



COST STUDY

TO

**PROVIDE SEWER AND
WATER SERVICE
TO UNSERVED AREAS**

PREPARED FOR:



PREPARED BY:



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EXECUTIVE SUMMARY

The purpose of this study is to estimate the cost to extend sewer service to three (3) areas in Glynn County that are located near the existing sewer system. In order to determine the potential costs of providing utility service to each of these areas, this cost study compares the capital costs and operation and maintenance costs associated with the installation of three (3) types of sewer systems: gravity, low-pressure grinder, and low-pressure STEP system. The areas include the area west of Highway 341 and north of Highway 33, the area east of Highway 341 and north of Community Road and west of Old Jesup Road, and parts of the Arco Community. The areas consist of approximately 840 parcels with up to 960 potential connections. This cost study is based upon an in-depth review of existing conditions in each of the unserved areas obtained from existing GIS information, previous evaluations, field investigation, and coordination efforts with the Brunswick-Glynn County Joint Water Sewer Commission (JWSC). The cost estimates provided within this report are based on the best information available on market conditions and the schematic layouts as provided within the study.

Each of these areas consist of single family residential, industrial and commercial properties as well as mobile home parks located in two (2) of the areas. Areas A and B are not currently on the JWSC's water or sewer system and most parcels use well water and septic tanks. Area C is not on the JWSC's sewer system and most parcels use septic tanks; however, a significant portion of this area is on the JWSC water system. Each of these areas present their own challenges which has played a significant role in determining a feasible layout for each type of system. While each system may be feasible, it may be appropriate to use multiple systems in parts of these areas where one type of system may be considered cost prohibitive versus another.

Following coordination efforts with the JWSC and adherence to the JWSC's water and sewer standards, GWES has put together schematic layouts of each system type in each of the three (3) areas. Based on those schematic layouts, GWES has estimated the capital costs and operation and maintenance costs over 20 years associated with each system. The cost estimate summary below assumes that only one sewer system is used throughout an area and that water and sewer projects are completed separately. The cost estimate also assumes milling and overlaying asphalt will be completed for each system in each area due to the relative unknowns at this time. As more information is available through engineering survey and preliminary design, there is the potential for significant cost savings in each area using multiple systems and combining water and sewer projects.

Area A Cost Estimate Summary				
Type of System	Gravity Sewer	LP Grinder System	LP STEP System	Water System
Potential # of Customers	447	447	447	447
Total Capital Cost Estimate	\$8,863,408.80	\$7,543,647.46	\$7,541,683.51	\$6,190,804.20
Total O&M Cost Estimate (20 Years)	\$497,025.00	\$1,383,022.00	\$1,964,122.00	Minimal
Total System Cost Estimate	\$9,360,433.80	\$8,926,669.46	\$9,505,805.51	\$6,190,804.20
Cost per Connection	\$20,940.57	\$19,970.18	\$21,265.78	\$14,750.17

Area B Cost Estimate Summary				
Type of System	Gravity Sewer	LP Grinder System	LP STEP System	Water System
Potential # of Customers	244	244	244	244
Total Capital Cost Estimate	\$6,940,565.10	\$5,227,023.86	\$5,163,171.61	\$5,495,843.10
Total O&M Cost Estimate (20 Years)	\$407,200.00	\$776,478.00	\$1,093,678.00	Minimal
Total System Cost Estimate	\$7,347,765.10	\$6,003,501.86	\$6,256,849.61	\$5,495,843.10
Cost per Connection	\$30,113.79	\$24,604.52	\$25,642.83	\$23,909.90

Area C Cost Estimate Summary				
Type of System	Gravity Sewer	LP Grinder System	LP STEP System	Water System
Potential # of Customers	268	268	268	45
Total Capital Cost Estimate	\$3,463,137.60	\$4,145,615.36	\$4,235,130.44	\$493,280.14
Total O&M Cost Estimate (20 Years)	\$46,110.00	\$819,614.00	\$1,168,014.00	Minimal
Total System Cost Estimate	\$3,509,247.60	\$4,965,229.36	\$5,403,144.44	\$493,280.14
Cost per Connection	\$13,094.21	\$18,526.98	\$20,160.99	\$13,221.00

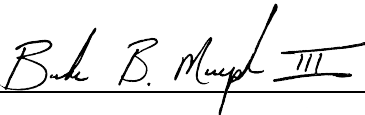
As shown in the cost estimate summary for each area, the cost per connection varies for each system. While Area A capital and O&M costs are the highest of the three (3) areas, the cost per connection is lower than Area B due to the relative density of the area and the potential # of customers. Due to the size and topography of Areas A and B, estimated costs are significantly higher than Area C. These costs are higher based on the linear footage of piping required, square yardage of asphalt removal/replacement, and the potential need for pump stations in these areas. Area C's estimated capital costs are considerably lower due to the relative location of each potential point of connection and existing infrastructure. O&M costs are considerably higher for low-pressure systems due to the maintenance and/or replacement required to maintain each individual pump system. The low-pressure STEP system has the highest estimated O&M costs since it also includes pumping out the septic tank system every 5-10 years. The water system cost estimates are based on a looped system and milling/overlaying asphalt for the entire project. The ability to use the right-of-way or combining water and sewer projects could significantly reduce the overall cost to install utility services in these areas.

PROFESSIONAL DISCLAIMER

This document entitled **Cost Study to Provide Sewer Service to Unserved Areas** was prepared by **GWES, LLC.** for the use of the **JWSC.** Information provided in this document was based on GWES' professional judgment of existing conditions in each of the unserved areas obtained from existing GIS information, previous evaluations, field investigation, and coordination efforts with the JWSC. It is the intent of this document to provide the JWSC with cost estimates to extend water and sewer service to three (3) areas that are located near existing systems.

Any reliance on this document by any third party is prohibited. Any use which a third party makes of this document is the responsibility of such third party to verify all information provided by GWES. Such third party agrees that GWES shall not be responsible for financial damages suffered as a result of use of this document to justify results and decisions for future development and projects.

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PURPOSE

The purpose of this study is to estimate the cost to extend sewer service to three (3) areas that are located near the existing sewer system. These areas include the following:

- **The Area West of Highway 341 and North of Highway 303**, consisting of approximately 340 parcels, over 90% residential and less than 10% commercial/industrial
 - **This will be designated Area 'A'**
- **The Area East of Highway 341 and North of Community Rd and West of Old Jesup Rd**, consisting of approximately 232 parcels, over 90% residential, less than 10% commercial/industrial, and less than 1% agriculture
 - **This will be designated Area 'B'**
- **The Arco Community**, consisting of approximately 268 parcels, over 80% residential and less than 20% commercial/industrial
 - **This will be designated Area 'C'**

The study shall provide the following cost estimates for each area:

- **Estimated Cost to Provide Sewer Service Via Gravity Flow System, Low-Pressure Grinder Pump System and/or Low-Pressure STEP System**
- **Estimated Cost to Provide Water Service**
- **Number of Potential Customers Gained/Cost Per Parcel**

The JWSC has requested to additionally include a 20-Year Life Cycle Cost analysis for each of three sewer service areas as defined in our proposal and an optional presentation of study findings to the JWSC Board in GWES' scope.

CURRENT CONDITIONS

Area A

Area A is the area west of Highway 341 and north of Highway 303 consisting of approximately 340 parcels. The area includes 301 single residential, 113 mobile homes, 4 industrial, and 29 commercial units based on the zoning map located in Appendix A. Currently, Area A is not on the JWSC's water or sewer system and most parcels use well water and septic tanks as shown in Figure 1 and Appendix B. Potential connection points for both types of systems are existing force main stub outs located in the southeastern corner of Area A according to GIS.

The area is relatively flat, mildly sloping toward Fancy Bluff Creek. Due to the low-lying area and approximate location near sea level, it is assumed to have a relatively high water table. The street layout could be considered meandering with multiple dead-end streets. While the neighborhood streets are approximately 25-foot wide, there are multiple side streets that are much narrower. There are undeveloped parcels located through the area which could lead to both commercial and residential development in the future.



Figure 1: Area A

Area B

Area B is the area between Highway 341 and Old Jesup Road and north of Community Road consisting of approximately 232 parcels. The area includes 192 single residential, 35 mobile homes, and 16 commercial potential customers based on the zoning map located in Appendix C. Currently, Area B is not on the JWSC's water or sewer system and most parcels use well water and septic tanks as shown in Figure 2 and Appendix D. Potential connection points for sewer include existing manholes along B and W Grade Road and Lift Station 4036. Potential connections points for water include existing water mains located along New Jesup Highway and Old Jesup Rd. While there are multiple potential connection points, a railroad and canal run through the middle of Area B.

The area is relatively flat, mildly sloping toward the canal. Due to the low-lying area and approximate location near sea level, it is assumed to have a relatively high water table in some areas. Similar to Area A, the street layout could be considered meandering with multiple dead-end streets. Additionally, there are a number of narrow streets that could be considered one lane. Future development in the area appears to be minimal.



Figure 2: Area B

Area C

Area C is the ARCO Community consisting of approximately 268 parcels. The area includes 223 single-residential, 12 industrial, and 33 commercial potential customers based on the zoning map located in Appendix E. Currently, Area C is not on the JWSC's sewer system and most parcels use septic tanks; however, a significant portion of this area is on the JWSC water system as shown in Figure 3 and Appendix F. Potential connection points for water and sewer include existing water mains and located throughout the area.

The area itself is relatively flat, mildly sloping toward Academy Creek. Due to the existence of relatively deep gravity sewer in the area, it is assumed that a high water table would not be an issue in designing either system. The street layout of the ARCO Community could be considered rectangular and future development in the area also appears to be minimal.



Figure 3: Area C

INITIAL SITE VISIT

On Friday, April 12th, 2019, GWES drove through each area to become familiar with existing conditions and identify potential challenges utilizing the service area maps provided by the JWSC.

RIDE ALONG

On Wednesday, May 1, 2019, GWES participated in a ride along with Ray Juliano, the Systems Monitoring Coordinator for the JWSC.

During the ride along GWES discussed the existing systems (or non-existent) in each of the three (3) areas. Ray was able to point out specific challenges in each area as well as some advantages for each type of system. It was apparent during our initial site visit and ride along with Ray that room outside the paved area for utilities appears limited in some areas.

While on the ride along, Ray identified the following potential points of connection (POC); however, determining the capacity of the existing system adjacent to each area is outside the scope of this study:

- Physically Accessible POC's
 - Area A
 - Tap into existing 6-inch force main just north of Highway 303, near the new Friendly's Gas Station
 - New lift station potentially in park located near Ellis Point
 - LS4052 (may) require significant upgrades
 - Area B
 - LS4036
 - Manhole located at corner of Lambert Lane and B and W Grade Road that runs to 30-inch gravity line
 - Area C
 - Manhole located at Magnolia and 9th (30-inch gravity)
 - Manhole located at Cedar and Knight (30-inch gravity)
 - Manhole located off of Reynolds (30-inch gravity)

PROJECT CHALLENGES

Based upon our preliminary research and our ride along, GWES has determined that there will be a number of challenges in each of these areas. There may be additional challenges as we move forward, but we did want to address a few of them in the preliminary stage of this cost study. These challenges include:

- It appears that right-of-way may be limited in some areas.
- Land acquisition could prove expensive and time consuming.
- The new infrastructure (especially gravity sewer), may have to be placed in the middle of the road due to the width of the rights-of-way.
- The existing utilities in these areas, including gas and power, may prevent ideal alignments for sewer and water lines.
- The topographical features of these areas may limit the types of systems that may be installed in certain parts.
- Based on the topographical features of these areas, multiple lift stations may be required.
- Crossing of the CSX tracks in Area B would require a crossing permit and would add time and expense to the project.
- Area B may require additional permitting due to its' location in relation to state highways and an existing canal.
- Area A improvements may impact jurisdictional waters.

ASSUMPTIONS AND PREFERENCES

FLOW ESTIMATES

In order to estimate costs for each area, it is necessary to determine the likely flow for each area. As shown in each table below, we have determined the potential number of customers, as well as the residential equivalent unit (REU), based upon the zoning classification. The REU's and design flows for mobile homes and single residential zones were calculated based on 300 gallons per day (GPD) or 115 gallons per day per capita. The approximate population was calculated assuming one REU shall be a single-family unit occupied by an average of 2.6 persons. The REU's and design flows for industrial and commercial zones were based on the JWSC's preference of 20 REU's per lot for industrial zones and 5 REU's per lot for commercial zones. During the design phase, the sewage flows for each commercial and industrial facility will need to be calculated individually.

While ADWF gives an estimate of GPD that will be added to the system, the estimated peak flow will be used in estimating costs for each system. The reason for this is to eliminate the potential for system overflows when the sewer collection system is experiencing peak flows. GWES determined the peaking factor using Lindburg's Civil Engineering Reference Manual, that cites on page 28-2 the Ten States Standards Equation:

$$Q_p/Q_{avg} = [18 + (\text{sq rt of Pop in thousands})] / [4 + (\text{sq rt of Pop in thousands})]$$

Using this formula, peaking factors range from 3.6-3.8. Based on the estimated peaking factors, GWES was then able to determine the Peak Flow (PF) in each area that would be necessary to determine the system's capacity requirements.

For water distribution design flows, GWES calculated the Annual Average Daily Flow (AADF) using the JWSC Standard that the AADF shall be 300 GPD per REU. Additionally, GWES used the JWSC Standard to calculate the Maximum Daily Flow (MDF) and Peak Hourly Flow (PHF) that states the MDF and PHF shall be calculated as 1.54 times the AADF and 2.2 times the AADF respectively.

In most cases, the JWSC Standard for distribution mains will dictate the minimum pipe size for typical neighborhoods and the flow calculations above will use as a check to see if they are adequate. According to those standards, the minimum water main size in residential subdivisions to which fire hydrants are connected shall be eight (8) inches. Distribution mains smaller than eight (8) inches in diameter will be considered on a case by case basis, but in no case shall distribution mains smaller than two (2) inch be used.

The flow projections in each area for residential, commercial and industrial are as follows:

Estimated Flows for Area A:

- 447 Potential Customers
- 222,000 GPD for AADF and 501,000 GPD for PHF for Water System Flow
- 223,000 GPD for ADWF and 700,000 GPD for PF for Sanitary Sewer Flow

AREA A		Water System Flows	Sanitary Sewer Flows
Zoning	Number of Customers	Peak Hourly Flow (PHF)	Peak Flow (PF)
Single Residential	301	198,000	328,000
Mobile Home	113	75,000	124,000
Industrial	4	132,000	88,000
Commercial	29	96,000	160,000
Total	447	501,000	700,000

Estimated Flows for Area B:

- 244 Potential Customers
- 151,000 GPD for AADF and 217,000 GPD for PHF for Water System Flow
- 151,000 GPD for ADWF and 379,000 GPD for PF for Sanitary Sewer Flow

AREA B		Water System Flows	Sanitary Sewer Flows
Zoning	Number of Customers	Peak Hourly Flow (PHF)	Peak Flow (PF)
Single Residential	192	128,000	223,000
Mobile Home	35	23,000	41,000
Industrial	1	13,000	23,000
Commercial	16	53,000	92,000
Total	244	217,000	379,000

Estimated Flows for Area C:

- 268 Potential Customers
- 180,000 GPD for AADF and 415,000 GPD for PHF for Water System Flow
- 180,000 GPD for ADWF and 689,000 GPD for PF for Sanitary Sewer Flow

AREA C		Water System Flows	Sanitary Sewer Flows
Zoning	Number of Customers	Peak Hourly Flow (PHF)	Peak Flow (PF)
Single Residential	223	147,500	245,000
Industrial	12	158,000	263,000
Commercial	33	109,000	181,000
Total	268	415,000	689,000

COLLECTION SYSTEMS CONSIDERED

Gravity Flow System

A gravity sewer system is a conduit utilizing the energy resulting from a difference in elevation to remove sewage. Conventional gravity sewers are large networks of underground pipes that convey blackwater, greywater and, in many cases, stormwater from individual households to a treatment facility, using gravity and pumps when necessary. Most sewers are gravity sewer because gravity offers reliable water movement with no energy costs where grades are favorable.

The sewer must be designed so that it maintains self-cleansing velocity so that it will not allow particles to accumulate. A constant downhill gradient must be guaranteed along the length of the sewer to maintain self-cleansing flows. Mainlines must be laid to grade, which requires excavations as deep as 20-40 feet, depending on terrain. The deep and wide trenches go in slowly with significant disruption to the community. When a downhill grade cannot be maintained, gravity sewers may drain to sumps where pumping is required to either force sewage to a distant location or lift sewage to a high elevation for entry into another gravity sewer. For that reason, lift stations are often required to lift sewage into sewage treatment plants. These large lift stations can significantly increase construction costs and require immediate alarm response, back-up power, and R&R costs.

Primary sewers are laid beneath roads at depths to avoid damages caused by traffic loads. The depth also depends on the groundwater table, the lowest point to be served and the topography. The selection of pipe diameter depends on the projected average and peak flows. Commonly used materials are concrete, PVC, and ductile or cast-iron pipes.

Access manholes are placed at set interval above the sewer, at pipe intersections and at changes in pipeline direction, not to exceed 500 LF per JWSC Standards.

While there may be less maintenance compared to simplified and solids-free-sewers, gravity sewers maintain very high capital costs as well as high operation and maintenance costs if a lift station is required.

Low Pressure Grinder Pump System

A low-pressure grinder pump system uses small-diameter pipes and grinder pumps, which are often installed at each home. The grinder pump station collects all of the wastewater from the home and grinds it into slurry. The wastewater is then pumped to a larger sewer main or directly to a wastewater treatment plant. While gravity sewer systems often use large mains that are installed in deep trenches, pressure sewer pipes may be as small as 2 inches in diameter and follow the contour of the land. These small trenches can equal huge savings. Pressure sewer systems are used in areas where a conventional gravity sewer system cannot be installed or is too expensive to do so. The land may be very flat, rocky, hilly, or wet.

The grinder pump stations may be owned by the council/water authority (and the pressure pipe on private property), or by the homeowners individually. In the first instance, the municipality would maintain the grinder pumps, and the local distributor would keep the municipality up to date on training and product changes. If the homeowners own their individual grinder pump stations, then they would be responsible for all installation and maintenance costs.

Many designers and utilities mistakenly confuse these residential grinder pump stations with traditional municipal lift stations when it comes to maintenance. Municipal lift stations require

significant preventive maintenance, which adds to the annual operating cost. Larger municipal pump stations typically require significant expenditures for power and repairs on an annual basis.

Preventive maintenance is not needed for residential pump stations. Maintenance costs for stations include staff time and materials required to respond to service calls (alarms) and make repairs, if needed.

Low-Pressure STEP System

Septic Tank Effluent Pump (STEP) systems are low-pressure sewer systems that were conceived to circumvent the challenges of gravity sewers when they are applied to small communities. The STEP system collects wastewater from each property in an underground tank and then pump the filtered effluent to the communities centralized treatment facility or to the nearest municipality's wastewater treatment plant, leaving solids in the tank to decompose naturally.

Systems can be installed in half the time. No deep (and costly) excavations are necessary, just a shallow trench that follows the contour of the land (or directional boring), small-diameter (typically 2-4") mainlines, and cleanouts instead of manholes. These and many other features of alternative collection systems can save developers thousands of dollars in up-front costs compared to gravity sewer solutions.

The O&M costs for a STEP system can be broken down into two major components. The first component is the onsite system. The onsite system includes the tank, effluent filter, pump and controls, building sewer, and service lateral that are located on each individual property. The second component is the conveyance system. The conveyance system includes the collection mains, air release valves, odor control filters, and shutoff valves, all of which are typically located in the streets right-of-way. Manholes and lift stations are not normally required. In the context of the overall system, the O&M cost of the conveyance component (mainlines, air release valves, etc.) is normally insignificant.

The O&M of onsite pump systems is best served when the onsite components are managed by the owner of the overall system, not the property owner. The O&M of onsite systems is typically divided into two activities: proactive maintenance (PM) and reactive maintenance (RM). A combination of both approaches is necessary to achieve the lowest overall cost for O&M. For instance, inspecting or cleaning the tank effluent screens every three to five years and pumping out the storage tank every ten (10) years can reduce the RM required for O&M. Additionally, the tank itself may need to be replaced based on the existing condition, which could add to the upfront cost of the system itself.

DESIGN CRITERIA

This study has provided cost estimates for each area including the total cost to provide sewer service via gravity, low-pressure grinder pump system, and low-pressure STEP system. Each sewer system component has been laid out to meet estimated flow requirements based upon the potential customers gained for each area. The method of preliminary design and estimated construction costs is based on the BGJWSC Standards for Water and Sewer Design and Construction and the following:

- *Recommended Standards for Sewage Works (Ten State Standards) Latest Edition*
- *Georgia Environmental Protection Division State of Georgia Regulations for Water and Sewerage Works, Latest Edition*
- *Applicable Federal, State and Local Requirements*

Minimum design guidelines for sewer system components for this cost study have included the following:

- All gravity sewer mains shall be designed to convey the Design Peak Flow at a flow depth not to exceed 94% of the pipe inside diameter or less than 0.6 inches, and at a self-cleansing velocity of between 1.99 FPS and 2.01 FPS
- Gravity sewer mains intended for public use and JWSC operation and maintenance shall be sized to meet these hydraulic guidelines with the minimum pipe size being 9-inches in diameter
- Gravity sewer mains shall be ASTM 3034, SDR-26 heavy wall sewer pipe
- The minimum manhole inside diameters for gravity sewer lines six (6) inch through sixteen (16) inch shall be four (4) feet
- Gravity sewer mains shall be designed meeting minimum depth requirements of thirty-six (36) inches as measured from finished grade to pipe crown
- Gravity sewer mains with service laterals shall not be constructed at any depth greater than fifteen (15) feet as measure from finished grade to pipe crown
- Gravity sewer mains shall be designed for installation on the centerline of roadways as much as possible where landscaping, trees or other obstruction to manhole access is anticipated or probable
- Sanitary sewers shall be laid at least ten (10) feet horizontally from an existing or proposed water main
- Gravity sewer services shall be a minimum of four (4) inches in diameter where serving a single unit
- The design depth for all manholes is to be at no less than thirty-six (36) inches from the top of the manhole to the pipe crown
- Force mains from single-family residential or single lot commercial users shall only connect to publicly owned Low-Pressure System force mains at service connection provided at the property line or public right-of-way in accordance with the Standards
- The minimum pressure sewer service laterally for single-family residential or single lot commercial shall be one and one-fourth (1 ¼) inch in diameter
- With the exception of single-family residential or single lot commercial, no public force main shall be smaller than two (2) inches in diameter while still meeting the minimum and maximum velocities in this standard
- Force mains shall be designed and constructed along the shoulder or within public rights-of-way on the opposite side from water mains
- Force mains shall be designed meeting minimum cover requirements of thirty-six (36) inches with a maximum of 60 inches
- Sewer force mains crossing major ditches, canals, streams, creeks and rivers shall be sub-aqueous crossings installed by horizontal directional drilling or other boring/tunneling method approved by the JWSC

This study has also provided cost estimates to provide water service for each area. Each water system component has been laid out in accordance with the BGJWSC Standards for Water and Sewer Design and Construction and the following:

- *Georgia Rules for Safe Drinking Water Chapter 391-3-5 promulgated under the Georgia Safe Drinking Water Act*
- *Georgia Environmental Protection Division Minimum Standards for Public Water Systems, Latest Edition*
- *American Water Works Association (AWWA)*
- *Applicable Federal, State and Local Requirements*

Minimum design guidelines for water system components for this cost study have included the following:

- Minimum water main size in residential subdivisions to which fire hydrants are connected shall be eight (8) inches in diameter
- Pipe for potable water lines shall be polyvinyl chloride (PVC)
- Roughness coefficient (C-factor) of 140 was used in the Hazen-Williams formula for preliminary hydraulic analysis
- Pipe shall be laid with a minimum cover of forty-two (42) inches in paved areas and thirty-six (36) inches in unpaved areas with an allowable maximum of sixty (60) inches

OVERALL PROJECT ASSUMPTION

- Due to the possibility of water and sewer projects being combined, it was assumed that milling and overlaying all streets would be more cost effective for two systems. The cost estimate per square yard (SY) for milling and overlaying is approximately \$18/SY versus \$75/SY for asphalt pavement replacement. At this time, it is unknown how much of each system could be installed in the right-of-way.

