

CITY OF STAUNTON, VIRGINIA

UNIONTOWN WATER AND SEWER EXTENSION STUDY

WILEY|WILSON COMM. NO. 221075

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1 EXECUTIVE SUMMARY

This water and sewer extension study was commissioned by the City of Staunton Department of Public Works in response to proposed residential rezoning in the Uniontown area. The Uniontown Service Area is defined in Figure 1-1 below. This study is intended to develop alternatives for extending utility service to the study area, facilitating future residential development. Additionally, the water alternative assessed in this study are intended to improve water quality in the study area.

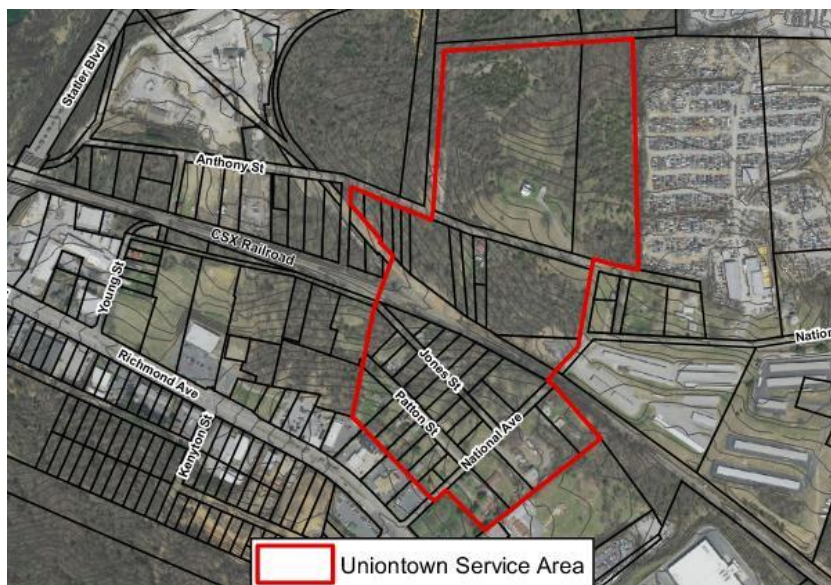


Figure 1-1 – Uniontown Service Area

The Uniontown study area is divided by the existing Buckingham Branch Railroad Company tracks, requiring multiple alternatives for utility extension to serve both the north and south portions of the study area. Based on collaborative review with City staff, this study provides three (3) alternatives for water service extension – one (1) north of the railroad and two (2) south of the railroad – and four (4) alternatives for sewer service extension – one (1) north of the railroad and three (3) south of the railroad. The alternatives are shown graphically on Figures 3 – 9 in Appendix A.

The alternatives identified in this study provide a backbone for utility service to the study area by extending service to existing parcels. If parcels within the study area are further subdivided during development, additional utility extensions completed by the developer would be required to provide utility frontage to the individual, subdivided parcels.

Additionally, this study projects population growth and resulting water and sewer demands in the study area. Based on proposed zoning, potential subdivision of larger parcels to minimum lot sizes, and assuming average household sizes reflected by United States Census data, the build out population of the study area may increase to as much as approximately 626 people, resulting in approximately 62,600 gallons of daily water demand and 46,900 gallons of daily sanitary sewage generation.



1.1 NEXT STEPS

It is recommended that a preliminary engineering report (PER) be developed to further define the alignments for utility service and provide a recommendation for preferred alternatives. The preliminary engineering report should include modeling of existing and proposed utility infrastructure to verify the capacity and required pipe sizes for the proposed water and sewer utilities, and to quantify the extent of water quality improvement resulting from the completion of the individual water extension alternatives. Additionally, the preliminary engineering report should include topographic analysis of the study area, including limited survey of portions of the gravity sewer alignments to verify feasibility, as well as coordination with property owners along the proposed utility alignments.

1.2 PROBABLE COST

Table 1-1 and Table 1-2 list the probable cost associated with each of the water and sanitary sewer alternatives assessed. These costs reflect the total project cost, including design and construction phases.

TABLE 1-1: Opinion of Probable Construction Cost – Water Alternatives	
Alternative	TOTAL PROJECT COST
North Water Alternative 1	\$1,173,000
South Water Alternative 1 – Option 1	\$1,002,000
South Water Alternative 1 – Option 2	\$1,205,000
South Water Alternative 2	\$1,042,000

TABLE 1-2: Opinion of Probable Construction Cost – Sewer Alternatives	
Alternative	TOTAL PROJECT COST
North Sewer Alternative 1 – Option 1	\$1,653,000
North Sewer Alternative 1 – Option 2	\$1,668,000
South Sewer Alternative 1	\$1,486,000
South Sewer Alternative 2	\$1,331,000
South Sewer Alternative 3	\$2,782,000



2 INTRODUCTION

The City of Staunton Public Works Department commissioned Wiley|Wilson to prepare a study to identify and evaluate several alternatives to provide water and sanitary sewer service to the Uniontown area. The area involved in this study includes the portion of Uniontown planned for rezoning as R-2 Low Density Residential District. This study identifies three alternatives for extending water service and four alternatives for extending sanitary sewer service. These alternatives were developed in collaboration with City staff during a project kickoff meeting, held at the City of Staunton Public Works Department on June 2, 2021, as well as a draft study review meeting held on August 11, 2021. A conceptual layout, an opinion of probable construction cost, and an assessment of the advantages and challenges of each alternative were developed as part of this study and are included within this report.

The study includes a projection of build-out water demand and sanitary sewage generation for the area of Uniontown zoned as R-2, divided by areas north and south of the railroad. These flow projections were used to estimate the required sizes for new gravity sewer mains necessary to serve the study area. Modeling of existing and proposed utility infrastructure was not conducted at this stage of plan development.

2.1 PROJECT PURPOSE

Forty-four parcels totaling approximately 35 acres within the Uniontown area are proposed for rezoning as R-2 Low Density Residential District. Additionally, parcel 3576 is within the Uniontown Study area and is currently zoned R-2. Figure 1 of Appendix A displays the parcels currently proposed for rezoning. This service area is currently zoned as I-1 and I-2 industrial. Rezoning of parcels within the service area boundary will allow for development of the land into single-family or two-family residential lots. To support future residential development in this location, an extension of water and sanitary sewer utilities is necessary.

In addition to the need for service extension, deficiencies in existing water quality have been identified within the project area both north and south of the railroad along National Avenue. Existing water distribution infrastructure, as described in the following sections of this report, terminates along National Avenue on either side of the railroad tracks, resulting in minimal water circulation and increased water age.

This study identifies alternatives to extend the service area of the existing water distribution and sewer collection systems, while also improving the system's redundancy and improving water quality. Future efforts should include a preliminary engineering level study that includes water and sewer system modeling, more detailed topographic analysis, and coordination with landowners to recommend preferred alternatives.



2.2 EXISTING WATER AND SEWER INFRASTRUCTURE

Existing water and sewer infrastructure in the vicinity of the project area is shown on Figure 2 of Appendix A.

The existing water distribution infrastructure located within the vicinity of the study area includes a 6-inch water main along National Avenue south of the railroad tracks, fed from the 6-inch water main along Richmond Avenue. Existing 2-inch galvanized water mains are installed along Patton Street and Jones Street, branching from the main on National Avenue.

North of the railroad tracks, a 6-inch main along National Avenue serves an existing 2-inch galvanized water main at the east end of Anthony Street. This 6-inch main is fed from Frontier Drive and does not connect to the 6-inch main on the southern portion of National Avenue. An automatic flushing valve is currently installed at the end of the water main on National Avenue to periodically flush water from the system and maintain adequate water quality. Approximately 1,000 feet west of the study area, a 6-inch water main along Young Street extends north to Anthony Street, serving the concrete plant.

The existing sanitary sewerage facilities in the vicinity of the project area include a 6-inch gravity sewer along Richmond Avenue and an 8-inch gravity sewer west of Statler Boulevard.



3 DEMAND PROJECTIONS

3.1 METHODOLOGY

Projections for build-out water demands and sewage generation rates were developed to assist with planning for the development of the Uniontown area. Projections for water and sewer demands were calculated separately for portions of Uniontown north and south of the railroad tracks and are based on the estimated number of lots in the region following development, as well as an estimated number of persons per lot. Water demands and sewage generation rates per person were estimated based on the guidance included in the Virginia Administrative Code, including 12VAC5-590-690, *Capacity of Waterworks*, and 12VAC5-610-670, *Sewage Flows*. Modeling of the projected water demand and sewage flows were not included in this study, though the estimated sewage generation was used to verify proposed pipe diameters for cost estimating purposes.

South of the railroad tracks, there are 29 parcels currently zoned as I-1 or I-2 and proposed for rezoning to R-2. Additionally, parcel 3576 is already zoned as R-2 and is included in the projected water and sewer demand calculations as it will be provided with water and sewer frontage by the alternatives identified in this study.

Of the parcels identified within the service area south of the railroad, four of these parcels are further subdivided into smaller lots. Parcels 8843 and 1845 are currently divided into two lots each, and parcels 5149 and 1094 are divided into three lots each. It is assumed that these 36 total existing lots south of the railroad will not be subdivided further during development.

North of the railroad, there are 15 existing parcels proposed for rezoning. Parcel 1864 and the portion of parcels 1096 and 1867 that are between the main railroad track and the spur will not be serviced by the alternatives included within this study and are excluded from the build out demand projections. Parcels 1876, 1848, and 1865 are each several acres and may be further subdivided during development. Per Staunton City Code, Title 18, *Zoning*, Chapter 18.25, *R-2 Low Density Residential District*, the minimum lot size for R-2 zoning is 8,750 sf, or 0.2 acres. It is assumed for this study that parcels 1876, 1848, and 1865 will each be subdivided to minimum lot sizes during development. Table 3-1 lists the estimated number of developed lots for each of these three parcels.

