for the UAJA to implement Alternative 4, it would certainly increase the capital cost of construction.

Source Water Protection

The State College Borough Water Authority's Source Water Protection Program consists of both a Wellhead Protection Program for Wellfields 2, 4, 5, 6, and 7, and a Watershed Protection Program for Wellfields 1 and 3 and the Shingletown Reservoir. The UAJA, the State College Borough Water Authority, the College Township Water Authority, and the Centre Region Council of Governments have each signed the Source Water Protection Agreement, expressing joint commitment to protecting source waters.

Alternative 3 includes the construction of a community on-lot disposal system to manage peak flows through a series of tanks and a leach field system. The UAJA believes that on-lot disposal systems in karst geology should be avoided where possible and recommends that this alternative not be given further consideration due to the commitment to source water protection reflected in the Source Water Protection Agreement.

Protection of Rare, Endangered and Threatened Species

As the site specific alternatives are developed and evaluated during detailed design, potential environmental limitations will be considered. However, an initial assessment for the protection of rare, endangered, and threatened species was performed using the Pennsylvania Natural Diversity Inventory (PNDI). The final PNDI receipts (included in Appendix E) based on the project boundaries submitted included the following agency results:

- PA Game Commission (PGC): No Known Impact
- PA Department of Conservation and Natural Resources (DCNR): No Known Impact
- PA Fish and Boat Commission: No Known Impact
- U.S. Fish and Wildlife Service: No Known Impact

Historical and Archeological Resource Protection

Project Review Forms were submitted to the State Historic Preservation Office (SHPO) for an initial determination of how the project(s) will impact significant resources. The SHPO's response letter is included in Appendix D. Alternatives 1, 2, and 3 will have no effect on historic properties. Previously recorded archeological sites are located within or adjacent to the project area of Alternative 4. The SHPO states that these resources could be adversely affected by project activities and have not been evaluated

for their eligibility for listing on the National Register of Historic Places, and therefore a Phase 1 archaeological survey to relocate these known sites and locate other potentially significant sites within the project are of Alternative 4 would need to be conducted.

6.2 Economic Analysis

In order to evaluate the economic impacts of the alternatives, conceptual-level cost estimates were prepared. These costs include estimated capital construction costs, project costs, and, for major Alternatives 1, 2, and 3, annual operation and maintenance (O&M) costs. It was assumed that the construction work would generally be completed by the UAJA's collection and conveyance system staff, and as such, the estimated capital costs include quotes obtained from manufacturers as well as costs associated with labor and installation. The total project costs include the estimated construction costs as well as soft costs and a 15% contingency. O&M cost estimates for major Alternatives 1, 2, and 3 include the cost of electricity consumed by the pump station(s) as well as operating costs. The O&M cost estimate for Alternative 4 includes operating costs only. Appendix F contains detailed estimates for each alternative.

Soft costs, including engineering (design, permitting, and construction administration) and legal fees, were estimated based on a percentage (20%) of the estimated construction capital costs reflective of projected design complexity.

O&M costs were developed using the following (where applicable):

- Electricity: The UAJA's General Power Service cost averaged 6.10 cents per kWh from December 2018 to October 2019. However, in order to capture the overall cost of electrical service including capacity, transmission and miscellaneous charges, an electrical cost of 9 cents per kWh was used. This value was derived by calculating the average total monthly bill amount divided by the average monthly kWh used.
- 72 horsepower consumption by the proposed submersible pumps/controls, running an average of 20 minutes per hour for Alternative 1.
- Combined 70 horsepower consumption by the existing submersible and dry-pit pumps/controls, and 7 horsepower consumption by the proposed supplemental submersible pumps/controls, running an average of 20 minutes per hour for Alternative 2.
- For Alternatives 1 and 2, each pump station would require one system operator, approximately two hours per day performing general operation and maintenance.
- For Alternative 4, two system operators would spend approximately two days per year checking the gravity alignment and performing general operation and maintenance.

To compare the major alternatives justly, present worth estimates were completed. Present worth is the currently invested amount at a fixed rate that would provide exactly the funds required to make all future payments. A project life of twenty years and an interest rate of 2.50% were assumed.

No detailed field survey or investigations were conducted as part of this Special Study to confirm the accuracy of record drawings, to confirm the location of below grade utilities, or to confirm the site subsurface conditions. Additional analysis and evaluation of the proposed infrastructure will be required

during design of the system to fully develop the scope and extent of the facilities required to complete the work and identify site conditions that may impact the cost and schedule of the project. Table 6.1 presents a summary of the cost estimates developed for the Scott Road Pump Station alternatives.