GRAVITY SEWER ASSUMPTIONS

- Mill/Overlay Asphalt Pavement: Approximately 25 feet wide (width of road) for length of gravity sewer pipe
- Service Laterals: Approximately 50 feet long
- Miscellaneous Restoration: Approximately \$500 per lot
- Maximum Depth of Pump Station: 25 Feet
- Maximum Depth of Gravity Sewer: 15 Feet
- Minimum Depth of Manhole: 6 Feet
- Minimum Slope: 0.4%
- Maximum Length Between Manholes: 500 Feet
- Manhole Cost Estimate: Average Depth of Manhole 10 feet lined with SewperCoat
- Easement Acquisition Cost Estimate: \$30k per pump station and pipe alignment
- Gravity Sewer Pipe Cost Estimate: Average Cut 8-10 Feet Deep

GRINDER SYSTEM ASSUMPTIONS

- Mill/Overlay Asphalt Pavement: Approximately 25 feet wide (width of road) for length of low-pressure sewer pipe
- Service Laterals: Approximately 50 feet long
- Miscellaneous Restoration: Approximately \$500 per lot
- Analysis based upon drawings and data provided. Station recommendations are preliminary.
- GPD values impact retention times only, not line sizing or hydraulics. GP laterals to be 1.25".
- General recommendations for valve placement 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 peaks of 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.
- Assume tie in pressure of 30 psi (69ft) and static due to elevation of 15 ft.
- Easement Acquisition may be necessary for each connection on private property to

provide on-going maintenance services but has not been included in project cost estimates

STEP SYSTEM ASSUMPTIONS

- Mill/Overlay Asphalt Pavement: Approximately 25 feet wide (width of road) for length of low-pressure sewer pipe
- Service Laterals: Approximately 50 feet long
- Miscellaneous Restoration: Approximately \$500 per lot
- Residential STEP Pump Package Includes:
 - Roth 1060-gallon tank
 - PF100511 Pump w/ 10-year warranty
 - S1 Panel
 - External Splice Box
 - 1 Riser Adapter, 1 24" Riser, 1 Lid
 - Pump Vault w/ Float Stem and Filter Cartridge
 - Hose and Valve Discharge Assembly
 - Adhesive ADH200
 - Homeowners Manual
- Commercial/Industrial STEP Pump Package Includes:
 - Roth 1500-gallon tank
 - Two (2) PF200512 Pumps
 - MVP Duplex Dual Mode Panel
 - External Splice Box (2)
 - 2 Riser Adapters, 2 24" Riser, 2 Lids
 - Pump Vault w/ Float Stem and Filter Cartridge
 - Two (2) Hose and Valve Assemblies
 - Adhesive ADH200
- Easement Acquisition may be necessary for each connection on private property to provide on-going maintenance services but has not been included in project cost estimates

WATER SYSTEM ASSUMPTIONS

- Mill/Overlay Asphalt Pavement: Approximately 25 feet wide (width of road) for length of water pipe (looped system not included)
- Mill/Overlay Asphalt Pavement Cost Estimate was included in case water and sewer projects were not combined
- Waterline Depth: Minimum 4' Cover
- Valve Placement: Approximately 300 Feet Apart
- Remove/Replace Asphalt Pavement: 8-Inch Waterline (6 ft wide x length)
- Pipe size based upon 1,000 GPM (6-inch @ 11.5 FPS) (8-inch @ 6.4 FPS)
- Additional Cost Estimate Provided for 6-inch Piping
- Length Between Fire Hydrants: 500 Feet
- Looped system
- Utilize same easements as sewer where applicable

ENGINEERING FEES

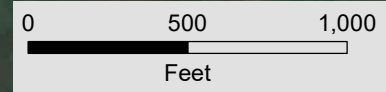
- Estimated at 14% of construction cost total + 15% contingency
- Includes survey, design, permitting, bid and construction admin, and construction inspection

SCHEMATIC LAYOUT

The schematic layouts for each system in each of the three (3) areas include the following:

- Gravity Sewer System Schematic for Areas A, B & C
- Low-Pressure Sewer System Schematic for Areas A, B & C
- Water System Schematic for Areas A, B & C

AREA A - GRAVITY SEWER SYSTEM SCHEMATIC



MAP LEGEND

- Gravity Sewer Piping Schematic
- Existing Gravity Sewer Main
- Existing Force Main
- PS Existing Pump Station
- Existing Manhole
- Potential Point of Connection
- Potential Manhole Location
- GS Potential Grinder Station
- PS Potential 0.75 MGD Pump Station
- NS Potential Neighborhood Lift Station

AREA A - LOW-PRESSURE SEWER SYSTEM SCHEMATIC



MAP LEGEND

- Low-Pressure Piping Schematic
- Existing Gravity Sewer Main
- Existing Force Main
- PS Existing Pump Station
- Existing Manhole
- Potential Point of Connection

AREA A - WATER SYSTEM SCHEMATIC



AREA B - GRAVITY SEWER SYSTEM SCHEMATIC



MAP LEGEND

Gravity Sewer Piping Schematic

Existing Gravity Sewer Main

Existing Force Main

Existing Pump Station

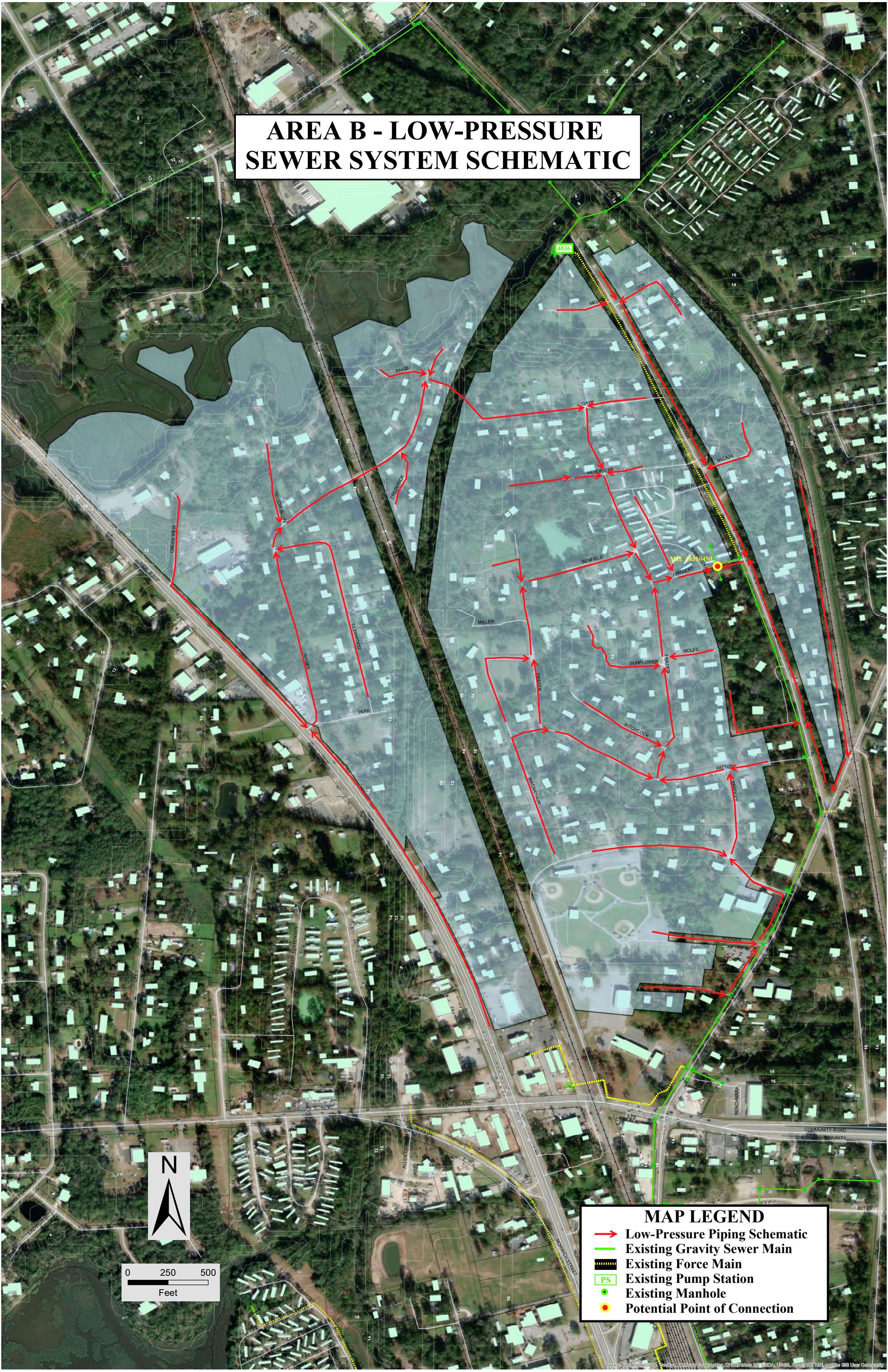
Existing Manhole

Potential Point of Connection







Potential Manhole Location

Potential Grinder Station

AREA B - LOW-PRESSURE SEWER SYSTEM SCHEMATIC

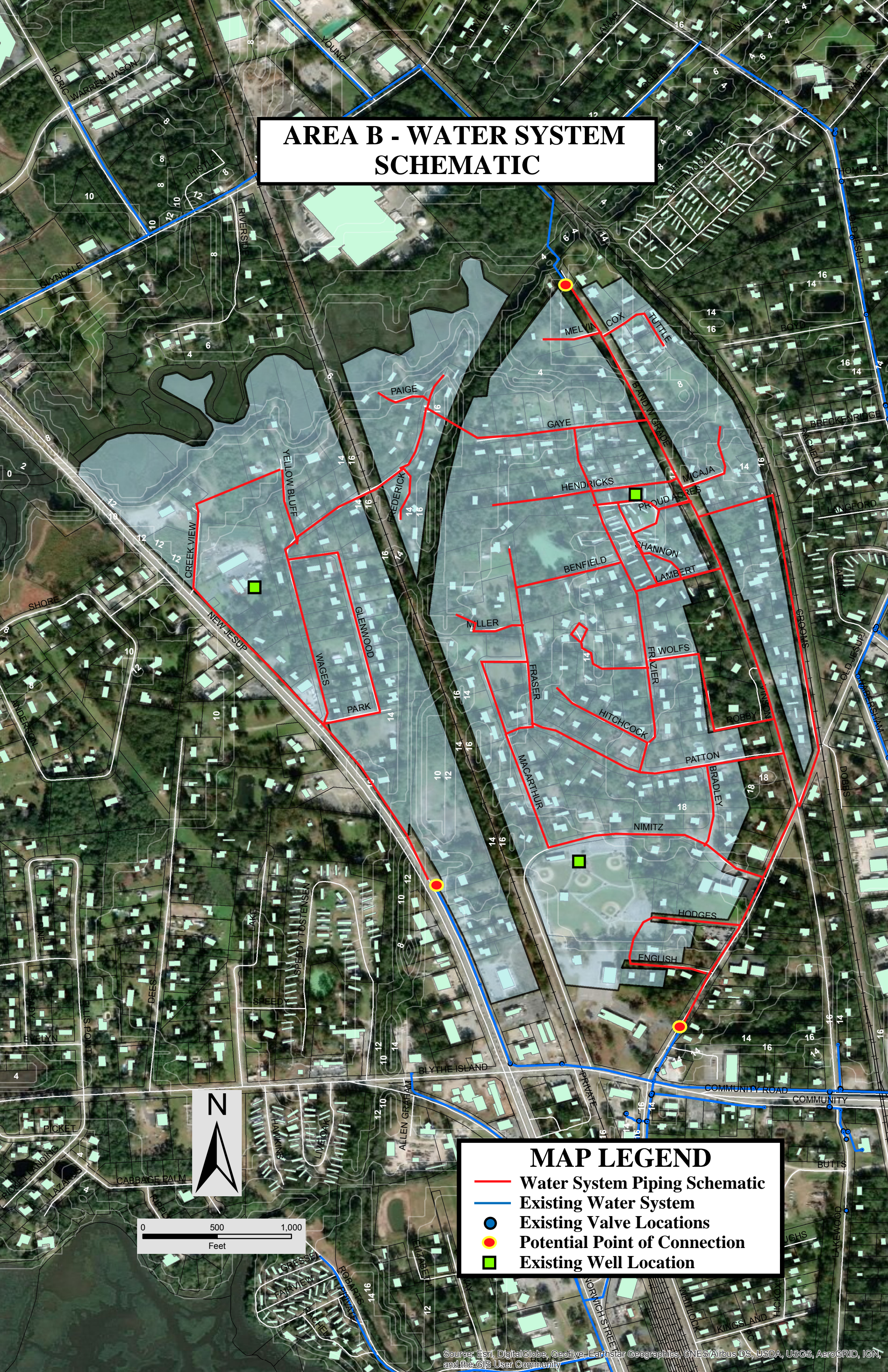


MAP LEGEND

-  **Low-Pressure Piping Schematic**
-  **Existing Gravity Sewer Main**
-  **Existing Force Main**
-  **Existing Pump Station**
-  **Existing Manhole**
-  **Potential Point of Connection**

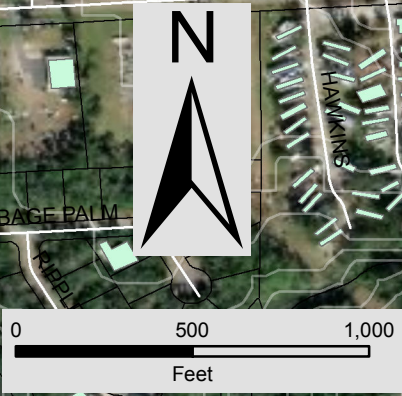


AREA B - WATER SYSTEM SCHEMATIC



MAP LEGEND

- Water System Piping Schematic
- Existing Water System
- Existing Valve Locations
- Potential Point of Connection
- Existing Well Location



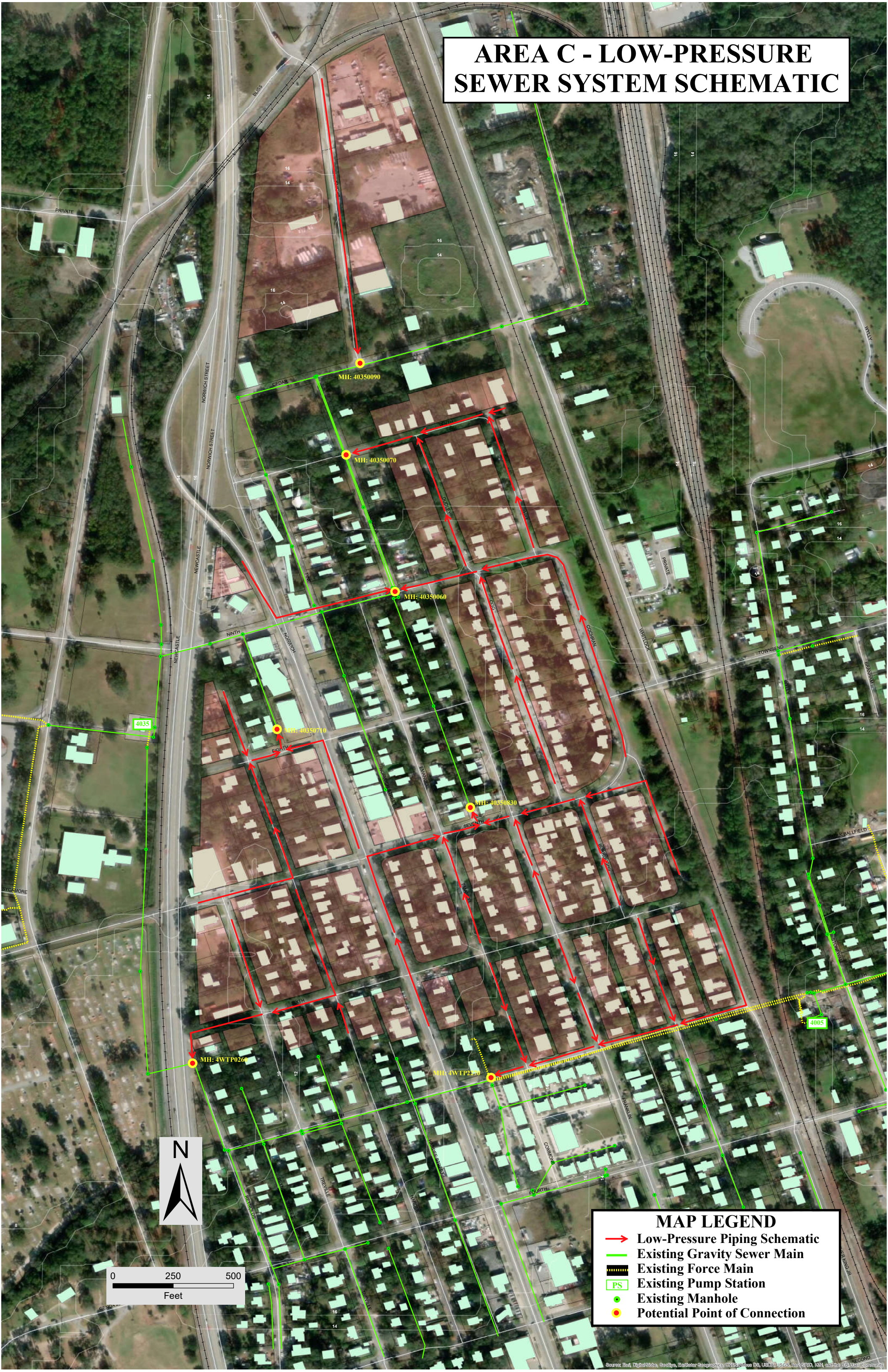
AREA C - GRAVITY SEWER SYSTEM SCHEMATIC



MAP LEGEND

- Gravity Sewer Piping Schematic
- Existing Gravity Sewer Main
- Existing Force Main
- Existing Pump Station
- Existing Manhole
- Potential Point of Connection
- Potential Manhole Location

AREA C - LOW-PRESSURE SEWER SYSTEM SCHEMATIC



AREA C - WATER SYSTEM SCHEMATIC



MAP LEGEND

- Water System Piping Schematic
- Existing Water System
- Existing Valve Locations
- Potential Point of Connection

COST CONSIDERATIONS

The capital cost considerations of the proposed systems have been based on the best information available on market conditions and the schematic layouts as shown. The cost estimates may vary from actual costs of a full design following engineering survey, potential funding options, and the opinions of the JWSC. There is also the potential for multiple types of systems to be used in each area due to existing conditions. Cost estimates that were considered in each area are as follows:

Mobilization/Demobilization

- *Estimated at \$100,000 for each area except Area C Water Service which only has 45 potential connections*

Erosion and Sedimentation Control

- *Estimate based on size of area, type of system and number of potential connections*

Removal/Replacement

- Mill/Overlay Asphalt Pavement
 - *Includes milling and overlaying asphalt pavement for length of each pipe system due to unknowns at this time*
 - *The ability to install low pressure systems and water systems in the right-of-way could significantly reduce costs*
 - *Combining water and sewer would eliminate the water system line item*
- Existing Septic Tank Abandonment
 - *Septic tank abandonment would be necessary for gravity and grinder systems*
- Miscellaneous (Curb & Gutter, Sidewalk, Landscaping, Etc.) per Connection
 - *Estimated at \$500 per connection to return areas to pre-construction conditions*
 - *Specific quantities would be determined during engineering design*

Gravity Sewer

- Gravity Sewer Installation
 - Manholes
 - *4' Diameter Manholes (SewperCoat Lined)*
 - *Connect to Existing Manhole/System*
- Pressurized System Installation
 - Pump Station
 - Grinder Station (Up to 50 REU Capacity)
 - *Proposed stations include railroad crossing, canal crossing, and areas where gravity sewer cannot go any deeper*
 - Neighborhood Grinder Station (Up to 100 REU Capacity)
 - *Similar to grinder station but with more capacity required based on number of REU's flowing to it*
 - Pump Station (0.75 MGD Capacity)
 - *Pump station required to connect to existing 6-inch force main in Area A*
 - *Estimated peak flows for this area are 700,000 GPD*
 - Force Main
 - *2-inch force main to be used with grinder stations and 6-inch force main to be used with pump station*

Low-Pressure Grinder Sewer System

- Grinder Sewer System Installation
 - Valves
 - *Includes Air/Vacuum Release Valve and Clean Out based on length of pipe, branch ends and junctions*
 - Pumps
 - *On-site grinder pump system included with an estimated 50-foot service lateral per connection*
 - *Pump/Panel installation varies per connection, estimated at \$1,000 per connection*
 - Piping
 - *Pipe sizes and lengths estimated by E-One for each area*

Low-Pressure STEP Sewer System

- STEP Sewer System Installation
 - Valves
 - *Includes Air/Vacuum Release Valve and Clean Out based on length of pipe, branch ends and junctions*
 - Residential STEP Pump Package
 - *On-site STEP system included with an estimated 50-foot service lateral per connection*
 - *Includes replacement of existing septic tank*
 - *Installation has been estimated at 40% of Pump Package cost*
 - Commercial/Industrial STEP Pump Package
 - *On-site STEP system included with an estimated 50-foot service lateral per connection*
 - *Includes replacement of existing septic tank*
 - *Installation has been estimated at 40% of Pump Package cost*
 - Piping
 - *The same pipe sizes and lengths for the grinder pump system layout were used to maintain consistency*

Water System

- Water System Installation
 - Valves
 - Water Valves
 - *Valves were estimated to be located every 300 feet*
 - Connect to Existing System
 - Fire Hydrants
 - Fire Hydrant Assembly
 - *Estimated to be located every 500 feet*
 - Service Laterals
 - *Estimated to be 50-foot per connection*
 - *Depending upon asphalt replacement, service lateral may be bored or open cut*
 - Piping
 - *8-inch PVC DR piping was used for the cost estimate based on JWSC Standards; however, 6-inch pricing was included as an alternative but would require JWSC approval*

Allowances

- Easement Acquisition
 - *Estimated at \$30,000 per potential easement for gravity sewer system*
 - *Potential easements include pump stations and pipes located on private property*
-
- Permitting
 - *Includes potential permitting in each area*

Contingency

- *Estimated at 15% at this design level*
- *Includes potential unknowns at this time*
- *Based on JWSC feedback from initial draft review*

Engineering

- *Estimated at 14% of construction cost total + 15% contingency*
- *Includes survey, design, permitting, bid and construction administration, and construction inspection*

Private/Resident Costs (not included in overall project estimates)

- Sewer service connection costs
 - *Existing septic tank abandonment and sewer service installation estimated at \$1,500 to \$2,000 per connection*
- Water service connection costs
 - *Basic water service and connection estimated at \$1,000 per connection*
 - *Plugging and decommissioning of wells is not included*

ESTIMATE OF PROJECT COST

Below is a summary estimate of project costs for each type of system in each of the three (3) project areas. A full breakdown of project costs has been included in Appendix H. As mentioned in the assumptions and cost considerations sections, these costs assume the JWSC will be covering all capital and O&M costs for each system. Due to unknowns at this time and a variety of funding options, GWES has provided a conservative estimate of potential project cost. There is the potential for significant cost reduction depending upon engineering survey, federal and state grants that are available, private and public cost sharing, and combining water and sewer system projects.

