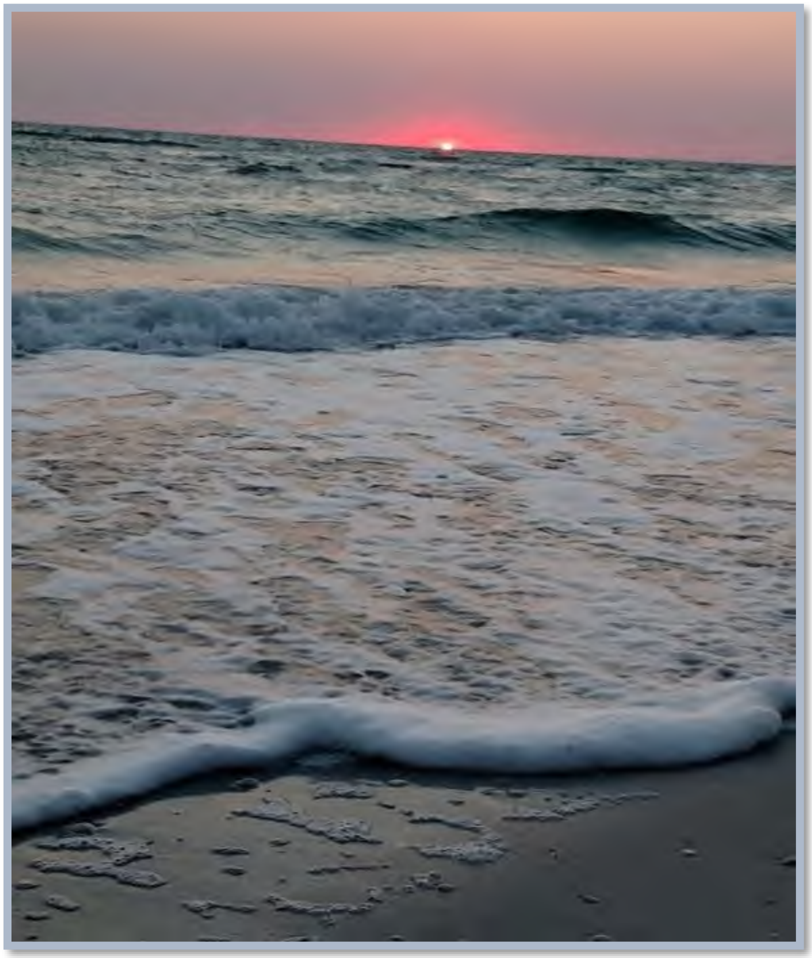

EVALUATION OF WASTEWATER COLLECTION TECHNOLOGIES

TECHNICAL MEMORANDUM

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April 2, 2021

GWE Project #6374.20

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APPENDICES

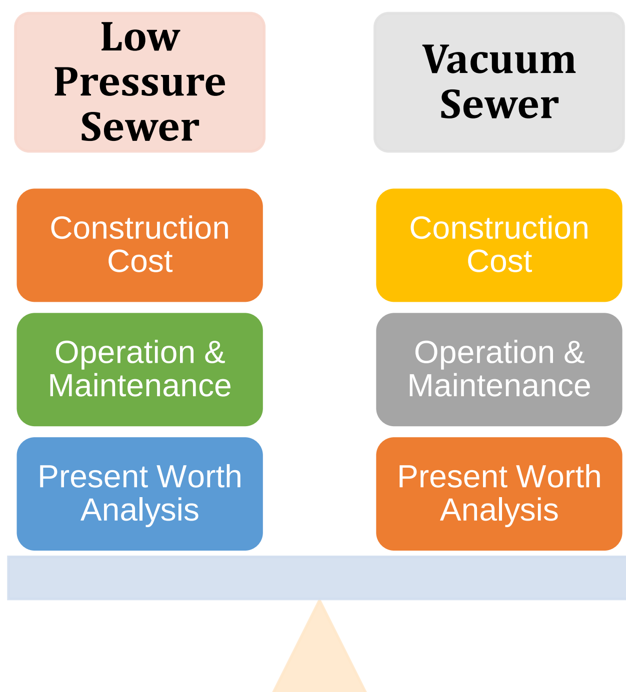
1. INTRODUCTION

Environmental Utilities, LLC is in the process of analyzing the costs to provide sewer service to a portion of Don Pedro/Knight Island and Little Gasparilla Island in Charlotte County, Florida. The purpose of this report is to review two types of wastewater collection systems, low pressure sewer and vacuum sewer, specifically to examine their limitations, and advantages, as well as estimate the initial and long term costs to determine the best system for this area.