Table 3-1: Sub-division of Existing Parcels 1876, 1848, and 1865			
Existing Parcel ID	Acreage	Minimum Developed Lot Size	Subdivided Number of Lots
1876	5.36	0.2	26
1848	10.62	0.2	53
1865	3.36	0.2	16



Table 3-2 summarizes the current number of parcels and lots in Uniontown proposed for R-2 zoning, as well as the projected build-out number of lots. In accordance with the requirements of R-2 zoning, these lots may be developed into single-family or two-family residential units. For the purposes of this study, it is conservatively assumed that all lots will be developed into two-family residences. The estimated number of persons per residence is based on United States Census data for the City of Staunton, which indicates an average of approximately 2.2 persons per household.

Table 3-2: Projected Number of Developed Lots			
Region/Basin	Current No. of Parcels	Current No. of Lots	Projected No. of Lots at Build-Out
Uniontown R-2 North of RR	14 ¹	14	106
Uniontown R-2 South of RR	30	36	36
Footnote: 1. Parcel 1864 excluded from calculations.			

3.2 PROJECTED WATER DEMANDS

Table 3-3 provides an estimate of the average daily water demand for portions of Uniontown north and south of the railroad. Average water consumption rates per person per day are based on the guidelines included in the Virginia Administrative Code, 12VAC5-590-690, *Capacity of Waterworks*. Values included in this table reflect estimates of average daily water demand. Peaking factors should be used as necessary to model the maximum day and peak hour demands.

Table 3-3: Projected Water Demands					
Region/Basin	Lots	Estimated Persons/Lot ¹	Total No. of Persons in Region	Water Demand/Person ²	Avg. Daily Water Demand (gpd)
Uniontown R-2 North of RR	106	4.4	467	100 gpd	46,700
Uniontown R-2 South of RR	36	4.4	159	100 gpd	15,900
Footnote: 1. Persons per lot assumes all lots to be developed into two-family homes. Per U.S. Census data, the average persons/household in Staunton, Virginia is approximately 2.2. 2. Water consumption rate per person/day based on the guidelines of the Virginia Administrative Code, 12VAC5-590-690.					

An estimate of 4.4 persons per lot and an average water demand per person of 100 gallons per day results in an estimated water demand of 440 gallons per lot per day. This estimate is conservative in relation to the equivalent residential connection volume of 400 gallons per day for residential connections, as specified by the Virginia Department of Health.



3.3 PROJECTED SANITARY SEWAGE GENERATION

Table 3-4 provides an estimate of the average daily sanitary sewage generation for portions of Uniontown north and south of the railroad. Average sewage generation rates per person per day are based on the guidelines included in the Virginia Administrative Code, 12VAC5-610-670, *Sewage Flows*. Values included in this table reflect estimates of average daily sewage generation. Peaking factors should be used as necessary for pipe sizing calculations and modeling purposes. Per Virginia Administrative Code 9VAC25-790-310, a peaking factor of 2.5 should be used for main and trunk sewers and a peaking factor of 4.0 should be used for submains.

An estimate of 4.4 persons per lot and an average sewage generation per person of 75 gallons per day results in an estimated total sewage generation of 330 gallons per lot per day. This estimate is conservative in relation to typical equivalent dwelling units for wastewater, which often range from 200 to 300 gallons per day.

Table 3-4: Projected Sanitary Sewage Generation					
Region/Basin	Lots	Estimated Persons/Lot ¹	Total # of Persons in Region	Sewage Generation/Person ²	Avg. Daily Sewage Generation (gpd)
Uniontown R-2 North of RR	106	4.4	467	75 gpd	35,000
Uniontown R-2 South of RR	36	4.4	159	75 gpd	11,900
Footnote: 1. Persons per lot assumes all lots to be developed into two-family homes. Per U.S. Census data, the average persons/household in Staunton, Virginia is approximately 2.2. 2. Sewage Generation rate per person/day based on the guidelines of the Virginia Administrative Code, 12VAC5-610-670.					

The estimated sewage generation rates identified in Table 3-4 were used to verify the gravity sewer pipe size necessary to convey flows from the north and south portions of Uniontown. Using a peaking factor of 2.5, the maximum flow rates anticipated from Uniontown are 61 gallons per minute (gpm) and 21 gpm from the regions north and south of the railroad, respectively. At a minimum slope of 0.4 ft/100 ft, as specified in 9VAC25-790-320, *Design Details*, an 8-inch gravity sewer main flowing half-full has a capacity of 171.5 gpm. Using a peaking factor of 4.0 as required for sewers designated as submains would also result in estimated flow rates below the half full capacity of an 8-inch main. 9VAC25-790-320 requires a minimum gravity sewer pipe size of 8-inches. Based on the current assumptions used to project build-out sewage generation rates, an 8-inch pipe will be sufficient to convey flows from both the north and south regions of Uniontown.



4 WATER DISTRIBUTION ALTERNATIVES

Approximately 35 acres within the Uniontown area is proposed for rezoning from industrial to R-2 residential zoning. To develop the area into residential lots, water mains must be extended or replaced throughout the Uniontown area to provide residential water service and adequate fire protection to the adjacent properties.

The Uniontown area is divided by existing CSX Transportation railroad tracks operated by the Buckingham Branch Railroad Company, a short line partner of CSX Transportation. The separation of the Uniontown service area by the railroad requires alternatives for water main extensions capable of addressing water service needs on both the north and south sides of the railroad tracks. Three alternatives were developed and evaluated for their ability to extend water service to the rezoned parcels and to address previously identified deficiencies in water quality in the northern portion of Uniontown.

4.1 NORTH WATER ALTERNATIVE 1

North Water Alternative 1 replaces the existing 2-inch galvanized water main along Anthony Street and provides connection between the existing 6-inch water mains on Young Street and National Avenue with a new 6-inch water line. Figure 3 of Appendix A provides a layout of the water main replacement and extension included in North Water Alternative 1, which will require approximately 2,200 LF of new 6-inch water main.

The replacement of water mains on Anthony Street will provide water mains of minimum size to connect new hydrants. The connection between the existing water mains on National Avenue and Young Street will improve water quality and extend service to parcels north of the railroad.

North Water Alternative 1 can be installed almost entirely within the public right of way of Anthony Street and National Avenue. A railroad crossing will be required under the spur line, though the topography is favorable for installation by jack and bore in this location. This alternative is not intended to improve water quality or expand capacity for parcels south of the railroad.

4.2 SOUTH WATER ALTERNATIVE 1

South Water Alternative 1 connects water mains south of the railroad tracks to the existing 6-inch water main north of the railroad at the intersection of National Avenue and Anthony Street. This connection can be accomplished through the installation of a jack and bore crossing of the railroad west of National Avenue. Alternatively, this connection can be accomplished through the installation of approximately 330 linear feet (LF) of new 6-inch water main along National Avenue, crossing the railroad on a new pipe bridge. Water mains north of the railroad, including the 6-inch water main along National Avenue, are served from North Frontier Drive. The water mains south of the railroad, including the 6-inch water main along National Avenue and 2-inch galvanized water mains along Patton and Jones Streets, are served from Richmond Avenue. The connection of water mains on either side of the railroad would be expected to increase available capacity in both the north and south



portions of the region, as well as improve the water quality currently observed at the existing dead-end water mains on National Avenue, Jones Street, and Patton Street.

Crossing of the railroad at National Avenue with a new water main could be accomplished with an aerial pipe bridge. Per CSX Transportation Design and Construction Standards, a pipe bridge must have a minimum vertical clearance from the tracks of 23 feet. This clearance requirement would require the pipe bridge and water main crossing of the railroad to be installed at an elevation approximately 5 to 10 feet higher than adjacent grade. The configuration of a pipe bridge to meet the clearance requirement removes this as a viable alternative. Additionally, due to a difference in grade of more than 15 feet between the railroad tracks and the adjacent ends of National Avenue and the visual presence of rock in this location, crossing the railroad at National Avenue by jack and bore would also be infeasible or cost prohibitive. However, a jack and bore crossing can be accomplished approximately 380 feet west of National Avenue. Crossing the railroad by jack and bore would require a minimum 45° angle to the railroad tracks, as well as a minimum horizontal clearance of 15 feet beyond the last long timber of the railroad turnout. This option for a jack and bore crossing would extend approximately 850 LF of new 6-inch watermain from the west end of Jones Street to the existing 6-inch watermain north of the railroad.

In addition to connecting water mains north and south of the railroad, South Water Alternative 1 includes the replacement of existing 2-inch galvanized water mains along Patton Street and Jones Street with approximately 850 linear feet (LF) of new 6-inch water mains. This replacement will provide the minimum water main size for serving new fire hydrants. It is additionally recommended to install approximately 530 LF of new 6-inch water main connecting the end of Patton Street to the end of Jones Street. This additional connection will eliminate the existing dead end water mains, improving the anticipated capacity and water quality on these streets.

Figure 4 of Appendix A provides a layout of the improvements proposed in South Water Alternative 1, including Option 1 which involves a total of approximately 2,200 LF of new 6-inch water main and a jack and bore railroad crossing, and Option 2 which involves crossing the railroad by pipe bridge. The complete construction of this alternative would be expected to improve capacity on both sides of the railroad, provide adequately sized water mains to serve new hydrants on Jones and Patton Street, improve system resiliency, and improve the water quality in the study area. However, additional extension of the water main from the intersection of National Avenue and Anthony Street by either developers or by the City would be required to provide service to rezoned parcels north of the railroad.

While most of the proposed water main associated with South Water Alternative 1 would be installed within existing public right-of-way or railroad right-of-way, the additional connection at the west end of Jones and Patton Streets would require easement acquisition. Additionally, to install the jack and bore beneath the railroad west of National Avenue, several easements would be required from the affected parcels north and south of the railroad. Construction within the public streets would require pavement restoration as well as traffic control measures to maintain access to existing residences.

