

Preliminary Cost Estimates and General Sequencing of Master Plan

***Task 4 of
Contract No. 2020-02***

Prepared for:

City of North Port Utilities

6644 W Price Blvd.
North Port, FL 34291

Prepared by:

Giffels-Webster Engineers, Inc.

900 Pine Street, Suite 225
Englewood, Florida 34223

October 15, 2020

GWE Project # 6450.00

PRELIMINARY COST ESTIMATES AND GENERAL SEQUENCING OF MASTER PLAN

INTRODUCTION

Using the Conceptual Map and the various identified Sewer Areas for Expansion produced in Task 3, “Task 4” consists of developing a general cost estimate as well as suggested construction sequencing of the wastewater expansion areas for consideration.

Several scenarios were developed based upon three fundamental parameters, namely density, status of City Roadway Paving Program, and cost.

Conditional relationships for areas occur due to geographic location of existing force main lines and/or existing lift stations. For example, the primary west to east flow of existing wastewater force main transmission lines on their way to the City’s wastewater treatment plant generally runs along Price Boulevard. Logical sequencing for proposed expansion areas would be to “build out” geographically along Price Boulevard.

Each area planned for construction includes the collection, vacuum / pump station, and force mains within the collection area. All new force mains within each area to be constructed includes: (1) the “pump-out” wastewater transmission line for the area itself, and (2) additional wastewater transmission lines to serve as future point-of-connection for the adjacent area.

The Task 4 scope does not include considerations for Wastewater Plant expansions or upgrades, nor include upgrades for existing wastewater force main transmission lines.

MASTER LIST

The Master List for Sewer Areas from the City of North Port Overall Wastewater Plan is provided herein as (Table 4.00)

The Master List includes (29) identified areas from the City of North Port Overall Wastewater Plan. The Master List order is generally by geographic location of each area, from east to west. Where conditional relationships exist, the conditional wastewater areas are listed in order of a logical construction sequence.

Tabular data for each wastewater collection area lists the following:

- Name of collection area with number of connections and proposed system type
- Number of occupied lots and approximate developed density as a percentage of total lots.
- Extent of existing city water main through the collection area
- Proposed vacuum station property identification number and zoning
- Year of road pavement overlay / maintenance
- Conditional relationships
- Budget estimates for water expansion, collection system costs

City of North Port Master Wastewater Plan												
MASTER LIST												
Name of Area	Number of Connections Lots / ERC's	Proposed System Type	Number of Occupied Lots	Approximate Density % Developed	Existing City Water Main Through the Area	Proposed Vac Station PID Number	Proposed Vac Station Lot Zoning	Year of Road Pavement Overlay / Maint	Conditional on FM already built for Vac Station	Water Cost (\$M)	Sewer Area Cost (\$M)	TOTAL Cost (\$M)
LANCELOT/GLENALLEN/FLORIBANNA *	1,864	Vacuum	664	36%	20%	0973-17-0428	RSF2	PAVED 2018	01.0 - N/A	11.2	28.0	39.1
MERONI PARADISE *	1,514	Vacuum	623	41%	10%	0950-13-5215	RSF2	PAVED 2016	01.1a - Lancelot	10.2	22.7	32.9
SKYVIEW/PONCE DE LEON *	1,796	Vacuum	517	29%	10%	0969-06-5413	RSF2	10% 2016	01.1b - Lancelot	12.1	26.9	39.1
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LADYSLIPPER NORTH	544	PAC-VAC	51	9%	0%	0954-14-1754	RSF2	PAVED 2016	02.1 - Ladyslipper	4.1	8.2	12.2
LORRI CIRCLE	27	Gravity	15	56%	0%	Right of Way	RSF2 (ROW)	PAVED 2016	02.2 - Ladyslipper and Ladyslipper North	0.2	0.4	0.6
SUNBURST	1,283	Vacuum	625	49%	10%	0956-14-3728	RSF2	PAVED 2016	03.0 - N/A	8.7	19.2	27.9
MADAGASCAR	2,058	Vacuum	834	41%	20%	0956-14-4263	RSF2	50% 2017	04.0 - N/A	12.3	30.9	43.2
CRANBERRY FIELDS EAST	1,444	Vacuum	593	41%	NO (Only Cranberry Blvd)	0961-11-2450	RSF2	PAVED 2021	05.0 - N/A	10.8	21.7	32.5
CRANBERRY FIELDS NORTH	1,235	Vacuum	361	29%	NO (Only Cranberry Blvd)	0960-11-2236	RSF2	PAVED 2020	05.1 - Cranberry E	9.3	18.5	27.8
CRANBERRY FIELDS SOUTH	1,375	Vacuum	609	44%	NO (Only Cranberry Blvd)	0964-08-4912	RSF2	PAVED 2020	06.0 - N/A	10.3	20.6	30.9
BLUE RIDGE-SALFORD NORTH	1,583	Vacuum	993	63%	60%	0980-03-9221	RSF2	PAVED 2016	07.0 - N/A	4.7	23.7	28.5
BLUE RIDGE-SALFORD SOUTH	1,467	Vacuum	1022	70%	80%	1003-00-8009	RSF2	30% 2016	07.1 - Blue Rdg-Salford N	2.2	22.0	24.2
SUMTER GARDENS	537	PAC-VAC	243	45%	10%	0991-19-0946	RSF2	PAVED 2016	08.0 - N/A	3.6	8.1	11.7
NORTH PORT GARDENS NORTH	1,882	Vacuum	891	47%	20%	0980-04-1544	RSF2	60% 2019 - 2021 100%	09.0 - N/A	11.3	28.2	39.5
NORTH PORT GARDENS SOUTH	1,900	Vacuum	891	47%	30%	0990-03-2036	RSF2	PAVED 2019	09.1 - NP Gardens N	10.0	28.5	38.5
CHAMBERLIN NORTH	1,667	Vacuum	780	47%	20%	0982-04-7228	RSF2	60% 2019 - 2021 100%	10.0 - N/A	10.0	25.0	35.0
CHAMBERLIN MID	1,603	Vacuum	718	45%	5%	0988-01-3223	RSF2	PAVED 2018	10.1 - Chamberlin N	11.4	24.0	35.5
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TOLEDO BLADE	1,626	Vacuum	389	24%	0%	1118-16-8641	GU (SCHOOL)	0%	12.0 - N/A	12.2	24.4	36.6
HABERLAND SOUTH	1,404	Vacuum	420	30%	NO (Only on S. Haberland Blvd, Jeannin Dr)	1140-17-7431	RSF2	80% 2017	12.1 - Toledo Blade	10.5	21.1	31.6
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SAN MATEO NORTH	1,848	Vacuum	549	30%	NO (Only on San Mateo Dr, E. Price Blvd)	1122-08-8230	GU (PARK)	PAVED 2017	15.0 - N/A	13.9	27.7	41.6
SAN MATEO SOUTH	1,918	Vacuum	574	30%	NO (Only on San Mateo Dr)	1143-07-4424	RSF2	25% 2017	15.1 - San Mateo N	14.4	28.8	43.2
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Total	43,812		15,940	36%						291	657	949

* FL Scrubjay Permit Area affects 20% to 50% of these Lots

- Notes: (1) Water Cost is computed at \$7,500 per Lot / ERC (for Lots where existing City Water not available)
(2) Sewer Area Cost computed at \$15,000 per Lot / ERC
(includes Sewer Collection, Vacuum / Pump Station, and Sewer FM)
(3) TOTAL Cost = Water Cost + Sewer Area Cost

Legend

Good / Attractor Parameter

Detracter Parameter

Area is Conditional - needs FM constructed in another area

Area is small and proposed to be served by either Gravity or PAC-VAC Sewer System

HISTORIC COSTS

Comparative construction costs were developed for some areas in Task 1 for the purpose of determining which type of collection was the most cost effective for a given area. However, without a specific design layout for each area to at least the 30% level, obtaining accurate quantities and pricing for specific areas cannot be achieved.

What can be done is to look at other completed projects in Florida that have similar characteristics as North Port in order to provide a *budget level estimate* of total project cost per connection. We provide a collection system cost comparison (Table 4.01) from other areas outside North Port to compare overall past collection system costs (design and construction) for similar septic to sewer projects built within the last five years.

Those historic cost comparisons are then used to estimate appropriate costs (2020 Dollars) for new water and wastewater utility project construction costs per ERC (Equivalent Residential Connection), summarized as follows:

Total Vacuum Sewer	\$ 15,000 per ERC
Total Water System	\$ 7,500 per ERC

The above figures include project “soft costs” such as survey, design, easements, station site cost, and legal costs; as well as the construction costs.

What is *not included* are any plant capacity fees, transmission fees, connection fees or any other base utility fees. Costs for the “on lot” connection from the structure to the right of way line, as well as septic tank abandonment are also *not* included.

The cost per ERC is for the current year (2020), so cost escalators may be appropriate as time goes on.

City of North Port Master Wastewater Plan														
HISTORIC SEPTIC TO SEWER PROJECT COST COMPARISON														
COUNTY	PROJECT NAME	YEAR BID	ERC'S	VACUUM PUMPING STATION	COLLECTION SYSTEM	TOTAL SYSTEM CONSTRUCTION	TOTAL SYSTEM CONSTRUCTION	Soft costs* per ERC	TOTAL VACUUM SEWER	POTABLE WATER SYSTEM CONSTRUCTION	WATER ERCs	WATER SYSTEM	Soft costs* per ERC	TOTAL WATER SYSTEM
							Cost/ERC	x 30%	Cost/ERC			Cost/ERC	x 25%	Cost/ERC
MARTIN	GOLDEN GATE	2020	775	\$ 1,655,000	\$ 10,343,244	\$ 11,998,244	\$ 15,482	\$ 4,644	\$ 20,126					
MARTIN	NORTH RIVER SHORES II	2018	300	\$ 1,498,025	\$ 4,047,686	\$ 5,545,711	\$ 18,486	\$ 5,546	\$ 24,031					
CHARLOTTE	ACKERMAN COUNTRYMAN	EOPC	1,696	\$ 1,500,000	\$ 19,702,366	\$ 21,202,366	\$ 12,501	\$ 3,750	\$ 16,252	\$ 9,543,352	1,696	\$ 5,627	\$ 1,407	\$ 7,034
CHARLOTTE	SPRING LAKE CONTRACT D	2017	504	\$ 1,545,715	\$ 3,285,934	\$ 4,831,649	\$ 9,587	\$ 2,876	\$ 12,463	\$ 1,841,385	504	\$ 3,654	\$ 913	\$ 4,567
CHARLOTTE	SPRING LAKE CONTRACTS A,B,C	2016	2,195	\$ 1,467,000	\$ 19,384,984	\$ 20,851,984	\$ 9,500	\$ 2,850	\$ 12,350					
CHARLOTTE	EL JOBEAN	2020	612	\$ 1,467,001	\$ 5,749,148	\$ 7,216,149	\$ 11,791	\$ 3,537	\$ 15,328					
SARASOTA	PCSSRP: AREA O&P	2015	1,300	\$ 947,810	\$ 11,743,132	\$ 12,690,942	\$ 9,762	\$ 2,929	\$ 12,691	\$ 4,586,121	723	\$ 6,343	\$ 1,586	\$ 7,929
	ALL PROJECTS Average								\$ 16,177					\$ 6,510
							Cost/ERC	x 30%	Cost/ERC			Cost/ERC	x 25%	Cost/ERC
CHARLOTTE	ACKERMAN COUNTRYMAN	EOPC	1,696	\$ 1,500,000	\$ 19,702,366	\$ 21,202,366	\$ 12,501	\$ 3,750	\$ 16,252	\$ 9,543,352	1,696	\$ 5,627	\$ 1,407	\$ 7,034
CHARLOTTE	SPRING LAKE CONTRACTS A,B,C	2016	2,195	\$ 1,467,000	\$ 19,384,984	\$ 20,851,984	\$ 9,500	\$ 2,850	\$ 12,350					
SARASOTA	PCSSRP: AREA O&P	2015	1,300	\$ 947,810	\$ 11,743,132	\$ 12,690,942	\$ 9,762	\$ 2,929	\$ 12,691	\$ 4,586,121	723	\$ 6,343	\$ 1,586	\$ 7,929
	COMPARABLE SIZE PROJECTS Average								\$ 13,764					\$ 7,481
	Future Budget Estimate/ERC (2020 Dollars)								\$ 15,000					\$ 7,500
*Soft costs include survey, design, easements, station site cost, legal costs														

RECOMMENDED PROGRAM SEQUENCING

There are several options that the City can select to proceed with the overall program. These options include proceeding based on:

- Maximum developed density (conversely based on lowest density)
- Pavement age (installing utilities in the oldest pavement areas first)
- Total project cost (starting with the lowest cost first)

GWE recommends the following sequencing of projects for each of the three options, further described as follows.

PROJECT SEQUENCE – BASED ON DENSITY

If the City decides to proceed based on developed *density* then the recommended sequencing is provided in Table 4.1.

That tabular format is depicted on Map 4.1.

The (29) rows of identified areas are sorted by approximate density % developed. The sort order is “high to low” and outlying high density figures are indicated as a good / attracter parameter. High density areas may be considered “good” with respect to choosing to maximize the number of septic to sewer conversions in selecting an Area for design and construction. Outlying high-density areas include:

- BLUE RIDGE-SALFORD NORTH (Density 63% Developed)
- BLUE RIDGE-SALFORD SOUTH (Density 70% Developed)

Low density areas may be desirable because the number of homeowners affected by a project would be minimal. Outlying low density areas include:

- ATWATER NORTH (Density 16% Developed)
- ATWATER SOUTH (Density 17% Developed)
- CONSTITUTION * (Density 13% Developed)

All the project sequence tables contain a color coding legend of attracter / detractor parameters, gray shading for *conditionality* where there is a logical construction sequence, and a color code for the (3) small collection areas planned for service by gravity or PAC-VAC System. Note that there are (4) areas (Name *) where Florida Scrub jay permitting *may* affect 20% to 50% of those lots.

Also note that the conditionality of an area is not intended to be a restrictive parameter. A “conditional” project may be engaged out of logical sequence. In that case, work outside of the conditional area would be needed to construct new “pump-out” force main through other collection areas in order to reach an existing point of connection.

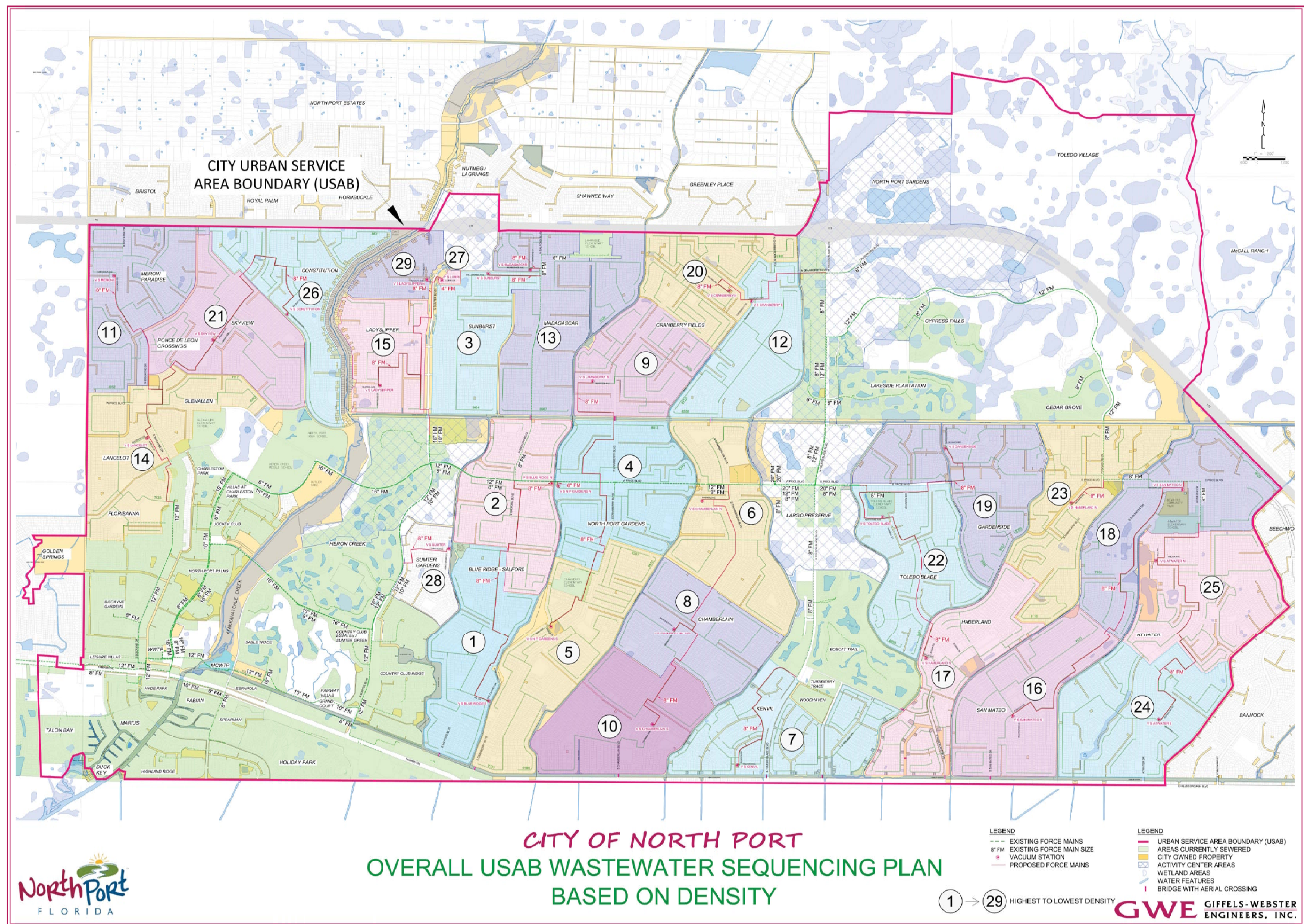
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* FL Scrubjay Permit Area affects 20% to 50% of these Lots

- Notes: (1) Water Cost is computed at \$7,500 per Lot / ERC (for Lots where existing City Water not available)
(2) Sewer Area Cost computed at \$15,000 per Lot / ERC (includes Sewer Collection, Vacuum / Pump Station, and Sewer FM)
(3) TOTAL Cost = Water Cost + Sewer Area Cost

Legend

- Good / Attractor Parameter
- Detractor Parameter
- Area is Conditional - needs FM constructed in another area
- Area is small and proposed to be served by either Gravity or PAC-VAC Sewer System



PROJECT SEQUENCE BASED ON PAVEMENT AGE

If the City decides to proceed based on pavement age or percent paved, then the recommended sequencing is provided in Table 4.2.

The tabular format in this spreadsheet is also shown as Map 4.2.

The City of North Port has implemented a comprehensive paving program from 2016 to the present, with substantial completion of paving program in 2021. The paving parameter may be considered “unfavorable” for a future collection area, where the area was very recently paved and the expansion project necessarily requires extensive cutting, trenching and restoration of all the roads.

With nearly all of the areas having received at least some road pavement overlay or maintenance paving, consideration is given to the extent (% of roads paved in a given area) as well as the pavement age so that a “good” choice of project work area may affect more of the oldest roadway pavements.

- TOLEDO BLADE (0% new pavement since 2016)
- SKYVIEW/PONCE DE LEON (10% paved in 2016)
- ** SAN MATEO SOUTH (25% paved in 2017)
- CONSTITUTION (30% paved in 2016)
- BLUE RIDGE-SALFORD SOUTH (30% paved in 2016)

** San Mateo from Hillsborough to Price Blvd: new water main & sidewalk under construction in 2020

The following would comprise the “unfavorable” list of very recently paved areas:

- NORTH PORT GARDENS NORTH (to be 100% paved in 2021)
- CHAMBERLIN NORTH (to be 100% paved in 2021)
- CRANBERRY FIELDS EAST (to be 100% paved in 2021)
- CRANBERRY FIELDS NORTH (100% paved in 2020)
- CRANBERRY FIELDS SOUTH (100% paved in 2020)

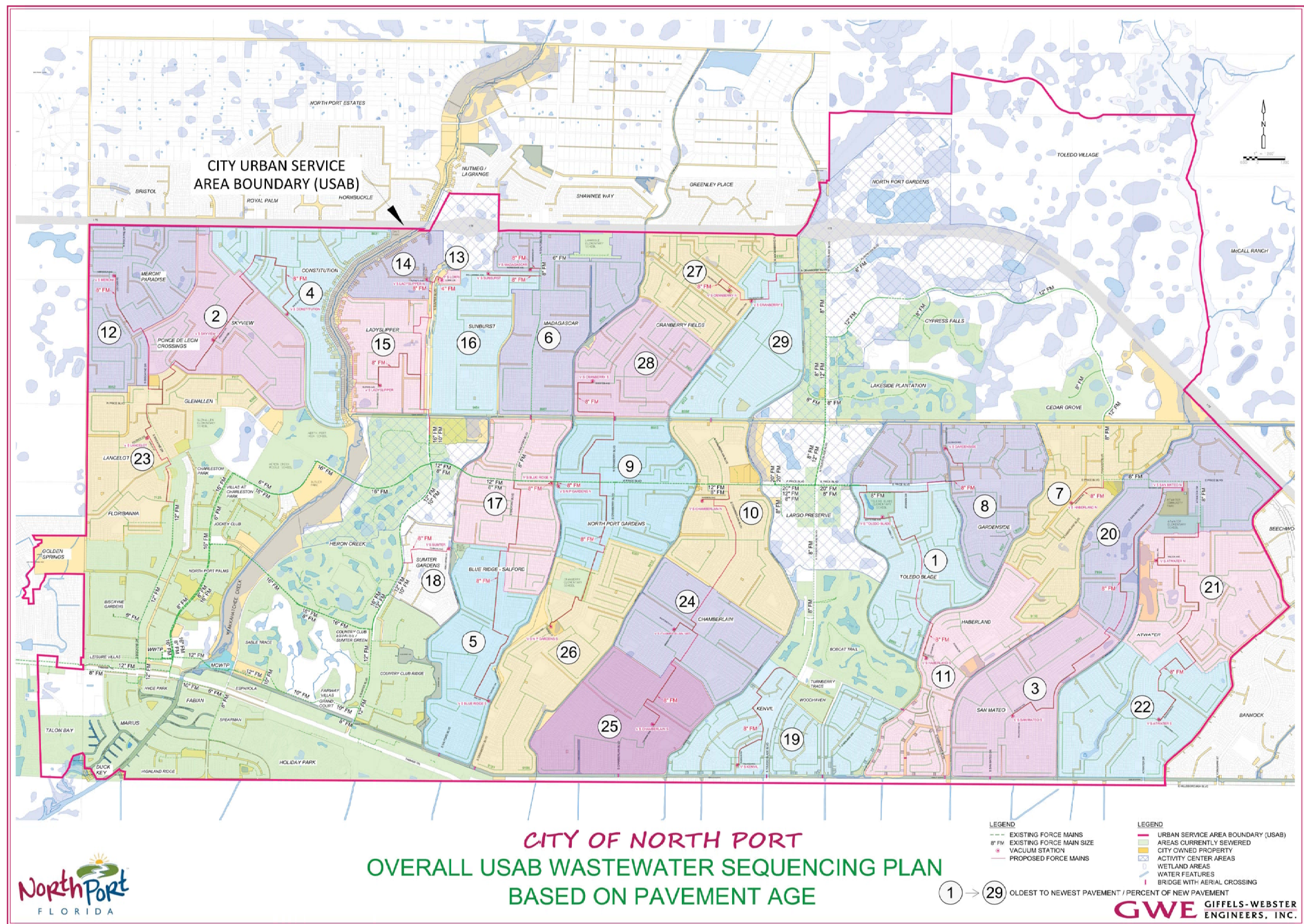
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	Total	43,812		15,940	36%						291	657	949

* FL Scrubjay Permit Area affects 20% to 50% of these Lots

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Legend

- Good / Attractor Parameter
- Detractor Parameter
- Area is Conditional - needs FM constructed in another area
- Area is small and proposed to be served by either Gravity or PAC-VAC Sewer System



PROJECT SEQUENCE BASED ON TOTAL COST

If the City decides to proceed based on total construction cost then the recommended sequencing is provided in Table 4.3.

That same information is also provided graphically as Map 4.3.

PROJECT SEQUENCE BASED ON TOTAL COST – (w/ Grouping of small & conditional areas)

Finally, we sequenced based on construction cost but with *conditional grouping* shown in Table 4.4 and provided as Map 4.4.

The grouping can be summarized as:

Collection areas that are independent of adjacent areas to be built first in order to connect the collection area force main to an existing City force main.

Collection areas that need adjacent areas built first, in order to provide a connection point for the collection areas force main.

Smaller projects serving the least number of connections (lots / ERC's) will naturally have a smaller total cost. For areas where potable water main lines and distribution does not exist, the cost to provide water service adds a significant increase to the total cost.

A *conditional* project may be engaged out of logical sequence. In that case, work outside of the conditional area would be needed to construct new “pump-out” force main through other adjacent areas to reach an existing point of connection.

In other words, if the decision is to build an area without the adjacent area being built first, then the cost to build a force main through the adjacent area will need to be *added* to the total cost. However, the significance of force main construction compared to total cost typically represents a relatively small increase (about 2%).