2. SCOPE OF STUDY

The scope of this technical memorandum is to:

- Evaluate two methods of wastewater collection systems, specifically a low pressure sewer (LPS) and a vacuum sewer system.
- Provide conceptual layouts for both LPS and vacuum to serve the area.
- Provide quantity take-offs of the key components for both systems.
- Provide cost estimates for each system. The evaluation cost analysis will include construction costs, land acquisition, restoration (included in construction estimates), long-term operation and maintenance (O&M) and a present worth analysis to determine which type of collection system would best serve the area in the long run.



3. TOPOGRAPHY AND DRAINAGE

3.1 TOPOGRAPHY

The study area is low, virtually level, and flat. Differential elevations will vary but will not have any significant effect on a vacuum system or low pressure system.

3.2 SOILS

The soil profiles are generally a mix of Canaveral fine sand and St. Augustine fine sand down to 80 inches based on the Soil Conservation Service publications. Hardpan and caprock in significant quantities are not anticipated.

3.2.1 Don Pedro/Knight Island

The predominant soils within the Don Pedro/Knight Island area are Canaveral fine sand and St. Augustine sand.

Canaveral Fine Sand:

This moderately well drained soil is found on nearly level (0-2%) lands. The seasonal high groundwater table (SHGWT) is high at approximately 18”-40” below the surface, which may require dewatering for both LPS and vacuum sewer if installed in the wet season. The depths to known cap rock, rock, ledge or restrictive features is in excess of 80”.

St. Augustine Sand:

This somewhat poorly drained soil is found on nearly level (0-2%) lands. The SHGWT is typically 24”-36” below the surface, requiring dewatering for LPS and vacuum sewer if installed in the wet season. The depths to known cap rock, rock, ledge or restrictive features is in excess of 80”.

3.2.2 Little Gasparilla

The primary soil found in the Little Gasparilla area is Canaveral fine sand with the same characteristics as that found in the Don Pedro/Knight Island area.

3.3 Flood Plain

Much of the area is a barrier island with VE (velocity) FEMA flood zones. Moreover, some of the island is seaward of the Coastal Construction Control Line (CCCL).

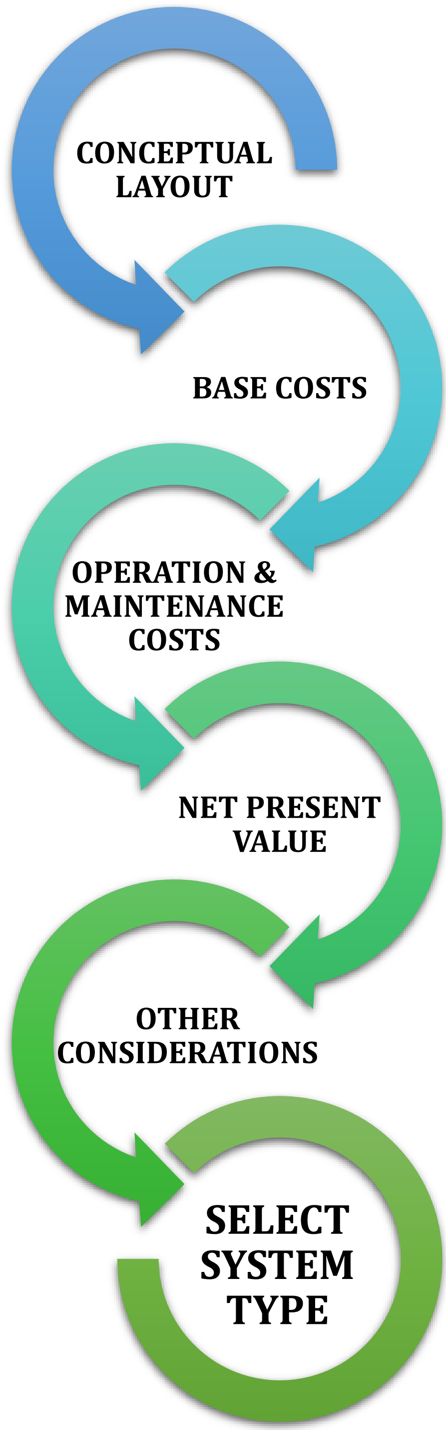
Small portions of the island in the easterly areas are in AE FEMA flood areas.