4.3 SOUTH WATER ALTERNATIVE 2

South Water Alternative 2 involves the replacement of existing water mains along Patton Street and Jones Street with new 6-inch water mains, as well as the installation of a new



connection at the west end of Patton and Jones Streets. Additionally, this alternative proposes an extension of the water main along Jones Street, connecting to the existing 6-inch water main along Young Street. Figure 5 of Appendix A displays the recommended water main replacement and extensions included in South Water Alternative 2, which involves a total of approximately 2,630 LF of new 6-inch water main.

As with South Water Alternative 1, this replacement and connection of water mains on Jones Street and Patton Street would provide water mains of sufficient size to connect new hydrants. Like the connection on National Avenue proposed in South Water Alternative 1, the connection between Jones and Young Streets would improve the redundancy of water mains serving the southern portion of the Uniontown Service Area, resulting in improved capacity and a decrease in expected water age.

The new water main between Jones Street and Young Street could be installed primarily within existing public right of way for Jones Street. Approximately 800 feet west of National Avenue, a segment of Jones Street is close to the railroad. Through this segment, easements may be required if sufficient space is not available outside the railroad right-of-way. Survey of the adjacent property lines and railroad right-of-way would be required to verify the extent of easement necessary to facilitate installation of this connection. This alternative does not involve a railroad crossing and therefore would likely require less coordination with CSX Transportation. However, it may not provide the same increase in capacity north of the railroad that would be expected from the railroad crossing and connection proposed in South Water Alternative 1. The lack of a railroad crossing would also decrease system resiliency relative to South Water Alternative 1. Modeling of the existing water distribution system and the proposed alternatives would be required to fully evaluate the effect of improvements on capacity and water age.



5 SANITARY SEWER ALTERNATIVES

Approximately 35 acres within the Uniontown area is proposed for rezoning from industrial to R-2 residential zoning. There is currently no City owned sanitary sewer infrastructure within the proposed Uniontown service area. To develop the area into residential lots, sanitary sewer infrastructure must be extended through the Uniontown area. The extensions would provide new service north of the railroad tracks and eliminate existing septic systems south of the tracks.

The Uniontown area is divided by existing railroad tracks, requiring multiple alternatives for sewer main extensions to provide service on both the north and south sides of the railroad tracks. Four alternatives were developed and evaluated for their ability to collect wastewater from the rezoned parcels. North Sewer Alternative 1 provides service north of the railroad tracks, and South Sewer Alternatives 1, 2, and 3 provide service south of the railroad tracks.

5.1 NORTH SEWER ALTERNATIVE 1

North Sewer Alternative 1 provides service to the parcels north of the railroad via gravity sewer. Under this alternative, the parcels between the railroad and Anthony Street are served by a sewer main that parallels the spur railroad. The parcels north of Anthony Street are bifurcated by an east-west ridge, creating two sewersheds. The portion of the current parcels that drain south will be served by a new 8-inch sewer main along Anthony Street. The parcels that drain north will be served by another new 8-inch sewer main that would be routed through a combination of existing public right-of-way and new utility easement. Flows collected from the Uniontown parcels north of the railroad would be discharged to existing sanitary manhole SMX4314 near Statler Boulevard.

Two options for the location of the railroad crossing were considered for this Alternative. Option 1, as shown on Figure 6, locates the railroad crossing further south, while Option 2 crosses the railroad spur further north. Due to adjacent grade, Option 1 would likely require deeper bore pits than Option 2 but would result in a shorter total length of pipe. The total length of Option 1 is approximately 4,580 LF, while Option 2 involves approximately 4,940 LF of new 8-inch gravity sewer. While Option 2 involves a greater length of pipe, this route would likely result in less disruption to concrete plant operations. The downstream portion of Option 2 would require installation against grade to discharge to manhole SMX4314. GIS information verified in the field by the City indicates that manhole SMX4314 is approximately 7.5 feet deep. This depth would likely make Option 2 infeasible, due to insufficient cover upstream. The inverts of existing sewer infrastructure and adjacent grade must be surveyed during detailed design to verify the feasibility of Option 2 and to further develop an alignment that would minimize the impact to operation of the concrete plant.

An alternative to provide sewer service to the parcels north of the railroad is to install a pump station and force main. However, conveyance of wastewater collected on the north side of the railroad would require similar gravity sewer infrastructure to that proposed in North Sewer Alternative 1 in addition to a pump station and force main, or potentially multiple pump stations to route flows over the ridge along Parcels 1848 and 1876. A pump



station may be required at the railroad crossing for Option 1 due to a swale on the west side of the tracks that may provide insufficient cover for the sewer line. Detailed survey is needed in this area to verify.

Serving the area north of the railroad with gravity sewer is the preferred alternative because it minimizes both operations and maintenance and capital expense compared to a pump station alternative. However, the gravity sewer alternative requires modeling and evaluation of the collection system downstream of Statler Boulevard to ensure adequate capacity.

5.2 SOUTH SEWER ALTERNATIVE 1

South Sewer Alternative 1 involves the installation of approximately 4,300 LF of new 8-inch gravity sewer to collect sanitary waste from parcels south of the railroad. The new sewers proposed in this alternative include a gravity sewer along National Avenue draining north, new sewers along Patton and Jones Street draining west, and approximately 2,600 LF of gravity sewer along the south side of the railroad to collect and convey sewage from Uniontown to Statler Boulevard. The proposed gravity sewer infrastructure included in South Sewer Alternative 1 is displayed in Figure 7 of Appendix A.

Flows collected from Uniontown would be discharged to the existing sanitary manhole SMX3417 at the west side of the Valley Building Supply property. The gravity sewer crossing Statler Boulevard downstream of the Valley Building Supply property is 6-inch pipe per GIS information. However, the City has not been able to locate this manhole, and the 6-inch pipe may be a private sanitary lateral. The City may have to assume control of this sewer line and replace it with larger diameter pipe depending on the current flow rates through the existing sewer. Conveying wastewater flows to Statler Boulevard would eliminate the need for a pump station and force main, which would be required to send flows from Uniontown to the existing sanitary main on Richmond Avenue. The elimination of a pump station and force main would reduce the operation and maintenance costs associated with the new sanitary sewer infrastructure. However, conveying wastewater to Statler Boulevard by gravity would require easement acquisition from several properties along the south side of the railroad tracks, including easement for approximately 440 LF of gravity sewer across the Valley Building Supply property. Properties along the proposed alignment for South Sewer Alternative 1 west of Uniontown would also be able to connect to the proposed gravity sewer, though these connections would require further verification of capacity.

In addition to the requirement for easement from several parcels, constructing gravity sewer to Statler Boulevard would require aligning the proposed sewer main to avoid low lying areas such as the north end of Parcel 729, or installation at greater depths to maintain sufficient slope and cover. Near Young Street, the proposed gravity sewer would likely need to be routed around the existing homes and installed against grade before crossing the Valley Building Supply lot.

While the installation of gravity sewer would minimize the operations and maintenance challenges and expense associated with a pump station, this alternative requires further modeling and evaluation of the collection system downstream of Statler Boulevard to ensure adequate capacity.



5.3 SOUTH SEWER ALTERNATIVE 2

South Sewer Alternative 2 involves the installation of approximately 3,700 LF of new 8-inch gravity sewer to collect sanitary waste from parcels south of the railroad. This alternative modifies South Sewer Alternative 1 to route the sewage collected from National Avenue, Patton Street, and Jones Street north under the railroad to connect to North Sewer Alternative 1, Option 1 enroute to existing sanitary manhole SMX4314. This alternative, displayed in Figure 8 of Appendix A, reduces the length of sewer installation required on or adjacent to existing roads and decreases the complexities involved with routing through the Valley Building Supply property, including grade and adjacent structures. However, it requires a jack and bore railroad crossing under the CSX mainline. The new sewers proposed in this alternative include a gravity sewer along National Avenue draining north, new sewers along Patton and Jones Street draining west, and approximately 1,320 LF of gravity sewer along Jones Street parallel to the railroad, under the railroad, and to the concrete plant.

5.4 SOUTH SEWER ALTERNATIVE 3

South Sewer Alternative 3 involves the installation of a new pump station, 1,300 LF of 4-inch force main, and 2,500 LF of new 8-inch gravity sewer to collect wastewater from Uniontown parcels south of the railroad. South Sewer Alternative 3 includes a similar gravity sewer collection network to South Sewer Alternatives 1 and 2, including gravity sewer along National Avenue draining north towards the railroad, with additional gravity sewers along Patton Street, Jones Street, and south of the railroad to collect wastewater from parcels along Jones and Patton Streets. Flows collected from these gravity mains will be conveyed to a new pump station at the west end of the Uniontown service area and pumped to the gravity sewer main along Richmond Avenue. The proposed gravity sewer infrastructure included in South Sewer Alternative 3 is displayed in Figure 9 of Appendix A.

This alternative would reduce the extent of potential utility easements compared to South Sewer Alternative 1, while also preventing the need for deep installation that may be necessary in downstream portions of South Alternative 1. However, land acquisition will be required to facilitate the construction of the new pump station. Additionally, the installation of a new pump station and force main would result in increased maintenance and operations expenses, such as equipment repairs and electricity costs.

In addition to collection of wastewater from parcels within the rezoned portion of Uniontown, this alternative would provide the opportunity to extend gravity sewer west from the proposed pump station and collect additional parcels south of the railroad. Future collection of additional parcels outside the rezoned portion of Uniontown would require verification of pump station and force main capacity.



6 OPINION OF PROBABLE COST

6.1 COST OPINION METHODOLOGY

Following desktop review and evaluation of the proposed alternatives, an opinion of probable cost was prepared for each alternative. These cost opinions are intended to provide comparison of the anticipated construction costs for each option, as well as aid in future budgeting for design and construction phases of the proposed water and sewer extensions.