Table 6.1: Summary of Major Alternatives' Costs Estimates and Present Worth Analysis

Alternative	Capital Cost	Annual O&M Cost	Annual O&M Present Worth	Total Present Worth
1: Pump Station and Forcemain Upgrades	$ 1,743,000	$ 28,710	$ 447,562	$ 2,191,000
2: Equalization Tank	$ 1,111,000	$ 44,290	$ 690,439	$ 1,801,000
3: Community On-Lot Disposal System	$ 2,376,000	$ 31,261	$ 487,340	$ 2,863,000
4: Gravity Conveyance	$ 3,665,000	$ 640	$ 9,977	$ 3,675,000

As discussed in Chapter 5, the implementation of Alternatives 1, 2, or 3 would require the additional implementation of one of the Bristol/Westerly Parkway Interceptor alternatives. Table 6.2 presents a summary of the cost estimates developed for the minor alternatives.

Table 6.2: Summary of Bristol/Westerly Parkway Interceptor Costs Estimates

Alternative	Capital Cost
1-A: (PS & FM Upgrades) Increased Diameter Downstream	$ 775,000
1-B: (PS & FM Upgrades) Modified Slope Downstream	$ 690,000
1-C: (PS & FM Upgrades) Forcemain Extension	$ 342,000
2-A: (EQ Tank) Increased Diameter Downstream	$ 93,000
2-B: (EQ Tank) Modified Slope Downstream	$ 319,000
3-A: (COLDS) Increased Diameter Downstream	$ 93,000
3-B: (COLDS) Modified Slope Downstream	$ 319,000

Table 6.3 presents the combined costs of each major alternative with its associated lowest estimated capital cost Bristol/Westerly Parkway Interceptor alternative.

Table 6.3: Total Costs Estimates of Paired Alternatives

Alternative	Total Cost
1-C: PS and FM Upgrades with Forcemain Extension	$ 2,533,000
2-A: EQ Tank with Increased Diameter Downstream	$ 1,894,000
3-A: COLDS with Increased Diameter Downstream	$ 2,956,000
4: Gravity Conveyance	$ 3,675,000

Alternative 2, when paired with the efforts that will be necessary regarding the downstream gravity segments, represents the lowest total project costs. Alternative 1 represents the second lowest total cost. The UAJA plans to fund the project with capital reserves or acquire funding through the municipal bond market or a conventional bank loan.

6.3 Assessment of Greenhouse Gas Emissions

Another component considered in evaluating the pump station alternatives was the effects of greenhouse gas (GHG) emissions, which are integral to the understanding of a project's impact and should be factored into the decision making process accordingly. The significance of GHG emissions from wastewater treatment plants has been increasingly acknowledged in recent years. It has been estimated that approximately 17 million tons of CO_2 equivalent GHG emissions per year are released during wastewater treatment in the United States, primarily from the biological processes taking place at treatment facilities, which release CO_2 and methane, as well as from the consumption of energy used to power lift stations (Center for Sustainable Systems, University of Michigan. 2019. "U.S. Wastewater Treatment Factsheet". Pub. No. CSS04-14).

In addition, a recently published study demonstrated that emission of CO_2 and methane is extensively present in sewers (Jin, P., Gu, Y., Shi, X., & Yang, W. 2019. "Non-negligible greenhouse gases from urban sewer system". *Biotechnology for biofuels*, *12*, 100). The study included 3 years of monitoring an urban sewer system and concluded that approximately 0.22 kg of CO_2 equivalent GHG is emitted per day in every 10 meters of sub-main sewer pipe.

The potential amount of GHG emissions associated with each pump station alternative is outlined below. This evaluation also utilized the following data, which was developed specifically for the UAJA's system (where applicable):

- 424 kg of CO2 equivalent GHG emissions per 1,000 kWh of electrical usage
- 8.89 kg of CO2 equivalent GHG emissions per gasoline gallon

Table 6.4: Potential Annual GHG Emissions, kg CO_2

Emission Source	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Electricity Consumption	66,473	71,089	69,243	-
Gasoline Consumption	3,817	3,817	3,817	21
Sewer Generation	-	-	81,960	47,238
Annual Total:	**70,290**	**74,907**	**155,020**	**47,259**

The implementation of a gravity conveyance line to replace the Scott Road Pump Station could reduce greenhouse gas emissions by approximately 35% compared to Alternatives 1 and 2.

6.4 Operability

The final aspect to consider in evaluating the pump station alternatives is the overall operability of each conveyance option. An operability review insures quality and reliability from an O&M standpoint at this important early stage of a project.