Assuming the adjacent (conditional) area is built first, the following would comprise the lowest water and wastewater construction total cost:

- LADYSLIPPER (\$24.5 M)
- SUNBURST (\$27.9 M)
- BLUE RIDGE-SALFORD NORTH (\$28.5 M)
- CRANBERRY FIELDS SOUTH (\$30.9 M)
- CRANBERRY FIELDS EAST (\$32.5 M)

The following would comprise areas with the highest total cost:

- ** SAN MATEO NORTH (\$41.6 M)
- ATWATER NORTH (\$42.4 M)
- MADAGASCAR (\$43.2 M)
- ** SAN MATEO SOUTH (\$43.2 M)
- ATWATER SOUTH (\$45.5 M)

** San Mateo from Hillsborough to Price Blvd: new water main & sidewalk under construction in 2020

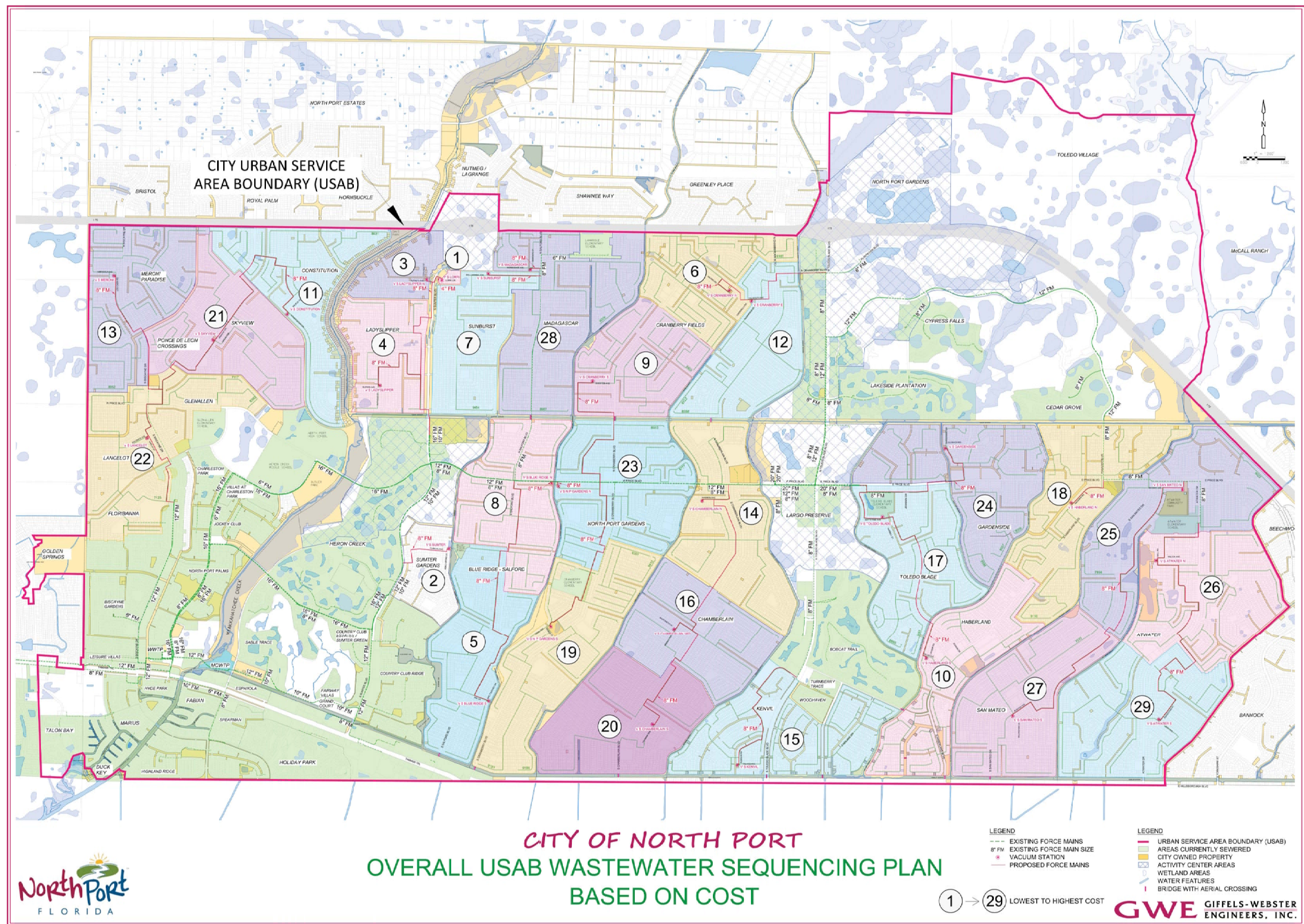
City of North Port Master Wastewater Plan													
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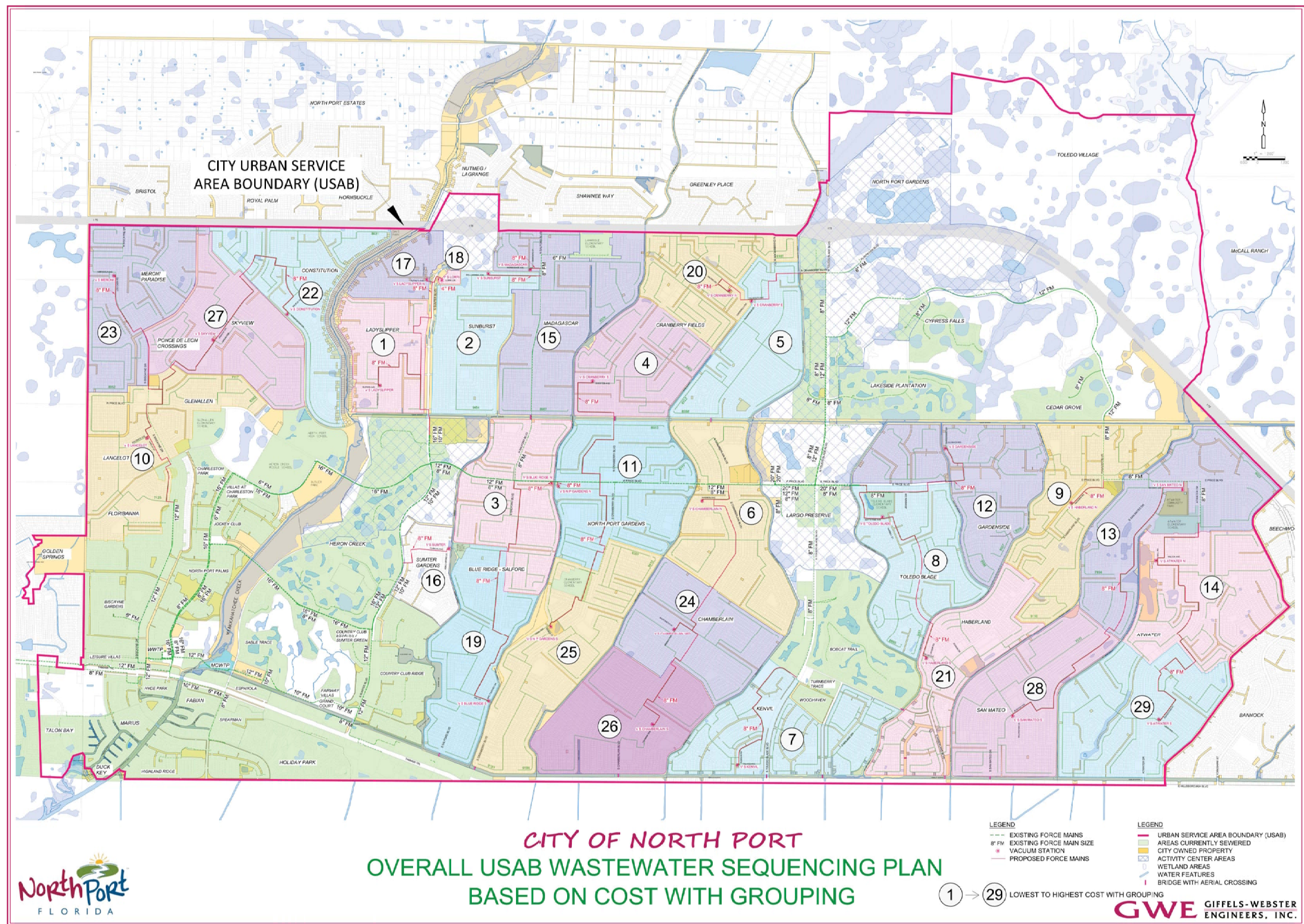
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POTABLE WATER MAIN EXPANSION PROJECT SEQUENCE

Currently, more areas in the City have water mains than wastewater mains. However, whenever possible it's generally best to install both wastewater as well as water systems into areas in order to avoid redundant disruption to the roads, minimize mobilization costs, minimize conflicts and enhance the ability coordinate the main and service placement during the construction of both systems with the same contractor.

If the City is to pursue a wastewater expansion program into areas, we recommend the installation of a water distribution system at the same time in order to reduce disruption and conflicts, assuming funds are available.

The sequencing of the water expansion will therefore follow the same sequencing of the wastewater expansion program when that sequencing is determined.

CONCLUSION

This Plan provides the recommended sequencing regardless of whether the City decides to proceed based on density, pavement age, or cost for the City of North Port's future wastewater expansion program.

However, the sequences presented are not necessarily the only possible sequences. The Plan is intended to be flexible as adjustments to master plans are normal and expected. For example, future economic development that are unknown at this time could generate the need to extend wastewater service to specific areas that may be out of our recommended sequence.

There could be other reasons that might alter the sequencing, such as funding sources and availability, the desire to encourage development in specific areas, zoning changes or paving and infrastructure project timing.

Similarly, the precise boundaries of each collection may be adjusted for a variety of reasons. For example, there may be new unforeseen conflicts that reduce the reach of a particular vacuum main. On the other hand extending a main across a road or bridge may be simpler then assumed allowing for an extension. Slight boundary adjustments from the initial Master Plan are normal and expected.

EVALUATION OF WASTEWATER COLLECTION TECHNOLOGIES

Contract No. 2020-02

Prepared for:

North Port Utilities

6644 W Price Blvd.
North Port, FL 34291

Prepared by:

Giffels-Webster Engineers, Inc.

900 Pine Street, Suite 225
Englewood, Florida 34223

February 7, 2020

GWE Project # 6450.00

THE CITY OF NORTH PORT

CONTRACT No. 2020-02

EVALUATIONS OF WASTEWATER COLLECTION TECHNOLOGIES

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Evaluation of Wastewater Collection Technologies

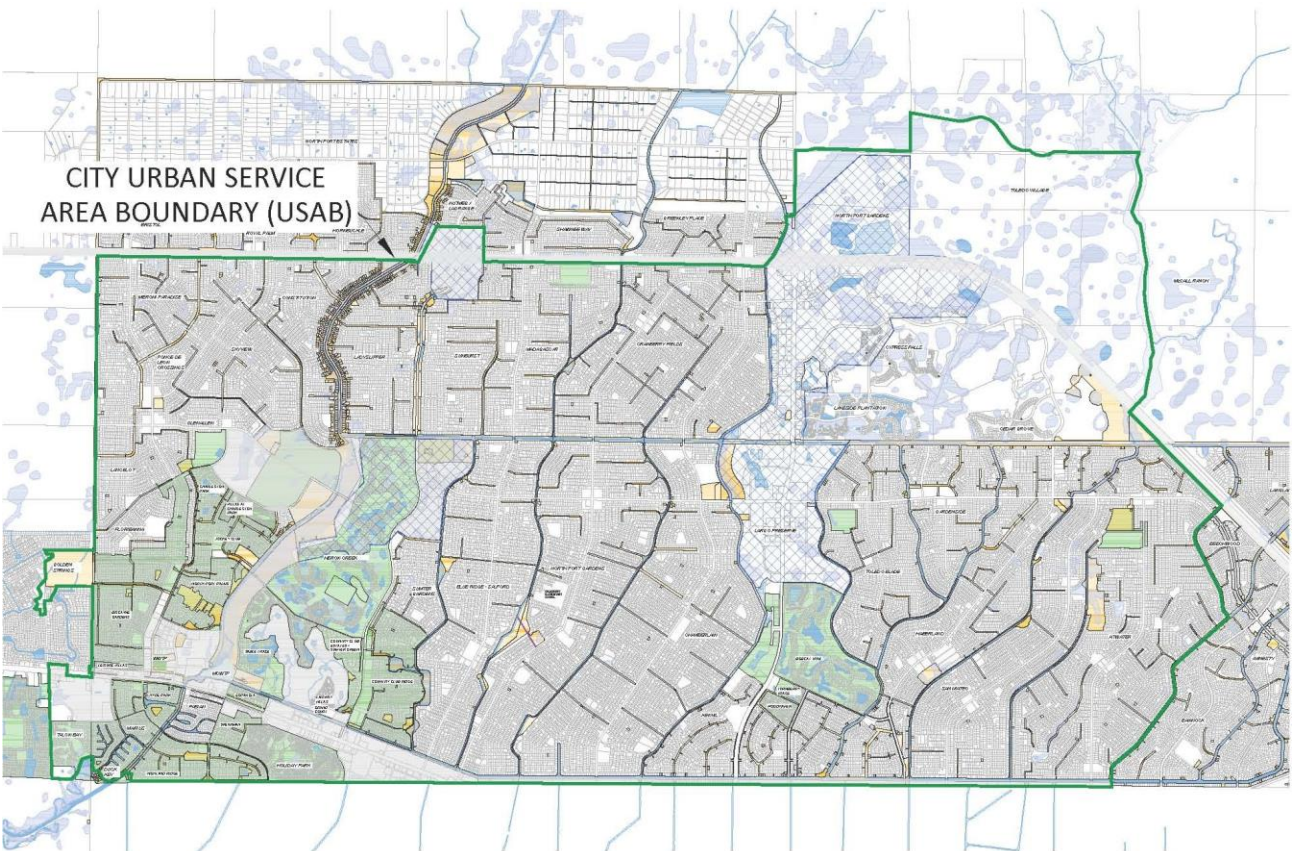
INTRODUCTION

The City of North Port, located in Sarasota County on the west coast of Florida, provides a range of municipal services including central water and sewer utility services for both residential and commercial properties throughout some parts of the City. However, many large areas do not have a central sewer collection system, and rely on on-site septic systems for wastewater disposal.

One of the primary goals as called for in the City's Strategic plan is to *"Continue to expand the waste water and water system distribution"*. Moreover, the current draft strategic planning document suggests the need to *"Complete long-range plan and identify funding sources for expansion of potable water and wastewater collection system in platted-lot areas City-wide, assimilating local and state data and studies."*

In order to progress on a logical path to reach these goals, the City has embarked on a preliminary study for a wastewater expansion program to install a central collection system to areas anticipated or currently served by septic systems.

This specific "Task 1" consists of evaluating three potential options for a centralized sewer system that could be installed in the Urban Service Area Boundary (USAB) of the City of North Port.



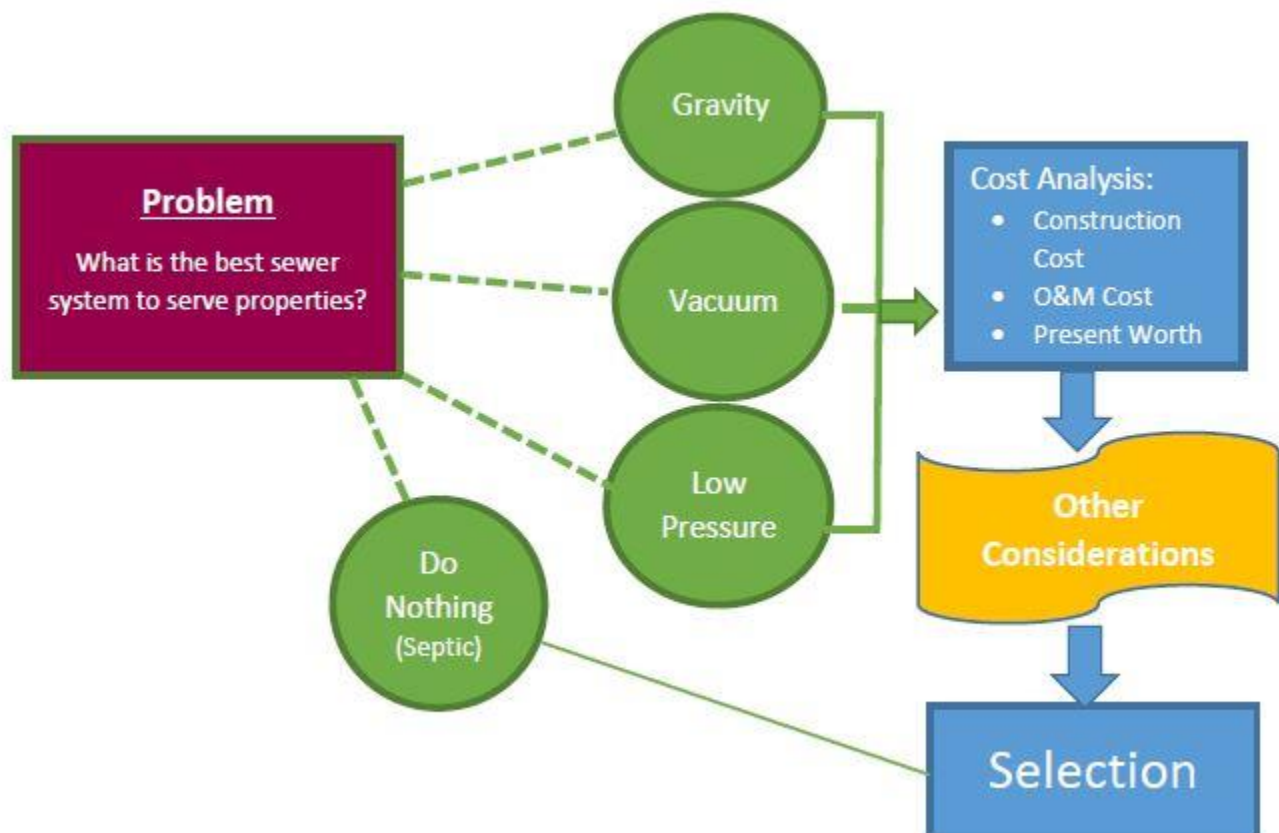
City of North Port Urban Service Area Boundary

The installation of a central sewer collection system would allow the elimination of on-site septic systems on developed lots and currently anticipated on the thousands of vacant lots within the area. However, the cost to install a central system, especially in areas already developed with roads and infrastructure, is very expensive and careful consideration must be given to ensure the best system is selected for consideration. The intent of this report is to provide collection system guidelines for use in the development of the wastewater master plan within the USAB.

SCOPE OF STUDY

The scope of this technical memorandum is to:

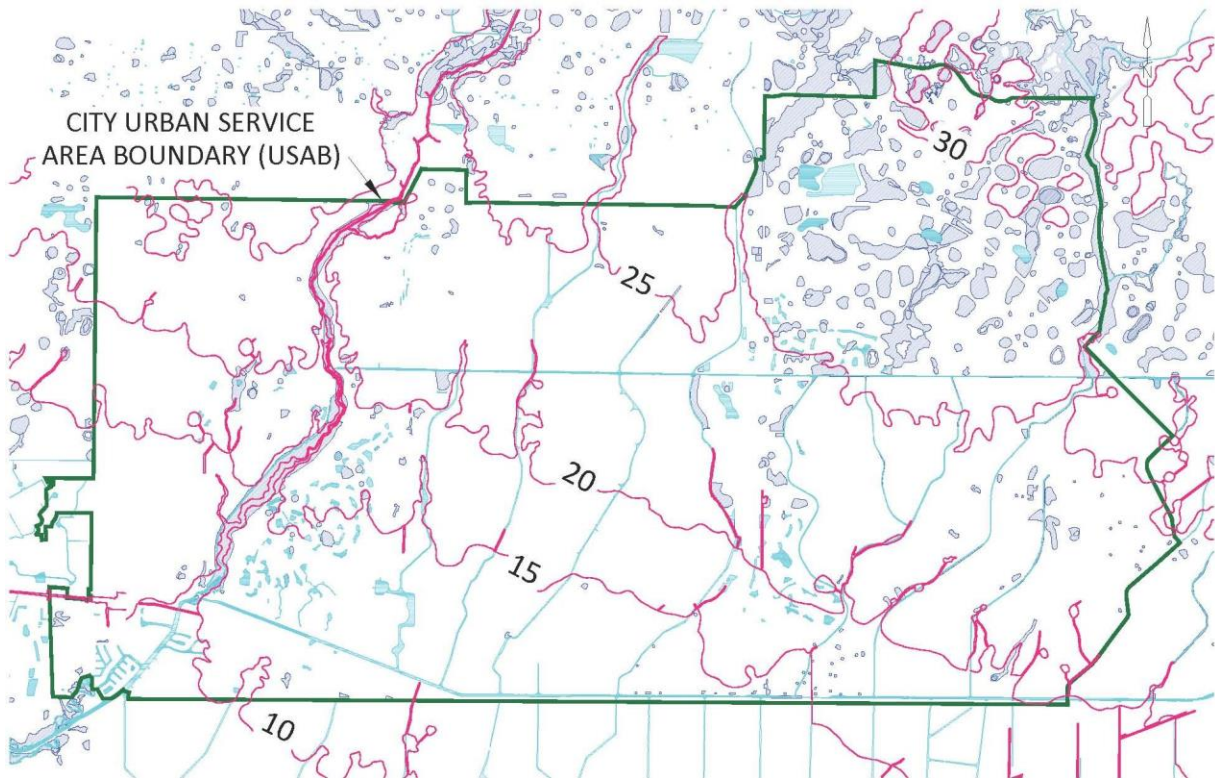
- Describe three methods of wastewater collection systems, specifically a conventional gravity collection system, a vacuum system and low pressure collection system (LPS).
- Develop cost estimates for the three systems, for various sizes of collection areas.
- Provide estimates for operation and maintenance of each system.
- Develop present worth costs bringing future costs to an equivalent cost today in order to compare the equivalent value of each system.
- Discuss non-financial issues for each system, such as impacting newly paved roads or needing access to private property in order to install and maintain the system.
- Recommend the best type of system for a given area size.



TOPOGRAPHY AND DRAINAGE

The topography of the USAB is a gentle slope from the northeast to the southwest as indicated on the contour map below. The total elevation differential is about 20 feet from the northeast (at elevation 30), down to the southwest (at around elevation 10) for an average slope of less than 0.1% across the USAB.

This average slope is not significant and considered be virtually level with minimal impacts.



Soils

The predominant soils within the USAB consist of EauGallie Fine Sands, Holopaw fine sand and Pineda sands.

EauGallie Fine Sands:

The EauGallie series consists of very deep, very poorly or poorly drained, slowly permeable sandy soils in flats, sloughs and depressional areas in the Southern Florida Flatwoods. Slopes range from 0 to 2%.

Holopaw Fine Sand:

The Holopaw series consists of deep and very deep, poorly and very poorly drained soil that formed in sandy and loamy marine sediments. Nearly level low lying flats, poorly defined drainage ways and depressional areas.

Pineda Fine Sands:

This very deep, nearly level, poorly drained soil is on broad low flats, hammocks, sloughs, depressions, poorly defined drainage ways and flood plains in the Southern Florida Flatwoods and to a lesser extent in South Central Florida Ridge, Southern Florida Lowlands.

Based on a review of the soil strata and for the purpose of comparing the costs to install the three types of collection system, the following is assumed:

1. High seasonal ground water tables are anticipated through the USAB.
2. No significant ledge or hard pan is contemplated that will make the installation of the deeper gravity system overly difficult to install with conventional excavation methods, understanding that site specific soil borings are recommended prior to any design.

Flood Plain

The vast majority of the City lies outside of any special 100 year flood prone areas.

A portion of the City particularly along the canals and the Myakkahatchee Creek lies in FEMA Zone AE.

The installation of utility mains within right of ways will not require any net filling and therefor will not have any significant impact on the flood Plain. Any proposed pump stations should have the finished floor elevated or flood proofed above the 100-year flood elevation.

DEVELOPMENT OF ALTERNATIVES

Three types of collection systems were analyzed to determine the most cost effective option for the City of North Port.

1. Conventional gravity collection system
2. Vacuum collection system
3. Low pressure collection system

Although generalities can be assumed for future collection areas in the City of North Port such as topography, soils and ground water elevations, the choice of the best type of collection system for an area may be dependent on the total lots served, as well other factors such as street condition and specific location. For example, there may be some enclaves or small isolated areas constrained by waterways or other impediments. Conversely, many areas are very large and contiguous. Accordingly, several sized areas were analyzed for each collection type to help determine the best selection.

- Very small areas < 50 lots
- Small areas 50 - 250 lots
- Mid-size areas 250 – 750 lots
- Large areas 750 – 1500 lots
- Very large areas 1500 - 2600 lots

In addition, the possibility of expansion of the City's existing gravity lift stations were evaluated, wherever there is capacity and/or ability to expand without the need to enlarge the physical size of the existing wet well.

WASTEWATER COLLECTION SYSTEM OPTIONS

Methodology

In order to develop costs, general layouts of each type of collection system were developed for a typical service area. The Madagascar/Sunburst area was selected for the analysis because it contains constraints that are similar to the entire USAB area. Moreover, it has existing infrastructure that could be expanded including lift station 83 as well as existing force mains that can be tied to, again similar to the balance of the study area. After the layouts were generated, costs (including the potential of expanding the existing infrastructure as well as long term operation and maintenance) for each type of layout were then developed.