Costs associated with the construction of the proposed alternatives were developed using unit prices from similar projects for the installation of water and sewer pipe, as well as prices for appurtenant items including valves, hydrants, fittings, manholes, and surface restoration. A detailed take-off for the quantities of these appurtenant items was not completed for this study and are instead accounted for in the unit price per foot of pipe. The unit prices per foot of pipe were developed based on the required minimum spacing between valves and hydrants per the City of Staunton standards, as well as an estimated average spacing between sewer manholes. All costs are provided in 2021 dollars. Escalation factors for inflation and increases in material cost should be applied to estimate costs in future dollars.

Final construction costs will depend on actual labor, material, and equipment costs; competitive market conditions; actual site conditions; final project scope; implementation schedule; and other factors that cannot be precisely quantified at the current level of detail. To account for potential variations in final construction costs, a 30 percent contingency was included with the estimated construction costs.

6.2 COST OPINION

Table 6-1 provides a summary of the costs associated with the construction of the proposed water alternatives. Construction costs associated with the proposed sewer alternatives are included in Table 6-2. Cost estimate worksheets for each of the alternatives in this study are provided in Appendix B.

TABLE 6-1: Opinion of Probable Construction Cost – Water Alternatives	
Alternative	TOTAL PROJECT COST
North Water Alternative 1	\$1,173,000
South Water Alternative 1 – Option 1	\$1,002,000
South Water Alternative 1 – Option 2	\$1,205,000
South Water Alternative 2	\$1,042,000



TABLE 6-2: Opinion of Probable Construction Cost – Sewer Alternatives	
Alternative	TOTAL PROJECT COST
North Sewer Alternative 1 – Option 1	\$1,653,000
North Sewer Alternative 1 – Option 2	\$1,668,000
South Sewer Alternative 1	\$1,486,000
South Sewer Alternative 2	\$1,331,000
South Sewer Alternative 3	\$2,782,000



7 CONCLUSIONS

The alternatives defined within this report provide methods of extending water and wastewater utility service to parcels within the Uniontown area. These alternatives provide the backbone of utility service to the region, serving the existing parcels. Subdivision of individual parcels would require additional utility extensions by the developer. The service area includes 44 existing parcels totaling approximately 35 acres that are planned for rezoning to R-2 Low Density Residential District, and an additional parcel that is currently zoned R-2. The Uniontown service area is divided by existing railroad tracks, with approximately 24 acres of private parcels north of the railroad tracks and 11 acres of private parcels south of the tracks. Serving both the north and south portions of Uniontown will require a combination of the alternatives provided in this study to extend utilities to the entire service area.

In addition to extending service, the water main alternatives address existing water quality deficiencies observed both north and south of the railroad tracks. South Water Alternatives 1 and 2 are expected to provide improvements to water quality south of the railroad tracks by eliminating dead ends, and they will increase the redundancy of the water distribution system. North Water Alternative 1 is expected to provide improvements to water quality north of the railroad tracks by eliminating a dead end, and it will increase the redundancy of the water distribution system. The construction of either South Water Alternative 1 or 2 in conjunction with the construction of North Water Alternative 1 would provide water service to the full Uniontown service area and is expected to improve capacity and reduce water age. Further modeling of the existing water system and the proposed extensions would be required to verify the extent of the capacity and water age improvements.

While both South Water Alternatives 1 and 2 provide improved service south of the railroad, these alternatives differ in their method of increasing redundancy in the system. South Water Alternative 1 provides a shorter length of pipe when compared to South Water Alternative 2 but would require the installation of a jack and bore crossing and additional coordination with CSX Transportation and Buckingham Branch Railroad Company.

Extending sewer service to the Uniontown area will require a combination of the alternatives defined in this study. North Sewer Alternative 1 provides gravity sewer service to properties north of the railroad tracks, while South Sewer Alternatives 1, 2, and 3 serve the area south of the tracks by gravity sewer or pump station/force main. All gravity sewers proposed in this report are recommended to be 8-inch diameter, which would provide sufficient capacity for the built-out Uniontown area. If additional properties adjacent to the Uniontown study area are to be served by the proposed sewer alternatives, these capacities must be reviewed to verify the appropriate diameter. Additionally, further evaluation of the downstream sewers on Statler Boulevard and Richmond Avenue is necessary to verify the adequacy of the existing collection system receiving the proposed Uniontown flows. In addition to the total project costs provided in this study, lifecycle costs related to operating and maintaining a pump station should be considered when comparing South Sewer Alternatives 1, 2, and 3.



Planning and design efforts following this study should include a preliminary engineering level study that includes water and sewer system modeling, more detailed topographic analysis, and coordination with landowners to recommend preferred alternatives.