4. WASTEWATER COLLECTION SYSTEMS

4.1 DEVELOPMENT OF ALTERNATIVES

Two types of collection systems were analyzed to determine the most cost-effective option for the Don Pedro/Knight Island and Little Gasparilla Island areas.

1. Low Pressure Collection System
2. Vacuum Sewer Collection System



4.1.1 Methodology

To generate comparative costs, general layouts of each type of collection system were developed for the study area. Once the conceptual layouts were generated, construction costs, long term operation and maintenance and other costs for each layout were developed. These costs were then converted to a net present value to effectively compare the costs of each system for the different areas.

Once the comparative cost analysis is complete, other considerations are discussed to present additional factors that may not be reflected in the financial analysis.

After closely analyzing both wastewater collection systems and their respective costs and considerations, GWE will make a recommendation based on the engineer's opinion of the most suitable system type for the area.

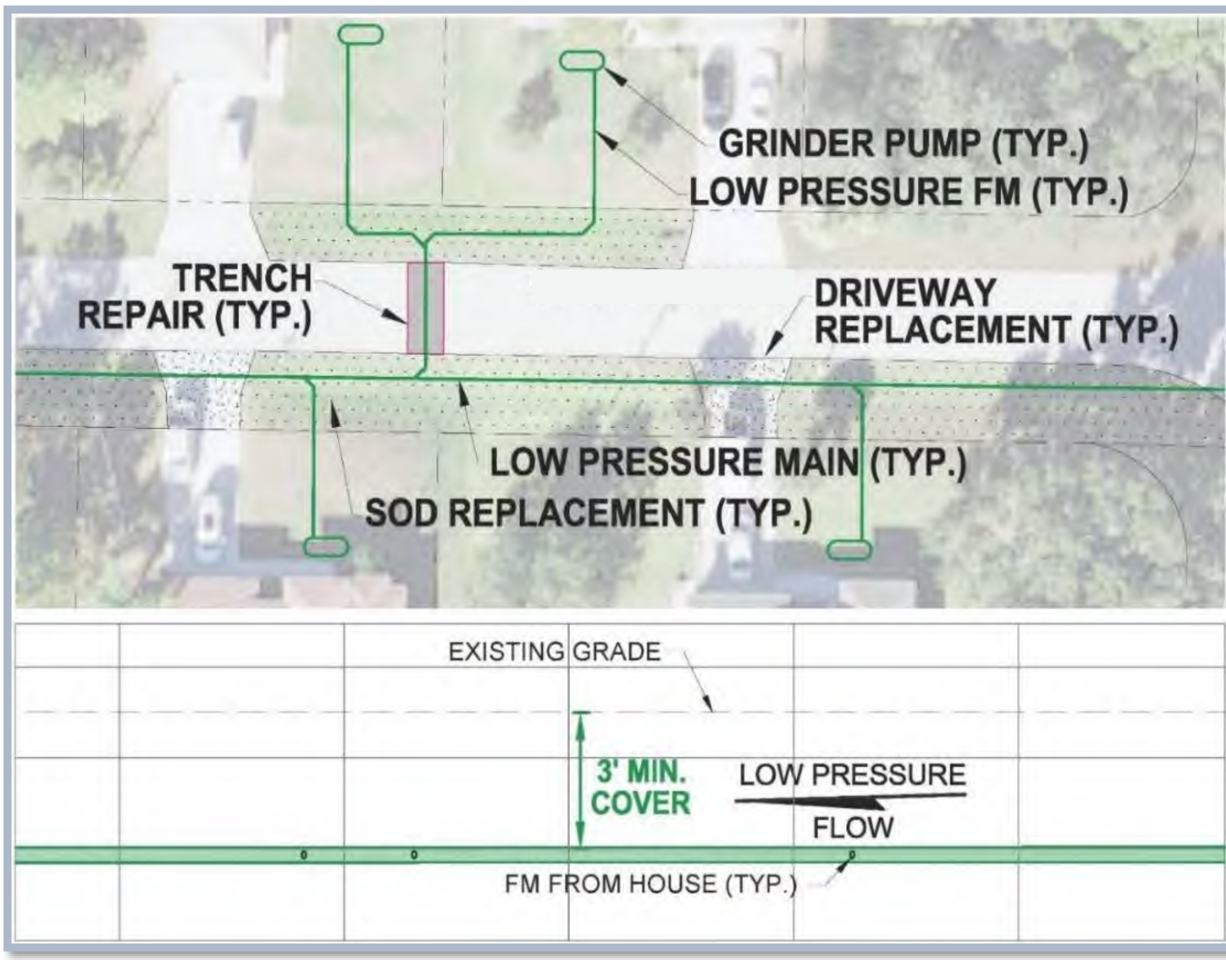
4.2 Low Pressure Sewer

4.2.1 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.

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 shoulder areas at a minimal depth making installation relatively easy and inexpensive.

A schematic layout of a typical low-pressure system is shown below.



4.2.2 LPS Tank

A LPS tank is installed at every home or parcel to receive the flows from each connection, respectively. The tanks accept the flow from the house via a gravity line, within the tank the solids settle, and when the sewage level in the tank reaches the "pump on" elevation, the effluent pump turns on and pumps a portion of the liquid out of the tank and into the LPS mains towards the master pump station and eventually the wastewater treatment plant (WWTP).

4.2.3 High Head Effluent Pumps

Each tank requires a LPS submersible effluent pump to discharge the effluent from the tank to the collection system. Power supply is from each home and power consumption is quite low.