Gravity Collection System

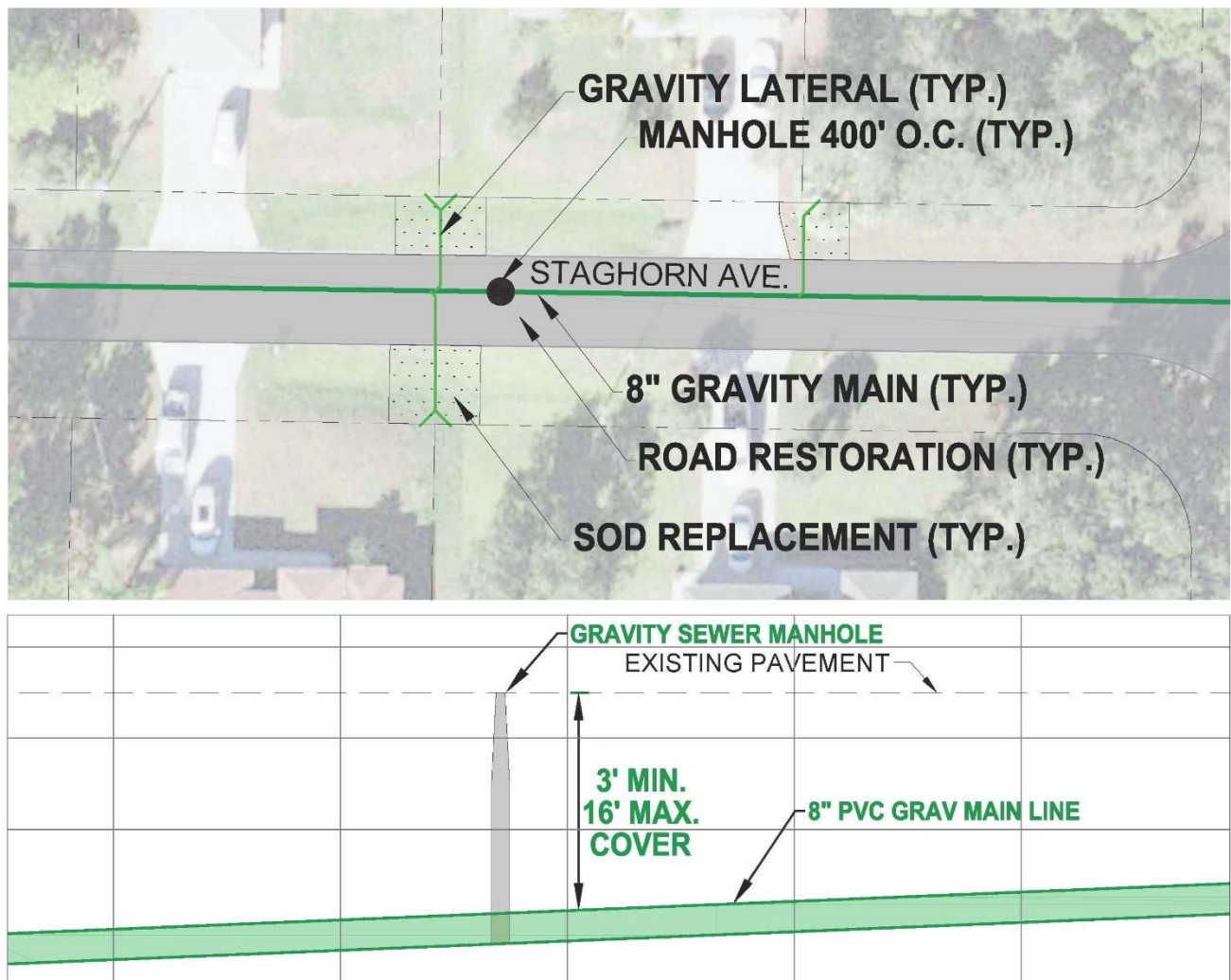
General Description

A gravity sewer network generally consists of 8" mains installed at a slope of 0.4 % with manholes spaced at bend and intersections at a spacing of no more than 400 feet. In addition to the main slope there is also a 0.1 foot drop between inverts at each manhole.

All mains eventually lead to a lift (pump) station. Each pump station has a receiving wet well that collects the sewage from the pipe system. Two (duplex) pumps transmit the collected sewage through force mains that are connected to the existing City force mains, which eventually discharge to the City Waste Water Treatment Plant (WWTP).

Depths of the gravity collection mains are assumed to range from about 3 feet of cover at the terminal manhole to about 15 feet of cover at the pump station. Gravity main depths greater than 16 feet are problematic and expensive to install. Using the slope and depth parameters, the maximum practical length of the pipe network from the lift station is approximately 2800 feet.

While short and shallow runs of gravity mains and manholes can be installed in the grass shoulder, any installation over about 8 feet in depth will affect the existing pavement. Normally, in order to install the mains at the deeper depths, the road asphalt base and subbase are completely excavated and replaced. The main lines and manholes are typically placed in the middle of the road and laterals from the main are installed to the property lines so that homes can be connected. Restoration consists of the rebuilding of the roads, and the establishment of grass or sod along the shoulders where the laterals are installed. A schematic of a typical gravity installation follows.



Advantages and Disadvantages

Advantages: Gravity sewers do not require individual pumps at each parcel nor do they require vacuum assistance to convey flow. Since gravity drives the flow, they are the most efficient with regard to electrical costs for sewage transport. They are most advantageous in new subdivisions or where the roads are scheduled to be reconstructed after installation of the pipe system.

Disadvantages: Due to the depths of installation, generally the full road width is excavated requiring the entire reconstruction of the existing roads. Dewatering is needed in areas with high ground water tables and construction is more disruptive than vacuum or low pressure systems. Because of the depths, shoring is necessary to keep the trench walls stable in accordance with the Trench Safety Act.

In addition, because gravity flows are of lesser velocity than vacuum or LPS, pipe sizes need to be larger to convey equivalent flows. Due to the need for road reconstruction in developed neighborhoods, the larger diameter pipes, and the need to dewater more, the cost to install a gravity sewer system is considerably more expensive than LPS or vacuum.

Vacuum Collection System

General Description

Vacuum collection systems rely on a central station providing energy (vacuum) to the collection pipe network pulling all flow to a central station and conveying the sewage once collected to a treatment plant. Since the velocities are higher due to the vacuum propelling the flows, the main lines can be smaller and typically range in size from 4" to 8" for an average system. In addition, because the vacuum assist sewage can be physically lifted up, the main lines do not have to be installed at excessive depths. The main lines are normally installed at a depth of 3 to 6 feet meaning that it can be installed in the grass shoulder of the road network minimizing disruption of the asphalt pavement. Only lateral and valve pit connections are needed to cross the street and those asphalt trenches will need to be restored to City standards.

Sewage from the homes are not under vacuum; the connection from the home is similar to a gravity system using a gravity lateral connecting from the house to a valve pit. Sewage enters the valve pit until there is approximately 10 gallons of sewage. A vacuum valve then opens and sewage is pulled into the mains flowing toward the central vacuum station.

The vacuum station is typically installed on a vacant residential lot and can be designed to blend into the neighborhood. The larger stations are constructed of concrete foundations, masonry walls and wood truss system, similar to a conventional residential home.



Conventional Vacuum Station

Package Vacuum (Pac-Vac) Vacuum Station

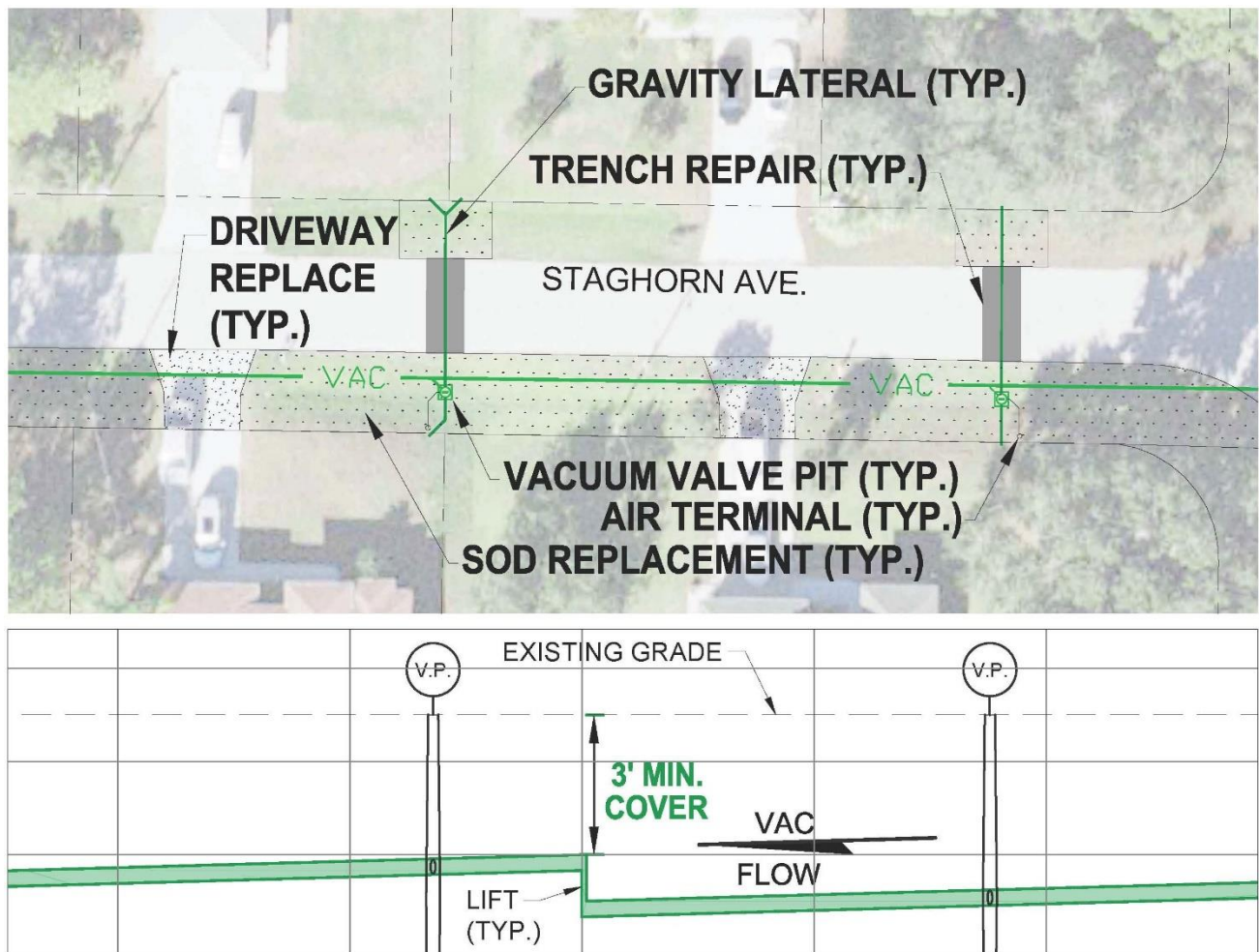
Rather than design and construct a conventional building using poured in place concrete foundation, block walls and roof trusses, smaller “pre-engineered” packaged stations are now offered that are built offsite, preassembled under factory conditions, trucked to the site and set up. The “pac-vac” provides factory quality control and testing, and in some cases, a faster, less disruptive assembly process.



“Pac-Vac” Station

The pac-vac station can also offer some cost savings. Normally, pac-vacs are considered for smaller areas serving up to 750 Equivalent Residential connections (ERC's) due to limitations in tank and pump sizing of the smaller buildings.

A typical layout of a vacuum collection system is shown in the following schematic.



Advantages and Disadvantages

Advantages: Vacuum collection systems are advantageous in highly developed areas with high groundwater or hardpan / rock. Collection lines can be installed within the grass right of way (R-O-W) eliminating the need for a total road reconstruction. Additionally, they can be installed at minimal depths, generally from 3 to 6 feet in depth, minimizing dewatering during construction. Since velocities within the pipes will be much higher than a gravity system, the collection pipe diameter can be reduced.

A vacuum station can serve up to 2,600 ERC's, replacing multiple gravity lift stations. With one central station, there is no need for electrical connections or individual pumps at each home. Moreover, only one large generator is needed to run the entire station during a power outage event rather than multiple generators. The operation and maintenance is relatively clean because it's a sealed airtight system and the operators do not need to enter manholes or wet wells to maintain the system operation. In the event of a leak, sewage is pulled into the system rather than pushed out, making large scale environmental spills virtually nonexistent, at least on the collection mains within the system.

Disadvantages: Vacuum systems are not cost competitive for small areas, primarily because of the cost of the central station. Operation and maintenance (O&M) is higher than gravity systems because energy is needed to pull the sewage to the central station rather than relying only on gravity. Pipe slopes and tolerances are critical during the installation process.

Low Pressure Collection System

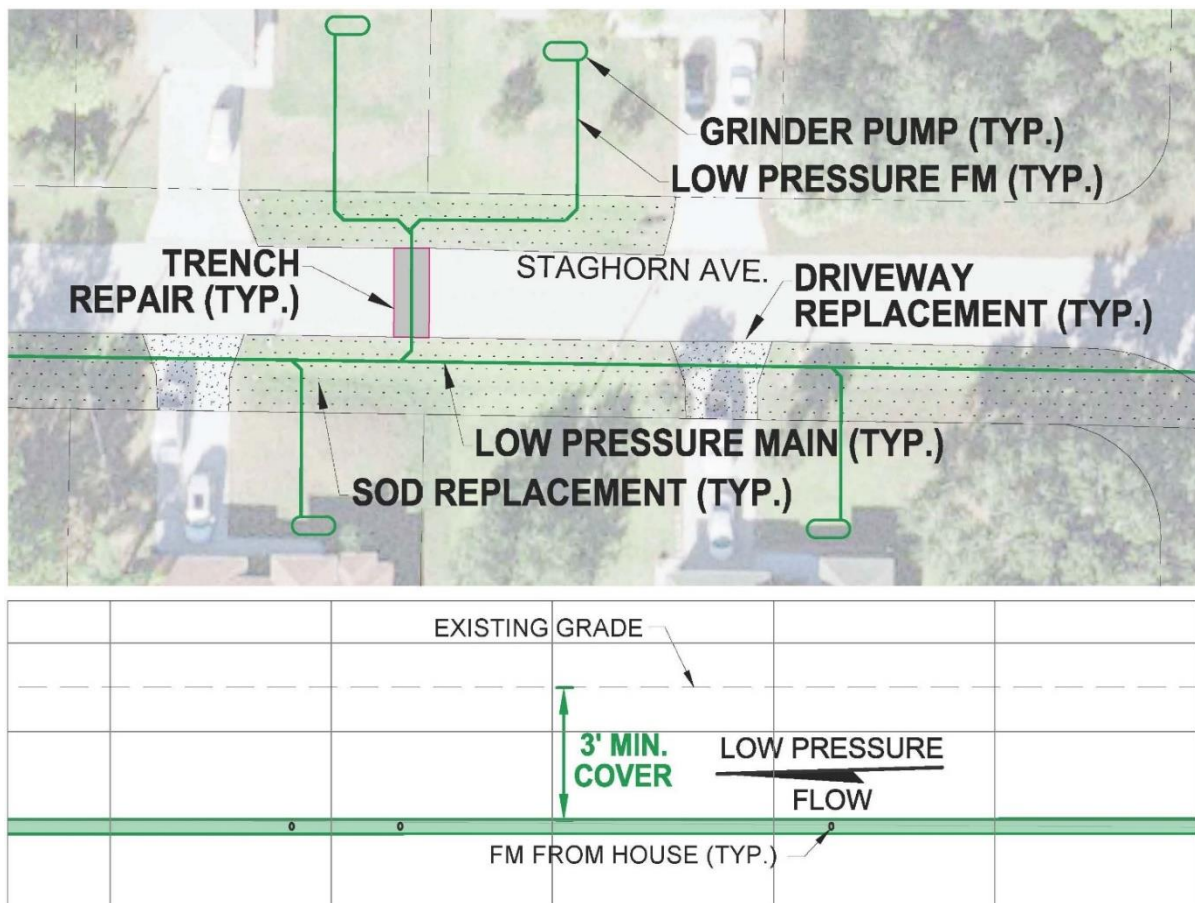
General Description

Low pressure systems consist of relatively small diameter pipes normally installed in the road shoulder, with individual pumping units at each home or parcel to convey the sewage to a central station. Generally, the low pressure units cannot overcome the higher pressures in a transmission network and therefore an intermediate master pump station is necessary.

The master pump station is similar to a conventional gravity lift station, with the exception that the station does not have to be as deep because the lines conveying the sewage are under pressure from the individual pump and therefore at a relatively shallow depth.

Since the LPS mains are under pressure, the velocities are higher than gravity mains, meaning that the pipe sizes can be considerably smaller to convey the equivalent amount of flow. Moreover, because the mains are under pressure, they can be installed in the grass shoulder areas at a minimal depth making installation relatively easy and inexpensive.

A schematic layout is shown below.



Advantages and Disadvantages

Advantages: Low-pressure systems are the least expensive to install in the right-of-way because pipes can be smaller in diameter than gravity and pipe slopes are not as critical as vacuum or gravity. Road disruption is minimized.

Disadvantages: Low-pressure sewer systems require the installation of a pump at each parcel or property. Permission from each property owner would be necessary if the intention is for the City to install and maintain the individual pumps on private property. If the intent is to have the individual property owner maintain the system, most owners may find it costly and difficult. Regardless of who maintains the pumps, each property should have a backup generator for power outages in order to operate the pumps, meaning there will be thousands of generators running during an emergency. In addition to the operation and maintenance (O&M) of the pumps themselves, O&M for each generator would be necessary that is not necessary for the other collection system types. The sum total of all the O&M costs for a large low pressure system is considerably higher than the other options.

Expansion of Existing City Gravity Lift Stations

General Description

The City currently has numerous gravity lift stations that may be able to accept more flow with nominal modifications such as duplex pump upgrades only.

The ability to expand the existing gravity collection area should be investigated on a case by case basis.

ESTIMATE OF CONSTRUCTION COSTS AND PRESENT WORTH

A general layout was developed for each type of collection system for a service area. Gravity, vacuum and low pressure concepts were developed and specific quantities of key construction components were estimated. Soft costs such as surveying, design, easements and legal are generally consistent regardless of which type collection system is selected and therefore for the purpose of this *comparative* analysis those soft costs were neglected. Construction unit prices, based on previous experience and similar projects were then applied to develop an order of magnitude construction cost. Operation and maintenance costs were developed for each type of system for each area. Using an appropriate discount and useful life, a present worth analysis was applied to each system current value.

A summary of costs, including a present worth analysis is included for each area in the appendices of this report.

CONCLUSIONS

Conceptual layouts for the various sized areas as well as cost estimates, operational and maintenance (O&M) and life cycle / present worth calculations are contained in the Appendices. Based on the conceptual layouts and financial analysis the following guidelines are summarized.

Pump Station Comparison

An approximate “*rule of thumb*” for the number of pump stations for gravity and low pressure needed to serve an equivalent vacuum service area can be summarized as follows:

<u>Type of collection System</u>	<u>ERC's per pump station</u>	<u>Number of pump stations</u>
Gravity	400	7
Low Pressure	500	5
Pac-Vac Vacuum	750	3
Standard Vacuum	2600	1

MASTER PLANNING GUIDELINES

Gravity sewer

The primary reason why gravity sewer is not recommended for most large areas is because of the cost of the deep installation and the extensive disruption to existing city roads. However, there may be specific areas where the main line run is relatively short (and therefore relatively shallow) making it possible to install the collection system in the grass shoulder for very small areas or in areas where existing infrastructure can be used to serve more properties. In those instances, gravity installation makes sense because the entire road will not need to be reconstructed.

Vacuum sewer

The largest component cost of a vacuum sewer system is the vacuum station. In order to pay for the station, the cost should be shared with as many customers as possible. Therefore, installing vacuum sewer for small or isolated areas is not cost effective and does not make good economic sense.

However, vacuum sewer does make sense where there are sufficient lots to share the station cost. The biggest advantages of vacuum sewer over gravity is the relatively shallow installation within the shoulder and therefore less disruptive to the roads. The biggest advantage over low pressure is the significantly lower O&M costs and convenience of one large generator at the station, rather than thousands of small generators at individual homes during an power outage. Since the City of North Port has many large areas with standard residential lots, vacuum sewer should be the primary collection system type considered within the Urban Service Area Boundary.

Low Pressure

Low pressure systems are the most inexpensive to install within the right of way because the small diameter mains do not have to be installed at a specific slope and therefore are easily installed with minimal disruption. This low initial installation cost is by far the biggest advantage of LPS.

However, the system relies on thousands of pumps on private property that must be maintained and periodically accessed. Moreover, during a power outage, if sewage is going to flow then those pumps on private property need to have an electrical generator provided by the homeowner or the City. If there is no emergency power provided than the level of service is less than city maintained pump stations with either gravity or vacuum and therefore not an equivalent collection system.

Since there are potentially thousands of small pumps that must be maintained, the O&M costs is the primary detriment to this type of system. This concern is significant and why LPS is not recommended for large areas, typical in the Urban Service Area Boundary.

However, LPS may be recommended in isolated areas or in areas where there is a preponderance of large lots where the homes are set back considerably from the public right of way.

Existing Gravity Sewer

Although there is tremendous advantages to utilize the existing pump station and infrastructure as much as possible, extending the gravity lines still involves replacement of roads making it expensive. For large expansions, vacuum is still more effective. However, for short shallow runs, or for just a few lots it may make sense to extend the gravity or use low pressure. The expansion of existing gravity systems are site specific and should be carefully analyzed prior to selection.

The collection system options that could be used for the development of the City of North Port Wastewater Master Plan is summarized below, understanding that each area should be evaluated on a case by case basis.

Area	Gravity	Vacuum	Low pressure
Very small areas < 50 lots	yes	no	yes
Small areas 50 - 250 lots	maybe	maybe	no
Mid-size areas 250 – 750 lots	no	yes	no
Large areas 750 – 1500 lots	no	yes	no
Very large areas 1500 - 2600 lots	no	yes	no
Existing Gravity sewer	maybe	maybe	maybe

APPENDIX A

Design Parameters

DESIGN PARAMETERS

For the purpose of the conceptual system layouts, the following assumptions were made:

Gravity Collection system

Maximum wet well depth = 20 feet

Maximum invert depth of gravity line = 16 feet.

Minimum invert depth of gravity main = 4 feet at terminal manhole.

8" Pipe slope - 0.4%

Pipe elevation drop through each manhole - 0.1 feet.

Maximum Manhole spacing – 400 ft

Maximum length of any single run of 8" main - 2800 feet from the lift station.

Vacuum collection system

Valve pit ratio – 2.5:1 (homes /valve pit)

Maximum vacuum line length - 10,000 feet from station.

Maximum ERC's served by one station:

Conventional (concrete/truss) 2600 ERC's

Pac Vac (pre-engineered) 750 ERC's

Low Pressure collection system

The design assumptions for the LPS are consistent with Table 2.1 of the EPA Alternative Wastewater Collection System manual:

<u>Pipe Diameter</u>	<u>No. of Homes served</u>
2"	6
3"	60
4"	120
6"	280
8"	560

Average low pressure main size is assumed at 4" diameter for cost analysis.

Maximum homes for master lift station = 500 ERC's

APPENDIX B

Unit Prices

UNIT PRICES

Unit prices were developed using previous bids and averages.