The gravity conveyance system (Alternative 4) plainly represents the least labor intensive alternative. Subsequent to construction, the UAJA's collection system staff may spend two to three days annually, checking the alignment and performing general maintenance. Additionally, Alternative 4 does not include any mechanical or electrical equipment; whereas the failure of such equipment could cause a disruption to sewage conveyance.

Construction of an equalization tank and supplemental pump station (Alternative 2) would add complexity to the existing system, which is undesirable from an operator's perspective. The layout of the existing pump station is abnormal compared with the UAJA's typical pump station configurations. The majority of the UAJA's lift stations consist of duplex submersible pumps within a wet well that convey wastewater directly through a forcemain to the gravity connection point, whereas the Scott Road Pump Station consists of a series pumping system comprised of both submersible pumps and dry pit pumps. The implementation of a supplemental submersible pump station and flow equalization tank would increase the labor required by the UAJA's collection system staff to perform daily tasks and general O&M. The addition of mechanical and electrical equipment to the existing system also introduces another point in which failure of such equipment could cause a disruption to sewage conveyance.

Implementation of Alternative 1, would provide a decrease in labor required by the UAJA's collection system staff compared to both existing conditions and to Alternatives 2 and 3. The proposed pump station modifications would bring the Scott Road Pump Station into coherence with the UAJA's standard specifications for lift stations.

7 INSTITUTIONAL EVALUATION

7.1 Analysis of Existing Wastewater Treatment Authorities and Entities

The Centre Region consists of six municipalities located in the south-central portion of Centre County, Pennsylvania: College, Ferguson, Halfmoon, Harris, and Patton Townships and State College Borough. The Centre Region Council of Governments (CRCOG) is a voluntary association of these six municipalities that was established in 1969 to provide cost effective and high quality public services, including but not limited to regional planning, parks and recreation, emergency management, and recycling programs. The CRCOG website provides the following description:

> "The Centre Region COG is governed by the General Forum, which is comprised of 32 elected officials from the six municipalities. In addition, there is a non-voting representative from Penn State University and a liaison from the local school district. Surprisingly, despite its large size, most General Forum votes are unanimous. In large measure, this consensus flows from the COG's Committee system, which is designed to prepare recommendations to be developed on regional policy issues. Each municipality appoints one elected official to each of the COG Committees – Executive, Finance, Human Resources, Parks Capital, Public Safety, Public Services & Environmental, and Transportation & Land Use. Committee recommendations are presented in the form of a motion that provides a starting point for the General Forum's discussions. If the issue is particularly "politically" charged, the Committee may refer the issue to the individual municipal Boards/Councils for comment. Municipal responses are considered by the Committee in preparing its recommendation."

The CRCOG has tasked the UAJA with providing sanitary sewer service to the Centre Region, which includes collection, conveyance, treatment, and construction and maintenance of all related facilities.

8 RECOMMENDED TECHNICAL & INSTITUTIONAL ALTERNATIVE

8.1 Identification and Justification of Selected Alternative(s)

Based on the analysis outlined in Chapter 6, it is recommended to pursue the implementation of Alternative 1-C, which generally involves the replacement of the existing wet well, installation of new submersible pumps, and forcemain replacement and extension. This alternative addresses both existing and projected hydraulic overload conditions at both the Scott Road Pump Station and the downstream gravity conveyance system.

Although Alternative 1-C represents a higher capital cost over Alternative 2-A, upgrading the pump station and forcemain will provide improved operability through the modified configuration of pumping and controls to cohere to the UAJA's standard specifications.

The UAJA will continue to own and operate the proposed pump station and its associated facilities. The UAJA will be responsible for complying with all applicable water quality standards and effluent limitations.

8.2 Preliminary Implementation Schedule

A general project schedule is outlined in the following table.

Table 8.1: Implementation Schedule

Milestone	Date
Submit Special Study to Municipalities/Planning Commissions (60-day Review)	June 2020
Begin Public Comment Period (30-day)	July 2020
Receive Municipal/Planning Comments, Conclude Public Comment Period	August 2020
Submit Revised Special Study to Municipalities/Planning Commission	September 2020
Present Special Study to CRCOG General Forum	September 2020
Adoption by Municipalities and CRCOG	October 2020
Submission of Special Study to PA DEP (120-day Review)	October 2020
Receive DEP Comments/Approval of Special Study	January 2021
Complete Preliminary Design	April 2021
Submit Permit Applications (WQM, NPDES)	May 2021
Complete Final Design	August 2021
Receive DEP Comments/Approval of Permits	August 2021
Begin Construction	September 2021
Project Completion	August 2022