However, these LPS pumps need to be repaired or replaced every 5-10 years depending on the specific pump used.

4.2.4 Master Pump Station

The master pump station is like 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.

For our analysis, it was assumed that Charlotte County will be building a pump station that will be able to receive the flows from the project area in the Cape Haze area. Therefore, the cost of constructing and operating a pump station on the mainland was not included in the analysis.

4.2.5 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.

Low pressure is advantageous in areas with high ground water and level lands. It is also well suited to areas bisected with canals, as the sewage can be pumped up and over bridges and obstacles as well as under canals and water courses. There are several bridge crossings in the project area; therefore, the ability to directionally drill a LPS main is highly advantageous for this project.

Main lines can be installed shallow and pipe elevations or slope is not critical to its installation. Both vertical and horizontal alignment is more flexible than other collection systems.

Additionally, for this specific project, we are assuming that Charlotte County is to build and maintain the master pump station which will receive the flow. This greatly reduces the costs for LPS and is a significant advantage over vacuum which requires the construction of multiple vacuum stations.

Disadvantages:

Low-pressure sewer systems require the installation of a pump at each parcel or property. During power outages each pump should have a backup generator or special arrangements made to pump out systems, so they do not back up. The utility rather than the customer, will be responsible for having a FDEP approved plan for power outages and emergency operations.

Operation and maintenance costs for low pressure systems is normally considerably more than other collection systems that have only one central pump station with only a few larger pumps.