Area A Cost Estimates				
Type of System	Gravity Sewer	LP Grinder System	LP STEP System	Water System
Potential # of Customers	447	447	447	447
Estimated Construction Costs	\$6,760,800.00	\$5,754,117.06	\$5,752,619.00	\$4,722,200.00
Contingency (15%)	\$1,014,120.00	\$863,117.56	\$862,892.85	\$708,330.00
Engineering Fees (14%)	\$1,088,488.80	\$926,412.85	\$926,171.66	\$760,274.20
Total	\$8,863,408.80	\$7,543,647.46	\$7,541,683.51	\$6,190,804.20
Per Connection	\$19,828.66	\$16,876.17	\$16,871.78	\$13,849.67

Area B Cost Estimates				
Type of System	Gravity Sewer	LP Grinder System	LP STEP System	Water System
Potential # of Customers	244	244	244	244
Estimated Construction Costs	\$5,294,100.00	\$3,987,051.00	\$3,938,346.00	\$4,192,100.00
Contingency (15%)	\$794,115.00	\$598,057.65	\$590,751.90	\$628,815.00
Engineering Fees (14%)	\$852,350.10	\$641,915.21	\$634,073.71	\$674,928.10
Total	\$6,940,565.10	\$5,227,023.86	\$5,163,171.61	\$5,495,843.10
Per Connection	\$28,444.94	\$21,422.23	\$21,247.62	\$22,523.95

Area C Cost Estimates				
Type of System	Gravity Sewer	LP Grinder System	LP STEP System	Water System
Potential # of Customers	268	268	268	45
Estimated Construction Costs	\$2,641,600.00	\$3,162,178.00	\$3,230,458.00	\$376,262.50
Contingency (15%)	\$396,240.00	\$474,326.70	\$484,568.70	\$56,439.38
Engineering Fees (14%)	\$425,297.60	\$509,110.66	\$520,103.74	\$60,578.26
Total	\$3,463,137.60	\$4,145,615.36	\$4,235,130.44	\$493,280.14
Per Connection	\$12,922.16	\$15,468.71	\$15,802.73	\$12,332.00

20-YEAR LIFE CYCLE ANALYSIS

Initial capital cost is an important consideration, but it is also important to consider the life cycle (operation, maintenance, rehabilitation) cost of the proposed systems. The following section discusses the estimated 20-year life cycle costs of the systems considered for each area. The life cycle costs for each system were based on the following O&M parameters:

Gravity Sewer System O&M Parameters

Inspection & Cleaning Frequency (% of system per year)

- Sewer Root Removal – 1.0%
- Sewer Light Cleaning – 5.0%
- Manhole Inspection & Cleaning – 5.0%

Gravity Sewer System O&M Costs

- Gravity Sewer General System O&M - \$0.20 per linear foot
- Manhole Inspection and Cleaning - \$25 per manhole

Inspection & Cleaning Unit Cost (All Unit Costs in \$/L.F.)

- 8-inch Diameter – Light Cleaning (\$2.00) and Root Removal (\$3.25)

Lift Stations: Annual Costs (incl. Power, Maintenance, Repair/Replace Reserve)

- Sub Area Lift Station (Capacity <0.25 mgd) - \$8,000
- Area Wide Lift Station (Capacity >0.25 mgd, <1.0 mgd) - \$12,000
- Major Lift Station (Capacity >1.0 mgd) - \$15,000
- Average Pump Station Costs: \$7,739.00 based on JWSC FY20 Budget (does not include personnel costs)
- Total budgeted O&M costs for collection system and pumping station for FY19 - \$7,628,640.00 and FY20 - \$7,705,200.00

Low-Pressure Grinder Sewer System O&M Parameters and Costs

- Pressure Sewer General System O&M - \$0.10 per linear foot
- Annual Pump Power - \$12.00 per year per installed pump
- Reactive Maintenance / Equipment Replacement - \$135.00 per year per installed pump
- Pump Replacement – Manufacturer estimated every 20 years, \$1,750 per pump

Low-Pressure STEP Sewer System O&M Parameters and Costs

- STEP Sewer General System O&M - \$0.10 per linear foot
- STEP Annual Pump Power - \$12.00 per year per installed pump
- Reactive Maintenance / Equipment Replacement - \$125.00 per year per installed pump
- On-Property PM, Inspection, Filter Cleaning Frequency – 5 years
- Septic Tank Pumping Frequency – 5-10 years between pump-outs
- On-Property Inspection/Filter Cleaning Unit Cost - \$75.00
- Septic Tank Pumping Unit Cost - \$400

Water System O&M Parameters and Costs

If installed correctly, the typical life expectancy of a PVC water pipe is approximately 50 years. Additionally, if exercised on a regular basis (1 hour per valve per year), the typical life expectancy of a water valve is approximately 20 years. Unlike sewer systems, a newly installed water system requires very little O&M over a 20-year life cycle.

ESTIMATED 20-YEAR O&M COSTS PER SYSTEM

The O&M costs for each sewer system based on the parameters listed above have been provided in the following table:

Gravity Sewer 20-Year Operations and Maintenance Cost Estimates						
Operations and Maintenance Service	Area A		Area B		Area C	
	Total	Avg./Year	Total	Avg./Year	Total	Avg./Year
Sewer Root Removal	\$21,450.00	\$1,072.50	\$19,175.00	\$958.75	\$10,140.00	\$507.00
Sewer Light Cleaning	\$66,000.00	\$3,300.00	\$59,000.00	\$2,950.00	\$31,200.00	\$1,560.00
Manhole Inspection & Cleaning	\$2,975.00	\$148.75	\$3,125.00	\$156.25	\$1,650.00	\$82.50
Gravity Sewer General System O&M	\$6,600.00	\$330.00	\$5,900.00	\$295.00	\$3,120.00	\$156.00
Pump Station (Power, Maintenance, Repair/Replace)	\$160,000.00	\$8,000.00	N/A	N/A	N/A	N/A
Neighborhood Grinder Station (up to 100 REU Capacity)	\$240,000.00	\$12,000.00	N/A	N/A	N/A	N/A
Grinder Station (up to 50 REU Capacity)	N/A	N/A	\$320,000.00	\$16,000.00	N/A	N/A
Total	\$497,025.00	\$24,851.25	\$407,200.00	\$20,360.00	\$46,110.00	\$2,305.50
Total O&M Cost/Connection	\$1,111.91	\$55.60	\$910.96	\$83.44	\$103.15	\$8.60
Cost/Connection/Month	N/A	\$4.63	N/A	\$6.95	N/A	\$0.72

Low-Pressure Grinder Sewer System 20-Year Operations and Maintenance Cost Estimates						
Operations and Maintenance Service	Area A		Area B		Area C	
	Total	Avg./Year	Total	Avg./Year	Total	Avg./Year
Pressure Sewer General System O&M	\$68,842.00	\$3,442.10	\$59,118.00	\$2,955.90	\$31,694.00	\$1,584.70
Annual Pump Power	\$107,280.00	\$5,364.00	\$58,560.00	\$2,928.00	\$64,320.00	\$3,216.00
Reactive Maintenance / Equipment Replacement	\$1,206,900.00	\$60,345.00	\$658,800.00	\$32,940.00	\$723,600.00	\$36,180.00
Total	\$1,383,022.00	\$69,151.10	\$776,478.00	\$38,823.90	\$819,614.00	\$40,980.70
Total O&M Cost/Connection	\$3,094.01	\$154.70	\$1,737.09	\$159.11	\$1,833.59	\$152.91
Cost/Connection/Month	N/A	\$12.89	N/A	\$13.26	N/A	\$12.74

Low-Pressure STEP Sewer System 20-Year Operations and Maintenance Cost Estimates						
Operations and Maintenance Service	Area A		Area B		Area C	
	Total	Avg./Year	Total	Avg./Year	Total	Avg./Year
Pressure Sewer General System O&M	\$68,842.00	\$3,442.10	\$59,118.00	\$2,955.90	\$31,694.00	\$1,584.70
Annual Pump Power	\$107,280.00	\$5,364.00	\$58,560.00	\$2,928.00	\$64,320.00	\$3,216.00
Reactive Maintenance / Equipment Replacement	\$1,117,500.00	\$55,875.00	\$610,000.00	\$30,500.00	\$670,000.00	\$33,500.00
On-Property Inspection/Filter Cleaning	\$134,100.00	\$6,705.00	\$73,200.00	\$3,660.00	\$80,400.00	\$4,020.00
Septic Tank Pumping	\$536,400.00	\$26,820.00	\$292,800.00	\$14,640.00	\$321,600.00	\$16,080.00
Total	\$1,964,122.00	\$98,206.10	\$1,093,678.00	\$54,683.90	\$1,168,014.00	\$58,400.70
Total O&M Connection/Connection	\$4,394.01	\$219.70	\$2,446.71	\$224.11	\$2,613.01	\$217.91
Cost/Connection/Month	N/A	\$18.31	N/A	\$18.68	N/A	\$18.16

20-YEAR LIFE CYCLE COST ANALYSIS

A summary of initial capital costs and 20-year life cycle costs for each system has been provided in the following table:

Area A Cost Estimates			
Type of System	Gravity Sewer	LP Grinder System	LP STEP System
Potential # of Customers	447	447	447
Estimated Construction Costs	\$6,760,800.00	\$5,754,117.06	\$5,752,619.00
Contingency (15%)	\$1,014,120.00	\$863,117.56	\$862,892.85
Engineering Fees (14%)	\$1,088,488.80	\$926,412.85	\$926,171.66
Total Capital Cost Estimate	\$8,863,408.80	\$7,543,647.46	\$7,541,683.51
Total O&M Cost Estimate (20 Years)	\$497,025.00	\$1,383,022.00	\$1,964,122.00
Total System Cost Estimate	\$9,360,433.80	\$8,926,669.46	\$9,505,805.51
Cost per Connection	\$20,940.57	\$19,970.18	\$21,265.78

Area B Cost Estimates			
Type of System	Gravity Sewer	LP Grinder System	LP STEP System
Potential # of Customers	244	244	244
Estimated Construction Costs	\$5,294,100.00	\$3,987,051.00	\$3,938,346.00
Contingency (15%)	\$794,115.00	\$598,057.65	\$590,751.90
Engineering Fees (14%)	\$852,350.10	\$641,915.21	\$634,073.71
Total Capital Cost Estimate	\$6,940,565.10	\$5,227,023.86	\$5,163,171.61
Total O&M Cost Estimate (20 Years)	\$407,200.00	\$776,478.00	\$1,093,678.00
Total System Cost Estimate	\$7,347,765.10	\$6,003,501.86	\$6,256,849.61
Cost per Connection	\$30,113.79	\$24,604.52	\$25,642.83

Area C Cost Estimates			
Type of System	Gravity Sewer	LP Grinder System	LP STEP System
Potential # of Customers	268	268	268
Estimated Construction Costs	\$2,641,600.00	\$3,162,178.00	\$3,230,458.00
Contingency (15%)	\$396,240.00	\$474,326.70	\$484,568.70
Engineering Fees (14%)	\$425,297.60	\$509,110.66	\$520,103.74
Total Capital Cost Estimate	\$3,463,137.60	\$4,145,615.36	\$4,235,130.44
Total O&M Cost Estimate (20 Years)	\$46,110.00	\$819,614.00	\$1,168,014.00
Total System Cost Estimate	\$3,509,247.60	\$4,965,229.36	\$5,403,144.44
Cost per Connection	\$13,094.21	\$18,526.98	\$20,160.99

SUMMARY OF FINDINGS FOR COST ESTIMATES

As shown in the cost estimate summary for each area, the cost per connection varies for each system. While Area A capital and O&M costs are the highest of the three (3) areas, the cost per connection is lower than Area B due to the relative density of the area and the potential # of customers. Due to the size and topography of Areas A and B, estimated costs are significantly higher than Area C. Gravity sewer capital costs for Areas A and B are significantly higher than low-pressure sewer systems based on the elevation constraints within the area and the need for pump stations. Gravity sewer capital costs are lower in Area C due to the relative location of each potential point of connection and existing infrastructure. The capital costs for low-pressure systems are similar for each area and are typically less than gravity sewer based on the smaller diameter pipe required for the main lines and the ability of the pipe to be installed in the right-of-way. However, due to unknowns at this time, it was assumed for these cost estimates that milling and overlaying asphalt would be completed for the entire project.

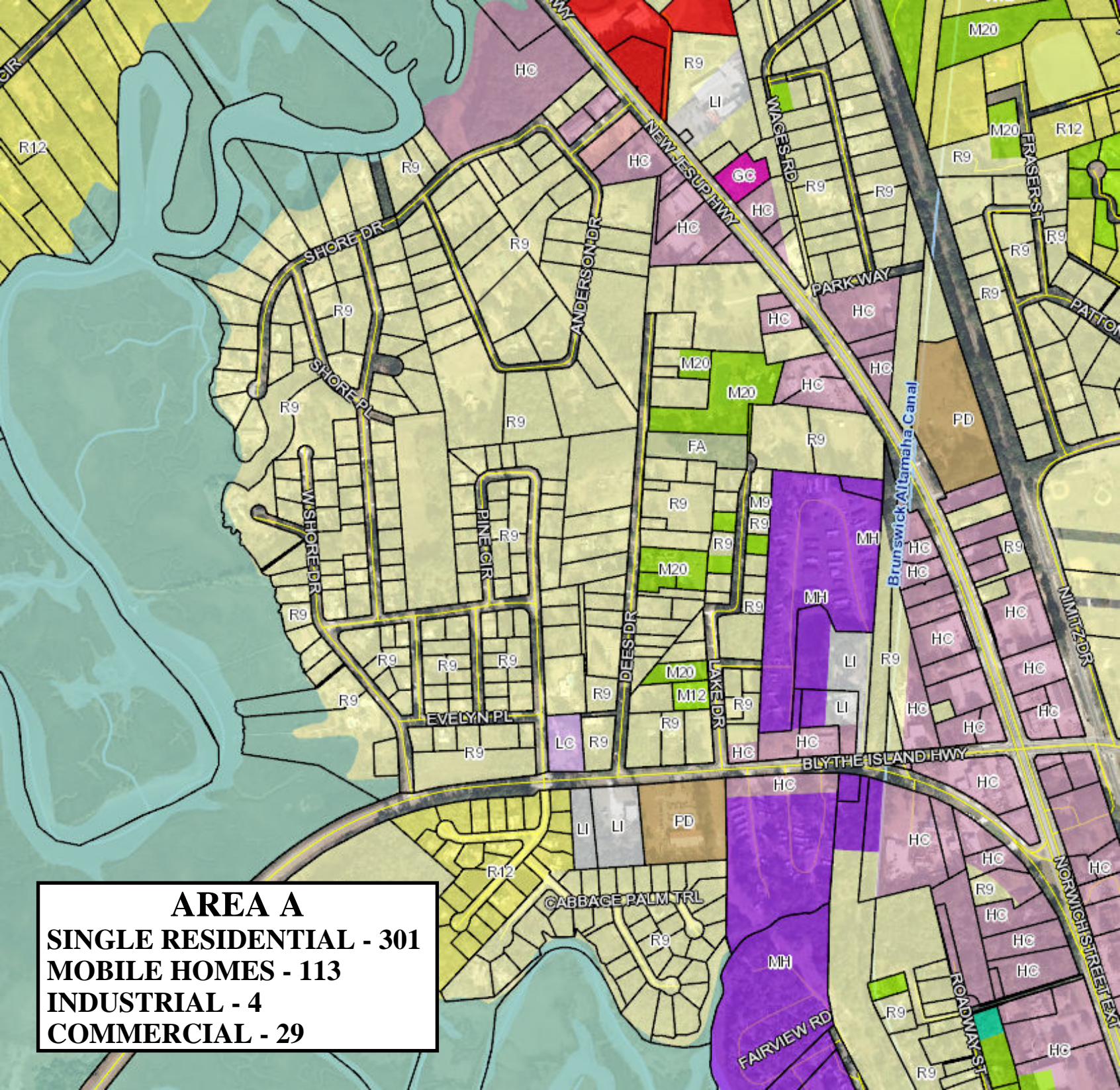
O&M costs for a new gravity sewer system are typically low for the first 20-years. The main costs, as shown in Areas A and B, are the O&M costs required to maintain each pump station. O&M costs are considerably higher for low-pressure systems due to the maintenance and/or replacement required to maintain each individual pump system. The low-pressure STEP system has the highest estimated O&M costs since it also includes pumping out the septic tank system every 5-10 years.

The water system cost estimates are based on a looped system and milling/overlaying asphalt for the entire project. The ability to use the right-of-way or combining water and sewer projects could significantly reduce the overall cost to install utility services in these areas.

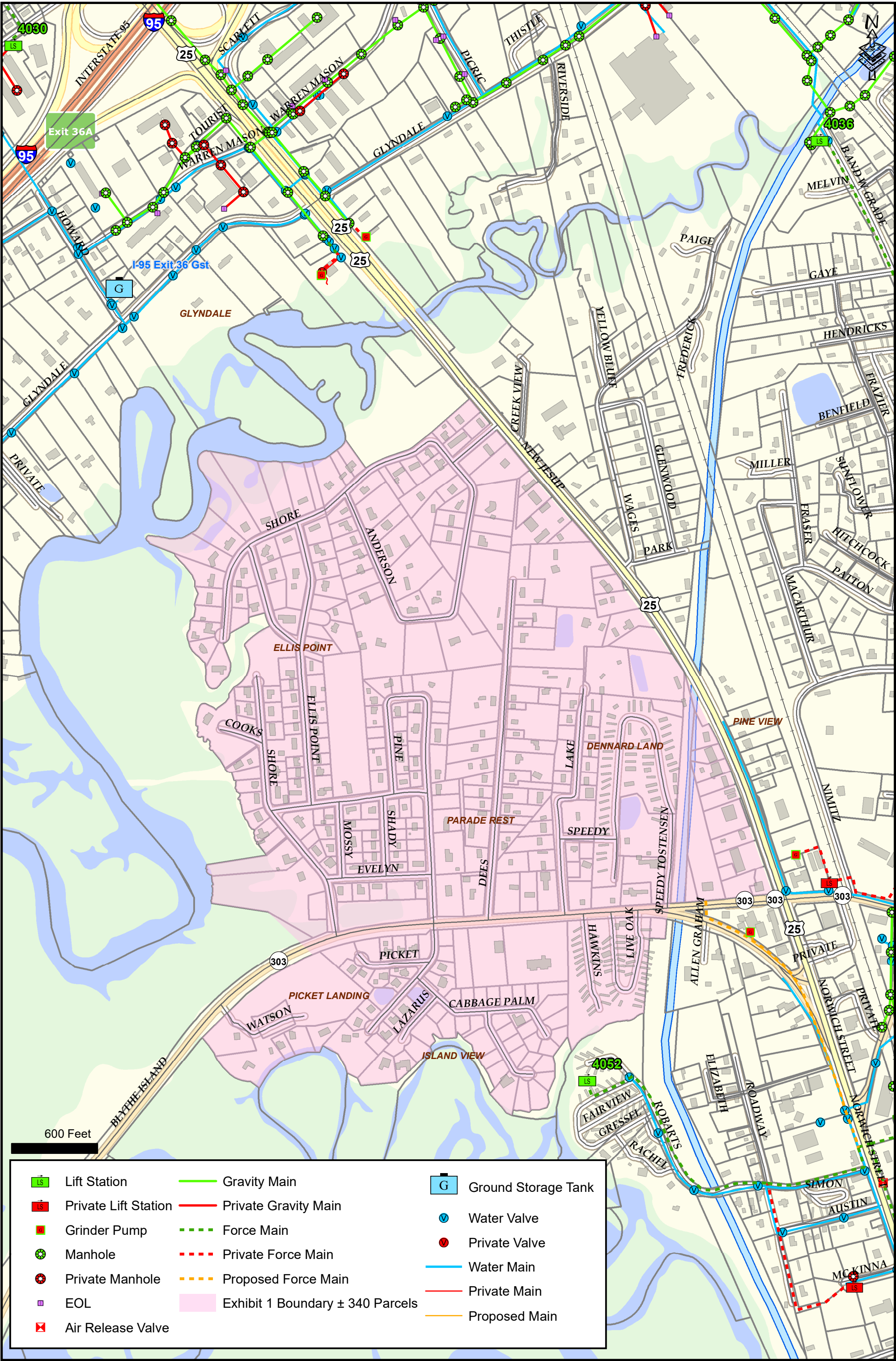
Overall, each of these areas present different challenges to each type of system and a single system may not be the best fit in each of these areas. A combination of gravity sewer and one of the low-pressure sewer systems may address these challenges in a more cost-effective and area-specific way. As more information is available through engineering survey and preliminary design, there is the potential for significant cost savings in each area using multiple systems and combining water and sewer projects.

