Wastewater Facility Plan

Town of Coventry

Coventry, Rhode Island

December 2023

FUSS & O'NEILL

146 Hartford Road
Manchester, CT 06040

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1 Executive Summary

The Town of Coventry (referred to herein as Coventry) retained Fuss & O'Neill Inc. in July of 2022 to prepare a Wastewater Facilities Plan in accordance with Rhode Island Department of Environmental Management (RIDEM) Division of Water Resources guidelines. This comprehensive wastewater facilities planning document summarizes the following:

- Effluent Limitations Defined by Existing Agreements in Relation to Wastewater for the Town
- Environmental Conditions in Coventry
- Existing Wastewater Infrastructure and Disposal in Coventry
- Existing Wastewater Flows
- Future Needs Assessment
- Projected Future Wastewater Flows
- Projected Wastewater Loading
- Planning Area Evaluation and Prioritization
- Pump Station Upgrades Recommendations
- Development of Wastewater Infrastructure Alternatives
- Recommended Plan for Wastewater Disposal for 20-year Planning Horizon
- Opinion of Cost for Recommended Plan
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Evaluation of wastewater infrastructure for the Town is centralized on the developed, eastern portion of the town where existing wastewater infrastructure is prevalent and parcels are less suitable for onsite wastewater treatment alternatives due to factors such as lot size, population density, proximity to waterbodies, and soil characteristics. Planning Area boundaries were developed based upon 2010 Census tracts, and affordability was considered by comparing State and Planning Area median household income levels. This approach may optimize funding opportunities and minimize financial impacts to users.

This comprehensive wastewater facility plan, which considers the water quality needs, is a "road map" to serve the long-term interests of the Town over a 20-year planning horizon.

1.1 Existing Wastewater Disposal In Coventry

The Town of Coventry owns its wastewater collection system. Operation and maintenance of the Town's pump stations and collection system is currently outsourced.

The Town's collection system is comprised of approximately seventeen (17) miles of gravity pipe and twelve (12) miles of force main. Wastewater is transported through Coventry's collection system via four (4) Town-owned pump stations that are commonly referred to as Woodland Manor Pump Station, Sandy Bottom Pump Station, Arnold Road Pump Station, and Industrial Drive Pump Station

Wastewater collected by Coventry's sewer system is ultimately treated at the Town of West Warwick's Wastewater Treatment Facility (WWTF). The Town of Coventry, Town of West Warwick and entities ultimately discharging to the WWTF via Coventry's collection system do so in accordance with the existing Intermunicipal Agreement (IMA) discussed herein.

Areas not currently served by public sewers are utilizing conventional on-site wastewater treatment systems (OWTS) such as septic tank-leach field or cesspool systems. The Coventry High School owns and operates a mechanical wastewater treatment system (WWTS) that is an activated sludge plant with gravity clarification. WWTS effluent is pumped to a sand bed (filter), which discharges to groundwater.

1.2 Recommended Plan – Administrative Improvements

1) **Coordination of Town Documents –** As with any Wastewater Facility Planning effort, it is important that supplementary documents having to do with the development and management of wastewater facilities in the Town dovetail with each other. Based on a review of the supplemental documents, it was discovered that many of the existing documents are outdated and require updates. This includes the following:

   a. Update Onsite Wastewater Management Plan (OWMP) – The Town's existing On-Site Wastewater Management Plan (OWMP) is dated 2003. This document is outdated and should be updated as part of the Town's wastewater management efforts moving forward. It is recommended that the plan be updated to consider the OWTS's that will remain over the long-term and OWTS's that will remain in service until such time as sewers are extended to certain planning areas, which are identified in this report.

   b. Sewer Ordinance – The existing Sewer Ordinance was recently modified to include a maximum sewer assessment of $15,000 per residential parcel. The overall Sewer Ordinance should be coordinated with the cost of service and facility plan recommendations identified within this report. The facility plan document recommends the use of low-pressure sewers. It is recommended that the Town consider updating the sewer ordinance such that the cost of the low-pressure sewer infrastructure and grinder pumps is borne by the project, and the infrastructure is maintained by the Town in the future. This is what is customarily done by other municipalities with low pressure sewer systems.

   c. Intermunicipal Agreement with West Warwick – The existing Intermunicipal Agreement (IMA) with West Warwick should be reviewed for coordination of the sewer ordinance, fees, and legal requirements for adjacent Towns connected to Coventry's collection system.

2) **Minimum Sewer Use Charge –** Based on discussions with Town Staff, the existing method of processing user charges for those connected to the sewer system is time consuming, cumbersome, and leaves a lot of room for error. We recommend the Town consider instituting a minimum service fee for sewer usage, with an annual usage allowance of 4,000 cubic feet, which is in keeping with the approach taken by neighboring towns. Additionally, West Warwick invoices Coventry minimum usage fees. The recommended 4,000 cubic feet minimum annual service fee would result in a

minimum annual sewer use fee of $204/property (4,000cf * $5.10/100cf). Properties that use more than 4,000cf would be charged the overage at the rate stipulated in the sewer ordinance, currently $5.10/100cf. This proposed modification will have a positive effect on the Town's revenue stream. Prior to implementation, the Town should fully consider the administrative effort required, as well as the customer impacts.

3) **Increase Revenues for Capital Improvements –** Consider increasing sewer use fees to defray increasing capital and Operations and Maintenance costs to properly maintain and extend the public sewer collection system. Given the poor financial condition of the Town's sewer fund, it would be prudent of the Town to begin to build reserve funds in the short term (1-5 years) to allow for more financial flexibility and viability in the long-term. This will allow the Town to increase rates annually at smaller, more predictable, amounts, rather than requiring significant increases in one year, as the Town is currently facing. Smaller annual increases will mitigate the risk of rate shock to customers and result in a more financial sustainable sewer fund.

4) **Move Sewer Operations Internal** – Consider creating a Sewer Department that will manage operation and maintenance of the Town's pump stations, gravity and low-pressure wastewater collection systems. The department and staff may be integrated into the Town's Public Works and/or Engineering Departments.

1.3 Recommended Plan – Infrastructure Improvements

- It is the recommendation of this report to perform a detailed evaluation of the existing conditions of the Woodland Manor and Sandy Bottom pump stations. The evaluations should identify capacity needs related to anticipated growth and should identify pump station deficiencies such that the Town may allocate funds for repair, maintenance, and upgrades.

  Previous investigations of the pump stations are as follows:
  - Woodland Manor Pump Station was evaluated by Fuss & O'Neill in 2013. Based on that evaluation, some of the recommended improvements included provision of new valves & pressure gauges, rebuilding of existing pumps as required, replacement of existing electrical equipment as required, and replacement of corroded suction piping within the wet well.

  - Sandy Bottom Pump Station was evaluated by others in 2021. The recommended improvements included replacement of existing 50 Horsepower Variable-Frequency Drives, rebuilding of Pumps No. 1 & 2, replacement of flow meters, and replacement of sewage grinder/comminutor.

- The on-site wastewater treatment system (OWTS) is no longer functioning appropriately to serve the high school and another viable solution needs to be determined to serve the high school moving forward. Four alternatives were evaluated for serving the high school. They are as follows:
  - **Alternative No. 1** – Extend Gravity Sewer from Tiogue Avenue to the High School Site
  - **Alternative No. 2** – Construct Equalization Tank and Pump Station at the High School, Tie into Existing Force Main on Reservoir Road / Discharge to Tiogue Avenue Force Main

- **Alternative No. 3 –** Construct On-Site Passive Treatment System with Groundwater Discharge (e.g. septic tanks and conventional leachfield)
- **Alternative No. 4** – Construct On-Site Active Treatment System with Groundwater Discharge (i.e. replace the existing on site system)

Based on an alternatives analysis (see **Appendix A**), it is recommended gravity sewers be extended to the high school. This alternative aligns with the other recommendations in this Facility Plan and is an investment in the Town's long-term sewer infrastructure. This alternative provides benefit to the Town in the long term by enabling future sewer service to Planning Areas 1 and 2.

- It is also the recommendation of this report to extend sewer infrastructure to the following planning areas within the 20-year planning period:
  - **Planning Areas 8 and 9**: Planning Area 8 and 9 are located south of the Tiogue Avenue gravity interceptor adjacent to Tiogue Lake, a popular recreational location within the Town. Two alternatives were developed for Planning Areas 8 and 9, the first being hybrid of gravity sewer and low-pressure sewer with a main, Town-owned pump station to be installed at the location of low elevation of Briar Point, and the second alternative being an entirely low-pressure sewer system. In both alternatives, flow will be conveyed north to the Tiogue Avenue gravity interceptor then to Sandy Bottom Pump Station, with termination at the West Warwick Treatment Facility. These two alternatives will be further analyzed during preliminary design for final selection. Refer to **Figures 8.2.1.1.A & 8.2.1.2.A**.

  - **Planning Areas 1 and 2**: Planning Areas 1 and 2 are located at the westernmost point of the boundary of the study area adjacent to the Johnson Pond and north of the Woodland Manor Pump Station. The proposed sewer layout consists of a mix of gravity and low-pressure sewer to convey wastewater to Reservoir Road towards Tiogue Avenue where it will tie in with the existing Tiogue Avenue gravity main. Due to topological restrictions, the proposed sewer configuration for Planning Area 2 is almost entirely comprised of low-pressure sewer that will convey wastewater to a highpoint on Club House Road. Refer to **Figure 8.2.2.A**.

  - **Planning Area 12**: Planning Area 12 is located north of the Tiogue Avenue gravity interceptor, adjacent to the South Pawtuxet River. The proposed alternative sewer configuration for this Planning Area incorporates a mix of gravity and low-pressure sewer. Due to topological restrictions, the conveyance of wastewater within the planning area is split geologically in two directions. The southern and western portion of the Planning Area will convey wastewater to the south by gravity towards the Tiogue Avenue gravity interceptor to the Sandy Bottom pump station and terminate at the West Warwick Treatment Facility. The northeastern portion of the planning area will convey wastewater north over the Pawtuxet River through Laurel Avenue to the Washington Street gravity Interceptor where it will terminate at the West Warwick Treatment Facility. Refer to **Figure 8.2.3.A**.

Planning Areas were chosen based on a ranking evaluation incorporating the parameters of Environmental Impacts, Affordability, Onsite Wastewater Treatment System Problem Areas, and Site Suitability. Planning Areas 9, 2 & 12 were identified as the top three Planning Areas that would derive the greatest benefit from the buildup of sewer infrastructure. Planning Areas 1 & 8 were included in our recommendation because sewering their adjacent Planning Areas (2 & 9 respectively) will allow for construction of shared infrastructure for the conveyance of wastewater from those Planning Areas and will bolster the Town's Sewer Fund.

1.3.1 Opinion of Cost for Recommended Infrastructure Improvements

Separate cost analysis was performed for each planning area and each alternative sewer configuration. Budgetary opinion of total project cost and range (-30% + 50%) are provided on the table below:

Table 1.3.A
Summary of Budgetary Opinion of Cost by Project

Project	Budgetary Opinion of Total Project Cost
Planning Area 9 (Gravity)[1]	**15,380,000**
	(Range -15% /+30%: $10,770,000 to $23,070,000)
Planning Area 9 (LPS)[2]	**13,350,000**
	(Range -15% /+30%: $9,350,000 to $20,030,000)
Planning Area 8 (Gravity)	**12,700,000**
	(Range -15% /+30%: $8,890,000 to $19,050,000)
Planning Area 8 (LPS)	**14,330,000**
	(Range -15% /+30%: $10,040,000 to $21,500,000)
Planning Area 12	**30,320,000**
	(Range -15% /+30%: $21,230,000 to $45,480,000)
Planning Area 1	**25,580,000**
	(Range -15% /+30%: $17,910,000 to $38,370,000)
Planning Area 2	**33,790,000**
	(Range -15% /+30%: $23,660,000 to $50,690,000)

Notes:

1.) Gravity Service Connections assumes 15 linear feet of service connection for each property connecting to gravity sewer system.

2.) Low pressure sewer assumes 40 linear feet of service connection for each property connecting to low pressure sewer system.

3.) Costs developed in 2022 dollars.

4.) Typical planning level costs carry contingencies of -30% to +50%. Opinion of costs will continue to be refined during subsequent phases.

5.) For those properties connecting via gravity, cost does not include gravity service connections from the building to the sewer stub in the street and abandonment of septic system (this cost is to be paid by the homeowner).

6.) For those properties connecting via low pressure sewer, cost does not include abandonment of existing septic system or electrical upgrades that are necessary to support the grinder pump.

Costs presented in **Table 1.3.A** are indicative of total project costs including engineering/legal/administrative fees. Prior studies performed before the creation of this Facilities Plan were indicative solely of costs related to construction and did not include engineering/legal/administrative fees. Furthermore, it should also be noted that Planning Areas 8 and 9 will both either be a hybrid of low pressure sewer and gravity collection systems or will both be low pressure sewer systems. The reason for this joint design criteria is the recommendation to share a pump station as the main discharge point from these collection systems.

1.4 Implementation of Recommended Plan

The 20-year facility plan implementation schedule was developed with the recommendation that sewers extend to Planning Area 9 and the evaluations and upgrades to the Woodland Manor and Sandy Bottom pump stations take precedence. Planning Area 9 is the first candidate for wastewater infrastructure extension due to the opportunity for funding and the concern for the environmental vulnerability of Tiogue Lake.

Planning Area 8 will take place after the complete construction of Planning Area 9 as it is adjacent to the construction. Construction for Planning Areas 12, 1 & 2 are anticipated to take longer for completion as compared to Planning Areas 8 & 9 due to their size. However, any sequence of sewer extensions may be considered as the Facility Plan is implemented. Updates to the existing facility plan will take place at five-year intervals to reevaluate the sequence and cost of extending wastewater infrastructure. At the conclusion of the 20-year interval, a new facility plan will be created and will consider the shifting landscape of the town past the 20-year projection period.

1.5 Environmental Impacts of Recommended Plan

Existing environmental parameters investigated include geophysical characteristics of soils, topology, geology, hydrology and current conditions of surface and ground waters. Historically, shallow bedrock is an environmentally restrictive factor that was investigated thoroughly and incorporated in the planning processes for recommendation of planning areas.

A survey was distributed to 9,000 Town residents within the boundary of the planning areas. Included in these surveys were questions related to environmental concerns regarding the presence of cesspools, age of OWTS system, OWTS repairs required and OWTS problems reported.

Extending sewer service to the proposed Planning Areas will alleviate OWTS issues associated with small parcel size, high density neighborhoods, impervious soils, and leakage to nearby waterbodies. Contamination of waterbodies is a topic of exceeding importance as historical limnological investigations have found elevated levels of nutrient loading and enterococcus bacteria in surface waters within the Town.

Parameters that were used to determine the extent of Planning Areas and sewer extensions include: proximity to impacted waterbody and proximity to wetlands.

The five (5) Planning Areas [PA's 9, 8, 12, 1, and 2] are adjacent to prominent waterbodies within the Town. Extension of sewer infrastructure to these planning areas is not predicted to adversely affect the environment of the surrounding area as all recommended Planning Areas are developed residential areas, and sewer lines will be installed in established roadways with appropriate mitigation of dust, noise, and erosion.

1.6 Financing Modeling

The Sewer Fund is currently operating in a structural deficit. This condition has existed for several years. Additional revenue is required immediately for financial sufficiency of the fund, even if sewer expansion is not enacted. Without rate increases, the Sewer Fund will require annual subsidies from the general fund, and will jeopardize the Sewer Fund's eligibility for Clean Water State Revolving Fund loans; leading to even greater cost increases if capital improvements are required. **Table 1.6.A** presents the Sewer Fund's projected cash flow with no rate increases. As can be seen, the Sewer Fund is projected to continue operating in a deficit for each fiscal year of the forecast.

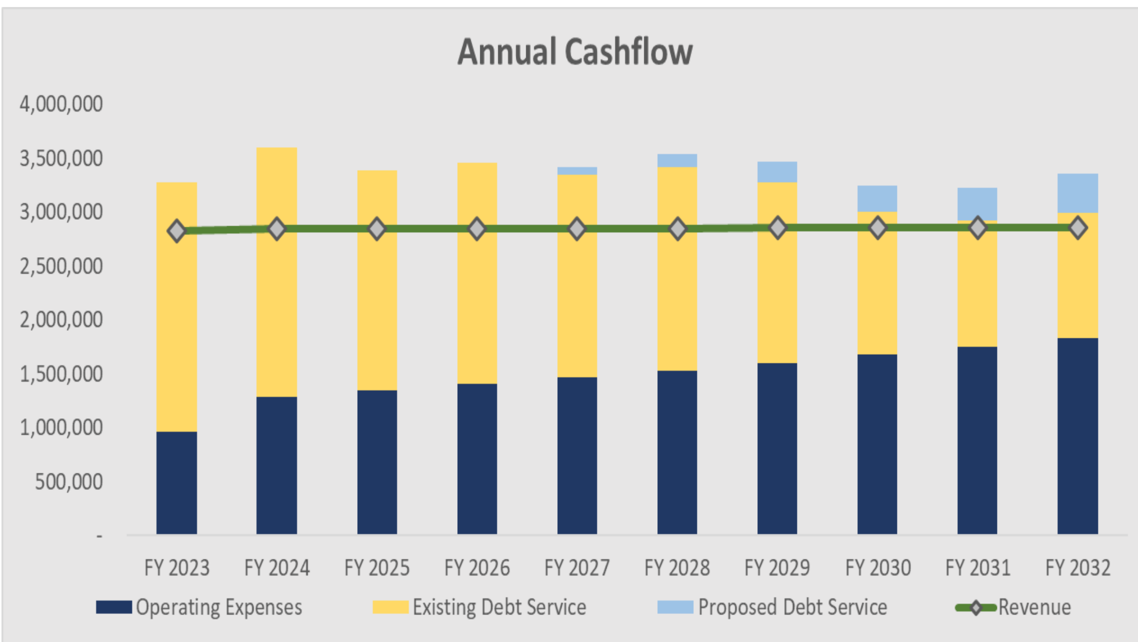

Figure 1.6.A Projected Sewer Fund Cashflow with No Rate Increases

In order to bring the Sewer Fund to self-sufficiency and support the Selected/Recommended Facility Plan and sewer extensions, three consecutive (3) annual rate increases of approximately 30% followed by 5% annual rate increases thereafter are recommended to bring the Sewer Fund into a positive financial position in 2027 and to reach the targeted Sewer Fund balance in 2029. This rate increase was established taking into consideration a beginning balance of $280,000, no development assessment revenue, and a phased approach to expansion of service per the Selected/Recommended Plan,

It should be noted that the Sewer Fund's financial plan should be updated on an annual basis to ensure decisions are based upon most-recent and most-accurate information. Actual results of the financial plan will often deviate from projections, and annual modifications may be required.

2 Planning Area

2.1 Town Description

Coventry is located in Kent County in west central Rhode Island, approximately 15 miles from the State's Capital Providence. Coventry is bordered by Foster, Scituate, and Cranston to the north; West Warwick to the east; East Greenwich and West Greenwich to the South and Connecticut to the West. Coventry measures approximately 13 miles east to west and 5.0 miles north to south with a total area of 64 square miles including both the land and water resources.

Coventry is governed by an elected five-member Town Council, and Council District mapping is provided in **Figure 2.1.A**. Coventry's Town Manager is appointed by the Council. Periodic public meetings are held for policy-making decisions. Coventry's collection system has historically been operated and maintained by the Department of Public Works (DPW). Oversight of Coventry's collection system design and extension is provided by Coventry's Engineering Department.

Eastern portions of Coventry are characterized by urban-suburban development, while the Western portion of Coventry is rural, including agricultural land and open space. Coventry's existing sewer infrastructure is located in densely populated, eastern portion of Town, and the sparsely populated, Western portion of Town [Council District 1] generally contains large lots that are well-served by on-site wastewater treatment systems (OWTSs). Therefore, sewer facility planning (sewer extension) does not extend to Council District 1.

While growth in the Town has increased at a slower rate than in previous decades with population growing by 1.9% in the 2020 census compared to 4.1% in the 2010 census, wastewater management is of important concern.

2.2 Planning Areas

Municipalities in the State of Rhode Island are required to conduct wastewater facilities planning to maintain eligibility for state and/or federal financing. The original facilities plan for the Town of Coventry was completed in 1995 with subsequent updates in 2003, 2010 and 2016, each carrying forward the original Planning Areas.

For the purposes of this Facilities Plan, Fuss & O'Neill delineated new Planning Areas, which will assist with prioritization of potential future sewer extension projects. Parcels located in Council Districts 2 through 5 contain smaller, more densely populated, and areas of greater concern than parcels located in Council District 1. In total, 31 PAs were established in Council Districts 2 through 5 and are depicted in **Figure 2.2.A**.

Planning Areas are grouped within 2010 Census Tract boundaries, and each Tract's respective income data is included on **Figure 2.2.B**. Sewer extension projects funded through the State Revolving Fund (SRF) for within Planning Areas that have a median income that is lower than State median income may be eligible for SRF loan forgiveness. Within census tracts, parcels on both sides of a road are included in the same Planning Area so that residents with access to a sewer line would be able to connect. However, to optimize funding opportunities for the Town, Planning Areas are bounded within a single census tract, even when Census Tracts split properties on a road into separate Planning Areas.

2.3 Community Comprehensive Plan

An important element of wastewater facilities planning is to dovetail previous and ongoing Town planning efforts. The Community Comprehensive Plan (CCP) is a document that synthesizes the existing and projected conditions of the Town to develop an informed plan to assist with future development. The CCP is developed in accordance with the General Laws for the State of Rhode Island, subsections 45-22.2-10(b). A wide range of elements are assessed including community profiles, natural resources, land use, historic and cultural resources, economic development, utilities, transportation, natural hazards, and climate change.

The data collection process is achieved through compilation of sources such as existing census data, public surveying, mapping, and existing records. In April 2022, an electronic survey was distributed to the residents of Coventry to collect public opinion, to which 70 submissions were collected. Existing data and projections are considered to plan future development such as the following:

- Social equity through housing affordability.
- Economic development through development of an economic profile and potential opportunity areas and sectors for expansion.
- Transportation equity through increased availability and accessibility. Historical and cultural enrichment through stewardship and promotion.
- Natural resource conservation through identification of water resources, identification of vulnerable habitat, and threat identification.
- Utility services and facilities availability through BMP management, maintenance of existing facilities, and ensuring compliance with federal regulations.
- Energy conservation and efficiency through decisions in land use, implementation of conservation measures, and a review of renewables.
- Natural hazards and climate change are examined by assessing the progress on implementation of the recommendations made in the 2018 Coventry Hazard Mitigation Plan (HMP) and its impacts on infrastructure development.

A CCP was certified for the Town in June of 2000. Standards for the CCP changed in the year 2011 and in 2017 the Town of Coventry was advised by the Division of Statewide Planning to create a new document. Due to an abundance of internal structural changes, and the unique challenges associated with the pandemic, during the 2019 – 2021 time frame the Town of Coventry created an Advisory Committee and solicited the services of Beta Group, Inc., an engineering, architecture, and construction services consulting firm for the development of a major plan update to the existing CCP. The CCP is being developed in conjunction with the wastewater facility plan and was scheduled to be completed in May 2023. As of the time of the publication of this Facilities Report, the draft 2023 CCP is still in review by the State. The Town anticipates receipt of CCP comments by the end of September, 2023.

3 Effluent Limitations

3.1 RIPDES Permit

The Town of Coventry maintains a collection system that consists of collector sewers, interceptors and four (4) Town-owned pump stations. There are no Publicly Owned Treatment Works (POTWs) in Coventry. Wastewater generated by parcels connected to the existing sewer infrastructure is conveyed to and treated at the West Warwick Wastewater Treatment Facility; therefore, the Town of Coventry does not have a Rhode Island Pollutant Discharge Elimination System (RIPDES) permit.

West Warwick's treatment facility is regulated under Rhode Island Pollutant Discharge Elimination System Permit No. RI 0100153, which can be found in **Appendix B**. Effluent flow limitations of the WWTF as per the permit are 11.0 MGD on an average monthly basis. West Warwick's sanitary system capacity was upgraded in 1983 to meet sizing requirements for adequate treatment and discharge of wastewater from the adjacent towns of Coventry, Cranston, Scituate, Warwick, and West Greenwich.

The West Warwick WWTF consists of preliminary treatment (screening, grit removal) and primary clarification including recent modifications for improved phosphorus removal with alum input. Secondary treatment is provided through an Activated Sludge Process. Secondary effluent is discharged through a tertiary denitrifying Biological Active Filter (BAF) for additional nutrient and solids removal. Effluent then undergoes disinfection through ultraviolent light and is discharged through an outfall into the Pawtuxet River, a 303(d) listed water body.

3.2 Intermunicipal Agreement

An Intermunicipal Agreement (IMA) serves as a document to provide specific guidelines for operation and maintenance, flow allowance, cost sharing and regulation conformity for shared infrastructure and wastewater treatment. The Town of Coventry and Town of West Warwick's IMA for Wastewater Services is an existing agreement that was facilitated through West Warwick's Sewer Commission and the Town of Coventry. The agreement between these parties is dated the 20th of July 1999. A copy of the executed IMA is provided in **Appendix C** of this report. Highlights of the Intermunicipal Agreement with West Warwick are as follows:

- The Town of Coventry has an allocated flow of 2.25 MGD average daily flow to the West Warwick WWTF.

- To determine Coventry's share of operation and maintenance costs, the following methodology is used:
    - Wastewater flows are based on the Town of Coventry water use records. Wastewater discharge from Coventry to West Warwick is calculated as eighty percent (80%) of the water consumed by sewered properties, using water meter records provided by Kent County Water Authority (KCWA). Coventry's sewered parcels that are not connected to KCWA are billed at a fixed consumption established by West Warwick.
    - Industrial users are billed directly by West Warwick in accordance with West Warwick's Sewer Ordinance.

- If Coventry determines that it will not require the entire reserve capacity (hydraulic and organic) as set forth in the IMA, and another Participating Municipality needs it, Coventry may petition West Warwick to transfer, sell, assign, or lease that portion of its reserved capacity.

- West Warwick agrees to accept residential septic tank and/or cesspool septage generated within the boundaries of Coventry for treatment. The charge for accepting and treating septage shall be reasonable and based on the cost for providing such services by West Warwick Sewer Commission. Currently the WWTF does not have the capacity to accept septage. Septage transportation is at the discrepancy of the septage hauler and is typically sent to the adjoining towns of Cranston, Scituate, Warwick, and West Greenwich. There are currently no proceedings to amend this stipulation in the IMA.

- At the time the IMA was executed there was an agreement between West Warwick and Woodland Manor Associates. This agreement included an average daily flow set aside of 200,000 gallons for users in the service area. It is understood that the capacity granted to Woodland Manor Associates is not part of Coventry's reserve capacity.

- Once the combined flows of either participating municipalities or individual flow from the town of Coventry reaches a threshold of eighty percent (80%), West Warwick shall cause a new projection of wastewater flows to be made. Flow capacity allocated to Coventry with West Warwick is 2.25 MGD. Eighty percent of these allocations is 1,800,000 MGD average daily flow. The projected average daily flow for the of the Selected/Recommended plan is 1,077,351 GPD, therefore the need for reevaluation from West Warwick should not be required as a result of the Recommended/Selected Plan.

- The agreement is to remain in full force and effect for a period of ninety-nine years (2098) unless and until it is amended by the mutual consent of all parties.

4 Existing Environmental Conditions Assessment

Pursuant to the RIDEM Wastewater Planning and Design Facilities Plan Checklist, the following sections discuss the existing conditions in the Town of Coventry. Data, maps, reports, files, and other information associated with the Planning Areas were collected from sources including:

- Town of Coventry
- Rhode Island Geographic Information Systems
- Kent County Water Authority (KCWA)
- Town of Coventry Engineering Department
- Town of Coventry Department of Public Works (DPW)
- Town of Coventry Assessor's Department
- Town of Coventry Planning and Zoning Department
- Rhode Island Department of Environmental Management (RIDEM)
- United States Department of the Interior Fish and Wildlife Service

4.1 Geophysical Conditions

4.1.1 Soils

The Town is comprised of soil resulting from glacial deposits, mainly Upland Till Plains with some Outwash Deposits along the eastern portion. The Upland Till Plains are characterized by older granite rocks, while the Outwash Deposits exhibit Pennsylvanian sedimentary rocks.

Figure 4.1.1.A depicts the soil locations and **Table 4.1.1.A** presents all soil types by area in the Town and the total percentage of each soil type. This data is from the National Cooperative Soil Survey (NCSS). Derivatives of Canton soils comprise the bulk of the Town's soil area with 34% coverage. Canton soils are well drained, coarse-loamy, and underlaid by sandy till. The Canton and Charlton soil type varieties are evenly distributed throughout the Town, except for in the urbanized areas west and northwest of Tiogue Lake and the southeast corner of the Town. Hinckley soil group accounts for 9.8% of the Town from central Coventry in mostly wooded areas. Ridgebury soils account for 10.1% of the Town centrally located in small groupings from north to south. Merrimac group accounts for 6% of the Town in north central and east. Woodbridge soils account for 5.5% of the Town northwest of Johnson Pond adjacent to the Quidnick Reservoir and west. The Narragansett group accounts for 4.2% of the Town in the north central area. Paxton group accounts for 4.1% of the Town in the northwest and along Johnson Pond and west.

Consistent with State and Soil Conservation Service standards, the predominant soil types found in the Town are grouped below relative to their individual characteristics and level of constraint regarding development, sanitary disposal, and open space/conservation.

Group A: Minimal Constraint
These soils encompass much of the developable land in the Town. Low and moderate residential densities, along with appropriate OWTS design can be accommodated.

- Hinckley
- Merrimac
- Narragansett
- Paxton
- Canton and Charlton (fine sandy through extremely stony)

Group B: Moderate Constraint
These soils are developable through sensitive engineering of OWTS design; however, the high-water table frequently results in regulated wetlands or areas posing serious pollution threats to the aquifer. Larger areas of these soils are found in the north central section the Town, much of which is intended for future development.

- Woodbridge

Group C: Steep Slope (15%)/Stony Soils
Small deposits of these soils are distributed through the previously identified Canton and Charlton soils in central and western Coventry. Constraint level is moderate, and development is possible with appropriate design to mitigate negative impacts. Erosion poses a potential environmental deterioration threat and requires close review and control measures.

- Canton and Charlton (CaC, CaD, CeC, ChD)

4.1.2 Topography

Topology is a major factor in determining the type of sanitary infrastructure required. In general, declines are associated with gravity sewer main which facilitates water movement though a passive process governed by slope. These systems are less expensive and require less maintenance than a pressurized force main, required for inclines. The expenses associated with construction and maintenance of pressurized systems makes gravity sewer the preferable option when possible.

Ground elevations in the Town range from a low of approximately 50 feet to a high of approximately 650 feet. The topography exhibits a gradient from east to west, with the lower elevations of the east along the Pawtuxet River, gradually rising westward to high points along Route 102 before a steep decline to 350 feet at the border of Connecticut and Rhode Island. **Figure 4.1.2.A** shows the United States Geological Survey (USGS) topography of the Town with the addition of the outlined Planning Areas.

4.1.3 Geology

The ground surface of the New England region was formed by the glaciers of the last Ice Age. Glacial till, made up of clay, silt, sand, gravel, and boulders was deposited as the glaciers advanced across the landscape. Glacial till is found within about half of Coventry, primarily sand and cobbles with dispersed boulders. As the glaciers melted, streams deposited material away to form outwash deposits made of silt, sand, and gravel with occasional boulders. The Town has alluvial floodplains and swamps created by recent surface deposits. Flood plains made of loose to medium density layers of fine to medium sand are found along the Pawtuxet River and its tributaries. Swamps are found adjacent to the floodplains, and are made of sand, silt, humus, and peat.

The historic glacial activity are the driving factors for the geological features of the landscape today. **Figure 4.1.3.A** depicts the distribution of Glacial deposits in the Planning Area as provided by the Town. Glacial deposits are split amongst the Northeastern segment which contains a majority of the towns till deposits and Southwestern segment which contains a majority of the glacial outwash. "Till" is derived from the movement of glaciers generating a mechanical force grinding rock and resulting in unsorted sediment of varying sizes. In contrast "Outwash" refers to a majority sand and gravel that was deposited with the movement of water that resulted from the melting of glaciers resulting in stratified deposits. Glacial deposits of stratified drift are crucial for the state as they hold substantial aquifers along with fractured bedrock.

Figure 4.1.3.B exhibits bedrock composition in the proposed Planning Areas with data provided by the Town. Composition is distributed with Alkali-Feldspar Granite, often referred to as "Red Granite" due to the red hues of the potassium feldspar to the Northeast and Granite to the Southeast. Bedrock depth is a limitation to the construction of OWTS as it represents a restrictive layer from the original ground surface. Traditionally, bedrock depth and composition are found with excavation of a test pit that must be performed when considering installation of a new OWTS development.

4.1.4 Hydrology

Rhode Island's history and culture has deep roots in its relationship with its water resources. The Town lies in two of the five drainage basins that comprise the state of Rhode Island. Three-fourths of the Town is located in the Narragansett Bay Basin, with the remaining area in the Thames River Basin. The Thames River Basin flows west to the Thames River in Connecticut, and the Narragansett Bay Basin flows east to Narragansett Bay. The Moosup River Basin is the major sub-drainage basin to the Thames River Basin in Rhode Island, and it drains the areas of Coventry generally west of Route 102. Eastern areas of the Town generally drain to the Pawtuxet River Basin which drains to the Narragansett Bay. **Figure 4.1.4.A** shows the limits of the drainage areas within the Town delineated by USGS Hydrological Unit Code (HUC) 8, 10, and 12.

4.2 Surface Waters and Water Supply

4.2.1 Surface Waters

Water and wetlands comprise approximately 20% of the Town's area and are generally evenly distributed throughout the Town. While most are narrow and linear in nature, occasionally, larger bodies are found that can expanse up to several hundred acres. A large proportion of these larger water bodies and wetlands are found near the southern portion of Town. A large proportion of water bodies within the Planning Areas are 303(d) listed including Tiogue Lake, Upper Dam Pond, Mishnock Lake, and Pawtuxet River. Installation of sanitary infrastructure has the potential to reduce point source pollution from faulty OWTS in the proximity of these water bodies.

Within the Planning Area, the largest body of water is Tiogue Lake whose perimeter touches the boundaries of seven (7) of the thirty-one (31) Planning Areas. The vulnerability of Tiogue Lake to point source contamination is a concern as multiple residential homes flank its borders. The lake also has a history of cyanobacteria blooms, an indicator of excessive nutrient input to the lake. On the western border of the Planning Areas lies Johnson Pond. Pawtuxet River cleaves through the center of the Planning Area, flowing from Johnson Pond to the adjacent Town of West Warwick.

Fuss & O'Neill has previously performed limnological investigations at the water bodies of Upper Dam Pond and Tiogue Lake. A Bacteria Source Investigation was conducted at Tiogue lake to identify likely cases of historically elevated levels of the fecal indicator bacteria enterococcus. Substantial build out has taken place around the lake in recent history, resulting in a significantly different land use makeup and increasing the potential for wastewater input through septic systems and cesspools. Groundwater seeps were identified along the eastern shore of the lake with elevated levels of enterococcus. A review of the septic system permit data revealed an addition of sixty (60) septic systems in the area from the year of 2012, forty-one (41) of which were identified as having been repaired. It was determined that the sources were likely attributed to stormwater runoff, cesspools, septic systems, and animal waste, though the study could not identify a single source as the primary culprit of fecal bacteria input. Recommendations to reduce fecal bacteria input into the lake include installation of stormwater infrastructure, extending sewer service to the area to eliminate traditional septic system use, improving septic system maintenance, and providing public education. The Tiogue Bacteria Study is included as **Appendix D**.

Nutrient loading was investigated in the Upper Dam Pond to determine sources of elevated phosphorus levels identified by RIDEM. Data collection included bathymetry and soft sediment depth surveying and sampling, as well as water quality sampling. Approximately 90% of the relative nutrient loading into the pond was determined to be from external sources. External sources include stormwater runoff, septic systems, illicit connections that discharge directly to the pond, and waterfowl. Recommendations associated with minimization of nutrient loading included: investigating illicit source monitoring for the eighteen (18) stormwater outfalls that discharge to the pond, implementing green infrastructure to reduce stormwater runoff, investigating OWTS failure through dry weather sampling, discouraging waterfowl from congregating in the pond through public education and limiting disturbances to the sediment at the bottom of the pond. The Upper Dam Pond Limnological Investigation is included as **Appendix E**.

4.2.2 Wetlands

Wetlands serve an important ecological function by providing a buffer for groundwater recharge areas, pollutant removal, serving as a barrier for erosion, providing retention capacity alleviating flooding, and providing habitat for wildlife. Swamps (wetlands dominated by trees) are the most common wetland type in Rhode Island and are often dominated by vegetation species such as red maple and Atlantic white cedar trees and shrubs such as blueberry, sweet pepperbush, and swamp azalea. Other wetland types include marshes (non-forested wetlands) and bogs, which are isolated depressions that continuously hold water and are often distinguished by mats of sphagnum moss that float on their surface.

Figure 4.2.2.A displays the location of all wetlands within the boundaries of the Planning Area. The largest wetland within the boundaries of the Planning Area is the Mishnock Swamp, which surrounds the Mishnock River, a 3.1-mile-long river with two associated dams. The swamp encapsulates approximately half of the largest Planning Area (PA 3). Scatterings of wetlands are found throughout the town in every Planning Area.