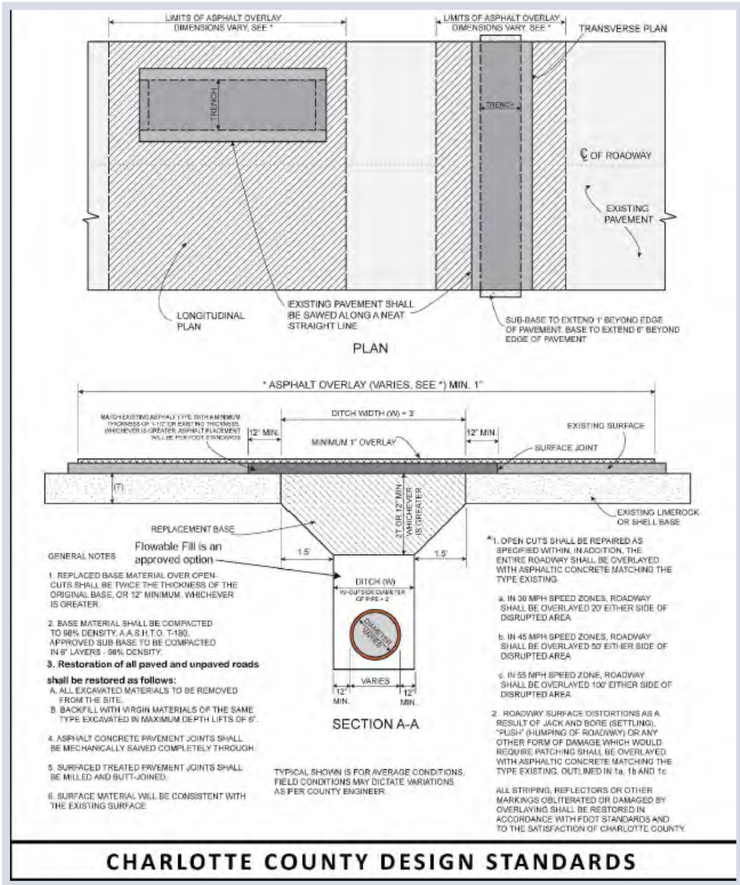
4.3 VACUUM SEWER

4.3.1 General Description

Vacuum collection systems rely on a central station providing energy (vacuum) in the collection pipe network pulling all flow to a central station and conveying the collected sewage to a wastewater treatment plant. Since the velocities are higher due to the vacuum propelling the flows, the main lines can be smaller as compared to a gravity system and typically range in size from 4” to 8” for an average system. In addition, because the vacuum assisted sewage can be physically lifted (to a limit), the main lines do not have to be installed at excessive depths.

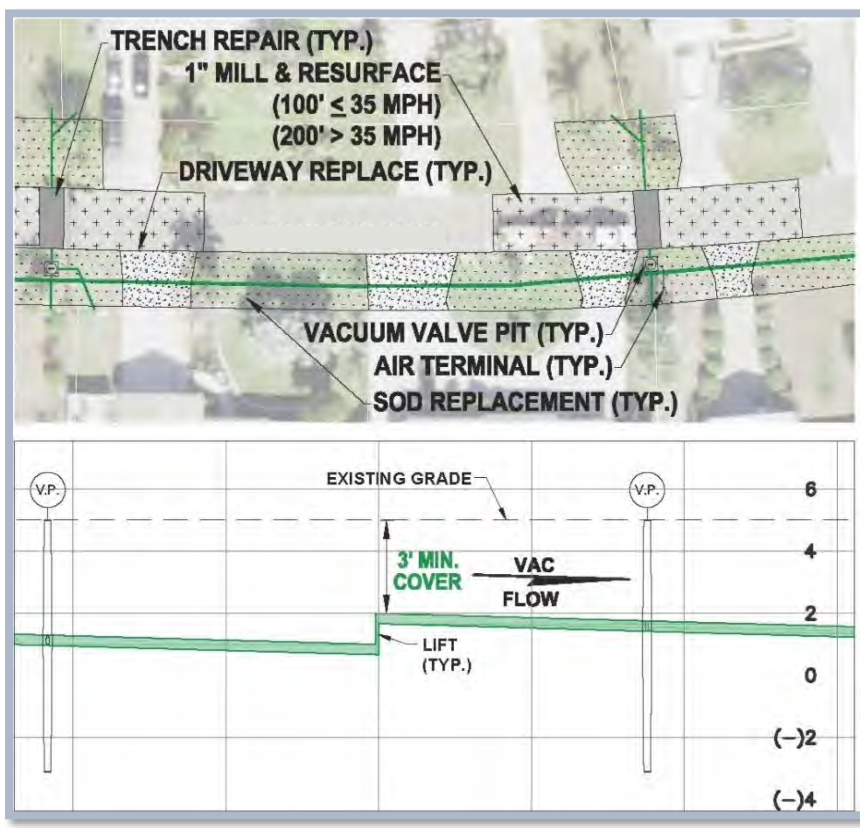
Vacuum main lines are normally installed at a depth of 3 to 6 feet, allowing it to be installed in the grass shoulder of the road network minimizing disruption of the pavement. Vacuum mains that cross side street intersections and gravity laterals from the valve pits cross the pavement using open cut methods.

Backfilling and restoration of the road at these trench crossings needs to be restored to current standards. After the trench is restored, a minimum 1” asphalt overlay of the entire road width and an additional distance depending on the posted speed limit will also be necessary.