APPENDIX

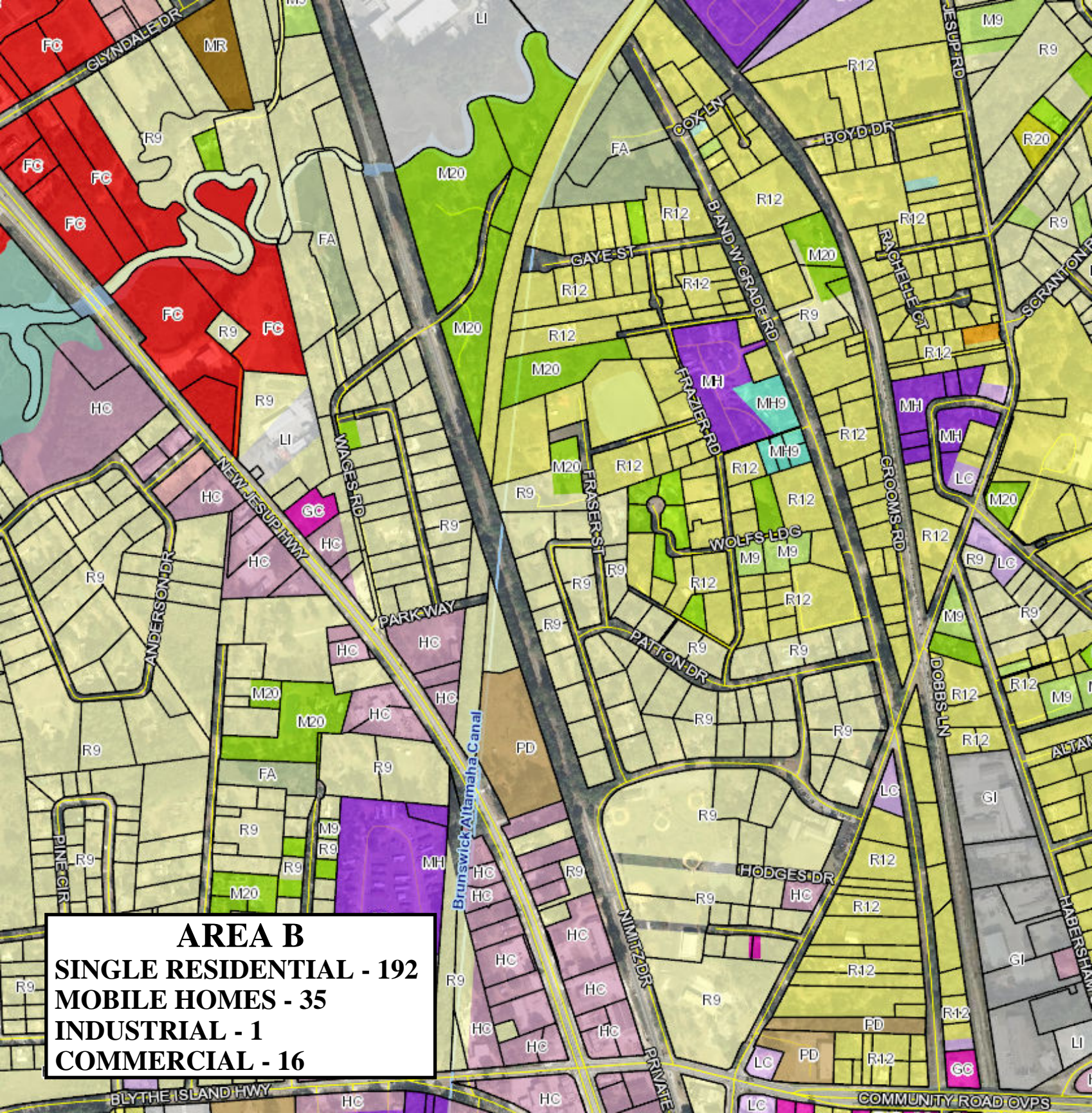
APPENDIX A: ZONING MAP FOR AREA A



APPENDIX B: PROJECT MAP FOR AREA A

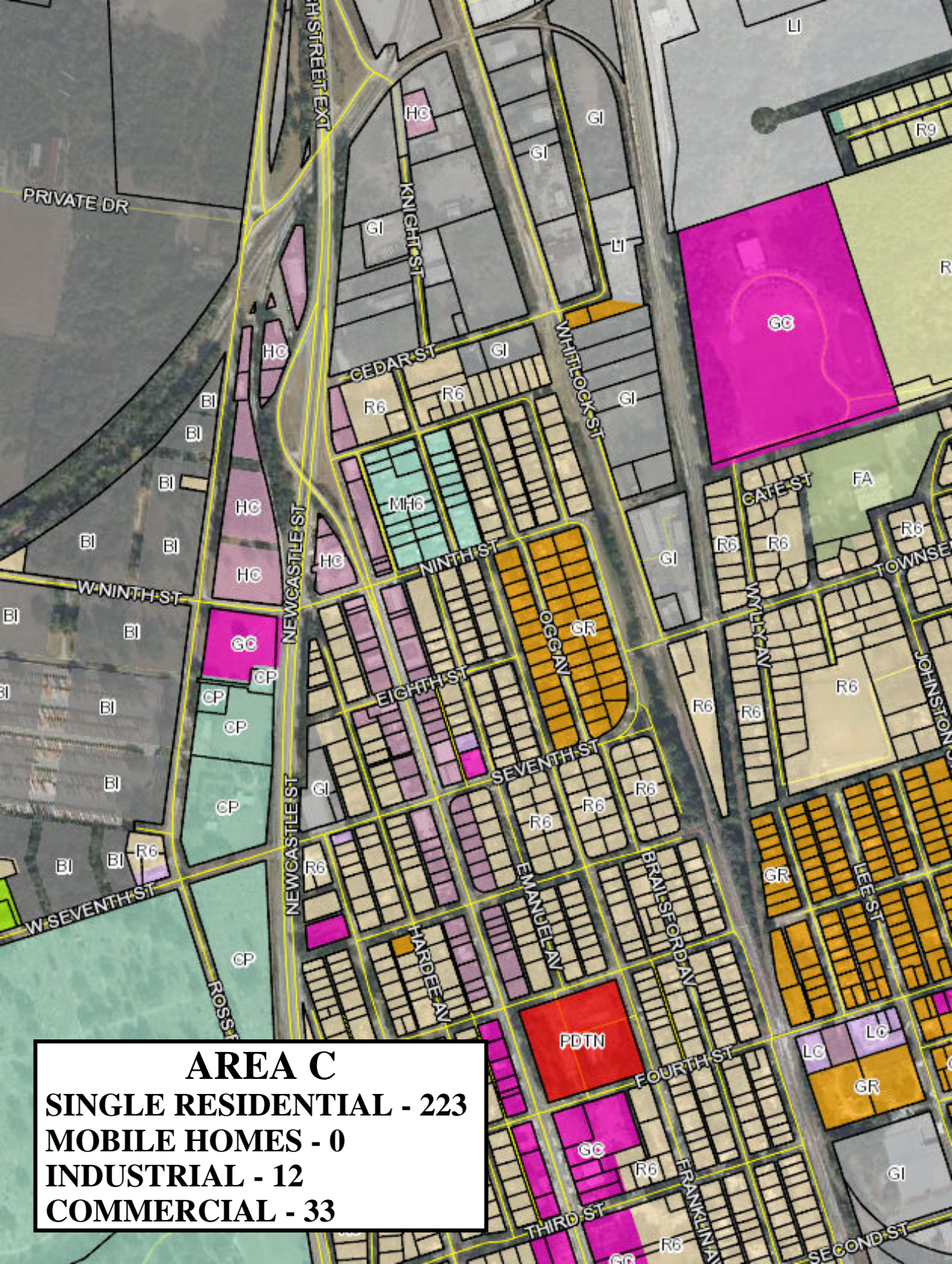


APPENDIX C: ZONING MAP FOR AREA B



APPENDIX D: PROJECT MAP FOR AREA B

APPENDIX E: ZONING MAP FOR AREA C



AREA C

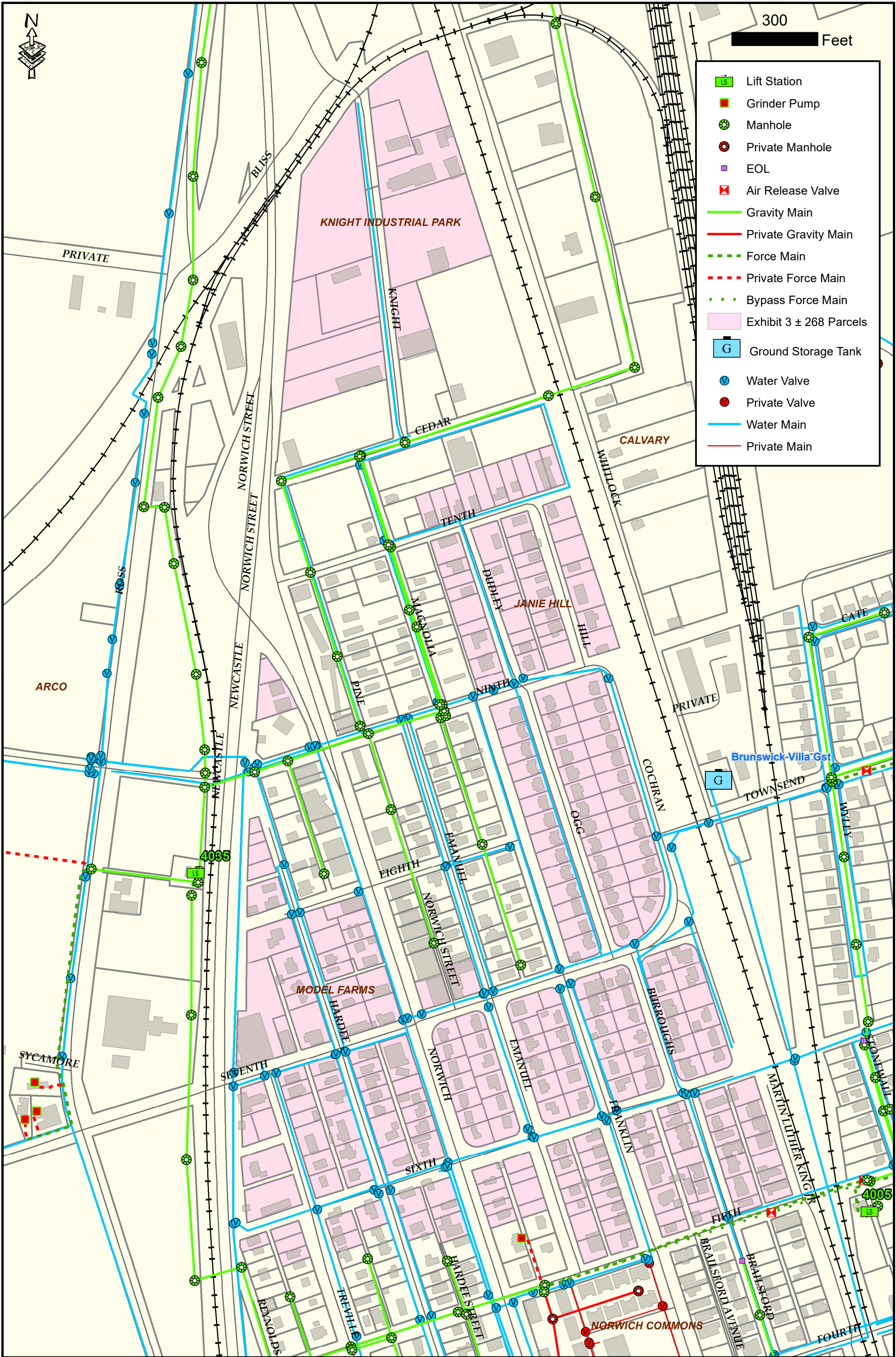
SINGLE RESIDENTIAL - 223

MOBILE HOMES - 0

INDUSTRIAL - 12

COMMERCIAL - 33

APPENDIX F: PROJECT MAP FOR AREA C



APPENDIX G: FLOW CALCULATIONS

The flow projections in each area for residential, commercial and industrial are as follows:

Estimated Flows for Area A:

- 447 Potential Customers
- 192,000 GPD for AADF and 501,000 GPD for PHF for Water System Flow
- 192,000 GPD for ADWF and 700,000 GPD for PF for Sanitary Sewer Flow

AREA A					Water Distribution Design Flows			Sewage Design Flows		
Zoning	Number of Customers	Residential Equivalent Unit (REU)	Approximate Population (2.6/REU)		Annual Average Daily Flow (AADF)	Maximum Daily Flow (MDF)	Peak Hourly Flow (PHF)	Daily Average Dry Weather Flow (ADWF)	Peaking Factor (P) Lindburg	Peak Flow (PF) Lindburg
Single Residential	301	301	783	Persons	90000	139000	198000	90000	3.6	328000
Mobile Home	113	113	294	Persons	34000	53000	75000	34000		124000
Industrial	4	80	208	Persons	24000	37000	132000	24000		88000
Commercial	29	145	377	Persons	44000	67000	96000	44000		160000
Total	447	639	1661	Persons	192000	296000	501000	192000		700000

Estimated Flows for Area B:

- 244 Potential Customers
- 99,000 GPD for AADF and 217,000 GPD for PHF for Water System Flow
- 99,000 GPD for ADWF and 379,000 GPD for PF for Sanitary Sewer Flow

AREA B					Water Distribution Design Flows			Sewage Design Flows		
Zoning	Number of Customers	Residential Equivalent Unit (REU)	Approximate Population (2.6/REU)		Annual Average Daily Flow (AADF)	Maximum Daily Flow (MDF)	Peak Hourly Flow (PHF)	Daily Average Dry Weather Flow (ADWF)	Peaking Factor (P) Lindburg	Peak Flow (PF) Lindburg
Single Residential	192	192	499	Persons	58000	89000	128000	58000	3.8	223000
Mobile Home	35	35	91	Persons	11000	16000	23000	11000		41000
Industrial	1	20	52	Persons	6000	9000	13000	6000		23000
Commercial	16	80	208	Persons	24000	37000	53000	24000		92000
Total	244	327	850	Persons	99000	151000	217000	99000		379000

Estimated Flows for Area C:

- 268 Potential Customers
- 189,000 GPD for AADF and 415,000 GPD for PHF for Water System Flow
- 189,000 GPD for ADWF and 689,000 GPD for PF for Sanitary Sewer Flow

AREA C					Water Distribution Design Flows			Sewage Design Flows		
Zoning	Number of Customers	Residential Equivalent Unit (REU)	Approximate Population (2.6/REU)		Annual Average Daily Flow (AADF)	Maximum Daily Flow (MDF)	Peak Hourly Flow (PHF)	Daily Average Dry Weather Flow (ADWF)	Peaking Factor (P) Lindburg	Peak Flow (PF) Lindburg
Single Residential	223	223	580	Persons	67000	103000	148000	67000	3.7	245000
Mobile Home	0	0	0	Persons	0	0	0	0		0
Industrial	12	240	624	Persons	72000	111000	158000	72000		263000
Commercial	33	165	429	Persons	50000	76000	109000	50000		181000
Total	268	628	1633	Persons	189000	290000	415000	189000		689000

* Industrial – Equivalent to 20 REUs/Lot

*Commercial – Equivalent to 5 REUs/Lot

*GPD for each design flow has been rounded to the nearest thousand for the cost study

APPENDIX H: BREAKDOWN OF PROJECT COST ESTIMATES

**GWES, LLC****OPINION OF PROBABLE COST**

Project: Cost Study to Provide Sewer Service to Unserved Areas
Client: Brunswick-Glynn County Joint Water and Sewer Commission
Project No.: 085.01.1.19
Location: Area West of Highway 341 and North of Highway 303

Designer: Barrett Neal
Reviewer: Matt Taylor, P.E.
Date: 6/26/2019
Design Level: 10%

**Area 'A' - Estimated Cost to Provide Sewer Service Via Gravity Flow System
Based on 447 Potential Connections**

Item No.	Description	Quantity	Unit	Price	Total
1	Mobilization/Demobilization	1	L.S.	\$ 100,000.00	\$ 100,000.00
2	Erosion and Sedimentation Control	1	L.S.	\$ 100,000.00	\$ 100,000.00
3	Removal/Replacement				
	Mill/Overlay Asphalt Pavement	91,667	S.Y.	\$ 18.00	\$ 1,650,000.00
	Miscellaneous (Curb & Gutter, Sidewalk, Landscaping, Etc.) per Connection	447	EA	\$ 500.00	\$ 223,500.00
4	Gravity Sewer Installation				
	Manholes				
	4' Diameter Precast Concrete Manhole	119	EA	\$ 6,500.00	\$ 773,500.00
	Connect to Existing Manhole/System	2	EA	\$ 5,000.00	\$ 10,000.00
	Service Laterals				
	4.00" SDR PVC Sewer Service Lateral w/ Cleanout	22,350	LF	\$ 14.00	\$ 312,900.00
	Piping				
	8.00" SDR PVC Pipe	33,000	LF	\$ 60.00	\$ 1,980,000.00
5	Pressurized System Installation				
	Pump Station				
	Neighborhood Grinder Station (Up to 100 REU Capacity)	2	EA	\$ 300,000.00	\$ 600,000.00
	Pump Station (0.75 MGD Capacity)	1	EA	\$ 700,000.00	\$ 700,000.00
	Force Main				
	2.00" SDR PVC Pipe	3,600	LF	\$ 14.00	\$ 50,400.00
	6.00" SDR PVC Pipe	1,850	LF	\$ 30.00	\$ 55,500.00
6	Allowances				
	Easement Acquisition	1	L.S.	\$ 180,000.00	\$ 180,000.00
	Permitting	1	L.S.	\$ 25,000.00	\$ 25,000.00
				<i>Sub-Total</i>	\$ 6,760,800.00
				<i>Contingency (15%)</i>	\$ 1,014,120.00
				<i>Engineering (14%)</i>	\$ 1,088,488.80
				Total	\$ 8,863,408.80
				<i>Per Connection</i>	\$ 19,828.66



GWES, LLC

OPINION OF PROBABLE COST

Project: Cost Study to Provide Sewer Service to Unserved Areas
Client: Brunswick-Glynn County Joint Water and Sewer Commission
Project No.: 085.01.1.19
Location: Area East of Highway 341 & North of Community Rd and West of Old Jesup Rd

Designer: Barrett Neal
Reviewer: Matt Taylor, P.E.
Date: 6/26/2019
Design Level: 10%

**Area 'B' - Estimated Cost to Provide Sewer Service Via Gravity Flow System
Based on 244 Potential Connections**

Item No.	Description	Quantity	Unit	Price	Total
1	Mobilization/Demobilization	1	L.S.	\$ 100,000.00	\$ 100,000.00
2	Erosion and Sedimentation Control	1	L.S.	\$ 80,000.00	\$ 80,000.00
3	Removal/Replacement				
	Mill/Overlay Asphalt Pavement	81,944	S.Y.	\$ 18.00	\$ 1,475,000.00
	Miscellaneous (Curb & Gutter, Sidewalk, Landscaping, Etc.) per Connection	244	EA	\$ 500.00	\$ 122,000.00
4	Gravity Sewer Installation				
	Manholes				
	4' Diameter Precast Concrete Manhole	125	EA	\$ 6,500.00	\$ 812,500.00
	Connect to Existing Manhole/System	7	EA	\$ 5,000.00	\$ 35,000.00
	Service Laterals				
	4.00" SDR PVC Sewer Service Lateral w/ Cleanout	12,200	LF	\$ 14.00	\$ 170,800.00
	Piping				
	8.00" SDR PVC Pipe	29,500	LF	\$ 60.00	\$ 1,770,000.00
5	Pressurized System Installation				
	Pump Station				
	Grinder Station (Up to 50 REU Capacity)	4	EA	\$ 125,000.00	\$ 500,000.00
	Force Main				
	2.00" SDR PVC Pipe	1,700	LF	\$ 14.00	\$ 23,800.00
6	Allowances				
	Easement Acquisition	1	L.S.	\$ 180,000.00	\$ 180,000.00
	Permitting	1	L.S.	\$ 25,000.00	\$ 25,000.00
				<i>Sub-Total</i>	\$ 5,294,100.00
				<i>Contingency (15%)</i>	\$ 794,115.00
				<i>Engineering (14%)</i>	\$ 852,350.10
				Total	\$ 6,940,565.10
				<i>Per Connection</i>	\$ 28,444.94

**GWES, LLC****OPINION OF PROBABLE COST**

Project: Cost Study to Provide Sewer Service to Unserved Areas
Client: Brunswick-Glynn County Joint Water and Sewer Commission
Project No.: 085.01.1.19
Location: The Arco Community

Designer: Barrett Neal
Reviewer: Matt Taylor, P.E.
Date: 6/26/2019
Design Level: 10%

**Area 'C' - Estimated Cost to Provide Sewer Service Via Gravity Flow System
Based on 268 Potential Connections**

Item No.	Description	Quantity	Unit	Price	Total
1	Mobilization/Demobilization	1	L.S.	\$ 100,000.00	\$ 100,000.00
2	Erosion and Sedimentation Control	1	L.S.	\$ 40,000.00	\$ 40,000.00
3	Removal/Replacement				
	Mill/Overlay Asphalt Pavement	43,333	S.Y.	\$ 18.00	\$ 780,000.00
	Miscellaneous (Curb & Gutter, Sidewalk, Landscaping, Etc.) per Connection	268	EA	\$ 500.00	\$ 134,000.00
4	Gravity Sewer Installation				
	Manholes				
	4' Diameter Precast Concrete Manhole	66	EA	\$ 6,500.00	\$ 429,000.00
	Connect to Existing Manhole/System	7	EA	\$ 5,000.00	\$ 35,000.00
	Service Laterals				
	4.00" SDR PVC Sewer Service Lateral w/ Cleanout	13,400	LF	\$ 14.00	\$ 187,600.00
	Piping				
	8.00" SDR PVC Pipe	15,600	LF	\$ 60.00	\$ 936,000.00
				Sub-Total	\$ 2,641,600.00
				Contingency (15%)	\$ 396,240.00
				Engineering (14%)	\$ 425,297.60
				Total	\$ 3,463,137.60
				Per Connection	\$ 12,922.16



GWES, LLC

OPINION OF PROBABLE COST

Project: Cost Study to Provide Sewer Service to Unserved Areas
Client: Brunswick-Glynn County Joint Water and Sewer Commission
Project No.: 085.01.1.19
Location: Area West of Highway 341 and North of Highway 303

Designer: Barrett Neal
Reviewer: Matt Taylor, P.E.
Date: 6/26/2019
Design Level: 10%

Area 'A' - Estimated Cost to Provide Sewer Service Via Low Pressure Grinder Pump System Based on 447 Potential Connections

Item No.	Description	Quantity	Unit	Price	Total
1	Mobilization/Demobilization	1	L.S.	\$ 100,000.00	\$ 100,000.00
2	Erosion and Sedimentation Control	1	L.S.	\$ 60,000.00	\$ 60,000.00
3	Removal/Replacement				
	Mill/Overlay Asphalt Pavement	95,614	SY	\$ 17.50	\$ 1,673,243.06
	Miscellaneous (Curb & Gutter, Sidewalk, Landscaping, Etc.) per Connection	447	EA	\$ 500.00	\$ 223,500.00
4	Grinder Sewer System Installation				
	Valves				
	Air/Vacuum Release Valve	10	EA	\$ 4,800.00	\$ 48,000.00
	Clean Out	54	EA	\$ 600.00	\$ 32,400.00
	Pumps				
	DH071-61 Grinder Pump	447	EA	\$ 4,315.00	\$ 1,928,805.00
	Lateral Kits (Includes Ball/Check Valve Assembly)	447	EA	\$ 575.00	\$ 257,025.00
	Lateral (Boundary) Installation	447	EA	\$ 170.00	\$ 75,990.00
	Pump/Panel Installation	447	EA	\$ 1,000.00	\$ 447,000.00
	1.25" SDR PVC Service Lateral Pipe	22,350	L.F.	\$ 12.00	\$ 268,200.00
	Piping				
	2.00" SDR PVC Pipe	15,015	L.F.	\$ 14.00	\$ 210,210.00
	3.00" SDR PVC Pipe	13,256	L.F.	\$ 19.00	\$ 251,864.00
	4.00" SDR PVC Pipe	5,270	L.F.	\$ 24.00	\$ 126,480.00
	6.00" SDR PVC Pipe	880	L.F.	\$ 30.00	\$ 26,400.00
5	Allowances				
	Permitting	1	L.S.	\$ 25,000.00	\$ 25,000.00
				Sub-Total	\$ 5,754,117.06
				Contingency (15%)	\$ 863,117.56
				Engineering (14%)	\$ 926,412.85
				Total	\$ 7,543,647.46
				Per Connection	\$ 16,876.17