4.2.3 Water Supply

Residents of the town acquire water services through the KCWA, or privately owned wells. Suburban and urban developments of the Eastern portion of the Town generally have existing drinking water infrastructure managed and supplied by the KCWA, while rural parcels rely on private wells for water supply.

Water originates from groundwater wells owned by KCWA and pretreated water that is purchased wholesale from the Scituate Reservoir, which is owned by the Providence Water Supply Board (PWSB). Price rates are regulated by the Public Utilities Council (PUC). Approximately 80% of KCWA's water supply is obtained through purchasing and approximately 20% is extracted from three wellfields owned by the KCWA. These wellfields consist of a total of 5 gravel packed wells. Four (4) of these wells are within the Town of Coventry, pulling water from the Mishnock Aquifer, and one (1) well is located in West Warwick, pulling water from the Hunt River Aquifer. The water is stored and distributed by the KCWA through usage of four (4) active water storage tanks within the boundaries of their service area.

4.3 Groundwater

Based on an estimate from the US Geological Survey, twenty-seven (27) million gallons of groundwater are used daily in the State of Rhode Island for drinking water and beneficial uses. Groundwater supplies drinking water for 26% of the state's population and 66% of the state's municipalities. Wellhead protection programs are in place to protect Rhode Island's groundwater and are managed by RIDEM Office of Water Resources. **Figure 4.3.A** outlines areas of Well Head Protection Program Areas that are within the boundaries of the Planning Area, which reside primarily in the southwestern portion of the Planning Area. Groundwater throughout Rhode Island is generally shallow in depth, leading to concern in potential vulnerability to pollution inputs into the system. Wellhead Protection Areas are defined by the Department of Environmental Management (DEM) in 2017 as a method of delineating areas that have high priority for remediation and source control.

Figure 4.3.B outlines the Groundwater Recharge Area within the boundaries of the Planning Areas, where surface waters replenish reservoirs of subsurface water. The rate and efficacy of this process is heavily influenced by surface land use, infiltration capacity of the soil, and rate of precipitation. Developed land surfaces such as pavement have little to no permeability to allow for groundwater recharge, promoting evaporation and runoff. Groundwater recharge areas generally extend from Johnson Pond to the border of Tiogue Lake.

4.4 OWTS Potential Problem Areas

Factors that impact the performance of onsite wastewater treatment systems (OWTS), such as septic tank-leach field systems or cesspools) in the priority areas include soil conditions, population density, age, and maintenance of OWTSs per RIDEM OWTS regulations. Inadequate soil absorption of wastewater flows results in health hazards and public nuisance. System malfunctions and failures can result in wastewater backing up into homes and insufficient travel time of effluent through the soil into the groundwater. Areas with insufficient depth to groundwater, an impervious soil layer, soils with too high a permeability, or excessive flows resulting in hydraulic overloading of the leaching area can all cause system failure. Improper system design or construction, deterioration of OWTS structures, lack of proper maintenance, or harmful substances which could clog the leaching system are also common causes of system failure.

Cesspools by design do not treat wastewater before discharge and have the potential to facilitate direct contamination of shallow ground water. As per the Rhode Island Cesspool Act of 2007, all existing cesspools are to be decommissioned and replaced with a conventional OWTS systems, or sanitary line connection. The phasing of cesspool decommissioning varies, with immediate cesspool replacement required if the cesspool is within 200 feet of an inland shore or public well/drinking water supply. Cesspools on non-residential or multifamily properties are required to abide by RIDEM and EPA regulations for replacement. Cesspools on properties subject to sale and failing cesspools are allowed 1 year for phaseout.

Public input was a major determinant of potential problem areas. Approximately 9,000 surveys were mailed to residents within the Planning Areas. **Appendix F** contains the distributed questionnaire materials received by the residents of the Town.

Over 1,500 survey responses were received. Survey results were analyzed to evaluate areas with potential problems (e.g. presence of cesspools, OWTS breakout, poor drainage, etc.). Some of the general responses received are presented in the following figures.

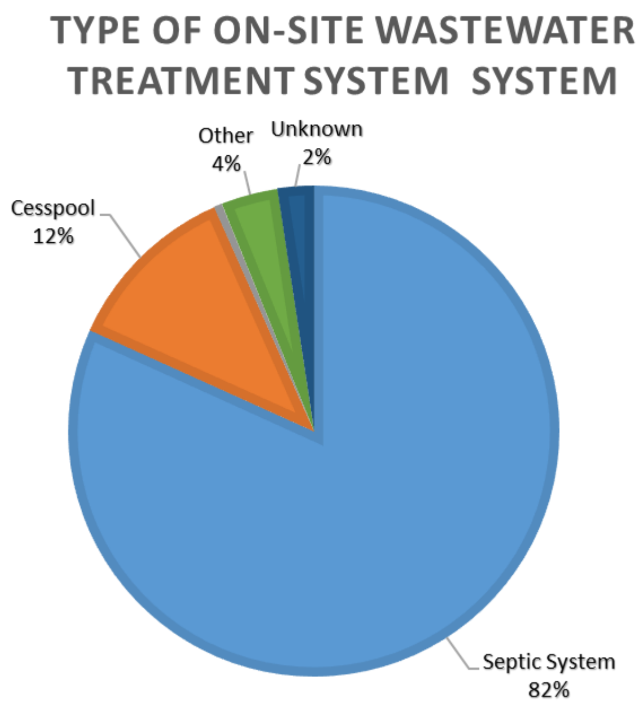

Figure 4.4.A – Treatment System Type Survey Response

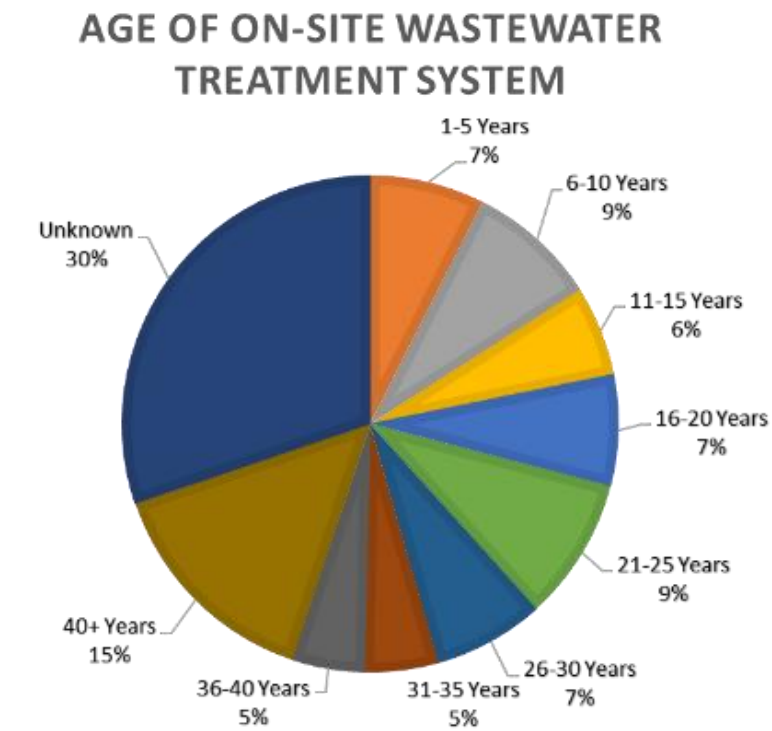

Figure 4.4.B – Treatment System Age Survey Response

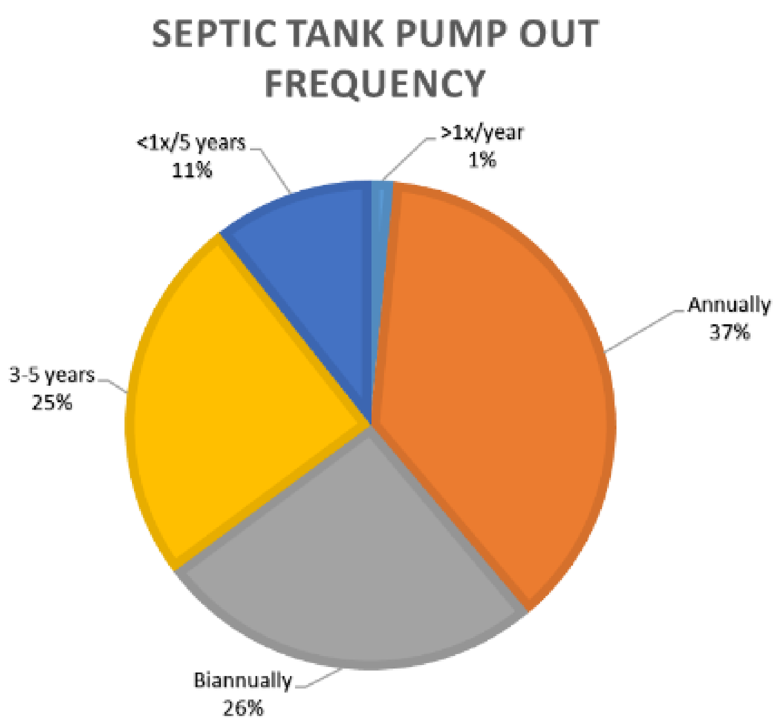

Figure 4.4.C – Septic Pump Out Frequency Survey Response

Figure 4.4.D displays potentially problematic installation and continued function of OWTS soil types within the boundaries of the Planning Area. Soil types were categorized as "potentially problematic", and "Groundwater Table < 2 Feet Below Soil Surface" based on the Soil Evaluation Guidance Document from the State of Rhode Island and Providence Plantations Department of Environmental Management Office of Water Resources. Consideration was given to Planning Areas with a high percentage of soil that have the potential to interfere with the function of OWTS as higher priority for installation of sanitary infrastructure.

4.5 Land Use And Demographic Data

Current land use throughout the Town is differentiated between the urbanized sector of the town to the east and the agricultural area to the west. Land use in the Town is increasingly urbanized. The most prevalent land use remains residential, concentrated in the eastern areas of the Town. Commercial development is primarily located along the Route 3 corridor from Tiogue Lake to Woodland Manor, and along Route 117 from West Warwick in the east to Abbotts Crossing Road. Some Industrial use exists in the Town, including manufacturing, extraction, transportation, communication, and utilities. These uses are primarily located along the State highways in eastern areas of the Town. Public uses including schools, churches, town facilities, Police and Fire Stations and other similar type uses are concentrated mainly in the eastern areas of the Town where the population density is highest. Agricultural use, as well as open space and recreational uses are located primarily in the western and central areas of the Town. Historical locations within the town are majority located within the western reaches, past Route 102 State Road. A Historical Location Type Map can be found in section 7 of the CCP which includes information regarding the location of Historical Districts and Historical Sites. Additionally, a list of threatened and endangered species that are located within the bounds of the Planning Areas can be found in **Appendix G**.

Urban and suburban development that encompass the project area are majority medium density residential zones, with proportionally little forest, conglomerates of business and industrial developments residing mostly along Reservoir Road, Nooseneck Hill Road, and Tiogue Avenue. To the west of Johnson Pond to Victory Highway is majority Single Family Residentials with approximately half of the land use by parcel forest, as well as scattered plots of large park and open space developments. To the west of Victory Highway resided Single Family Residential complexes with a large majority of forest and developments of agriculture to the westernmost portion of the Town. A map of the existing land uses of the Town is included in the 2023 CCP. A total of 66.5 percent of the total land cover of the town is classified as forest, with the second highest percentage being residential developments at 17%. Commercial and Industrial make up only 2.7 % of the land cover, all of which is in the eastern urbanized portion of the Town.

Land use and development in the Town is regulated by the Zoning Ordinance and Land and Subdivision Regulations. Distribution of Zoning Districts for the project area can be found on **Figure 4.5.A**, and 95% of the Town is zoned residential. "Rural Residential" zoning is characterized by large size and low density lots, required for well and OWTS installation and function, as Rural Residential areas of Town lack available utility infrastructure. Demographic information is based on 2020 ACS-5 Year Estimates. The total population of the Town is 34,747 individuals. The median age is 44.3 years, with less than 20% of the population being under the age of 18. Approximately 90% of households within the town speak English as their primary language with five percent speaking Spanish and English, and the remaining cumulative five percent speaking other languages. 1,330 individuals have a cumulative income that is below the poverty level. Two (2) of the five (5) Census Tracts encompassing the Planning Areas have median household income (MHI) below the State's

MHI. No Environmental Justice Areas are within the boundary of the designated Planning Area as per the 2022 RIDEM Environmental Justice Policy Map.

4.6 Existing System and Flows

4.6.1 Existing System

Wastewater is conveyed to the West Warwick WWTF, and the majority of flow is conveyed through the Pulaski Street flow meter via the interceptor along Washington Street. Connections to the existing West Warwick sanitary system lie at the following locations, along the boundary of Coventry and West Warwick:

- Main Stret (Planning Area 31)
- Pulaski Street (Planning Area 14)
- Tiogue Avenue (Planning Area 13)
- New London Turnpike (Planning Area 10)
- Lesser Points of Connection include Washington Street, Harris Avenue, Park Avenue, Herbert Street, and Ames Steet

The location of all sewers is described in section **4.6.1.2** and **Figure 2.2.A** depicts Coventry's existing wastewater infrastructure. Based on 2022 Raw Sewer Use Data provided by the Town, 715 unique addresses are serviced within the town. Using a design population density of 2.57 residents per household as per the 2010 decennial census, an approximation of population served by sewer is 1,838 individuals. A total of four (4) pump stations within the town facilitate the conveyance of wastewater through pressurized force mains. Location of each pump station is as follows:

- Industrial Drive Pump Station (Planning Area 24)
- Sandy Bottom Road Pump Station (Planning Area 28)
- Woodland Manor Pump Station (Planning Area 3)
- Arnold Road Pump Station (Planning Area 7)

The Woodland Manor Pump Station is located on Woodland Drive and services the Woodland Manor Housing Complex, as well as a mobile home community located along Comfort Way and Leisure Way. Effluent from the is conveyed through a 10-inch PVC force main that runs 18,000 feet along Tiogue Avenue and terminates at the West Warwick – Coventry town line. The Westwood Estate Complex, located at the northern end of Reservoir Road, has its own private pump station which ties into the force main at the intersection of Reservoir Road and Tiogue Avenue. The pump station was constructed in the 1980s and is a suction-lift style facility equipped with two sets of two pumps in series. Pump models consist of Gorman-Rupp T6A3-B and Gorman-Rupp T6a60-B. Both models of pumps have a 240 gpm at 52 feet capacity, a motor size of 40 HP, 60 HZ, 3 phase, voltage of 460, and 6-inch discharge. Influent is transported through a force main from the Woodland Manor Housing Complex. Discharge is facilitated by a 10-inch PVC Force Main that extends approximately 18,000 feet to its discharge manhole on Tiogue Avenue. The Town acquired this pump station from the Mapleroot Development Corporation in 2013 and now maintains both associated force mains. A 135 kW, 480Y/277 Volt, three-phase, four wire generator unit with 995 hours of operation is on standby generator is onsite to address potential power outages. The condition of the generator is poor with suggestions for improvement provided in the recommendations below. The pump station is also equipped with a 975-gallon Bioxide tank for odor control which is housed outside of the building. A flow meter station is also a part of the pump station complex and consists of a service entrance, control enclosure and meter manhole with a flow meter system manufactured by Thermo Scientific, model SX40 that is strapped to the force main in the manhole.

The Sandy Bottom Pump Station is located to the Northwest of Tiogue lake on Sandy Bottom Road. The pump station's elevation (199.00 at the bottom of the lower level) allows for service by gravity sewer for a large proportion of the Planning Area. The station receives flow from the interceptor on Tiogue Avenue, as well as the effluent from the Industrial Drive Pump Station. This consists of combined flow from Planning Areas 4, 5, 6, 23, 24, 26, 27, and 29. The pump station is equipped with four pumps and a wet well with a sewage grinder. A flow meter at the discharge measures wastewater flow from the facility. Discharge is facilitated by two 12-inch Ductile Iron Force Mains that extend approximately 2,500 feet to its discharge manhole adjacent to the intersection of Knotty Oak Road and Washington Street.

Arnold Road Pump Station and force main was installed in 1985 by the town to establish a service line to industrial complexes that resided on Arnold Road through funding by a grant from the Federal Department of Housing and Urban Development. Installation included a submersible pump station constructed on the premises of Cal Chemical Corporation along with installation of 1,200 feet of 4-inch diameter and 300 feet of 8-inch gravity sewer within Arnold Road along with a service connection to an adjacent property.
The Industrial Park Pump Station was created as part of the Town Annex and Town Hall Wastewater Collection Systems Improvements project in 2014. The pump station is located on Flat River Road and facilitates approximately 4,000 feet of force main from Town Hall and Town Hall Annex.

Further evaluation of these pump stations is not recommended in this planning cycle; however, flow meter calibration shall be completed for all of the Town's meters, as outlined below.

There are five (5) flow meters located on Coventry's collection system. The location of the flow meters are as follows:

- Sandy Bottom Road Pump Station Flow meter.
- Industrial Pump Station Flow Meter
- Woodland Manor Pump Station Flow meter.
- Hopkins Hill Flow Meter (Planning Area 7) – This flow meter is located in close proximity to the intersection of Clark Mill Road and Hopkins Hill Road on an 8-inch gravity main. It records flow from the facilities on the New London Turnpike including the Amgen Industrial Complex.
- Pulaski Street Flow Meter (Planning Area 14) – This flow meter is situated on Pulaski Street. It records the lion share of wastewater conveyed to the WWTF on the 30-inch PVC gravity main interceptor in close approximation to the Coventry – West Warwick town boundary.

The current configuration of the flow meters does not enable the town to account for all the wastewater flow generated by Coventry. Therefore, as previously mentioned, water use records are used as the method to estimate total wastewater flows from Coventry. Due to the multitude of sewer connection points between the shared Coventry – West Warwick town line, there is no feasible configuration of flow meters that would encapsulate total wastewater discharge to West Warwick. To prepare for the next planning cycle and prior to commencement of the next Facility Plan Update, all existing flow meters shall be calibrated and the resulting data will be compared to KCWA water usage records to verify general accuracy of meters.

The characteristics of wastewater generated by sewered, residential parcels are that of typical domestic wastewater. Major industrial discharge within the town comes from the biotechnical company Amgen Inc., located on Technology Way in West Greenwich, RI. Wastewater from the Amgen facility is conveyed through the force main on Hopkins Hill Road. Flow is conveyed to the interceptor on Tiogue Ave. Water consumption records from KCWA for 2021 indicate a daily average usage of 240,398 GPD. Flow from the Amgen facility is not counted toward the Town's allocation of flow to the WWTF as per the IMA and is instead accounted for through agreements with the Town of West Greenwich.

Noramco Coventry Reality LLC is a pharmaceutical production company located on Tiogue Avenue, which contributes approximately 800 GPD to the adjacent interceptor. As per the IMA between the Town and West Warwick, all Industrial users are billed in accordance with West Warwick's Sewer Ordinance.

There are no known wastewater bypasses or overflows located within the Town.

4.6.1.1 Wastewater Treatment Facilities

Coventry's wastewater is treated by the West Warwick Regional WWTF. The Town has secured a reserve capacity of 2.25 MPG of average daily flow in West Warwick's WWTF. The reserve capacity of 2.25 MGD average daily flow with West Warwick is greater than the 1,077,351 GPD projected average daily flow for the Selected/Recommended Plan and proposed developments. With selective development of new wastewater infrastructure recommended herein, the Town will be well within the range as specified in the IMA and below the 80% threshold requiring review of allocations and amendment of the IMA. As of 2021, the Town contributes approximately 0.3 MGD of average daily flow to West Warwick's WWTF, approximately 13% of its capacity allocation with West Warwick.

4.6.1.2 Collection System

A summary of past sewer infrastructure construction projects follows. The information for each project is based on record drawings provided by the Town. For those contracts where record drawings were not available, information from Weston & Sampson's 2016 Facilities Plan was used.

Hopkins Hill Road Sewer
The Hopkins Hill Road Sewer was constructed in 1989 by the town through a RIDOT road reconstruction project for the installation of sanitary infrastructure along Hopkins Hill Road to be put into use upon the completion of the Tiogue Avenue Interceptor and Pump Station. Installation began in Tiogue Avenue with total linear footage of infrastructure consisting of 850 feet of sewer between 18 and 24 inches in diameter. Within Hopkins Hill Road, 4,350 feet of sewer with diameters of 8, 10, 12, and 18 inches was installed. Service connections for all homes within the service area were installed.

North Road Terrace Sewers
The North Road Terrace Sewers was installed in 1985 in an effort to extend wastewater infrastructure to Old North Road. The project included construction of a submersible pump station and pipe installations of 3,100 feet of 6- and 8-inch sewer installed between Tiogue Avenue and property of the Coventry Housing

Authority. The project received funding from a grant provided by the Federal Department of Housing and Urban Development, along with connection to fronting properties.

North Branch Interceptor Sewer

The North Branch Interceptor Sewer was installed in 1985 by the town to extend services to industrial development on North Main Street. This project was funded by a grant from the Federal Department of Housing and Urban Development. Total linear footage of installation includes 200 feet of 15-inch sewer and 130 feet of 8-inch sewer from the New London Turnpike to the property of Victor Corporation. Service connections on adjacent properties were also installed during construction.

New London Turnpike Sewer

The North Road Terrace Sewer was installed in the early 1980's by the adjacent town of West Warwick for the purpose of extending service to industrial developments in West Greenwich. Total footage of pipe installation included 4,500 feet of 15-inch diameter pipe that connects to the Maisie Quinn Interceptor. Service connections on adjacent properties were also installed during construction.

Broad Street Sewer

Broad Street Sewer was installed by the adjacent town of West Warwick to extend services to Broad Street and Summit Avenue within West Warwick. Total linear footage of installation includes 1,950 feet of 18-inch sewer between North Main Street and Summit Avenue. Service connections on adjacent properties were also installed during construction.

Woodland Manor Pump Station and Force Main

The Woodland Manor Pump Station and force main was installed and managed in 1980 by the Mapleroot Development Corporation in order to extend connection to the developed Woodland Manor Housing Complex that resides on Nooseneck Hill Road. Since then, the town has acquired both the pump station and the forcemain. The pump station has a parallel pump configuration with a total of 4 pumps. The 10-inch force main extends a total of 19,360 linear feet running along Nooseneck Hill Road to the town line of West Warwick where it connects to the existing West Warwick System.

Contract 8904

The Town installed approximately 4,350 feet of 8-, 10-, 12- and 18-inch sewer main in Hopkins Hill Road and 850 feet of 18- and 24-inch sewer main in Tiogue Avenue during the reconstruction of Hopkins Hill Road (Contract 8904) performed by the Rhode Island Department of Transportation (RIDOT) between 1989 and 1991. Service connections were included for properties adjacent to the sewer line which was not activated until the completion of the Tiogue Avenue Interceptor and Sandy Bottom Pump Station projects (Contracts 03-01 and 03-02) in 2004.

Contract 03-01

Fast Track Sewer Interceptor Project (Contract 03-01) was constructed in 2004 by the Town to provide service to Washington Street and connect the previously constructed but inactive sewer line on Hopkins Hill Road to the Sandy Bottom Pump Station, being constructed concurrently. Two 12-inch ductile iron force mains provide connection from the Sandy Bottom Pump Station approximately 2,500 feet to the intersection of Washington Street and Knotty Oak Road. To pass under the South Branch of the Pawtuxet River, a depressed sewer was installed consisting of three DI pipes - one 16-inch and two 12-inch. From the force main, a 30-inch polyvinyl chloride (PVC) gravity sewer extends along Washington Street approximately 6,100 feet to Pulsaki Street. 24-inch PVC gravity sewer was also installed from the Sandy Bottom Pump Station to the west approximately 3,000 feet in Tiogue Avenue to connect the Hopkins Hill Road sewer to the system. This contract also included a flow meter installed in Pulaski Street to monitor flows from the Tiogue Avenue Interceptor into West Warwick.

Contract 03-02

Sandy Bottom Road Pump Station (Contract 03-02) was constructed in 2004 concurrently with Contract 03-01. The pump station was designed with separate dry and wet process areas, including sewage grinders in the wet well, a flow meter, and enhanced instrumentation and control (I&C) system. The dual 12-inch force main discharge pipes allow for variable design flow rates. The pump station is operated with two pumps that are equipped to handle the initial design flows and was designed to accommodate two additional pumps in order to handle the anticipated future capacity requirements.

Contract 03-03

Hopkins Hill Road Force Main Project (Contract 03-03) was constructed in 2006 by the Town to connect a force main from the West Greenwich Technology Park from the Coventry/West Greenwich town line to the gravity sewer on Hopkins Hill Road. From the West Greenwich town line, a 12-inch DIP force main runs approximately 2,500 feet before transitioning to an 8-inch DIP force main for approximately 970 feet to tie into the gravity sewer on Hopkins Hill Road.

Contract 4

Tiogue Avenue Sewer Project (Contract 4) was constructed in 2007 by the Town to extend services along Tiogue Avenue to Ramblewood Estates, a mobile home community in the Town, and several additional areas along the Tiogue Interceptor. An 18-inch PVC gravity sewer was extended from Tiogue Avenue approximately 2,900 feet to Morningside Drive

Contract 5

The Main Street Gravity Sewer Project (Contract 5) was constructed in 2008 by the Town to extend services to sections of Main Street (Route 117) by means of a gravity sewer connection to the Sandy Bottom Pump Station. Approximately 1,100 feet of 12-inch PVC gravity sewer was extended north along Sandy Bottom Road (Route 33) from the Sandy Bottom Pump Station, where it turned west and north through the property at 15 Sandy Bottom Road approximately 900 feet exiting between 1070 and 1076 Main Street. The 12-inch PVC gravity sewer then travels approximately 2,700 feet along Main Street to the west, in addition to an 8-inch PVC gravity sewer installed to the east for approximately 590 feet. The project included approximately 1,050 feet of 18-inch PVC from the Tiogue Interceptor in Sandy Bottom Road easterly along Tiogue Avenue to Idaho Street, and approximately 175 feet of 12-inch PVC gravity sewer south along Idaho Street. Sewer main installation in Tiogue Avenue halts at the intersection at Tiogue Avenue and Idaho Street where a 12-inch stub and end cap is installed. The project also included 8-inch PVC lateral pipe along several additional roads, including:

- Contentment Drive, 2,000 LF
- Boston Street, 1,675 LF
- Whitman Street, 75 LF
- Clearview Drive, 75 LF
- Johnson Boulevard, 550 LF (Formerly Contract 2008A)

Contract 6/6A
The Tiogue Lakeside gravity and low-pressure sewer system was constructed in 2012 by the Town of Coventry to provide service to the northwestern Tiogue Lake area.

The Lakeside Drive Area Sewer Project (Contract 6) was constructed in 2012 to expand sewer services to northwest Tiogue Lake and surrounding areas. Approximately 1,850 feet of 12-inch PVC gravity sewer was installed easterly along Tiogue Avenue from Idaho Street to approximately the Tiogue Dam. The residential neighborhood roads bordered by Tiogue Avenue to the north, Lakeside Drive to the south and Arnold Road to the west were installed with 12-inch PVC gravity sewer in Idaho Street to Montana Avenue, and along Montana Avenue between Arnold Road and Idaho Street. Approximately 3,375 feet 8-inch PVC sewer laterals were installed on Lakeside Drive, Alaska Street, Colorado Street, Idaho Street south of Montana Avenue, and Arizona Street. Contract 6A involved the construction of approximately 1,100 feet of 2-inch PVC low pressure sewer to extend service east of the Tiogue Dam towards Pilgrim Avenue.

Town Hall Annex and Town Hall Wastewater Collection System Improvements
Flat River Road and Industrial Drive Wastewater System Improvements was constructed in 2014 to extend services to Flat River Road, Main Street and Walker Lane. The construction also provides sanitary services to Town Hall and Town Hall Annex on Flat River Rod. The Industrial Drive pump station was constructed adjacent to Flat River Road to facilitate installation of force main. Wastewater pipe installation and diameter is as follows:

- 40 feet of 12-inch PVC pipe.
- 3,500 feet of 4-inch C900 PVC force main.
- 9,300 feet of low pressure SDR 21 pipe.
- 450 feet of 8-inch PVC pipe.

Contract 8-A
The Northern Arnold Road Sewer Project (Contract 8-A) was constructed in 2016 to extend service along Arnold Road. From Hazel Street, approximately 235 feet of 2-inch PVC LPS travels southerly towards Edith Street. From there, approximately 165 feet of 8-inch PVC gravity sewer was installed to Montana Avenue. From Dixie Road, approximately 1,450 feet of 2-inch PVC and 6-inch PVC forcemain travels northerly towards Overview Drive. From there, approximately 600 feet of 12-inch PVC gravity sewer was installed to Montana Avenue. At Montana Avenue and Arnold Road, a 12-inch PVC gravity sewer drop connection was extended 140 feet easterly along Montana Avenue to connect to the existing system by means of a core opening and an additional drop connection. Stub and end caps were included for each street adjacent to Arnold Road within the project area.

Contract 8-B
The Southern Arnold Road Sewer Project (Contract 8-B) was constructed in 2017 to extend service along Arnold Road to connect with adjacent roads. Numerous independent installations provide tie in points for property along Arnold Road and end in stub and end caps for adjacent roads within the project area.

Installations are as follows.

- From the conclusion of Contract 8-A at Dixie Street, 150 feet of 2-inch PVC LPS was installed that transitions to 140 feet of 8-inch PVC gravity sewer to Beach Street.
- From Cedar Tree Lane, approximately 170 LF of 8-inch PVC gravity sewer. Concludes with 8" PVC stub and end cap on Beach Street.
- Approximately 30 LF of PVC gravity sewer along Beechwood Street. Concludes with 8" PVC stub and end cap on Vale Street.
- Manhole installation on Arnold Road that concludes with stub and end cap on Forrest Street.
- Manhole installation on Acorn Street that connects to a manhole on Arnold Road with 8" PVC and ends with 8" PVC stub and end cap on Cook Street.
- Approximately 230 LF of 8" PVC that ends with a stub and end cap on Briar Point Avenue.
- Manhole installation on Grant Drive that connects to a manhole on Arnold Road with 8" PVC and ends with 8" PVC stub and end cap on Florida Avenue.
- Approximately 1,900 LF of 3" PS PVC along Arnold Road

Contract 8-C

Quidnick Village - Hazard Street Sewer Project (Contract 8-C) was constructed to extend service on Hazard Street. Approximately 1,315 feet of 8-inch PVC gravity sewer was installed along Hazard Street and connected into the Tiogue Avenue Interceptor on Washington Street. Stub and end caps were included on each street adjacent to Hazard Street within the project area.

4.6.2 Existing Flows

The existing sewer system within the delineated project areas was evaluated to assess the length of the wastewater infrastructure and the flowrate that is conveyed to the WWTF for treatment. The contribution from each Planning Area was evaluated for sewered and unsewered properties, resulting in delineation of existing and potential wastewater flow. The 2022 sewer billing data was used to map current public sewer use and to verify existing wastewater flow data. Kent County Water Authority (KCWA) water usage data from July 2021 to July 2022 was used to identify all users of the water distribution system. One year of billing data was used for flow estimation as it most accurately accounted for the contribution for new developments. As a conservative estimate, 100% of the water usage was assumed as sanitary waste load to the collection system.

A GIS database was established that assigned each property within the thirty-one (31) Planning Areas. The boundaries of these Planning Areas were delineated using existing census tracts and existing wastewater infrastructure. Each property within these Planning Areas was linked with its corresponding water usage data provided by KCWA through use of its address. KCWA account numbers and flowmeters with the same service addresses were consolidated into a single account that is the sum of all associated flow. The identified parcels from the 2022 sewer billing data provided by the Town established the basis for which parcels in our database are Sewered. Parcels with KCWA water usage data that were not identified by the 2022 sewer billing data are considered "non-Sewered".

Of the 7,700 accounts provided in the KCWA, a total of 490 are identified as "Sewered" by association with the 2022 sewer billing data. 97% of the accounts were verified between the Towns sewer billing database and the KCWA customer database. Increased water usage rates associated with multifamily dwellings are assumed to be accounted for in the KCWA water usage data. Vacant lots are not accounted for in the existing water consumption data as they contain no active flow data.

4.6.2.1 Existing Water Consumption Data Per Planning Area

Table 4.6.2.1.A summarizes the information of the existing flows generated by the Town for each Planning Area, as well as the total number of parcels associated with each Planning Area. A number of Planning Areas do not currently have any sewer infrastructure and as a result, show no Sewered Parcel Water Consumption Data.

Table 4.6.2.1.A
Summary of Existing Planning Area Water Consumption Data

Planning Area	Sewered Parcel Water Consumption (GPD)	Non-Sewered Parcel Water Consumption (GPD)	Number of Parcels
1	-	79,000	461
2	100	104,200	457
3	21,600	54,600	243
4	14,100	111,200	215
5	37,500	62,900	411
6	8,500	43,100	373
7	20,500	11,800	89
8	-	32,000	255
9	2,900	24,100	246
10	1,700	32,900	318
11	1,400	24,400	217
12	1,400	70,300	601
13	1,700	8,700	109
14	31,200	65,400	281
15	9,100	36,300	418
16	1,600	40,600	389
17	-	60,600	529
18	500	56,300	491
19	1,300	6,700	236
20	600	80,300	476
21	20,000	42,700	473
22	-	47,500	259
23	800	25,400	170
24	7,900	55,400	388
25	3,800	5,900	76
26	11,700	35,700	395
27	14,500	4,900	102
28	11,600	12,100	125
29	7,200	6,300	146
30	13,600	5,800	96
31	28,800	8,800	129
Outside of Planning Areas	3,300	107,500	291

Table 4.6.2.1.B summarizes the total contribution to the collection system with water usage and I&I, including Sewered parcels. This value was determined by summation of KCWA water usage data for all sewered properties.

Table 4.6.2.1.B
Summary of Total Water Consumption Data

	Sewered Parcel	Non-Sewered Parcel
Average Water Consumption Per Day (GPD)	278,900	1,363,400
I&I (GPD)	57,000	-

4.6.2.2 Inflow and Infiltration

Inflow and Infiltration was assessed using RIDEM's Flow Estimation Policy for Design of Sanitary Sewers allocating a design flow of 250 gallons per day per inch diameter mile (GPD/idm) of gravity mains were considered, and because Coventry's sewers are relatively new, the low end of the 250-500 range was used. Leakage points on Force Mains would contribute to exfiltration due to the pressure gradient, so force mains were not considered in the I/I estimation. **Table 4.6.2.2.A** provides a summary of the existing collection system per pipe diameter. No SSES or I&I Reduction program has been completed within the Town, in large part to the relatively recent construction of their wastewater system.

Table 4.6.2.2.A
Summary of Existing Collection System Composition

Pipe Diameter (inches)	Gravity Sewer (feet)
6	1,400
8	35,600
10	700
12	18,600
15	10,800
16	200
18	9,600
24	3,500
30	8,600
Total	89,000

Table 4.6.2.2.B summarizes the existing Inflow and Infiltration calculated using the existing lengths in **Table 4.6.2.2.A** and the design flow of 250 GPD/idm as designated by RIDEM's Flow Estimation Policy for Design of Sanitary Sewers.

Table 4.6.2.2.B
Summary of Daily I&I

Pipe Diameter (inches)	Gravity Sewer I&I (GPD)
6	400
8	13,500
10	300
12	10,600
15	7,700
16	200
18	8,200
24	4,000
30	12,100
Total	57,000

5 Future Needs Assessment

5.1 Land-use Forecast

Historic land usage in Coventry is a product of its past with textile manufacturing. Industry has resulted in centralized urban and suburban buildup east of Johnson Pond, encompassing approximately a third of the town's area. The western two thirds of the town is undeveloped agricultural land and forest scattered with low population density residential land use. The State of Rhode Island's land development plan (Land Use 2025, State Guide Plan Element 121) is to maintain distinct boundaries between rural and urban developments to preserve rural communities and historical agricultural lands, while also taking advantage of the existing infrastructure that has been developed in urbanized areas. This sentiment is reflected in the residents of the Town based on feedback received during the development of the town's updated CCP.

Future land development for the town will follow the sentiment of division between urban and suburban land usage. Opportunities for commercial growth along Route 3 are available if supporting municipal infrastructure is developed. Planning areas were developed to focus on this urban and suburbanized eastern portion of the town in consideration of the population density of these areas. A full built-out analysis of the Town which assesses maximum potential development can be found in the CCP document which is undergoing a major update in concurrence with the development of this report.

5.2 Demographic Forecast

The Town's population at the 2020 census was estimated at 35,688 individuals. Historically, the population increase in the late 1900s and early 2000s was driven by expansion of suburban development concentrated within the eastern areas of the Town. Between 1970 and 1990 a slow increase in suburban flight was shown as suburban populations migrated towards the western rural subdivision of the town (*Coventry Comprehensive Plan, Rev 2000).* The push towards rural migration is projected to continue as changes in remote workplace policy and adverse weather events due to climate change are predicted to continue to pull populations from suburban and coastal developments in favor of rural communities.

Projected population trends show an increase in total population of approximately 10% within the next 20 years (**Table 5.2.A**). Projected increases in population for the Town contrast with that of the modest decline in population projected for the State of Rhode Island for 2035-2040, driven mostly by ageing population and net migration out of the state *(RISPP Rhode Island Population Projections 2010-2040, 2013).* Socioeconomic forecast is to be added after coordination with BETA regarding their findings for the CCP document that is being developed in tandem with this report and is to be completed at the anticipated date of May 2023.