Gravity Sewer Unit Prices		
lift station > 50 ERC's	EA	\$ 300,000.00
lift station < 50 ERC's	EA	\$ 150,000.00
Gravity mains 4-16 feet deep	LF	\$ 125.00
Man Holes 4-16 feet deep	EA	\$ 9,500.00
service lines 30 feet per lot @ \$ 40 per foot	EA	\$ 1,200.00
Force Main	L.F.	\$ 30.00
Road repair 20 x 1/9 * \$50/s.y.	L.F.	\$ 111.00
Restoration - driveways 1000/drive for 1/2 erc's	N/A	
Restoration - sod 13 x 80/9 *\$4	ERC	\$ 70.00

Vacuum sewer unit prices		
Vacuum station 2250-2600 ERC's	EA	\$ 2,000,000.00
Vacuum station 1500 - 2250 ERC's	EA	\$ 1,500,000.00
Vacuum station 750-1500 ERC's	EA	\$ 1,250,000.00
Vacuum station 500-750 ERC's	EA	\$ 750,000.00
Vacuum station 200-500 ERC's	EA	\$ 500,000.00
Vacuum pipe	LF	\$ 35.00
Force Main	LF	\$ 30.00
valve pits	EA	\$ 6,000.00
Road Crossings 6'x20'/9 x \$50	ERC	\$ 666.00
Restoration - Driveway replacement, concrete 50 percent developed X 1000 /lot	ERC	\$ 500.00
Restoration - Sod, all types (13ft wide x 80 @4/SY) per lot	ERC	\$ 462.00

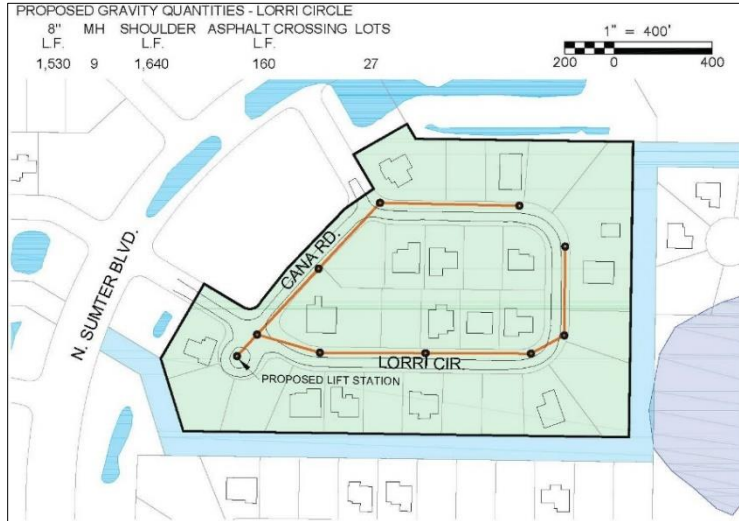
Low Pressure Unit Prices		
On Lot grinder pumps	EA	\$ 4,800.00
low pressure main 3"-8"	L.F.	\$ 20.00
Master Pump station (>200 ERC's)	EA	\$ 250,000.00
Master Pump station (<200 ERC's)	EA	\$ 150,000.00
Driveway replacement, concrete 50 percent developed X 1000 /lot	ERC	\$ 500.00
Sod, all types (13ft wide x 80 @4/SY) per lot	ERC	\$ 462.00
Road Crossings 6'x20'/9 x \$50	ERC	\$ 666.00

APPENDIX C

Very Small Areas <50 Lots

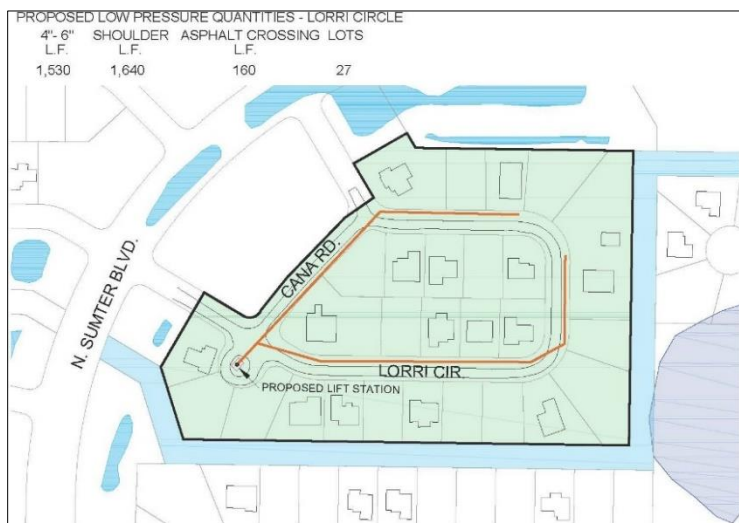
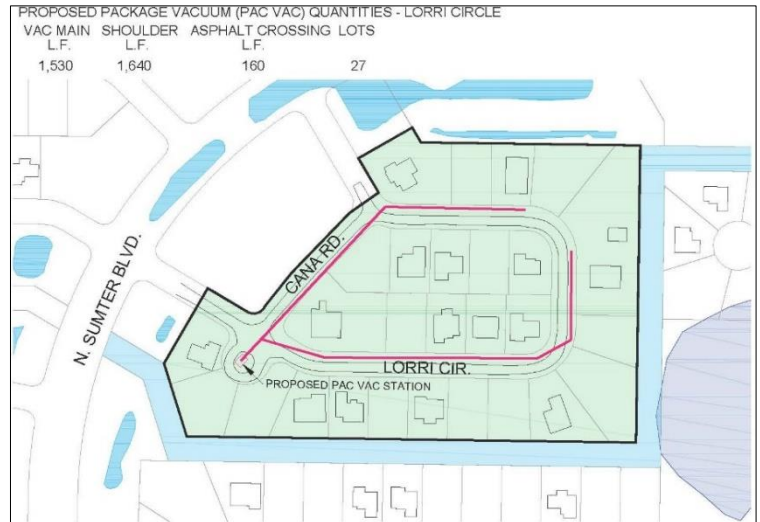
- **Conceptual layouts gravity, vacuum and low pressure.**
- **Operation and maintenance costs**
- **Operation and maintenance comparison**
- **Present worth analysis and ranking**

VERY SMALL AREAS



Gravity Sewer

Vacuum Sewer



Low Pressure Sewer

PROJECT INFORMATION

PROJECT NAME (city and state)

North Port Florida

TITLE

very small service area

CONNECTIONS

27

EDU'S

27

This spreadsheet is based on Airvac's standard peak flow rate of 0.64 gpm/EDU. If the actual flow rate is lower than that, the replacement costs for the vacuum station will be less than the value returned by the formulas as smaller vacuum stations skid models than shown would most likely result.

BASIC DATA

LOW PRESSURE SEWER

GRINDER PUMPS

SIMPLEX GRINDER PUMPS

27

ea

DUPLEX GRINDER PUMPS

0

TOTAL # GRINDER PUMPS

27

ea

Connection/GP ratio

1.00

INTERMEDIATE LIFT STATION REQ'D?

Yes

of Lift stations

15

hp

1

ea

LABOR RATE

Hourly labor rate

\$20.00

/hr

Overhead

25%

GRAVITY SEWER

LIFT STATIONS

OF LIFT STATIONS

1

ea

HP of pumps

15

hp

LABOR RATE

Hourly labor rate

\$20.00

/hr

Overhead

25%

VACUUM SEWER

VALVE PITS

AIRVAC VALVE PITS

11

ea

SINGLE BUFFER TANKS

0

ea

DUAL BUFFER TANKS

0

ea

TOTAL # VALVES

11

ea

Connection/VP ratio

2.45

VACUUM STATION

Skid Model (enter type of vacuum pump)

Mink

1

2BM-15

* compared to a typical system with this # of connections

small

LABOR RATE

Hourly rate

\$20.00

/hr

Overhead

25%

O&M INFORMATION

LABOR

Lift Station (180-240), if LS is req'd

180

hrs/yr/station

Piping (40 - 80)

60

hrs/yr/system

Grinder Pumps (0.5 to 2.75)

1.50

hrs/yr/gp

POWER

Lift station: Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$0.50 - \$1.50)

\$0.50

/mo/EDU

Grinder pumps: Usage fee (\$0.50-\$1.50/mo)

\$0.75

/mo/EDU

EQUIPMENT REPLACEMENT

LIFT STATION

n/a

Vacuum Pumps

n/a

2

Sewage Pumps

\$12,000

15

yrs

1

Wetwell tank

\$10,000

20

yrs

1

Control Panel

\$25,000

20

yrs

Misc Equip (\$1,000 - \$2,000)

\$1,000

15

yrs

GRINDER PUMPS

Rebuild pump cores (\$750 - \$1,500)

\$750

7

yrs

Replace controls (\$300 - \$700)

\$300

7

yrs

Misc. Parts (\$15.00 - \$30.00)

\$15

10

yrs

LABOR

Lift Station (180-240), if LS is req'd

180

hrs/yr/station

Piping (40 - 80)

20

hrs/yr/system

POWER

Lift station: Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$0.50 - \$1.50)

\$0.50

/mo/EDU

EQUIPMENT REPLACEMENT

LIFT STATION

n/a

Vacuum Pumps

n/a

2

Sewage Pumps

\$12,000

15

yrs

1

Wetwell tank

\$10,000

20

yrs

1

Control Panel

\$25,000

20

yrs

Misc Equip (\$1,000 - \$2,000)

\$1,000

15

yrs

LABOR

Vacuum Station (180-450)

450

hrs/yr/station

Piping (40 - 80)

60

hrs/yr/system

Valves (0.5 to 2.0)

1.75

hrs/yr/valve

POWER

Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$1.00 - \$2.50)

\$2.50

/mo/EDU

Vacuum valves: no power req'd

\$0.00

/mo/EDU

EQUIPMENT REPLACEMENT

VACUUM STATION

2

Vacuum Pumps

\$12,500

15

yrs

2

Sewage Pumps

\$6,000

15

yrs

1

Collection tank

\$20,000

30

yrs

1

Control Panel

\$20,000

20

yrs

Misc Equip (\$2,000 - \$3,000)

\$3,000

15

yrs

VACUUM VALVES (rebuild kits, etc)

Valves (\$35 - \$50)

\$45

15

yrs

Controller (\$35 - \$50)

\$45

10

yrs

Misc. Parts (\$15 - \$30)

\$20

10

yrs

19

North Port

connections27

EDU's27

ANNUAL O&M ESTIMATE

very small service area

GRAVITY SEWER

LABOR					
Item	Labor effort		Quantity		Annual Labor
Lift Station - (if req'd)	180 hrs/yr/station	x	1 station	=	180 hrs/yr
Piping	20 hrs/yr/system	x	1 system	=	20 hrs/yr
				=	0 hrs/yr
					200 hrs/yr
				x	\$20 /hr
				x	1.25 Overhead
					\$5,000 /yr
ROUND TO:					\$5,000 /yr

POWER					
Item	Unit cost		EDU	Duration	Annual Power
Lift Station - (if req'd)					
Flat rate	\$125.00 /mo	x	1 station	12 mo	\$1,500 /yr
Consumption	\$0.50 /mo/EDU	x	27 EDU	x 12 mo	= \$162 /yr
					\$1,662
ROUND TO:					\$1,662 /yr

EQUIPMENT REPLACEMENT					
Item	Replacement cost		Useful life	Quantity	Annual R&R
LIFT STATION (if req'd)					
Sewage Pumps	\$12,000 /ea	/	15 years	x 2 pumps	= \$1,600 /yr
Wetwell	\$10,000 /ea	/	20 years	x 1 ea	= \$500 /yr
Control Panel	\$25,000 /ea	/	20 years	x 1 ea	= \$1,250 /yr
Misc. Equip	\$1,000 /ea	/	15 years	x 1 ea	= \$67 /yr
					\$3,417 /yr
ROUND TO:					\$3,400 /yr

SUMMARY	
LABOR	\$5,000 /yr
POWER	\$1,662 /yr
EQUIPMENT REPLACEMENT (LIFT STATION)	\$3,400 /yr
	\$10,062 /yr
ANNUAL O&M	\$373 /yr/EDU

North Port

connections 27
EDU's 27

ANNUAL O&M ESTIMATE very small service area VACUUM SYSTEM

LABOR				
Item	Labor effort		Quantity	Annual Labor
Vacuum Station	450 hrs/yr/station	x	1 station	= 450 hrs/yr
Piping	60 hrs/yr/system	x	1 system	= 60 hrs/yr
Valves	1.75 hrs/yr/valve	x	11 valves	= 19 hrs/yr
				529 hrs/yr
				x \$20 /hr
				x 1.25 Overhead
				\$13,225 /yr
ROUND TO:				\$13,200 /yr

POWER				
Item	Unit cost		EDU	Duration
Vacuum Station				
Flat rate	\$125.00 /mo	x	1 Vac Sta	12 mo
Consumption	\$2.50 /mo/EDU	x	27 EDU	x 12 mo
				= \$1,500 /yr
				\$810 /yr
				\$2,310
ROUND TO:				\$2,300 /yr

EQUIPMENT REPLACEMENT				
Item	Replacement cost		Useful life	Quantity
VACUUM STATION				
Vacuum Pumps	\$12,500 /ea	/	15 years	x 2 pumps
Sewage Pumps	\$6,000 /ea	/	15 years	x 2 pumps
Collection Tank	\$20,000 /ea	/	30 years	x 1 ea
Control Panel	\$20,000 /ea	/	20 years	x 1 ea
Misc. Equip	\$3,000 /ea	/	15 years	x 1 ea
				= \$1,667 /yr
				= \$800 /yr
				= \$667 /yr
				= \$1,000 /yr
				= \$200 /yr
				\$4,333 /yr
ROUND TO:				\$4,300 /yr
VACUUM VALVES				
Vacuum Valves	\$45 /ea	/	15 years	x 11 valves
Controller	\$45 /ea	/	10 years	x 11 valves
Misc. Parts	\$20 /ea	/	10 years	x 11 valves
				= \$33 /yr
				= \$50 /yr
				= \$22 /yr
				\$105 /yr
ROUND TO:				\$100 /yr

SUMMARY	
LABOR	\$13,200 /yr
POWER	\$2,300 /yr
EQUIPMENT REPLACEMENT (STATION)	\$4,300 /yr
EQUIPMENT REPLACEMENT (VALVES)	\$100 /yr
	\$19,900 /yr
ANNUAL O&M	\$737 /yr/EDU

North Port

connections 27
EDU's 27

ANNUAL O&M ESTIMATE

very small service area
LOW PRESSURE SYSTEM

		LABOR		
Item	Labor effort	Quantity	Annual Labor	
Lift Station - (if req'd)	180 hrs/yr/station	x 1 station	=	180 hrs/yr
Piping	60 hrs/yr/system	x 1 system	=	60 hrs/yr
Grinder pumps	1.50 hrs/yr/GP	x 27 GP's	=	41 hrs/yr
				281 hrs/yr
			x	\$20 /hr
			x	1.25 Overhead
				\$7,025 /yr
ROUND TO:				\$7,000 /yr

		POWER		
Item	Unit cost	EDU	Duration	Annual Power
Lift Station - (if req'd)				
Flat rate	\$125.00 /mo	x 1	12 mo	\$1,500 /yr
Consumption	\$0.50 /mo/EDU	x 27 EDU	x 12 mo	= \$162 /yr
				\$1,662
Grinder Pumps	\$0.75 /mo/EDU	x 27 EDU	x 12 mo	\$243 /yr
				\$1,905
ROUND TO:				\$1,900 /yr

		EQUIPMENT REPLACEMENT		
Item	Replacement cost	Useful life	Quantity	Annual R&R
LIFT STATION (if req'd)				
Sewage Pumps	\$12,000 /ea	/ 15 years	x 2 pumps	= \$1,600 /yr
Wetwell	\$10,000 /ea	/ 20 years	x 1 ea	= \$500 /yr
Control Panel	\$25,000 /ea	/ 20 years	x 1 ea	= \$1,250 /yr
Misc. Equip	\$1,000 /ea	/ 15 years	x 1 ea	= \$67 /yr
				\$3,417 /yr
ROUND TO:				\$3,400 /yr
GRINDER PUMPS				
Rebuild pump core	\$750 /ea	/ 7 years	x 27 GP's	= \$2,893 /yr
Replace controls	\$300 /ea	/ 7 years	x 27 GP's	= \$1,157 /yr
Misc. Parts	\$15 /yr	/ 10 years	x 27 GP's	= \$41 /yr
				\$4,091 /yr
ROUND TO:				\$4,100 /yr

SUMMARY	
LABOR	\$7,000 /yr
POWER	\$1,900 /yr
EQUIPMENT REPLACEMENT (LIFT STATION)	\$3,400 /yr
EQUIPMENT REPLACEMENT (GP'S)	\$4,100 /yr
	\$16,400 /yr
ANNUAL O&M	\$607 /yr/EDU

ANNUAL O&M COMPARISON			
	VACUUM	GRAVITY SEWER	LOW PRESSURE
# CONNECTIONS	27 ea	27 ea	27 ea
# OF EDU'S	27 ea	27 ea	27 ea
# UNITS	11 valves	n/a	27 GP's
# VACUUM OR LIFT STATIONS	1 ea	1 ea	1 ea
LABOR	\$13,200 /yr	\$5,000 /yr	\$7,000 /yr
POWER	\$2,300 /yr	\$1,662 /yr	\$1,900 /yr
EQUIPMENT REPLACEMENT (Vac Sta/Lift Sta)	\$4,300 /yr	\$3,400 /yr	\$3,400 /yr
REBUILD/REPAIR FREQUENCY			
Rebuild/repair frequency (vacuum valve/wetwell pumps/GP core)	15 yrs	15 yrs	7 yrs
Rebuild/repair frequency (controllers/pump controls)	10 yrs	20 yrs	7 yrs
Rebuild/repair frequency (gravity wetwell)	n/a	20 yrs	20 yrs
Misc Spare parts frequency	10 yrs	15 yrs	10 yrs
EQUIPMENT REPLACEMENT (Valves/Grinder Pumps)	<u>\$100 /yr</u>	<u>n/a /yr</u>	<u>\$4,100 /yr</u>
ANNUAL O&M	\$19,935 /yr	\$10,132 /yr	\$16,444 /yr
ANNUAL O&M per EDU	\$738 /yr/EDU	\$375 /yr/EDU	\$609 /yr/EDU

Present Worth Analysis													
Project		City of North Port				For comparative analysis only							
Planning Time frame		40		years		(Does not include all costs)							
interest rate		4.500		percent									
ERC's		27		ERC's									
System Type	Construction cost	Other Costs	legal, engr , survey	const services/ contingency	total initial cost "C"	Annual O&M	O&M Uniform series Present worth factor	USPW (O+M)	Salvage Value	SPPW(S)	Salvage value	NET PRESENT VALUE	RANK
Gravity	484,218		0	0	484,218	10,132	18.402	186,445	75,810	0.1719	13,034	\$ 657,629	second
Vacuum	647,438		0	0	647,438	19,935	18.402	366,836	10,710	0.1719	1,841	\$ 1,012,432	third
Low Pressure	325,338		0	0	325,338	16,444	18.402	302,596	36,120	0.1719	6,210	\$ 621,724	first
NPV = C+ USPW (O&M)- SPPW(S) NPC Net Present Value C capital cost USPW (O&M) Uniform series Present worth equals $\frac{A(1+i)^{nth}-1}{i(1+i)^{nth}}$ SPPW (S) Single Payment Present Worth Salvage Value FV*1/(1+i)^{nth}													
Salvage value						Construction Cost Estimates							
	Element	life span	Value new	40 year dep	Remaining Value	% of const cost		Desc	qty	unit price	total		
Gravity	lift station	50	\$ 150,000.00	\$ 120,000.00	\$ 30,000.00			Gravity lift station	1	\$ 150,000.00	\$ 150,000.00		
	mains	50	\$ 191,250.00	\$ 153,000.00	\$ 38,250.00			Gravity mains	1,530	\$ 125.00	\$ 191,250.00		
	manholes	40	\$ 85,500.00	\$ 85,500.00	\$ -			Man Holes	9	\$ 9,500.00	\$ 85,500.00		
	service lines	50	\$ 37,800.00	\$ 30,240.00	\$ 7,560.00			service lines	945	\$ 40.00	\$ 37,800.00		
	force main	50	\$ -	\$ -	\$ -			Force Main		\$ 30.00	\$ -		
	Road repair	40						Road repair	4	\$ 111.00	\$ 444.00		
	Restoration	40						driveways	14	\$ 500.00	\$ 6,750.00		
								Sod	27	\$ 462.00	\$ 12,474.00		
				\$ 75,810.00	16%			total		\$ 484,218.00			
Vacuum	vac build/site	40	\$ 500,000.00	\$ 500,000.00	\$ -			Vac sta	1	\$ 500,000.00	\$ 500,000.00		
	pipe in road	50	\$ 53,550.00	\$ 42,840.00	\$ 10,710.00			Vacuum pipe	1530	\$ 35.00	\$ 53,550.00		
	f.m.	50	\$ -	\$ -	\$ -			Force Main	0	\$ 30.00	\$ -		
	valve pits	40	\$ 72,000.00	\$ 72,000.00	\$ -			valve pits	12	\$ 6,000.00	\$ 72,000.00		
	Road repair	40	\$ 2,664.00					Road Crossings	4	\$ 666.00	\$ 2,664.00		
								Driveways (50% dev)	14	\$ 500.00	\$ 6,750.00		
	Restoration							Sod	27	\$ 462.00	\$ 12,474.00		
				\$ 10,710.00	2%			total		\$ 647,438.00			
Low Pressure	lps systems on si	40	\$ 129,600.00	\$ 129,600.00	\$ -			grinder pumps	27	\$ 4,800.00	\$ 129,600.00		
	pipes in road	50	\$ 30,600.00	\$ 24,480.00	\$ 6,120.00			Low Pressure mains 3-8"	1,530	\$ 20.00	\$ 30,600.00		
	lift station	50	\$ 150,000.00	\$ 120,000.00	\$ 30,000.00			master lift station	1	\$ 150,000.00	\$ 150,000.00		
	fm	50	\$ -	\$ -	\$ -			Force Main	0	\$ 30.00	\$ -		
	Road repair							Road crossings	4	\$ 666.00	\$ 2,664.00		
	Restoration							Sod	27	\$ 462.00	\$ 12,474.00		
				\$ 36,120.00	11%			total		\$ 325,338.00			
O & M costs per year													
	Cost per EDU	EDU's	cost/year										
Gravity	\$ 375.26	27	\$ 10,132.00										
Vacuum	\$ 738.33	27	\$ 19,935.00										
Low pressure	\$ 609.04	27	\$ 16,444.00										
GWE # 6450													

APPENDIX D

Small Areas 50-250 Lots

- **Conceptual layouts gravity, vacuum and low pressure.**
- **Operation and maintenance costs**
- **Operation and maintenance comparison**
- **Present worth analysis and ranking**

SMALL AREAS



Gravity Sewer

Vacuum Sewer



Low Pressure Sewer

PROJECT INFORMATION

PROJECT NAME (city and state)
TITLE

North Port
small service area

CONNECTIONS
EDU'S

255
255

This spreadsheet is based on Airvac's standard peak flow rate of 0.64 gpm/EDU. If the actual flow rate is lower than that, the replacement costs for the vacuum station will be less than the value returned by the formulas as smaller vacuum stations skid models than shown would most likely result.

BASIC DATA

LOW PRESSURE SEWER

GRINDER PUMPS

SIMPLEX GRINDER PUMPS

255

ea

DUPLEX GRINDER PUMPS

0

TOTAL # GRINDER PUMPS

255

ea

Connection/GP ratio

1.00

INTERMEDIATE LIFT STATION REQ'D?

Yes

of Lift stations

HP of pumps (if lift station is req'd)

15

hp

1

ea

LABOR RATE

Hourly labor rate

\$20.00

/hr

Overhead

25%

GRAVITY SEWER

LIFT STATIONS

OF LIFT STATIONS

1

ea

HP of pumps

15

hp

LABOR RATE

Hourly labor rate

\$20.00

/hr

Overhead

25%

VACUUM SEWER

VALVE PITS

AIRVAC VALVE PITS

102

ea

SINGLE BUFFER TANKS

0

ea

DUAL BUFFER TANKS

0

ea

TOTAL # VALVES

102

ea

Connection/VP ratio

2.50

piping network size*

VACUUM STATION

Skid Model (enter type of vacuum pump)

Mink

1

3CM-25

* compared to a typical system with this # of connections

LABOR RATE

Hourly rate

\$20.00

/hr

Overhead

25%

O&M INFORMATION

LABOR

Lift Station (180-240), if LS is req'd

180

hrs/yr/station

Piping (40 - 80)

60

hrs/yr/system

Grinder Pumps (0.5 to 2.75)

1.50

hrs/yr/gp

POWER

Lift station: Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$0.50 - \$1.50)

\$0.50

/mo/EDU

Grinder pumps: Usage fee (\$0.50-\$1.50/mo)

\$0.75

/mo/EDU

EQUIPMENT REPLACEMENT

LIFT STATION

n/a

Vacuum Pumps

n/a

2

Sewage Pumps

\$12,000

15

yrs

1

Wetwell tank

\$10,000

20

yrs

1

Control Panel

\$25,000

20

yrs

Misc Equip (\$1,000 - \$2,000)

\$1,000

15

yrs

GRINDER PUMPS

Rebuild pump cores (\$750 - \$1,500)

\$750

7

yrs

Replace controls (\$300 - \$700)

\$300

7

yrs

Misc. Parts (\$15.00 - \$30.00)

\$15

10

yrs

LABOR

Lift Station (180-240), if LS is req'd

180

hrs/yr/station

Piping (40 - 80)

20

hrs/yr/system

POWER

Lift station: Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$0.50 - \$1.50)

\$0.50

/mo/EDU

EQUIPMENT REPLACEMENT

LIFT STATION

n/a

Vacuum Pumps

n/a

2

Sewage Pumps

\$12,000

15

yrs

1

Wetwell tank

\$10,000

20

yrs

1

Control Panel

\$25,000

20

yrs

Misc Equip (\$1,000 - \$2,000)

\$1,000

15

yrs

LABOR

Vacuum Station (180-450)

450

hrs/yr/station

Piping (40 - 80)

60

hrs/yr/system

Valves (0.5 to 2.0)

1.75

hrs/yr/valve

POWER

Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$1.00 - \$2.50)

\$2.50

/mo/EDU

Vacuum valves: no power req'd

\$0.00

/mo/EDU

EQUIPMENT REPLACEMENT

VACUUM STATION

3

Vacuum Pumps

\$21,500

15

yrs

2

Sewage Pumps

\$10,000

15

yrs

1

Collection tank

\$30,000

30

yrs

1

Control Panel

\$30,000

20

yrs

Misc Equip (\$2,000 - \$3,000)

\$3,000

15

yrs

VACUUM VALVES (rebuild kits, etc)

Valves (\$35 - \$50)

\$45

15

yrs

Controller (\$35 - \$50)

\$45

10

yrs

Misc. Parts (\$15 - \$30)

\$20

10

yrs

27

North Port

connections 255
EDU's 255

ANNUAL O&M ESTIMATE

small service area
GRAVITY SEWER

		LABOR		
Item	Labor effort	Quantity	Annual Labor	
Lift Station - (if req'd)	180 hrs/yr/station	X 1 station	=	180 hrs/yr
Piping	20 hrs/yr/system	X 1 system	=	20 hrs/yr
			=	0 hrs/yr
				200 hrs/yr
			X	\$20 /hr
			X	1.25 Overhead
				\$5,000 /yr
ROUND TO:				\$5,000 /yr

		POWER		
Item	Unit cost	EDU	Duration	Annual Power
Lift Station - (if req'd)				
Flat rate	\$125.00 /mo	X 1 station	12 mo	\$1,500 /yr
Consumption	\$0.50 /mo/EDU	X 255 EDU	X 12 mo	= \$1,530 /yr
				\$3,030
ROUND TO:				\$3,030 /yr

		EQUIPMENT REPLACEMENT		
Item	Replacement cost	Useful life	Quantity	Annual R&R
LIFT STATION (if req'd)				
Sewage Pumps	\$12,000 /ea	/ 15 years	X 2 pumps	= \$1,600 /yr
Wetwell	\$10,000 /ea	/ 20 years	X 1 ea	= \$500 /yr
Control Panel	\$25,000 /ea	/ 20 years	X 1 ea	= \$1,250 /yr
Misc. Equip	\$1,000 /ea	/ 15 years	X 1 ea	= \$67 /yr
				\$3,417 /yr
ROUND TO:				\$3,400 /yr

SUMMARY	
LABOR	\$5,000 /yr
POWER	\$3,030 /yr
EQUIPMENT REPLACEMENT (LIFT STATION)	\$3,400 /yr
	\$11,430 /yr
ANNUAL O&M	\$45 /yr/EDU