GWES, LLC

OPINION OF PROBABLE COST

Project: Cost Study to Provide Sewer Service to Unserved Areas
Client: Brunswick-Glynn County Joint Water and Sewer Commission
Project No.: 085.01.1.19
Location: Area East of Highway 341 & North of Community Rd and West of Old Jesup Rd

Designer: Barrett Neal
Reviewer: Matt Taylor, P.E.
Date: 6/26/2019
Design Level: 10%

**Area 'B' - Estimated Cost to Provide Sewer Service Via Low Pressure Grinder Pump System
Based on 244 Potential Connections**

Item No.	Description	Quantity	Unit	Price	Total
1	Mobilization/Demobilization	1	L.S.	\$ 100,000.00	\$ 100,000.00
2	Erosion and Sedimentation Control	1	L.S.	\$ 60,000.00	\$ 60,000.00
3	Removal/Replacement				
	Mill/Overlay Asphalt Pavement	82,108	SY	\$ 18.00	\$ 1,477,950.00
	Miscellaneous (Curb & Gutter, Sidewalk, Landscaping, Etc.) per Connection	244	EA	\$ 500.00	\$ 122,000.00
4	Grinder Sewer System Installation				
	Valves				
	Air/Vacuum Release Valve	9	EA	\$ 4,800.00	\$ 43,200.00
	Clean Out	51	EA	\$ 600.00	\$ 30,600.00
	Pumps				
	DH071-61 Grinder Pump	244	EA	\$ 4,315.00	\$ 1,052,860.00
	Lateral Kits (Includes Ball/Check Valve Assembly)	244	EA	\$ 575.00	\$ 140,300.00
	Lateral (Boundary) Installation	244	EA	\$ 170.00	\$ 41,480.00
	Pump/Panel Installation	244	EA	\$ 1,000.00	\$ 244,000.00
	1.25" SDR PVC Service Lateral Pipe	12,200	L.F.	\$ 12.00	\$ 146,400.00
	Piping				
	2.00" SDR PVC Pipe	14,110	L.F.	\$ 14.00	\$ 197,540.00
	3.00" SDR PVC Pipe	13,011	L.F.	\$ 19.00	\$ 247,209.00
	4.00" SDR PVC Pipe	2,438	L.F.	\$ 24.00	\$ 58,512.00
5	Allowances				
	Permitting	1	L.S.	\$ 25,000.00	\$ 25,000.00
				<i>Sub-Total</i>	\$ 3,987,051.00
				<i>Contingency (15%)</i>	\$ 598,057.65
				<i>Engineering (14%)</i>	\$ 641,915.21
				Total	\$ 5,227,023.86
				<i>Per Connection</i>	\$ 21,422.23

**GWES, LLC****OPINION OF PROBABLE COST**

Project: Cost Study to Provide Sewer Service to Unserved Areas
Client: Brunswick-Glynn County Joint Water and Sewer Commission
Project No.: 085.01.1.19
Location: The Arco Community

Designer: Barrett Neal
Reviewer: Matt Taylor, P.E.
Date: 6/26/2019
Design Level: 10%

**Area 'C' - Estimated Cost to Provide Sewer Service Via Low Pressure Grinder Pump System
Based on 268 Potential Connections**

Item No.	Description	Quantity	Unit	Price	Total
1	Mobilization/Demobilization	1	L.S.	\$ 100,000.00	\$ 100,000.00
2	Erosion and Sedimentation Control	1	L.S.	\$ 60,000.00	\$ 60,000.00
3	Removal/Replacement				
	Mill/Overlay Asphalt Pavement	44,019	SY	\$ 18.00	\$ 792,350.00
	Miscellaneous (Curb & Gutter, Sidewalk, Landscaping, Etc.) per Connection	268	EA	\$ 500.00	\$ 134,000.00
4	Grinder Sewer System Installation				
	Valves				
	Air/Vacuum Release Valve	2	EA	\$ 4,800.00	\$ 9,600.00
	Clean Out	34	EA	\$ 600.00	\$ 20,400.00
	Pumps				
	DH071-61 Grinder Pump	268	EA	\$ 4,315.00	\$ 1,156,420.00
	Lateral Kits (Includes Ball/Check Valve Assembly)	268	EA	\$ 575.00	\$ 154,100.00
	Lateral (Boundary) Installation	268	EA	\$ 170.00	\$ 45,560.00
	Pump/Panel Installation	268	EA	\$ 1,000.00	\$ 268,000.00
	1.25" SDR PVC Service Lateral Pipe	13,400	L.F.	\$ 12.00	\$ 160,800.00
	Piping				
	2.00" SDR PVC Pipe	8,029	L.F.	\$ 14.00	\$ 112,406.00
	3.00" SDR PVC Pipe	7,818	L.F.	\$ 19.00	\$ 148,542.00
				Sub-Total	\$ 3,162,178.00
				Contingency (15%)	\$ 474,326.70
				Engineering (14%)	\$ 509,110.66
				Total	\$ 4,145,615.36
				Per Connection	\$ 15,468.71



OPINION OF PROBABLE COST

Project: Cost Study to Provide Sewer Service to Unserved Areas
Client: Brunswick-Glynn County Joint Water and Sewer Commission
Project No.: 085.01.1.19
Location: Area West of Highway 341 and North of Highway 303

Designer: Barrett Neal
Reviewer: Matt Taylor, P.E.
Date: 6/26/2019
Design Level: 10%

**Area 'A' - Estimated Cost to Provide Sewer Service Via Low Pressure STEP System
Based on 447 Potential Connections**

Item No.	Description	Quantity	Unit	Price	Total
1	Mobilization/Demobilization	1	L.S.	\$ 100,000.00	\$ 100,000.00
2	Erosion and Sedimentation Control	1	L.S.	\$ 60,000.00	\$ 60,000.00
3	Removal/Replacement				
	Mill/Overlay Asphalt Pavement	95,614	SY	\$ 18.00	\$ 1,721,050.00
	Miscellaneous (Curb & Gutter, Sidewalk, Landscaping, Etc.) per Connection	447	EA	\$ 500.00	\$ 223,500.00
4	STEP System				
	Valves				
	Air Release Valve	10	EA	\$ 2,400.00	\$ 24,000.00
	Clean Out	54	EA	\$ 600.00	\$ 32,400.00
	Residential STEP Pump Package				
	Residential STEP Pump Package Total	414	EA	\$ 4,000.00	\$ 1,656,000.00
	Commercial/Industrial STEP Pump Package				
	Commercial/Industrial STEP Pump Package Total	33	EA	\$ 7,500.00	\$ 247,500.00
	Residential & Commercial Service Laterals				
	1.25" SDR PVC Service Lateral Pipe	22,350	L.F.	\$ 12.00	\$ 268,200.00
	Lateral Kits (Includes Ball/Check Valve Assembly)	447	EA	\$ 575.00	\$ 257,025.00
	Lateral (Boundary) Installation	447	EA	\$ 170.00	\$ 75,990.00
	Pump/Panel Installation	447	EA	\$ 1,000.00	\$ 447,000.00
	Piping				
	2.00" SDR PVC Pipe	15,015	L.F.	\$ 14.00	\$ 210,210.00
	3.00" SDR PVC Pipe	13,256	L.F.	\$ 19.00	\$ 251,864.00
	4.00" SDR PVC Pipe	5,270	L.F.	\$ 24.00	\$ 126,480.00
	6.00" SDR PVC Pipe	880	L.F.	\$ 30.00	\$ 26,400.00
5	Allowances				
	Permitting	1	L.S.	\$ 25,000.00	\$ 25,000.00
				Sub-Total	\$ 5,752,619.00
				Contingency (15%)	\$ 862,892.85
				Engineering (14%)	\$ 926,171.66
				Total	\$ 7,541,683.51
				Per Connection	\$ 16,871.78



GWES, LLC

OPINION OF PROBABLE COST

Project: Cost Study to Provide Sewer Service to Unserved Areas
Client: Brunswick-Glynn County Joint Water and Sewer Commission
Project No.: 085.01.1.19
Location: Area East of Highway 341 & North of Community Rd and West of Old Jesup Rd

Designer: Barrett Neal
Reviewer: Matt Taylor, P.E.
Date: 6/26/2019
Design Level: 10%

**Area 'B' - Estimated Cost to Provide Sewer Service Via Low Pressure STEP System
Based on 243 Potential Connections**

Item No.	Description	Quantity	Unit	Price		Total	
1	Mobilization/Demobilization	1	L.S.	\$	100,000.00	\$	100,000.00
2	Erosion and Sedimentation Control	1	L.S.	\$	60,000.00	\$	60,000.00
3	Removal/Replacement						
	Mill/Overlay Asphalt Pavement	82,108	SY	\$	18.00	\$	1,477,950.00
	Miscellaneous (Curb & Gutter, Sidewalk, Landscaping, Etc.) per Connection	243	EA	\$	500.00	\$	121,500.00
4	STEP System						
	Valves						
	Air Release Valve	9	EA	\$	2,400.00	\$	21,600.00
	Clean Out	51	EA	\$	600.00	\$	30,600.00
	Residential STEP Pump Package						
	Residential STEP Pump Package Total	227	EA	\$	4,000.00	\$	908,000.00
	Commercial/Industrial STEP Pump Package						
	Commercial/Industrial STEP Pump Package Total	16	EA	\$	7,500.00	\$	120,000.00
	Residential & Commercial Service Laterals						
	1.25" SDR PVC Service Lateral Pipe	12,200	L.F.	\$	12.00	\$	146,400.00
	Lateral Kits (Includes Ball/Check Valve Assembly)	243	EA	\$	575.00	\$	139,725.00
	Lateral (Boundary) Installation	243	EA	\$	170.00	\$	41,310.00
	Pump/Panel Installation	243	EA	\$	1,000.00	\$	243,000.00
	Piping						
	2.00" SDR PVC Pipe	14,110	L.F.	\$	14.00	\$	197,540.00
	3.00" SDR PVC Pipe	13,011	L.F.	\$	19.00	\$	247,209.00
	4.00" SDR PVC Pipe	2,438	L.F.	\$	24.00	\$	58,512.00
5	Allowances						
	Permitting	1	L.S.	\$	25,000.00	\$	25,000.00
				Sub-Total		\$	3,938,346.00
				Contingency (15%)		\$	590,751.90
				Engineering (14%)		\$	634,073.71
				Total		\$	5,163,171.61
				Per Connection		\$	21,247.62

**GWES, LLC****OPINION OF PROBABLE COST**

Project: Cost Study to Provide Sewer Service to Unserved Areas
Client: Brunswick-Glynn County Joint Water and Sewer Commission
Project No.: 085.01.1.19
Location: The Arco Community

Designer: Barrett Neal
Reviewer: Matt Taylor, P.E.
Date: 6/26/2019
Design Level: 10%

**Area 'C' - Estimated Cost to Provide Sewer Service Via Low Pressure STEP System
Based on 268 Potential Connections**

Item No.	Description	Quantity	Unit	Price		Total	
1	Mobilization/Demobilization	1	L.S.	\$	100,000.00	\$	100,000.00
2	Erosion and Sedimentation Control	1	L.S.	\$	60,000.00	\$	60,000.00
3	Removal/Replacement						
	Mill/Overlay Asphalt Pavement	44,019	SY	\$	18.00	\$	792,350.00
	Miscellaneous (Curb & Gutter, Sidewalk, Landscaping, Etc.) per Connection	268	EA	\$	500.00	\$	134,000.00
4	STEP System						
	Valves						
	Air Release Valve	2	EA	\$	2,400.00	\$	4,800.00
	Clean Out	34	EA	\$	600.00	\$	20,400.00
	Residential STEP Pump Package						
	Residential STEP Pump Package Total	223	EA	\$	4,000.00	\$	892,000.00
	Commercial/Industrial STEP Pump Package						
	Commercial/Industrial STEP Pump Package Total	45	EA	\$	7,500.00	\$	337,500.00
	Residential & Commercial Service Laterals						
	1.25" SDR PVC Service Lateral Pipe	13,400	L.F.	\$	12.00	\$	160,800.00
	Lateral Kits (Includes Ball/Check Valve Assembly)	268	EA	\$	575.00	\$	154,100.00
	Lateral (Boundary) Installation	268	EA	\$	170.00	\$	45,560.00
	Pump/Panel Installation	268	EA	\$	1,000.00	\$	268,000.00
	Piping						
	2.00" SDR PVC Pipe	8,029	L.F.	\$	14.00	\$	112,406.00
	3.00" SDR PVC Pipe	7,818	L.F.	\$	19.00	\$	148,542.00
				Sub-Total	\$		3,230,458.00
				Contingency (15%)	\$		484,568.70
				Engineering (14%)	\$		520,103.74
				Total	\$		4,235,130.44
				Per Connection	\$		15,802.73

**GWES, LLC****OPINION OF PROBABLE COST**

Project: Cost Study to Provide Sewer Service to Unserved Areas
Client: Brunswick-Glynn County Joint Water and Sewer Commission
Project No.: 085.01.1.19
Location: Area West of Highway 341 and North of Highway 303

Designer: Barrett Neal
Reviewer: Matt Taylor, P.E.
Date: 6/26/2019
Design Level: 10%

**Area 'A' - Estimated Cost to Provide Water Service
Based on 447 Potential Connections**

Item No.	Description	Quantity	Unit	Price	Total
1	Mobilization/Demobilization	1	L.S.	\$ 100,000.00	\$ 100,000.00
2	Erosion and Sedimentation Control	1	L.S.	\$ 80,000.00	\$ 80,000.00
3	Removal/Replace				
	Mill/Overlay Asphalt Pavement	91,667	S.Y.	\$ 18.00	\$ 1,650,000.00
	Miscellaneous (Curb & Gutter, Sidewalk, Landscaping, Etc.) per Connection	447	EA	\$ 500.00	\$ 223,500.00
4	Water System Installation				
	Valves				
	Water Valves	137	EA	\$ 3,000.00	\$ 410,000.00
	Connect to Existing System	2	EA	\$ 1,000.00	\$ 2,000.00
	Fire Hydrants				
	Fire Hydrant Assembly	82	EA	\$ 1,750.00	\$ 143,500.00
	Service Laterals				
	Water System Service Lateral	22,350	LF	\$ 12.00	\$ 268,200.00
	Piping				
	8.00" PVC DR Pipe	41,000	LF	\$ 40.00	\$ 1,640,000.00
5	Allowances				
	Easement Acquisition	1	L.S.	\$ 180,000.00	\$ 180,000.00
	Permitting	1	L.S.	\$ 25,000.00	\$ 25,000.00
				Sub-Total	\$ 4,722,200.00
				Contingency (15%)	\$ 708,330.00
				Engineering (14%)	\$ 760,274.20
				Total	\$ 6,190,804.20
				Per Connection	\$ 13,849.67
	* Pipe Alternative: 6" PVC DR Pipe	41,000	LF	\$ 30.00	\$ 1,230,000.00



GWES, LLC

OPINION OF PROBABLE COST

Project: Cost Study to Provide Sewer Service to Unserved Areas
Client: Brunswick-Glynn County Joint Water and Sewer Commission
Project No.: 085.01.1.19
Location: Area East of Highway 341 & North of Community Rd and West of Old Jesup Rd

Designer: Barrett Neal
Reviewer: Matt Taylor, P.E.
Date: 6/26/2019
Design Level: 10%

**Area 'B' - Estimated Cost to Provide Water Service
Based on 244 Potential Connections**

Item No.	Description	Quantity	Unit	Price	Total
1	Mobilization/Demobilization	1	L.S.	\$ 100,000.00	\$ 100,000.00
2	Erosion and Sedimentation Control	1	L.S.	\$ 80,000.00	\$ 80,000.00
3	Removal/Demolition				
	Mill/Overlay Asphalt Pavement	81,944	S.Y.	\$ 18.00	\$ 1,475,000.00
	Miscellaneous (Curb & Gutter, Sidewalk, Landscaping, Etc.) per Connection	244	EA	\$ 500.00	\$ 122,000.00
4	Water System Installation				
	Valves				
	Water Valves	134	EA	\$ 3,000.00	\$ 402,000.00
	Connect to Existing System	3	EA	\$ 1,000.00	\$ 3,000.00
	Fire Hydrants				
	Fire Hydrant Assembly	80	EA	\$ 1,750.00	\$ 140,700.00
	Service Laterals				
	Water System Service Lateral	12,200	LF	\$ 12.00	\$ 146,400.00
	Piping				
	8.00" PVC DR Pipe	40,200	LF	\$ 40.00	\$ 1,608,000.00
5	Allowances				
	Easement Acquisition	1	L.S.	\$ 90,000.00	\$ 90,000.00
	Permitting	1	L.S.	\$ 25,000.00	\$ 25,000.00
				<i>Sub-Total</i>	\$ 4,192,100.00
				<i>Contingency (15%)</i>	\$ 628,815.00
				<i>Engineering (14%)</i>	\$ 674,928.10
				Total	\$ 5,495,843.10
				<i>Per Connection</i>	\$ 22,523.95
	* Pipe Alternative: 6" PVC DR Pipe	40,200	LF	\$ 30.00	\$ 1,206,000.00



OPINION OF PROBABLE COST

Project: Cost Study to Provide Sewer Service to Unserved Areas
Client: Brunswick-Glynn County Joint Water and Sewer Commission
Project No.: 085.01.1.19
Location: The Arco Community

Designer: Barrett Neal
Reviewer: Matt Taylor, P.E.
Date: 6/26/2019
Design Level: 10%

**Area 'C' - Estimated Cost to Provide Water Service
Based on 45 Potential Connections**

Item No.	Description	Quantity	Unit	Price	Total
1	Mobilization/Demobilization	1	L.S.	\$ 25,000.00	\$ 25,000.00
2	Erosion and Sedimentation Control	1	L.S.	\$ 25,000.00	\$ 25,000.00
3	Removal/Demolition				
	Mill/Overlay Asphalt Pavement	7,153	S.Y.	\$ 18.00	\$ 128,750.00
	Miscellaneous (Curb & Gutter, Sidewalk, Landscaping, Etc.) per Connection	45	EA	\$ 500.00	\$ 22,500.00
4	Water System Installation				
	Valves				
	Water Valves	9	EA	\$ 3,000.00	\$ 27,000.00
	Connect to Existing System	9	EA	\$ 1,000.00	\$ 9,000.00
	Fire Hydrants				
	Fire Hydrant Assembly	5	EA	\$ 1,750.00	\$ 9,012.50
	Service Laterals				
	Water System Service Lateral	2,250	LF	\$ 12.00	\$ 27,000.00
	Piping				
	8.00" PVC DR Pipe	2,575	LF	\$ 40.00	\$ 103,000.00
				Sub-Total	\$ 376,262.50
				Contingency (15%)	\$ 56,439.38
				Engineering (14%)	\$ 60,578.26
				Total	\$ 493,280.14
				Per Connection	\$ 12,332.00
	* Pipe Alternative: 6" PVC DR Pipe	2,575	LF	\$ 30.00	\$ 77,250.00

APPENDIX I: BREAKDOWN OF 20-YEAR O&M COST ESTIMATES

Gravity Sewer 20-Year Life Cycle Cost Analysis

Area A Cost Estimates																						
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	Avg./Year
Sewer Root Removal	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$1,072.50	\$21,450.00	\$1,072.50
Sewer Light Cleaning	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$3,300.00	\$66,000.00	\$3,300.00
Manhole Inspection & Cleaning	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$148.75	\$2,975.00	\$148.75
Gravity Sewer General System O&M	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$330.00	\$6,600.00	\$330.00
Pump Station (Power, Maintenance, Repair/Replace)	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$8,000.00	\$160,000.00	\$8,000.00
Neighborhood Grinder Station (up to 100 REU Capacity)	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$12,000.00	\$240,000.00	\$12,000.00
Total	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$24,851.25	\$497,025.00	\$24,851.25
Cost per Connection/Year	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$55.60	\$1,111.91	\$55.60
Connection/Month	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	\$4.63	N/A	\$4.63

Area B Cost Estimates																						
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	Avg./Year
Sewer Root Removal	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$958.75	\$19,175.00	\$958.75
Sewer Light Cleaning	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$2,950.00	\$59,000.00	\$2,950.00
Manhole Inspection & Cleaning	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$156.25	\$3,125.00	\$156.25
Gravity Sewer General System O&M	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$295.00	\$5,900.00	\$295.00
Grinder Station (up to 50 REU Capacity)	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$16,000.00	\$320,000.00	\$16,000.00
Total	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$20,360.00	\$407,200.00	\$20,360.00
Cost per Connection/Year	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$83.44	\$910.96	\$83.44
Connection/Month	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	\$6.95	N/A	\$6.95

Area C Cost Estimates																						
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	Avg./Year
Sewer Root Removal	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$507.00	\$10,140.00	\$507.00
Sewer Light Cleaning	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$1,560.00	\$31,200.00	\$1,560.00
Manhole Inspection & Cleaning	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$82.50	\$1,650.00	\$82.50
Gravity Sewer General System O&M	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$156.00	\$3,120.00	\$156.00
Total	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$2,305.50	\$46,110.00	\$2,305.50
Cost per Connection/Year	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$8.60	\$103.15	\$8.60
Connection/Month	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	\$0.72	N/A	\$0.72

Gravity Sewer O&M Parameters and Costs					
Costs	\$ Per/LF/EA	% of System/Year	Area A Quantity	Area B Quantity	Area C Quantity
Sewer Root Removal	\$3.25	1%	33000	29500	15600
Sewer Light Cleaning	\$2.00	5%	33000	29500	15600
Manhole Inspection & Cleaning	\$25.00	5%	119	125	66
Gravity Sewer General System O&M	\$0.20	5%	33000	29500	15600
Pump Station (Power, Maintenance, Repair/Replace)	\$8,000.00	Per Station	1		
Neighborhood Grinder Station (up to 100 REU Capacity)	\$6,000.00	Per Station	2		
Grinder Station (up to 50 REU Capacity)	\$4,000.00	Per Station		4	

Low-Pressure Grinder Sewer System 20-Year Life Cycle Cost Analysis

Area A Cost Estimates																						
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	Avg./Year
Pressure Sewer General System O&M	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$68,842.00	\$3,442.10
Annual Pump Power	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$107,280.00	\$5,364.00
Reactive Maintenance / Equipment Replacement	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$60,345.00	\$1,206,900.00	\$60,345.00
Total	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$69,151.10	\$1,383,022.00	\$69,151.10
Cost per Connection/Year	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$154.70	\$3,094.01	\$154.70
Connection/Month	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	\$12.89	N/A	\$12.89