Table 5.2.A
Summarized Historical Population Data and Future

Year	1970	1980	1990	2000	2010	2020	2030	2040
Population	22,947	27,065	31,083	33,638	35,014	35,688	38,037	39,172
% Increase From Previous Year	-	17.9%	14.8%	8.2%	4.1%	1.9%	6.6%	3.0%

* Projections Data taken from State of Rhode Island Division of Statewide Planning "Overview of Rhode Island Population Projections 2010-2040".

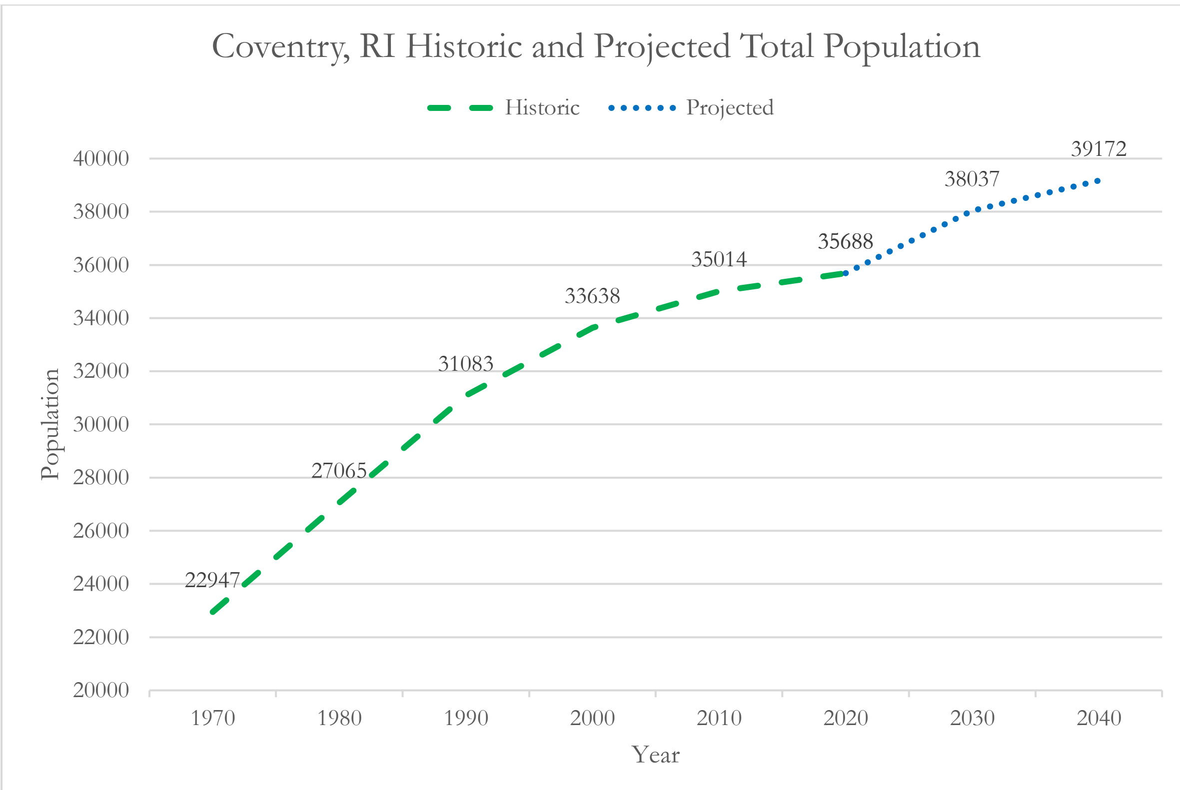

Figure 5.2.A: Historical Population Data and Future Projections

5.3 Forecasted Flows

Assessing forecasted flows informs the development of alternatives used to determine areas for prioritized future sanitary infrastructure build up locations. Future flows were evaluated on two separate projections, Projected Wastewater Flows for the 20-Year Planning Period, and Maximum Residential Wastewater Flow Potential. Inflow and Infiltration was also evaluated with existing and future installations in mind. Projections were based on a twenty-year planning period to 2040 incorporating property zoning information and projected commercial and industrial growth projections provided by the Town.

The RIDEM Office of Water Resources (OWR) Flow Estimation Policy for Design of Sanitary Sewers guidelines will be used to dimension sewer extensions.

5.3.1 Projected Wastewater Flows for the 20-Year Planning Period Wastewater Flows

Projected Wastewater flow for the 20-Year Planning Period incorporates the build out of all residential properties that do not have KCWA water usage data, and a flow projection based on TR-16 guidance of 70 GPD per capita flow for residential flows from new collection systems. The average persons per household for the town is 2.46 as per 2021 ACS Census data resulting in design flow of 172 GPD. This provides a build-out scenario in which all residential properties are contributing to our projection, whether they are currently developed as of the time of this report or not. Commercial and Industrial zoned lots are equal to their associated flow as per the KCWA water usage data. Commercial and Industrial zoned lots that do not have KCWA water usage data were maintained as noncontributing units unless otherwise noted as planned/potential developments. **Table 5.3.1.A** summarizes the total Projected Wastewater Flow for the 20-Year Planning Period for all properties within their associated Planning Area.

This projection includes flows associated with future developments. Future developments account for projected population increases and include the following:

- Sewer system connection from the town of East Greenwich to the interceptor on the New London Turnpike and Route 95 South off-ramp at Exit 7. This connection will service 410 mixed use residential properties and have an average daily flow allocation of 150,000 GPD. This flow is associated with Planning Area 7.
- A mixed-use development which includes 168 residential units will be constructed at the intersection of Hill Farm Road and Harkney Hill Road with a projected average wastewater average daily flow of 52,520 GPD. This flow is associated with Planning Area 3.
- Additionally, an independent living facility is planned to be constructed on the New London Turnpike that will be equipped with 202 residential units with average daily flow of 34,750 GPD approximated using a 172 GPD design flow for residential unit. An alternative concept for this parcel consists of seven 3-story residential complexes with 168 units and a projected average wastewater flow of 28,900 GPD. The higher of the two concepts (34,750 GPD) was used for projection of future flow rates. This flow is associated with Planning Area 10.
- A newly constructed Scrubadub Carwash will be located on 2305 New London Turnpike. The expected average daily wastewater flow from this facility is 7,820 GPD. This flow is accounted for in the Commercial Projected flows. This flow is associated with Planning Area 7.
- The West Greenwich Apartment Complex is a residential development planned to be constructed in the Centre of New England. This facility will include 225 units with a total of 467 bedrooms. The generated wastewater average daily flow is expected to be 53,705 GPD. It is anticipated that this facility will tie into the existing interceptor located on the New London Turnpike. This flow is associated with Planning Area 7.
- A 48-unit apartment complex is planned to be constructed at the intersection of 100 Viero Lane and Northwest of Woodland Drive as Phase 3 for the Woodland Manor Development. Projected average daily wastewater flow from the complex is 8,256 GPD. This flow is associated with Planning Area 3.

Build out of all Planning Areas is not the goal of this study, however this information will prove pertinent in informing which Planning Areas to focus development through assessing their potential wastewater contribution on an individual basis.

Table 5.3.1.A
Projected Planning Area Wastewater Flows

Planning Area	2040 Projected Wastewater Flows (GPD)
1	99,300
2	107,500
3	113,700
4	88,200
5	94,300
6	50,200
7	234,100
8	34,300
9	29,600
10	78,900
11	26,800
12	79,800
13	13,600
14	52,800
15	56,500
16	58,000
17	81,900
18	67,700
19	15,200
20	89,200
21	72,600
22	50,600
23	28,400
24	63,000
25	7,500
26	53,400
27	14,500
28	18,900
29	15,700
30	88,600
31	41,200
Total	1,926,000

Table 5.3.1.B provides a summary of all Zoning types and I&I for a comprehensive review of the total wastewater flow to the collection system for the 20-year planning period if sanitary infrastructure is fully extended to each Planning Area. This includes a summation of all projected flows in **Table 5.3.1.A**, including

Industrial and Commercial flows of all associated properties as per the KCWA water usage data between the dates July 2021 and July 2022, planned developments, and projected I&I contribution for full buildup outlined in S**ection 5.3.2.**

Table 5.3.1.B
Projected Wastewater Flows for All 31 Planning Areas

Zoning Area	Projected 2040 Wastewater Flow (GPD)
Residential	1,737,000
Industrial	71,600
Commercial	117,400
Average Projected Average Daily Flow	1,926,000
I&I	486,000

5.3.2 Inflow and Infiltration Evaluation

Inflow and Infiltration was projected over the 20-year projection period by accounting for the additional I&I contribution from installation of additional wastewater infrastructure for maximum build out of each Planning Area. Total length of unsewered road was calculated for each Planning Area individually. For properties that are public water customers outside of the Planning Areas, the roads leading to those properties from the nearest Planning Area was used. **Table 5.3.2.A** provides a summary of the total lengths of existing roadway that requires installation of sanitary infrastructure to project maximum buildout.

Table 5.3.2.A
Summary of Existing Road Length and Existing Sewer Length

Planning Area	Total Road Length (feet)	Existing Sewer Piping (feet)	Unsewered Roadway (feet)
1	38,200	800	37,400
2	47,700	6,300	41,400
3	42,300	8,100	34,200
4	30,200	11,300	19,000
5	33,000	6,700	26,300
6	28,000	7,800	20,200
7	36,200	3,500	32,700
8	20,100	800	19,400
9	17,800	3,600	14,200
10	22,800	5,000	17,900
11	13,800	4,800	9,100
12	38,400	3,500	35,000
13	8,600	3,300	5,400
14	19,900	4,100	15,900
15	31,000	6,700	24,300
16	35,100	1,400	33,800
17	45,300	0	45,300

Planning Area	Total Road Length (feet)	Existing Sewer Piping (feet)	Unsewered Roadway (feet)
18	35,500	0	35,500
19	19,700	800	19,000
20	40,300	0	40,300
21	47,300	8,600	38,700
22	20,200	0	20,200
23	18,300	1,000	17,300
24	48,200	7,700	40,600
25	35,000	8,300	26,800
26	31,800	6,300	25,500
27	10,600	6,400	4,200
28	16,700	9,700	7,100
29	11,300	10,400	1,000
30	9,900	4,600	5,400
31	12,000	2,900	9,100
Outside of Planning Areas	37,000	3,100	33,900
Total (feet)	902,200	147,500	756,100
Total (miles)	171	28	143

Table 5.3.2.B provides a summary of the projected I&I Increase that would occur per Planning Area if sanitary sewer was installed on the entire length of unsewered roadways. Gravity mains were assumed to be entirely 12-inch diameter. A design flow of 250 GPD/idm was assigned to the projected piping as per the RIDEM Flow Estimation Policy for Design of Sanitary Sewers Guidance Standard.

Table 5.3.2.B
Summary of Projected Planning Area I&I Increase

Planning Area	Projected I&I Increase (GPD)
1	21,300
2	23,500
3	19,500
4	10,800
5	15,000
6	11,500
7	18,600
8	11,100
9	8,100
10	10,200
11	5,200
12	19,900
13	3,100
14	9,000

Planning Area	Projected I&I Increase (GPD)
15	13,900
16	19,200
17	25,800
18	20,200
19	10,800
20	22,900
21	22,000
22	11,500
23	9,900
24	23,100
25	15,300
26	14,500
27	2,400
28	4,100
29	600
30	3,100
31	5,200
Outside of Planning Areas	17,700
Existing I&I	57,000
Total (GPD)	486,000

5.3.3 Summary of Flows for Selected/Recommended Plan

Table 5.3.3.A provides the projected wastewater flow for the Selected/Recommended Plan, including planned developments, residential, commercial, and industrial flows with associated I&I as depicted in **Table 5.3.2.B**. Wastewater flow projected from the Selected/Recommended Plan results in an average daily flow increase of approximately 350,500 GPD. This projected flow was summed with the existing average water consumption (278,900 GPD), existing and projected I&I, and the anticipated flow contribution from future planned developments. This resulted in a projected Average Daily Flow of 1,077,351 GPD to be conveyed to West Warwick through summation of the total average daily flow. Table 5-2 from West Warwick's approved 2012 Wastewater Facility Plan depicts an average daily flow reserve of 2.25 MGD and peak daily flow reserve of 4.275 MGD. Average Daily Flow depicted in the table below are below these thresholds, as well as the 80% threshold for IMA amendment. Pursuant to TR-16 Figure 2-1 Ratio of Extreme Flow to Average Daily Flow was calculated using a peaking factor of 2.25, applied to the projected average daily flow.

Table 5.3.3.A
Projected Wastewater Flows Summation

Existing Wastewater Flow	
Flow Contribution	**Wastewater Flow (GPD)**
Current Average Water Consumption Per Day for Sewered Parcels[1]	278,900
Subtotal For Existing Wastewater Flow	**278,900**
Projected Flow for Selected/Recommended Plan	
Flow Contribution	**Wastewater Flow (GPD)**
Planning Area 1	99,300
Planning Area 2	107,500
Planning Area 8	34,300
Planning Area 9	29,600
Planning Area 12	79,800
Subtotal for Selected/Recommended Plan[2]	**350,500**
Pending/Proposed Developments	
Flow Contribution	**Wastewater Flow (GPD)**
East Greenwich New London Turnpike Tie In (Planning Area 7)[3]	150,000
Coventry Crossing Development (Planning Area 3)[4]	52,520
New London Turnpike Development (Planning Area 10)[5]	34,750
2305 New London Turnpike Scrubadub Carwash (Planning Area 7)[6]	7,820
Centre of New England West Greenwich Apartment Complex (Planning Area 7)[7]	53,705
Woodland Manor Development Phase III (Planning Area 3)[8]	8,256
Subtotal for Planned Developments	**307,051**
Current Inflow and Infiltration Allocation - Existing Collection System[9]	**57,000**
Projected Inflow and Infiltration Allocation - Selected/Recommended Plan[9]	**83,900**
Total Projected Average Daily Flow[10]	**1,077,351**
Total Projected Max Day Flow[10,11]	**2,424,039**

Notes:
1.) Wastewater Flow is based on 2021 Kent County Water Authority water records for all those properties connected to public sewer.
2.) Projected wastewater flow for the Selected/Recommended Plan assumes 2.46 persons per household (2021 ACS Census) and allocation of 70 GPD per person for residential properties. This results in a design flow of 172 GPD per residential property. Commercial and Industrial zoned lots are equal to their associated flow as per the KCWA water usage data.
3.) Wastewater flow provided in memorandum to Coventry Sewer Subcommittee Dated September 12, 2022.
4.) Wastewater flow provided by Sam Hemenway of Garofalo Associates dated October 11, 2022.

5.) Flow based on Capstone Prosperities Preliminary Planning Approval Record provided by the Town on November 22, 2022. Projected wastewater flow assumes Concept No. 1 - Willow Lakes Independent Living Facility will be constructed. Assumed to be 202 units will a design flow of 172 GPD.
6.) Wastewater flow provided by Joseph J. Levesque P.E., Town Engineer in email dated July 14, 2023, and as presented by the prospective developer.
7.) Wastewater flow provided by Joseph J. Levesque P.E., Town Engineer in email dated July 7, 2023, and as presented by the prospective developer.
8.) Pursuant to Weston and Sampson memo dated March 19, 2021, Woodland Manor Phase III development is comprised of 48 apartment units. Projected average daily wastewater flow assumes 172 gpd per apartment unit.
9.) Inflow and Infiltration allocation is based on 250 gallons per day (GPD) per inch diameter mile of existing and proposed gravity sewer mains. This criterion is for dimensioning of sewer lines and not flow projections for the purposes of determining capacity allocation with West Warwick.
10.) Table 5-2 from West Warwick's approved 2012 Wastewater Facility Plan depicts an average daily flow reserve of 2.25 MGD and peak daily flow reserve of 4.275 MGD. Both numbers depicted in the table above are below these thresholds, as well as the 80% threshold for IMA amendment.
11.) Pursuant to TR-16 Figure 2-1 Ratio of Extreme Flow to Average Daily Flow, a peaking factor of 2.25 has been applied to the projected average daily flow.

5.3.4 Collection System Dimensioning

For collection system dimensioning design, a flow of 300 GPD for residential parcels will be used pursuant to the RIDEM OWR Flow Estimation Policy. This will be used in tandem with current KCWA data for industrial and commercial parcels.

5.3.5 Projected Waste Loading

The waste loading allowance as per the 1999 IMA with the Town of West Warwick permits 4,700 pounds per day of BOD & total suspended solids. Existing waste loads were calculated using the existing flow data from **Table 5.3.1.B**. **Table 5.3.5.A** displays the waste loading for full buildout of all Planning Areas, while **Table 5.3.5.B** displays waste loading associated with the Recommended/Suggested Planning Areas.

Design flows are as follows:

- Residential BOD for Untreated Domestic Wastewater: 200 mg/L as per Metcalf & Eddy medium strength concentration for untreated domestic wastewater
- Residential TSS for Untreated Domestic Wastewater: 195 mg/L as per Metcalf & Eddy medium strength concentration for untreated domestic wastewater
- Industrial TSS & BOD is to be pretreated to Untreated Domestic Wastewater quality: 250 mg/L (each) as per the West Warwick Facility Plan assuming pretreatment to compliant municipal influent wastewater quality
- Commercial TSS & BOD for Untreated Domestic Wastewater: 165 mg/L as per the West Warwick Facility Plan

Table 5.3.5.A
Waste Loading Projections For Full Buildout of All Planning Areas and Planned Developments

Zoning Area	Projected 2040 Wastewater Flow (GPD)[1]	Projected 2040 BOD Waste Loading (LBS/DAY)	Projected 2040 TSS Waste Loading (LBS/DAY)
Residential	1,737,000	2,900	2,830
Industrial	71,600	230	230
Commercial	117,400	170	170
Total	**1,926,000**	**3,300**	**3,230**

Notes:
1.) Projected 2040 Wastewater Flow does not account for infiltration.

Table 5.3.5.B
Additional Waste Loading Projections For The Selected/Recommended Plan and Planned Developments

Zoning Area	Projected 2040 Wastewater Flow (GPD)[1]	Projected 2040 BOD Waste Loading (LBS/DAY)	Projected 2040 TSS Waste Loading (LBS/DAY)
Residential	653,400	1,100	1,070
Industrial	2,800	10	10
Commercial	1,400	10	10
Total	**657,600**	**1,120**	**1,090**

Notes:
1.) Projected 2040 Wastewater Flow does not account for infiltration.

5.4 Climate Change and Resiliency

With the growing increase in storm frequency and intensity, wastewater design guidance has been updated to ensure existing and proposed infrastructure is resilient and better prepared to withstand the effects from severe weather events and expected climate change. Impacts include, but are not limited to, increases in frequency and severity of precipitation events, flooding, storm surge, wave action and sea level rise concerns. RIDEM has recognized the need to begin integrating climate change considerations into wastewater system planning and design, and through their Office of Water Resources, has issued a guidance document titled Guidance *for the Consideration of Climate Change Impacts in the Planning and Design of Municipal Wastewater Collection and Treatment Infrastructure.*

The guidance document builds on the recommendations in "*TR-16" Guide for the Design of Waste Treatment Works* issued by the New England Interstate Water Pollution Control Commission. RIDEM seeks at a minimum the protection of systems from:

- Interruptions in operations at Base Flood Elevations, or equivalent, as discussed below; as well as
- Damages to structural and electrical integrity at Base Flood Elevations, or equivalents, as discussed below, with an additional two feet of freeboard for non-critical structures and systems and three feet for critical structures and systems.
- These protections will be achieved to the maximum extent practicable as determined by cost-benefit analyses.

The following subsections provide a review of FEMA's regulatory Flood Insurance Rate Maps (FIRM) to document the existing flooding relative to existing pump stations throughout the collection system.

5.4.1 Woodland Manor Pump Station

The Woodland Manor Pump Station lies well outside of the perimeter of any flood hazard zones. **Figure 5.5.1.A** displays the National Flood Hazard FIRMette map for the area surrounding the Woodland Manor Pump Station.

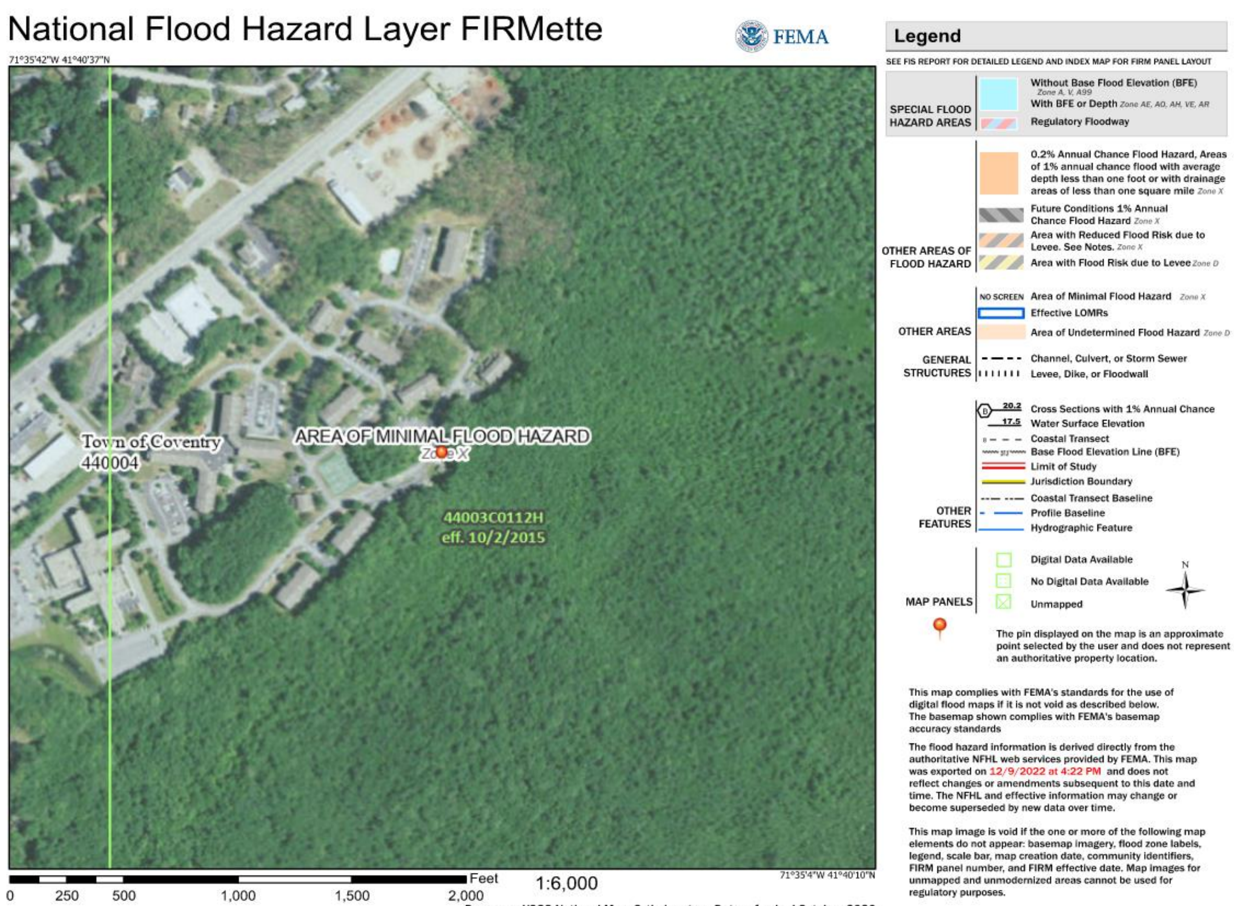

Figure 5.4.1.A: Woodland Manor Pump Station FIRM Map

5.4.2 Sandy Bottom Pump Station

The Sandy Bottom Pump Station is in close proximity to the 500 Year Flood Hazard Area of the South Pawtuxet Branch River. **Figure 5.4.2.A** displays the National Flood Hazard FIRMette map for the area surrounding the Sandy Bottom Pump Station.

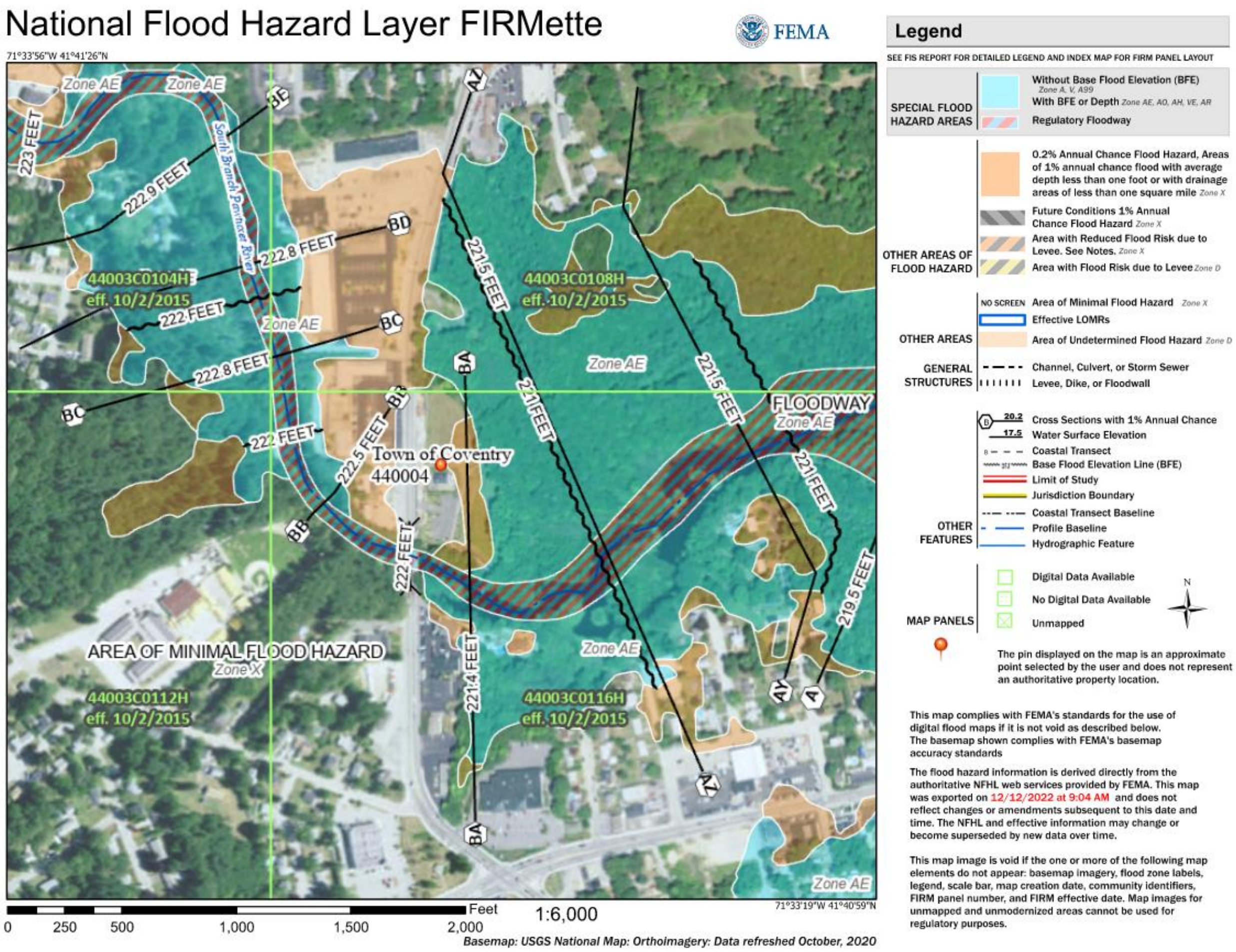

Figure 5.4.2.A: Sandy Bottom Pump Station FIRM Map

5.4.3 Industrial Drive Pump Station

Industrial Drive Pump Station is located to the North of the Pawtuxet River South Branch on Main Street. The Industrial Drive Pump Station lies within close proximity to the flood hazard area as depicted in **Figure 5.4.3.A**.

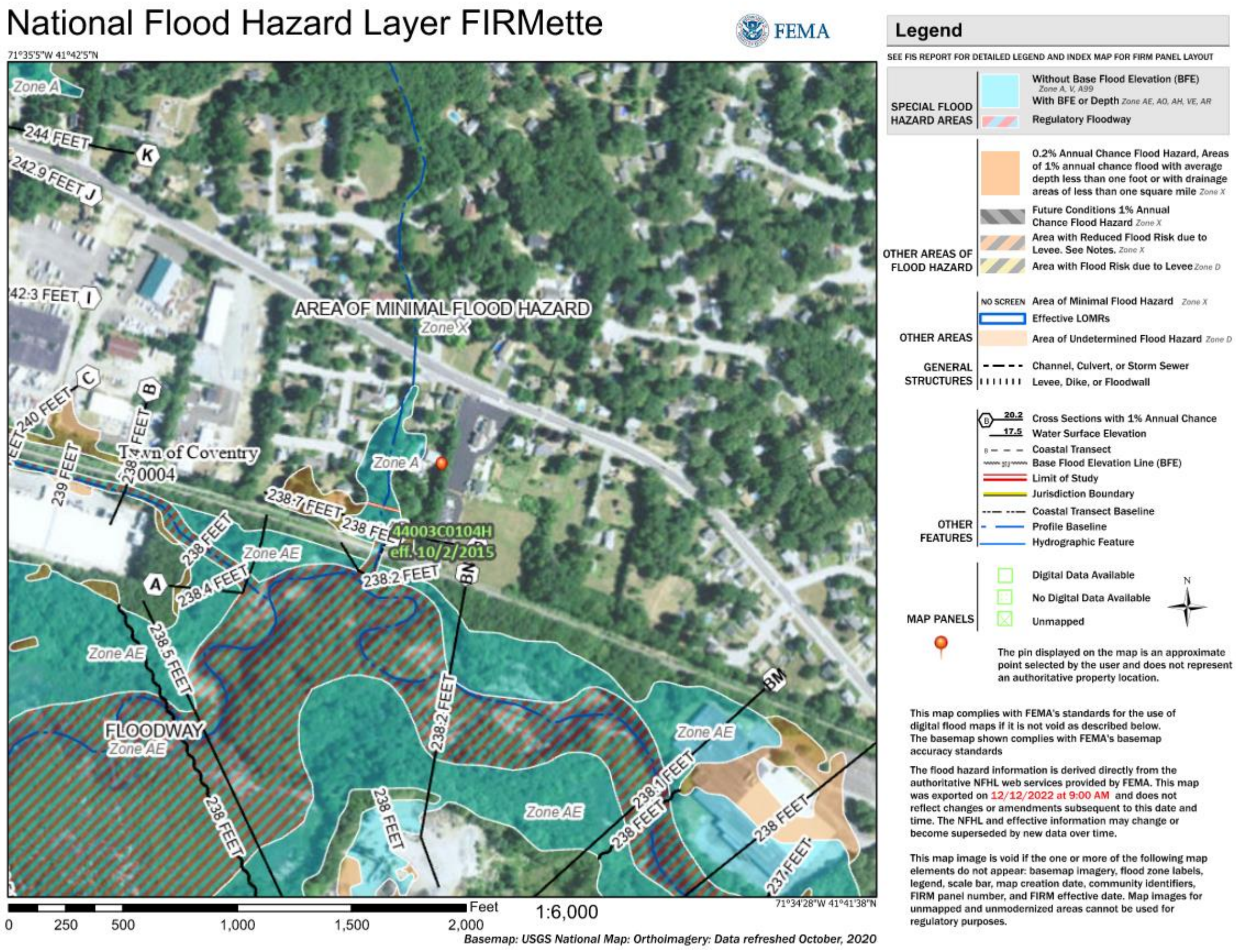

Figure 5.4.3.A: Industrial Drive Pump Station FIRM Map

5.4.4 Arnold Road Pump Station

The Arnold Road Pump Station is a submersible duplex pump station located within the property line of the Cal Chemical Corporation. The Arnold Road Pump Station lies well outside of the perimeter of any flood hazard zones. **Figure 5.4.4.A** displays the National Flood Hazard FIRMette map for the area surrounding the Arnold Road Pump Station.

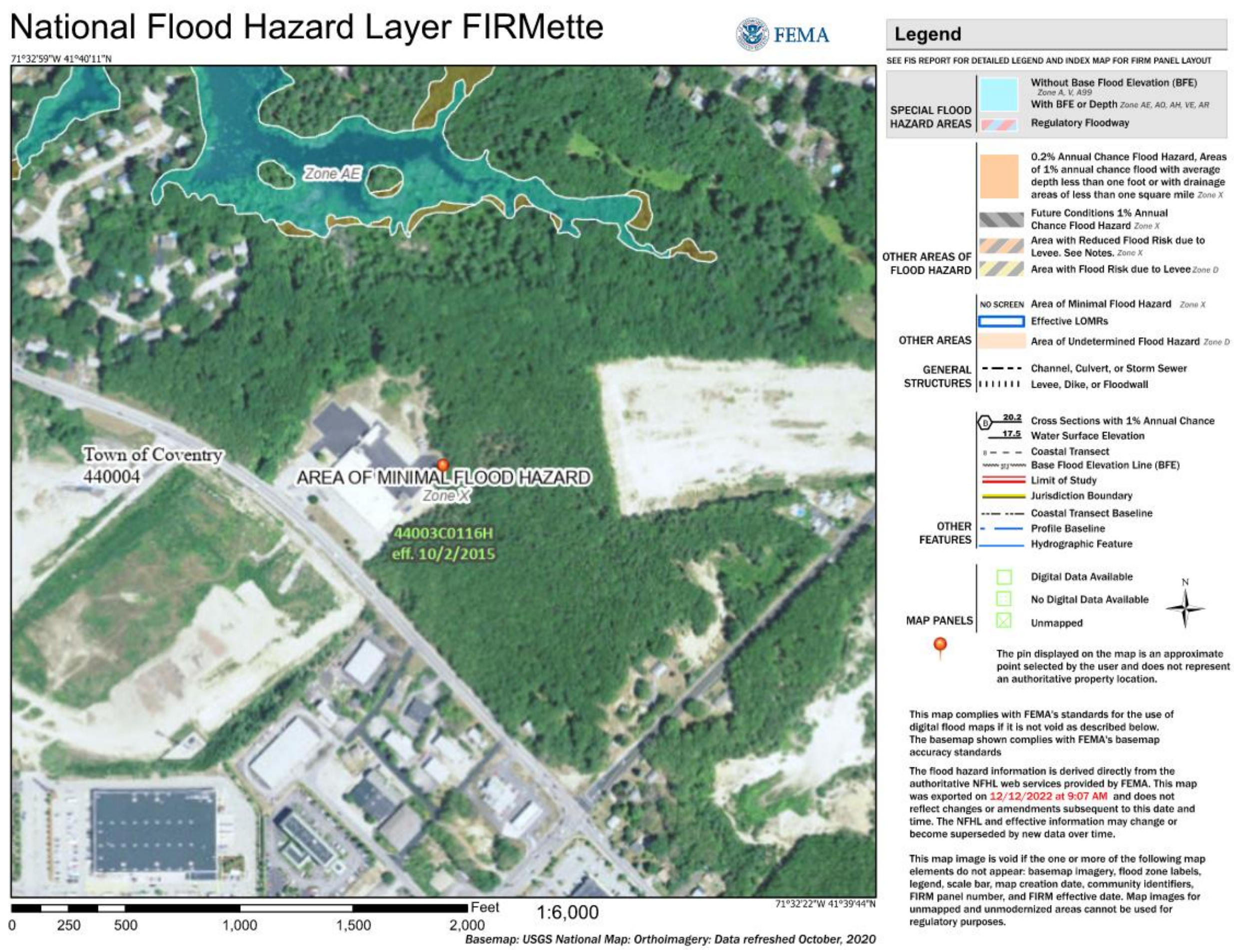

Figure 5.4.4.A: Arnold Road Pump Station FIRM Map

6 Planning Area Evaluation and Prioritization

Planning area evaluation and prioritization is based on a matrix system in which concern categories were assessed for each Planning Area. A matrix rank distribution scale for each concern category was created to assign Planning Areas a ranking score. Higher scores are indicative of an increased need for sanitary sewer infrastructure. Total scores for each concern category were summed to create a final prioritization ranking table. These rankings are the primary determinate of priority for the installation of sewer infrastructure as they quantify which Planning Areas would derive the most benefit from elimination of conventional OWTS use. Concern categories and rank distributions are summarized below.

6.1 Environmental Impacts

Proximity to Impacted Waterbody
Planning areas were evaluated based on the percentage of their parcels that are within a 200-foot buffer surrounding all water bodies as defined by the Pond and Lakes data set provided by the online database Rhode Island Geographic Information System (RIGIS). Any parcel that was fully or partially encompassed by the boundaries of this buffer contributing towards that Planning Area's percentage of parcels within the buffer's boundaries. A conservative estimation was made for partially encapsulated parcels, as any point on a given property has potential to hold the OWTS. Total parcel count for each Planning Area and parcel count within the 200-foot buffer boundary for each Planning Area were used to calculate percentage of Planning Area within the boundary and used as the determinate for the individual Planning Area's rank. **Figure 6.1.A** depicts the 200-foot buffer zone within the boundaries of the Planning Area.

Proximity to Wetlands
Planning areas were evaluated based on their total percentage of wetlands land area. Wetland land type was defined by the Wetlands (1993) data set provided by RIGIS. The total area of each PA and total area of wetlands land type for each PA was used to calculate percentage of each Planning Area with wetlands land type and used as the determinate for the individual Planning Area's rank. All types of wetlands were considered within percentage area wetland land type, including areas within the boundaries of the Planning Area in which the greater wetlands extend past the perimeter of the Planning Area. **Figure 4.2.2.A** depicts wetlands area within the boundaries of the Planning Area.