North Port

connections 255
EDU's 255

ANNUAL O&M ESTIMATE
small service area
LOW PRESSURE SYSTEM

LABOR			
Item	Labor effort	Quantity	Annual Labor
Lift Station - (if req'd)	180 hrs/yr/station	x 1 station	= 180 hrs/yr
Piping	60 hrs/yr/system	x 1 system	= 60 hrs/yr
Grinder pumps	1.50 hrs/yr/GP	x 255 GP's	= 383 hrs/yr
			623 hrs/yr
			x \$20 /hr
			x 1.25 Overhead
			\$15,575 /yr
ROUND TO:			\$15,600 /yr

		POWER					
Item	Unit cost	EDU		Duration		Annual Power	
Lift Station - (if req'd)							
Flat rate	\$125.00 /mo	x	1		12 mo		\$1,500 /yr
Consumption	\$0.50 /mo/EDU	x	255 EDU	x	12 mo	=	<u>\$1,530 /yr</u>
							\$3,030
Grinder Pumps							
	\$0.75 /mo/EDU	x	255 EDU	x	12 mo		<u>\$2,295 /yr</u>
							\$5,325
ROUND TO:							\$5,300 /yr

		EQUIPMENT REPLACEMENT					
Item	Replacement cost		Useful life		Quantity		Annual R&R
LIFT STATION (if req'd)							
Sewage Pumps	\$12,000 /ea	/	15 years	x	2 pumps	=	\$1,600 /yr
Wetwell	\$10,000 /ea	/	20 years	x	1 ea	=	\$500 /yr
Control Panel	\$25,000 /ea	/	20 years	x	1 ea	=	\$1,250 /yr
Misc. Equip	\$1,000 /ea	/	15 years	x	1 ea	=	<u>\$67 /yr</u>
							\$3,417 /yr
						ROUND TO:	\$3,400 /yr
GRINDER PUMPS							
Rebuild pump core	\$750 /ea	/	7 years	x	255 GP's	=	\$27,321 /yr
Replace controls	\$300 /ea	/	7 years	x	255 GP's	=	\$10,929 /yr
Misc. Parts	\$15 /yr	/	10 years	x	255 GP's	=	<u>\$383 /yr</u>
							\$38,633 /yr
						ROUND TO:	\$38,600 /yr

SUMMARY	
LABOR	\$15,600 /yr
POWER	\$5,300 /yr
EQUIPMENT REPLACEMENT (LIFT STATION)	\$3,400 /yr
EQUIPMENT REPLACEMENT (GP'S)	\$38,600 /yr
	\$62,900 /yr
ANNUAL O&M	\$247 /yr/EDU

North Port

connections 255
EDU's 255

ANNUAL O&M ESTIMATE
small service area
VACUUM SYSTEM

LABOR				
Item	Labor effort	Quantity		Annual Labor
Vacuum Station	450 hrs/yr/station	x	1 station	= 450 hrs/yr
Piping	60 hrs/yr/system	x	1 system	= 60 hrs/yr
Valves	1.75 hrs/yr/valve	x	102 valves	= 179 hrs/yr
				689 hrs/yr
				x \$20 /hr
				x 1.25 Overhead
				\$17,225 /yr
ROUND TO:				\$17,200 /yr

POWER				
Item	Unit cost	EDU		Annual Power
Vacuum Station				
Flat rate	\$125.00 /mo	x	1 Vac Sta	12 mo = \$1,500 /yr
Consumption	\$2.50 /mo/EDU	x	255 EDU	x 12 mo = \$7,650 /yr
				\$9,150
ROUND TO:				\$9,200 /yr

		EQUIPMENT REPLACEMENT						
Item	Replacement cost		Useful life		Quantity		Annual R&R	
VACUUM STATION								
Vacuum Pumps	\$21,500 /ea	/	15 years	x	3 pumps	=	\$4,300 /yr	
Sewage Pumps	\$10,000 /ea	/	15 years	x	2 pumps	=	\$1,333 /yr	
Collection Tank	\$30,000 /ea	/	30 years	x	1 ea	=	\$1,000 /yr	
Control Panel	\$30,000 /ea	/	20 years	x	1 ea	=	\$1,500 /yr	
Misc. Equip	\$3,000 /ea	/	15 years	x	1 ea	=	<u>\$200 /yr</u>	
							\$8,333 /yr	
ROUND TO:							\$8,300 /yr	
VACUUM VALVES								
Vacuum Valves	\$45 /ea	/	15 years	x	102 valves	=	\$306 /yr	
Controller	\$45 /ea	/	10 years	x	102 valves	=	\$459 /yr	
Misc. Parts	\$20 /ea	/	10 years	x	102 valves	=	<u>\$204 /yr</u>	
							\$969 /yr	
ROUND TO:							\$1,000 /yr	

SUMMARY	
LABOR	\$17,200 /yr
POWER	\$9,200 /yr
EQUIPMENT REPLACEMENT (STATION)	\$8,300 /yr
EQUIPMENT REPLACEMENT (VALVES)	\$1,000 /yr
	\$35,700 /yr
ANNUAL O&M	\$140 /yr/EDU

ANNUAL O&M COMPARISON			
	VACUUM	GRAVITY SEWER	LOW PRESSURE
# CONNECTIONS	255 ea	255 ea	255 ea
# OF EDU'S	255 ea	255 ea	255 ea
# UNITS	102 valves	n/a	255 GP's
# VACUUM OR LIFT STATIONS	1 ea	1 ea	1 ea
LABOR	\$17,200 /yr	\$5,000 /yr	\$15,600 /yr
POWER	\$9,200 /yr	\$3,030 /yr	\$5,300 /yr
EQUIPMENT REPLACEMENT (Vac Sta/Lift Sta)	\$8,300 /yr	\$3,400 /yr	\$3,400 /yr
REBUILD/REPAIR FREQUENCY			
Rebuild/repair frequency (vacuum valve/wetwell pumps/GP core)	15 yrs	15 yrs	7 yrs
Rebuild/repair frequency (controllers/pump controls)	10 yrs	20 yrs	7 yrs
Rebuild/repair frequency (gravity wetwell)	n/a	20 yrs	20 yrs
Misc Spare parts frequency	10 yrs	15 yrs	10 yrs
EQUIPMENT REPLACEMENT (Valves/Grinder Pumps)	<u>\$1,000 /yr</u>	<u>n/a /yr</u>	<u>\$38,600 /yr</u>
ANNUAL O&M	\$35,735 /yr	\$11,500 /yr	\$62,944 /yr
ANNUAL O&M per EDU	\$140 /yr/EDU	\$45 /yr/EDU	\$247 /yr/EDU

Present Worth Analysis													
Project	City of North Port				For comparative analysis only								
Planning Time frame	40	years	(Does not include all project costs)										
interest rate	4.500	percent											
ERC's	255	ERC's											
System Type	Construction cost	Other Costs	legal, engr , survey	const services/ contingency	total initial cost "C"	Annual O&M	O&M Uniform series Present worth factor	USPW (O+M)	Salvage Value	SPPW(S)	Salvage value	NET PRESENT VALUE	RANK
Gravity	\$ 4,709,433.00		0	0	\$ 4,709,433.00	\$ 11,500.00	18.402	\$ 211,618.22	\$ 481,692.00	0.1719	82,817	\$ 4,838,235	third
Vacuum	\$ 2,339,990.00		0	0	\$ 2,339,990.00	\$ 35,735.00	18.402	\$ 657,580.62	\$ 111,720.00	0.1719	19,208	\$ 2,978,363	first
Low Pressure	\$ 2,121,430.00		0	0	\$ 2,121,430.00	\$ 62,944.00	18.402	\$ 1,158,269.33	\$ 121,958.00	0.1719	20,968	\$ 3,258,731	second
NPV = C+ USPW (O&M)- NPC C USPW (O&M) equals SPPW (S)													
SPPW(S) Net Present Value capital cost			n (years) 40	i % 0.045	(1+i)nth 5.816364538	i(1+i)nth 0.261736404	Present W factor 18.40158						
Uniform series Present worth $\frac{A(1+i)^nth - 1}{i(1+i)^nth}$													
Single Payment Present Worth Salvage Value $FV*1/(1+i)^nth$								SPPW 0.17193					
Salvage value							Construction Cost Estimates						
Element		life span	Value new	40 year dep	Remaining Value	% of const cost	Desc		qty	unit price	total		
Gravity	lift station	50	\$ 300,000.00	\$ 240,000.00	\$ 60,000.00		Gravity lift station		1	\$ 300,000.00	\$ 300,000.00		
	mains	50	\$ 1,656,750.00	\$ 1,325,400.00	\$ 331,350.00		Gravity mains		13,254	\$ 125.00	\$ 1,656,750.00		
	manholes	40	\$ 570,000.00	\$ 570,000.00	\$ -		Man Holes		60	\$ 9,500.00	\$ 570,000.00		
	service lines	50	\$ 357,000.00	\$ 285,600.00	\$ 71,400.00		service lines		8,925	\$ 40.00	\$ 357,000.00		
	force main	50	\$ 94,710.00	\$ 75,768.00	\$ 18,942.00		Force Main		3,157	\$ 30.00	\$ 94,710.00		
	Road repair	40					Road repair		14,533	\$ 111.00	\$ 1,613,163.00		
	Restoration	40					driveways			\$ 500.00	\$ -		
							Sod		255	\$ 462.00	\$ 117,810.00		
					\$ 481,692.00	10%			total		\$ 4,709,433.00		
Vacuum	vac build/site	40	\$ 750,000.00	\$ 750,000.00	\$ -		Vac sta		1	\$ 750,000.00	\$ 750,000.00		
	pipe in road	50	\$ 463,890.00	\$ 371,112.00	\$ 92,778.00		Vacuum pipe		13,254	\$ 35.00	\$ 463,890.00		
	f.m.	50	\$ 94,710.00	\$ 75,768.00	\$ 18,942.00		Force Main		3,157	\$ 30.00	\$ 94,710.00		
	valve pits	40	\$ 680,000.00	\$ 680,000.00	\$ -		valve pits		113	\$ 6,000.00	\$ 680,000.00		
	Road repair	40	\$ 169,830.00				Road Crossings		255	\$ 666.00	\$ 169,830.00		
							Driveways (50% dev)		128	\$ 500.00	\$ 63,750.00		
	Restoration						Sod		255	\$ 462.00	\$ 117,810.00		
					\$ 111,720.00	5%			total		\$ 2,339,990.00		
Low Pressure	lps systems on site	40	\$ 1,224,000.00	\$ 1,224,000.00	\$ -		grinder pumps		255	\$ 4,800.00	\$ 1,224,000.00		
	pipes in road	50	\$ 265,080.00	\$ 212,064.00	\$ 53,016.00		Low Pressure mains 3-8"		13,254	\$ 20.00	\$ 265,080.00		
	lift station	50	\$ 250,000.00	\$ 200,000.00	\$ 50,000.00		master lift station		1	\$ 250,000.00	\$ 250,000.00		
	fm	50	\$ 94,710.00	\$ 75,768.00	\$ 18,942.00		Force Main		3,157	\$ 30.00	\$ 94,710.00		
	Road repair						Road crossings		255	\$ 666.00	\$ 169,830.00		
	Restoration						Sod		255	\$ 462.00	\$ 117,810.00		
					\$ 121,958.00	6%			total		\$ 2,121,430.00		
O & M costs per year													
Cost per EDU		EDU's	cost/year										
Gravity	\$ 45.10	255	\$ 11,500.00										
Vacuum	\$ 140.14	255	\$ 35,735.00										
Low pressure	\$ 246.84	255	\$ 62,944.00										

GWE # 6450

APPENDIX E

Mid-Size Areas 250-750 Lots

- **Conceptual layouts gravity, vacuum and low pressure.**
- **Operation and maintenance costs**
- **Operation and maintenance comparison**
- **Present worth analysis and ranking**

MID SIZE AREAS



Gravity Sewer

Vacuum Sewer



Low Pressure Sewer

PROJECT INFORMATION

PROJECT NAME (city and state)
TITLE

North Port Florida
small service area

CONNECTIONS
EDU'S

534
534

This spreadsheet is based on Airvac's standard peak flow rate of 0.64 gpm/EDU. If the actual flow rate is lower than that, the replacement costs for the vacuum station will be less than the value returned by the formulas as smaller vacuum stations skid models than shown would most likely result.

BASIC DATA

LOW PRESSURE SEWER

GRINDER PUMPS

SIMPLEX GRINDER PUMPS

534

ea

DUPLEX GRINDER PUMPS

0

TOTAL # GRINDER PUMPS

534

ea

Connection/GP ratio

1.00

INTERMEDIATE LIFT STATION REQ'D?

Yes

of Lift stations

HP of pumps (if lift station is req'd)

15

hp

1

ea

LABOR RATE

Hourly labor rate

\$20.00

/hr

Overhead

25%

GRAVITY SEWER

LIFT STATIONS

OF LIFT STATIONS

1

ea

HP of pumps

15

hp

LABOR RATE

Hourly labor rate

\$20.00

/hr

Overhead

25%

VACUUM SEWER

VALVE PITS

AIRVAC VALVE PITS

214

ea

SINGLE BUFFER TANKS

0

ea

DUAL BUFFER TANKS

0

ea

TOTAL # VALVES

214

ea

Connection/VP ratio

2.50

piping network size*

VACUUM STATION

Skid Model (enter type of vacuum pump)

Mink

1

2DM-30

* compared to a typical system with this # of connections

LABOR RATE

Hourly rate

\$20.00

/hr

Overhead

25%

O&M INFORMATION

LABOR

Lift Station (180-240), if LS is req'd

180

hrs/yr/station

Piping (40 - 80)

60

hrs/yr/system

Grinder Pumps (0.5 to 2.75)

1.50

hrs/yr/gp

POWER

Lift station: Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$0.50 - \$1.50)

\$0.50

/mo/EDU

Grinder pumps: Usage fee (\$0.50-\$1.50/mo)

\$0.75

/mo/EDU

EQUIPMENT REPLACEMENT

LIFT STATION

n/a

Vacuum Pumps

n/a

2

Sewage Pumps

\$12,000

15

yrs

1

Wetwell tank

\$10,000

20

yrs

1

Control Panel

\$25,000

20

yrs

Misc Equip (\$1,000 - \$2,000)

\$1,000

15

yrs

GRINDER PUMPS

Rebuild pump cores (\$750 - \$1,500)

\$750

7

yrs

Replace controls (\$300 - \$700)

\$300

7

yrs

Misc. Parts (\$15.00 - \$30.00)

\$15

10

yrs

LABOR

Lift Station (180-240), if LS is req'd

180

hrs/yr/station

Piping (40 - 80)

20

hrs/yr/system

POWER

Lift station: Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$0.50 - \$1.50)

\$0.50

/mo/EDU

EQUIPMENT REPLACEMENT

LIFT STATION

n/a

Vacuum Pumps

n/a

2

Sewage Pumps

\$12,000

15

yrs

1

Wetwell tank

\$10,000

20

yrs

1

Control Panel

\$25,000

20

yrs

Misc Equip (\$1,000 - \$2,000)

\$1,000

15

yrs

LABOR

Vacuum Station (180-450)

450

hrs/yr/station

Piping (40 - 80)

60

hrs/yr/system

Valves (0.5 to 2.0)

1.75

hrs/yr/valve

POWER

Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$1.00 - \$2.50)

\$2.50

/mo/EDU

Vacuum valves: no power req'd

\$0.00

/mo/EDU

EQUIPMENT REPLACEMENT

VACUUM STATION

2

Vacuum Pumps

\$26,000

15

yrs

2

Sewage Pumps

\$12,000

15

yrs

1

Collection tank

\$35,000

30

yrs

1

Control Panel

\$30,000

20

yrs

Misc Equip (\$2,000 - \$3,000)

\$3,000

15

yrs

VACUUM VALVES (rebuild kits, etc)

Valves (\$35 - \$50)

\$45

15

yrs

Controller (\$35 - \$50)

\$45

10

yrs

Misc. Parts (\$15 - \$30)

\$20

10

yrs

35

North Port Florida

connections 534
EDU's 534

ANNUAL O&M ESTIMATE
small service area
GRAVITY SEWER

		LABOR			
Item	Labor effort		Quantity		Annual Labor
Lift Station - (if req'd)	180 hrs/yr/station	X	1 station	=	180 hrs/yr
Piping	20 hrs/yr/system	X	1 system	=	20 hrs/yr
				=	0 hrs/yr
					200 hrs/yr
				X	\$20 /hr
				X	1.25 Overhead
					\$5,000 /yr
ROUND TO:					\$5,000 /yr

		POWER			
Item	Unit cost		EDU	Duration	Annual Power
Lift Station - (if req'd)					
Flat rate	\$125.00 /mo	X	1 station	12 mo	\$1,500 /yr
Consumption	\$0.50 /mo/EDU	X	534 EDU	X 12 mo	= \$3,204 /yr
					\$4,704
ROUND TO:					\$4,704 /yr

		EQUIPMENT REPLACEMENT			
Item	Replacement cost		Useful life	Quantity	Annual R&R
LIFT STATION (if req'd)					
Sewage Pumps	\$12,000 /ea	/	15 years	X 2 pumps	= \$1,600 /yr
Wetwell	\$10,000 /ea	/	20 years	X 1 ea	= \$500 /yr
Control Panel	\$25,000 /ea	/	20 years	X 1 ea	= \$1,250 /yr
Misc. Equip	\$1,000 /ea	/	15 years	X 1 ea	= \$67 /yr
					\$3,417 /yr
ROUND TO:					\$3,400 /yr

SUMMARY	
LABOR	\$5,000 /yr
POWER	\$4,704 /yr
EQUIPMENT REPLACEMENT (LIFT STATION)	\$3,400 /yr
	\$13,104 /yr
ANNUAL O&M	\$25 /yr/EDU

North Port Florida

connections 534
EDU's 534

ANNUAL O&M ESTIMATE
small service area
VACUUM SYSTEM

LABOR				
Item	Labor effort	Quantity		Annual Labor
Vacuum Station	450 hrs/yr/station	x	1 station	= 450 hrs/yr
Piping	60 hrs/yr/system	x	1 system	= 60 hrs/yr
Valves	1.75 hrs/yr/valve	x	214 valves	= 374 hrs/yr
				884 hrs/yr
				x \$20 /hr
				x 1.25 Overhead
				\$22,100 /yr
ROUND TO:				\$22,100 /yr

POWER				
Item	Unit cost	EDU	Duration	Annual Power
Vacuum Station				
Flat rate	\$125.00 /mo	x	1 Vac Sta	12 mo = \$1,500 /yr
Consumption	\$2.50 /mo/EDU	x	534 EDU	x 12 mo = \$16,020 /yr
				\$17,520
ROUND TO:				\$17,500 /yr

		EQUIPMENT REPLACEMENT					
Item	Replacement cost		Useful life		Quantity		Annual R&R
VACUUM STATION							
Vacuum Pumps	\$26,000 /ea	/	15 years	x	2 pumps	=	\$3,467 /yr
Sewage Pumps	\$12,000 /ea	/	15 years	x	2 pumps	=	\$1,600 /yr
Collection Tank	\$35,000 /ea	/	30 years	x	1 ea	=	\$1,167 /yr
Control Panel	\$30,000 /ea	/	20 years	x	1 ea	=	\$1,500 /yr
Misc. Equip	\$3,000 /ea	/	15 years	x	1 ea	=	<u>\$200 /yr</u>
							\$7,933 /yr
						ROUND TO:	\$7,900 /yr
VACUUM VALVES							
Vacuum Valves	\$45 /ea	/	15 years	x	214 valves	=	\$641 /yr
Controller	\$45 /ea	/	10 years	x	214 valves	=	\$961 /yr
Misc. Parts	\$20 /ea	/	10 years	x	214 valves	=	<u>\$427 /yr</u>
							\$2,029 /yr
						ROUND TO:	\$2,000 /yr

SUMMARY	
LABOR	\$22,100 /yr
POWER	\$17,500 /yr
EQUIPMENT REPLACEMENT (STATION)	\$7,900 /yr
EQUIPMENT REPLACEMENT (VALVES)	\$2,000 /yr
	\$49,500 /yr
ANNUAL O&M	\$93 /yr/EDU

North Port Florida

connections 534
EDU's 534

ANNUAL O&M ESTIMATE
small service area
LOW PRESSURE SYSTEM

LABOR			
Item	Labor effort	Quantity	Annual Labor
Lift Station - (if req'd)	180 hrs/yr/station	x 1 station	= 180 hrs/yr
Piping	60 hrs/yr/system	x 1 system	= 60 hrs/yr
Grinder pumps	1.50 hrs/yr/GP	x 534 GP's	= 801 hrs/yr
			1041 hrs/yr
			x \$20 /hr
			x 1.25 Overhead
			\$26,025 /yr
ROUND TO:			\$26,000 /yr

		POWER					
Item	Unit cost	EDU		Duration		Annual Power	
Lift Station - (if req'd)							
Flat rate	\$125.00 /mo	x	1		12 mo		\$1,500 /yr
Consumption	\$0.50 /mo/EDU	x	534 EDU	x	12 mo	=	<u>\$3,204 /yr</u>
							\$4,704
Grinder Pumps	\$0.75 /mo/EDU	x	534 EDU	x	12 mo		<u>\$4,806 /yr</u>
							\$9,510
ROUND TO:							\$9,500 /yr

		EQUIPMENT REPLACEMENT						
Item	Replacement cost		Useful life		Quantity		Annual R&R	
LIFT STATION (if req'd)								
Sewage Pumps	\$12,000 /ea	/	15 years	x	2 pumps	=	\$1,600 /yr	
Wetwell	\$10,000 /ea	/	20 years	x	1 ea	=	\$500 /yr	
Control Panel	\$25,000 /ea	/	20 years	x	1 ea	=	\$1,250 /yr	
Misc. Equip	\$1,000 /ea	/	15 years	x	1 ea	=	<u>\$67 /yr</u>	
							\$3,417 /yr	
ROUND TO:							\$3,400 /yr	
GRINDER PUMPS								
Rebuild pump core	\$750 /ea	/	7 years	x	534 GP's	=	\$57,214 /yr	
Replace controls	\$300 /ea	/	7 years	x	534 GP's	=	\$22,886 /yr	
Misc. Parts	\$15 /yr	/	10 years	x	534 GP's	=	<u>\$801 /yr</u>	
							\$80,901 /yr	
ROUND TO:							\$80,900 /yr	

SUMMARY	
LABOR	\$26,000 /yr
POWER	\$9,500 /yr
EQUIPMENT REPLACEMENT (LIFT STATION)	\$3,400 /yr
EQUIPMENT REPLACEMENT (GP'S)	\$80,900 /yr
	\$119,800 /yr
ANNUAL O&M	\$224 /yr/EDU

ANNUAL O&M COMPARISON			
	VACUUM	GRAVITY SEWER	LOW PRESSURE
# CONNECTIONS	534 ea	534 ea	534 ea
# OF EDU'S	534 ea	534 ea	534 ea
# UNITS	214 valves	n/a	534 GP's
# VACUUM OR LIFT STATIONS	1 ea	1 ea	1 ea
LABOR	\$22,100 /yr	\$5,000 /yr	\$26,000 /yr
POWER	\$17,500 /yr	\$4,704 /yr	\$9,500 /yr
EQUIPMENT REPLACEMENT (Vac Sta/Lift Sta)	\$7,900 /yr	\$3,400 /yr	\$3,400 /yr
REBUILD/REPAIR FREQUENCY			
Rebuild/repair frequency (vacuum valve/wetwell pumps/GP core)	15 yrs	15 yrs	7 yrs
Rebuild/repair frequency (controllers/pump controls)	10 yrs	20 yrs	7 yrs
Rebuild/repair frequency (gravity wetwell)	n/a	20 yrs	20 yrs
Misc Spare parts frequency	10 yrs	15 yrs	10 yrs
EQUIPMENT REPLACEMENT (Valves/Grinder Pumps)	<u>\$2,000 /yr</u>	<u>n/a /yr</u>	<u>\$80,900 /yr</u>
ANNUAL O&M	\$49,535 /yr	\$13,174 /yr	\$119,844 /yr
ANNUAL O&M per EDU	\$93 /yr/EDU	\$25 /yr/EDU	\$224 /yr/EDU