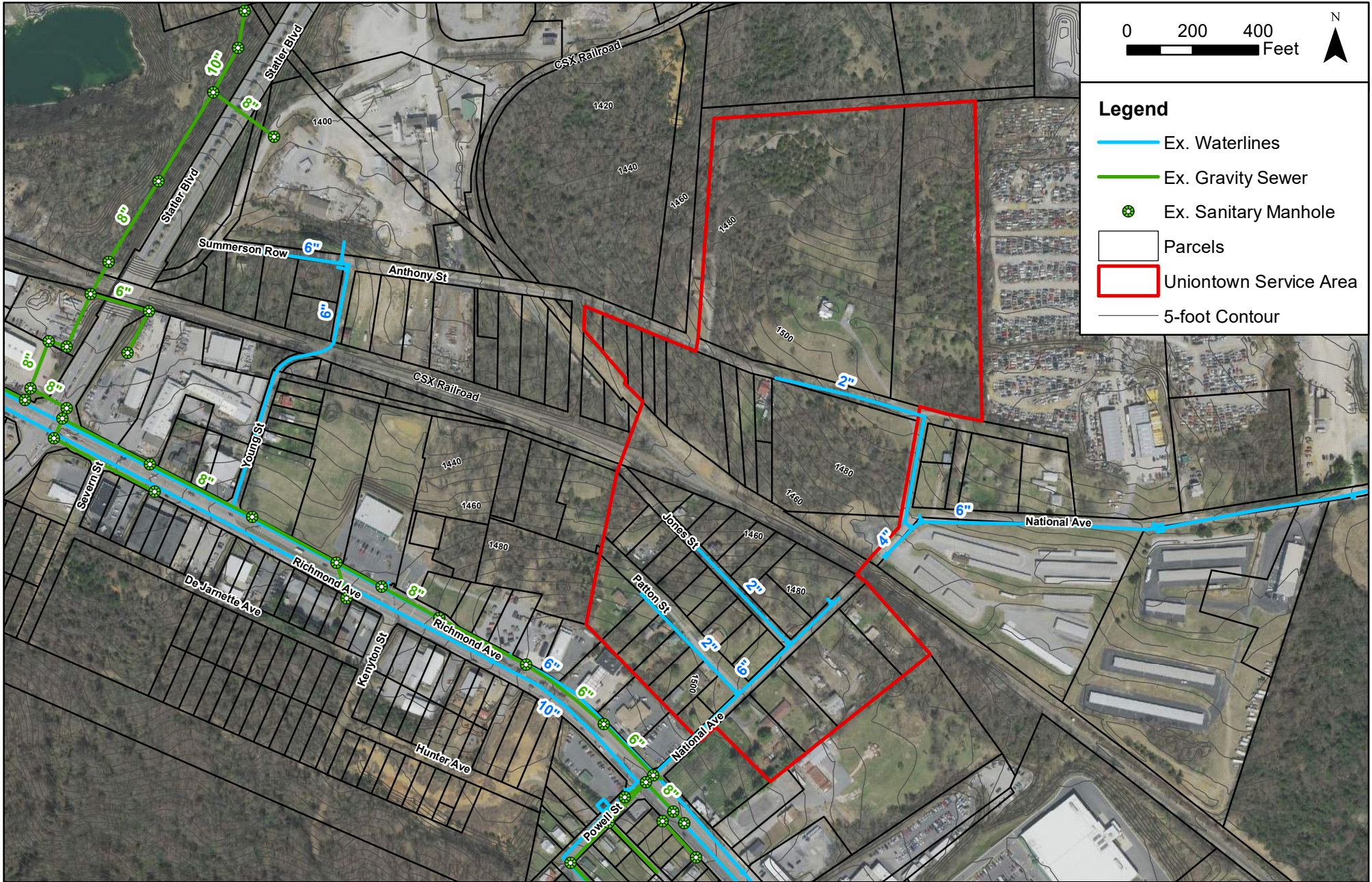


Appendix A

Figures



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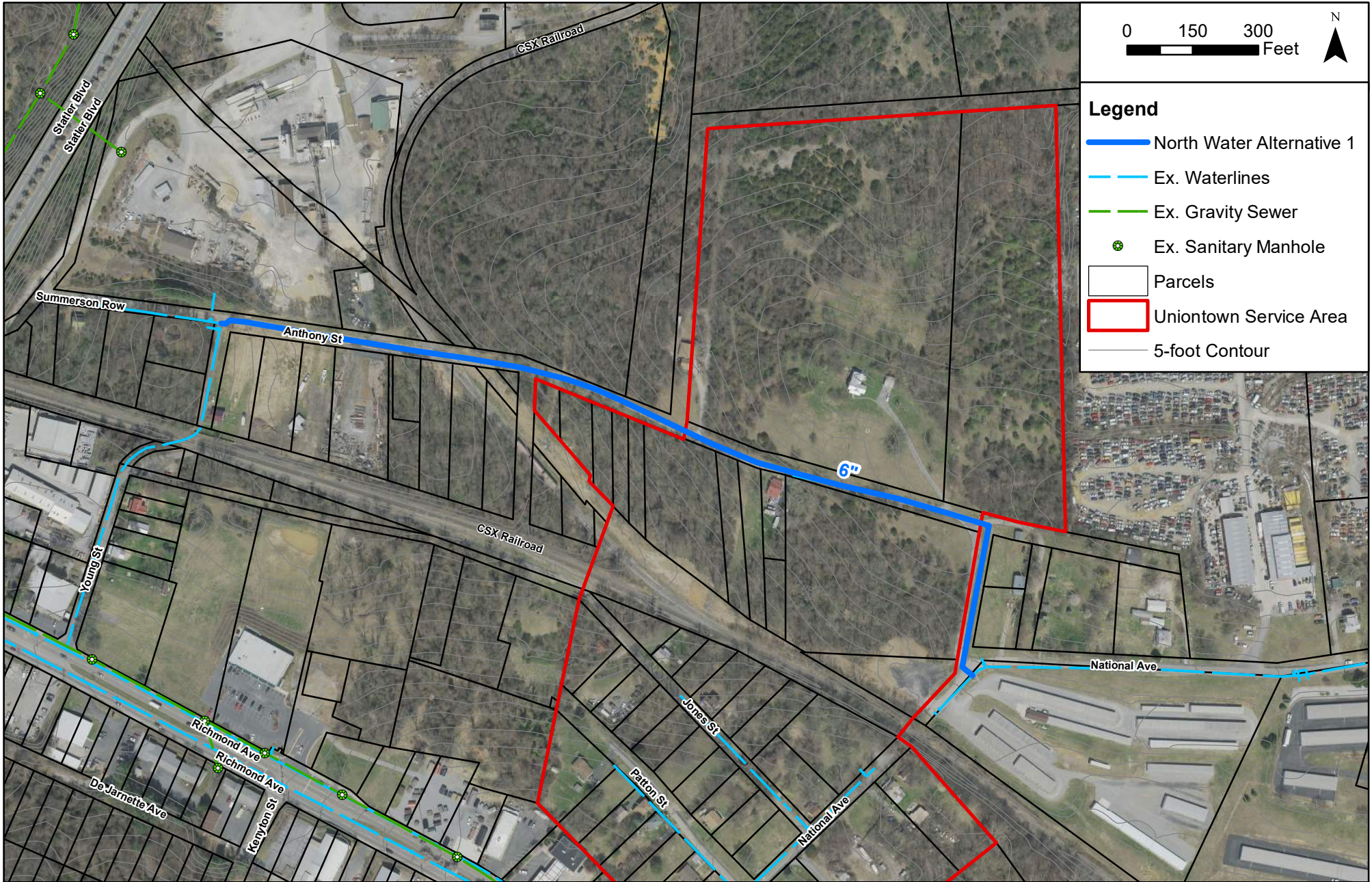


CITY OF STAUNTON, VIRGINIA
DEPARTMENT OF PUBLIC WORKS

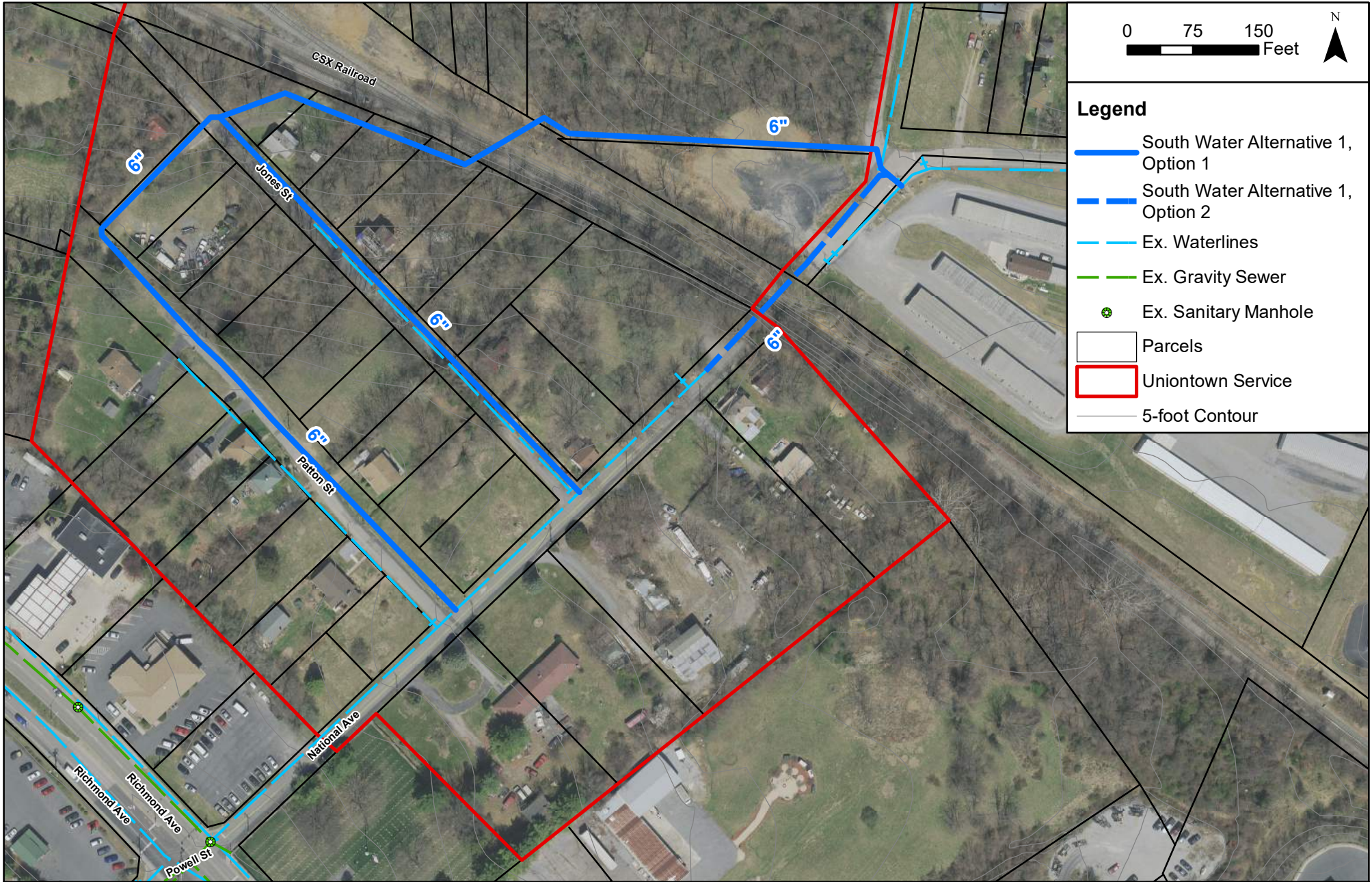
UNIONTOWN WATER AND SEWER STUDY

Existing Utility Infrastructure

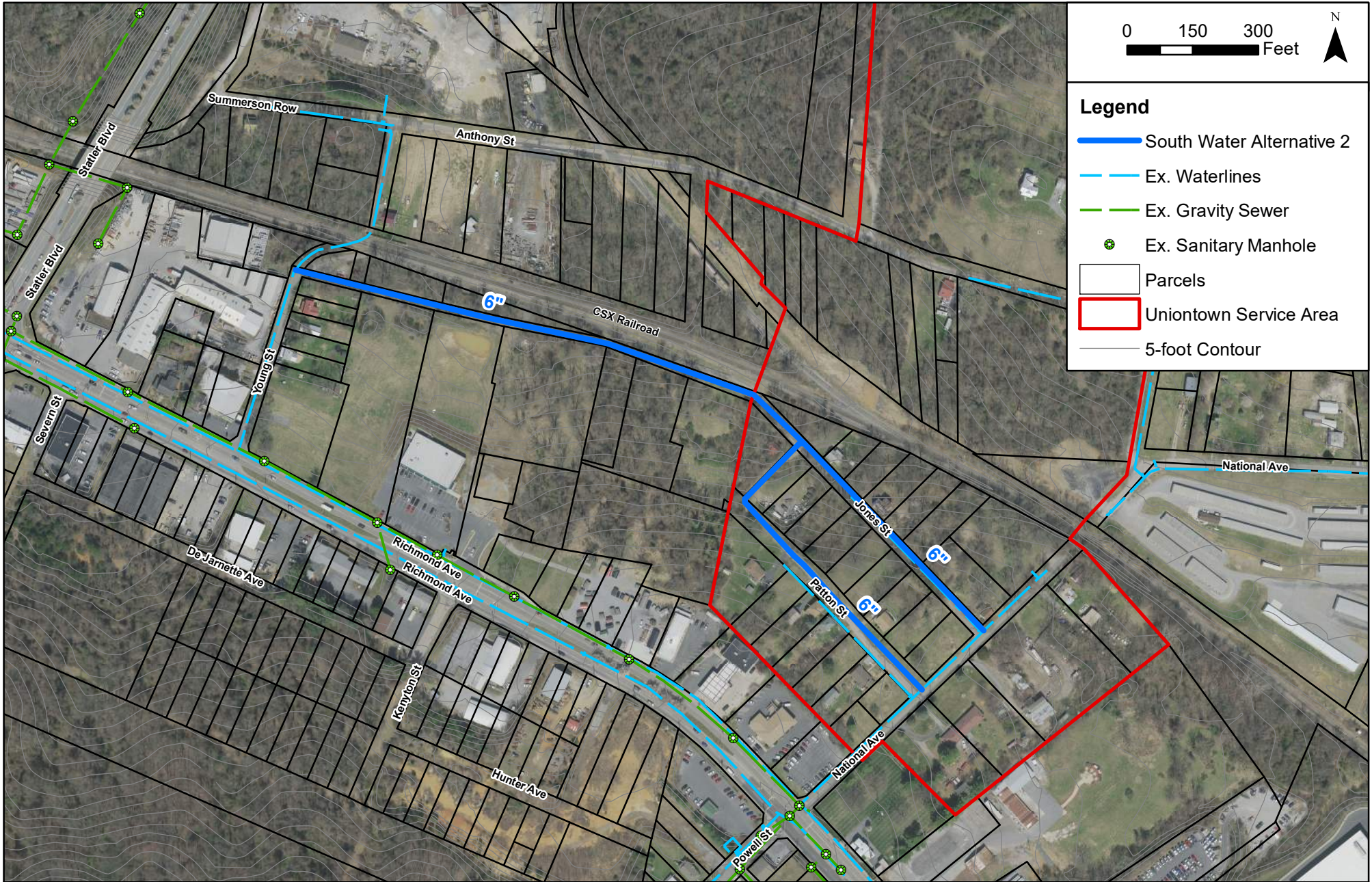
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WW NO.:	221075.00
CONTRACT NO.:	---
FIGURE NUMBER:	2