Table 6.1.A
Summary of Environmental Impacts Matrix Rank Distribution

Matrix Rank	Percentage Parcels Within 200 Feet of Water Body	Wetland Land Type Percentage
5	7.2-9.0%	8.1-10.0%
4	4.1-7.2%	6.1-8.1%
3	3.6-5.4%	4.1-6.1%
2	1.8-3.6%	2.1-4.1%
1	0-1.8%	0.0-2.1%

6.2 Affordability

Census Tract Median Household Income
Borders for Planning Areas were defined around census tracts, allowing each Planning Area to confine in its entirety within one census tract. This allows for each Planning Area to be assigned an individual census tract and be accurately associated with the census information. A total of five census tracts bound the thirty-one (31) Planning Areas. Median Household Income was found for each tract using information from the 2020 American Community Survey 5 Year Estimate of Income (ACS). The five median incomes were ranked based on sum and used as the determinate for the individual Planning Area's rank. Lower median income was ranked higher within the matrix because of the increased availability of funding opportunities. There is potential for RIIB SRF funding forgiveness for those Planning Areas that have a household median income that is less than the State of Rhode Island's median household income. **Figure 2.2.B** depicts census tract boundaries and provides census tract and State of RI income summaries.

Potential Use of ARPA Funding Sources
The American Rescue Plan Act (ARPA) is a stimulus bill with a total monetary sum of $1.9 trillion USD. Of this sum, $350 billion is to be distributed to assist state and local governments recover from financial shock brought upon by the Covid 19 pandemic. This funding is also available to invest in utility infrastructure. One of the projects that is currently being considered by the Town Council for the use of ARPA funds is the Briar Point Sewer Extension and the proposed Briar Point Pump Station (PA 9). Given grant funding could imminently become available, this category was given an adjusted matrix ranking scale (10 – 0), which was distributed solely to Planning Area 9, placing PA 9 at the top of the priority ranking. If this risk matrix category were to be omitted, Planning Area 9 Comment would be placed at rank 7 in the overall evaluation matrix.

Approximate Cost to Construct Sewers
Planning areas were evaluated based upon approximate cost to construct sewers based on the linear footage of unsewered roadway encompassing that Planning Area. The length of road that lies on the border between two Planning Areas was added to the total sum of each Planning Area to allow for independent evaluation. It was assumed for the purpose of this evaluation that to achieve buildout of a Planning Area, all unsewered roads would require installation of sanitary pipes. The total length of unsewered street was divided by the total number of parcels for each Planning Area to find length of unsewered roadway per parcel. The percentage difference of the average length of roadway per parcel of the Planning Area was used as the determinate for the individual Planning Area's rank.

Pump Stations Required
The factor that determines the necessity for a pump station is the elevation gradient along the roadways within the Planning Area, and the elevation of sewer infrastructure. Manual determination of the necessity for an additional pump station was performed by evaluation of 10-foot contour maps provided by RIGIS. The applicability of gravity, force main, and low-pressure sewer infrastructure was considered for each Planning Area. Planning areas that were identified as potentially needing a pump station for wastewater conveyance received a higher matrix score as they would have a higher project capital cost. As note, this analysis was not a full determination of the needs of each Planning Area, but instead a review of the general trends of elevation gradients to identify potential Planning Areas of concern. A full evaluation is needed to determine the precise composition of sanitary infrastructure to develop each Planning Area.

Proximity of Existing Infrastructure
Planning areas were evaluated based on the infrastructure that would be required to connect to the existing collection system. The evaluation is based on connection to any of the multiple interceptors that flow to the West Warwick Treatment Facility (WWTF). This is significant as each Planning Area is independently evaluated, and a high priority Planning Area may have additional costs associated with its build-out if it is relatively far away from existing infrastructure. Three categories were established for determination of rank distribution, the highest being a Planning Area adjacent to existing infrastructure, a medium score for Planning Areas one Planning Area away from existing infrastructure, and the lowest for those areas two or more Planning Areas away from existing infrastructure. A map of the Planning Areas was manually evaluated to assign a score to each Planning Area based on this distribution. **Figure 2.2.A** depicts existing wastewater infrastructure within the town alongside Planning Areas.

Depth to Bedrock
Construction of wastewater infrastructure through bedrock has a significant impact on cost as excavation requires increased time and is facilitated by specialized machinery. Shallow bedrock also limits the function of OWTS by posing risks of septage contamination of groundwater. Areas that have the potential for shallow bedrock were evaluated per Planning Area. Potential areas of shallow bedrock were computed using a surface elevation raster derived from 10-foot Contour Lines taken from RIGIS and an altitude of bedrock raster that was developed using point data from the Data Release for Depth to Bedrock from Rhode Island Water Resources dataset from USGS. Point data consisted of depth to bedrock altitudes and bottom of well altitudes which was used to produce a surface layer that consists of interpolated elevations derived from all known altitudes that are above bedrock within the Planning Area. Interpolated bedrock depths were subtracted from surface elevations and areas in which the difference between depths was less than 10 feet were considered areas with potentially shallow bedrock. 10 feet was chosen as a conservative estimation of sanitary pipe installation depth. The percentage of potentially shallow bedrock areas that encompasses each Planning Area was calculated and an average was established as the determinate for the individual Planning Area's rank. **Figure 6.2.A** depicts potential areas of bedrock under 10-feet in depth within the boundaries of the Planning Area.

Table 6.2.A
Summary of Affordability Matrix Rank Distribution

Matrix Rank	Median Income Level of Census Tract	Pump Stations Required	Proximity to Existing Sanitary Infrastructure	Depth to Bedrock
5	$58,769	None	Existing WW Infrastructure	> -75%
4	$61,250	-	-	> -25%
3	$70,305	-	Adjacent to Existing WW Infrastructure	< +/- 25%
2	$75,591	-	-	> 25%
1	$123,397	One or More Pump Stations	<1 PA from Existing WW Infrastructure	> 75%

Table 6.2.B
Summary of ARPA Funding Matrix Rank Distribution

Matrix Rank	ARPA Funding
10	ARPA Funding
0	No ARPA Funding

6.3 OWTS Problem Areas

All OWTS Problem Area matrix categories were determined by survey responses provided by residents of the Town within the Planning Areas. Resident responses were linked to Planning Areas based on address. 9,000 surveys were distributed to residents of the Town within the Planning Areas as part of an effort to collect public input. A total of 1,516 responses were received throughout the survey's duration. Ranking analysis for the OWTS Problem Areas concern categories were all determined using percentage calculated with the number of confirmatory responses per Planning Area over the total number of confirmatory responses.

- Cesspools Reported – Cesspool checked for OWTS Type question on survey response.
- Age of System Reported – Age of system > 21 checked for Age of System question on survey response.
- Repairs Required – Replaced checked for Replacement Status question on survey response.
- Problems Reported – Yes checked for OWTS Problems question on Reported WW Disposal Problems in Area question on survey response.
- Concern About OWTS – Yes checked for Concerned About OWTS on survey response.

Table 6.3.A
Summary of OWTS Problem Areas Matrix Rank Distribution

Matrix Rank	Cesspools Reported as Compared to Total Cesspools Reported Responses	OWTS System Over Age 21 Reported as Compared to Total OWTS System Over Age 21 Responses	Repairs Reported as Compared to Total Repairs Reported Responses	Problems Reported as Compared to Total Problems Reported Responses	Problems Concerns About OWTS as Compared to Total Concerns About OWTS Reported Responses
5	7.2-9.0%	8.1-10.0%	8.9-11.0%	8.1-10.0%	8.1-10.0%
4	5.4-7.2%	6.1-8.1%	6.7-8.8%	6.1-8.1%	6.1-8.1%
3	3.6-5.4%	4.1-6.1%	4.5-6.6%	4.1-6.1%	4.1-6.1%
2	1.8-3.6%	2.1-4.1%	2.3-4.4%	2.1-4.1%	2.1-4.1%
1	0.0-1.8%	0.0-2.1%	0.0-2.2%	0.0-2.1%	0.0-2.1%

Table 6.3.B
Summary of Survey Responses

Planning Area	Cesspool Pool Reported		Age of System Reported		Repairs Reported		Problems Reported		Concerns About OWTS Reported	
	Total Response	Total Cesspool Response	Total Response	Total Age of System Reported 21+	Total Response	Total Repairs Reported	Total Response	Total Problems Reported	Total Response	Total Concerned Response
1	90	4	89	51	61	7	85	3	89	24
2	127	7	123	56	79	19	118	8	126	44
3	6	2	6	3	3	0	6	9	6	2
4	16	0	10	9	10	1	12	1	15	3
5	84	12	72	30	51	11	70	6	73	26
6	66	14	64	14	47	7	59	4	64	15
7	1	1	1	0	0	0	1	0	1	1
8	52	3	52	21	33	13	51	4	50	13
9	47	4	46	14	25	8	45	6	46	20
10	56	7	57	20	32	8	52	3	55	16
11	39	7	35	13	24	4	37	3	39	20
12	114	11	110	35	82	19	106	10	109	27
13	14	1	15	9	11	2	13	0	14	3
14	22	7	23	10	16	4	22	5	24	11
15	58	13	54	16	35	8	52	4	58	21
16	55	7	53	15	39	5	53	6	53	14
17	72	4	72	38	51	6	67	12	71	21
18	80	7	76	34	52	5	74	5	78	20
19	44	5	43	17	36	2	38	4	43	10
20	74	4	77	36	50	10	71	6	72	21
21	73	12	72	23	54	15	76	4	76	21

Planning Area	Cesspool Pool Reported		Age of System Reported		Repairs Reported		Problems Reported		Concerns About OWTS Reported	
	Total Response	Total Cesspool Response	Total Response	Total Age of System Reported 21+	Total Response	Total Repairs Reported	Total Response	Total Problems Reported	Total Response	Total Concerned Response
22	70	0	74	38	44	11	68	10	73	24
23	27	0	27	16	18	4	25	1	26	9
24	57	11	55	19	31	2	53	6	56	15
25	4	0	4	1	3	0	4	0	4	0
26	50	15	50	13	33	5	44	5	52	20
27	7	1	3	0	3	1	7	0	6	1
28	15	4	14	6	7	0	13	2	13	5
29	10	1	3	0	3	0	8	0	8	3
30	13	2	9	4	5	1	10	0	11	3
31	14	7	11	3	8	1	13	0	13	7
Total	1457	173	1400	564	946	179	1353	127	1424	440

6.4 Site Suitability for Continued Use of OWTS

Median Lot Size

The size of a Planning Area's lots is indicative of the availability of space for functional leaching fields. Each Planning Area was evaluated based on their median lot size, calculated with the area parcels associated with each Planning Area and finding. The percentage difference from the average medium size of each Planning Area was used as the determinate for the individual Planning Area's rank.

Density

Planning areas were evaluated based on density of parcels. A higher density of parcels would be an indicator of an increased need for sanitary sewer infrastructure as properties are closer in proximity to each other and less space is available for conventional septic. The average area per parcel was calculated by the total area of each Planning Area over the number of parcels in each Planning Area. The percentage difference of the average area per parcel of the Planning Area was used as the determinate for the individual Planning Area's rank.

Soils

Potentially problematic areas within the Planning Areas were determined by examining the soil classes in each of the Planning Areas as soil type influences OWTS function properties such as loading rate and installation cost. Different soil classes were designated as "Potentially Problematic", and "Groundwater Table Likely to be Less Than 2-feet Below The Soil Surface" with information sourced from the Soil Evaluation Guidance Document from the State of Rhode Island and Providence Plantations Department of Environmental Management Office of Water Resources. These designations were linked to a GIS data set of soil types provided by RIGIS and derived from data collected by the U.S Department of Agriculture, Natural Resources Conservation Service, Rhode Island Office. The percentage of Planning Area that contains "Potentially Problematic" or "Groundwater Table Likely to be Less Than 2-feet Below the Soil Surface" was calculated and the average was found. The percentage difference from the average for each Planning Area was used as the determinate for the individual Planning Area's rank. **Figure 4.4.A** depicts the areas of potentially problematic soil types within the Planning Areas.

Table 6.4.A
Summary of Site Suitability for Continued use of OWTS Matrix Rank Distribution

Matrix Rank	Median Lot Size Per Planning Area Compared to Average Median Lot Size	Parcel Density Per Planning Area Compared to Average Parcel Density	Potentially Problematic Soils Percentage
5	> -40%	> -25%	> 50%
4	> -20%	> -10%	> 25%
3	< +/- 20%	< +/- 10%	< +/- 25%
2	> 20%	> 10%	> 25%
1	> 40%	> 25%	> 50%

6.5 Ranking Summary Table

Table 6.5.A depicts the rank of each Planning Area based on the sum of concern categories ranking from highest to lowest. A summary table of each Planning Area's rank for each concern category can be found in **Appendix H and I**.

Table 6.5.A
Summary of Priority Area Ranking

Planning Area	Priority Ranking
9	61
2	60
12	58
21	55
17	53
1	52
5	51
11	51
26	50
6	49
15	49
8	46
3	46
18	46
20	46
24	46
16	45
10	44
19	44
22	44
14	43
23	43
13	42
29	42
30	42
28	41
27	40
4	39
7	39
25	39
31	38

6.6 Pump Station Upgrades

In addition to recommendations for sewer placements, it is the recommendation of this report to allocate funds to update the evaluation of existing conditions and projected wastewater flows to the Woodland Manor pump station and the Sandy Bottom pump station and to subsequently allocate funding for the repair, maintenance, and upgrading of these two identified pump stations. Prior evaluations of these pump stations can be found in **Sections 6.6.1** and **6.6.2**.

6.6.1 Woodland Manor Pump Station Upgrades

The Woodland Manor Pump Station was evaluated by Fuss & O'Neill in 2013 to provide recommendations for improvement of the Pump Station and Flow Meter Station. These improvements will increase the operational longevity and resilience of the pump station. Budgetary opinion of cost associated with all improvements updated from the 2013-time frame of the report was evaluated at between $540,000 and $826,000 for short- and long-term improvements.

The recommendations for the pump station and flow meter station are as follows:

Woodland Manor Pump Station

- Site re-grade, removal of stained / contaminated soil and backfill with new soil (further evaluation may be required)
- Repair roof flashing and membrane
- Replace steel door to storage closet
- Prep and repaint walls and slab
- Provide hoist foundation and Crane for equipment removal
- Provide new valves and pressure gauges
- Provide new heater, dehumidifier, and exhaust fan
- Rebuild existing pumps as required
- Replace existing sump pump
- Replace existing with new electrical equipment
- Replace existing diesel generator set and concrete pad with a new automatic transfer switch (ATS)
- New control panel and programming
- New Bioxide double-walled tank and chemical feed pump for odor control
- Provide shredder (bypass pumping)
- Replace corroded suction piping within the wet well

Flow Meter Station

- New Autodialer
- Alarm programing
- Control and telephone service writing (alarms) improvements

The full evaluation report can be found in **Appendix J**.

6.6.2 Sandy Bottom Pump Station Upgrades

The Sandy Bottom Pump Station was evaluated by Weston & Sampson in 2021 to provide recommendations for improvement of the Pump Station and Flow Meter Station. At the time of the evaluation, Weston & Sampson was the contract operator for the Town. Budgetary opinion of cost associated with all improvements updated from the 2013-time frame of the report was evaluated at $500,000 for short- and long-term improvements.

The recommendations for the pump station are as follows:

- Upgrade to LED type lighting
- Raising and resurfacing of the driveway, including upgrading the valve vault hatch with a new H-20 rated hatch
- Replace level control system with a new PLC and installation of a submersible level transmitter in place of the bubbler system in each of the two wet wells
- Replace existing 50 Hp VFDs
- Replace SF1 supply fan 1.5 HP VFD
- Replace sensors and preform testing / calibration on gas detection system
- Install Mission Cell SCADA unit to replace Telephone Autodialer
- Replace sewer grinder control panel
- Service mini split unit
- Service surge control valves
- Replace existing flow meters
- Rebuild Pumps No. 1 and No. 2
- Replace bolts and repackaging valve on pump discharge gate
- Replace discharge check valve
- Replace 2-inch check valves on sump pump No. 2
- Pump and clean the wet well
- Replace sewage grinder
- Replace motor on Supply Fan SF-2
- Continued annual service for the generator

The full evaluation report can be found in **Appendix K**.

7 Development and Evaluation of Alternatives

7.1 Unsewered Area

Sewered properties within the planning area are localized on adjoining properties to Tiogue Ave, Sandy Bottom Road, Washington Street, and Main Street. A map of the unsewered area can be found in **Figure 7.1.A.** All the non-sewered parcels use on-site wastewater treatment systems, with 11.87% of OWTS systems being reported as cesspools in the survey distributed to Town members within the boundaries of the Planning Area. 13.2% of survey responses indicated problems with their existing OWTS that are indicative of a failing or deteriorating system.

Costs for septic system repairs and replacements can be wide ranging based on the type of repair and existing site conditions. Site conditions which can influence the type of OWTS, and the price include depth to restrictive layer (bedrock or groundwater), existing soils, and parcel size. An estimated price range for the replacement of a conventional septic system is $15,000 to $50,000 depending on the beforementioned factors.

7.2 Continued Use of OWTS

7.2.1 Conventional Septic Systems

Continued use of individual septic systems generally is the most cost-effective alternative for handling wastewater disposal needs from a particular area providing physical conditions allow for use of these systems. Conventional septic systems have the benefits of recharging the groundwater with treated wastewater, and in some cases encourage some level of water conservation. Conventional septic systems tend to limit the intensity of use of the land on which they are located when compared to other means of wastewater disposal.

A conventional septic system is defined for the purposes of this report to be a septic tank and leaching trenches (filled with crushed stone or galleries). The entire system is installed below ground. The septic tank removes many of the solids in the wastewater through settling and removes much of the grease in the wastewater through flotation. Wastewater flows out of the septic tank under the influence of gravity and into the leaching trenches through a subsurface piping network, into the leaching trenches and eventually into the soil. The size requirement of the leaching area is dependent upon the estimated wastewater flow and permeability of the soil.

The wastewater treatment process occurs in the soil beneath the leaching field. The soil medium supports biological growth. A "biomat" is formed at the point where the septic tank effluent enters the soil. The biomat is the essential element of the treatment systems and is very effective in removing organic material and pathogens from wastewater. Proper maintenance by periodic septic tank pumping and care in controlling what is discharged to these systems is essential for long term management of these systems.

7.2.2 Repair and Enhancement of Conventional Septic Systems

The common mode of failure of a septic system is clogging of the leaching field and a reduction in the infiltrative capacity of the soil. Often, this is the result of excessive solids carryover from the septic tank, however permeability of the native soils in which the system was constructed plays a key role. Age is also a factor. A mature biomat is a very effective filter. Solids that pass through the septic tank are trapped in the filter, and, over time, can clog a leaching field. Many older systems were constructed to standards that were far less demanding than current regulations, resulting in insufficient septic tank storage/operating volume.

Often, septic system failures are repaired on site. The success of a repair depends largely on the physical characteristics of the property, such as area of the lot, depth to groundwater, soil permeability, slope of the land surface, depth to bedrock and distance to wells, as well as the quality of the design and construction methods followed. When septic systems are repaired/replaced on site, they are upgraded to current design standards, if possible.

Wastewater Volume Reduction
By reducing flows, inadequately sized systems can be brought into compliance and can be made to operate more efficiently. Wastewater flows can be reduced through the use of low flow plumbing fixtures, non-discharging toilets and public education. Each of these alternatives should be considered as part of an overall approach to reducing the volume of wastewater discharged in areas with severe site limitations.

On-Site Wastewater Disposal Facilities
Commonly used leaching systems include conventional leaching trenches (using crushed stone and perforated pipe), leaching beds, and shallow or deep leaching chambers. Other technologies are being implemented more frequently for challenging system repairs.

In areas of shallow bedrock or shallow groundwater or excessively drained soils, a mounded system can be constructed by placing suitable soil fill on top of the ground and then installing the leaching trenches in the fill. Constructing the leaching trenches in the fill creates a vertical separation between the bottom of the leaching trench and the high bedrock or groundwater level. This vertical separation provides a zone in the soil where aerobic bacteria can sufficiently treat the septic tank effluent. The leaching field must have a large enough area to allow the effluent to enter the underlying native soil which is generally less permeable than the fill placed to create the mounded system.

A mounded system can be considerably more expensive than a conventional repair, depending on the amount of fill required. In most situations a pump is required to lift the effluent up to the raised leaching field. Pumping wastewater into the leaching trenches adds both a capital cost for the pump and an operational cost for electricity.

Assistance for repairing existing on-site wastewater treatment system is made available to the Town by the RI Housing association as a participating community in the Community Septic System Loan Program (CSSLP). Loans generally can cover costs associated with engineering and system replacement. The loan allows for the participating communities that do not have wastewater treatment facilities to use funds recycled from previous Clean Water State Revolving Funds Loans to assist in repairing and replacing failing septic systems or cesspools. Residents are able to access the CSSLP through the municipality. The municipality advertises the loan to those when applicable. The average loan amount is $15,435.

Terms of the CSSLP Loan are as follows:

- One-time $300 origination fee to RI Housing and a 1% service fee on the outstanding loan balance that is split between RI Housing and the Rhode Island Infrastructure Bank for servicing the loan.
- Other program criteria vary somewhat from community to community. However, most programs cap loans at $25,000, require a debt-to-income ratio for borrowers of no more than 45% and allow non-owner occupants, as well as homeowners whose primary residence can benefit from CSSLP, to participate.
- Funding is released to the homeowner when RI Housing receives a Department of Environmental. Management (DEM) Certificate of Conformance after the work is completed.
- Work must be completed by a state-licensed installer.
- No income limits for program participants.
- Residential properties with up to 4 units.

7.2.3 Concerns With Continued Use of OWTS

The Town of Coventry's existing On-Site Wastewater Management Plan (OWMP) is dated 2003. This document is outdated and should be updated as part of the Town's wastewater management efforts moving forward.

Although outdated, the 2003 Onsite Wastewater Management Plan does identify a significant number of on-site systems in the eastern areas of the Town which show evidence of failure based on the RIDEM Rules Establishing Minimum Standards Relating to Location, Design, Construction and Maintenance of Onsite Wastewater Treatment Systems. The identified areas in the Town are a priority for wastewater management. See **Appendix L** for a copy of the 2003 OWMP. These areas are primarily located in the eastern areas of the Town within the designated Planning Area. While the Town has constructed sanitary sewers to service a proportion of these priority areas, most properties still rely on OWTS for wastewater treatment and disposal.

Environmental concerns were identified as the basis for OWTS' unsuitability for continued use. Provided below are the environmental conditions of the planning area which a conventional septic system may not be able to perform as desired:

- *High density areas containing many houses on small lots*. Due to the density of residential parcels within the planning area, smaller lots are often an influencing factor in proper OWTS function. In these situations, there may be inadequate room to construct a code compliant leaching system or a repair to leaching system that has sufficient leaching area for the estimated flow. Commonly, they may fail to meet the minimum leaching area requirements, separation distance from wells or other setback requirements. This may result in contamination of shallow wells and the migration of plumes across property lines.

- *Seasonal high groundwater table*. Seasonal high groundwater table is shallow in depth throughout the planning area. Proper wastewater treatment requires that an adequate aerobic zone be maintained in the soil below the leaching field. If the groundwater table is at or near the bottom of the leaching field, the aerobic treatment zone is reduced or eliminated. In these cases, there is inadequate treatment of the wastewater.

- *Impermeable soil.* The Soil Suitability analysis **Figure 4.4.D** identifies multiple areas within the boundary of the planning areas that are detrimental to OWTS function. Where there is ledge or very tight (i.e., non-porous) soils, the ability of the leaching field to properly treat the wastewater is severely diminished. This lack of hydraulic conductivity often results in system failure and surface breakout of sewage. It also may cause wastewater within the plumbing system to back up into the home.

- *Areas close to surface water bodies*. Within the planning area rivers, embayments, ponds, streams and other surface waters may be impacted by partially or inadequately treated wastewater from nearby leaching systems. Bacterial contamination of the water may result as has been identified in past limnological studies conducted for Tiogue Lake and Upper Dam Pond. It is also a common occurrence to have nutrient contamination of these water bodies. In these instances, it is possible that nutrients such as nitrogen and phosphorous are not removed sufficiently from the wastewater plume before it reaches the surface water. Surface waterbodies of primary concern within the Planning Area include Tiogue Lake, Upper Dam Pond, Mishnock Lake, Johnson Pond and the Pawtuxet River.

- *Depth to Bedrock*. Bedrock is defined as rock (commonly referred to as ledge) that forms the earth's crust, including "Rotten Rock". Rotten rock includes any decomposed but greater than 50% coherent rock that lies above or equal to more coherent rock. Bedrock depth plays a significant role in OWTS function as septage needs a semi permeable layer for proper treatment. An impermeable layer such as bedrock has the potential to result in wastewater runoff. As per RIDEM Rules Establishing Minimum Standards Relating to Location, Design, Construction, and Maintenance of Onsite Wastewater Treatment Systems, Rule 32.5, a leach field shall not be located in an area where bedrock is a minimum of 4 feet below the original ground surface, and the minimum depth to bedrock shall be met within 25 feet of all sides of the leach field. Within the planning area, multiple locations were identified as shallow bedrock areas as per **Figure 6.2.A**.

- *Other older systems*. In areas where houses were built several decades ago, the septic systems were typically installed to significantly less stringent standards than required by today's codes. The leaching fields and septic tanks are often undersized or incomplete. This is reflected in the updated regulations of today in which cesspools have been banned and mandated to be removed. The percentage of OWTS Systems reported as age 30 or above from survey responses was 34%.

As a result of concerns regarding environmental vulnerability, continued use and maintenance of OWTS is not a recommended action within the boundary of the Planning Area. Areas outside of the Planning Area are typically larger, less dense plots with more opportunities for proper OWTS installation, fewer surface water bodies, and no pre-existing installed sewer infrastructure. Those parcels are recommended to continue with OWTS usage and take advantage of CSSLP Loans to comply with Town cesspool elimination ordinances.

7.3 Extension of Public Sewers

7.3.1 Public Sewer System Components

Off-site disposal involves a system for collecting wastewater (sewers) and a treatment/disposal facility, which can be a wastewater treatment plant or a local, neighborhood facility such as a community leaching field. Extension of public sewers can be done via gravity sewers, force main, and low-pressure sewers. Definitions for each are as follows:

- **Gravity Sewers** – The gravity collection system would carry wastewater to several low points and would utilize pump stations and force mains to lift the wastewater to the next high point from which the wastewater would once again flow under the influence of gravity.

- **Low Pressure Sewers** – Low pressure sewers would utilize individual grinder pumps at each lot to convey wastewater through small diameter pressure pipes, rather than relying on gravity to move wastewater through the system. The pipes can be laid at relatively shallow depth (typically 4½ feet of cover to provide protection from frost) and generally follow surface topography, unlike considerably deeper gravity sewers.

- **Force Main** – Force main is a sewer designed to receive the wastewater discharged from a pumpstation and to convey it under pressure to the point of discharge, which may be a gravity sewer manhole, a storage tank, or a treatment plant.

- **Pump Station** – The function of a pump station is to pump wastewater from a low point to a higher point of discharge. A wastewater pump station should be designed to handle the projected peak wastewater flows of its tributary sewer collection system. Pump stations must have facilities for the servicing, removal, and replacement of equipment. Wet wells are required in pump stations to store the wastewater before it is pumped. To protect the pumps from clogging, devices such as bar racks, or comminutors are commonly used with wet wells.

7.3.2 Extension of Public Sewers Recommendation

The framework for the extension of Public Sewer Recommendation was investigated through the water flow rate 2040 projection and the matrix analysis to determine what Planning Areas would derive the greatest benefit from sanitary sewer infrastructure. Extension of Public Sewers will allow for environmental and sewer program benefits as follows:

- *Environmental Advantages.* Installation of sanitary infrastructure would alleviate environmental constraints of current OWTS usage. Additionally, it would allow for safe means of wastewater treatment for smaller plots, plots that have or are in close proximity to impervious soils, and properties that are close to water bodies. While environmental concerns are not eliminated with the addition of sewer infrastructure, the conveyance of wastewater for treatment and discharge in place of onsite treatment and discharge are beneficial as a result of the environmental characteristics of the Planning Area as outlined in **Section 7.2.3**.

- *Revenue Generation.* Expanding sewer infrastructure to additional residents has implications for the Town's Sewer Fund as outlined in **Section 11.** At present, the Town is operating at a deficiency with annual revenue being less than combined operating costs and debt services. Expanding sewer infrastructure will contribute to the goal of running the Sewer Fund to be brought into the positive with lower customer rate increase as the number of residents serviced by the sewer infrastructure increases.

- *Utilization of Preinstalled Sanitary Infrastructure.* A significant amount of preinstalled sanitary infrastructure is in place to convey wastewater from sewered parcels. This infrastructure includes dry gravity sewers, force main, and low-pressure sewer that can be tied into to convey wastewater from newly sewered planning area. The existing wastewater infrastructure map can be found in **Figure 2.2.A**. A study is needed to determine if the current flow capacity of existing infrastructure is adequate for the increased flow associated with tying in additional properties, or if upgrades will be needed.

- *Established IMA with 100-year duration.* The Town is currently in agreement with the neighboring town of West Warwick to convey wastewater to the WWTF for treatment and discharge. Existing infrastructure is in place to allow for the transport of wastewater to the WWTF and the IMA is established for the duration of 100 years. The maximum flow allowance is significantly higher than the current flow generated in the Town. The opportunity to take advantage of the capacity allowance as per the IMA.

Extension of sewers will be installed on developed roadways and designed in a way that will not hamper identified environmentally sensitive areas.

7.4 Additional Treatment Technologies

7.4.1 Individual Innovative Treatment Systems

A number of advanced or innovative systems are available for treating sewage from individual homes. The systems use aerobic and/or anaerobic biological treatment processes, and often a filtration step, prior to discharge. These systems can provide an additional level of treatment beyond that attained in a septic system, and as a result the required area of the leaching field that follows the treatment unit can be downsized somewhat.

Some of the drawbacks to these systems are the increased capital cost and the operational costs of an electro-mechanical system. They can improve effluent quality, but typically do not adequately remove nitrates, which are a concern for groundwater quality. In addition, they do not reduce the flow rate of wastewater effluent, and, therefore, are of limited usefulness in relatively impermeable soils where hydraulics is limiting. The operational and maintenance requirements of these systems are quite sophisticated in comparison to an ISDS.

7.4.2 Community Collection Systems

In locations where individual lot sizes are not adequate to support conventional septic systems, community sewage disposal systems (CSDS) may be an acceptable alternative. CSDS consist of a septic tank for the removal of solids, and a leaching field (typically with some type of gallery surrounded by crushed stone) installed to allow the septic tank effluent to seep into the existing soil. The purpose of the gallery is to maximize the effective leaching area provided by the trench and to provide storage so that if a high volume of wastewater enters the CSDS in a short period of time then the water will have a chance to slowly seep into the ground without backing up the system.

A CSDS site would require deep deposits of well-drained soil and sufficient depths for groundwater and bedrock. The parcel would need to be large in area to provide the necessary nitrogen dilution to meet drinking water standards at the property line, or else pretreatment of the wastewater would be required prior to discharge. Unless a town-owned parcel suitable for subsurface disposal systems is available, this alternative will require land acquisition.

7.5 Environmental Evaluation

A future environment with a no build scenario will result in OWTS as the primary solution to wastewater disposal for non-sewered residents. The town will still be underutilizing their allocated limit of wastewater flow as per the IMA with West Warwick. Action will be needed to ensure elimination of the Town's cesspools and concerns will continue regarding the vulnerability of Rhode Island's shallow groundwater and health of water bodies as per the limnological studies performed in the past.

Since the designated planning areas lie within the residentially developed eastern portion of the town, no damage is predicted to occur to historical, archeological, cultural, prime farmlands, or recreational areas during construction or permanently. Sanitary infrastructure will not be installed on barrier beaches or other coastal zone features. Projected sewer infrastructure and pump station placements will not cause displacement of existing properties. Aesthetics will be restored upon construction completion and pump stations will be designed to match conventional building design. Curb to curb roadway restoration for all installations over 100 feet will be performed as per town ordinance.

During the course of sewer installation, noise will be generated by the heavy equipment used to install the sewers. This noise is unavoidable but is of only a temporary nature and is restricted to certain hours of the day. The Town can limit the construction to certain hours each day in the project specifications if desired. A certain amount of dust will be generated by the sewer installation. Dust control through the use of water will be practiced wherever necessary. Dust generation impacts will be minimized to the extent practicable.

As with any significant construction project, there exists a potential for soil erosion with sediment washed away into surface water. Appropriate erosion and sediment control measures, such as hay bales, silt socks, and silt fences, must be used wherever necessary to prevent the dispersion of sediments into wetlands and water courses. Water pumped during trench dewatering operations must be discharged into sediment traps or dewatering bags. Disturbed vegetated areas need to be loamed, seeded, and mulched as soon as possible after the installation of sewers to re-establish the vegetation cover and prevent erosion. The use of silt sacks in catch basins drainage system is also recommended to reduce the amount of sediment discharged into water courses. No increase in solid waste production or potable water consumption is anticipated from construction.

Another impact of the sewer construction will be the disruption of traffic on state and local roads. Maintenance of reasonable access to the homes along the sewer route for local residents and emergency vehicles must be maintained. Good communications with residents and business owners will be important, as will maintenance and provision of access to driveways adjacent to the sewer construction.

The temporary disruption of utilities is another potential impact of sewer construction. Careful design of the sewer system can avoid conflicts. Test pits can be dug prior to trench excavation where existing utility depth and/or locations are unknown. Record research by contacting the utility companies serving the Town is integral to the design process of any new sewers.

Indirect environmental impacts will also be recognized as part of the construction. Environmental characteristics of the planning area were categorized and reviewed within **Section 4** of this report. Throughout the evaluation phase, local, federal, and state laws were reviewed to ensure compliance. It is unlikely that the presented alternatives will result in an increase in development for these areas as a majority of the project area is residentially built out. Also, a townwide push to conserve separation between rural and residential areas mitigates the potential for induced sprawl.

Shallow bedrock depth has been a historical issue with the town as identified by past wastewater infrastructure installations. A map of potential bedrock depths of sub-10 feet was created and can be found in **Figure 6.2.A.** In general, the identified priority planning areas were identified as not having significant challenges associated with bedrock depth. At the onset of the design phase, further subsurface investigation will be performed via borings and probes to identify the underlying rock profile.

7.6 Financial Consideration

This Facilities Plan considers the necessary infrastructure improvements through a Capital Improvements Plan (CIP), indicating the timing, cost, and financing source(s) for each required project over a twenty-year planning period. The CIP was integrated into the Sewer Fund's financial plan, indicating the necessary rate increases to fully finance all capital improvements, while at the same time providing adequate funding for the Sewer Fund's other cost obligations on an annual basis. We attempted to "smooth out" annual rate increases beyond the first year or two in order to mitigate the risk of rate shock and allow for a more stable and predictable forecast of increases to customers.

We also analyzed a rate structural change, specifically with regard to the establishment of a minimum charge inclusive of a usage allowance. The Town is currently determining the administrative capability of making this change as well as the associated customer impacts, as the Town's existing rate structure seems to allow for the least expensive cost recovery methodology for the Town's ratepayers.

8 Plan Selection

8.1 Plan Evaluation

It is the recommendation of this report to prioritize extension of centralized wastewater infrastructure to Planning Areas 12, 9, 8, 1, and 2. We do not recommend extension of wastewater infrastructure to PA 21 in this Facility Plan cycle, even though it is within the top five PAs based on our Ranking Summary Table 6.5 because bedrock is expected to be within 10 feet of ground surface. Additionally, we recommend extension of centralized wastewater systems to the adjacent Planning Areas of PA 9 (PA 8) and PA 1 (PA 2) as described in **Section 8.2**. Based on the presence of a Sole Source Aquifer within Planning Area 5 (PA 5), we recommend consideration of extending sewer service to PA 5 as a priority in the next planning cycle. Construction of centralized sewers in these areas will eliminate the environmental concerns associated with decentralized systems as outlined in **Section 7.2.3**. Also, extending sewer infrastructure will allow for the Town to take advantage of funding opportunities as outlined in **Section 9.1**.

8.2 Priority Planning Areas

8.2.1 Planning Area 8 & 9

Planning Areas 8 and 9 are neighboring PAs that are currently maintained entirely by decentralized wastewater systems. Planning areas 8 and 9 are positioned to the west of Tiogue Lake and are bisected by Arnold Road. Planning Area 9 encompasses Briar Point Beach, a popular recreational park with a sand beach and small swimming area. These planning areas are positioned southwards of the Tiogue Avenue gravity sewer interceptor that conveys flow to the Sandy Bottom Pump Station before discharging for treatment in West Warwick.

Planning Areas 8 and 9 are identified as the first recommendation for the expansion of sewer infrastructure due to their matrix evaluation ranking. PA 9 was identified to have the highest risk matrix evaluation score when examining concern categories, with PA 8 placing 12th in the ranking. Environmental factors play a leading role in the selection of these two PAs for wastewater infrastructure expansion due to the proximity to the vulnerable waterbody of Tiogue Lake, which has past experiences with high bacteria levels and potential wastewater seepage. Additionally, there is the potential for ARPA funding opportunities for expansion of centralized wastewater infrastructure to PA 9.