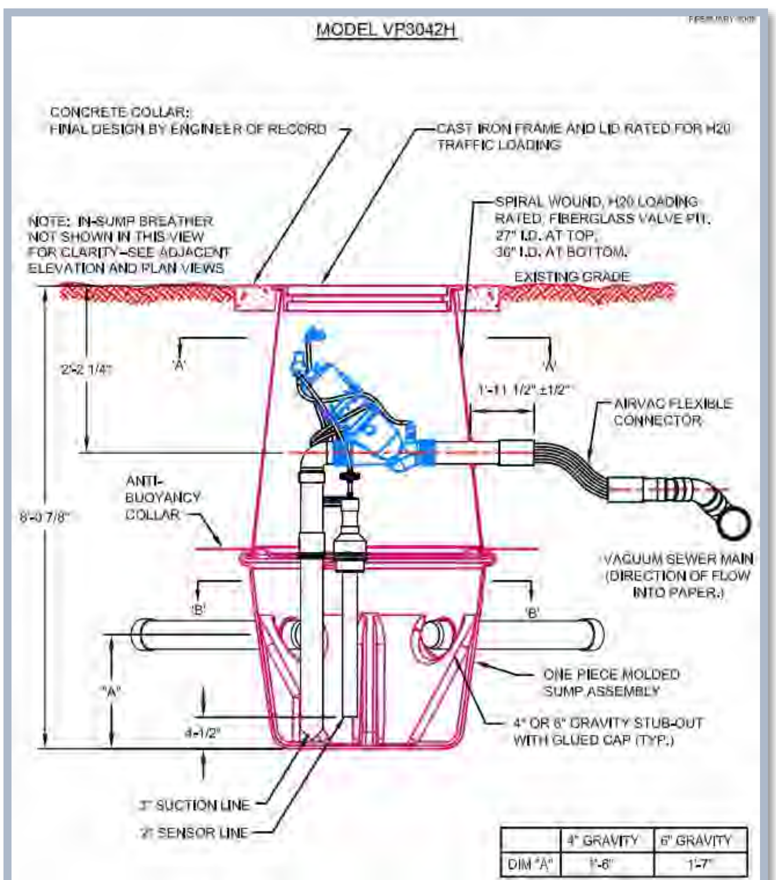
According to County standards, the roadway shall be overlayed 20’, 50’, or 100’ either side of the disrupted area depending on if the speed zone is 30, 45, or 55 mph, respectively on the island.

Since the vacuum main is normally installed on one side of the road, typically only half of the driveways are impacted by the construction. Usually, sod will need to be restored along the entire side of the main line, as well as portions of the opposite side of the roadway where the gravity lateral is installed. However, on the barrier islands with shell and sand roads there is virtually little or no sod. There may be some areas of sod along the paved road that may need to be replaced; however, the quantity should be minimal.



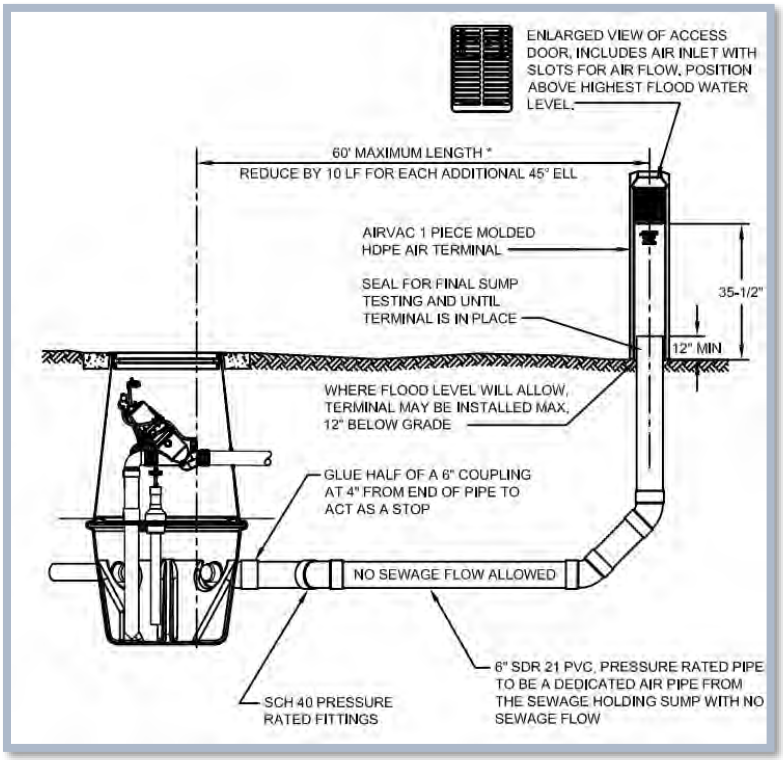
4.3.2 Valve Pits

To separate the negative pressure of the vacuum from the atmospheric pressure from the gravity service lateral, a vacuum interface valve is installed inside a "valve pit" normally located within the right of way. The valve pits are installed in the ground such that the top of the valve pit is at grade. A typical two-piece valve pit consists of a sump assembly which receives the sewage via gravity laterals and the valve located in the upper portion which conveys sewage from the sump to the vacuum sewer main.