	CITY OF STAUNTON, VIRGINIA DEPARTMENT OF PUBLIC WORKS	North Water Alternative 1	DATE:	AUGUST 2021
	UNIONTOWN WATER AND SEWER STUDY		WW NO.:	221075.00
			CONTRACT NO.:	---
			FIGURE NUMBER:	3



 Wiley Wilson® Constant Progress	CITY OF STAUNTON, VIRGINIA DEPARTMENT OF PUBLIC WORKS	South Water Alternative 1	DATE:	AUGUST 2021
	UNIONTOWN WATER AND SEWER STUDY		WW NO.:	221075.00
			CONTRACT NO.:	---
			FIGURE NUMBER:	4



Legend

- South Water Alternative 2
- Ex. Waterlines
- Ex. Gravity Sewer
- Ex. Sanitary Manhole
- Parcels
- Uniontown Service Area
- 5-foot Contour

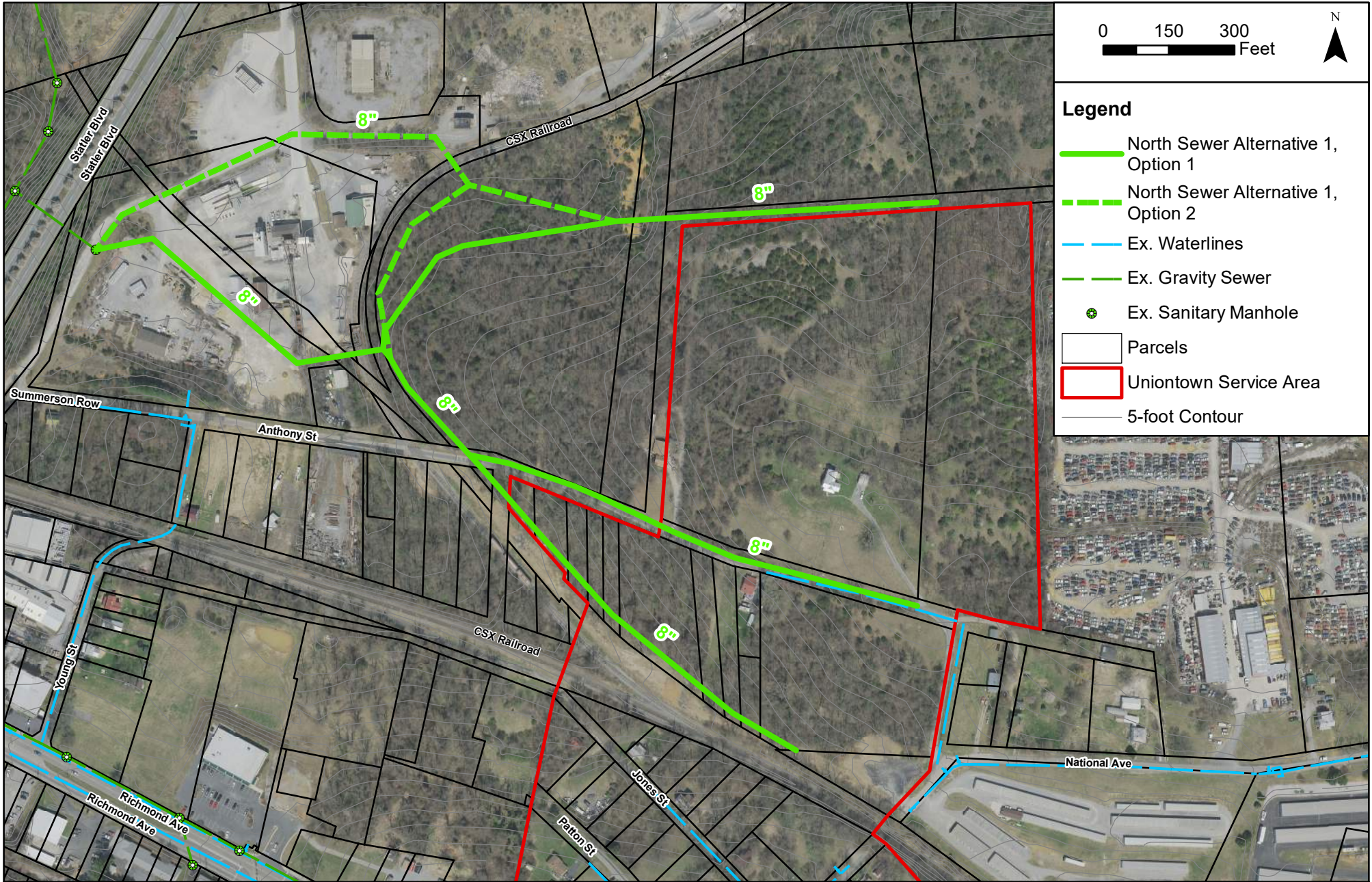


CITY OF STAUNTON, VIRGINIA
DEPARTMENT OF PUBLIC WORKS

UNIONTOWN WATER AND SEWER STUDY

South Water Alternative 2

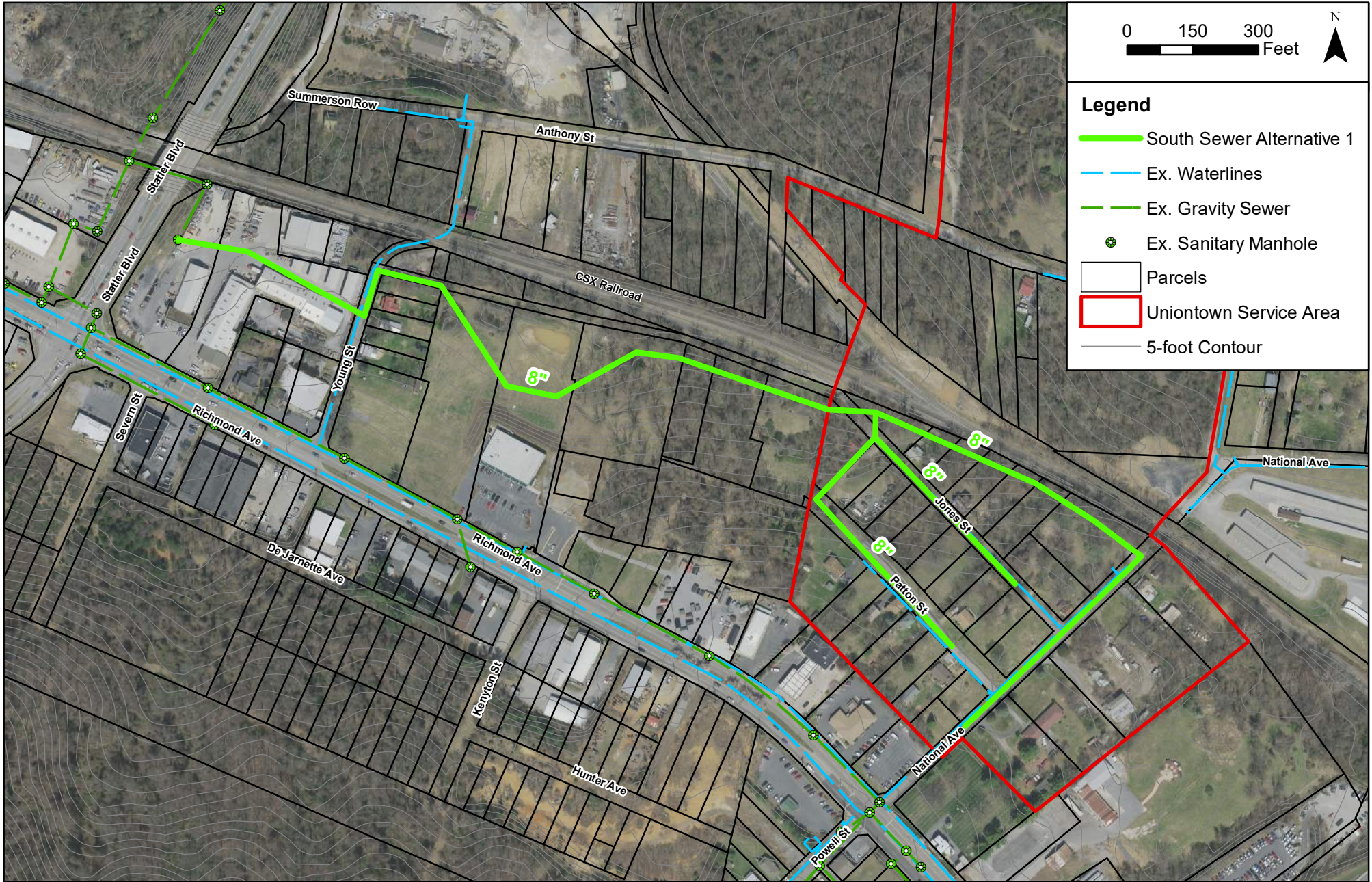
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CONTRACT NO.:	---
FIGURE NUMBER:	5



Legend

- North Sewer Alternative 1, Option 1
- North Sewer Alternative 1, Option 2
- Ex. Waterlines
- Ex. Gravity Sewer
- Ex. Sanitary Manhole
- Parcels
- Uniontown Service Area
- 5-foot Contour

 Wiley Wilson® Constant Progress	CITY OF STAUNTON, VIRGINIA DEPARTMENT OF PUBLIC WORKS	North Sewer Alternative 1	DATE: AUGUST 2021
	UNIONTOWN WATER AND SEWER STUDY		WW NO.: 221075.00
			CONTRACT NO.: ---
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CITY OF STAUNTON, VIRGINIA
DEPARTMENT OF PUBLIC WORKS