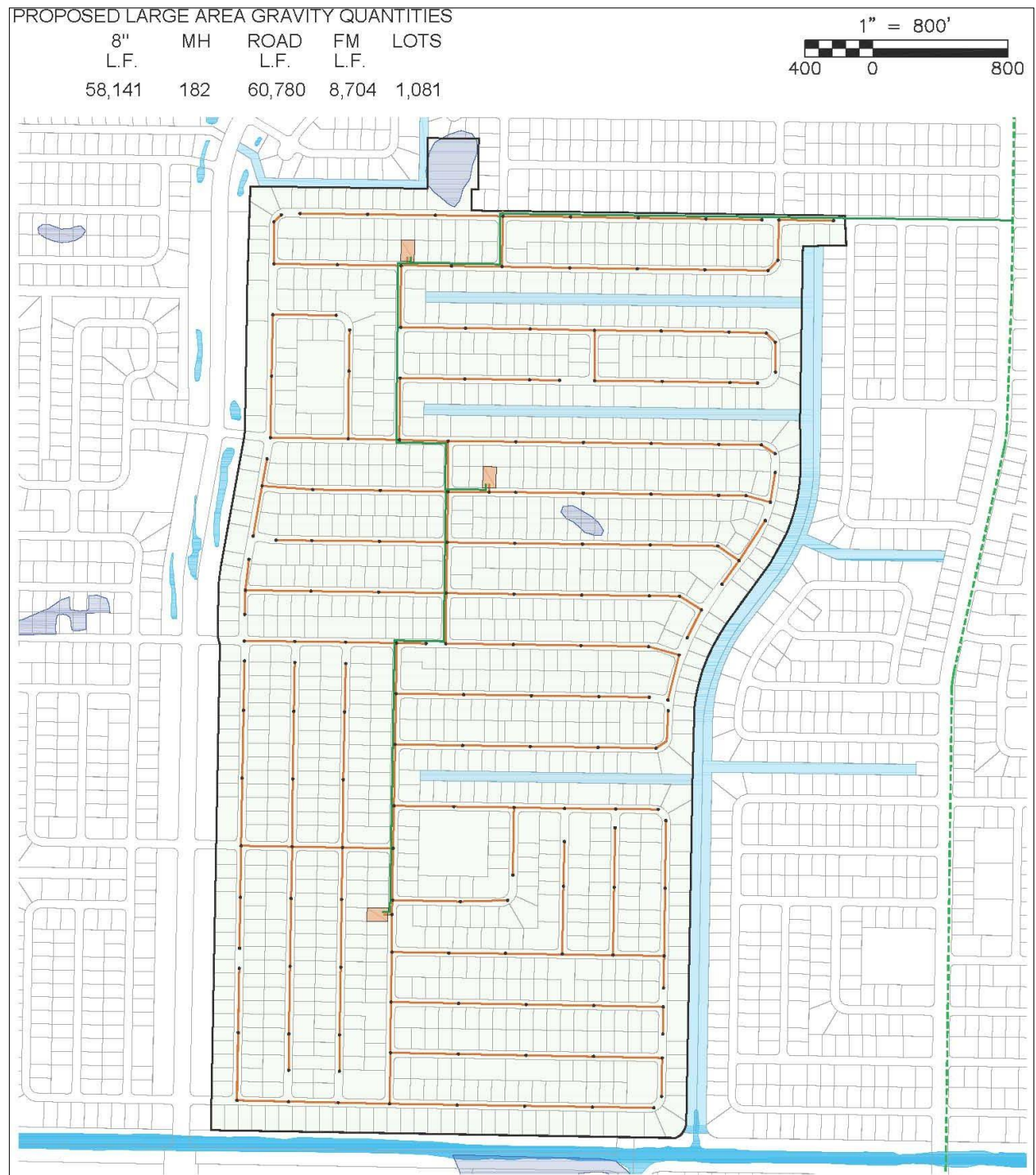
Present Worth Analysis													
Project	City of North Port			For comparative analysis only									
Planning Time frame	40	years	(Does not include all project costs)										
interest rate	4.500	percent											
ERC's	534	ERC's											
System Type	Construction cost	Other Costs	legal, engr , survey	const services/ contingency	total initial cost "C"	Annual O&M	O&M Uniform series Present worth factor	USPW (O+M)	Salvage Value	SPPW(S)	Salvage value	NET PRESENT VALUE	RANK
Gravity	\$ 9,079,468.00		0	0	\$ 9,079,468.00	\$ 13,174.00	18.402	\$ 242,422.47	\$ 927,952.00	0.1719	159,542	\$ 9,162,349	third
Vacuum	\$ 3,973,077.00		0	0	\$ 3,973,077.00	\$ 49,535.00	18.402	\$ 911,522.48	\$ 212,645.00	0.1719	36,560	\$ 4,848,040	first
Low Pressure	\$ 4,061,412.00		0	0	\$ 4,061,412.00	\$ 119,844.00	18.402	\$ 2,205,319.48	\$ 179,172.00	0.1719	30,805	\$ 6,235,927	second
NPV = C+ USPW (O&M)- NPC C	SPPW(S) Net Present Value capital cost												
USPW (O&M) equals	Uniform series Present worth		n (years) 40	i % 0.045	(1+i)nth 5.816364538	i(1+i)nth 0.261736404	Present W factor 18.40158						
SPPW (S)	i(1+i)nth							SPPW 0.17193					
	Single Payment Present Worth Salvage Value FV*1/(1+i)nth												
Salvage value						Construction Cost Estimates							
	Element	life span	Value new	40 year dep	Remaining Value	% of const cost		Desc	qty	unit price	total		
Gravity	lift station	50	\$ 300,000.00	\$ 240,000.00	\$ 60,000.00			Gravity lift station	1	\$ 300,000.00	\$ 300,000.00		
	mains	50	\$ 3,507,500.00	\$ 2,806,000.00	\$ 701,500.00			Gravity mains	28,060	\$ 125.00	\$ 3,507,500.00		
	manholes	40	\$ 807,500.00	\$ 807,500.00	\$ -			Man Holes	85	\$ 9,500.00	\$ 807,500.00		
	service lines	50	\$ 747,600.00	\$ 598,080.00	\$ 149,520.00			service lines	18,690	\$ 40.00	\$ 747,600.00		
	force main	50	\$ 84,660.00	\$ 67,728.00	\$ 16,932.00			Force Main	2,822	\$ 30.00	\$ 84,660.00		
	Road repair	40						Road repair	30,500	\$ 111.00	\$ 3,385,500.00		
	Restoration	40						driveways		\$ 500.00	\$ -		
								Sod	534	\$ 462.00	\$ 246,708.00		
					\$ 927,952.00	10%				total	\$ 9,079,468.00		
Vacuum	vac build/site	40	\$ 750,000.00	\$ 750,000.00	\$ -			Vac sta	1	\$ 750,000.00	\$ 750,000.00		
	pipe in road	50	\$ 978,565.00	\$ 782,852.00	\$ 195,713.00			Vacuum pipe	27959	\$ 35.00	\$ 978,565.00		
	f.m.	50	\$ 84,660.00	\$ 67,728.00	\$ 16,932.00			Force Main	2822	\$ 30.00	\$ 84,660.00		
	valve pits	40	\$ 1,424,000.00	\$ 1,424,000.00	\$ -			valve pits	237	\$ 6,000.00	\$ 1,424,000.00		
	Road repair	40	\$ 355,644.00					Road Crossings	534	\$ 666.00	\$ 355,644.00		
								Driveways (50% dev)	267	\$ 500.00	\$ 133,500.00		
	Restoration							Sod	534	\$ 462.00	\$ 246,708.00		
						\$ 212,645.00	5%			total	\$ 3,973,077.00		
Low Pressure	lps systems on site	40	\$ 2,563,200.00	\$ 2,563,200.00	\$ -			grinder pumps	534	\$ 4,800.00	\$ 2,563,200.00		
	pipes in road	50	\$ 561,200.00	\$ 448,960.00	\$ 112,240.00			Low Pressure mains 3-8"	28,060	\$ 20.00	\$ 561,200.00		
	lift station	50	\$ 250,000.00	\$ 200,000.00	\$ 50,000.00			master lift station	1	\$ 250,000.00	\$ 250,000.00		
	fm	50	\$ 84,660.00	\$ 67,728.00	\$ 16,932.00			Force Main	2,822	\$ 30.00	\$ 84,660.00		
	Road repair							Road crossings	534	\$ 666.00	\$ 355,644.00		
	Restoration							Sod	534	\$ 462.00	\$ 246,708.00		
						\$ 179,172.00	4%			total	\$ 4,061,412.00		
O & M costs per year													
	Cost per EDU	EDU's	cost/year										
Gravity	\$ 24.67	534	\$ 13,174.00										
Vacuum	\$ 92.76	534	\$ 49,535.00										
Low pressure	\$ 224.43	534	\$ 119,844.00										
GWE # 6450													

APPENDIX F

Large Areas 750-1500 Lots

- Conceptual layouts gravity, vacuum and low pressure.
- Operation and maintenance costs
- Operation and maintenance comparison
- Present worth analysis and ranking

Large Areas

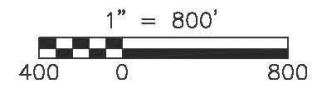


Gravity Sewer

Large Areas

PROPOSED LARGE AREA VACUUM QUANTITIES

VAC MAIN L.F.	SHOULDER L.F.	FM L.F.	LOTS
58,608	60,780	5,820	1,081



Vacuum Sewer

Large Areas

PROPOSED LARGE AREA LOW PRESSURE QUANTITIES

4"-6" L.F.	SHOULDER L.F.	FM L.F.	LOTS
58,548	60,780	8,652	1,081

1" = 800'
400 0 800



Low Pressure Sewer

PROJECT INFORMATION

PROJECT NAME (city and state)
TITLE

North Port Florida
Large service area

CONNECTIONS
EDU'S

1081
1081

This spreadsheet is based on Airvac's standard peak flow rate of 0.64 gpm/EDU. If the actual flow rate is lower than that, the replacement costs for the vacuum station will be less than the value returned by the formulas as smaller vacuum stations skid models than shown would most likely result.

BASIC DATA

LOW PRESSURE SEWER

GRINDER PUMPS

SIMPLEX GRINDER PUMPS

1,081

ea

DUPLEX GRINDER PUMPS

0

TOTAL # GRINDER PUMPS

1,081

ea

Connection/GP ratio

1.00

INTERMEDIATE LIFT STATION REQ'D?

Yes

of Lift stations

HP of pumps (if lift station is req'd)

15

hp

2

ea

LABOR RATE

Hourly labor rate

\$20.00

/hr

Overhead

25%

GRAVITY SEWER

LIFT STATIONS

OF LIFT STATIONS

3

ea

HP of pumps

15

hp

LABOR RATE

Hourly labor rate

\$20.00

/hr

Overhead

25%

VACUUM SEWER

VALVE PITS

AIRVAC VALVE PITS

432

ea

SINGLE BUFFER TANKS

0

ea

DUAL BUFFER TANKS

0

ea

TOTAL # VALVES

432

ea

Connection/VP ratio

2.50

piping network size*

VACUUM STATION

Skid Model (enter type of vacuum pump)

Mink

1

5DM-60

larger than ave

LABOR RATE

Hourly rate

\$20.00

/hr

Overhead

25%

* compared to a typical system with this # of connections

O&M INFORMATION

LABOR

Lift Station (180-240), if LS is req'd

180

hrs/yr/station

Piping (40 - 80)

60

hrs/yr/system

Grinder Pumps (0.5 to 2.75)

1.50

hrs/yr/gp

POWER

Lift station: Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$0.50 - \$1.50)

\$0.50

/mo/EDU

Grinder pumps: Usage fee (\$0.50-\$1.50/mo)

\$0.75

/mo/EDU

EQUIPMENT REPLACEMENT

LIFT STATION

n/a

Vacuum Pumps

n/a

4

Sewage Pumps

\$12,000

15

yrs

2

Wetwell tank

\$10,000

20

yrs

2

Control Panel

\$25,000

20

yrs

Misc Equip (\$1,000 - \$2,000)

\$1,000

15

yrs

GRINDER PUMPS

Rebuild pump cores (\$750 - \$1,500)

\$750

7

yrs

Replace controls (\$300 - \$700)

\$300

7

yrs

Misc. Parts (\$15.00 - \$30.00)

\$15

10

yrs

LABOR

Lift Station (180-240), if LS is req'd

180

hrs/yr/station

Piping (40 - 80)

20

hrs/yr/system

POWER

Lift station: Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$0.50 - \$1.50)

\$0.50

/mo/EDU

EQUIPMENT REPLACEMENT

LIFT STATION

n/a

Vacuum Pumps

n/a

6

Sewage Pumps

\$12,000

15

yrs

3

Wetwell tank

\$10,000

20

yrs

3

Control Panel

\$25,000

20

yrs

Misc Equip (\$1,000 - \$2,000)

\$1,000

15

yrs

LABOR

Vacuum Station (180-450)

450

hrs/yr/station

Piping (40 - 80)

60

hrs/yr/system

Valves (0.5 to 2.0)

1.75

hrs/yr/valve

POWER

Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$1.00 - \$2.50)

\$2.50

/mo/EDU

Vacuum valves: no power req'd

\$0.00

/mo/EDU

EQUIPMENT REPLACEMENT

VACUUM STATION

5

Vacuum Pumps

\$26,000

15

yrs

2

Sewage Pumps

\$15,000

15

yrs

1

Collection tank

\$50,000

30

yrs

1

Control Panel

\$50,000

20

yrs

Misc Equip (\$2,000 - \$3,000)

\$3,000

15

yrs

VACUUM VALVES (rebuild kits, etc)

Valves (\$35 - \$50)

\$45

15

yrs

Controller (\$35 - \$50)

\$45

10

yrs

Misc. Parts (\$15 - \$30)

\$20

10

yrs

45

North Port Florida

connections 1081
EDU's 1081

ANNUAL O&M ESTIMATE

Large service area
GRAVITY SEWER

		LABOR				
Item	Labor effort		Quantity			Annual Labor
Lift Station - (if req'd)	180 hrs/yr/station	X	3 station	=		540 hrs/yr
Piping	20 hrs/yr/system	X	1 system	=		20 hrs/yr
				=		0 hrs/yr
						560 hrs/yr
				X		\$20 /hr
				X		1.25 Overhead
						\$14,000 /yr
ROUND TO:						\$14,000 /yr

		POWER				
Item	Unit cost		EDU	Duration		Annual Power
Lift Station - (if req'd)						
Flat rate	\$125.00 /mo	X	3 station	12 mo		\$4,500 /yr
Consumption	\$0.50 /mo/EDU	X	1081 EDU	X 12 mo	=	\$6,486 /yr
						\$10,986
ROUND TO:						\$10,986 /yr

		EQUIPMENT REPLACEMENT				
Item	Replacement cost		Useful life	Quantity		Annual R&R
LIFT STATION (if req'd)						
Sewage Pumps	\$12,000 /ea	/	15 years	X 6 pumps	=	\$4,800 /yr
Wetwell	\$10,000 /ea	/	20 years	X 3 ea	=	\$1,500 /yr
Control Panel	\$25,000 /ea	/	20 years	X 3 ea	=	\$3,750 /yr
Misc. Equip	\$1,000 /ea	/	15 years	X 1 ea	=	\$67 /yr
						\$10,117 /yr
ROUND TO:						\$10,100 /yr

SUMMARY	
LABOR	\$14,000 /yr
POWER	\$10,986 /yr
EQUIPMENT REPLACEMENT (LIFT STATION)	\$10,100 /yr
	\$35,086 /yr
ANNUAL O&M	\$32 /yr/EDU

North Port Florida

connections 1081
EDU's 1081

ANNUAL O&M ESTIMATE
Large service area
VACUUM SYSTEM

LABOR				
Item	Labor effort	Quantity		Annual Labor
Vacuum Station	450 hrs/yr/station	x	1 station	= 450 hrs/yr
Piping	60 hrs/yr/system	x	1 system	= 60 hrs/yr
Valves	1.75 hrs/yr/valve	x	432 valves	= 757 hrs/yr
				1267 hrs/yr
				x \$20 /hr
				x 1.25 Overhead
				\$31,675 /yr
ROUND TO:				\$31,700 /yr

POWER				
Item	Unit cost	EDU		Annual Power
Vacuum Station				
Flat rate	\$125.00 /mo	x	1 Vac Sta	12 mo = \$1,500 /yr
Consumption	\$2.50 /mo/EDU	x	1081 EDU	x 12 mo = \$32,430 /yr
				\$33,930
ROUND TO:				\$33,900 /yr

		EQUIPMENT REPLACEMENT						
Item	Replacement cost		Useful life		Quantity		Annual R&R	
VACUUM STATION								
Vacuum Pumps	\$26,000 /ea	/	15 years	x	5 pumps	=	\$8,667 /yr	
Sewage Pumps	\$15,000 /ea	/	15 years	x	2 pumps	=	\$2,000 /yr	
Collection Tank	\$50,000 /ea	/	30 years	x	1 ea	=	\$1,667 /yr	
Control Panel	\$50,000 /ea	/	20 years	x	1 ea	=	\$2,500 /yr	
Misc. Equip	\$3,000 /ea	/	15 years	x	1 ea	=	<u>\$200 /yr</u>	
							\$15,033 /yr	
ROUND TO:							\$15,000 /yr	
VACUUM VALVES								
Vacuum Valves	\$45 /ea	/	15 years	x	432 valves	=	\$1,297 /yr	
Controller	\$45 /ea	/	10 years	x	432 valves	=	\$1,946 /yr	
Misc. Parts	\$20 /ea	/	10 years	x	432 valves	=	<u>\$865 /yr</u>	
							\$4,108 /yr	
ROUND TO:							\$4,100 /yr	

SUMMARY	
LABOR	\$31,700 /yr
POWER	\$33,900 /yr
EQUIPMENT REPLACEMENT (STATION)	\$15,000 /yr
EQUIPMENT REPLACEMENT (VALVES)	\$4,100 /yr
	\$84,700 /yr
ANNUAL O&M	\$78 /yr/EDU

North Port Florida

connections 1081
EDU's 1081

ANNUAL O&M ESTIMATE
Large service area
LOW PRESSURE SYSTEM

LABOR					
Item	Labor effort	Quantity		Annual Labor	
Lift Station - (if req'd)	180 hrs/yr/station	x	2 station	=	360 hrs/yr
Piping	60 hrs/yr/system	x	1 system	=	60 hrs/yr
Grinder pumps	1.50 hrs/yr/GP	x	1,081 GP's	=	1622 hrs/yr
					2042 hrs/yr
				x	\$20 /hr
				x	1.25 Overhead
					\$51,050 /yr
ROUND TO:					\$51,100 /yr

POWER					
Item	Unit cost	EDU		Duration	Annual Power
Lift Station - (if req'd)					
Flat rate	\$125.00 /mo	x	2	12 mo	\$3,000 /yr
Consumption	\$0.50 /mo/EDU	x	1081 EDU	x 12 mo	= \$6,486 /yr
					\$9,486
Grinder Pumps	\$0.75 /mo/EDU	x	1081 EDU	x 12 mo	\$9,729 /yr
					\$19,215
ROUND TO:					\$19,200 /yr

EQUIPMENT REPLACEMENT					
Item	Replacement cost	Useful life		Quantity	Annual R&R
LIFT STATION (if req'd)					
Sewage Pumps	\$12,000 /ea	/	15 years	x 4 pumps	= \$3,200 /yr
Wetwell	\$10,000 /ea	/	20 years	x 2 ea	= \$1,000 /yr
Control Panel	\$25,000 /ea	/	20 years	x 2 ea	= \$2,500 /yr
Misc. Equip	\$1,000 /ea	/	15 years	x 1 ea	= \$67 /yr
					\$6,767 /yr
ROUND TO:					\$6,800 /yr
GRINDER PUMPS					
Rebuild pump core	\$750 /ea	/	7 years	x 1,081 GP's	= \$115,821 /yr
Replace controls	\$300 /ea	/	7 years	x 1,081 GP's	= \$46,329 /yr
Misc. Parts	\$15 /yr	/	10 years	x 1,081 GP's	= \$1,622 /yr
					\$163,772 /yr
ROUND TO:					\$163,800 /yr

SUMMARY	
LABOR	\$51,100 /yr
POWER	\$19,200 /yr
EQUIPMENT REPLACEMENT (LIFT STATION)	\$6,800 /yr
EQUIPMENT REPLACEMENT (GP'S)	\$163,800 /yr
	\$240,900 /yr
ANNUAL O&M	\$223 /yr/EDU

ANNUAL O&M COMPARISON			
	VACUUM	GRAVITY SEWER	LOW PRESSURE
# CONNECTIONS	1081 ea	1081 ea	1081 ea
# OF EDU'S	1081 ea	1081 ea	1081 ea
# UNITS	432 valves	n/a	1,081 GP's
# VACUUM OR LIFT STATIONS	1 ea	3 ea	2 ea
LABOR	\$31,700 /yr	\$14,000 /yr	\$51,100 /yr
POWER	\$33,900 /yr	\$10,986 /yr	\$19,200 /yr
EQUIPMENT REPLACEMENT (Vac Sta/Lift Sta)	\$15,000 /yr	\$10,100 /yr	\$6,800 /yr
REBUILD/REPAIR FREQUENCY			
Rebuild/repair frequency (vacuum valve/wetwell pumps/GP core)	15 yrs	15 yrs	7 yrs
Rebuild/repair frequency (controllers/pump controls)	10 yrs	20 yrs	7 yrs
Rebuild/repair frequency (gravity wetwell)	n/a	20 yrs	20 yrs
Misc Spare parts frequency	10 yrs	15 yrs	10 yrs
EQUIPMENT REPLACEMENT (Valves/Grinder Pumps)	<u>\$4,100 /yr</u>	<u>n/a /yr</u>	<u>\$163,800 /yr</u>
ANNUAL O&M	\$84,735 /yr	\$35,156 /yr	\$240,944 /yr
ANNUAL O&M per EDU	\$78 /yr/EDU	\$33 /yr/EDU	\$223 /yr/EDU

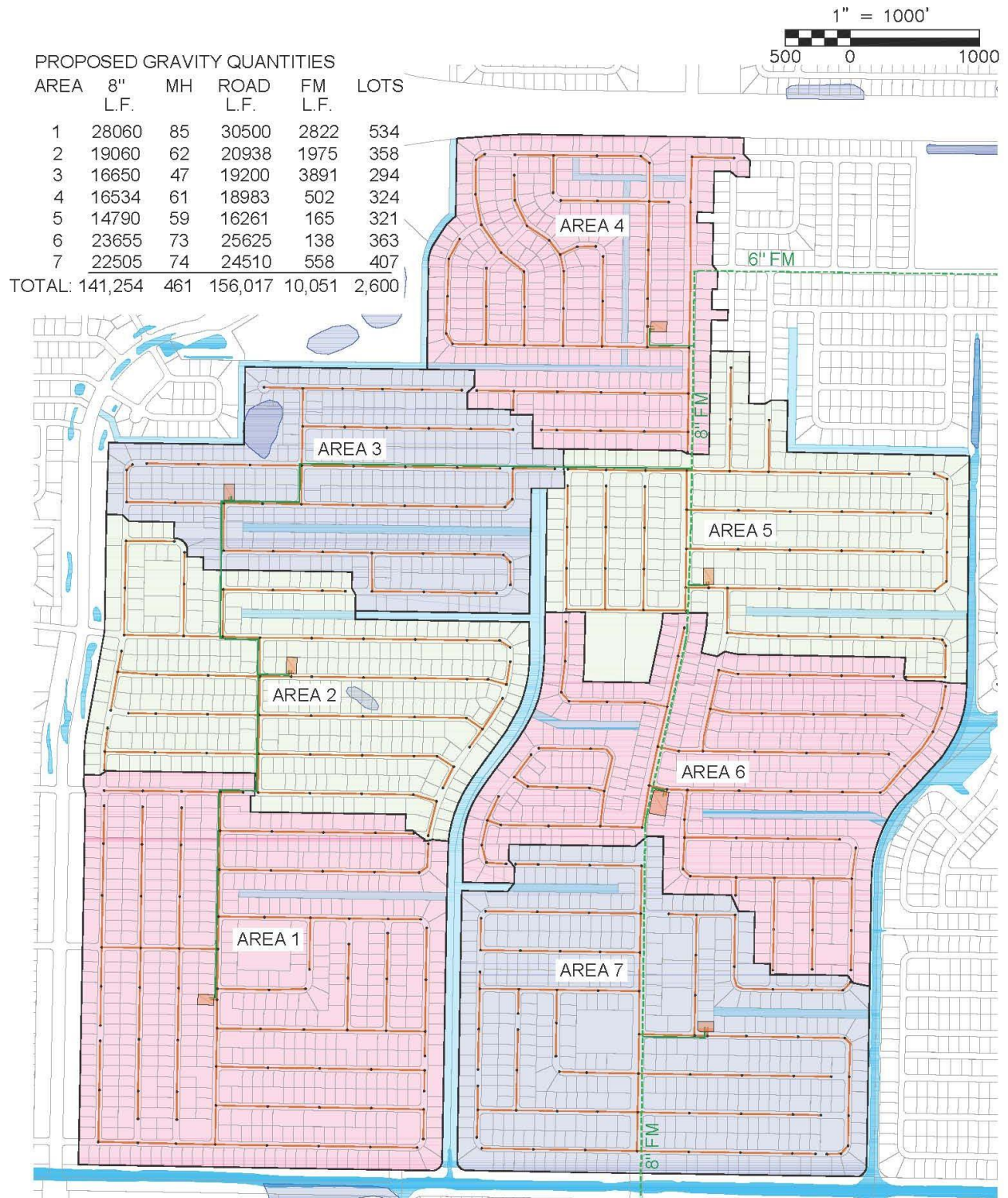
Present Worth Analysis													
Project	City of North Port				For comparative analysis only								
Planning Time frame	40		years		(Does not include all project costs)								
interest rate	4.500		percent										
ERC's	1081		ERC's										
System Type	Construction cost	Other Costs	legal, engr , survey	const services/ contingency	total initial cost "C"	Annual O&M	O&M Uniform series Present worth factor	USPW (O+M)	Salvage Value	SPPW(S)	Salvage value	NET PRESENT VALUE	RANK
Gravity	\$ 18,917,147.00		0	0	\$ 18,917,147.00	\$ 35,156.00	18.402	\$ 646,926.10	\$ 1,988,429.00	0.1719	341,868	\$ 19,222,205	third
Vacuum	\$ 7,848,164.67		0	0	\$ 7,848,164.67	\$ 84,735.00	18.402	\$ 1,559,258.26	\$ 445,176.00	0.1719	76,539	\$ 9,330,884	first
Low Pressure	\$ 8,338,688.00		0	0	\$ 8,338,688.00	\$ 240,944.00	18.402	\$ 4,433,751.36	\$ 386,104.00	0.1719	66,382	\$ 12,706,057	second
NPV = C+ USPW (O&M)- NPC C													
		SPPW(S) Net Present Value capital cost											
				n (years)	i %	(1+i)nth	i(1+i)nth	Present W factor					
USPW (O&M) equals	Uniform series Present worth	A(1+i)nth -1 i(1+i)nth		40	0.045	5.816364538	0.261736404	18.40158					
SPPW (S)								SPPW 0.17193					
		Single Payment Present Worth Salvage Value FV*1/(1+i)nth											