Area B Cost Estimates																						
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	Avg./Year
Pressure Sewer General System O&M	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$59,118.00	\$2,955.90
Annual Pump Power	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$58,560.00	\$2,928.00
Reactive Maintenance / Equipment Replacement	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$32,940.00	\$658,800.00	\$32,940.00
Total	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$38,823.90	\$776,478.00	\$38,823.90
Cost per Connection/Year	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$159.11	\$1,737.09	\$159.11
Connection/Month	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	\$13.26	N/A	\$13.26

Area C Cost Estimates																						
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	Avg./Year
Pressure Sewer General System O&M	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$31,694.00	\$1,584.70
Annual Pump Power	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$64,320.00	\$3,216.00
Reactive Maintenance / Equipment Replacement	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$36,180.00	\$723,600.00	\$36,180.00
Total	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$40,980.70	\$819,614.00	\$40,980.70
Cost per Connection/Year	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$152.91	\$1,833.59	\$152.91
Connection/Month	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	\$12.74	N/A	\$12.74

Grinder Pump System O&M Parameters and Costs					
Costs	\$ Per/LF/EA	% of System/Year	Area A Quantity	Area B Quantity	Area C Quantity
Pressure Sewer General System O&M	\$0.10	100%	34421	29559	15847
Annual Pump Power	\$12.00	100%	447	244	268
Reactive Maintenance / Equipment Replacement	\$135.00	100%	447	244	268
*Pump Replacement Included in 20 Years					

Low-Pressure STEP Sewer System 20-Year Life Cycle Cost Analysis

Area A Cost Estimates																						
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	Avg./Year
Pressure Sewer General System O&M	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$3,442.10	\$68,842.00	\$3,442.10
Annual Pump Power	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$5,364.00	\$107,280.00	\$5,364.00
Reactive Maintenance / Equipment Replacement	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$55,875.00	\$1,117,500.00	\$55,875.00
On-Property Inspection/Filter Cleaning	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$6,705.00	\$134,100.00	\$6,705.00
Septic Tank Pumping	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$26,820.00	\$536,400.00	\$26,820.00
Total	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$98,206.10	\$1,964,122.00	\$98,206.10
Cost per Connection/Year	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$219.70	\$4,394.01	\$219.70
Connection/Month	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	\$18.31	N/A	\$18.31

Area B Cost Estimates																						
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	Avg./Year
Pressure Sewer General System O&M	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$2,955.90	\$59,118.00	\$2,955.90
Annual Pump Power	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$2,928.00	\$58,560.00	\$2,928.00
Reactive Maintenance / Equipment Replacement	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$30,500.00	\$610,000.00	\$30,500.00
On-Property Inspection/Filter Cleaning	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$3,660.00	\$73,200.00	\$3,660.00
Septic Tank Pumping	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$14,640.00	\$292,800.00	\$14,640.00
Total	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$54,683.90	\$1,093,678.00	\$54,683.90
Cost per Connection/Year	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$224.11	\$2,446.71	\$224.11
Connection/Month	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	\$18.68	N/A	\$18.68

Area C Cost Estimates																						
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	Avg./Year
Pressure Sewer General System O&M	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$1,584.70	\$31,694.00	\$1,584.70
Annual Pump Power	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$3,216.00	\$64,320.00	\$3,216.00
Reactive Maintenance / Equipment Replacement	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$33,500.00	\$670,000.00	\$33,500.00
On-Property Inspection/Filter Cleaning	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$4,020.00	\$80,400.00	\$4,020.00
Septic Tank Pumping	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$16,080.00	\$321,600.00	\$16,080.00
Total	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$58,400.70	\$1,168,014.00	\$58,400.70
Cost per Connection/Year	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$217.91	\$2,613.01	\$217.91
Connection/Month	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	\$18.16	N/A	\$18.16

STEP System O&M Parameters and Costs					
Costs	\$ Per/LF/EA	% of System/Year	Area A Quantity	Area B Quantity	Area C Quantity
Pressure Sewer General System O&M	\$0.10	100%	34421	29559	15847
Annual Pump Power	\$12.00	100%	447	244	268
Reactive Maintenance / Equipment Replacement	\$125.00	100%	447	244	268
On-Property Inspection/Filter Cleaning	\$75.00	20%	447	244	268
Septic Tank Pumping	\$400.00	15%	447	244	268
*Pump Replacement included in 20 Years					

APPENDIX J: E-ONE GRINDER SYSTEM AREA A ANALYSIS



Environment One Corporation

**Pressure Sewer Preliminary
Cost and Design Analysis
For
Ex1 - W341&N303**

**Prepared For:
Brunswick-Glynn County Joint Water & Sewer Commission**

GA

USA

Tel:

Fax:

Prepared By: M. Crowley

May 14, 2019

Ex1 - W341&N303

Prepared by : M. Crowley

On: May 14, 2019

Notes :

Analysis based upon drawings and data provided. Station recommendations are preliminary.

GPD values impact retention times only, not line sizing or hydraulics. GP laterals to be 1.25".

General recommendations for valve placement 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 peaks of 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.

Assume tie in pressure of 30psi (69ft) and static due to elevation of 15ft.

<<<< END OF NOTES >>>>

Budgetary Low Pressure Sewer System Costs**Ex1 - W341&N303**

	<u>Quantity</u>	<u>Description</u>	<u>Unit Cost</u>	<u>Installation</u>	<u>Sub Total</u>
Valves	10	Air/Vacuum Release Valve	\$0.00	0.00	\$0.00
	54	Clean Out	\$0.00	0.00	\$0.00
					<u>\$0.00</u>

Pumps	340	DH071-61	\$0.00	0.00	\$0.00
	340	Lateral Kits (Includes Ball/Check Valve Assembly)	\$0.00	0.00	\$0.00
	340	Lateral (Boundary) Installation	\$0.00	0.00	\$0.00
	340	Pump/Panel Installation	\$0.00	0.00	\$0.00
	17,000	LF of 1.25" Lateral Pipe	\$0.00	0.00	\$0.00
					<u>\$0.00</u>

Piping	15,015	2.00" Pipe	\$0.00	0.00	\$0.00
	13,256	3.00" Pipe	\$0.00	0.00	\$0.00
	5,270	4.00" Pipe	\$0.00	0.00	\$0.00
	880	6.00" Pipe	\$0.00	0.00	\$0.00
					<u>\$0.00</u>

Number of Connections	<u>340</u>		
Total Per Connection	<u>\$0.00</u>	Total (w/o other)	<u>\$0.00</u>
Grand Total Per Connection	<u>\$0.00</u>	Grand Total (including other)	<u>\$0.00</u>

Note: The System Costs above are based on piping sized for, and Grinder Pumps manufactured by Environment One Corporation.

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Ex1 - W341&N303

Prepared By:
M. Crowley

May 14, 2019

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Gals/day per Pump	Max Flow Per Pump (gpm)	Max Sim Ops	Max Flow (GPM)	Pipe Size (inches)	Max Velocity (FPS)	Length of Main this Zone	Friction Loss Factor (ft/100 ft)	Friction Loss This Zone	Accum Friction Loss (feet)	Max Main Elevation	Minimum Pump Elevation	Static Head (feet)	Total Dynamic Head (ft)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE										Friction loss calculations were based on a Constant for inside roughness "C" of: 150							
1.00	2.00	9	9	200	11.00	3	33.00	2.00	3.57	1,770.00	2.52	44.59	67.33	84.00	0.00	84.00	151.33
2.00	3.00	9	18	200	11.00	4	44.00	3.00	2.19	1,679.00	0.65	10.91	22.74	84.00	0.00	84.00	106.74
3.00	3.00	6	24	200	11.00	5	55.00	3.00	2.74	1,204.00	0.98	11.83	11.83	84.00	0.00	84.00	95.83
4.00	54.00	9	9	200	11.00	3	33.00	2.00	3.57	2,593.00	2.52	65.33	66.26	84.00	0.00	84.00	150.26
5.00	9.00	5	5	200	11.00	3	33.00	2.00	3.57	1,648.00	2.52	41.52	65.65	84.00	0.00	84.00	149.65
6.00	7.00	9	9	200	11.00	3	33.00	2.00	3.57	195.00	2.52	4.91	39.94	84.00	0.00	84.00	123.94
7.00	8.00	9	18	200	11.00	4	44.00	3.00	2.19	580.00	0.65	3.77	35.03	84.00	0.00	84.00	119.03
8.00	9.00	6	24	200	11.00	5	55.00	3.00	2.74	726.00	0.98	7.13	31.26	84.00	0.00	84.00	115.26
9.00	39.00	0	29	200	11.00	5	55.00	3.00	2.74	686.00	0.98	6.74	24.13	84.00	0.00	84.00	108.13
10.00	11.00	9	9	200	11.00	3	33.00	2.00	3.57	313.00	2.52	7.89	38.57	84.00	0.00	84.00	122.57
11.00	14.00	4	13	200	11.00	4	44.00	3.00	2.19	276.00	0.65	1.79	30.68	84.00	0.00	84.00	114.68
12.00	13.00	9	9	200	11.00	3	33.00	2.00	3.57	293.00	2.52	7.38	37.72	84.00	0.00	84.00	121.72
13.00	14.00	3	12	200	11.00	4	44.00	3.00	2.19	223.00	0.65	1.45	30.34	84.00	0.00	84.00	114.34
14.00	16.00	6	31	200	11.00	6	66.00	3.00	3.29	393.00	1.38	5.41	28.89	84.00	0.00	84.00	112.89
15.00	16.00	5	5	200	11.00	3	33.00	2.00	3.57	473.00	2.52	11.92	35.40	84.00	0.00	84.00	119.40
16.00	18.00	1	37	200	11.00	6	66.00	3.00	3.29	193.00	1.38	2.66	23.48	84.00	0.00	84.00	107.48
17.00	18.00	9	9	200	11.00	3	33.00	2.00	3.57	511.00	2.52	12.87	33.69	84.00	0.00	84.00	117.69
18.00	20.00	1	47	200	11.00	6	66.00	3.00	3.29	141.00	1.38	1.94	20.82	84.00	0.00	84.00	104.82
19.00	20.00	9	9	200	11.00	3	33.00	2.00	3.57	512.00	2.52	12.90	31.78	84.00	0.00	84.00	115.78
20.00	39.00	4	60	200	11.00	7	77.00	4.00	2.32	277.00	0.54	1.49	18.88	84.00	0.00	84.00	102.88
21.00	22.00	9	9	200	11.00	3	33.00	2.00	3.57	647.00	2.52	16.30	76.65	84.00	0.00	84.00	160.65
22.00	25.00	12	21	200	11.00	5	55.00	3.00	2.74	1,060.00	0.98	10.41	60.35	84.00	0.00	84.00	144.35
23.00	24.00	9	9	200	11.00	3	33.00	2.00	3.57	875.00	2.52	22.04	75.47	84.00	0.00	84.00	159.47
24.00	25.00	9	18	200	11.00	4	44.00	3.00	2.19	537.00	0.65	3.49	53.43	84.00	0.00	84.00	137.43
25.00	27.00	3	42	200	11.00	6	66.00	3.00	3.29	400.00	1.38	5.51	49.94	84.00	0.00	84.00	133.94
26.00	27.00	5	5	200	11.00	3	33.00	2.00	3.57	291.00	2.52	7.33	51.76	84.00	0.00	84.00	135.76
27.00	30.00	11	58	200	11.00	7	77.00	4.00	2.32	883.00	0.54	4.76	44.43	84.00	0.00	84.00	128.43
28.00	29.00	9	9	200	11.00	3	33.00	2.00	3.57	555.00	2.52	13.98	59.93	84.00	0.00	84.00	143.93
29.00	30.00	5	14	200	11.00	4	44.00	3.00	2.19	967.00	0.65	6.28	45.95	84.00	0.00	84.00	129.95
30.00	31.00	8	80	200	11.00	7	77.00	4.00	2.32	1,008.00	0.54	5.44	39.67	84.00	0.00	84.00	123.67
31.00	35.00	21	101	200	11.00	8	88.00	4.00	2.65	1,529.00	0.69	10.57	34.23	84.00	0.00	84.00	118.23
32.00	33.00	9	9	200	11.00	3	33.00	2.00	3.57	461.00	2.52	11.61	42.02	84.00	0.00	84.00	126.02
33.00	34.00	9	18	200	11.00	4	44.00	3.00	2.19	637.00	0.65	4.14	30.41	84.00	0.00	84.00	114.41
34.00	35.00	7	25	200	11.00	5	55.00	3.00	2.74	266.00	0.98	2.61	26.27	84.00	0.00	84.00	110.27
35.00	38.00	3	129	200	11.00	9	99.00	4.00	2.98	317.00	0.86	2.72	23.66	84.00	0.00	84.00	107.66

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Ex1 - W341&N303

Prepared By:

M. Crowley

May 14, 2019

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Gals/day per Pump	Max Flow Per Pump (gpm)	Max Sim Ops	Max Flow (GPM)	Pipe Size (inches)	Max Velocity (FPS)	Length of Main this Zone	Friction Loss Factor (ft/100 ft)	Friction Loss This Zone	Accum Friction Loss (feet)	Max Main Elevation	Minimum Pump Elevation	Static Head (feet)	Total Dynamic Head (ft)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE										Friction loss calculations were based on a Constant for inside roughness "C" of: 150							
36.00	37.00	9	9	200	11.00	3	33.00	2.00	3.57	692.00	2.52	17.43	42.69	84.00	0.00	84.00	126.69
37.00	38.00	9	18	200	11.00	4	44.00	3.00	2.19	664.00	0.65	4.32	25.26	84.00	0.00	84.00	109.26
38.00	39.00	1	148	200	11.00	10	110.00	4.00	3.31	340.00	1.04	3.55	20.94	84.00	0.00	84.00	104.94
39.00	43.00	3	240	200	11.00	12	132.00	4.00	3.98	380.00	1.46	5.56	17.39	84.00	0.00	84.00	101.39
40.00	41.00	9	9	200	11.00	3	33.00	2.00	3.57	877.00	2.52	22.10	46.75	84.00	0.00	84.00	130.75
41.00	42.00	9	18	200	11.00	4	44.00	3.00	2.19	476.00	0.65	3.09	24.65	84.00	0.00	84.00	108.65
42.00	43.00	12	30	200	11.00	5	55.00	3.00	2.74	990.00	0.98	9.73	21.56	84.00	0.00	84.00	105.56
43.00	47.00	4	274	200	11.00	13	143.00	4.00	4.31	536.00	1.70	9.10	11.83	84.00	0.00	84.00	95.83
44.00	45.00	9	9	200	11.00	3	33.00	2.00	3.57	523.00	2.52	13.18	24.96	84.00	0.00	84.00	108.96
45.00	46.00	9	18	200	11.00	4	44.00	3.00	2.19	700.00	0.65	4.55	11.78	84.00	0.00	84.00	95.78
46.00	47.00	4	22	200	11.00	5	55.00	3.00	2.74	458.00	0.98	4.50	7.23	84.00	0.00	84.00	91.23
47.00	49.00	0	296	200	11.00	14	154.00	6.00	2.14	13.00	0.30	0.04	2.73	84.00	0.00	84.00	86.73
48.00	49.00	2	2	200	11.00	2	22.00	2.00	2.38	677.00	1.19	8.05	10.74	84.00	0.00	84.00	94.74
49.00	51.00	2	300	200	11.00	14	154.00	6.00	2.14	199.00	0.30	0.59	2.69	84.00	0.00	84.00	86.69
50.00	51.00	2	2	200	11.00	2	22.00	2.00	2.38	561.00	1.19	6.67	8.77	84.00	0.00	84.00	92.77
51.00	53.00	1	303	200	11.00	14	154.00	6.00	2.14	191.00	0.30	0.57	2.10	84.00	0.00	84.00	86.10
52.00	53.00	2	2	200	11.00	2	22.00	2.00	2.38	548.00	1.19	6.52	8.05	84.00	0.00	84.00	92.05
53.00	54.00	1	306	200	11.00	14	154.00	6.00	2.14	201.00	0.30	0.60	1.53	84.00	0.00	84.00	85.53
54.00	54.00	1	316	200	11.00	15	165.00	6.00	2.29	276.00	0.34	0.93	0.93	84.00	0.00	84.00	84.93

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME(HR)

Ex1 - W341&N303

Prepared By:
M. Crowley

May 14, 2019

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (inches)	Gallons per 100 lineal feet	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE							Gals per Day per Dwelling		200	
1.00	2.00	9	2.00	15.40	1,770.00	272.63	1,800	6.60	3.64	9.40
2.00	3.00	18	3.00	33.47	1,679.00	561.90	3,600	6.41	3.75	5.76
3.00	3.00	24	3.00	33.47	1,204.00	402.94	4,800	11.91	2.01	2.01
4.00	54.00	9	2.00	15.40	2,593.00	399.40	1,800	4.51	5.33	5.45
5.00	9.00	5	2.00	15.40	1,648.00	253.84	1,000	3.94	6.09	7.69
6.00	7.00	9	2.00	15.40	195.00	30.04	1,800	59.93	0.40	4.51
7.00	8.00	18	3.00	33.47	580.00	194.11	3,600	18.55	1.29	4.11
8.00	9.00	24	3.00	33.47	726.00	242.97	4,800	19.76	1.21	2.81
9.00	39.00	29	3.00	33.47	686.00	229.58	5,800	25.26	0.95	1.60
10.00	11.00	9	2.00	15.40	313.00	48.21	1,800	37.34	0.64	3.29
11.00	14.00	13	3.00	33.47	276.00	92.37	2,600	28.15	0.85	2.65
12.00	13.00	9	2.00	15.40	293.00	45.13	1,800	39.88	0.60	3.14
13.00	14.00	12	3.00	33.47	223.00	74.63	2,400	32.16	0.75	2.54
14.00	16.00	31	3.00	33.47	393.00	131.52	6,200	47.14	0.51	1.79
15.00	16.00	5	2.00	15.40	473.00	72.86	1,000	13.73	1.75	3.03
16.00	18.00	37	3.00	33.47	193.00	64.59	7,400	114.57	0.21	1.28
17.00	18.00	9	2.00	15.40	511.00	78.71	1,800	22.87	1.05	2.12
18.00	20.00	47	3.00	33.47	141.00	47.19	9,400	199.20	0.12	1.07
19.00	20.00	9	2.00	15.40	512.00	78.86	1,800	22.82	1.05	2.01
20.00	39.00	60	4.00	55.31	277.00	153.22	12,000	78.32	0.31	0.95
21.00	22.00	9	2.00	15.40	647.00	99.66	1,800	18.06	1.33	7.55
22.00	25.00	21	3.00	33.47	1,060.00	354.74	4,200	11.84	2.03	6.22
23.00	24.00	9	2.00	15.40	875.00	134.77	1,800	13.36	1.80	7.19
24.00	25.00	18	3.00	33.47	537.00	179.71	3,600	20.03	1.20	5.40
25.00	27.00	42	3.00	33.47	400.00	133.87	8,400	62.75	0.38	4.20
26.00	27.00	5	2.00	15.40	291.00	44.82	1,000	22.31	1.08	4.89
27.00	30.00	58	4.00	55.31	883.00	488.42	11,600	23.75	1.01	3.81
28.00	29.00	9	2.00	15.40	555.00	85.49	1,800	21.06	1.14	6.72
29.00	30.00	14	3.00	33.47	967.00	323.62	2,800	8.65	2.77	5.58
30.00	31.00	80	4.00	55.31	1,008.00	557.56	16,000	28.70	0.84	2.80
31.00	35.00	101	4.00	55.31	1,529.00	845.74	20,200	23.88	1.00	1.97
32.00	33.00	9	2.00	15.40	461.00	71.01	1,800	25.35	0.95	3.76
33.00	34.00	18	3.00	33.47	637.00	213.18	3,600	16.89	1.42	2.81
34.00	35.00	25	3.00	33.47	266.00	89.02	5,000	56.17	0.43	1.39
35.00	38.00	129	4.00	55.31	317.00	175.34	25,800	147.14	0.16	0.96

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME(HR)

Ex1 - W341&N303

Prepared By:

M. Crowley

May 14, 2019

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (inches)	Gallons per 100 lineal feet	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE							Gals per Day per Dwelling		200	
36.00	37.00	9	2.00	15.40	692.00	106.59	1,800	16.89	1.42	3.70
37.00	38.00	18	3.00	33.47	664.00	222.22	3,600	16.20	1.48	2.28
38.00	39.00	148	4.00	55.31	340.00	188.06	29,600	157.39	0.15	0.80
39.00	43.00	240	4.00	55.31	380.00	210.19	48,000	228.36	0.11	0.65
40.00	41.00	9	2.00	15.40	877.00	135.08	1,800	13.33	1.80	4.73
41.00	42.00	18	3.00	33.47	476.00	159.30	3,600	22.60	1.06	2.93
42.00	43.00	30	3.00	33.47	990.00	331.32	6,000	18.11	1.33	1.87
43.00	47.00	274	4.00	55.31	536.00	296.48	54,800	184.84	0.13	0.54
44.00	45.00	9	2.00	15.40	523.00	80.56	1,800	22.34	1.07	3.88
45.00	46.00	18	3.00	33.47	700.00	234.27	3,600	15.37	1.56	2.81
46.00	47.00	22	3.00	33.47	458.00	153.28	4,400	28.71	0.84	1.25
47.00	49.00	296	6.00	119.90	13.00	15.59	59,200	3,798.07	0.01	0.41
48.00	49.00	2	2.00	15.40	677.00	104.28	400	3.84	6.26	6.66
49.00	51.00	300	6.00	119.90	199.00	238.60	60,000	251.47	0.10	0.41
50.00	51.00	2	2.00	15.40	561.00	86.41	400	4.63	5.18	5.50
51.00	53.00	303	6.00	119.90	191.00	229.01	60,600	264.62	0.09	0.31
52.00	53.00	2	2.00	15.40	548.00	84.41	400	4.74	5.06	5.28
53.00	54.00	306	6.00	119.90	201.00	241.00	61,200	253.95	0.09	0.22
54.00	54.00	316	6.00	119.90	276.00	330.92	63,200	190.98	0.13	0.13



PS

NUMBER (TYP.)

DIVIDER/FLOW DIRECTION (TYP.)

ER PUMP STATION (TYP.)

APPENDIX K: E-ONE GRINDER SYSTEM AREA B ANALYSIS



Environment One Corporation

**Pressure Sewer Preliminary
Cost and Design Analysis
For
Ex2 - E341**

**Prepared For:
Brunswick-Glynn County Joint Water & Sewer Commission**

GA

USA

Tel:

Fax:

Prepared By: M. Crowley

May 14, 2019

Ex2 - E341

Prepared by : M. Crowley

On: May 14, 2019

Notes :

Analysis based upon drawings and data provided. Station recommendations are preliminary.

GPD values impact retention times only, not line sizing or hydraulics. GP laterals to be 1.25".

General recommendations for valve placement 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 peaks of 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.