UNIONTOWN WATER AND SEWER STUDY

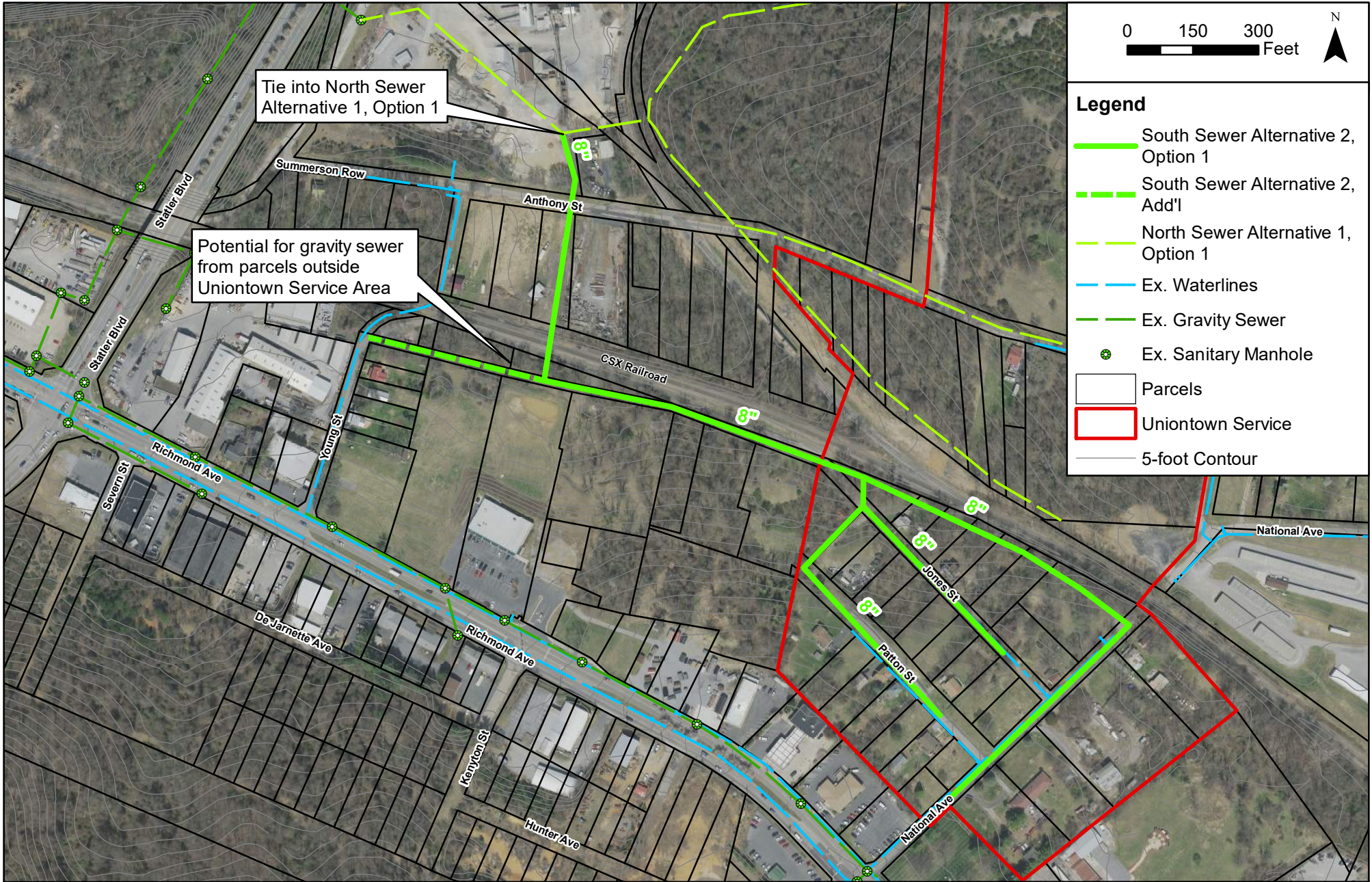
South Sewer Alternative 1

DATE: AUGUST 2021

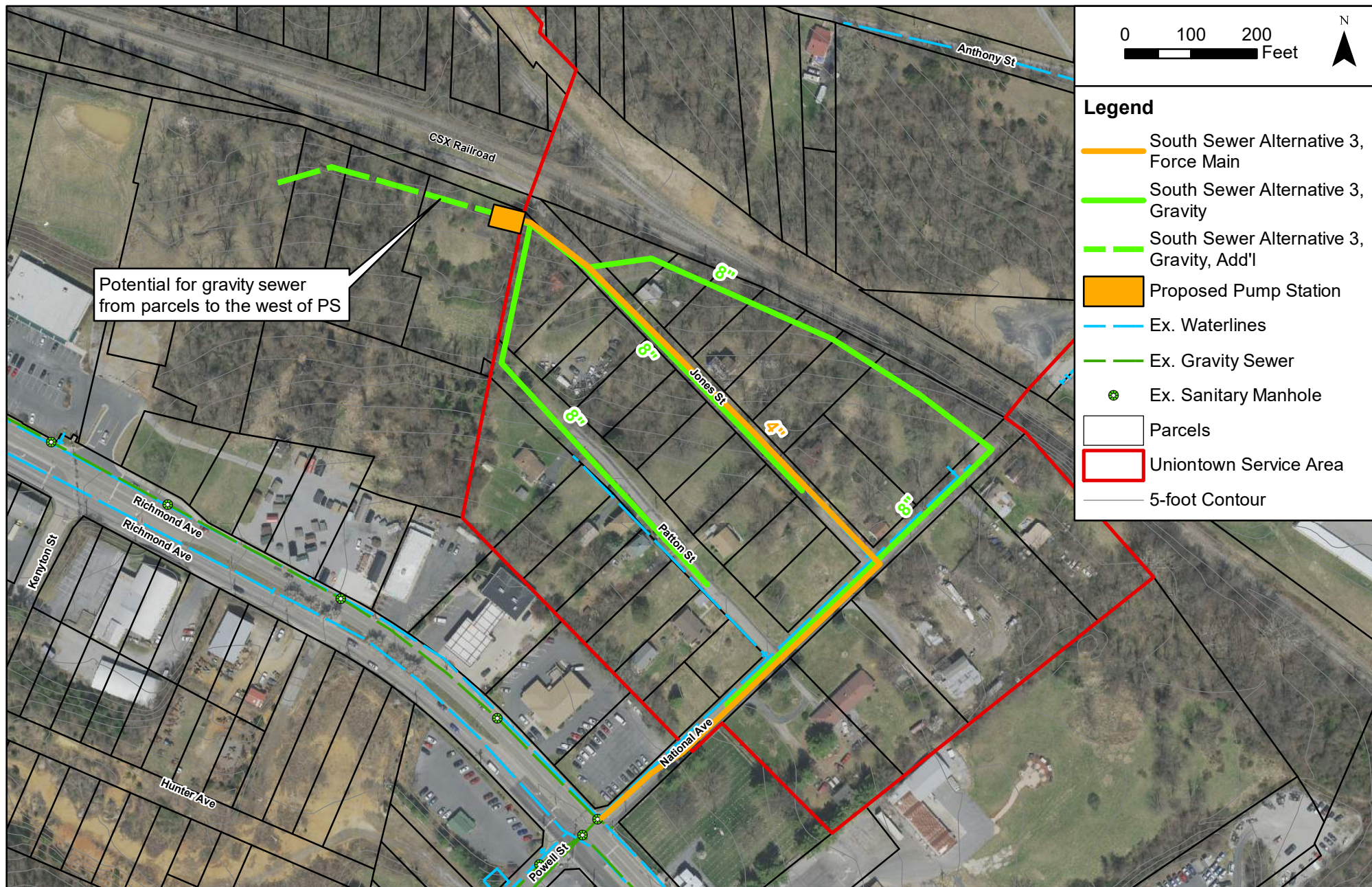
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CONTRACT NO.: ---

FIGURE NUMBER: 7



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	UNIONTOWN WATER AND SEWER STUDY			WW NO.:	221075.00
				CONTRACT NO.:	---
				FIGURE NUMBER:	8





Appendix B

Opinion of Probable Cost



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W|W PROJECT NO.: 221075CALCULATIONS BY: G. HOLLBERG CHECKED BY: T. ELSHOF**Opinion of Probable Cost****NORTH WATER ALTERNATIVE 1**

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	6" Watermain Installation (On-Road)	LF	2,190	\$225	\$492,750
2	Railroad Crossings	---	---	---	---
2a	Bore Pit Excavation	CY	300	\$75	\$22,500
2b	12" Casing Pipe Installation	LF	80	\$250	\$20,000
A	Construction Subtotal	----	-----	-----	\$536,000
B	Overhead	----	40%	of A	\$215,000
C	Contingencies	----	30%	of A+B	\$226,000
D	Construction Total	----	-----	-----	\$977,000
E	Design	----	20%	of D	\$196,000
	PROJECT TOTAL	----		D+E	\$1,173,000

Assumptions

1. Water line unit prices account for inline valves. Average valve spacing assumed to be 800 feet (DPW max spacing is 1,000 ft).
2. Water line unit prices account for hydrant assemblies. Average hydrant spacing assumed to be 400 feet (DPW max for multi-family residential is 500 ft).
3. Water line unit prices account fittings. Assumes 4,000 lb/1,000 ft.
4. On-road water line unit price accounts for pavement patching - assumes 4 ft width of patch and traffic control. Assumes 80 ft/day production.
5. Bore pit excavation assumes 15x30 entrance and exit pits, estimated to be 10 ft deep or less.