APPENDIX G

Very Large Areas 1500-2600 Lots

- **Conceptual layouts gravity, vacuum and low pressure.**
- **Operation and maintenance costs**
- **Operation and maintenance comparison**
- **Present worth analysis and ranking**

Very Large Areas



Gravity Sewer

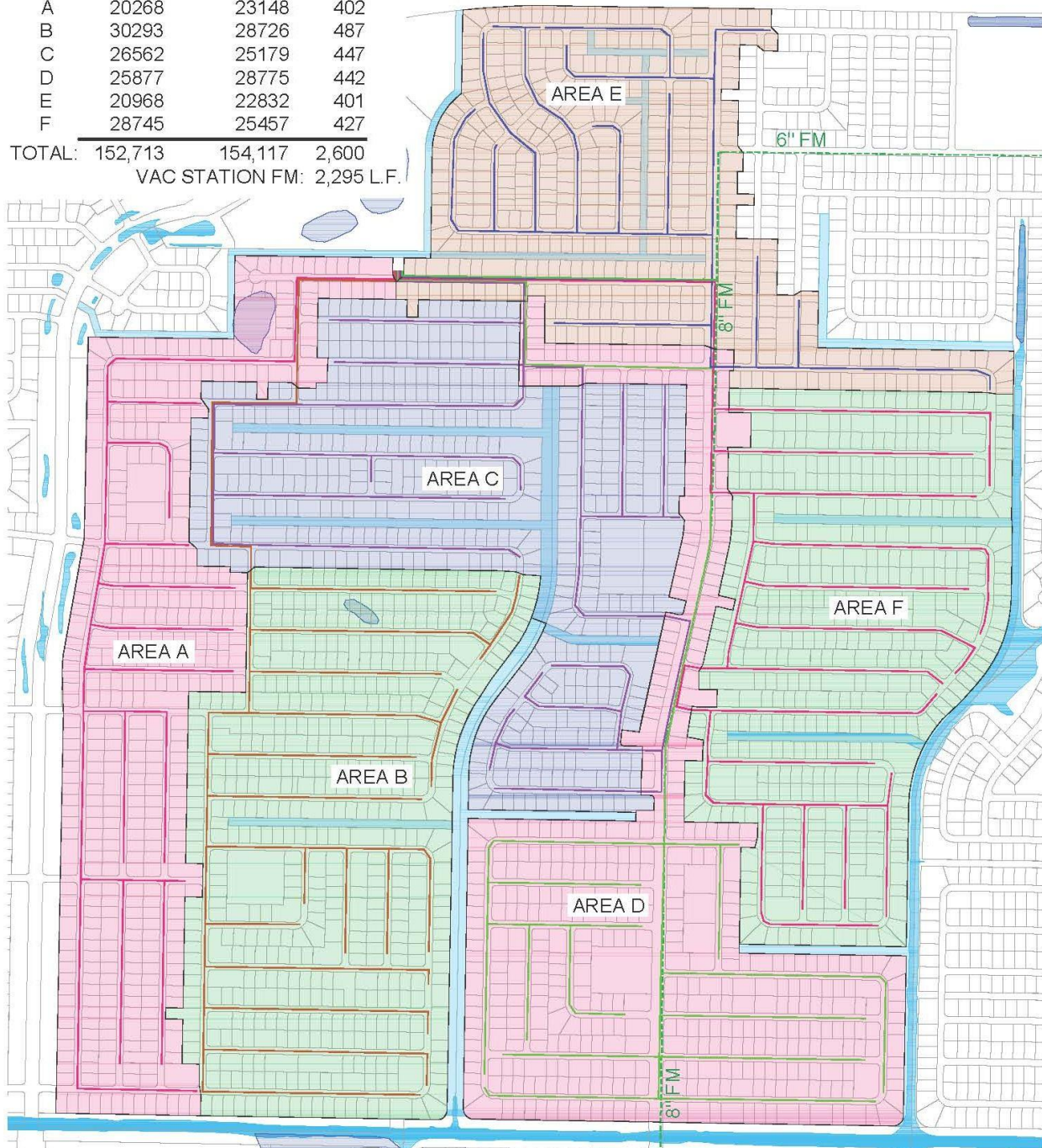
Very Large Areas

PROPOSED VACUUM QUANTITIES
 AREA VAC MAIN SHOULDER LOTS
 L.F. L.F.

A	20268	23148	402
B	30293	28726	487
C	26562	25179	447
D	25877	28775	442
E	20968	22832	401
F	28745	25457	427

TOTAL: 152,713 154,117 2,600
 VAC STATION FM: 2,295 L.F.

1" = 1000'
 500 0 1000



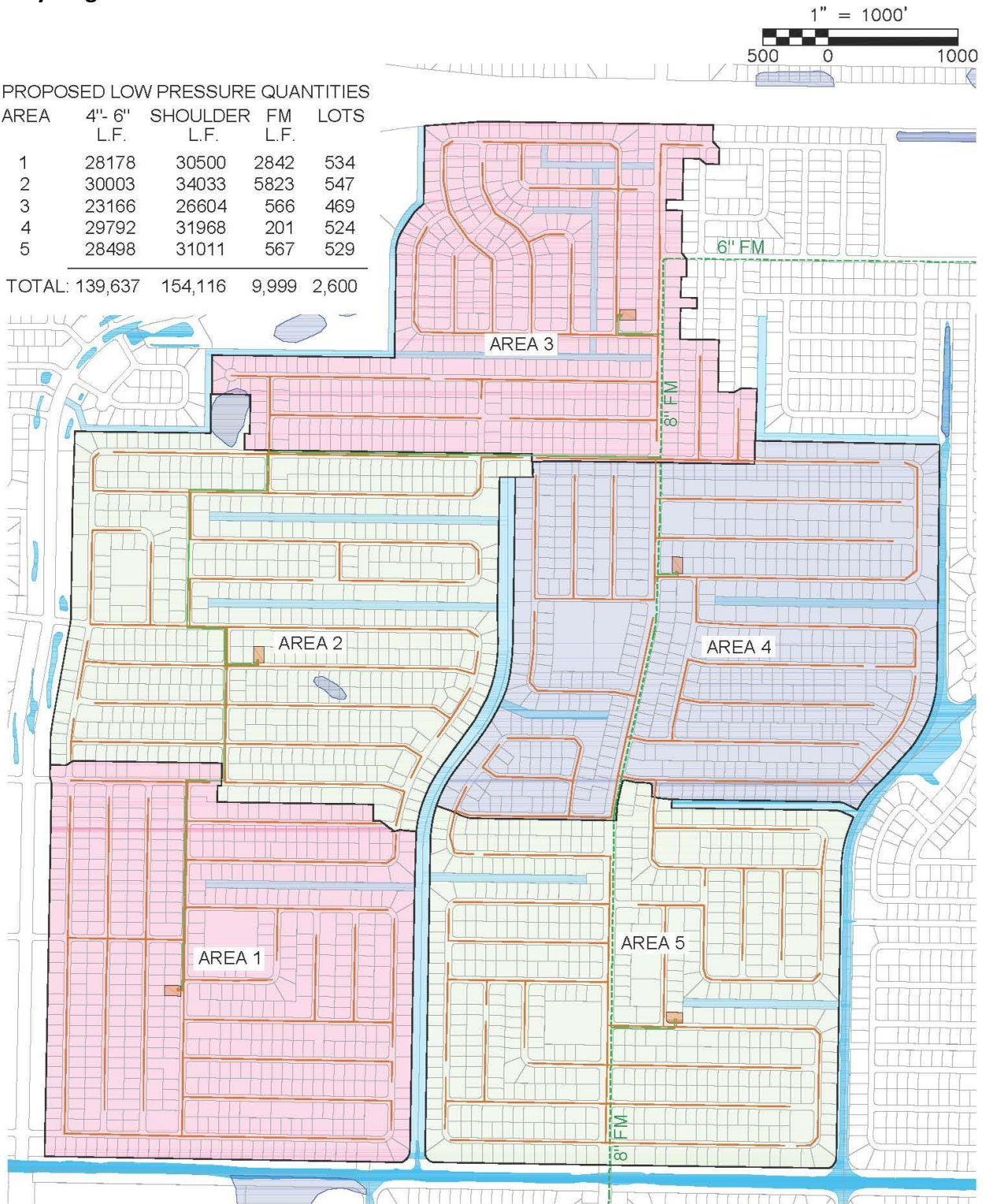
Vacuum Sewer

Very Large Areas

PROPOSED LOW PRESSURE QUANTITIES

AREA	4"- 6" L.F.	SHOULDER L.F.	FM L.F.	LOTS
1	28178	30500	2842	534
2	30003	34033	5823	547
3	23166	26604	566	469
4	29792	31968	201	524
5	28498	31011	567	529

TOTAL: 139,637 154,116 9,999 2,600



Low Pressure Sewer

PROJECT INFORMATION

PROJECT NAME (city and state)
TITLE

North Port
very large service area

CONNECTIONS
EDU'S

2600
2600

This spreadsheet is based on Airvac's standard peak flow rate of 0.64 gpm/EDU. If the actual flow rate is lower than that, the replacement costs for the vacuum station will be less than the value returned by the formulas as smaller vacuum stations skid models than shown would most likely result.

BASIC DATA

LOW PRESSURE SEWER

GRINDER PUMPS

SIMPLEX GRINDER PUMPS

2,600

ea

DUPLEX GRINDER PUMPS

0

TOTAL # GRINDER PUMPS

2,600

ea

Connection/GP ratio

1.00

INTERMEDIATE LIFT STATION REQ'D?

Yes

of Lift stations

HP of pumps (if lift station is req'd)

15

hp

5

ea

LABOR RATE

Hourly labor rate

\$20.00

/hr

Overhead

25%

GRAVITY SEWER

LIFT STATIONS

OF LIFT STATIONS

7

ea

HP of pumps

15

hp

LABOR RATE

Hourly labor rate

\$20.00

/hr

Overhead

25%

VACUUM SEWER

VALVE PITS

AIRVAC VALVE PITS

1,200

ea

SINGLE BUFFER TANKS

0

ea

DUAL BUFFER TANKS

0

ea

TOTAL # VALVES

1,200

ea

Connection/VP ratio

2.17

piping network size*

VACUUM STATION

Skid Model (enter type of vacuum pump)

Mink

1

4EM-60

very large

LABOR RATE

Hourly rate

\$20.00

/hr

Overhead

25%

* compared to a typical system with this # of connections

O&M INFORMATION

LABOR

Lift Station (180-240), if LS is req'd

180

hrs/yr/station

Piping (40 - 80)

60

hrs/yr/system

Grinder Pumps (0.5 to 2.75)

1.50

hrs/yr/gp

POWER

Lift station: Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$0.50 - \$1.50)

\$0.50

/mo/EDU

Grinder pumps: Usage fee (\$0.50-\$1.50/mo)

\$0.75

/mo/EDU

EQUIPMENT REPLACEMENT

LIFT STATION

n/a

Vacuum Pumps

n/a

10

Sewage Pumps

\$12,000

15

yrs

5

Wetwell tank

\$10,000

20

yrs

5

Control Panel

\$25,000

20

yrs

Misc Equip (\$1,000 - \$2,000)

\$1,000

15

yrs

GRINDER PUMPS

Rebuild pump cores (\$750 - \$1,500)

\$750

7

yrs

Replace controls (\$300 - \$700)

\$300

7

yrs

Misc. Parts (\$15.00 - \$30.00)

\$15

10

yrs

LABOR

Lift Station (180-240), if LS is req'd

180

hrs/yr/station

Piping (40 - 80)

20

hrs/yr/system

POWER

Lift station: Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$0.50 - \$1.50)

\$0.50

/mo/EDU

EQUIPMENT REPLACEMENT

LIFT STATION

n/a

Vacuum Pumps

n/a

14

Sewage Pumps

\$12,000

15

yrs

7

Wetwell tank

\$10,000

20

yrs

7

Control Panel

\$25,000

20

yrs

Misc Equip (\$1,000 - \$2,000)

\$1,000

15

yrs

LABOR

Vacuum Station (180-450)

450

hrs/yr/station

Piping (40 - 80)

60

hrs/yr/system

Valves (0.5 to 2.0)

1.75

hrs/yr/valve

POWER

Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$1.00 - \$2.50)

\$2.50

/mo/EDU

Vacuum valves: no power req'd

\$0.00

/mo/EDU

EQUIPMENT REPLACEMENT

VACUUM STATION

4

Vacuum Pumps

\$65,000

15

yrs

2

Sewage Pumps

\$15,000

15

yrs

1

Collection tank

\$50,000

30

yrs

1

Control Panel

\$50,000

20

yrs

Misc Equip (\$2,000 - \$3,000)

\$3,000

15

yrs

VACUUM VALVES (rebuild kits, etc)

Valves (\$35 - \$50)

\$45

15

yrs

Controller (\$35 - \$50)

\$45

10

yrs

Misc. Parts (\$15 - \$30)

\$20

10

yrs

55

North Port

connections 2600
EDU's 2600

ANNUAL O&M ESTIMATE
very large service area
GRAVITY SEWER

		LABOR				
Item	Labor effort		Quantity			Annual Labor
Lift Station - (if req'd)	180 hrs/yr/station	x	7 station	=		1260 hrs/yr
Piping	20 hrs/yr/system	x	1 system	=		20 hrs/yr
				=		0 hrs/yr
						1280 hrs/yr
				x		\$20 /hr
				x		1.25 Overhead
						\$32,000 /yr
ROUND TO:						\$32,000 /yr

		POWER				
Item	Unit cost		EDU	Duration		Annual Power
Lift Station - (if req'd)						
Flat rate	\$125.00 /mo	x	7 station	12 mo		\$10,500 /yr
Consumption	\$0.50 /mo/EDU	x	2600 EDU	x	12 mo	\$15,600 /yr
						\$26,100
ROUND TO:						\$26,100 /yr

		EQUIPMENT REPLACEMENT				
Item	Replacement cost		Useful life		Quantity	Annual R&R
LIFT STATION (if req'd)						
Sewage Pumps	\$12,000 /ea	/	15 years	x	14 pumps	\$11,200 /yr
Wetwell	\$10,000 /ea	/	20 years	x	7 ea	\$3,500 /yr
Control Panel	\$25,000 /ea	/	20 years	x	7 ea	\$8,750 /yr
Misc. Equip	\$1,000 /ea	/	15 years	x	1 ea	\$67 /yr
						\$23,517 /yr
ROUND TO:						\$23,500 /yr

SUMMARY	
LABOR	\$32,000 /yr
POWER	\$26,100 /yr
EQUIPMENT REPLACEMENT (LIFT STATION)	\$23,500 /yr
	\$81,600 /yr
ANNUAL O&M	\$31 /yr/EDU

North Port

connections 2600
EDU's 2600

ANNUAL O&M ESTIMATE
very large service area
VACUUM SYSTEM

LABOR				
Item	Labor effort	Quantity		Annual Labor
Vacuum Station	450 hrs/yr/station	x	1 station	= 450 hrs/yr
Piping	60 hrs/yr/system	x	1 system	= 60 hrs/yr
Valves	1.75 hrs/yr/valve	x	1,200 valves	= 2100 hrs/yr
				2610 hrs/yr
				x \$20 /hr
				x 1.25 Overhead
				\$65,250 /yr
ROUND TO:				\$65,300 /yr

POWER				
Item	Unit cost	EDU		Annual Power
Vacuum Station				
Flat rate	\$125.00 /mo	x	1 Vac Sta	12 mo = \$1,500 /yr
Consumption	\$2.50 /mo/EDU	x	2600 EDU	x 12 mo = \$78,000 /yr
				\$79,500
ROUND TO:				\$79,500 /yr

		EQUIPMENT REPLACEMENT						
Item	Replacement cost		Useful life		Quantity		Annual R&R	
VACUUM STATION								
Vacuum Pumps	\$65,000 /ea	/	15 years	x	4 pumps	=	\$17,333 /yr	
Sewage Pumps	\$15,000 /ea	/	15 years	x	2 pumps	=	\$2,000 /yr	
Collection Tank	\$50,000 /ea	/	30 years	x	1 ea	=	\$1,667 /yr	
Control Panel	\$50,000 /ea	/	20 years	x	1 ea	=	\$2,500 /yr	
Misc. Equip	\$3,000 /ea	/	15 years	x	1 ea	=	<u>\$200 /yr</u>	
							\$23,700 /yr	
ROUND TO:							\$23,700 /yr	
VACUUM VALVES								
Vacuum Valves	\$45 /ea	/	15 years	x	1,200 valves	=	\$3,600 /yr	
Controller	\$45 /ea	/	10 years	x	1,200 valves	=	\$5,400 /yr	
Misc. Parts	\$20 /ea	/	10 years	x	1,200 valves	=	<u>\$2,400 /yr</u>	
							\$11,400 /yr	
ROUND TO:							\$11,400 /yr	

SUMMARY	
LABOR	\$65,300 /yr
POWER	\$79,500 /yr
EQUIPMENT REPLACEMENT (STATION)	\$23,700 /yr
EQUIPMENT REPLACEMENT (VALVES)	\$11,400 /yr
	\$179,900 /yr
ANNUAL O&M	\$69 /yr/EDU

North Port

connections 2600
EDU's 2600

ANNUAL O&M ESTIMATE
very large service area
LOW PRESSURE SYSTEM

LABOR				
Item	Labor effort	Quantity		Annual Labor
Lift Station - (if req'd)	180 hrs/yr/station	x	5 station	= 900 hrs/yr
Piping	60 hrs/yr/system	x	1 system	= 60 hrs/yr
Grinder pumps	1.50 hrs/yr/GP	x	2,600 GP's	= 3900 hrs/yr
				4860 hrs/yr
				x \$20 /hr
				x 1.25 Overhead
				\$121,500 /yr
ROUND TO:				\$121,500 /yr

POWER				
Item	Unit cost	EDU		Annual Power
Lift Station - (if req'd)				
Flat rate	\$125.00 /mo	x	5	12 mo = \$7,500 /yr
Consumption	\$0.50 /mo/EDU	x	2600 EDU	x 12 mo = \$15,600 /yr
				\$23,100
Grinder Pumps	\$0.75 /mo/EDU	x	2600 EDU	x 12 mo = \$23,400 /yr
				\$46,500
ROUND TO:				\$46,500 /yr

EQUIPMENT REPLACEMENT				
Item	Replacement cost	Useful life		Annual R&R
LIFT STATION (if req'd)				
Sewage Pumps	\$12,000 /ea	/	15 years	x 10 pumps = \$8,000 /yr
Wetwell	\$10,000 /ea	/	20 years	x 5 ea = \$2,500 /yr
Control Panel	\$25,000 /ea	/	20 years	x 5 ea = \$6,250 /yr
Misc. Equip	\$1,000 /ea	/	15 years	x 1 ea = \$67 /yr
				\$16,817 /yr
ROUND TO:				\$16,800 /yr
GRINDER PUMPS				
Rebuild pump core	\$750 /ea	/	7 years	x 2,600 GP's = \$278,571 /yr
Replace controls	\$300 /ea	/	7 years	x 2,600 GP's = \$111,429 /yr
Misc. Parts	\$15 /yr	/	10 years	x 2,600 GP's = \$3,900 /yr
				\$393,900 /yr
ROUND TO:				\$393,900 /yr

SUMMARY	
LABOR	\$121,500 /yr
POWER	\$46,500 /yr
EQUIPMENT REPLACEMENT (LIFT STATION)	\$16,800 /yr
EQUIPMENT REPLACEMENT (GP'S)	\$393,900 /yr
	\$578,700 /yr
ANNUAL O&M	\$223 /yr/EDU

ANNUAL O&M COMPARISON			
	VACUUM	GRAVITY SEWER	LOW PRESSURE
# CONNECTIONS	2600 ea	2600 ea	2600 ea
# OF EDU'S	2600 ea	2600 ea	2600 ea
# UNITS	1,200 valves	n/a	2,600 GP's
# VACUUM OR LIFT STATIONS	1 ea	7 ea	5 ea
LABOR	\$65,300 /yr	\$32,000 /yr	\$121,500 /yr
POWER	\$79,500 /yr	\$26,100 /yr	\$46,500 /yr
EQUIPMENT REPLACEMENT (Vac Sta/Lift Sta)	\$23,700 /yr	\$23,500 /yr	\$16,800 /yr
REBUILD/REPAIR FREQUENCY			
Rebuild/repair frequency (vacuum valve/wetwell pumps/GP core)	15 yrs	15 yrs	7 yrs
Rebuild/repair frequency (controllers/pump controls)	10 yrs	20 yrs	7 yrs
Rebuild/repair frequency (gravity wetwell)	n/a	20 yrs	20 yrs
Misc Spare parts frequency	10 yrs	15 yrs	10 yrs
EQUIPMENT REPLACEMENT (Valves/Grinder Pumps)	<u>\$11,400 /yr</u>	<u>n/a /yr</u>	<u>\$393,900 /yr</u>
ANNUAL O&M	\$179,935 /yr	\$81,670 /yr	\$578,744 /yr
ANNUAL O&M per EDU	\$69 /yr/EDU	\$31 /yr/EDU	\$223 /yr/EDU

Present Worth Analysis

Project	City of North Port		For comparative analysis only	
Planning Time frame	40	years	(Does not include all costs)	
interest rate	4.500	percent		
ERC's	2600	ERC's		

System Type	Construction cost	Other Costs	legal, engr , survey	const services/ contingency	total initial cost "C"	Annual O&M	O&M Uniform series Present worth factor	USPW (O+M)	Salvage Value	SPPW(S)	Salvage value	NET PRESENT VALUE	RANK
Gravity	\$ 42,557,667.00		0	0	\$ 42,557,667.00	\$ 81,600.00	18.402	1,501,569	4,135,656	0.1719	711,038	\$ 43,348,198	third
Vacuum	\$ 17,617,938.33		0	0	\$ 17,617,938.33	\$ 179,900.00	18.402	3,310,445	1,082,761	0.1719	186,158	\$ 20,742,226	First
Low Pressure	\$ 18,289,110.00		0	0	\$ 18,289,110.00	\$ 578,700.00	18.402	10,648,997	868,542	0.1719	149,327	\$ 28,788,780	second

NPV = C+ USPW (O&M)- NPC	SPPW(S)							
C	Net Present Value capital cost							
		n (years)	i %	(1+i)nth	i(1+i)nth	Present W factor		
USPW (O&M) equals	Uniform series Present worth $\frac{A(1+i)^nth - 1}{i(1+i)^nth}$	40	0.045	5.816364538	0.261736404	18.40158		
SPPW (S)	Single Payment Present Worth Salvage Value $FV * 1 / (1+i)^nth$					SPPW 0.17193		