While the planning areas are jointly proposed in this report, it is our recommendation that they be separately planned as individual projects, with precedence for planning area 9 to take priority. Because PA 8 and PA 9 adjoin Arnold Road, they have been grouped to share wastewater infrastructure. Both planning areas will have flow conveyed northwards towards the Tiogue Avenue interceptor via Arnold Road.

The general topology of the planning areas consists of a decline from the highpoint of approximately 289 feet at the southwestern area of PA 8 towards the northeasterly point of PA 9. Multiple properties adjoin the perimeter of Tiogue Lake, which lies at an elevation of approximately 230 feet. A map of the topology for the planning areas can be found in **Figure 4.1.2.A**.

Disconnected dry wastewater infrastructure has been previously installed within Arnold Road in the past with the intention to extend sewer service in that area. These previous installations include:

- A 3-inch PVC low pressure to the southern portion of Arnold Road approximately 2,200 feet in length with stubs that extend towards Harrington Road, Larch Drive, and Crestwood Drive.

- A 2-inch PVC low pressure sewer with approximate length of 150 feet within Arnold Road between the adjacent streets of Johnson Boulevard and Cedar Tree Lane. This installation connects with the installed gravity main outlined in the subsequent bullet point.

- Seven segmented 8-inch gravity sewers installations with combined length of 900 feet. Based on the slope of the installed gravity segments, it is assumed that the intention of the previous work was to convey flow from Planning Area 8 across Arnold Road into Planning Area 9.

- An existing 6-inch PVC force main and (2) 2-inch PVC low pressure sewers. This force main and low-pressure sewer terminate at the intersection of Arnold Road and Johnson Boulevard and run northwards for approximately 1,500 feet before connecting into an existing manhole drop connection at the intersection of Arnold Road and Overview Drive. This is where the sewer then transitions into a 12" PVC gravity main and travels in the northern direction to the Tiogue Avenue gravity interceptor.

Two alternatives were evaluated for configuration of wastewater infrastructure in PAs 8 and 9. The first is a hybrid low-pressure sewer and gravity main configuration with flow conveyance facilitated by a new pump station located on Town-owned property at Briar Point. The other alternative is solely a low-pressure sewer configuration for all parcels within PA 8 and PA 9. Detailed information on the analysis and configuration of the alternatives can be found in the following sections of **8.2.1.1** and **8.2.1.2**. During analysis of alternatives, existing infrastructure was evaluated for incorporation in future planning. Expansion of infrastructure to these planning areas will serve a combined number of approximately 460 parcels.

8.2.1.1 Planning Area 8 and 9 Gravity Sewer Analysis

Gravity sewer was evaluated for planning areas 8 and 9. This alternative includes wastewater flow conveyance to a pump station constructed at the low point of elevation for the PAs at Briar Point. From the pump station, a 6" force main will convey wastewater north to the along West Shore Drive and tie into the existing dry 6-inch force main at the intersection of Arnold Road and Johnson Boulevard. Flow is then conveyed northwards to a drop manhole connection to gravity sewer and to the Tiogue Avenue gravity interceptor. Low pressure sewer will be used for areas in which topography is restrictive such as the southeastern corner of PA 9, where existing low pressure sewer infrastructure has been installed in the past. Wastewater from this low-pressure system will tie into gravity sewer that conveys to the pump station.

Estimated quantities associated with this alternative are as follows:

- 314 gravity sewer property tie ins
- 175 low pressure sewer property tie ins with grinder pumps
- 18,670 LF of 8-inch gravity sewer.
- 1,730 LF of 1.5-inch HDPE Low Pressure Sewer

- 5,140 LF of 2-inch HDPE Low Pressure Sewer
- 2,590 LF of 3-inch HDPE Low Pressure Sewer

Figure 8.2.1.1.A displays the piping configuration for the gravity sewer alternative. The opinion of cost for this analysis is included in **Appendix M.** Detailed descriptions of payment items are provided in **Section 10**.

8.2.1.2 Planning Area 8 and 9 Low Pressure Sewer Analysis

Conceptual low pressure sewer layouts were established and verified with Environmental One Corporation, a low-pressure sewer manufacturer used within and approved by the Town of Coventry's Engineering Department. Low pressure sewer configuration, pipe diameters, number of grinder pumps required, and wastewater velocities were provided for both planning areas.

Analysis was performed for the following reasons:

- Evaluate the feasibility of incorporating existing wastewater infrastructure within the two planning areas into future design.
- Confirm that both planning areas will meet the velocity thresholds required for low pressure sewer function.
- Evaluate the need for construction of a pump station at Briar Point for investigation of possible cost saving opportunities.

Figure 8.2.1.2.A displays the piping configuration for the low-pressure sewer alternative. The analysis provided by Environmental One Corporation can be found in **Appendix N**.

General layout recommendations for low pressure sewer systems are:

- Clean out valves at intervals of approximately 1,000 ft and at branch ends and junctions; isolation valves at branch junctions; and air release valves at changes in grade of 20 to 25 ft or more and/or at intervals of 2,000 to 2,500 ft.
- Lateral kits comprised of a ball and check valve are required to be installed between the pump discharge and street main on all installations.
- Laterals should be located as close to the public right of way as possible.

The configuration of this analysis consists of conveyance of flow towards Arnold Road for both planning areas. The wastewater will be conveyed to a previously installed six-inch force main that transitions to 12" gravity main at a manhole drop connection at the intersection between Arnold Road and Overlook Drive which terminated at the gravity interceptor on Tiogue Avenue. All existing wastewater infrastructure in the area that is not currently in use was installed with the intention of expanding wastewater infrastructure to this area.

Estimated quantities associated with this alternative are as follows:

- 489 low pressure sewer property tie ins with grinder pumps
- 5,370 LF of 1.5-inch HDPE Low Pressure Sewer
- 8,410 LF of 2-inch HDPE Low Pressure Sewer
- 6,770 LF of 3-inch HDPE Low Pressure Sewer
- 1,390 LF of 4-inch HDPE Low Pressure Sewer
- 7,10 LF of 6-inch HDPE Low Pressure Sewer

The opinion of cost for this analysis is included in **Appendix M.** Detailed descriptions of payment items are provided in **Section 10**.

8.2.2 Planning Area 1 and 2

It is the recommendation of this report to extend sewer infrastructure to the PAs of 1 and 2. These PAs are located at the westernmost point of the planning area, adjacent to Johnson Pond. and north of the Woodland Manor pump station. Currently they are being served entirely by decentralized wastewater treatment systems. A privately owned force main and pump station are located on reservoir road which services PA 25 and does not extend into PA 1 or 2.

Planning areas 1 and 2 are jointly recommended as the infrastructure required to extend sewer to planning area 1 would facilitate the expansion into PA 2 as well. Even with a joint recommendation, PA 2 has a higher priority for construction than PA 1 as indicated by its rank on the matrix rank evaluation. Sewering these planning areas derives an environmental benefit due to their proximity to Johnson Pond. Additionally, there is not significant concern for bedrock to impede constriction as indicated by the bedrock depth map on **Figure 6.2.A**. Preliminary validation for pipe length and minimum slope for proposed gravity main was performed using spot elevations and minimum slope design values as per TR-16.

For PA 1, sewer layout conveys all wastewater towards 10-inch gravity main southwards through Reservoir Road. The western portion of the planning area conveys wastewater to the Club House Road gravity main to resolve topological restrictions associated with gravity sewer. All adjacent roads to the Reservoir Road gravity main tie into the main, barring a low-pressure sewer on the northernmost point of Reservoir Road due to topological restrictions. For PA 2, all parcels not adjacent to the Reservoir Road gravity main convey flow northwards to the Club House Road gravity main through low pressure sewer due to numerous sites of steep elevation gradients within the PA. To connect to the existing system, the gravity main Reservoir Road gravity main will have to connect to an extension of the Tiogue Avenue gravity interceptor that conveys flow to the Sandy Bottom pump station, terminating in West Warwick.

Quantities associated with this alternative are as follows:

- 471 gravity sewer property tie ins.
- 648 low pressure sewer property tie ins with grinder pumps.
- 19,401 LF of 8-inch gravity sewer.
- 4,598 LF of 10-inch gravity sewer.
- 2,025 LF of 18-inch gravity sewer.
- 40,660 LF of HDPE low pressure sewer.

Figure 8.2.2.A displays the piping configuration for the sewer alternative. The opinion of cost is included for these planning areas in **Appendix M.** Detailed descriptions of payment items are provided in **Section 10**.

The Coventry High School and its on-site wastewater treatment and disposal system is within Planning Area 2. The existing treatment system was originally constructed in or around 1973 with electro-mechanical upgrades occurring as recently as 1997. The current condition of the OWTS requires repair or replacement of the OWTS or extension of public sewer. The Town is currently considering alternatives. One alternative involves a partial sewer extension west along Tiogue Avenue and north along Reservoir Road to the high school. This would be a subset of and constructed in advance of the larger Planning Area 2 and 1 project. Please refer to **Figure 8.2.2.B**.

8.2.3 Planning Area 12

We recommend extension of wastewater infrastructure to planning area 12, ranked third in the risk matrix evaluation. This planning area is located northeast of Tiogue Lake, above the Tiogue Avenue gravity interceptor. The planning area is also adjacent to the South Pawtuxet River which shares a border to the east, and the Pawtuxet River which shares a border with the west of the PA. Planning area 12 is comparatively large with over expansion into the area servicing over 600 parcels.

Figure 8.2.3.A displays the piping configuration for the sewer alternative.

Quantities associated with this alternative are as follows:

- 347 gravity sewer property tie ins.
- 254 low pressure sewer property tie ins with grinder pumps.
- 22,680 LF of 8-inch gravity sewer.
- 13,140 LF of HDPE Low Pressure Sewer.

The recommended sewer configuration for PA 12 conveys wastewater from the northeastern portion north through the Pawtuxet River by means of Laurel Avenue to discharge into the gravity interceptor on Washington Street. This gravity interceptor flows east to West Warwick for treatment and discharge. The western portion of the planning area will flow south by gravity towards the gravity interceptor on Tiogue Avenue to be conveyed to the Sandy Bottom pump station. This division of flow direction is due to the design approach to use gravity sewer where applicable. The eastern portion of PA 12 is recommended to be serviced by low pressure sewer which discharges into the extended gravity interceptor on Tiogue Avenue.

The opinion of cost is included for these planning areas in **Appendix M.** Detailed descriptions of payment items are provided in **Section 9.4**.

9 Plan Implementation

A plan implementation schedule can be found in **Figure 9.A**.

9.1 Funding Sources

The list of potential funding sources follows. The list is not all-inclusive; however, outlines the most-likely sources available to the Town for the projects recommended herein.

- *American Recovery Plan Act.* ARPA was signed into law with the purpose of providing additional funding to state and local governments to alleviate burdens accrued during the 2020-time frame. The Town has received funds from the American Recovery Plan Act and is considering allocating a portion of that funding to sewer extensions for PA 9, as well as upgrades to the Woodland Manor and Sandy Bottom Pump Stations. The general deadline for obligating ARPA funds is December 31, 2024, and the deadline for spending is December 31, 2026.

- *RIDEM/RIIB SRF Loan.* The purpose of these loans is to provide a below market financing rate for water related projects including sewer construction, repair, and maintenance at a below market rate fixed interest rate. The loans are provided on a project priority list basis. Loans are co-managed by the RI Infrastructure Bank and the Office of Water Resources. Low-income planning areas of low income have the potential for loan forgiveness. As part of this report, census 2010 median housing income data was reviewed and incorporated into the matrix evaluation in **Section 6.5.** A map for median income per census tract can be found in **Figure 2.2.B**. The RIIB Application can be found on **Appendix O**.

- *RIIB Municipal Resilience Program.* The Rhode Island Infrastructure Bank Municipal Resilience Program is the State's action strategy to provide funding through grants for the purpose of building statewide climate resilience. Induction into the program is through a Municipal Resilience Program workshop, which upon its completion allows the municipalities to apply for MRP Action Grants annually, and the Town has completed this induction. The Sandy Bottom pump station project may be eligible for Action Grant funding.

- *RIIB Municipal Infrastructure Grant Program.* The Rhode Island Infrastructure Bank Municipal Grant Program is a grant program with the purpose of providing funding support for municipalities to use for public infrastructure. Restrictions include a 25% match and completion of the grant agreement within 24 months. Projects are submitted annually through a Request for Proposal forum. We recommend the Town apply to this program for funding of PA 12, as the median household income of PA 12 is below that of the State.

- *Congressionally Directed Spending.* Congressionally Directed Spending items can promote economic development, education, health care initiatives, and other worthy investments in communities across the country. The Town has applied for a 2024 CDS earmark through Senator Whitehouse's office for PA 9.

9.2 Operation and Maintenance

Operations and maintenance of a wastewater system is a critical step in maintaining and effectiveness and longevity of the system. Activities associated with the operations and maintenance of a centralized sewer system as recommended by this report include the following:

- Physical Inspections: Systems must be monitored for identification of defects, future planning, and developing system baselines. This is traditionally done through methods such as air testing, vacuum testing, mandrel testing, smoke testing, dye testing, CCTV, sonic testing, and visual observations. Due to the difficulties associated with visual observations of force mains, a determination of force main condition can be done through routine calibration of pump stations.
- Cleaning: Pipes and motors associated with the collection system must be routinely cleaned to prevent pump failure, pipe blockage, and root intrusion. It is recommended that a schedule for cleaning be implemented that allows for a full cleaning cycle of equipment.
- Spare Parts & Equipment: A stockpile of inventory is necessary for fast response to emergency events. Having a stockpile will increase the resilience of the system to outside factors such as high lead times.

A centralized sewer system caries the lowest annual O&M costs because the wastewater treatment and disposal costs are split among the numerous parcels connected to the WWTF. A decentralized management alternative includes a significant annual operation and maintenance cost as the systems must be monitored, tested, and reported upon regularly to comply with the system design and RIDEM wastewater disposal regulations.

A gravity sewer collection system with a central pump station carries a slightly higher capital cost but lower annual O&M cost because all of the system maintenance occurs at a single community pump station. This option is the preferred collection system method, but the pump station would require land acquisition, flood control measures, backup power, and approval from the local planning and zoning commission. A low-pressure sewer collection system has a lower capital cost but more expensive annual operations and maintenance (O&M) cost and slightly higher life cycle cost.

9.3 Phased Construction

A phased approach to the extension of public sewers throughout the town is recommended with the focus of the identified priority PAs. These PAs are those which would derive the most benefit from sewer infrastructure as identified by the evaluation matrix in **Section 6**. Phased construction allows for expediency to take advantage of ARPA funds which must be obligated by end of year 2024 and expended by end of calendar year 2026. Planning with funding opportunities in mind is critical as the Town does not currently have the financial capacity for providing full build out of public sewers within the planning area, which is substantially more than the phased approach. Consideration is being given to use available ARPA funds for financing sewer extension in PA 9, as well as upgrading the Woodland Manor Pump Station and Sandy Bottom Pump Station before the expiratory date. This approach also allows priority targeting of PAs of substantial environmental concerns as promptly as possible.

9.4 Detailed Cost Estimate

Cost estimates are provided below for their corresponding planning areas and alternatives. Total cost is provided as Total Opinion of Project Cost as the sum of project cost including Construction, Engineering/Legal/Administrative fees, and a 25% contingency. This cost is reflected in the summary table provided in **Table 9.4.A**. The project cost is also provided as a range incorporating an order of magnitude cost estimate within -30% to 50% of the actual project cost.

The opinion of costs presented does not include the fees associated with the abandonment of existing on-site wastewater treatment systems. Furthermore, for proposed gravity systems, the opinion of costs of cost does not include the cost associated with extending the gravity pipe from the building outlet to the public sewer at the property line. Nor, for proposed low pressure sewer systems, does the opinion of cost include the fees associated with electrical upgrades that are necessary to support the grinder pumps.

Cost associated with construction of the pump station necessary for conveyance of flow by gravity main for both planning areas is allocated solely to the opinion of cost for Planning Area 9 as it is the area in which the pump station is recommended to be constructed.

While the Opinion of Costs associated with both alternatives for Planning Areas 8 and 9 are provided separately, it is assumed that if the gravity alternative was chosen for Planning Area 9, the same alternative would be chosen for Planning Area 8 as the pump station infrastructure would be in place to facilitate conveyance of wastewater in Planning Area 8 by gravity main.

Table 9.4.A
Summary of Budgetary Opinion of Cost by Project

Project	Budgetary Opinion of Cost
Planning Area 9 (Gravity)	**15,380,000**
	(Range -15% /+30%: $10,770,000 to $23,070,000)
Planning Area 9 (LPS)	**13,350,000**
	(Range -15% /+30%: $9,350,000 to $20,030,000)
Planning Area 8 (Gravity)	**12,700,000**
	(Range -15% /+30%: $8,890,000 to $19,050,000)
Planning Area 8 (LPS)	**14,330,000**
	(Range -15% /+30%: $10,040,000 to $21,500,000)
Planning Area 12	**30,320,000**
	(Range -15% /+30%: $21,230,000 to $45,480,000)
Planning Area 1	**25,580,000**
	(Range -15% /+30%: $17,910,000 to $38,370,000)
Planning Area 2	**33,790,000**
	(Range -15% /+30%: $23,660,000 to $50,690,000)

Notes:

1.) Gravity Service Connections assumes 15 linear feet of service connection for each property connecting to gravity sewer system.

2.) Low pressure sewer assumes 40 linear feet of service connection for each property connecting to low pressure sewer system.

3.) Costs developed in 2022 dollars.

4.) Typical planning level costs carry contingencies of -30% to +50%. Opinion of costs will continue to be refined during subsequent phases.

5.) For those properties connecting via gravity, cost does not include gravity service connections from the building to the sewer stub in the street and abandonment of septic system (this cost is to be paid by the homeowner).

6.) For those properties connecting via low pressure sewer, cost does not include abandonment of existing septic system or electrical upgrades that are necessary to support the grinder pump.

9.4.1 Opinion of Cost Unit Quantities

The following item quantities are based on calculations regarding the length of sewer installation and number of adjacent parcels:

- *1.25-inch HDPE Low Pressure Sewer Service Connections:* calculated using 40 LF of pipe per simplex grinder pump connection.
- *Simplex Grinder Pumps:* calculated by number of parcels adjacent to low pressure proposed gravity sewer installation.
- *Low Pressure Sewer Lateral Kits:* equivalent to the number of Simplex Grinder Pump Installations.
- *Low Pressure Cleanout Chambers:* calculated by total length of proposed low-pressure sewer divided by 1000.
- *Air/Vacuum Release Valve:* based on guidance provided by Environmental One Corporation.
- *6-inch Gravity Sewer Connection:* calculated by multiplying number of parcels adjacent to gravity proposed gravity sewer installation by 15 LF.
- *6-inch Gravity Sewer Service Connection Wye/Tee:* calculated by number of parcels adjacent to gravity proposed gravity sewer installation.
- *Sanitary Sewer Manholes:* calculated by taking total length of proposed gravity sewer divided by 500.
- *Rock Excavation:* calculated using the assumption of 1 foot of rock during excavation of 4-foot-wide trench for both gravity sewer and low-pressure sewer installation. As per **Figure 6.2.A**, proposed planning areas are not expected to have a large amount of bedrock to excavate.
- *Temporary Bituminous Repair:* calculated using sum of low-pressure sewer installation and gravity sewer installation plus 15 feet per adjacent parcel connecting to the installed system.
- *Permanent Bituminous Repair:* calculated using sum of low-pressure sewer installation and gravity sewer installation plus 15 feet per adjacent parcel connecting to the installed system.
- *Mill and Overlay (Town Road):* Calculated by multiplying average road width by length of gravity sewer and low-pressure sewer installation. Town ordinance dictates that for all road cuttings over 100 feet,

curb to curb restoration is necessary. Average road length was found to be 27.75 feet based on average road length measurements.

9.5 Cost Effectiveness

While the disparity in cost between the two alternative sewer layouts for planning areas 8 and 9 are minimal, low-pressure sewer requires additional responsibility in maintenance for the town. In the event of power outages, a maintenance crew would be necessary to pump down wastewater within the grinder unit with a portable generator. Grinder pump units typically have a minimum storage capacity of a day. Additionally, maintenance of grinder pumps and storage of additional parts would fall under the responsibility of the Town and carry its own additional cost not captured in the provided opinion of cost.

10 Financial Planning

10.1 Sewer Billing

The Town of Coventry's sewer ordinance and sewer use billings are based upon either minimum usage volumes or actual water consumption. Sewer use rates are multiplied by 80% of the actual water consumption, which is the presumed generation of wastewater per the IMA with West Warwick. Sewer use rate adjustments are typically approved by Town Council in July of each year, and sewer bills are issued in September of each year. Sewer bills are due in quarterly segments, and the alignment of water usage, Billing Quarter, and the cash flow by Calendar Quarter are summarized in **Table 10.1.A.**

Table 10.1.A
Sewer Use Billing

Water Usage	Billing Year Quarter	Cash Flow by Calendar Quarter (Payment Due)
KCWA Water Meter Data 2021	Billing Year 2022 Q1	[September 2022 – December 2022, Q4 2022] (**Oct 2022**)
	Billing Year 2022 Q2	[December 2022 – March 2023, Q1 2023] (**Jan 2023**)
	Billing Year 2022 Q3	[March 2023 – June 2023, Q2 2023] (**April 2023**)
	Billing Year 2022 Q4	[June 2023 – September 2023, Q3 2023] (**July 2023**)

The hysteresis or delay between actual water usage, receipt of water data from KCWA, and cash receipts recognized by Coventry's sewer department is approximately 2 years.

10.2 Existing Sewer Fund

A key component of Coventry's Wastewater Facility Plan is understanding the existing financial position of the Town's Sewer Fund and the fiscal impact of implementing the Selected/Recommended Facility Plan to both the Town and its residents. Currently, the Sewer Fund is operating in a deficit on an annual basis. The deficit is depicted on Chart 10.2 with the annual revenue line falling below the total operating and debt service costs.

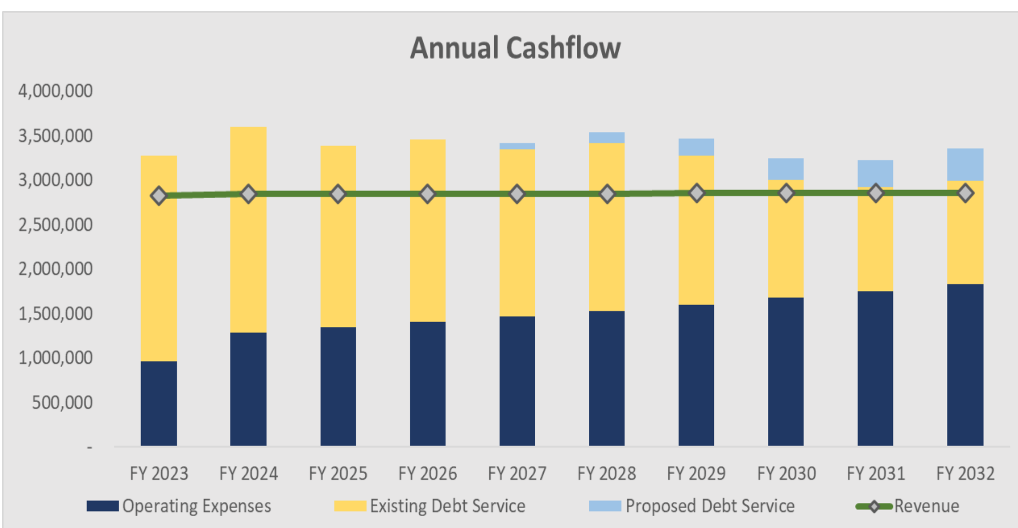

Figure 10.2: Sewer Fund Financial Forecast with No Rate Increases or Expansion

The current Sewer Fund balance is approximately $280,000 [as-of October 2023], and this value was used to model the financial position of the Sewer Fund under the two (2) scenarios outlined, below.

10.3 Cost Model and Financial Plan

A financial plan was developed in order to forecast the fiscal status of Coventry's Sewer Fund assuming a variety of parameters. Specifically, the financial plan takes into consideration:

- The Sewer Fund's annual revenue requirements, including operating expenses, existing debt service obligations, and the financing of future capital expenditures.
- Forecasts of revenue, assuming the Town's existing customer base, as well as revenue from new customers, both from user charges as well as assessments.
- The Sewer Fund's annual unrestricted reserve fund balance needs to be maintained at an adequate level for financial sustainability purposes.
- The timing and cost associated with capital expenditures required to not only maintain and improve existing wastewater service, but also to expand wastewater service to currently unsewered portions of the Town.
- The funding sources for said capital expenditures. The currently assumed funding sources are a mixture of American Rescue Plan Act (ARPA) funds; Rhode Island Infrastructure Bank grants; and Rhode Island State Revolving Fund (SRF) loans, with and without principal forgiveness.
- The overall goal is to bring the sewer fund to a balance equal to a year's operating cost.

Raftelis completed Cost Modeling. Scenario 1 involves maintenance of the existing sewer infrastructure with no additional sewer extensions. Scenario 2 involves extension of sewer service in accordance with the Selected/Recommended Facility Plan. The anticipated Sewer Fund balance are graphed for each scenario, below, and are based upon presumptions or conditions outlined herein.

For Scenario 1, taking into consideration a beginning balance of $280,000 and <u>no further expansion of wastewater service</u>, three consecutive (3) annual rate increases of approximately 10% followed by 5% annual rate increases thereafter to bring the Sewer Fund into a positive financial position in 2027 and to reach the targeted Sewer Fund balance in 2032. For reference, the national average cost of sewer service rate increase is approximately 6%, but it should be noted that the Sewer Fund has not had a rate increase in several years.

Table 10.3.A
Scenario 1: No Facilities Plan Implementation

Billing Year	Revenue Year	COV Fee Per HCF	WW Regional Fee Per HCF		
			Pass-thru	Cov add-on	Total
2023	2024	$ 5.10	$ 4.65	$ 1.43	$ 6.08
2024	2025	$ 5.61	$ 4.79	$ 1.57	$ 6.36
2025	2026	$ 6.17	$ 4.93	$ 1.73	$ 6.66
2026	2027	$ 6.79	$ 5.08	$ 1.90	$ 6.98
2027	2028	$ 7.13	$ 5.23	$ 2.00	$ 7.23
2028	2029	$ 7.48	$ 5.39	$ 2.10	$ 7.49
2029	2030	$ 7.86	$ 5.55	$ 2.20	$ 7.76
2030	2031	$ 8.25	$ 5.72	$ 2.31	$ 8.03
2031	2032	$ 8.66	$ 5.89	$ 2.43	$ 8.32
2032	2033	$ 9.10	$ 6.07	$ 2.55	$ 8.62

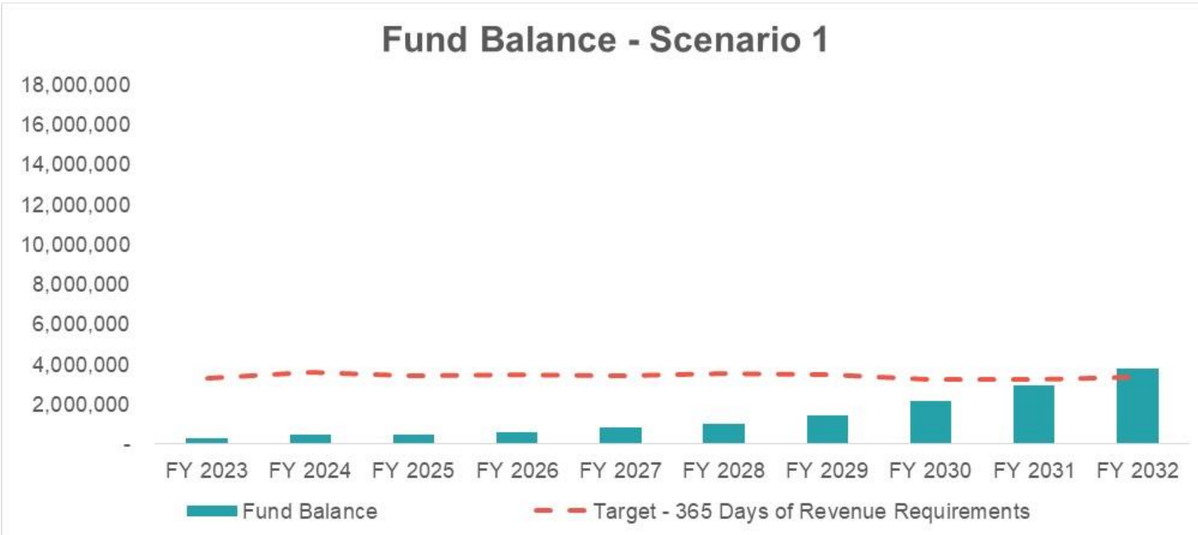

Figure 10.3.A: Scenario 1 - Sewer Fund Balance Forecast

For Scenario 2, taking into consideration a beginning balance of $280,000, no development assessment revenue, and a phased approach to expansion of service per the Selected/Recommended Plan, three consecutive (3) annual rate increases of approximately 30% followed by 5% annual rate increases thereafter to bring the Sewer Fund into a positive financial position in 2027 and to reach the targeted Sewer Fund balance in 2029.

Table 10.3.B
Scenario 2: Implement Facilities Plan

Billing Year	Revenue Year	COV Fee Per HCF	WW Regional Fee Per HCF		
			Pass-thru	Cov add-on	Total
2023	2024	$ 5.10	$ 4.65	$ 1.43	$ 6.08
2024	2025	$ 6.63	$ 4.79	$ 1.86	$ 6.65
2025	2026	$ 8.62	$ 4.93	$ 2.04	$ 6.98
2026	2027	$ 11.20	$ 5.08	$ 2.25	$ 7.33
2027	2028	$ 11.76	$ 5.23	$ 2.36	$ 7.60
2028	2029	$ 12.35	$ 5.39	$ 2.48	$ 7.87
2029	2030	$ 12.97	$ 5.55	$ 2.60	$ 8.16
2030	2031	$ 13.62	$ 5.72	$ 2.73	$ 8.45
2031	2032	$ 14.30	$ 5.89	$ 2.87	$ 8.76
2032	2033	$ 15.02	$ 6.07	$ 3.01	$ 9.08

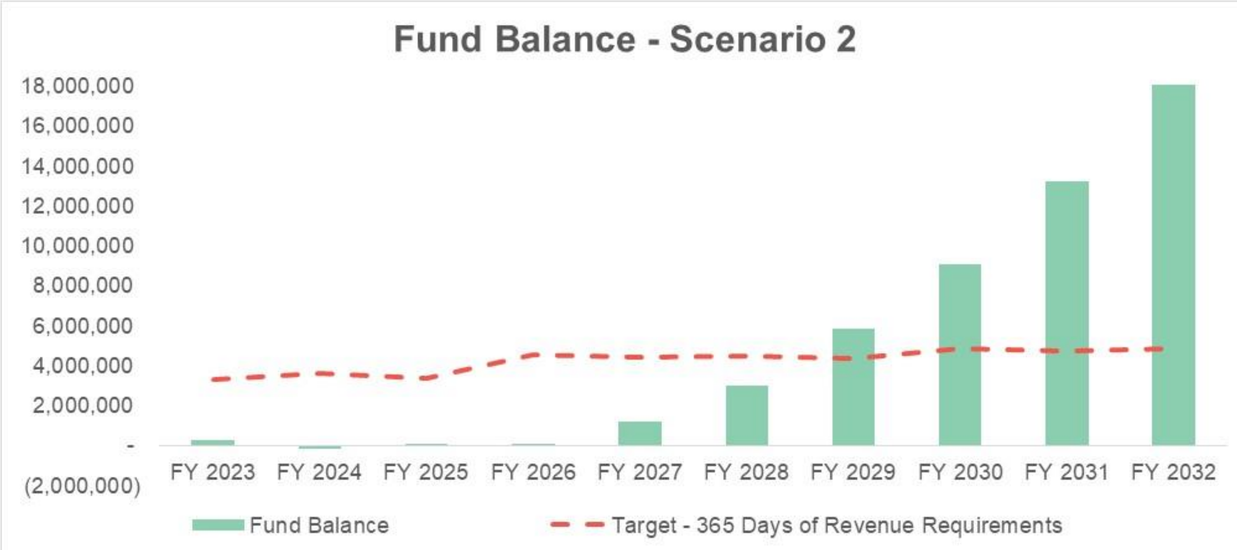

Figure 10.3.B: Scenario 2 - Sewer Fund Balance Forecast

The expansion of service, even with the associated costs of doing so, will help the long-term sustainability of the Sewer Fund by significantly increasing the revenue base. Additionally, there is potential that the Town could recover approximately $1M to $2M in funds in arrears from an existing development that has received sewer service. It is recommended that this influx of funds be placed in the Sewer Fund such that the beginning balance and ongoing operating balance provides the town opportunity for grant and loan eligibility. A healthier beginning balance in the sewer fund will allow the Town to minimize short term rate increases while implementing the Selected/Recommended Plan.

The Town may elect to adjust sewer use rates once the Sewer Fund reaches the target with Selected/Recommended Facility Plan Implementation. Impacts associated with residential sewer use rate increases on the average customer are compared for Scenarios 1 and 2 in the short-term, only, i.e. over the next three (3) billing years.

Table 10.3.C
Comparison of Customer Impacts / Annual Sewer Bill

Billing Year	Average Annual Bill Scenario 1	Average Annual Bill Scenario 2
2023	$ 805	$ 805
2024	$ 862	$ 956
2025	$ 924	$ 1,123
2026	$ 992	$ 1,335

11 Public Participation

Feedback from the public, members of the Sewer Subcommittee, Town Staff, Tiogue Lake Association, and the Town Council were incorporated into this Facility Plan. Information regarding the project and the opportunity to provide comments was included on the questionnaire documents that were distributed to the 9,000 properties that are within the boundary of the Planning Area through an open-ended comments section. These distributed documents can be found in **Appendix F**. A phone number was supplied with the questionnaire documents to contact Fuss & O'Neill to provide clarification and discuss concerns for the public. Public outreach through a survey was also incorporated with the CCP that is being prepared in conjunction with this document. Progress meetings were held with Town staff.

A major concern of public opinion is the cost associated with construction of sanitary infrastructure, and loss of investment in upgraded OWTS systems. Affordability has been incorporated as a concern category in our matrix evaluation, with high emphasis on Planning Areas that are eligible for funding opportunities such as the American Rescue Plan Act, RIDEM/Rhode Island Infrastructure Bank (RIIB) State Revolving Fund Loan and Loan Forgiveness Determination, RIIB Municipal Resilience Program and Action Grants, and the RIIB Municipal Infrastructure Grant Program. During public outreach events, cost modeling was presented to provide context for rate increases for existing sewer users with the first step (FY24) of the alternative financial plan, as well as comparing annual costs for OWTS users connecting to sewer. **Figure 11.1.A** provides dates and details for public participation events throughout the project.

- **July 13 2022**
  - F&O Participation at Sewer Subcommittee Meeting; Project Introduction to Sewer Subcommittee members
- **August 18 2022**
  - Meeting with Town staff to review GIS Mapping and perform boat tour with Tiogue Lake Association with Association Members, Town Manager, and Hillary Lima (District 4 Town Council Member)
- **August 22 2022**
  - Town Council Attendance
- **August 31 2022**
  - Presentation to Tiogue Lake Association Regarding Planning Area 9
- **September 14 2022**
  - Sewer Subcommittee Meeting Attendance
- **September 26 2022**
  - Town Council Meeting Project Update
- **October 4 2022**
  - Town Meeting #1 Workshop
- **October 12 2022**
  - Attended Community Comprehensive Plan Project Update Meeting
- **November 17 2022**
  - Public Open House
- **November 22 2022**
  - Town Meeting #2 Workshop and Cost of Service Model
- **April 11 2023**
  - Town Council Public Meeting
- **January 9th 2024**
  - Formal Public Hearing

Figure 11.1.A
Summary of Public Outreach Events

Photos taken during the Public Open House conducted on November 17, 2022 are provided below. The goal of the Public Open House event was to educate the public on the methodology for aspects of the project including selecting priority areas to sewer through the various alternatives, provide an anticipated schedule for the Facility Planning Milestones, questionnaire results, and most significant to many members of the audience, cost estimations and modeling. During the event, the public was given the opportunity to ask direct questions and voice concerns directly to Fuss & O'Neill employees. A copy of the Story Boards presented at the Public Open House are provided in **Appendix P**.

Figure 11.1.B – November 17, 2022 Public Open House Photos

Figure 11.1.C – November 17, 2022 Public Open House Photos

A preliminary public hearing was held during the Town Council meeting on April 11, 2023. The Public Hearing was advertised on the Town Council meeting agenda, which was posted on April 7, 2023 on the Secretary of State website. The alternatives and recommendations of this Facility Plan were presented, and the public was given an opportunity to provide feedback. No public comment was received.

A formal public hearing was held during the Town Council meeting on January 9, 2024. The public hearing was advertised on the in the Kent County Daily Times and posted on the Town's bulletin board and website. The presentation conveyed all administrative and infrastructure improvements as recommended in this Facilities Plan with accompanying opinion of cost and anticipatory implementation schedule. Additionally, sewer user rate impacts and potential funding sources were presented. Public comment conveyed support for extending sewer infrastructure to Planning Area 9 in leu of mounting decentralized wastewater system costs and environmental impacts on Lake Tiogue. Please see **Appendix Q** for the Wastewater Facility Plan Public Hearing Presentation presented to the public on January 9, 2024 as well as advertisement for the public hearing.