WJW PROJECT NO.: 221075CALCULATIONS BY: G. HOLLBERG CHECKED BY: T. ELSHOF**Opinion of Probable Cost****SOUTH WATER ALTERNATIVE 1 - OPTION 1 (Bore)**

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	6" Watermain Installation (On-Road)	LF	1,160	\$225	\$261,000
2	6" Watermain Installation (Off-Road)	LF	1,070	\$140	\$149,800
3	Railroad Crossings	---	---	---	---
3a	Bore Pit Excavation	CY	300	\$75	\$22,500
3b	12" Casing Pipe Installation	LF	95	\$250	\$23,750
A	Construction Subtotal	----	-----	-----	\$458,000
B	Overhead	----	40%	of A	\$184,000
C	Contingencies	----	30%	of A+B	\$193,000
D	Construction Total	----	-----	-----	\$835,000
E	Design	----	20%	of D	\$167,000
	PROJECT TOTAL	----		D+E	\$1,002,000

SOUTH WATER ALTERNATIVE 1 - OPTION 2 (Bridge)

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	6" Watermain Installation (On-Road)	LF	1,310	\$225	\$294,750
2	6" Watermain Installation (Off-Road)	LF	400	\$140	\$56,000
3	Construct New Pipe Bridge	LS	1	\$200,000	\$200,000
A	Construction Subtotal	----	-----	-----	\$551,000
B	Overhead	----	40%	of A	\$221,000
C	Contingencies	----	30%	of A+B	\$232,000
D	Construction Total	----	-----	-----	\$1,004,000
E	Design	----	20%	of D	\$201,000
	PROJECT TOTAL	----		D+E	\$1,205,000

Assumptions

1. Water line unit prices account for inline valves. Average valve spacing assumed to be 800 feet (DPW max spacing is 1,000 ft).
2. Water line unit prices account for hydrant assemblies. Average hydrant spacing assumed to be 400 feet (DPW max for multi-family residential is 500 ft).
3. Water line unit prices account fittings. Assumes 4,000 lb/1,000 ft.
4. On-road water line unit price accounts for pavement patching - assumes 4 ft width of patch and traffic control. Assumes 80 ft/day production.
5. Bore pit excavation assumes 15x30 entrance and exit pits, estimated to be 10 ft deep or less.

WJW PROJECT NO.: 221075CALCULATIONS BY: G. HOLLBERG CHECKED BY: T. ELSHOF**Opinion of Probable Cost****SOUTH WATER ALTERNATIVE 2**

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	6" Watermain Installation (On-Road)	LF	1,260	\$225	\$283,500
2	6" Watermain Installation (Off-Road)	LF	1,370	\$140	\$191,800
A	Construction Subtotal	-----	-----	-----	\$476,000
B	Overhead	-----	40%	of A	\$191,000
C	Contingencies	-----	30%	of A+B	\$201,000
D	Construction Total	-----	-----	-----	\$868,000
E	Design	-----	20%	of D	\$174,000
	PROJECT TOTAL	-----		D+E	\$1,042,000

Assumptions

1. Water line unit prices account for inline valves. Average valve spacing assumed to be 800 feet (DPW max spacing is 1,000 ft).
2. Water line unit prices account for hydrant assemblies. Average hydrant spacing assumed to be 400 feet (DPW max for multi-family residential is 500 ft).
3. Water line unit prices account fittings. Assumes 4,000 lb/1,000 ft.
4. On-road water line unit price accounts for pavement patching - assumes 4 ft width of patch and traffic control. Assumes 80 ft/day production.
5. Bore pit excavation assumes 15x30 entrance and exit pits, estimated to be 10 ft deep or less.

WJW PROJECT NO.: 221075CALCULATIONS BY: G. HOLLBERG CHECKED BY: T. ELSHOF**Opinion of Probable Cost****NORTH SEWER ALTERNATIVE 1 - OPTION 1**

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	8" Gravity Sewer (On-road)	LF	1,880	\$215	\$404,200
2	8" Gravity Sewer (Off-road)	LF	2,700	\$110	\$297,000
3	Railroad Crossings	---	---	---	---
3a	Bore Pit Excavation	CY	400	\$75	\$30,000
3b	16" Casing Pipe Installation	LF	80	\$300	\$24,000
A	Construction Subtotal	----	-----	-----	\$756,000
B	Overhead	----	40%	of A	\$303,000
C	Contingencies	----	30%	of A+B	\$318,000
D	Construction Total	----	-----	-----	\$1,377,000
E	Design	----	20%	of D	\$276,000
	PROJECT TOTAL	----		D+E	\$1,653,000

NORTH SEWER ALTERNATIVE 1 - OPTION 2

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	8" Gravity Sewer (On-road)	LF	1,670	\$215	\$359,050
2	8" Gravity Sewer (Off-road)	LF	3,270	\$110	\$359,700
3	Railroad Crossings	---	---	---	---
3a	Bore Pit Excavation	CY	267	\$75	\$20,000
3b	16" Casing Pipe Installation	LF	80	\$300	\$24,000
A	Construction Subtotal	----	-----	-----	\$763,000
B	Overhead	----	40%	of A	\$306,000
C	Contingencies	----	30%	of A+B	\$321,000
D	Construction Total	----	-----	-----	\$1,390,000
E	Design	----	20%	of D	\$278,000
	PROJECT TOTAL	----		D+E	\$1,668,000

Assumptions

1. Sewer line unit prices account for 4-foot diameter MHs. Assumes an average of 300 feet between manholes.
2. On-road sewer line unit price accounts for pavement patching - assumes 5 ft width of patch and traffic control. Assumes 80 ft/day production.
3. Off-road sewer line unit price accounts for clearing and grubbing. Assumes 30 ft wide corridor of clearing.
4. Bore pit excavation assumes 15x30 entrance and exit pits, estimated to be 10 ft deep or less.

W|W PROJECT NO.: 221075CALCULATIONS BY: G. HOLLBERG CHECKED BY: T. ELSHOF**Opinion of Probable Cost****SOUTH SEWER ALTERNATIVE 1**

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	8" Gravity Sewer (On-road)	LF	1,960	\$215	\$421,400
2	8" Gravity Sewer (Off-road)	LF	2,350	\$110	\$258,500
A	Construction Subtotal	-----	-----	-----	\$680,000
B	Overhead	-----	40%	of A	\$272,000
C	Contingencies	-----	30%	of A+B	\$286,000
D	Construction Total	-----	-----	-----	\$1,238,000
E	Design	-----	20%	of D	\$248,000
	PROJECT TOTAL	-----		D+E	\$1,486,000

Assumptions

1. Sewer line unit prices account for 4-foot diameter MHs. Assumes an average of 300 feet between manholes.
2. On-road sewer line unit price accounts for pavement patching - assumes 5 ft width of patch and traffic control. Assumes 80 ft/day production.
3. Off-road sewer line unit price accounts for clearing and grubbing. Assumes 30 ft wide corridor of clearing.
4. Bore pit excavation assumes 15x30 entrance and exit pits, estimated to be 10 ft deep or less.

WJW PROJECT NO.: 221075CALCULATIONS BY: G. HOLLBERG CHECKED BY: T. ELSHOF**Opinion of Probable Cost****SOUTH SEWER ALTERNATIVE 2**

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	8" Gravity Sewer (On-road)	LF	1,400	\$215	\$301,000
2	8" Gravity Sewer (Off-road)	LF	2,320	\$110	\$255,200
3a	Bore Pit Excavation	CY	333	\$75	\$25,000
3b	16" Casing Pipe Installation	LF	90	\$300	\$27,000
A	Construction Subtotal	----	-----	-----	\$609,000
B	Overhead	----	40%	of A	\$244,000
C	Contingencies	----	30%	of A+B	\$256,000
D	Construction Total	----	-----	-----	\$1,109,000
E	Design	----	20%	of D	\$222,000
	PROJECT TOTAL	----		D+E	\$1,331,000

Assumptions

1. Sewer line unit prices account for 4-foot diameter MHs. Assumes an average of 300 feet between manholes.
2. On-road sewer line unit price accounts for pavement patching - assumes 5 ft width of patch and traffic control. Assumes 80 ft/day production.
3. Off-road sewer line unit price accounts for clearing and grubbing. Assumes 30 ft wide corridor of clearing.
4. Bore pit excavation assumes 15x30 entrance and exit pits, estimated to be 10 ft deep or less.
5. Additional line not included in cost estimate.
6. North Sewer Alternative 1, Option 2 required for this alternative to work. Cost of North Sewer Alternative 1, Option 2 not included in this estimate.

W|W PROJECT NO.: 221075CALCULATIONS BY: G. HOLLBERG CHECKED BY: T. ELSHOF**Opinion of Probable Cost****SOUTH SEWER ALTERNATIVE 3**

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL COST
1	8" Gravity Sewer (On-road)	LF	1,520	\$215	\$326,800
2	8" Gravity Sewer (Off-road)	LF	1,000	\$110	\$110,000
3	4" Force Main Installation (On-road)	LF	1,230	\$60	\$73,800
4	4" Force Main Installation (Off-road)	LF	90	\$135	\$12,150
5	Construct New Pump Station	LS	1	\$750,000	\$750,000
A	Construction Subtotal	----	-----	-----	\$1,273,000
B	Overhead	----	40%	of A	\$510,000
C	Contingencies	----	30%	of A+B	\$535,000
D	Construction Total	----	-----	-----	\$2,318,000
E	Design	----	20%	of D	\$464,000
	PROJECT TOTAL	----		D+E	\$2,782,000

Assumptions

1. Sewer line unit prices account for 4-foot diameter MHs. Assumes an average of 300 feet between manholes.
2. On-road sewer line unit price accounts for pavement patching - assumes 5 ft width of patch and traffic control. Assumes 80 ft/day production.
3. Off-road sewer line unit price accounts for clearing and grubbing. Assumes 30 ft wide corridor of clearing.
4. Bore pit excavation assumes 15x30 entrance and exit pits, estimated to be 10 ft deep or less.
5. Additional line not included in cost estimate.