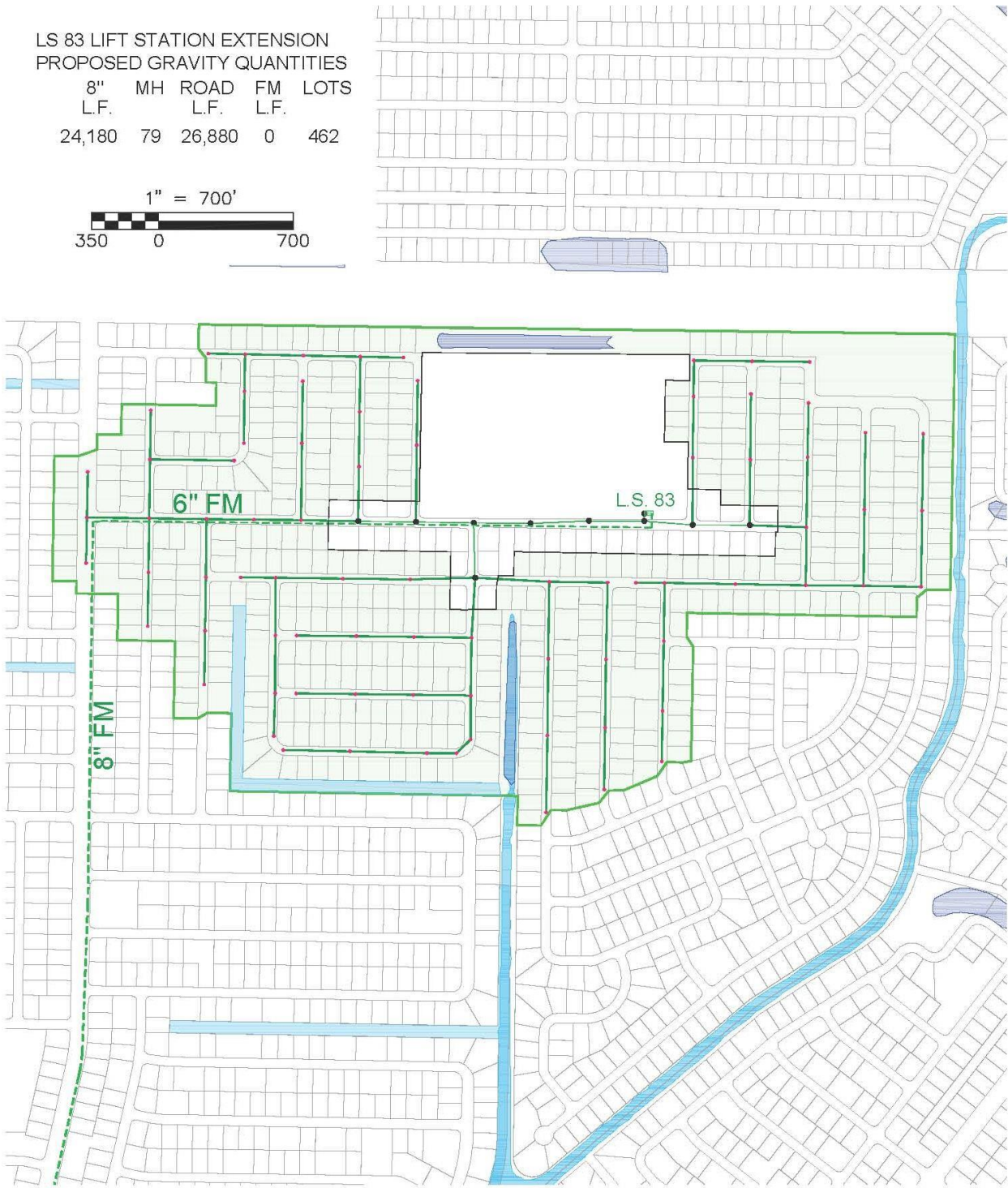
Salvage value						Construction Cost Estimates			
Element	life span	Value new	40 year dep	Remaining Value	% of const cost	Desc	qty	unit price	total
Gravity	lift station	\$ 2,100,000.00	\$ 1,680,000.00	\$ 420,000.00		Gravity lift station	7	\$ 300,000.00	\$ 2,100,000.00
	mains	\$ 17,656,750.00	\$ 14,125,400.00	\$ 3,531,350.00		Gravity mains	141,254	\$ 125.00	\$ 17,656,750.00
	manholes	\$ 4,379,500.00	\$ 4,379,500.00	\$ -		Man Holes	461	\$ 9,500.00	\$ 4,379,500.00
	service lines	\$ 620,000.00	\$ 496,000.00	\$ 124,000.00		service lines	15,500	\$ 40.00	\$ 620,000.00
	force main	\$ 301,530.00	\$ 241,224.00	\$ 60,306.00		Force Main	10,051	\$ 30.00	\$ 301,530.00
	Road repair					Road repair	156,017	\$ 111.00	\$ 17,317,887.00
	Restoration					Sod	2,600	\$ 70.00	\$ 182,000.00
				\$ 4,135,656.00	10%	total			\$ 42,557,667.00
Vacuum	vac build/site	\$ 2,000,000.00	\$ 2,000,000.00	\$ -		Vac sta	1	\$ 2,000,000.00	\$ 2,000,000.00
	pipe in road	\$ 5,344,955.00	\$ 4,275,964.00	\$ 1,068,991.00		Vacuum pipe	152713	\$ 35.00	\$ 5,344,955.00
	f.m.	\$ 68,850.00	\$ 55,080.00	\$ 13,770.00		Force Main	2295	\$ 30.00	\$ 68,850.00
	valve pits	\$ 6,933,333.33	\$ 6,933,333.33	\$ -		valve pits	1156	\$ 6,000.00	\$ 6,933,333.33
	Road repair	\$ 769,600.00				Road Crossings	1156	\$ 666.00	\$ 769,600.00
						Driveways (50% dev)	2600	\$ 500.00	\$ 1,300,000.00
	Restoration					Sod	2600	\$ 462.00	\$ 1,201,200.00
				\$ 1,082,761.00	6%	total			\$ 17,617,938.33
Low Pressure	lps systems on site	\$ 12,480,000.00	\$ 12,480,000.00	\$ -		grinder pumps	2,600	\$ 4,800.00	\$ 12,480,000.00
	pipes in road	\$ 2,792,740.00	\$ 2,234,192.00	\$ 558,548.00		Low Pressure mains 3-8"	139,637	\$ 20.00	\$ 2,792,740.00
	lift station	\$ 1,250,000.00	\$ 1,000,000.00	\$ 250,000.00		master lift station	5	\$ 250,000.00	\$ 1,250,000.00
	fm	\$ 299,970.00	\$ 239,976.00	\$ 59,994.00		fm	9,999	\$ 30.00	\$ 299,970.00
	Road repair					Road crossings	1,300	\$ 666.00	\$ 865,800.00
	Restoration					Sod	1,300	\$ 462.00	\$ 600,600.00
				\$ 868,542.00	5%	total			\$ 18,289,110.00

O & M costs per year			
	Cost per EDU	EDU's	cost/year
Gravity	\$ 31.38	2600	\$ 81,600.00
Vacuum	\$ 69.19	2600	\$ 179,900.00
Low pressure	\$ 222.58	2600	\$ 578,700.00

APPENDIX H

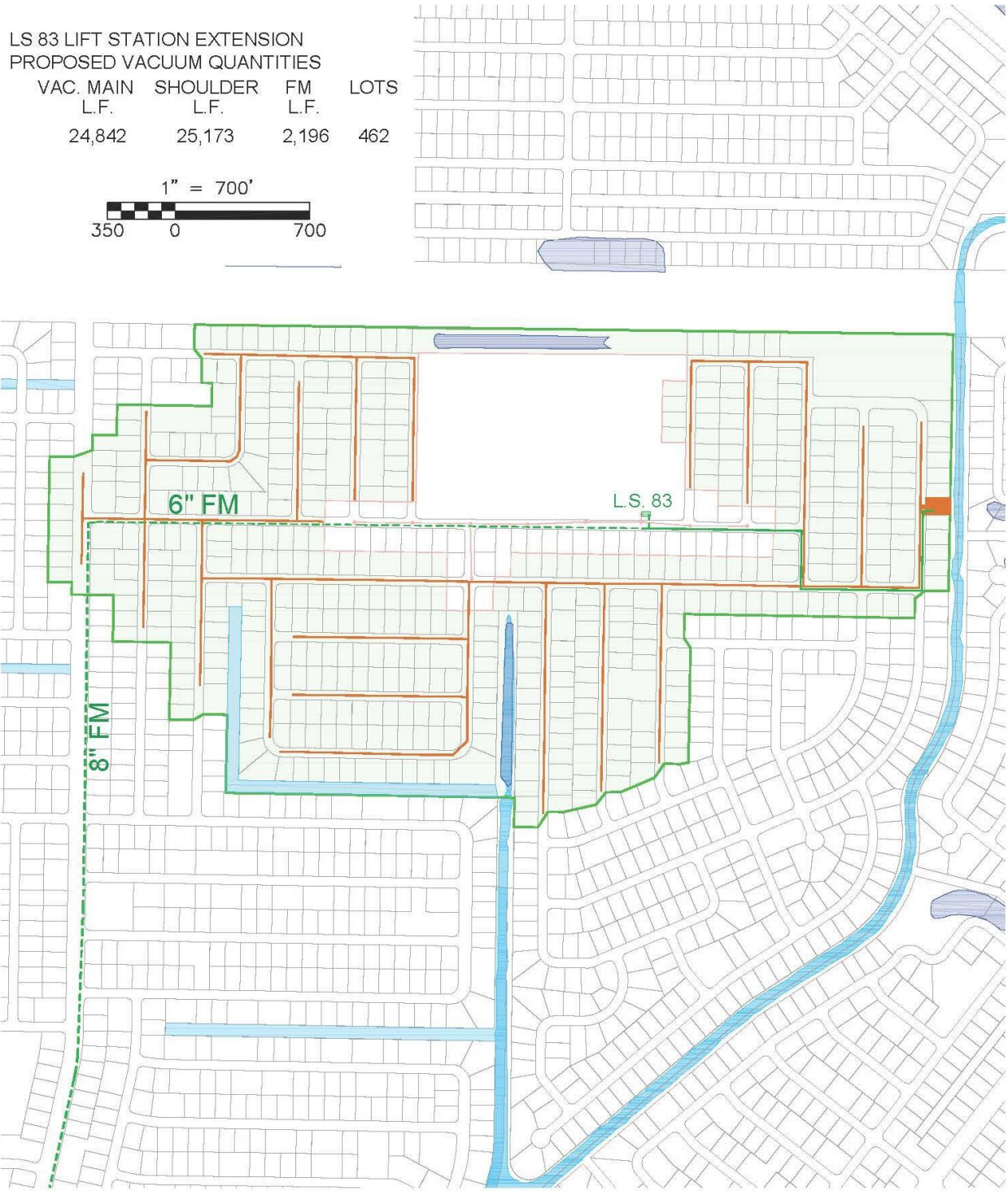
Existing Gravity Area

Existing Gravity



Gravity Sewer

Existing Gravity

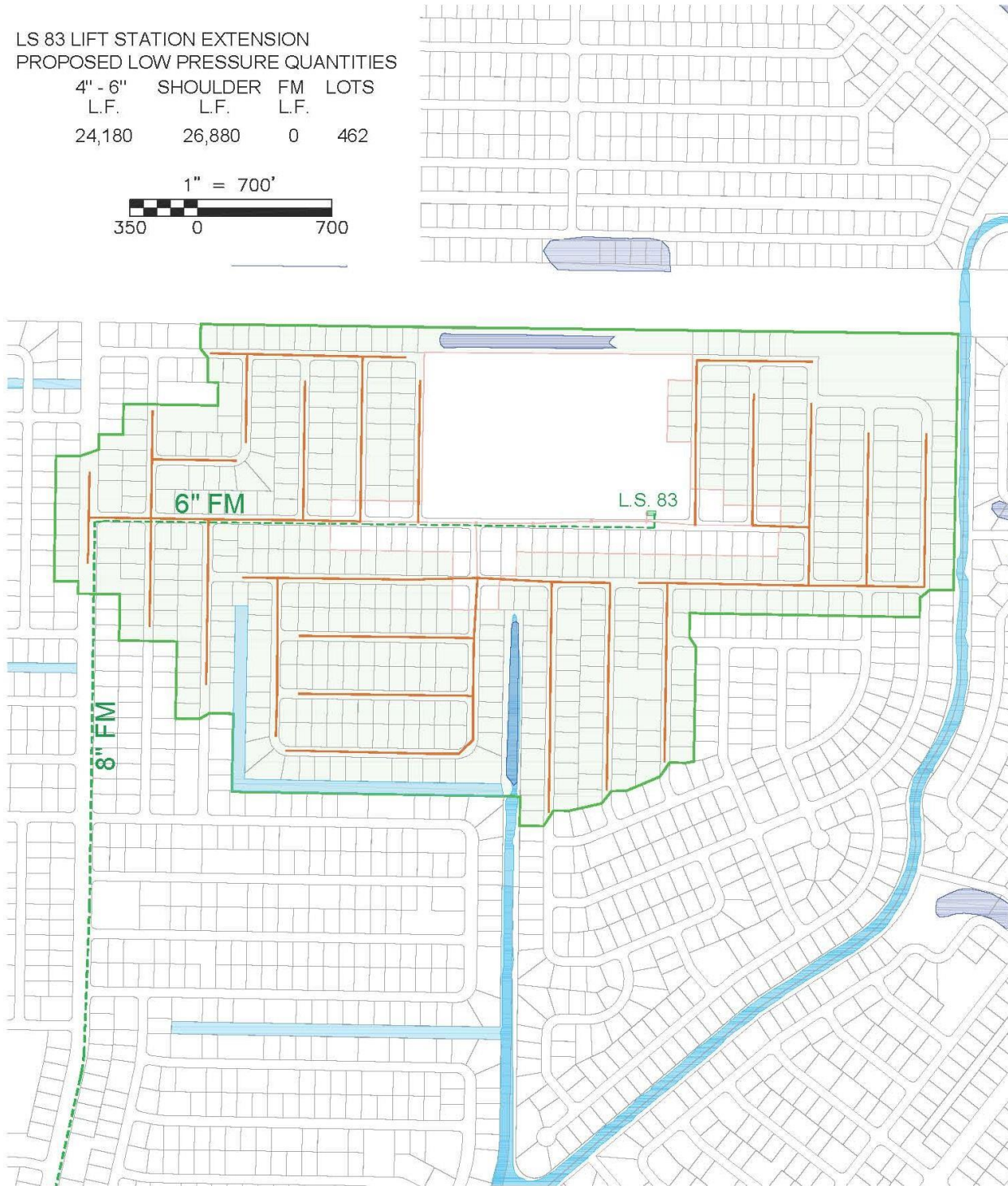
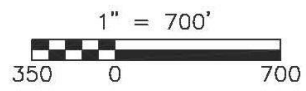


Vacuum Sewer

Existing Gravity

LS 83 LIFT STATION EXTENSION
PROPOSED LOW PRESSURE QUANTITIES

4" - 6" L.F.	SHOULDER L.F.	FM L.F.	LOTS
24,180	26,880	0	462



Low Pressure Sewer

PROJECT INFORMATION

PROJECT NAME (city and state)
TITLE

North Port Florida
Existing Gravity area

CONNECTIONS
EDU'S

462
462

This spreadsheet is based on Airvac's standard peak flow rate of 0.64 gpm/EDU. If the actual flow rate is lower than that, the replacement costs for the vacuum station will be less than the value returned by the formulas as smaller vacuum stations skid models than shown would most likely result.

BASIC DATA

LOW PRESSURE SEWER

GRINDER PUMPS

SIMPLEX GRINDER PUMPS

462

ea

DUPLEX GRINDER PUMPS

0

TOTAL # GRINDER PUMPS

462

ea

Connection/GP ratio

1.00

INTERMEDIATE LIFT STATION REQ'D?

Yes

of Lift stations

HP of pumps (if lift station is req'd)

15

hp

0

ea

LABOR RATE

Hourly labor rate

\$20.00

/hr

Overhead

25%

GRAVITY SEWER

LIFT STATIONS

OF LIFT STATIONS

0

ea

HP of pumps

15

hp

LABOR RATE

Hourly labor rate

\$20.00

/hr

Overhead

25%

VACUUM SEWER

VALVE PITS

AIRVAC VALVE PITS

185

ea

SINGLE BUFFER TANKS

0

ea

DUAL BUFFER TANKS

0

ea

TOTAL # VALVES

185

ea

Connection/VP ratio

2.50

piping network size*

VACUUM STATION

Skid Model (enter type of vacuum pump)

Mink

1

3DM-25

larger than ave

* compared to a typical system with this # of connections

LABOR RATE

Hourly rate

\$20.00

/hr

Overhead

25%

O&M INFORMATION

LABOR

Lift Station (180-240), if LS is req'd

180

hrs/yr/station

Piping (40 - 80)

60

hrs/yr/system

Grinder Pumps (0.5 to 2.75)

1.50

hrs/yr/gp

POWER

Lift station: Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$0.50 - \$1.50)

\$0.50

/mo/EDU

Grinder pumps: Usage fee (\$0.50-\$1.50/mo)

\$0.75

/mo/EDU

EQUIPMENT REPLACEMENT

LIFT STATION

n/a

Vacuum Pumps

\$12,000

15

yrs

0

Sewage Pumps

\$10,000

20

yrs

0

Wetwell tank

\$25,000

20

yrs

0

Control Panel

\$1,000

15

yrs

Misc Equip (\$1,000 - \$2,000)

GRINDER PUMPS

Rebuild pump cores (\$750 - \$1,500)

\$750

7

yrs

Replace controls (\$300 - \$700)

\$300

7

yrs

Misc. Parts (\$15.00 - \$30.00)

\$15

10

yrs

LABOR

Lift Station (180-240), if LS is req'd

180

hrs/yr/station

Piping (40 - 80)

20

hrs/yr/system

POWER

Lift station: Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$0.50 - \$1.50)

\$0.50

/mo/EDU

EQUIPMENT REPLACEMENT

LIFT STATION

n/a

Vacuum Pumps

\$12,000

15

yrs

0

Sewage Pumps

\$10,000

20

yrs

0

Wetwell tank

\$25,000

20

yrs

0

Control Panel

\$1,000

15

yrs

Misc Equip (\$1,000 - \$2,000)

LABOR

Vacuum Station (180-450)

450

hrs/yr/station

Piping (40 - 80)

60

hrs/yr/system

Valves (0.5 to 2.0)

1.75

hrs/yr/valve

POWER

Flat fee (\$25-\$125)

\$125.00

/mo

Consumption (\$1.00 - \$2.50)

\$2.50

/mo/EDU

Vacuum valves: no power req'd

\$0.00

/mo/EDU

EQUIPMENT REPLACEMENT

VACUUM STATION

3

Vacuum Pumps

\$26,000

15

yrs

2

Sewage Pumps

\$10,000

15

yrs

1

Collection tank

\$30,000

30

yrs

1

Control Panel

\$40,000

20

yrs

Misc Equip (\$2,000 - \$3,000)

VACUUM VALVES (rebuild kits, etc)

Valves (\$35 - \$50)

\$45

15

yrs

Controller (\$35 - \$50)

\$45

10

yrs

Misc. Parts (\$15 - \$30)

\$20

10

yrs

65

North Port Florida

connections 462
EDU's 462

ANNUAL O&M ESTIMATE
Existing Gravity area
GRAVITY SEWER

		LABOR				
Item	Labor effort		Quantity			Annual Labor
Lift Station - (if req'd)	180 hrs/yr/station	X	0 station	=		0 hrs/yr
Piping	20 hrs/yr/system	X	1 system	=		20 hrs/yr
				=		0 hrs/yr
						20 hrs/yr
				X		\$20 /hr
				X		1.25 Overhead
						\$500 /yr
ROUND TO:						\$500 /yr

		POWER				
Item	Unit cost		EDU	Duration		Annual Power
Lift Station - (if req'd)						
Flat rate	\$125.00 /mo	X	0 station	12 mo		\$0 /yr
Consumption	\$0.50 /mo/EDU	X	462 EDU	X 12 mo	=	\$2,772 /yr
						\$2,772
ROUND TO:						\$2,772 /yr

		EQUIPMENT REPLACEMENT				
Item	Replacement cost		Useful life	Quantity		Annual R&R
LIFT STATION (if req'd)						
Sewage Pumps	\$12,000 /ea	/	15 years	X 0 pumps	=	\$0 /yr
Wetwell	\$10,000 /ea	/	20 years	X 0 ea	=	\$0 /yr
Control Panel	\$25,000 /ea	/	20 years	X 0 ea	=	\$0 /yr
Misc. Equip	\$1,000 /ea	/	15 years	X 1 ea	=	\$67 /yr
						\$67 /yr
ROUND TO:						\$100 /yr

SUMMARY	
LABOR	\$500 /yr
POWER	\$2,772 /yr
EQUIPMENT REPLACEMENT (LIFT STATION)	\$100 /yr
	\$3,372 /yr
ANNUAL O&M	\$7 /yr/EDU

North Port Florida

connections 462
EDU's 462

ANNUAL O&M ESTIMATE
Existing Gravity area
VACUUM SYSTEM

LABOR				
Item	Labor effort	Quantity		Annual Labor
Vacuum Station	450 hrs/yr/station	x	1 station	= 450 hrs/yr
Piping	60 hrs/yr/system	x	1 system	= 60 hrs/yr
Valves	1.75 hrs/yr/valve	x	185 valves	= 323 hrs/yr
				833 hrs/yr
				x \$20 /hr
				x 1.25 Overhead
				\$20,825 /yr
ROUND TO:				\$20,800 /yr

POWER				
Item	Unit cost	EDU	Duration	Annual Power
Vacuum Station				
Flat rate	\$125.00 /mo	x	1 Vac Sta	12 mo = \$1,500 /yr
Consumption	\$2.50 /mo/EDU	x	462 EDU	x 12 mo = \$13,860 /yr
				\$15,360
ROUND TO:				\$15,400 /yr

		EQUIPMENT REPLACEMENT					
Item	Replacement cost		Useful life		Quantity		Annual R&R
VACUUM STATION							
Vacuum Pumps	\$26,000 /ea	/	15 years	x	3 pumps	=	\$5,200 /yr
Sewage Pumps	\$10,000 /ea	/	15 years	x	2 pumps	=	\$1,333 /yr
Collection Tank	\$30,000 /ea	/	30 years	x	1 ea	=	\$1,000 /yr
Control Panel	\$40,000 /ea	/	20 years	x	1 ea	=	\$2,000 /yr
Misc. Equip	\$3,000 /ea	/	15 years	x	1 ea	=	<u>\$200 /yr</u>
							\$9,733 /yr
ROUND TO:							\$9,700 /yr
VACUUM VALVES							
Vacuum Valves	\$45 /ea	/	15 years	x	185 valves	=	\$554 /yr
Controller	\$45 /ea	/	10 years	x	185 valves	=	\$832 /yr
Misc. Parts	\$20 /ea	/	10 years	x	185 valves	=	<u>\$370 /yr</u>
							\$1,756 /yr
ROUND TO:							\$1,800 /yr

SUMMARY	
LABOR	\$20,800 /yr
POWER	\$15,400 /yr
EQUIPMENT REPLACEMENT (STATION)	\$9,700 /yr
EQUIPMENT REPLACEMENT (VALVES)	\$1,800 /yr
	\$47,700 /yr
ANNUAL O&M	\$103 /yr/EDU

North Port Florida

connections 462
EDU's 462

ANNUAL O&M ESTIMATE
Existing Gravity area
LOW PRESSURE SYSTEM

LABOR			
Item	Labor effort	Quantity	Annual Labor
Lift Station - (if req'd)	180 hrs/yr/station	x 0 station	= 0 hrs/yr
Piping	60 hrs/yr/system	x 1 system	= 60 hrs/yr
Grinder pumps	1.50 hrs/yr/GP	x 462 GP's	= 693 hrs/yr
			753 hrs/yr
			x \$20 /hr
			x 1.25 Overhead
			\$18,825 /yr
ROUND TO:			\$18,800 /yr

		POWER					
Item	Unit cost	EDU		Duration		Annual Power	
Lift Station - (if req'd)							
Flat rate	\$125.00 /mo	x	0		12 mo		\$0 /yr
Consumption	\$0.50 /mo/EDU	x	462 EDU	x	12 mo	=	<u>\$2,772 /yr</u>
							<u>\$2,772</u>
Grinder Pumps	\$0.75 /mo/EDU	x	462 EDU	x	12 mo		<u>\$4,158 /yr</u>
							<u>\$6,930</u>
ROUND TO:							\$6,900 /yr

		EQUIPMENT REPLACEMENT						
Item	Replacement cost		Useful life		Quantity		Annual R&R	
LIFT STATION (if req'd)								
Sewage Pumps	\$12,000 /ea	/	15 years	X	0 pumps	=	\$0 /yr	
Wetwell	\$10,000 /ea	/	20 years	X	0 ea	=	\$0 /yr	
Control Panel	\$25,000 /ea	/	20 years	X	0 ea	=	\$0 /yr	
Misc. Equip	\$1,000 /ea	/	15 years	X	1 ea	=	<u>\$67 /yr</u>	
							\$67 /yr	
ROUND TO:							\$100 /yr	
GRINDER PUMPS								
Rebuild pump core	\$750 /ea	/	7 years	X	462 GP's	=	\$49,500 /yr	
Replace controls	\$300 /ea	/	7 years	X	462 GP's	=	\$19,800 /yr	
Misc. Parts	\$15 /yr	/	10 years	X	462 GP's	=	<u>\$693 /yr</u>	
							\$69,993 /yr	
ROUND TO:							\$70,000 /yr	

SUMMARY	
LABOR	\$18,800 /yr
POWER	\$6,900 /yr
EQUIPMENT REPLACEMENT (LIFT STATION)	\$100 /yr
EQUIPMENT REPLACEMENT (GP'S)	\$70,000 /yr
	\$95,800 /yr
ANNUAL O&M	\$207 /yr/EDU

ANNUAL O&M COMPARISON			
	VACUUM	GRAVITY SEWER	LOW PRESSURE
# CONNECTIONS	462 ea	462 ea	462 ea
# OF EDU'S	462 ea	462 ea	462 ea
# UNITS	185 valves	n/a	462 GP's
# VACUUM OR LIFT STATIONS	1 ea	0 ea	0 ea
LABOR	\$20,800 /yr	\$500 /yr	\$18,800 /yr
POWER	\$15,400 /yr	\$2,772 /yr	\$6,900 /yr
EQUIPMENT REPLACEMENT (Vac Sta/Lift Sta)	\$9,700 /yr	\$100 /yr	\$100 /yr
REBUILD/REPAIR FREQUENCY			
Rebuild/repair frequency (vacuum valve/wetwell pumps/GP core)	15 yrs	15 yrs	7 yrs
Rebuild/repair frequency (controllers/pump controls)	10 yrs	20 yrs	7 yrs
Rebuild/repair frequency (gravity wetwell)	n/a	20 yrs	20 yrs
Misc Spare parts frequency	10 yrs	15 yrs	10 yrs
EQUIPMENT REPLACEMENT (Valves/Grinder Pumps)	<u>\$1,800 /yr</u>	<u>n/a /yr</u>	<u>\$70,000 /yr</u>
ANNUAL O&M	\$47,735 /yr	\$3,442 /yr	\$95,844 /yr
ANNUAL O&M per EDU	\$103 /yr/EDU	\$7 /yr/EDU	\$207 /yr/EDU

Present Worth Analysis													
Project	City of North Port				For comparative analysis only								
Planning Time frame	40		years		(Does not include all project costs)								
interest rate	4.500		percent										
ERC's	462		ERC's										
System Type	Construction cost	Other Costs	legal, engr , survey	const services/ contingency	total initial cost "C"	Annual O&M	O&M Uniform series Present worth factor	USPW (O+M)	Salvage Value	SPPW(S)	Salvage value	NET PRESENT VALUE	RANK
Gravity	\$ 7,616,924.00		0	0	\$ 7,616,924.00	\$ 3,442.00	18.402	\$ 63,338.25	\$ 733,860.00	0.1719	126,172	\$ 7,554,091	third
Vacuum	\$ 4,053,986.00		0	0	\$ 4,053,986.00	\$ 47,735.00	18.402	\$ 878,399.63	\$ 187,070.00	0.1719	32,163	\$ 4,900,223	first
Low Pressure	\$ 3,276,336.00		0	0	\$ 3,276,336.00	\$ 95,844.00	18.402	\$ 1,763,681.46	\$ 107,520.00	0.1719	18,486	\$ 5,021,532	second
NPV = C+ USPW (O&M)- SPPW(S)													
NPC Net Present Value													
C capital cost													
n (years) i % (1+i)nth i(1+i)nth Present W factor													
40 0.045 5.816364538 0.261736404 18.40158													
USPW (O&M) equals A(1+i)nth -1 i(1+i)nth													
SPPW (S) SPPW 0.17193													