12 Intergovernmental Review

A draft of the Facilities Plan was provided to those agencies prescribed by RIDEM for review and comment. **Appendix S** includes copies of the correspondence regarding the intergovernmental review. A summary of the agencies contacted and their comments follows:

Rhode Island Department of Environmental Management (RIDEM)
RIDEM emphasized the recommendation outlined in Sections 1.2 & 7.3 of this report to update the Town's Onsite Waste Management Plan. Additionally, the Town should consider putting greater emphasis on extending sewer to Planning Area 5 for the purpose of enhancing drinking water protection through reduction of contamination potential for the Spring Lake well, which has exhibited enhanced nitrate readings in the past. This comment has been incorporated into Section 8.1 of the Facilities Plan. Lastly, the Office of Air Resources indicated that if any emergency generators are to be installed as part of the Selected/Recommended Facility Plan and sewer extensions, the owner will need to apply for a generator permit.

Fish and Wildlife Service
The Fish and Wildlife Service required a review be submitted for an Official Species Lists for the project area, as well as an Endangered Species Act Project Review. The findings of the Endangered Species Act indicated the presence of 3 threatened, endangered, or candidate species within the boundaries of the project area. These species consist of the Northern Long-eared Bat *Myotis septentrionalis*, the Monarch Butterfly *Danaus plexippus*, and the Small Whorled Pogonia *Istria Medeoloiders*. No critical habitats are within the bounds of the Planning Areas.

Coastal Resources Management Council
The Coastal Resources Management Council review concluded that there will not be an adverse impact to coastal resources of the state, provided the project is constructed, operated, and maintained in accordance with the State and EPA regulations.

Rhode Island Statewide Planning Program
The Rhode Island Statewide Planning Program reviewed the draft Facilities Plan and did not provide comment.

Narragansett Tribal Historic Preservation Office
The Narragansett Tribal Historic Preservation Office provided comment that the proposed infrastructure improvements for the Coventry High School are not eligible for listing in the National or State Registers of Historic Places. Additionally, extension of infrastructure within Planning Areas 8 & 9 includes two properties published in the Rhode Island Historical Preservation & Heritage Commission (RIHPHC) *Historic and Architectural Resources of Coventry: A Preliminary Report* which consist of the Sam Tarbox House on Arnold Road, and the William H. Antony House on Holmes Road. Within Planning Area 12 are multiple historic properties including the Anthony Village Historic District, which is listed in the National and State Registers of Historic Places, The General Nathaniel Greene Homestead at 50 Taft Street which is a designated National Historic Landmark and listed in both the National and State Registers, and the Quidnick Historic District. The RIHPHC must review and approve of any changes including ground disturbance for the General Nathaniel Greene Homestead as the holder of an easement in perpetuity on the property. Additionally, if this project

uses federal funds, permits, or licenses, an architectural survey to further identify unknown historic properties may be required. The RIHPHC will need to review the capital projects if they move forward.

National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration provided comment that there are no mapped Essential Fish Habitats within the boundaries of the Planning Areas. Additionally, there are no diadromous prey species that would be considered under FWCA. As such, no EFH and FWCA coordination is necessary going forward.

Natural Resources Conservation District

The Natural Resources Conservation District commented that the federal agency providing the funding must adhere to the Farmland Protection Policy Act and submit a D 1006 form along with the areas that will be impacted.

Rhode Island Department of Transportation (RIDOT)

RIDOT was contacted, but no response was received.

Tables

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Table 4.1.1.A
Soil Type Percentage
Town of Coventry, Rhode Island
Facilites Plan Update 2022

Soil Acronym	Soil Name	Sum of Sq Miles	Percentage of Total
AfA	Agawam fine sandy loam, 0 to 3 % slopes	0.153808399	0.26%
AfB	Agawam fine sandy loam, 3 to 8 % slopes	0.175159354	0.30%
BhB	Bridgehampton silt loam, 3 to 8 % slopes	0.003931491	0.01%
BmA	Bridgehampton silt loam, till Substratum, 0 to 3 % slopes	0.04594278	0.08%
BmB	Bridgehampton silt loam, till Substratum, 3 to 8 % slopes	0.007576005	0.01%
BoC	Bridgehampton-Charlton complex, extremely stony, 3 to 15 % slopes	0.499306478	0.84%
CkC	Canton And Charlton extremely stony fine sandy loams, 3 to 15 % slopes	3.39016419	5.73%
CdA	Canton And Charlton fine sandy loams, 0 to 3 % slopes	0.243437473	0.41%
CdB	Canton And Charlton fine sandy loams, 3 to 8 % slopes	0.607757223	1.03%
CdC	Canton And Charlton fine sandy loams, 8 to 15 % slopes	0.225004992	0.38%
CeC	Canton And Charlton fine sandy loams, very rocky, 3 to 15 % slopes	2.187601093	3.70%
ChD	Canton And Charlton very stony fine sandy loams, 15 to 25 % slopes	0.494107113	0.83%
ChB	Canton And Charlton very stony fine sandy loams, 3 to 8 % slopes	7.75538843	13.10%
ChC	Canton And Charlton very stony fine sandy loams, 8 to 15 % slopes	2.895980713	4.89%
CxC	Canton fine sandy loam, 3 to 15 percent slopes, extremely bouldery	0.457160597	0.77%
CaD	Canton-Charlton-Rock outcrop complex, 15 to 35 % slopes	0.272360918	0.46%
CaC	Canton-Charlton-Rock outcrop complex, 3 to 15 % slopes	0.526962417	0.89%
CB	Canton-Urban land complex	1.457173102	2.46%
CC	Canton-Urban land complex, very rocky	0.109707894	0.19%
Dc	Deerfield loamy fine Sand	0.386237896	0.65%
Du	Dumps	0.029811407	0.05%
EfA	Enfield silt loam, 0 to 3 % slopes	0.226106448	0.38%
EfB	Enfield silt loam, 3 to 8 % slopes	0.24693956	0.42%
FeA	Freetown, mucky peat, 0 to 2 % slopes	1.259200013	2.13%
GhD	Gloucester-Hinckley very stony sandy loams, hilly	0.027435059	0.05%
GhC	Gloucester-Hinckley very stony sandy loams, rolling	0.140840935	0.24%
HkA	Hinckley gravelly sandy loam, 0 to 3 % slopes	0.85486208	1.44%
HkD	Hinckley gravelly sandy loam, hilly	0.381992899	0.65%
HkC	Hinckley gravelly sandy loam, rolling	4.246845775	7.17%
HnC	Hinckley-Enfield complex, rolling	0.340706069	0.58%
LgC	Lippitt gravelly sandy loam, very rocky, 3 to 15 % slopes	1.018220797	1.72%
MmA	Merrimac sandy loam, 0 to 3 % slopes	1.169543348	1.98%
MmB	Merrimac sandy loam, 3 to 8 % slopes	1.272324137	2.15%
MU	Merrimac-Urban land complex	0.84857817	1.43%
NcC	Narragansett extremely stony silt loam, 3 to 15 % slopes	1.278192126	2.16%
NaA	Narragansett silt loam, 0 to 3 % slopes	0.07100129	0.12%
NaB	Narragansett silt loam, 3 to 8 % slopes	0.259327295	0.44%
NbB	Narragansett very stony silt loam, 0 to 8 % slopes	0.868951311	1.47%
NbC	Narragansett very stony silt loam, 8 to 15 % slopes	0.014377875	0.02%
Nt	Ninigret fine sandy loam	0.086933321	0.15%
PcC	Paxton extremely stony fine sandy loam, 3 to 15 % slopes	0.313115292	0.53%
PaA	Paxton fine sandy loam, 0 to 3 % slopes	0.351166992	0.59%
PaB	Paxton fine sandy loam, 3 to 8 % slopes	0.277617921	0.47%
PbB	Paxton very stony fine sandy loam, 0 to 8 % slopes	1.349368921	2.28%
PbC	Paxton very stony fine sandy loam, 8 to 15 % slopes	0.043787615	0.07%
PD	Paxton-Urban land complex	0.070766312	0.12%
Pg	Pits, gravel	0.474604551	0.80%
Pk	Pits, quarries	0.010619707	0.02%
Pp	Pootatuck fine sandy loam	0.020031559	0.03%
RbB	Rainbow very stony silt loam, 0 to 8 % slopes	0.013389149	0.02%
Rc	Raypol silt loam	0.097433503	0.16%
Re	Ridgebury fine sandy loam	0.004767719	0.01%
Rf	Ridgebury, Whitman, And Leicester extremely stony fine sandy loams	5.979124075	10.10%
Ru	Rippowam fine sandy loam	0.534917789	0.90%
Rp	Rock outcrop-Canton complex	0.047211597	0.08%

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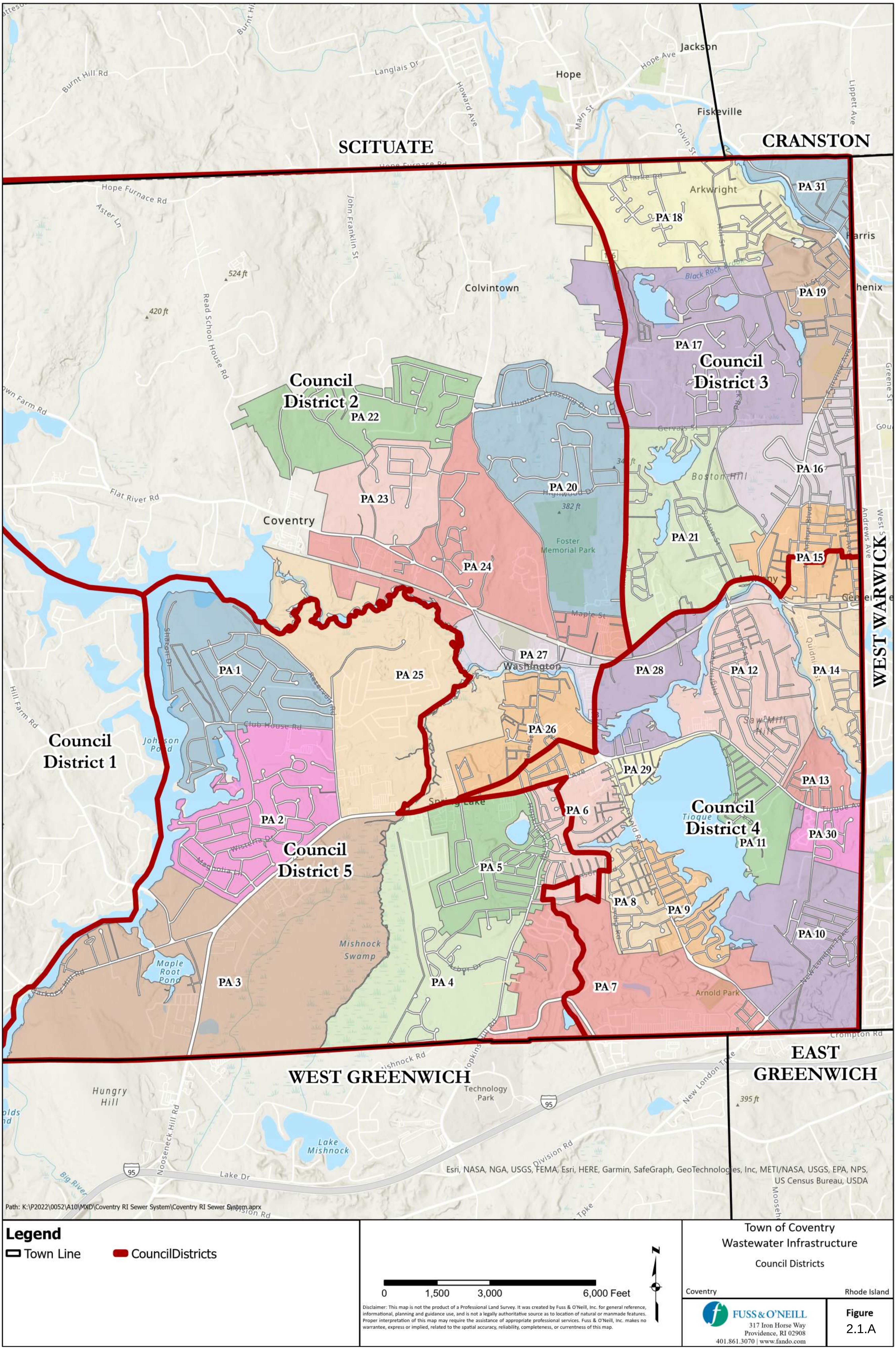
Soil Type Percentage
Town of Coventry, Rhode Island
Facilites Plan Update 2022

Soil Acronym	Soil Name	Sum of Sq Miles	Percentage of Total
Sb	Scarboro mucky sandy loam	0.948559379	1.60%
ScA	Scio silt loam, 0 to 3 % slopes	0.038226667	0.06%
Ss	Sudbury sandy loam	0.742280571	1.25%
SvB	Sutton extremely stony fine sandy loam, 0 to 8 % slopes	0.274924579	0.46%
StA	Sutton fine sandy loam, 0 to 3 % slopes	0.07560444	0.13%
StB	Sutton fine sandy loam, 3 to 8 % slopes	0.196262967	0.33%
SuB	Sutton very stony fine sandy loam, 0 to 8 % slopes	1.151892777	1.95%
SwA	Swansea mucky peat, 0 to 2 percent slopes	1.777870123	3.00%
Tb	Tisbury silt loam	0.055377923	0.09%
UD	Udorthents-Urban land complex	0.999023472	1.69%
Ur	Urban land	0.199531603	0.34%
Wa	Walpole sandy loam	1.179518768	1.99%
WdB	Wapping extremely stony silt loam, 0 to 8 % slopes	0.154881669	0.26%
WbB	Wapping silt loam, 3 to 8 % slopes	0.039044118	0.07%
WcB	Wapping very stony silt loam, 0 to 8 % slopes	0.267402079	0.45%
WgA	Windsor loamy sand, 0 to 3 % slopes	0.514209936	0.87%
WgB	Windsor loamy sand, 3 to 8 % slopes	0.46131499	0.78%
WrB	Woodbridge extremely stony fine sandy loam, 0 to 8 % slopes	0.877677453	1.48%
WhA	Woodbridge fine sandy loam, 0 to 3 % slopes	0.358522812	0.61%
WhB	Woodbridge fine sandy loam, 3 to 8 % slopes	0.223333726	0.38%
WoB	Woodbridge very stony fine sandy loam, 0 to 8 % slopes	2.50116093	4.22%

Figures



SCITUATE
CRANSTON
WEST WARWICK
WEST GREENWICH
EAST GREENWICH
Council District 1
Council District 2
Council District 3
Council District 4
Council District 5
PA 1
PA 2
PA 3
PA 4
PA 5
PA 6
PA 7
PA 8
PA 9
PA 10
PA 11
PA 12
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PA 31
Coventry
Washington
Hope
Jackson
Fiskeville
Arkwright
Harris
Colvintown
Foster Memorial Park
Johnson Pond
Tioque Lake
Maple Root Pond
Mishnock Swamp
Lake Mishnock
Technology Park
Hungry Hill
Boston Hill
Arnold Park
Spring Lake
Esri, NASA, NGA, USGS, FEMA, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA
Path: K:\P2022\0052\A10\MXD\Coventry RI Sewer System\Coventry RI Sewer System.aprx
Legend
Town Line
CouncilDistricts
0 1,500 3,000 6,000 Feet
N
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Wastewater Infrastructure
Council Districts
Coventry
Rhode Island
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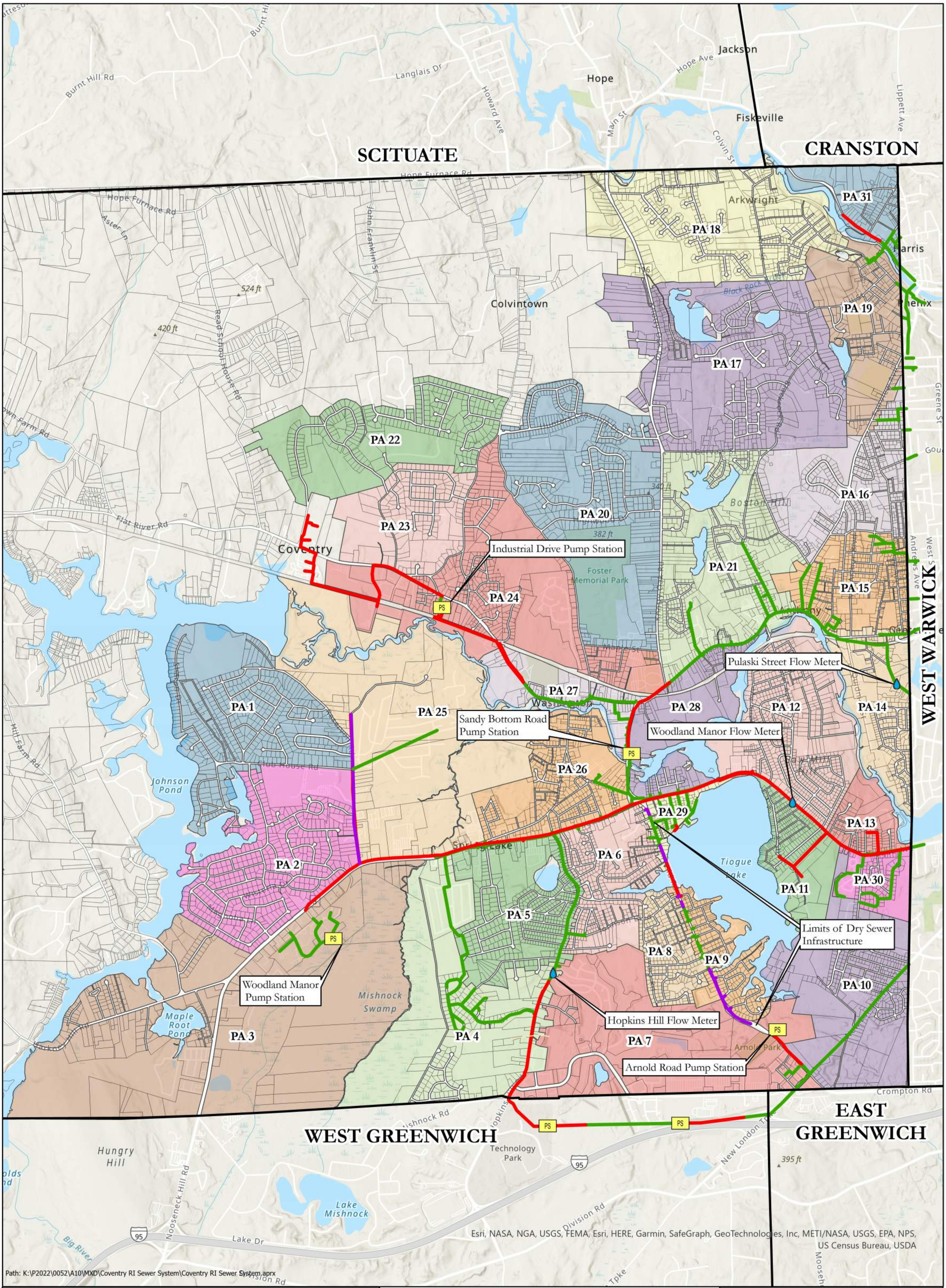
Figure
2.1.A



Legend

- Town Line
- Sanitary Sewer Gravity Main
- Sanitary Sewer Force Main
- Sanitary Sewer Low Pressure Sewer
- PS Pump Station

0 1,500 3,000 6,000 Feet

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Town of Coventry
Wastewater Infrastructure

Coventry Sewer Facility Plan

Coventry | Rhode Island

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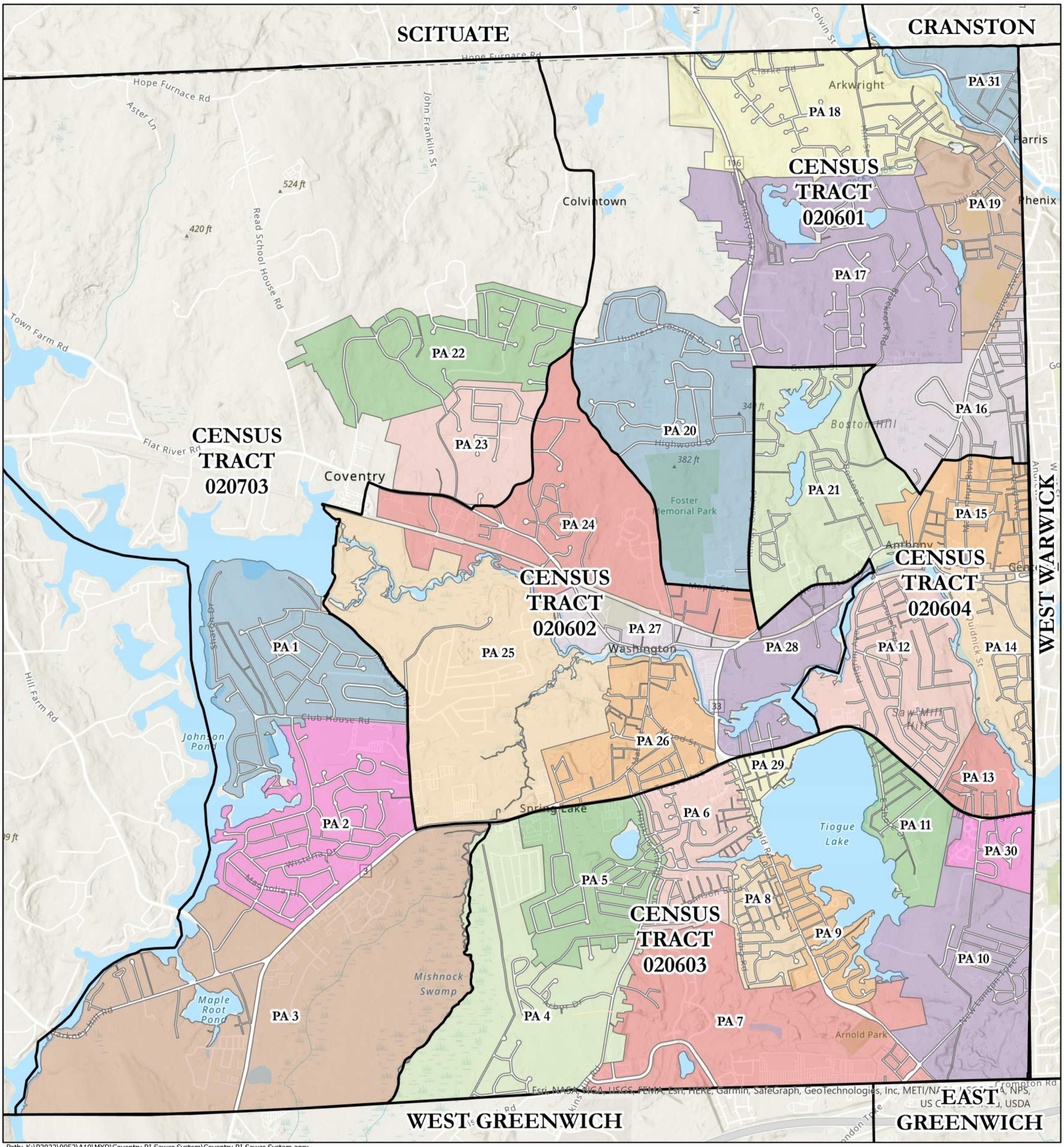
Figure
2.2.A



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	State of Rhode Island	Census Tract 020601	Census Tract 020602	Census Tract 020603	Census Tract 020604	Census Tract 020703
Median income (dollars)	$70,305	$91,994	$61,250	$75,591	$58,769	$123,397
Mean income (dollars)	$92,427	$106,562	$76,290	$94,874	$,71,887	$135,731
	Number of households					
Income Range	414,730	2,354	1,548	2,928	2,497	2,423
Less than $10,000	5.6%	2.1%	9.5%	2.2%	3.4%	1.2%
$10,000 to $14,999	4.9%	1.5%	4.4%	7.5%	3.4%	3.4%
$15,000 to $24,999	8.1%	3.6%	7.2%	15.5%	16.6%	3.9%
$25,000 to $34,999	7.8%	7.0%	7.0%	3.6%	6.5%	4.1%
$35,000 to $49,999	10.8%	7.0%	9.3%	11.0%	13.9%	4.8%
$50,000 to $74,999	15.8%	11.9%	19.0%	9.4%	19.0%	10.4%
$75,000 to $99,999	13.3%	19.9%	12.6%	18.8%	11.0%	12.3%
$100,000 to $149,999	18.3%	32.1%	23.2%	17.0%	15.4%	21.7%
$150,000 to $199,999	7.8%	8.8%	3.0%	4.1%	9.1%	20.6%
$200,000 or more	7.7%	6.1%	4.8%	10.9%	1.8%	17.6%

Legend

Census Tract

0 1,500 3,000 6,000 Feet

N

Source: 2020: ACS 5-Year Estimates of Income, https://data.census.gov/

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Town of Coventry
Planning Areas With 2020 ACS 5-Year Estimates of Income Data
Coventry Sewer Facility Plan

Coventry Rhode Island

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Figure 2.2.B

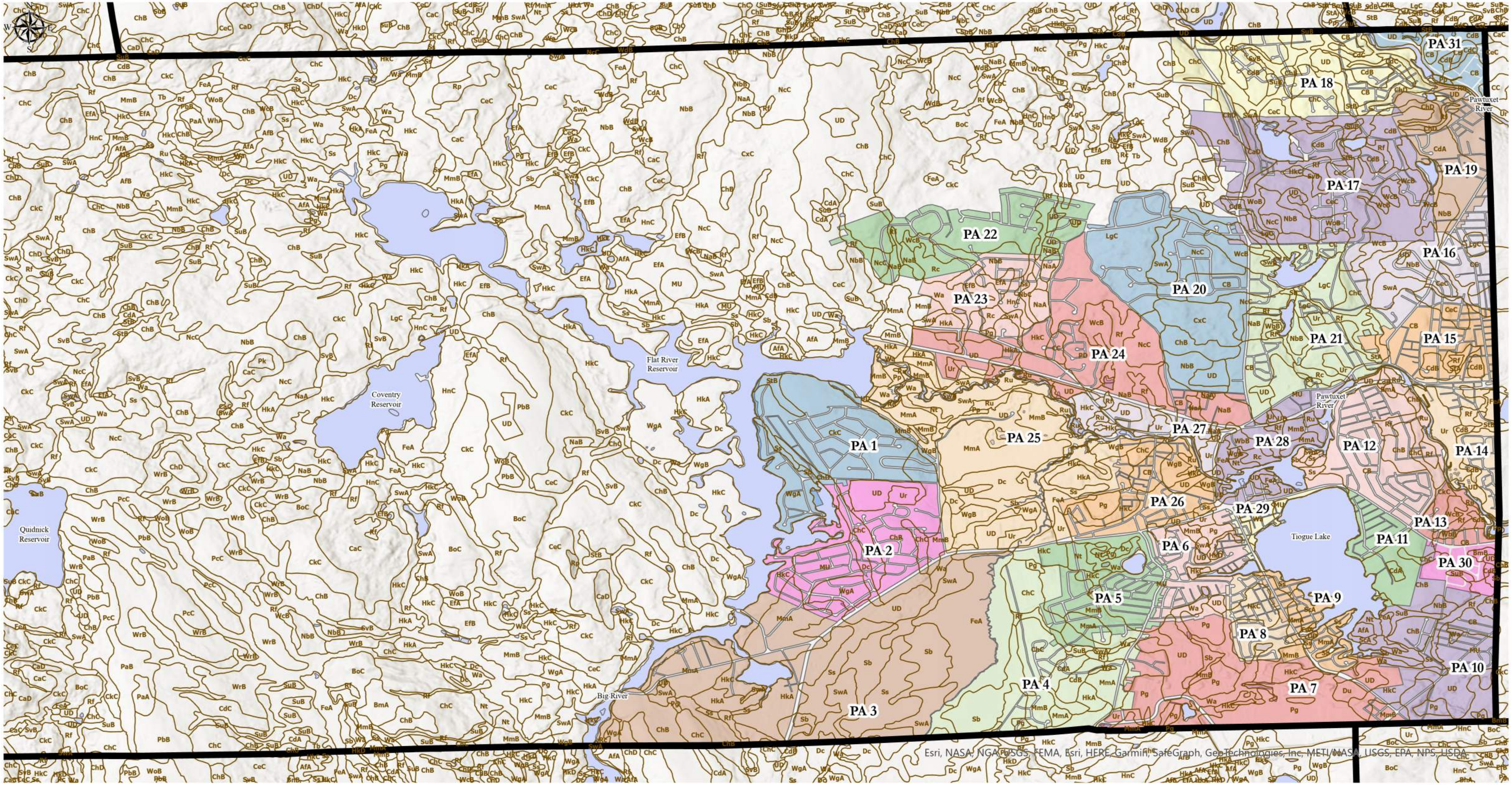


FIGURE 4.1.1.A DECEMBER 2022

Legend

Soils

Coventry, RI

0 2,500 5,000 10,000

Feet

Town of Coventry, RI
Sewer Facility Plan

Soils Delineation

FUSS & O'NEILL

Sources: https://www.rigis.org/
Path: \\private\DFS\GIS\P2022\0052\A10\MXD\Coventry RI Soil Types\Coventry RI Soil Types.aprx

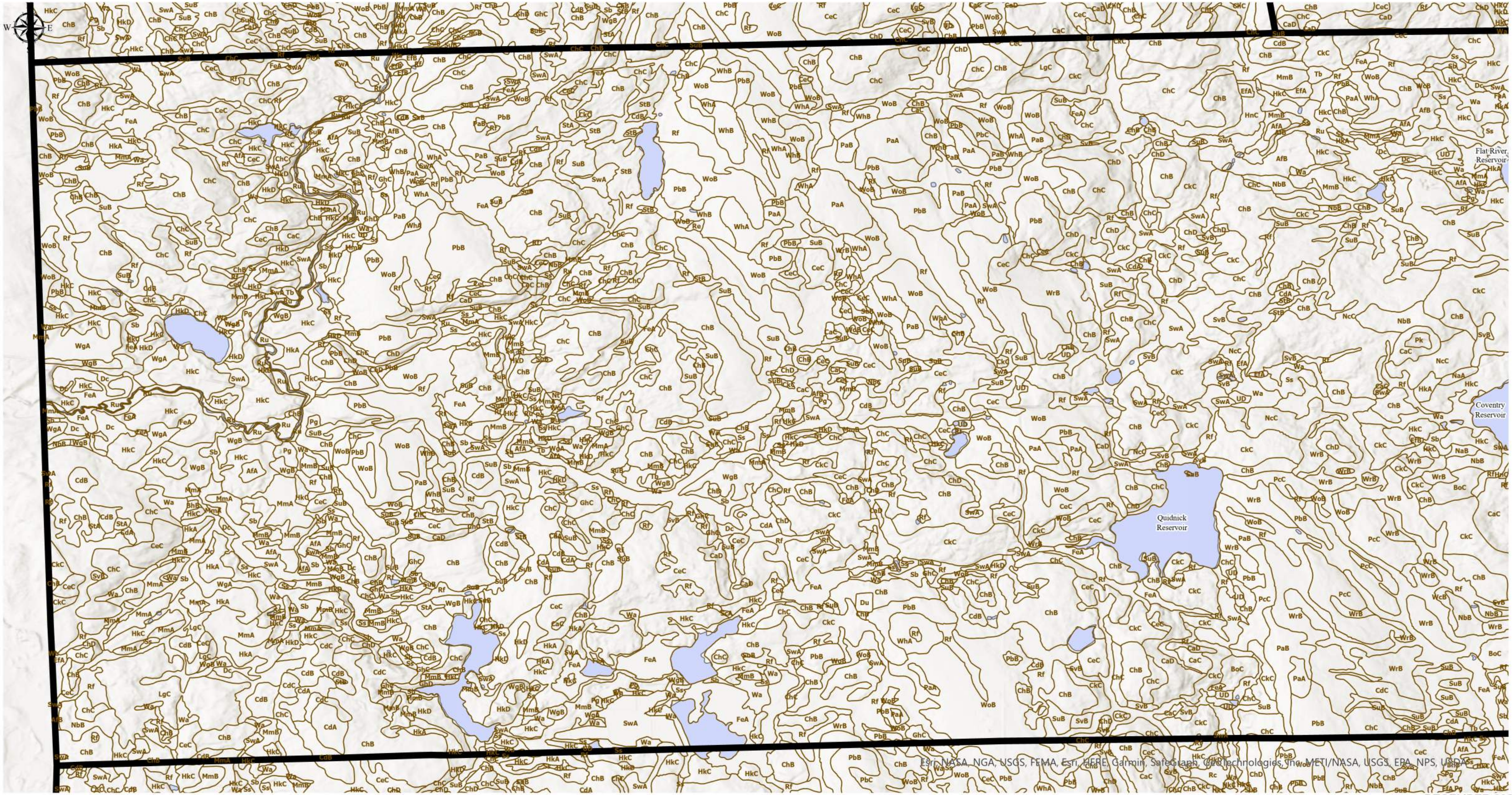


FIGURE 4.1.1.A

DECEMBER 2022

Legend

Soils

Coventry, RI

0 2,500 5,000 10,000

Feet

Town of Coventry, RI

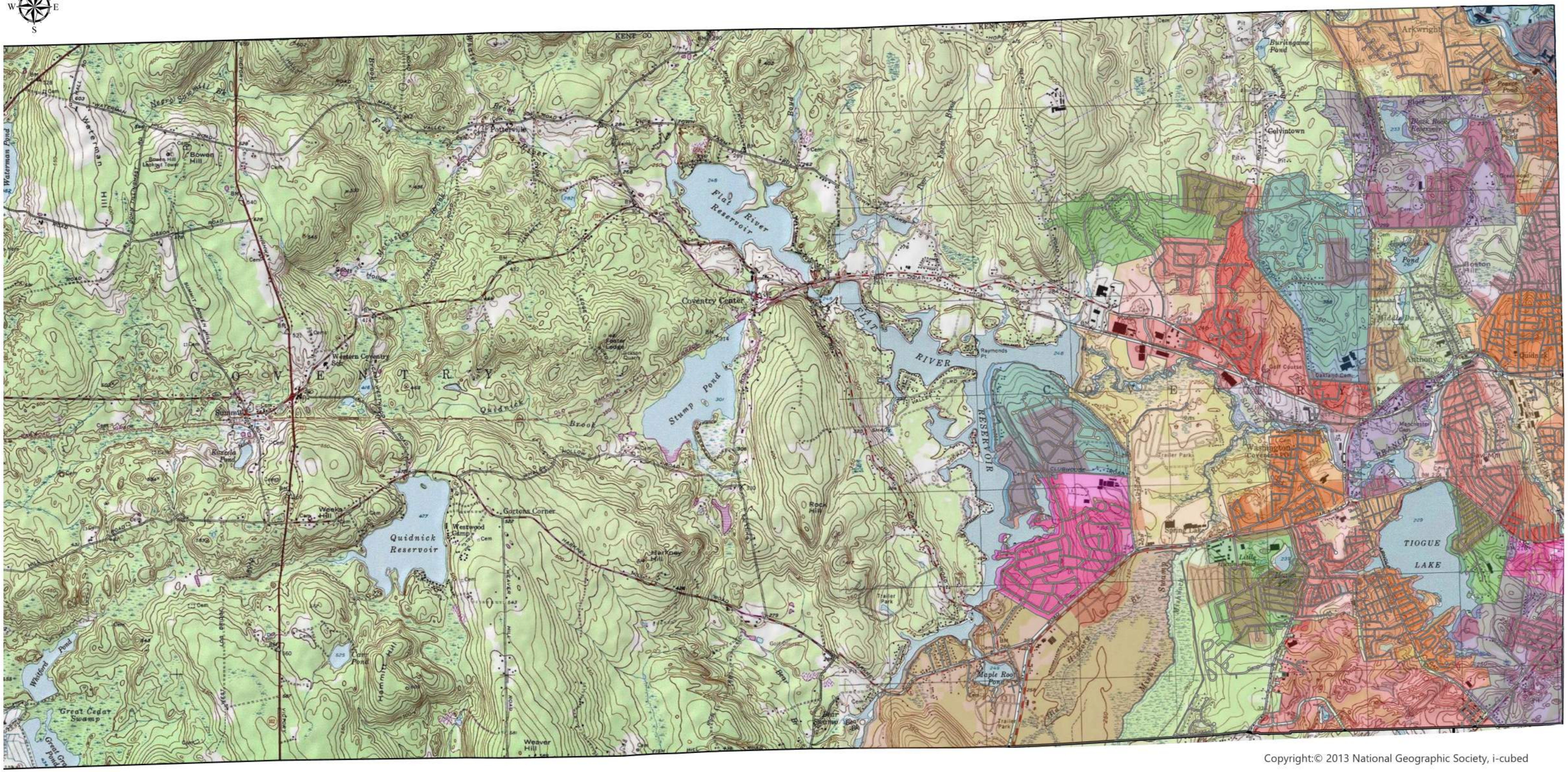
Sewer Facility Plan

Soils Delineation

FUSS & O'NEILL

Sources: https://www.rigis.org/

Path: \\private\DFS\GIS\P2022\0052\A10\MXD\Coventry RI Soil Types\Coventry RI Soil Types.aprx