<<<< END OF NOTES >>>>

Budgetary Low Pressure Sewer System Costs**Ex2 - E341**

	<u>Quantity</u>	<u>Description</u>	<u>Unit Cost</u>	<u>Installation</u>	<u>Sub Total</u>
Valves	9	Air/Vacuum Release Valve	\$0.00	0.00	\$0.00
	51	Clean Out	\$0.00	0.00	\$0.00
					<u>\$0.00</u>

Pumps	256	DH071-61	\$0.00	0.00	\$0.00
	256	Lateral Kits (Includes Ball/Check Valve Assembly)	\$0.00	0.00	\$0.00
	256	Lateral (Boundary) Installation	\$0.00	0.00	\$0.00
	256	Pump/Panel Installation	\$0.00	0.00	\$0.00
	12,800	LF of 1.25" Lateral Pipe	\$0.00	0.00	\$0.00
					<u>\$0.00</u>

Piping	13,610	2.00" Pipe	\$0.00	0.00	\$0.00
	12,011	3.00" Pipe	\$0.00	0.00	\$0.00
	2,438	4.00" Pipe	\$0.00	0.00	\$0.00
					<u>\$0.00</u>

Number of Connections	<u>256</u>		
Total Per Connection	<u>\$0.00</u>	Total (w/o other)	<u>\$0.00</u>
Grand Total Per Connection	<u>\$0.00</u>	Grand Total (including other)	<u>\$0.00</u>

Note: The System Costs above are based on piping sized for, and Grinder Pumps manufactured by Environment One Corporation.

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Ex2 - E341

Prepared By:

M. Crowley

May 14, 2019

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Gals/day per Pump	Max Flow Per Pump (gpm)	Max Sim Ops	Max Flow (GPM)	Pipe Size (inches)	Max Velocity (FPS)	Length of Main this Zone	Friction Loss Factor (ft/100 ft)	Friction Loss This Zone	Accum Friction Loss (feet)	Max Main Elevation	Minimum Pump Elevation	Static Head (feet)	Total Dynamic Head (ft)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE										Friction loss calculations were based on a Constant for inside roughness "C" of: 150							
1.00	3.00	3	3	200	11.00	2	22.00	2.00	2.38	233.00	1.19	2.77	12.36	15.00	0.00	15.00	27.36
2.00	3.00	4	4	200	11.00	3	33.00	2.00	3.57	621.00	2.52	15.65	25.24	15.00	0.00	15.00	40.24
3.00	10.00	11	18	200	11.00	4	44.00	3.00	2.19	1,056.00	0.65	6.86	9.59	15.00	0.00	15.00	24.59
4.00	6.00	3	3	200	11.00	2	22.00	2.00	2.38	162.00	1.19	1.93	20.70	15.00	0.00	15.00	35.70
5.00	6.00	6	6	200	11.00	3	33.00	2.00	3.57	540.00	2.52	13.60	32.37	15.00	0.00	15.00	47.37
6.00	7.00	9	18	200	11.00	4	44.00	3.00	2.19	934.00	0.65	6.07	18.77	15.00	0.00	15.00	33.77
7.00	9.00	3	21	200	11.00	5	55.00	3.00	2.74	179.00	0.98	1.76	12.70	15.00	0.00	15.00	27.70
8.00	9.00	3	3	200	11.00	2	22.00	2.00	2.38	568.00	1.19	6.75	17.69	15.00	0.00	15.00	32.69
9.00	10.00	9	33	200	11.00	6	66.00	3.00	3.29	596.00	1.38	8.21	10.94	15.00	0.00	15.00	25.94
10.00	10.00	0	51	200	11.00	7	77.00	3.00	3.83	149.00	1.83	2.73	2.73	15.00	0.00	15.00	17.73
11.00	12.00	9	9	200	11.00	3	33.00	2.00	3.57	1,032.00	2.52	26.00	93.29	15.00	0.00	15.00	108.29
12.00	14.00	4	13	200	11.00	4	44.00	3.00	2.19	1,070.00	0.65	6.95	67.29	15.00	0.00	15.00	82.29
13.00	14.00	9	9	200	11.00	3	33.00	2.00	3.57	1,765.00	2.52	44.47	104.81	15.00	0.00	15.00	119.81
14.00	17.00	12	34	200	11.00	6	66.00	3.00	3.29	1,152.00	1.38	15.86	60.34	15.00	0.00	15.00	75.34
15.00	16.00	9	9	200	11.00	3	33.00	2.00	3.57	466.00	2.52	11.74	63.96	15.00	0.00	15.00	78.96
16.00	17.00	10	19	200	11.00	5	55.00	3.00	2.74	788.00	0.98	7.74	52.22	15.00	0.00	15.00	67.22
17.00	19.00	1	54	200	11.00	7	77.00	3.00	3.83	169.00	1.83	3.10	44.48	15.00	0.00	15.00	59.48
18.00	19.00	3	3	200	11.00	2	22.00	2.00	2.38	536.00	1.19	6.37	47.75	15.00	0.00	15.00	62.75
19.00	23.00	17	74	200	11.00	7	77.00	3.00	3.83	1,210.00	1.83	22.17	41.38	15.00	0.00	15.00	56.38
20.00	22.00	4	4	200	11.00	3	33.00	2.00	3.57	201.00	2.52	5.06	25.73	15.00	0.00	15.00	40.73
21.00	22.00	3	3	200	11.00	2	22.00	2.00	2.38	318.00	1.19	3.78	24.45	15.00	0.00	15.00	39.45
22.00	23.00	0	7	200	11.00	3	33.00	2.00	3.57	58.00	2.52	1.46	20.67	15.00	0.00	15.00	35.67
23.00	25.00	11	92	200	11.00	8	88.00	4.00	2.65	928.00	0.69	6.41	19.21	15.00	0.00	15.00	34.21
24.00	25.00	7	7	200	11.00	3	33.00	2.00	3.57	321.00	2.52	8.09	20.89	15.00	0.00	15.00	35.89
25.00	28.00	2	101	200	11.00	8	88.00	4.00	2.65	437.00	0.69	3.02	12.80	15.00	0.00	15.00	27.80
26.00	28.00	3	3	200	11.00	2	22.00	2.00	2.38	231.00	1.19	2.75	12.53	15.00	0.00	15.00	27.53
27.00	28.00	2	2	200	11.00	2	22.00	2.00	2.38	247.00	1.19	2.94	12.72	15.00	0.00	15.00	27.72
28.00	34.00	3	109	200	11.00	8	88.00	4.00	2.65	508.00	0.69	3.51	9.78	15.00	0.00	15.00	24.78
29.00	31.00	3	3	200	11.00	2	22.00	2.00	2.38	290.00	1.19	3.45	17.05	15.00	0.00	15.00	32.05
30.00	31.00	7	7	200	11.00	3	33.00	2.00	3.57	624.00	2.52	15.72	29.32	15.00	0.00	15.00	44.32
31.00	33.00	2	12	200	11.00	4	44.00	3.00	2.19	499.00	0.65	3.24	13.60	15.00	0.00	15.00	28.60
32.00	33.00	2	2	200	11.00	2	22.00	2.00	2.38	299.00	1.19	3.56	13.92	15.00	0.00	15.00	28.92
33.00	34.00	4	18	200	11.00	4	44.00	3.00	2.19	630.00	0.65	4.09	10.36	15.00	0.00	15.00	25.36
34.00	50.00	2	129	200	11.00	9	99.00	4.00	2.98	200.00	0.86	1.72	6.27	15.00	0.00	15.00	21.27
35.00	37.00	8	8	200	11.00	3	33.00	2.00	3.57	828.00	2.52	20.86	61.58	15.00	0.00	15.00	76.58

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Ex2 - E341

Prepared By:

M. Crowley

May 14, 2019

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Gals/day per Pump	Max Flow Per Pump (gpm)	Max Sim Ops	Max Flow (GPM)	Pipe Size (inches)	Max Velocity (FPS)	Length of Main this Zone	Friction Loss Factor (ft/100 ft)	Friction Loss This Zone	Accum Friction Loss (feet)	Max Main Elevation	Minimum Pump Elevation	Static Head (feet)	Total Dynamic Head (ft)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE										Friction loss calculations were based on a Constant for inside roughness "C" of: 150							
36.00	37.00	3	3	200	11.00	2	22.00	2.00	2.38	516.00	1.19	6.14	46.86	15.00	0.00	15.00	61.86
37.00	39.00	2	13	200	11.00	4	44.00	3.00	2.19	767.00	0.65	4.98	40.72	15.00	0.00	15.00	55.72
38.00	39.00	7	7	200	11.00	3	33.00	2.00	3.57	700.00	2.52	17.64	53.38	15.00	0.00	15.00	68.38
39.00	41.00	3	23	200	11.00	5	55.00	3.00	2.74	546.00	0.98	5.36	35.74	15.00	0.00	15.00	50.74
40.00	41.00	2	2	200	11.00	2	22.00	2.00	2.38	179.00	1.19	2.13	32.51	15.00	0.00	15.00	47.51
41.00	44.00	5	30	200	11.00	5	55.00	3.00	2.74	382.00	0.98	3.75	30.38	15.00	0.00	15.00	45.38
42.00	43.00	9	9	200	11.00	3	33.00	2.00	3.57	944.00	2.52	23.78	54.51	15.00	0.00	15.00	69.51
43.00	44.00	8	17	200	11.00	4	44.00	3.00	2.19	631.00	0.65	4.10	30.73	15.00	0.00	15.00	45.73
44.00	46.00	0	47	200	11.00	6	66.00	3.00	3.29	195.00	1.38	2.69	26.63	15.00	0.00	15.00	41.63
45.00	46.00	4	4	200	11.00	3	33.00	2.00	3.57	497.00	2.52	12.52	36.46	15.00	0.00	15.00	51.46
46.00	49.00	4	55	200	11.00	7	77.00	3.00	3.83	538.00	1.83	9.86	23.94	15.00	0.00	15.00	38.94
47.00	49.00	8	8	200	11.00	3	33.00	2.00	3.57	585.00	2.52	14.74	28.82	15.00	0.00	15.00	43.82
48.00	49.00	2	2	200	11.00	2	22.00	2.00	2.38	280.00	1.19	3.33	17.41	15.00	0.00	15.00	32.41
49.00	50.00	6	71	200	11.00	7	77.00	3.00	3.83	520.00	1.83	9.53	14.08	15.00	0.00	15.00	29.08
50.00	52.00	0	200	200	11.00	11	121.00	4.00	3.65	130.00	1.25	1.62	4.55	15.00	0.00	15.00	19.55
51.00	52.00	4	4	200	11.00	3	33.00	2.00	3.57	569.00	2.52	14.34	17.27	15.00	0.00	15.00	32.27
52.00	52.00	1	205	200	11.00	11	121.00	4.00	3.65	235.00	1.25	2.93	2.93	15.00	0.00	15.00	17.93

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME(HR)

Ex2 - E341

Prepared By:
M. Crowley

May 14, 2019

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (inches)	Gallons per 100 lineal feet	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE							Gals per Day per Dwelling		200	
1.00	3.00	3	2.00	15.40	233.00	35.89	600	16.72	1.44	3.91
2.00	3.00	4	2.00	15.40	621.00	95.65	800	8.36	2.87	5.34
3.00	10.00	18	3.00	33.47	1,056.00	353.41	3,600	10.19	2.36	2.47
4.00	6.00	3	2.00	15.40	162.00	24.95	600	24.05	1.00	4.27
5.00	6.00	6	2.00	15.40	540.00	83.18	1,200	14.43	1.66	4.93
6.00	7.00	18	3.00	33.47	934.00	312.58	3,600	11.52	2.08	3.27
7.00	9.00	21	3.00	33.47	179.00	59.90	4,200	70.11	0.34	1.18
8.00	9.00	3	2.00	15.40	568.00	87.49	600	6.86	3.50	4.34
9.00	10.00	33	3.00	33.47	596.00	199.46	6,600	33.09	0.73	0.84
10.00	10.00	51	3.00	33.47	149.00	49.87	10,200	204.55	0.12	0.12
11.00	12.00	9	2.00	15.40	1,032.00	158.96	1,800	11.32	2.12	9.06
12.00	14.00	13	3.00	33.47	1,070.00	358.09	2,600	7.26	3.31	6.94
13.00	14.00	9	2.00	15.40	1,765.00	271.86	1,800	6.62	3.62	7.26
14.00	17.00	34	3.00	33.47	1,152.00	385.53	6,800	17.64	1.36	3.63
15.00	16.00	9	2.00	15.40	466.00	71.78	1,800	25.08	0.96	4.89
16.00	17.00	19	3.00	33.47	788.00	263.72	3,800	14.41	1.67	3.94
17.00	19.00	54	3.00	33.47	169.00	56.56	10,800	190.95	0.13	2.27
18.00	19.00	3	2.00	15.40	536.00	82.56	600	7.27	3.30	5.45
19.00	23.00	74	3.00	33.47	1,210.00	404.94	14,800	36.55	0.66	2.14
20.00	22.00	4	2.00	15.40	201.00	30.96	800	25.84	0.93	2.57
21.00	22.00	3	2.00	15.40	318.00	48.98	600	12.25	1.96	3.60
22.00	23.00	7	2.00	15.40	58.00	8.93	1,400	156.71	0.15	1.64
23.00	25.00	92	4.00	55.31	928.00	513.31	18,400	35.85	0.67	1.49
24.00	25.00	7	2.00	15.40	321.00	49.44	1,400	28.32	0.85	1.67
25.00	28.00	101	4.00	55.31	437.00	241.72	20,200	83.57	0.29	0.82
26.00	28.00	3	2.00	15.40	231.00	35.58	600	16.86	1.42	1.95
27.00	28.00	2	2.00	15.40	247.00	38.05	400	10.51	2.28	2.81
28.00	34.00	109	4.00	55.31	508.00	280.99	21,800	77.58	0.31	0.53
29.00	31.00	3	2.00	15.40	290.00	44.67	600	13.43	1.79	5.08
30.00	31.00	7	2.00	15.40	624.00	96.11	1,400	14.57	1.65	4.95
31.00	33.00	12	3.00	33.47	499.00	167.00	2,400	14.37	1.67	3.30
32.00	33.00	2	2.00	15.40	299.00	46.05	400	8.69	2.76	4.39
33.00	34.00	18	3.00	33.47	630.00	210.84	3,600	17.07	1.41	1.63
34.00	50.00	129	4.00	55.31	200.00	110.63	25,800	233.22	0.10	0.22
35.00	37.00	8	2.00	15.40	828.00	127.54	1,600	12.55	1.91	6.72

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME(HR)

Ex2 - E341

Prepared By:
M. Crowley

May 14, 2019

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (inches)	Gallons per 100 lineal feet	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE							Gals per Day per Dwelling		200	
36.00	37.00	3	2.00	15.40	516.00	79.48	600	7.55	3.18	7.99
37.00	39.00	13	3.00	33.47	767.00	256.69	2,600	10.13	2.37	4.81
38.00	39.00	7	2.00	15.40	700.00	107.82	1,400	12.98	1.85	4.29
39.00	41.00	23	3.00	33.47	546.00	182.73	4,600	25.17	0.95	2.44
40.00	41.00	2	2.00	15.40	179.00	27.57	400	14.51	1.65	3.14
41.00	44.00	30	3.00	33.47	382.00	127.84	6,000	46.93	0.51	1.48
42.00	43.00	9	2.00	15.40	944.00	145.40	1,800	12.38	1.94	4.40
43.00	44.00	17	3.00	33.47	631.00	211.17	3,400	16.10	1.49	2.46
44.00	46.00	47	3.00	33.47	195.00	65.26	9,400	144.04	0.17	0.97
45.00	46.00	4	2.00	15.40	497.00	76.55	800	10.45	2.30	3.10
46.00	49.00	55	3.00	33.47	538.00	180.05	11,000	61.09	0.39	0.81
47.00	49.00	8	2.00	15.40	585.00	90.11	1,600	17.76	1.35	1.76
48.00	49.00	2	2.00	15.40	280.00	43.13	400	9.27	2.59	3.00
49.00	50.00	71	3.00	33.47	520.00	174.03	14,200	81.60	0.29	0.41
50.00	52.00	200	4.00	55.31	130.00	71.91	40,000	556.27	0.04	0.12
51.00	52.00	4	2.00	15.40	569.00	87.64	800	9.13	2.63	2.71
52.00	52.00	205	4.00	55.31	235.00	129.99	41,000	315.42	0.08	0.08

▶ E/ONE ZONE DIVIDER/FLOW DIRECTION (TYP.)

● E/ONE GRINDER PUMP STATION (TYP.)



APPENDIX L: E-ONE GRINDER SYSTEM AREA C ANALYSIS



Environment One Corporation

**Pressure Sewer Preliminary
Cost and Design Analysis
For
Arco, GA
Rev1**

**Prepared For:
Brunswick-Glynn County Joint Water & Sewer Commission**

GA

USA

Tel:

Fax:

Prepared By: M. Crowley

May 10, 2019

Arco, GA
Rev1

Prepared by : M. Crowley

On: May 10, 2019

Notes :

Analysis based upon drawings and data provided. Station recommendations are preliminary.

GPD values impact retention times only, not line sizing or hydraulics. GP laterals to be 1.25".

General recommendations for valve placement 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 peaks of 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.

<<<< END OF NOTES >>>>

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Prepared By:
M. Crowley

Arco, GA

Rev1

May 10, 2019

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Gals/day per Pump	Max Flow Per Pump (gpm)	Max Sim Ops	Max Flow (GPM)	Pipe Size (inches)	Max Velocity (FPS)	Length of Main this Zone	Friction Loss Factor (ft/100 ft)	Friction Loss This Zone	Accum Friction Loss (feet)	Max Main Elevation	Minimum Pump Elevation	Static Head (feet)	Total Dynamic Head (ft)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE										Friction loss calculations were based on a Constant for inside roughness "C" of: 150							
1.00	4.00	3	3	200	11.00	2	22.00	2.00	2.38	77.00	1.19	0.92	7.15	15.00	15.00	0.00	7.15
2.00	3.00	9	9	200	11.00	3	33.00	2.00	3.57	319.00	2.52	8.04	15.89	15.00	13.00	2.00	17.89
3.00	4.00	6	15	200	11.00	4	44.00	3.00	2.19	250.00	0.65	1.62	7.85	15.00	15.00	0.00	7.85
4.00	7.00	4	22	200	11.00	5	55.00	3.00	2.74	258.00	0.98	2.53	6.23	15.00	15.00	0.00	6.23
5.00	6.00	9	9	200	11.00	3	33.00	2.00	3.57	276.00	2.52	6.95	12.53	15.00	13.00	2.00	14.53
6.00	7.00	8	17	200	11.00	4	44.00	3.00	2.19	289.00	0.65	1.88	5.58	15.00	14.00	1.00	6.58
7.00	7.00	4	43	200	11.00	6	66.00	3.00	3.29	269.00	1.38	3.70	3.70	15.00	14.00	1.00	4.70
8.00	9.00	9	9	200	11.00	3	33.00	2.00	3.57	617.00	2.52	15.54	23.17	15.00	14.00	1.00	24.17
9.00	13.00	4	13	200	11.00	4	44.00	3.00	2.19	534.00	0.65	3.47	7.63	14.00	13.00	1.00	8.63
10.00	11.00	9	9	200	11.00	3	33.00	2.00	3.57	266.00	2.52	6.70	16.37	15.00	14.00	1.00	17.37
11.00	12.00	9	18	200	11.00	4	44.00	3.00	2.19	296.00	0.65	1.92	9.67	14.00	14.00	0.00	9.67
12.00	13.00	10	28	200	11.00	5	55.00	3.00	2.74	365.00	0.98	3.59	7.75	14.00	13.00	1.00	8.75
13.00	13.00	0	41	200	11.00	6	66.00	3.00	3.29	302.00	1.38	4.16	4.16	14.00	13.00	1.00	5.16
14.00	18.00	6	6	200	11.00	3	33.00	2.00	3.57	590.00	2.52	14.86	15.67	15.00	14.00	1.00	16.67
15.00	15.10	9	9	200	11.00	3	33.00	2.00	3.57	584.00	2.52	14.71	18.33	15.00	12.00	3.00	21.33
15.10	17.00	5	14	200	11.00	4	44.00	3.00	2.19	231.00	0.65	1.50	3.62	15.00	12.00	3.00	6.62
16.00	17.00	5	5	200	11.00	3	33.00	2.00	3.57	273.00	2.52	6.88	9.00	15.00	14.00	1.00	10.00
17.00	18.00	0	19	200	11.00	5	55.00	3.00	2.74	133.00	0.98	1.31	2.12	15.00	14.00	1.00	3.12
18.00	18.00	0	25	200	11.00	5	55.00	3.00	2.74	82.00	0.98	0.81	0.81	15.00	15.00	0.00	0.81
19.00	20.00	9	9	200	11.00	3	33.00	2.00	3.57	298.00	2.52	7.51	15.74	13.00	12.00	1.00	16.74
20.00	22.00	8	17	200	11.00	4	44.00	3.00	2.19	446.00	0.65	2.90	8.23	13.00	10.00	3.00	11.23
21.00	22.00	9	9	200	11.00	3	33.00	2.00	3.57	428.00	2.52	10.78	16.11	13.00	11.00	2.00	18.11
22.00	22.00	5	31	200	11.00	6	66.00	3.00	3.29	387.00	1.38	5.33	5.33	13.00	11.00	2.00	7.33
23.00	24.00	9	9	200	11.00	3	33.00	2.00	3.57	396.00	2.52	9.98	19.40	15.00	12.00	3.00	22.40
24.00	27.00	12	21	200	11.00	5	55.00	3.00	2.74	651.00	0.98	6.40	9.42	15.00	13.00	2.00	11.42
25.00	26.00	6	6	200	11.00	3	33.00	2.00	3.57	250.00	2.52	6.30	10.67	15.00	13.00	2.00	12.67
26.00	27.00	6	12	200	11.00	4	44.00	3.00	2.19	208.00	0.65	1.35	4.37	15.00	13.00	2.00	6.37
27.00	35.00	0	33	200	11.00	6	66.00	3.00	3.29	120.00	1.38	1.65	3.02	15.00	13.00	2.00	5.02
28.00	31.00	6	6	200	11.00	3	33.00	2.00	3.57	700.00	2.52	17.64	21.99	15.00	13.00	2.00	23.99
29.00	30.00	6	6	200	11.00	3	33.00	2.00	3.57	223.00	2.52	5.62	11.50	15.00	13.00	2.00	13.50
30.00	31.00	6	12	200	11.00	4	44.00	3.00	2.19	235.00	0.65	1.53	5.88	15.00	13.00	2.00	7.88
31.00	34.00	0	18	200	11.00	4	44.00	3.00	2.19	242.00	0.65	1.57	4.35	15.00	13.00	2.00	6.35
32.00	33.00	6	6	200	11.00	3	33.00	2.00	3.57	228.00	2.52	5.74	9.89	15.00	14.00	1.00	10.89
33.00	34.00	6	12	200	11.00	4	44.00	3.00	2.19	211.00	0.65	1.37	4.15	15.00	13.00	2.00	6.15
34.00	35.00	0	30	200	11.00	5	55.00	3.00	2.74	144.00	0.98	1.41	2.78	15.00	14.00	1.00	3.78