Copyright:© 2013 National Geographic Society, i-cubed

FIGURE 4.1.2.A DECEMBER 2022

Legend

▭ Coventry, RI

0 2,500 5,000 10,000

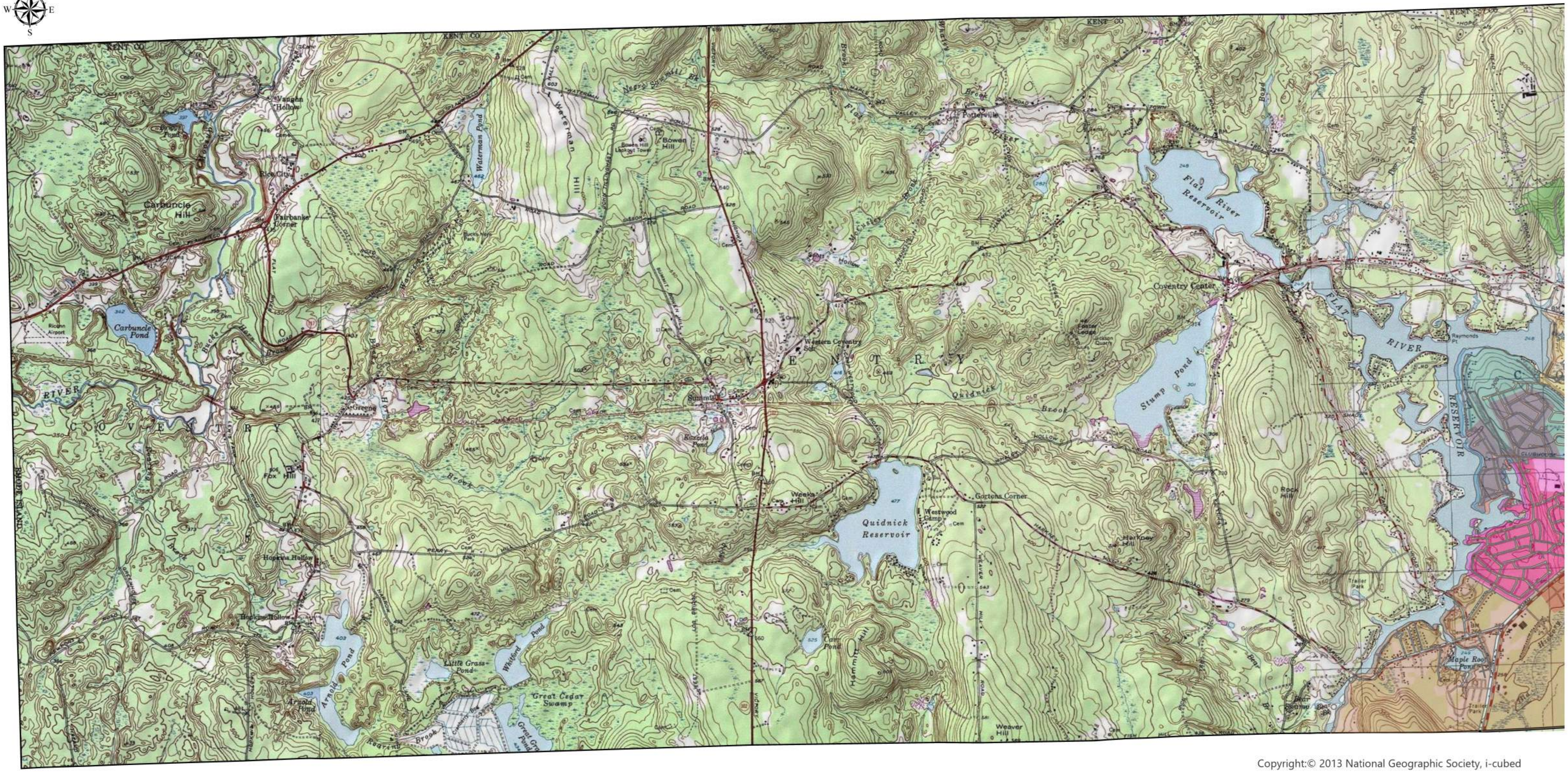
Feet

Sources: https://www.rigis.org/
Path: K:\P2022\0052\A10\MXD\Coventry RI Topographic Map\Coventry RI Topographic Map.aprx

Town of Coventry, RI
Sewer Facility Plan

USGS MAP

FUSS & O'NEILL



Copyright:© 2013 National Geographic Society, i-cubed

FIGURE 4.1.2.A DECEMBER 2022

Legend

▭ Coventry, RI

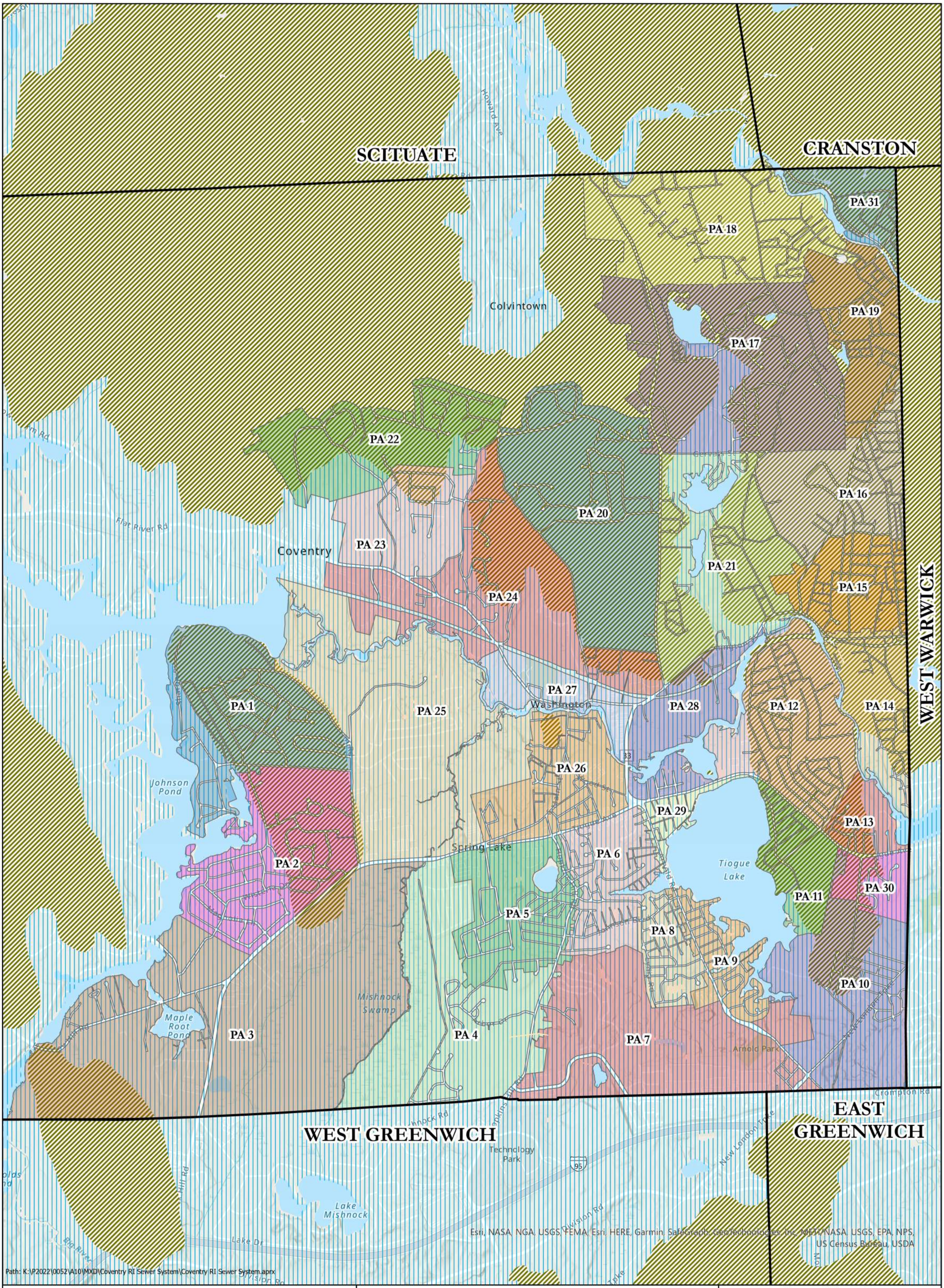
0 2,500 5,000 10,000

Feet

Sources: https://www.rigis.org/
Path: K:\P2022\0052\A10\MXD\Coventry RI Topographic Map\Coventry RI Topographic Map.aprx

Town of Coventry, RI
Sewer Facility Plan
USGS MAP

FUSS & O'NEILL



Legend

OUTWASH

TILL

Town Line

0 1,500 3,000 6,000 Feet

N

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Town of Coventry
Glacial Deposits

Coventry Sewer Facility Plan

Coventry Rhode Island

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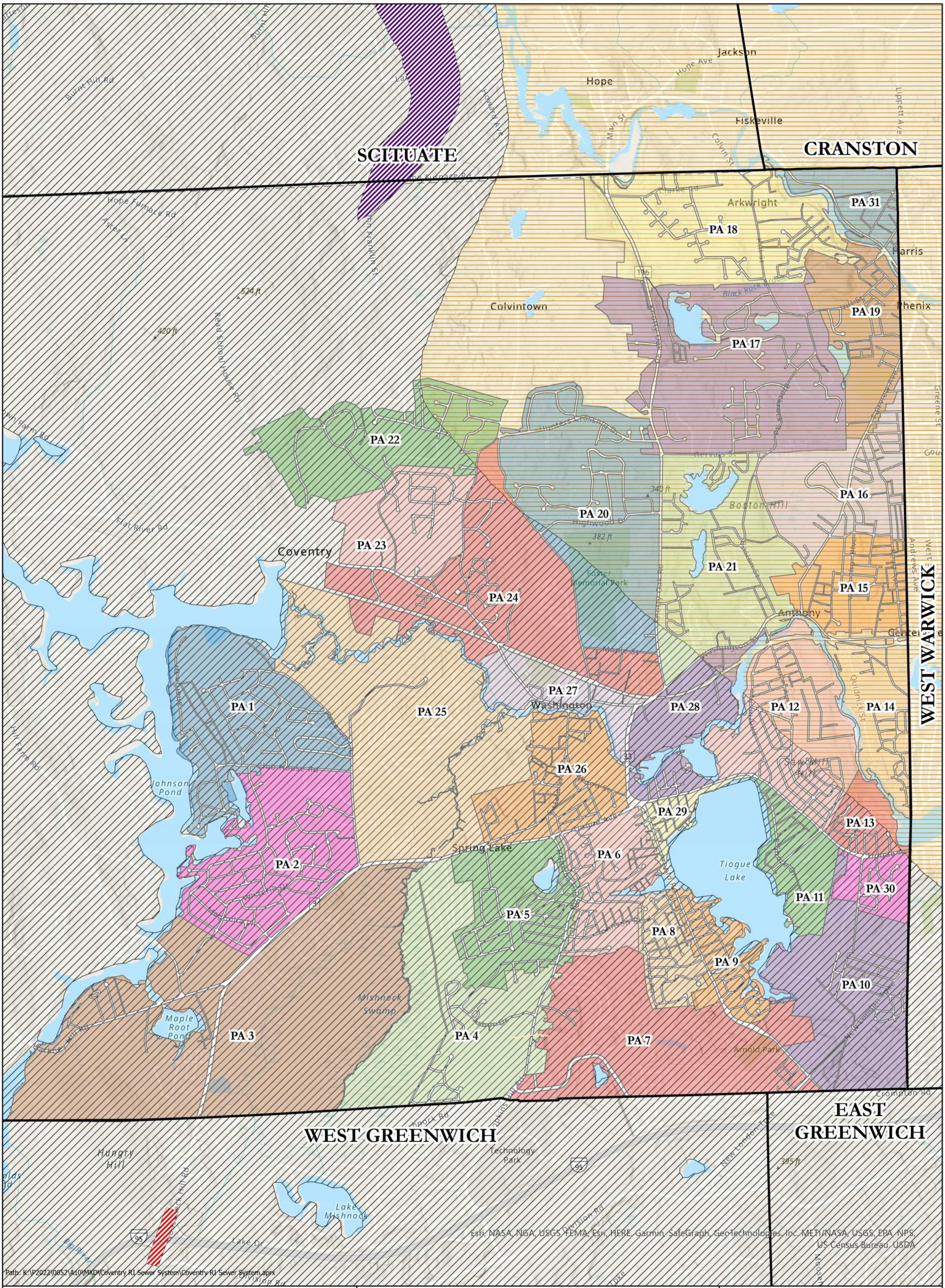
Figure
4.1.3.A



Legend

- Alkali-Feldspar Granite
- Diabase
- Fine-Grained Granite
- Granite
- Town Line

0 1,500 3,000 6,000 Feet

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Town of Coventry
Bedrock Type

Coventry Sewer Facility Plan

Coventry Rhode Island

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Figure
4.1.3.B

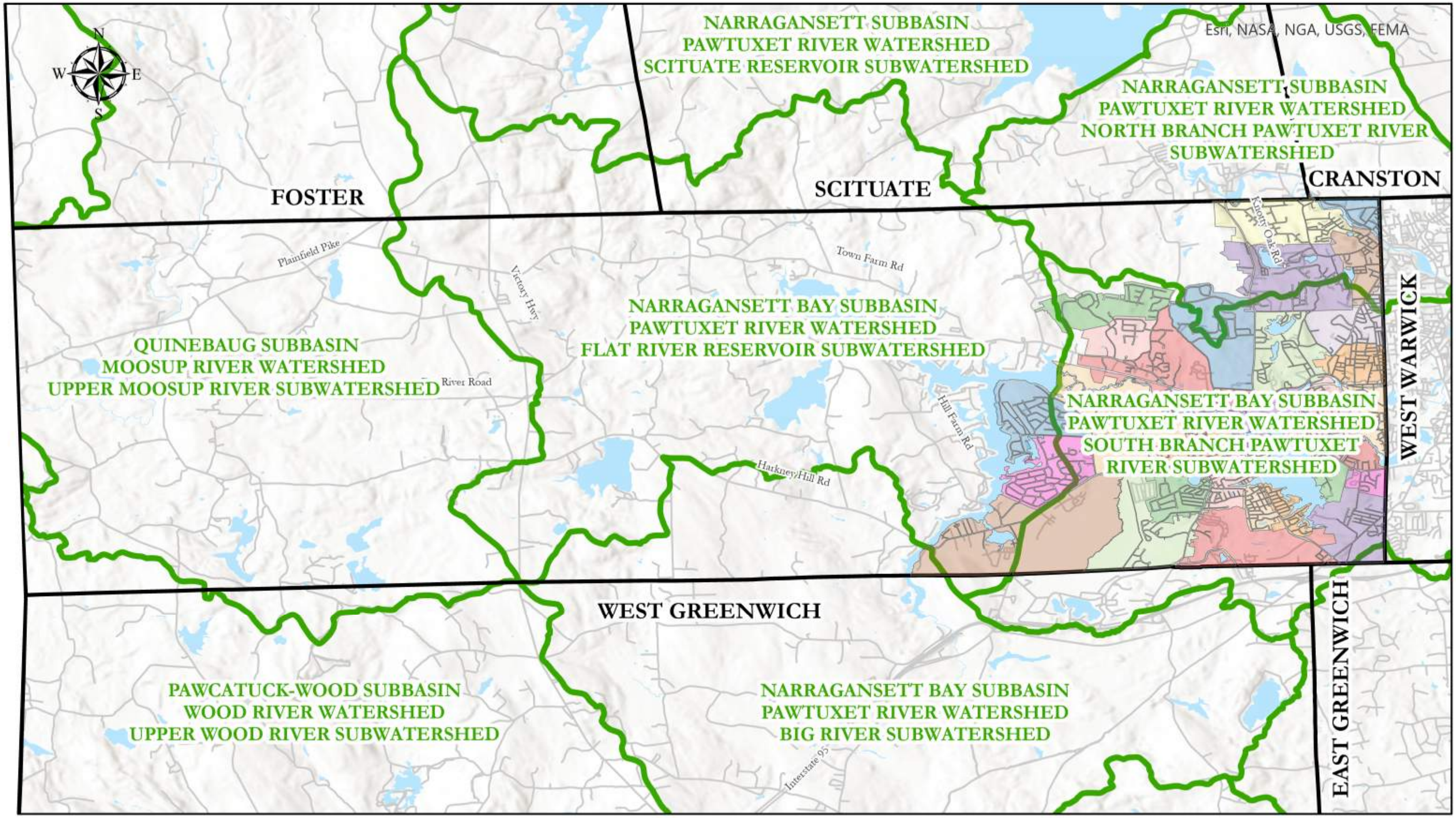


FIGURE 4.1.4.A

DECEMBER 2022

Legend

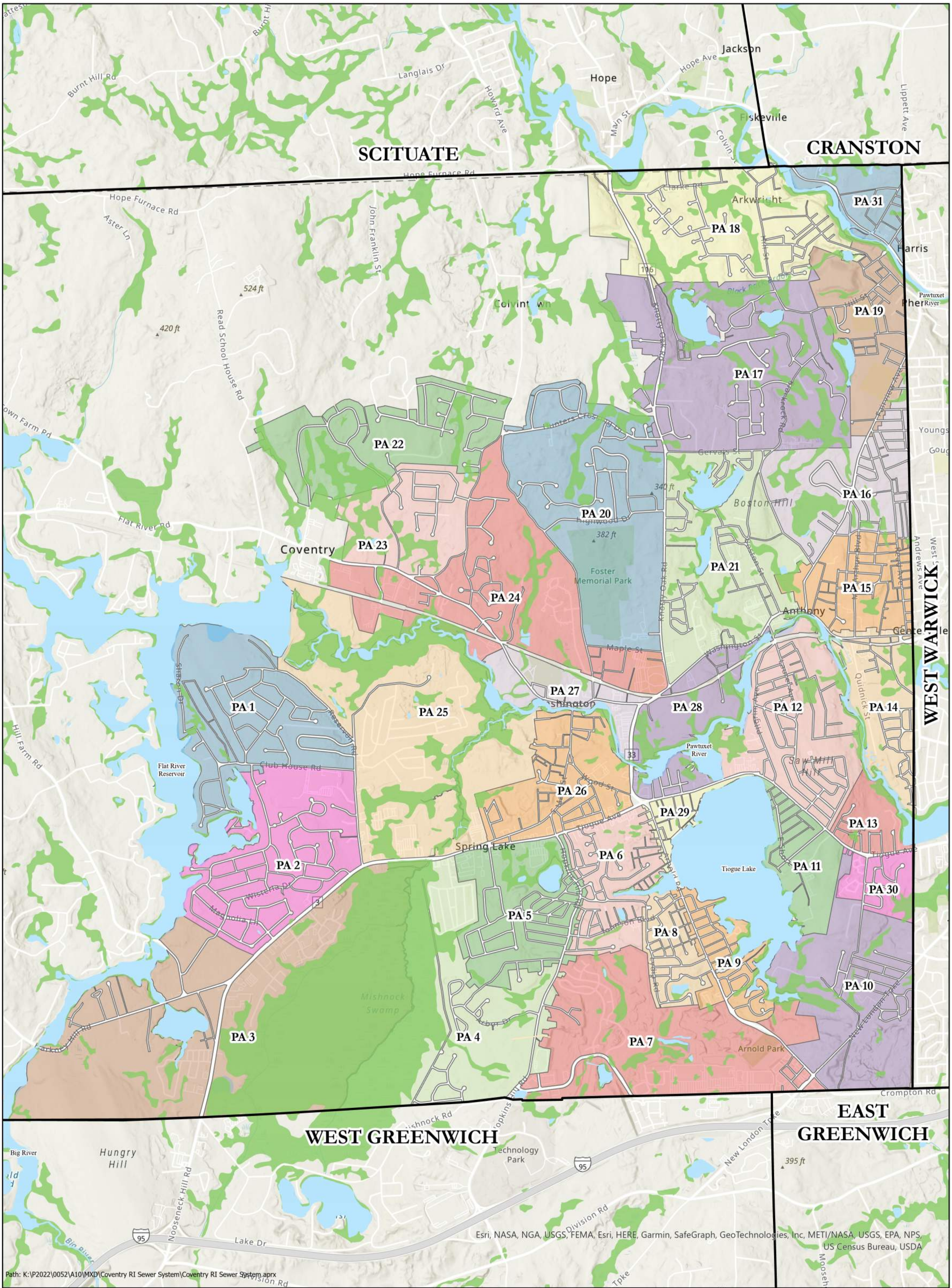
- Watershed Boundaries
- Ponds and Lakes
- Roads
- Municipalities

0 5,000 10,000 20,000
Feet

Sources: https://www.rigis.org/
Path: K:\P2022\0052\A10\MXD\Coventry RI Drainage Basins\Coventry RI Drainage Basins.aprx

Town of Coventry, RI
Sewer Facility Plan
Drainage Basin Delineation

FUSS & O'NEILL



Legend

- Town Line
- Ponds and Lakes
- Wetlands

0 1,500 3,000 6,000 Feet

N

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Town of Coventry
Wetlands Delineation Map
Coventry Sewer Facility Plan

Coventry Rhode Island

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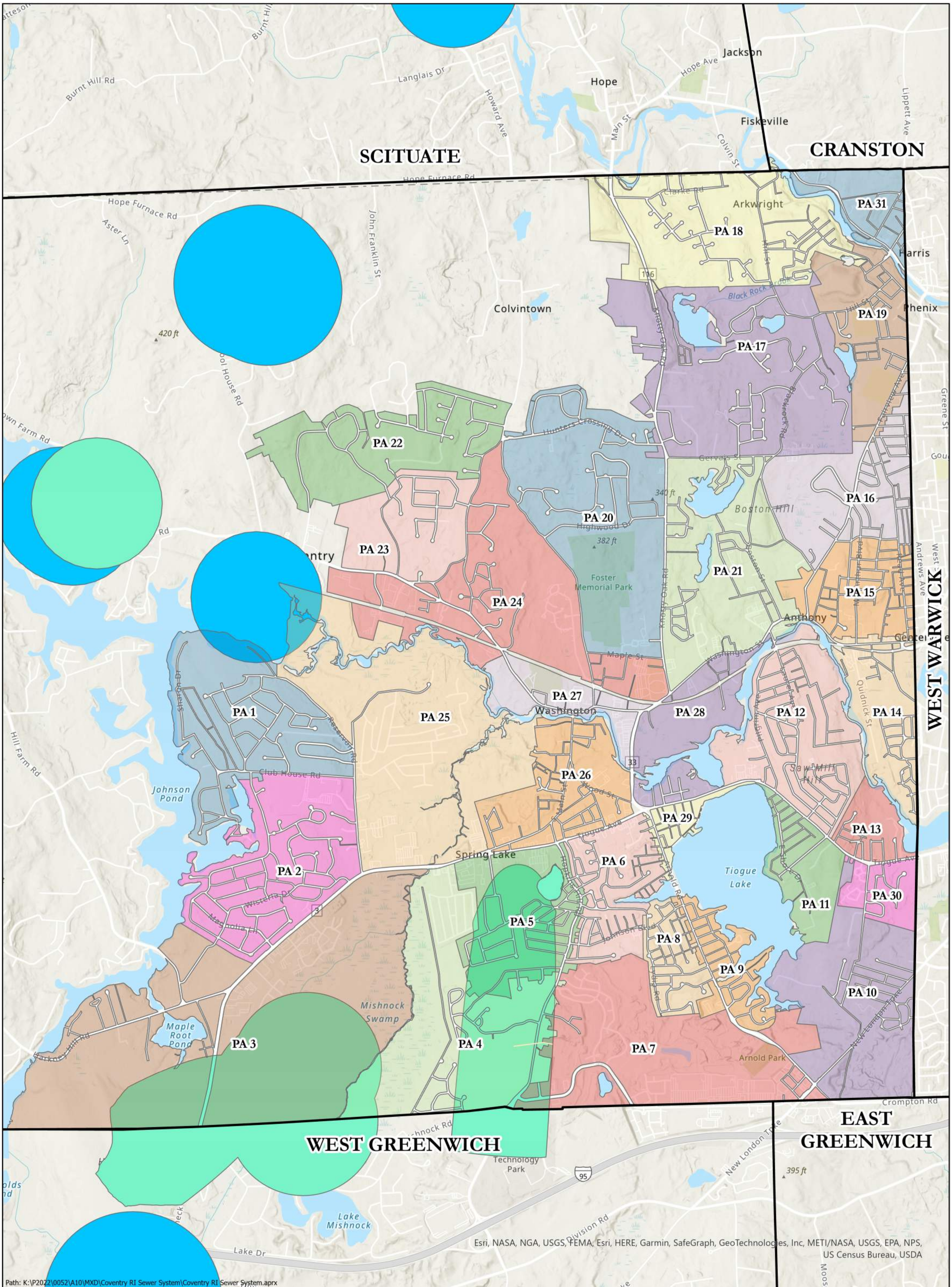
Figure
4.2.2.A



Legend

Well Head Protection Area

NonCommunity Well Head Protection Area

Town Line

0 1,500 3,000 6,000 Feet

N

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Town of Coventry
Wellhead Protection Area

Coventry Sewer Facility Plan

Coventry | Rhode Island

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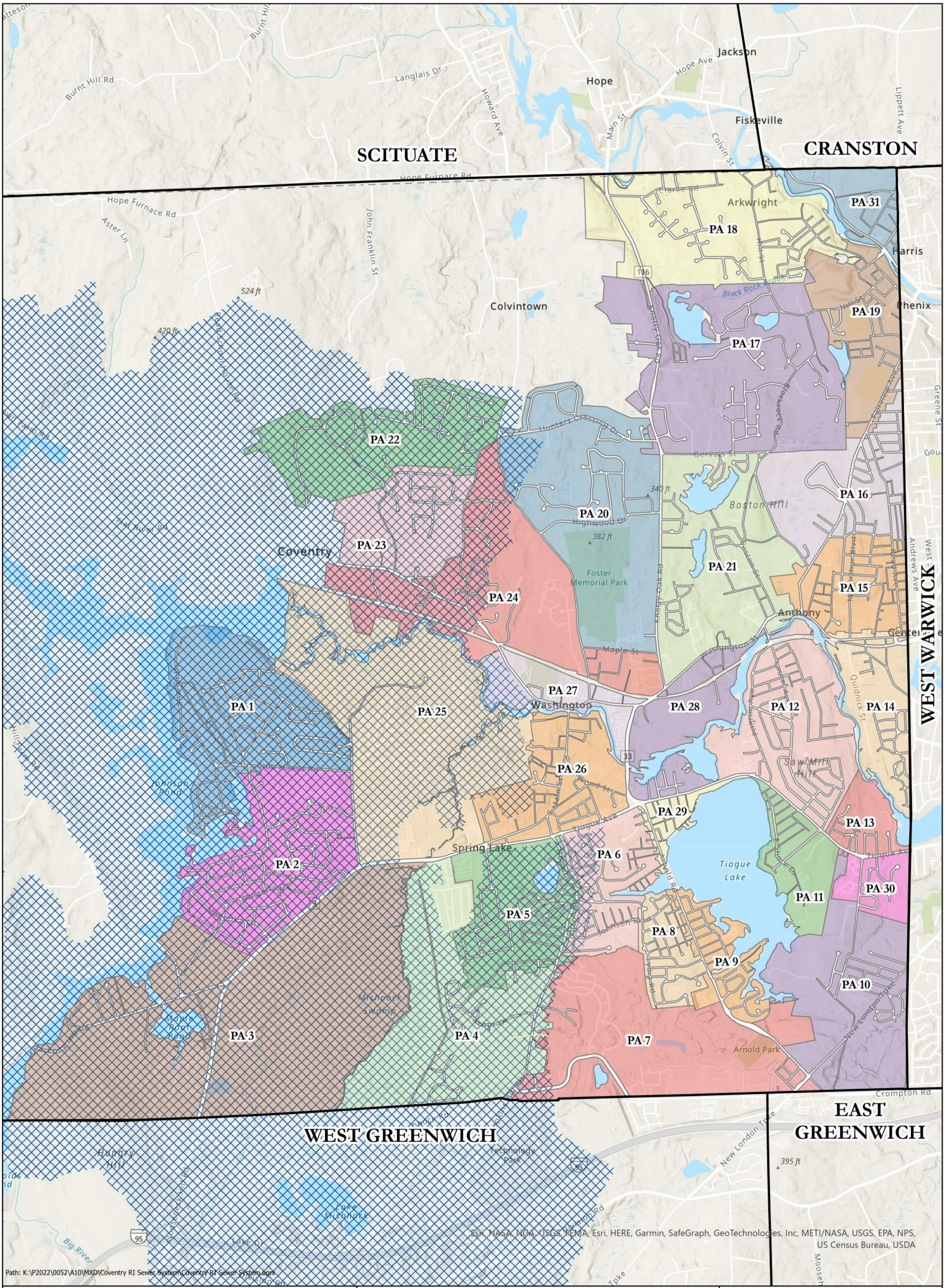
Figure
4.3.A



Legend

Town Line

Groundwater Recharge Area

0 1,500 3,000 6,000 Feet

N

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Town of Coventry
Groundwater Recharge Area

Coventry Sewer Facility Plan

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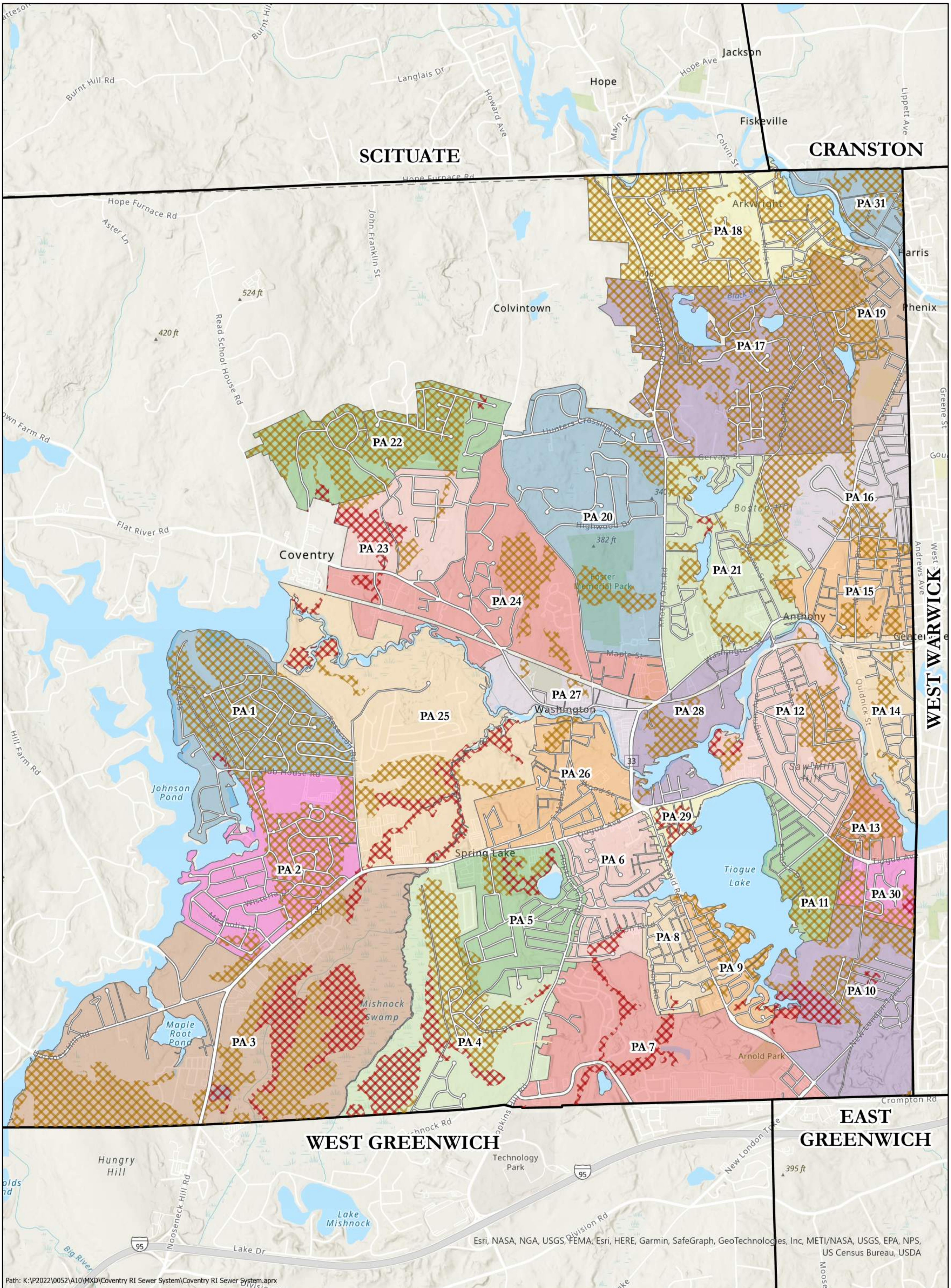
Figure
4.3.B



Legend

- Groundwater Table < 2 Feet Below Soil Surface
- Potentially Problematic
- Town Line

0 1,500 3,000 6,000 Feet

N

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Town of Coventry
Problematic Soil Areas
Coventry Sewer Facility Plan

Coventry | Rhode Island

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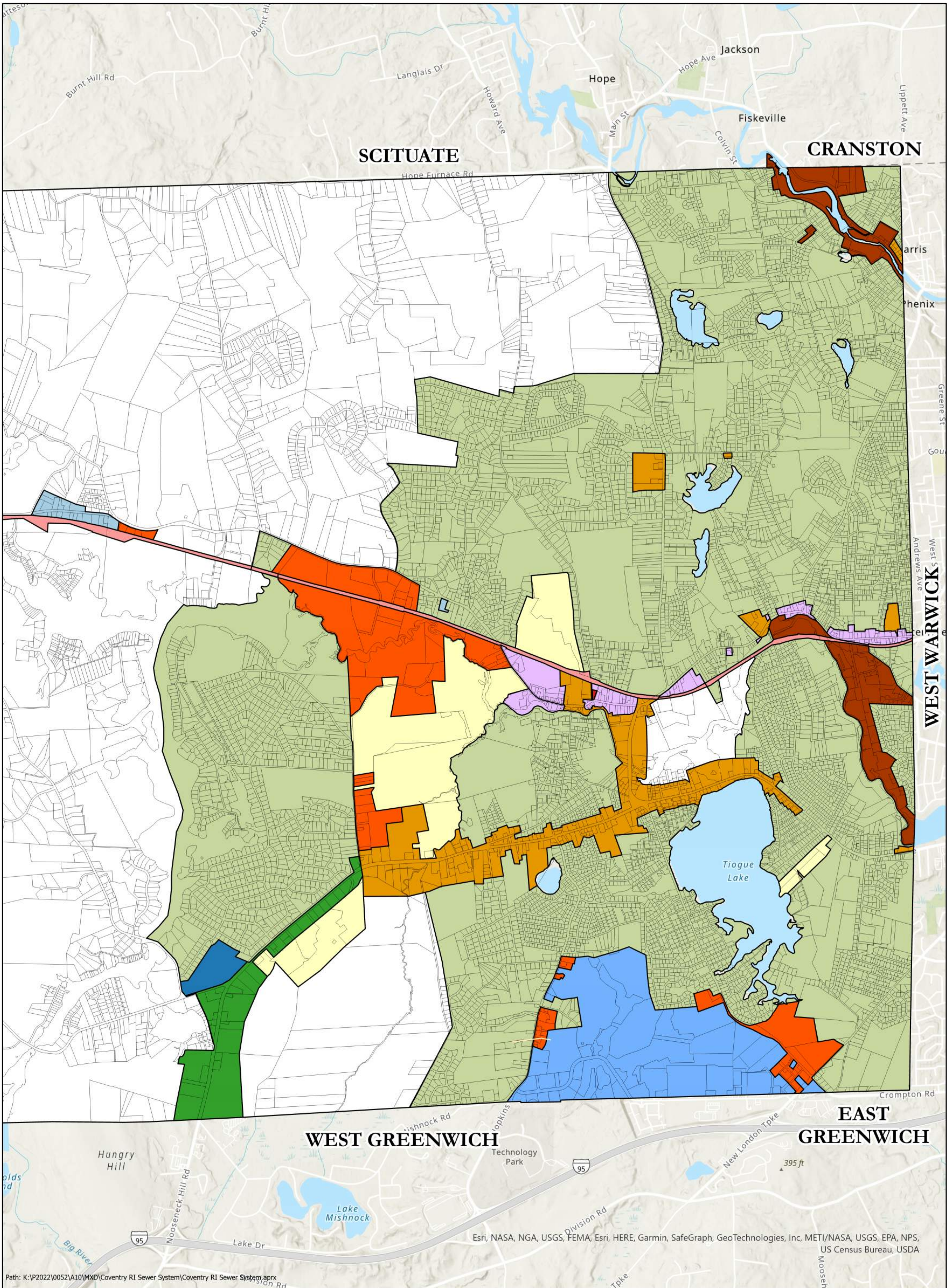
Figure
4.4.D



Legend

Zoning Code

- VRC
- BP
- GB
- GB1
- GW
- HD
- I1
- I2
- PD
- R20
- RR2
- RR3
- RR5
- SPD
- VMC

0 1,500 3,000 6,000 Feet

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Town of Coventry
Zoning Map
Coventry Sewer Facility Plan

Coventry Rhode Island

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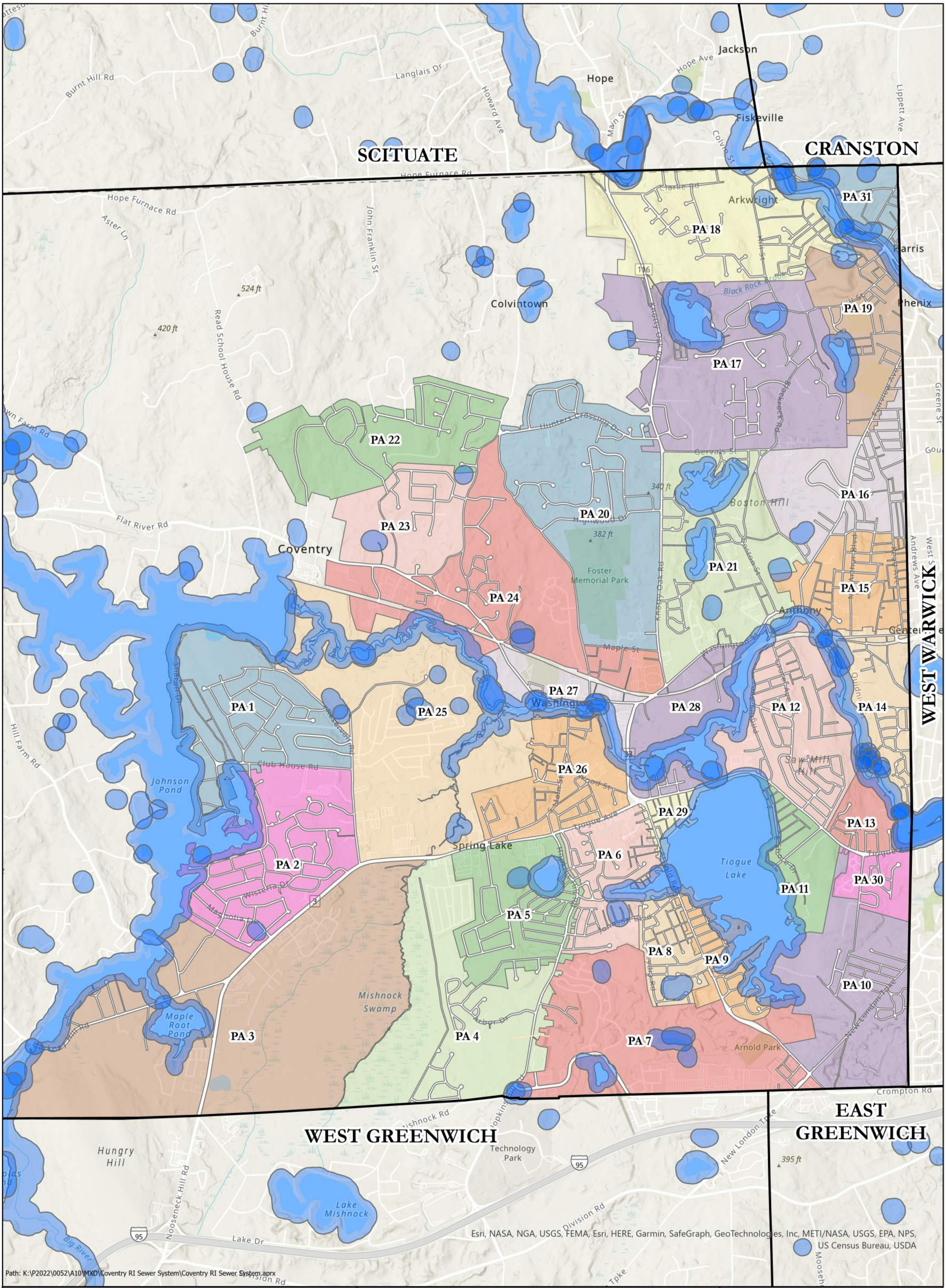
Figure
4.5.A



Legend

Town Line

Ponds and Lakes Buffer 200ft

0 1,500 3,000 6,000 Feet

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Town of Coventry
Water Body 200-Foot Buffer

Coventry Sewer Facility Plan

Coventry Rhode Island

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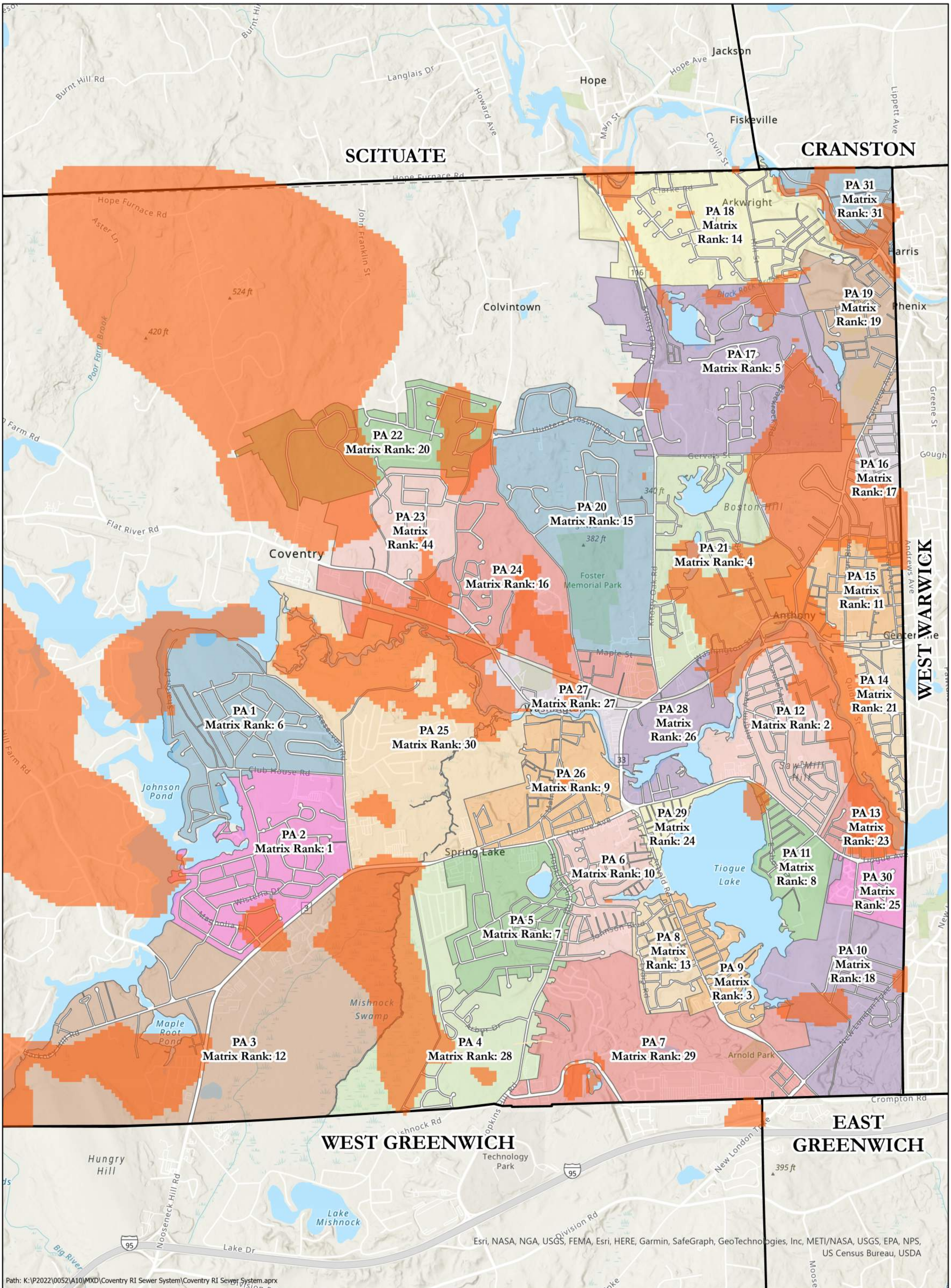
Figure 6.1.A



Legend

Town Line

Less Than 10 Feet of Soil Cover

0 1,500 3,000 6,000 Feet

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Town of Coventry

Cover Above Bedrock Map

Coventry Sewer Facility Plan

Coventry Rhode Island

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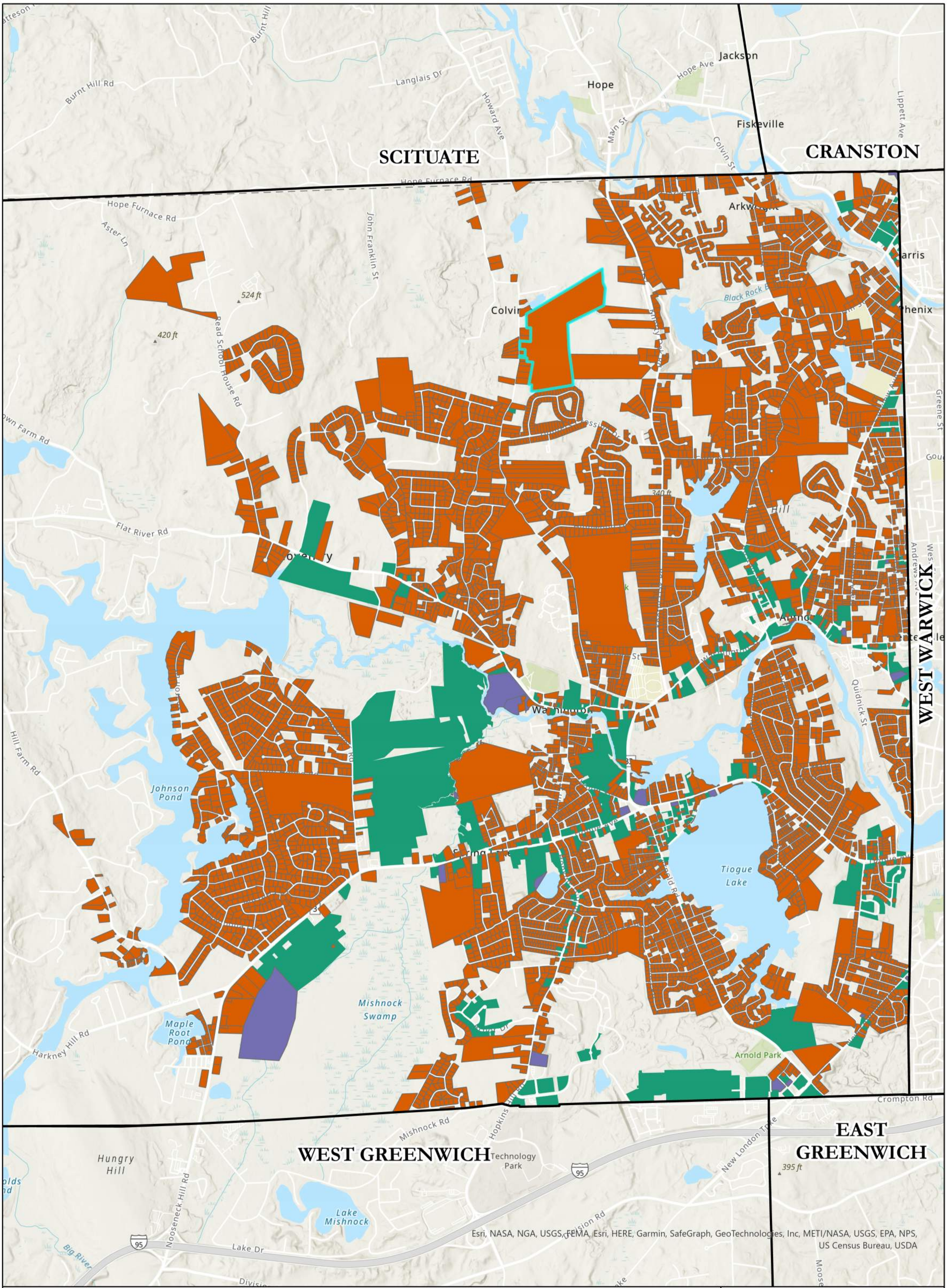
Figure 6.2.A



Legend

Sewer & Water Usage Data

- Sewered Parcel With Water Usage Data
- Not Sewered Parcel With Water Usage Data
- Sewered Parcel Without Water Usage Data

0 1,500 3,000 6,000 Feet

N

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Town of Coventry
Water Usage Layout
Coventry Sewer Facility Plan

Coventry | Rhode Island

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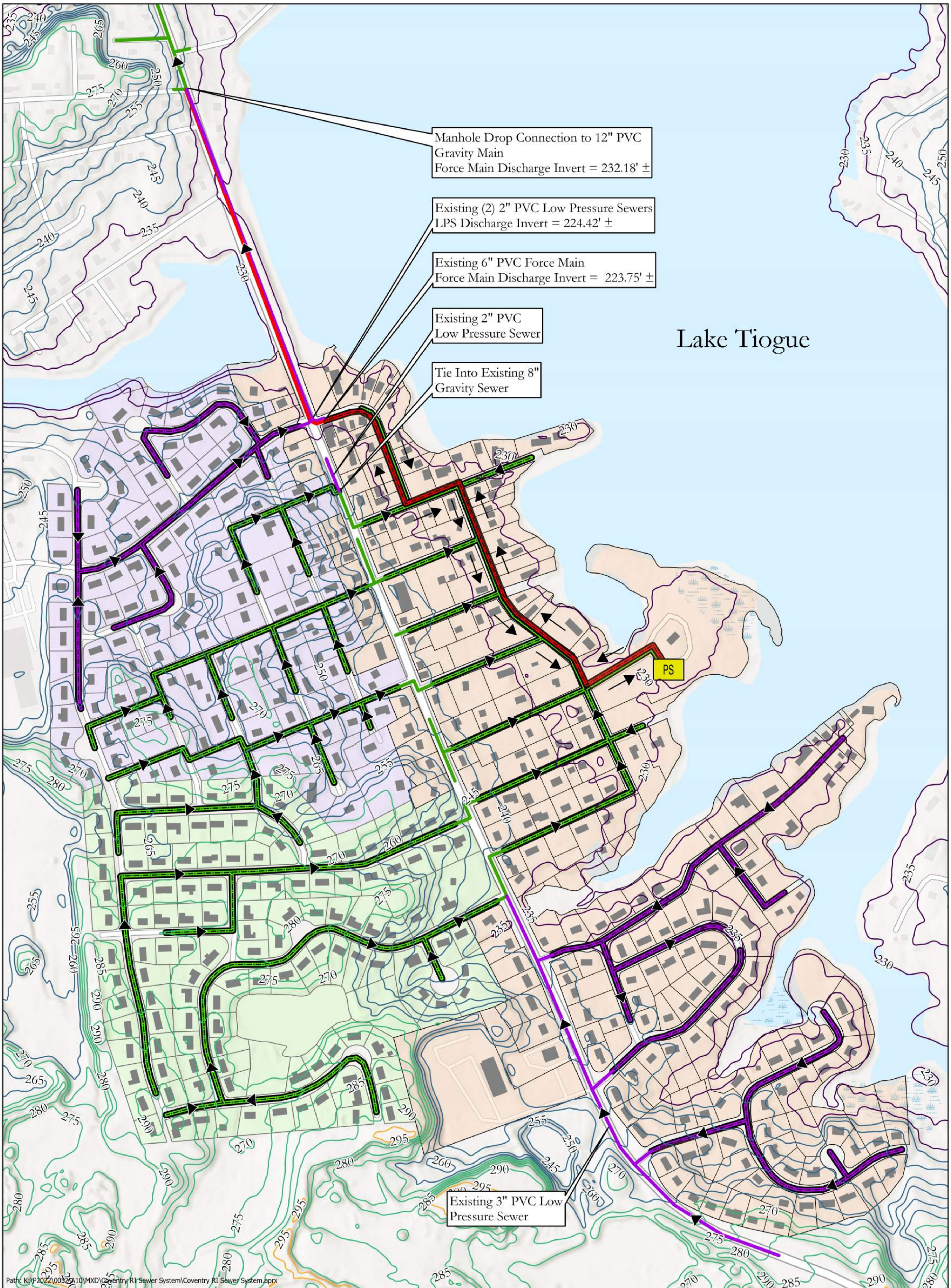
Figure 7.1.A



Legend

- Existing Low Pressure Sewer
- Existing Force Main
- Existing Gravity Sewer
- PS Proposed Pump Station
- Proposed Low Pressure Sewer
- Proposed Force Main
- Proposed Gravity
- Phase 1 (PA 9)
- Phase 2 (PA 8)
- Phase 3 (PA 8)

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0 200 400 800 Feet

N

Town of Coventry
Planning Area 8 & 9
Gravity Sewer Phases

Coventry Sewer Facility Plan

Coventry Rhode Island

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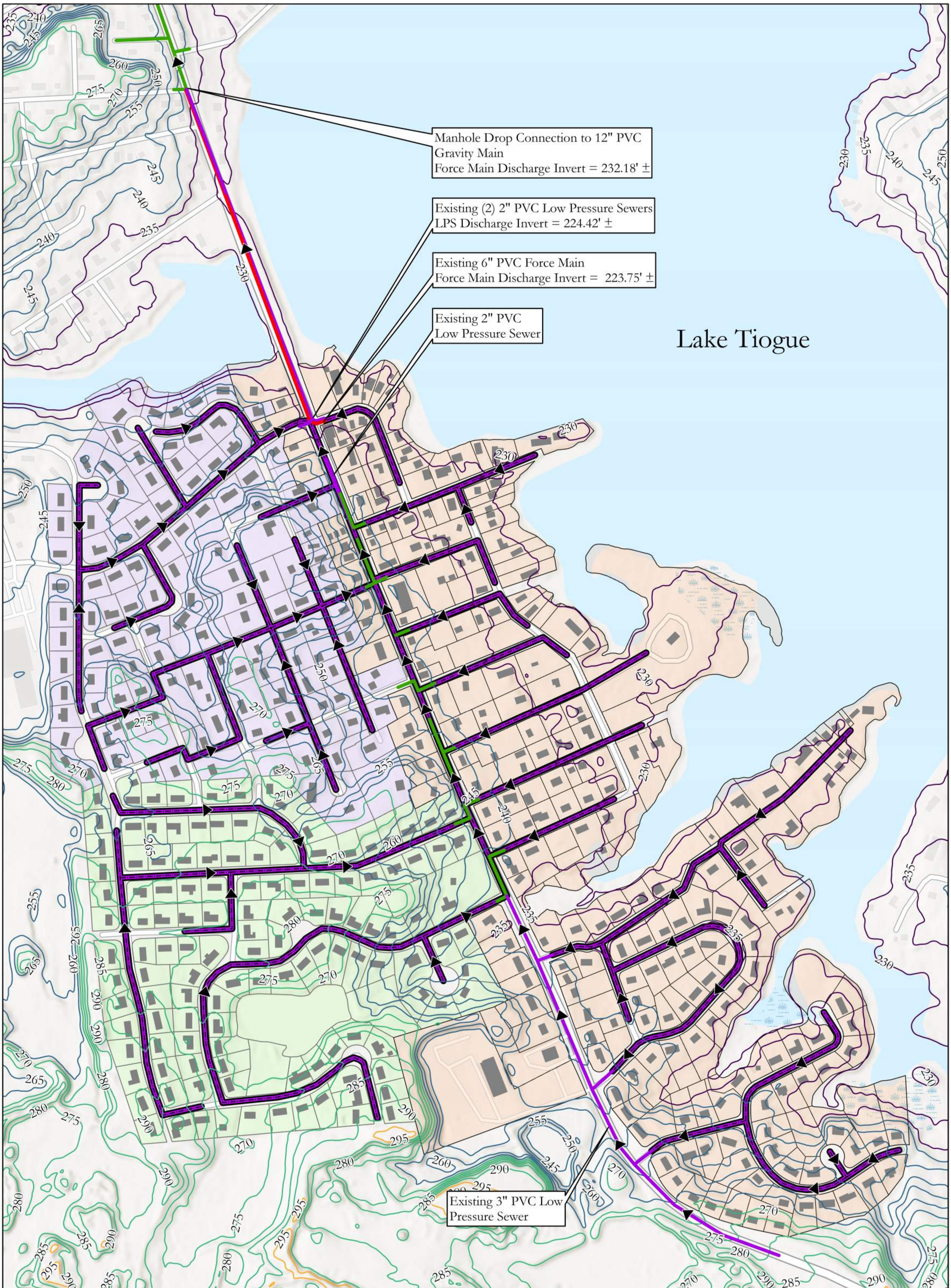
Figure
8.2.1.1.A



Legend

- Existing Low Pressure Sewer
- Existing Force Main
- Existing Gravity Sewer
- Proposed Low Pressure Sewer
- Phase 1 (PA 9)
- Phase 2 (PA 8)
- Phase 3 (PA 8)

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N

0 200 400 800 Feet

Town of Coventry
Planning Area 8 & 9
Low Pressure Sewer Phases

Coventry Sewer Facility Plan

Coventry Rhode Island

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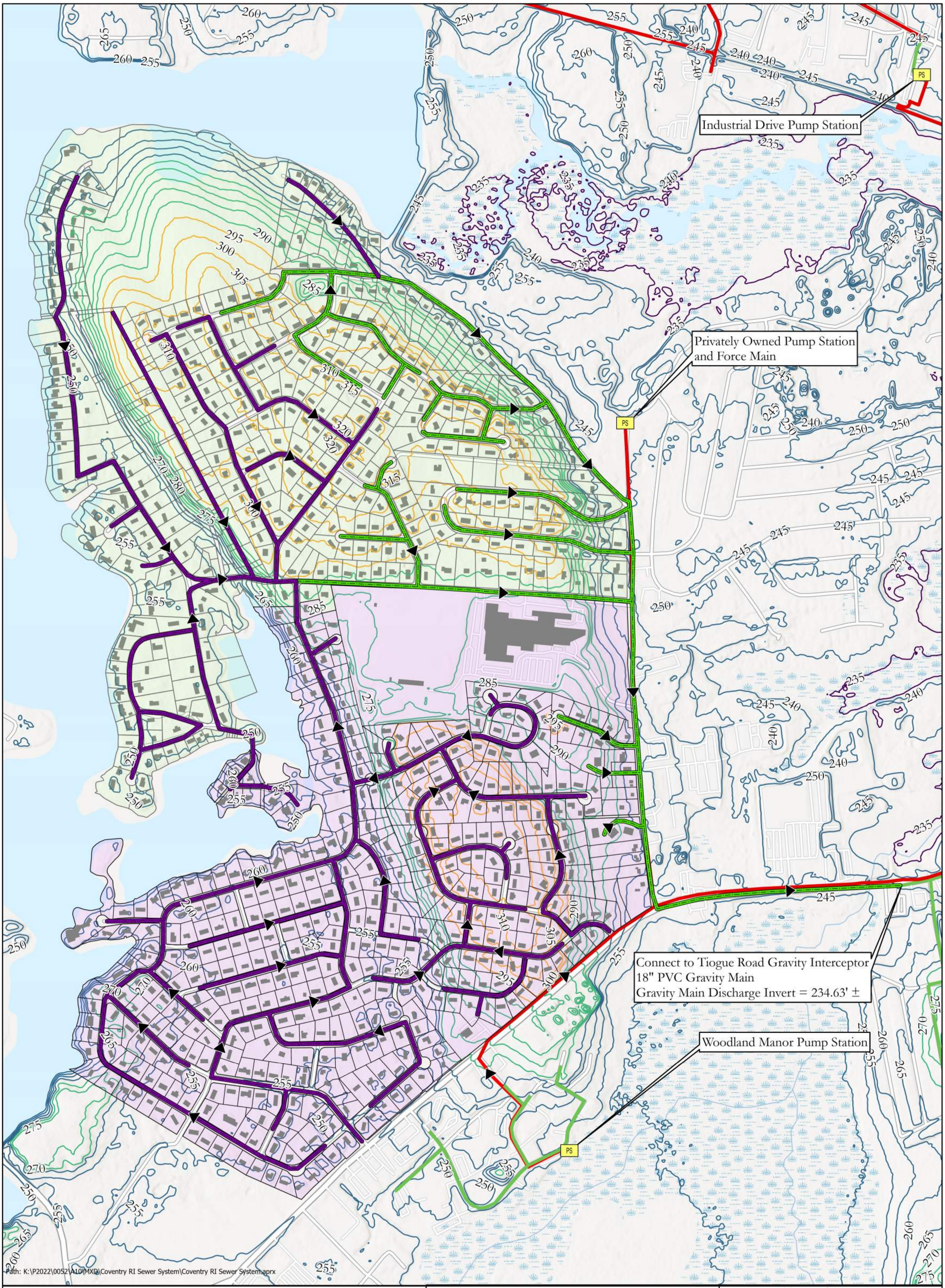
Figure
8.2.1.2.A



Legend

- Existing Low Pressure Sewer
- Existing Force Main
- Existing Gravity Sewer
- PS Pump Station
- Proposed Low Pressure Sewer
- Proposed Force Main Sewer
- Proposed Gravity Sewer
- Planning Area 1
- Planning Area 2

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0 375 750 1,500 Feet

N

Town of Coventry
Planning Area 1 & 2
Proposed Sewer Layout
Coventry Sewer Facility Plan

Coventry Rhode Island

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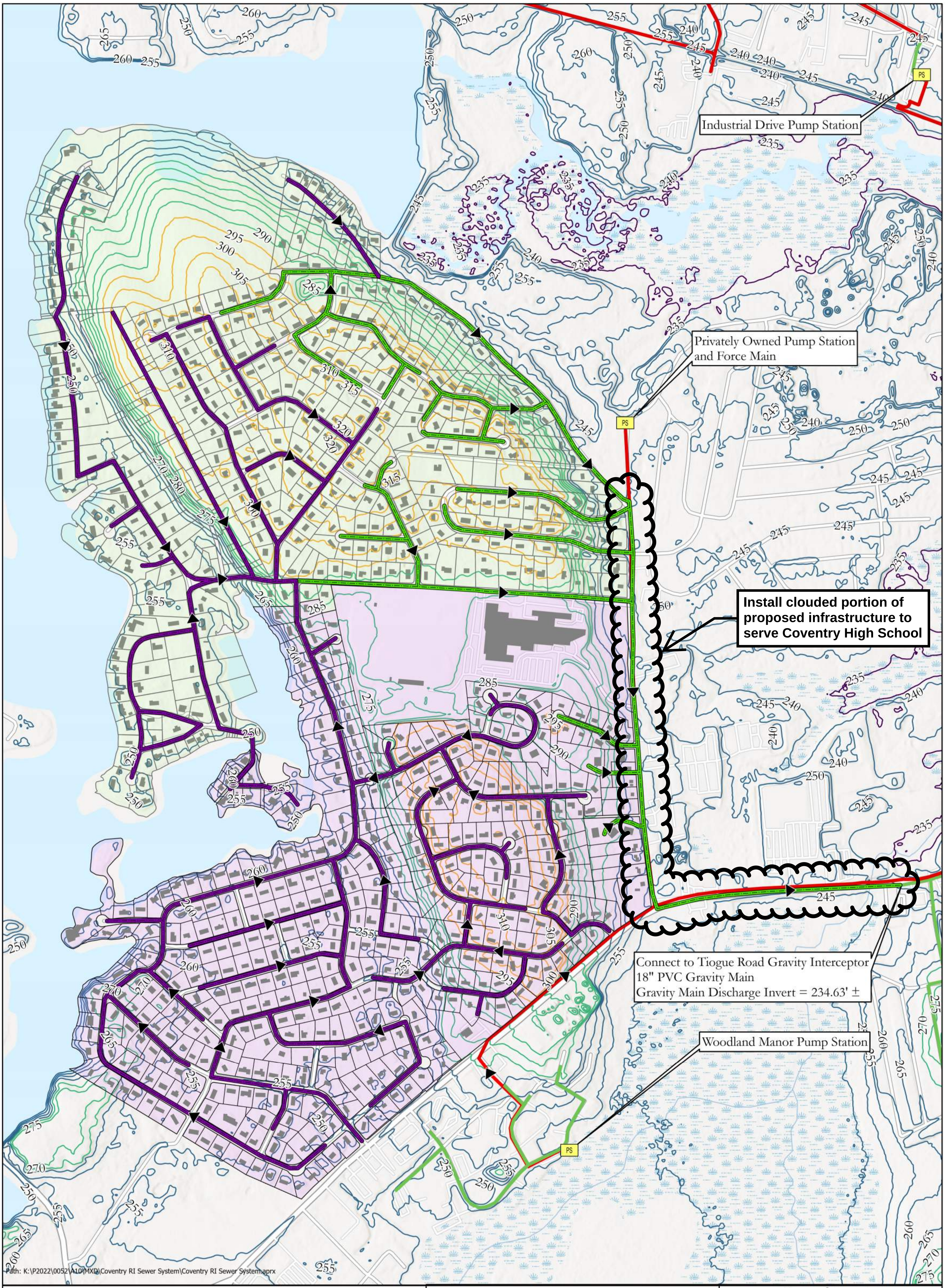
Figure
8.2.2.A



Legend

- Existing Low Pressure Sewer
- Existing Force Main
- Existing Gravity Sewer
- PS Pump Station
- Proposed Low Pressure Sewer
- Proposed Force Main Sewer
- Proposed Gravity Sewer
- Planning Area 1
- Planning Area 2

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0 375 750 1,500 Feet

N

Town of Coventry
Planning Area 1 & 2
High School Sewer Extension
Coventry Sewer Facility Plan

Coventry Rhode Island

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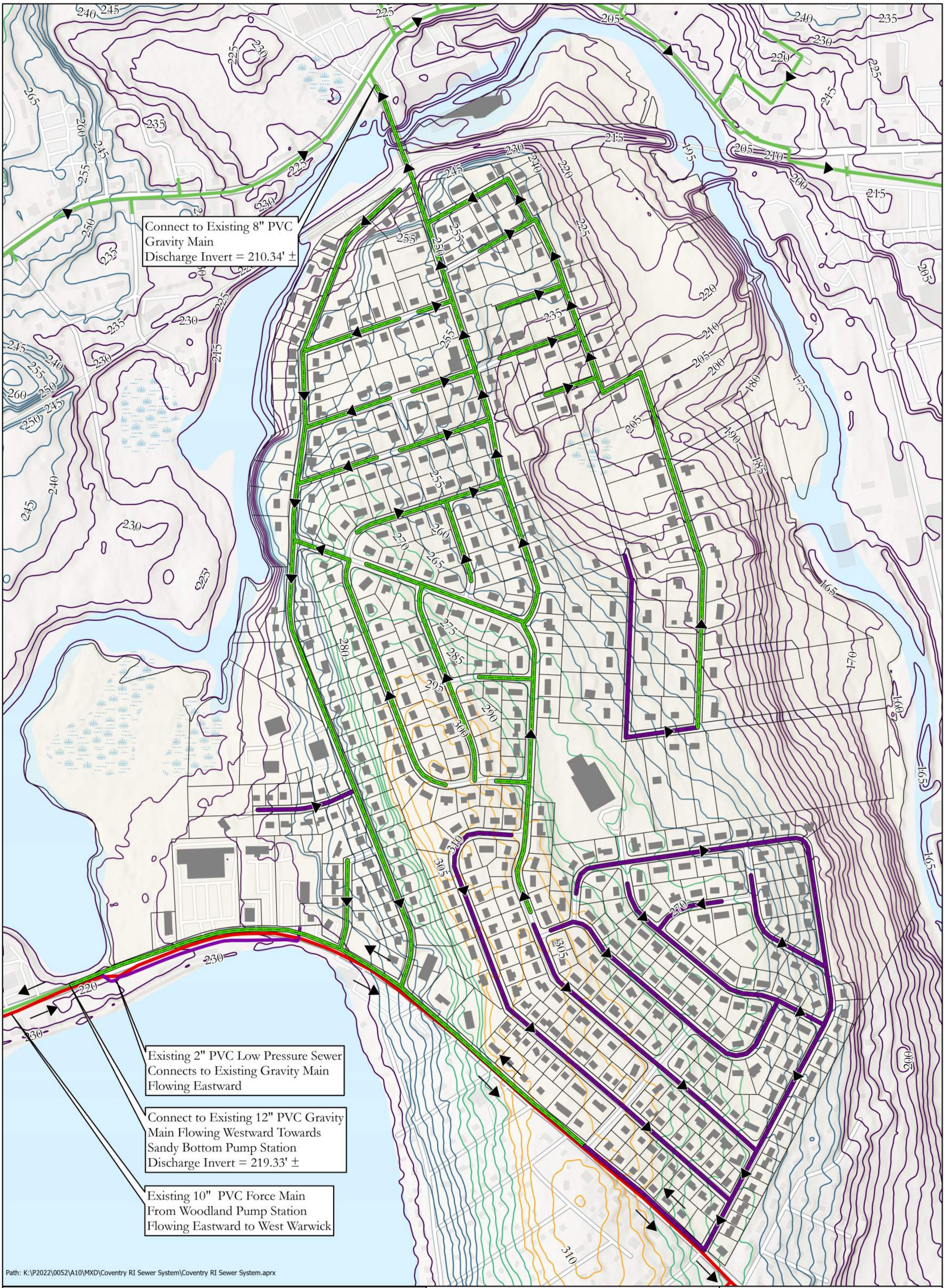
Figure
8.2.2.B



Legend

- Existing Low Pressure Sewer
- Existing Force Main
- Existing Gravity Sewer
- Proposed Low Pressure Sewer
- Proposed Force Main
- Proposed Gravity

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0 250 500 1,000 Feet

N

Town of Coventry
Planning Area 12
Proposed Sewer Layout
Coventry Sewer Facility Plan

Coventry Rhode Island

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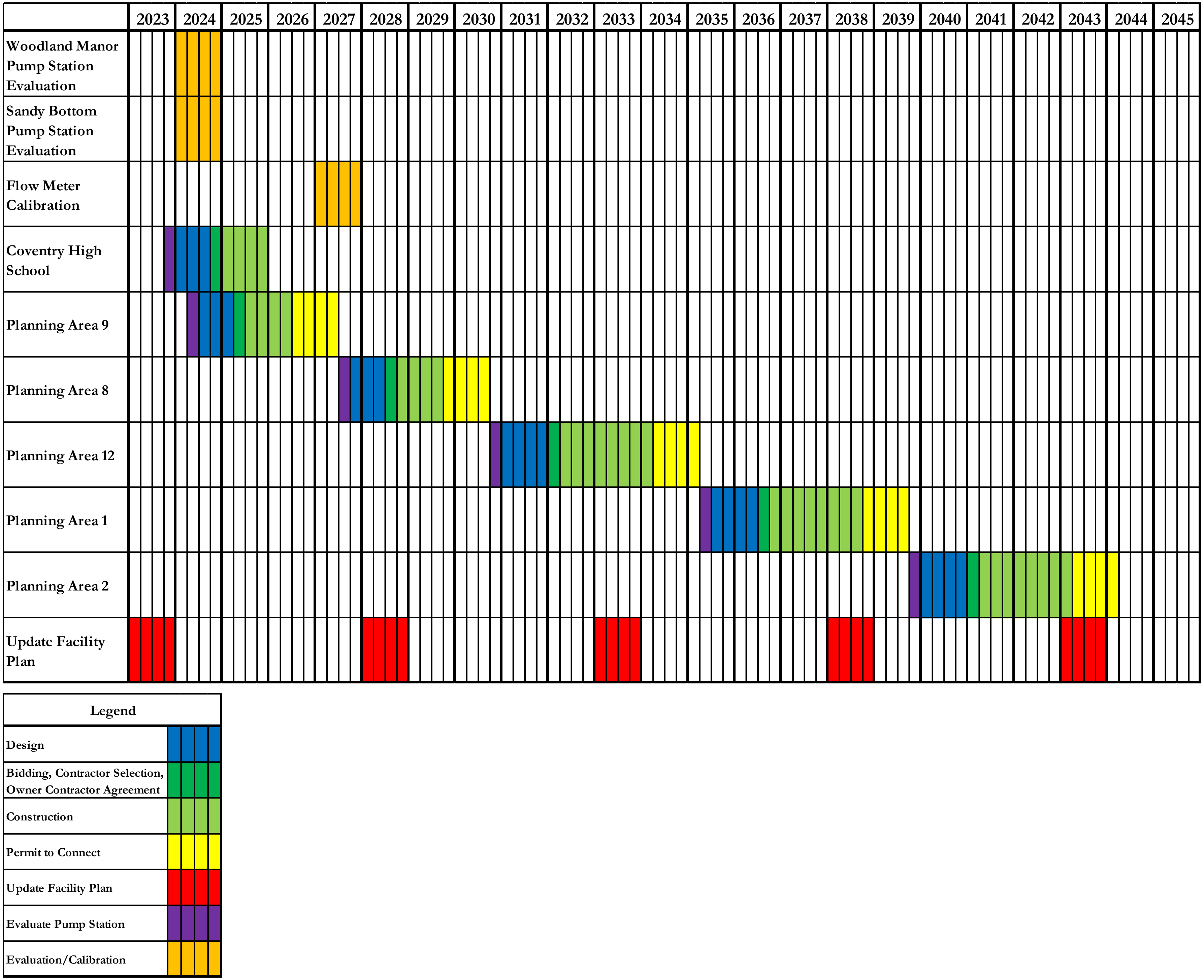
Figure
8.2.3.A

Figure 9.A


2023
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2045
Woodland Manor Pump Station Evaluation
Sandy Bottom Pump Station Evaluation
Flow Meter Calibration
Coventry High School
Planning Area 9
Planning Area 8
Planning Area 12
Planning Area 1
Planning Area 2
Update Facility Plan
Legend
Design
Bidding, Contractor Selection, Owner Contractor Agreement
Construction
Permit to Connect
Update Facility Plan
Evaluate Pump Station
Evaluation/Calibration