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Prepared By:
M. Crowley

Arco, GA
Rev1

May 10, 2019

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Gals/day per Pump	Max Flow Per Pump (gpm)	Max Sim Ops	Max Flow (GPM)	Pipe Size (inches)	Max Velocity (FPS)	Length of Main this Zone	Friction Loss Factor (ft/100 ft)	Friction Loss This Zone	Accum Friction Loss (feet)	Max Main Elevation	Minimum Pump Elevation	Static Head (feet)	Total Dynamic Head (ft)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE										Friction loss calculations were based on a Constant for inside roughness "C" of: 150							
35.00	35.00	0	63	200	11.00	7	77.00	3.00	3.83	75.00	1.83	1.37	1.37	15.00	15.00	0.00	1.37
36.00	39.00	7	7	200	11.00	3	33.00	2.00	3.57	669.00	2.52	16.85	25.26	15.00	12.00	3.00	28.26
37.00	38.00	9	9	200	11.00	3	33.00	2.00	3.57	289.00	2.52	7.28	16.70	15.00	12.00	3.00	19.70
38.00	39.00	6	15	200	11.00	4	44.00	3.00	2.19	155.00	0.65	1.01	9.42	15.00	13.00	2.00	11.42
39.00	42.00	0	22	200	11.00	5	55.00	3.00	2.74	293.00	0.98	2.88	8.41	15.00	14.00	1.00	9.41
40.00	41.00	9	9	200	11.00	3	33.00	2.00	3.57	271.00	2.52	6.83	13.50	15.00	13.00	2.00	15.50
41.00	42.00	6	15	200	11.00	4	44.00	3.00	2.19	175.00	0.65	1.14	6.67	15.00	13.00	2.00	8.67
42.00	45.00	0	37	200	11.00	6	66.00	3.00	3.29	272.00	1.38	3.75	5.53	15.00	13.00	2.00	7.53
43.00	44.00	9	9	200	11.00	3	33.00	2.00	3.57	217.00	2.52	5.47	8.46	15.00	14.00	1.00	9.46
44.00	45.00	4	13	200	11.00	4	44.00	3.00	2.19	186.00	0.65	1.21	2.99	15.00	14.00	1.00	3.99
45.00	45.00	0	50	200	11.00	6	66.00	3.00	3.29	129.00	1.38	1.78	1.78	15.00	15.00	0.00	1.78
46.00	46.00	2	2	200	11.00	2	22.00	2.00	2.38	778.00	1.19	9.25	9.25	15.00	13.00	2.00	11.25
47.00	48.00	3	3	200	11.00	2	22.00	2.00	2.38	280.00	1.19	3.33	9.05	15.00	13.00	2.00	11.05
48.00	48.00	7	10	200	11.00	4	44.00	3.00	2.19	880.00	0.65	5.72	5.72	15.00	13.00	2.00	7.72

PRELIMINARY PRESSURE SEWER- ACCUMULATED RETENTION TIME(HR)

Prepared By:
M. Crowley

Arco, GA
Rev1

May 10, 2019

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (inches)	Gallons per 100 lineal feet	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE							Gals per Day per Dwelling		200	
1.00	4.00	3	2.00	15.40	77.00	11.86	600	50.59	0.47	1.20
2.00	3.00	9	2.00	15.40	319.00	49.14	1,800	36.63	0.66	2.05
3.00	4.00	15	3.00	33.47	250.00	83.67	3,000	35.86	0.67	1.39
4.00	7.00	22	3.00	33.47	258.00	86.34	4,400	50.96	0.47	0.72
5.00	6.00	9	2.00	15.40	276.00	42.51	1,800	42.34	0.57	1.50
6.00	7.00	17	3.00	33.47	289.00	96.72	3,400	35.15	0.68	0.93
7.00	7.00	43	3.00	33.47	269.00	90.02	8,600	95.53	0.25	0.25
8.00	9.00	9	2.00	15.40	617.00	95.04	1,800	18.94	1.27	3.21
9.00	13.00	13	3.00	33.47	534.00	178.71	2,600	14.55	1.65	1.95
10.00	11.00	9	2.00	15.40	266.00	40.97	1,800	43.93	0.55	2.03
11.00	12.00	18	3.00	33.47	296.00	99.06	3,600	36.34	0.66	1.48
12.00	13.00	28	3.00	33.47	365.00	122.15	5,600	45.84	0.52	0.82
13.00	13.00	41	3.00	33.47	302.00	101.07	8,200	81.13	0.30	0.30
14.00	18.00	6	2.00	15.40	590.00	90.88	1,200	13.20	1.82	1.95
15.00	15.10	9	2.00	15.40	584.00	89.95	1,800	20.01	1.20	2.27
15.10	17.00	14	3.00	33.47	231.00	77.31	2,800	36.22	0.66	1.08
16.00	17.00	5	2.00	15.40	273.00	42.05	1,000	23.78	1.01	1.42
17.00	18.00	19	3.00	33.47	133.00	44.51	3,800	85.37	0.28	0.41
18.00	18.00	25	3.00	33.47	82.00	27.44	5,000	182.20	0.13	0.13
19.00	20.00	9	2.00	15.40	298.00	45.90	1,800	39.22	0.61	2.17
20.00	22.00	17	3.00	33.47	446.00	149.26	3,400	22.78	1.05	1.55
21.00	22.00	9	2.00	15.40	428.00	65.92	1,800	27.30	0.88	1.38
22.00	22.00	31	3.00	33.47	387.00	129.52	6,200	47.87	0.50	0.50
23.00	24.00	9	2.00	15.40	396.00	61.00	1,800	29.51	0.81	2.25
24.00	27.00	21	3.00	33.47	651.00	217.87	4,200	19.28	1.24	1.44
25.00	26.00	6	2.00	15.40	250.00	38.51	1,200	31.16	0.77	1.66
26.00	27.00	12	3.00	33.47	208.00	69.61	2,400	34.48	0.70	0.89
27.00	35.00	33	3.00	33.47	120.00	40.16	6,600	164.34	0.15	0.19
28.00	31.00	6	2.00	15.40	700.00	107.82	1,200	11.13	2.16	2.94
29.00	30.00	6	2.00	15.40	223.00	34.35	1,200	34.94	0.69	2.25
30.00	31.00	12	3.00	33.47	235.00	78.65	2,400	30.52	0.79	1.57
31.00	34.00	18	3.00	33.47	242.00	80.99	3,600	44.45	0.54	0.78
32.00	33.00	6	2.00	15.40	228.00	35.12	1,200	34.17	0.70	1.65
33.00	34.00	12	3.00	33.47	211.00	70.61	2,400	33.99	0.71	0.95
34.00	35.00	30	3.00	33.47	144.00	48.19	6,000	124.50	0.19	0.24

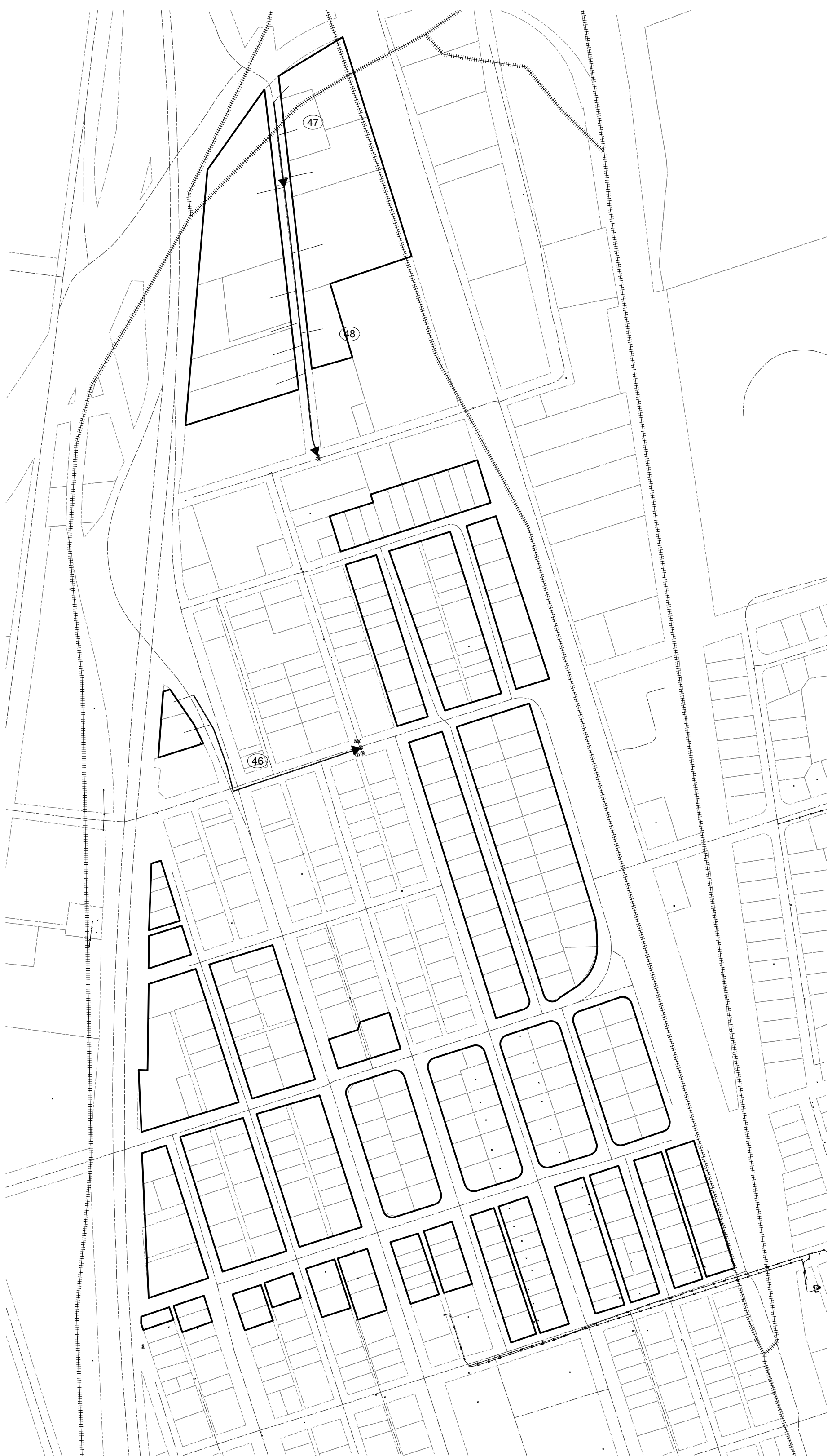
PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME(HR)

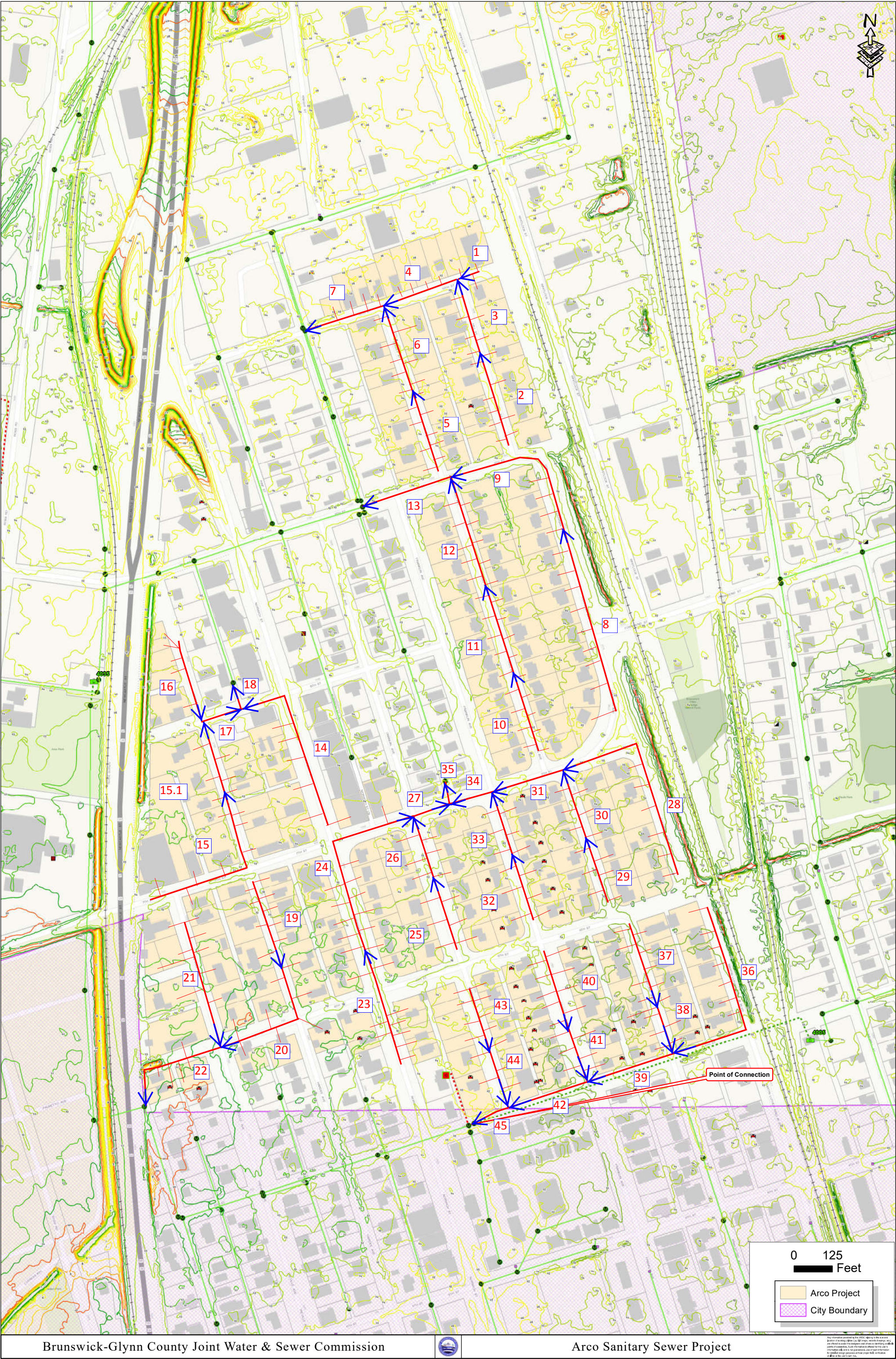
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Arco, GA
Rev1

May 10, 2019

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (inches)	Gallons per 100 lineal feet	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE							Gals per Day per Dwelling		200	
35.00	35.00	63	3.00	33.47	75.00	25.10	12,600	502.00	0.05	0.05
36.00	39.00	7	2.00	15.40	669.00	103.05	1,400	13.59	1.77	2.70
37.00	38.00	9	2.00	15.40	289.00	44.51	1,800	40.44	0.59	1.94
38.00	39.00	15	3.00	33.47	155.00	51.87	3,000	57.83	0.41	1.35
39.00	42.00	22	3.00	33.47	293.00	98.06	4,400	44.87	0.53	0.93
40.00	41.00	9	2.00	15.40	271.00	41.74	1,800	43.12	0.56	1.42
41.00	42.00	15	3.00	33.47	175.00	58.57	3,000	51.22	0.47	0.87
42.00	45.00	37	3.00	33.47	272.00	91.03	7,400	81.29	0.30	0.40
43.00	44.00	9	2.00	15.40	217.00	33.42	1,800	53.85	0.45	1.12
44.00	45.00	13	3.00	33.47	186.00	62.25	2,600	41.77	0.57	0.68
45.00	45.00	50	3.00	33.47	129.00	43.17	10,000	231.63	0.10	0.10
46.00	46.00	2	2.00	15.40	778.00	119.83	400	3.34	7.19	7.19
47.00	48.00	3	2.00	15.40	280.00	43.13	600	13.91	1.73	5.26
48.00	48.00	10	3.00	33.47	880.00	294.50	2,000	6.79	3.53	3.53





Any information provided by the AGSC, relating to the use and
purpose of the project, shall be used for the purpose of the project
and shall not be used for any other purpose. This information is
provided for informational purposes only and is not intended to
be used for any other purpose. The AGSC is not responsible for
any errors or omissions in this information.

APPENDIX M: ORENCO STEP SYSTEM BUDGET ESTIMATES



PROTECTING THE WORLD'S WATER

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May 24, 2019

Barrett Neal
GWES, LLC

Dear Mr. Neal,

We are happy to provide you with budgetary numbers for inclusion in your report to Brunswick-Glynn County Joint Water and Sewer Commission. We believe based on the data you provided that an effluent sewer would provide the utility with an approachable upfront cost and low long term maintenance costs. Enclosed in this letter you will find individualized costs for two basic on lot configurations and detailed operations and maintenance cost estimate.

The residential and commercial STEP (Septic Tank Effluent Pump) systems we are proposing are comprised of basic components, including a control panel, interceptor tank, effluent pump vault, pump, float tree, splice box, discharge assembly, riser adapter, riser, and bolt down lids. That equipment is detailed in the package components list. Additional features can be added to these systems, should budget allow. However, the equipment suggested makes for a robust and well-designed system that will serve all the needs of the utility.

Please note that costs for mainlines, laterals, service connections, air release valves, and installation are not included. We would be happy to work with you on detailed hydraulic analysis as the project progresses.

Tank Information

An important part of a STEP system is the onsite interceptor or septic tank. We are proposing the use of the Roth MultiTank as the tank product. These Roth tanks are built to high standards, extremely durable, and most importantly, watertight. Compared to concrete tanks, they are much easier to install in existing communities, as they are lightweight enough to use smaller pieces of equipment. Orenco employs Roth tanks on many nationwide, and international, STEP system installations.

We are providing the costs for two tank types. The 1,060-gallon tank would be used as a residential tank, with the 1,500-gallon being used for larger residences or commercial properties or even put in series for larger commercial/industrial properties. It is recommended to achieve two to three days of hydraulic retention time in the onsite tanks based on estimated flow.

For the purposes of this preliminary assessment, all residential lots will be assumed to use a 1060-gallon tank, and all commercial packages will be assumed to use a single 1,500-gallon tank. An additional 1,500-gallon tank and access equipment cost are provided for the commercial system package, should you need to increase the primary volume in your estimate.

Residential STEP Pump Package Costs

Package Type	Quantity Expected	Components
Residential	864	<ul style="list-style-type: none">• Roth 1060-gallon tank• PF100511 Pump <u>with 10-year warranty</u>• S1 Panel• External splice box• 1 Riser adapter, 1 24" riser, 1 lid• Pump vault with float stem and filter cartridge• Hose and valve discharge assembly• Adhesive ADH200• Homeowners manual
Cost per Package		\$2,950

*Shipping is included and is assumed to be truckload quantity.

*Connection quantity obtained from engineer

*10-year warranty applies to pump only. All other components are 5-year.

Commercial/Industrial STEP Pump Package

Package Type	Quantity Expected	Components
Commercial & Industrial	95	<ul style="list-style-type: none">• Roth 1,500-gallon tank• Two (2) PF200512 pumps• MVP Duplex dual mode panel• External splice box (2)• 2 riser adapters, 2 24" risers, 2 lids• Pump vault with float stem and filter cartridge• Two (2) hose and valve assemblies• Adhesive ADH200
Cost per Package		\$5,500
Additional 1,500-gallon tank & access equipment cost		\$2,350

*Shipping is assumed to be truckload quantity.

*Connection quantity obtained from engineer.

Shipping Costs, Installation Costs

Estimated shipping costs are included in the total package prices. It is assumed that the client will order in truckload quantities. Should smaller quantities be ordered, the shipping cost per package will likely increase?

Installation costs vary based on things like an installer’s experience, site conditions, work phasing, electrical requirements, etc. Those all make it very difficult to estimate. We would recommend assigning a standard % of material cost to any package you’re evaluating.

Operation and Maintenance Costs

The O&M costs for an Orenco Sewer system can be broken into two major components. The first component is the onsite system (also known as an “on-lot” system). The onsite or on-lot system includes the tank, effluent filter, pump and controls, building sewer, and service lateral that are located on each individual property. The second component is the conveyance system. The conveyance system includes the collection mains, air release valves, odor control filters, and shutoff valves, all of which are typically located in the streets right-of-way. Manholes and lift stations are not normally required for Orenco Sewer systems. In the context of the overall system, the O&M cost of the conveyance component (mainlines, air release valves, etc.) is normally insignificant.

The O&M of onsite pump systems is best served when the onsite components are managed by the owner of the overall system, not the property owner. The O&M of onsite Orenco Sewer systems is typically divided into two activities: proactive maintenance (PM) and reactive maintenance (RM). Practically speaking, the most cost-efficient management approaches balance PM and RM to achieve the lowest overall cost for O&M. Systems that typically achieve the best overall O&M cost tend to base them on the required PM cycles for each different component. For example, tank effluent screens typically need inspection and, if necessary, cleaning every three to five years. The minimum frequency for pump and controls inspection is also about five years.

Long-term studies have found that managed Orenco Sewer tank pump-out programs can achieve pump-out intervals more than 10 years. Extended tank pump-out intervals can be achieved through use of larger tanks and through the measurement of sludge and scum accumulation. When a management program is in place, as is the case with centrally managed STEP systems, operators can arrange for earlier pump-out intervals for systems that have higher accumulation rates while extending pump-outs for systems with lower accumulation rates, providing cost efficiencies.

Below is a table outlining STEP system and septic tank O&M costs. For 864 residential units, the estimated O&M cost per equivalent dwelling unit (EDU) per month comes to **\$7.65**.

Primary Tank Pump-Out Costs (1,060-gal STEP Tank)

Pump-Out Frequency	10 years
Number of Events Per Term	4
Cost Per Pump-Out (\$)	\$300.00
Uniform Equivalent Annual Cost (UEAC)	\$22,610.15
Present Worth	\$522,628.40

Pro-Active Preventative Maintenance

Uniform Equivalent Annual Cost (UEAC): Pro-Active Preventative Maintenance	\$27,254.20
Present Worth	\$629,974.57

Reactive Maintenance

Uniform Equivalent Annual Cost (UEAC): Unscheduled Service Calls	\$10,108.80
Present Worth	\$336,960.00

Equipment Repair and Replacement

Uniform Equivalent Annual Cost (UEAC): Equipment Repair and Replacement	\$19,292.62
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	Present Worth	\$445,944.58
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Total STEP Management (1,060-gal STEP Tank)

Uniform Equivalent Annual Cost (UEAC): 1,060-gal Tank	\$79,265.77
Monthly O&M Cost Per EDU	\$7.65
Present Worth	\$1,935,508

1. Pump-out frequency is based on 4 persons per EDU.
2. Routine Service typically includes: Measurement of tank solids; cleaning pump and effluent filter; verifying float and panel operations. Total time, including travel and reporting, 1.5 hours per visit.
3. Unscheduled Service Call Cost is based on estimating 1.5 hours/month/100 EDUs
4. For detailed justification of cost and frequencies used refer to "Operational Cost of Two Pressure Sewer Technologies"
5. Excludes travel time.
6. Excludes repair and replacement costs for treatment facility.
7. Excludes mainline O&M costs.
8. Assume commercial facility average flow is 1/2 max day flow.

Please don't hesitate to reach out to us with questions or request some additional detail or information. We look forward to working with you on this evaluation, and hopefully on the design for this project.

Best regards,



Mike Sams
Vice President
Environmental Management Services inc.



Lindsay I. Tucker, P.E.
Sales Engineer, SE Region