Sewage enters the valve pit until there is approximately 10 gallons of sewage. A vertical tube senses the pressure differential and activates the vacuum valve to open, and sewage from the sump is pulled up and into the vacuum main toward the central vacuum station. There are four "knock outs" on the lower sump for receiving gravity laterals and one valve pit can accept flows from four or more locations. However, because of offsetting costs to extend gravity laterals and other constraints on average for the purposes of budgeting a single valve pit can serve approximately 2.5 ERC's.

4.3.3 Air Terminals



Atmospheric air is necessary in the sump so as not to pull fluids from the traps inside the structures.

Earlier systems relied on “candy cane” or 4” air intakes on each gravity service lateral installed by the plumber at each home to “break the vacuum”. In addition to general unsightliness, maintenance, and control of the “candy cane” was outside the utilities control.

Today’s systems now use a single air terminal that is installed in the ROW as part of the system construction. One air terminal is needed for each valve pit to allow air into the valve pit.

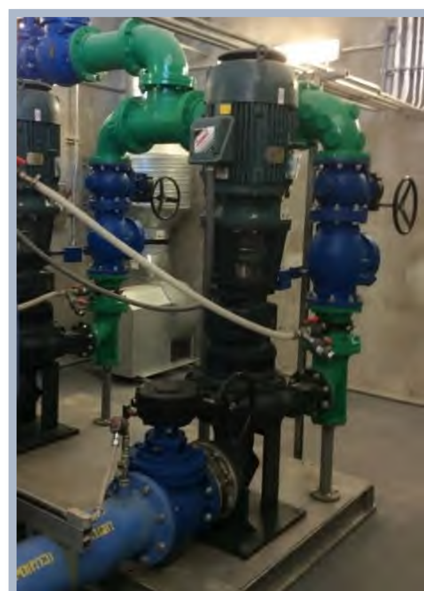
A 6” PVC lateral is extended from the sump of the valve pit over to the air terminal to allowing free flow of atmospheric air into the sump when the valve is activated.

An image of a typical air terminal is shown to the right.

4.3.4 Vacuum Station

Sewage from the homes is not under direct vacuum. Rather the "on-lot" connection from the structure is virtually the same as a gravity system using a gravity lateral except that the pipe material is slightly thicker for a vacuum connection.

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



Inside the station are a series of vacuum pumps which pull air from the top of a large collection tank. The sewage from the collection lines drops to the tank bottom and when the appropriate level is reached, adjacent sewage pumps draw down the tank sewage discharging into a force main that eventually goes to the treatment plant.

4.3.5 Package Vacuum (Pac-Vac) Station

Rather than design and build a large conventional building using poured in place concrete foundation, block walls and roof trusses; smaller "pre-engineered" package 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.

The "Pac-Vac" station can also offer some cost savings. Normally, "Pac-Vacs" are considered for smaller areas serving up to 600 Equivalent Residential Connections (ERC's) due to limitations in tank and pump sizing of the smaller buildings.

4.3.6 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 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 are high, the collection pipe diameter can be reduced.

A vacuum station can serve up to 2,500 ERC's provided the area is compact and not separated by waterways, long stretches of vacant land or bridges. 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.

The operation and maintenance of vacuum systems are relatively clean because it is 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, the negative pressure assures that sewage is pulled into the system rather than pushed out, making large scale environmental spills virtually nonexistent on the collection mains within the system.

Disadvantages:

Vacuum systems are normally cost competitive when compared to LPS. However, this analysis has revealed many problems which make serving the area with vacuum sewer more difficult.

The design of a vacuum sewer collection system and station is very site specific. The design of the saw tooth profile to ensure the appropriate slopes are maintained while allowing for enough cover is necessary. The installation must be closely monitored to ensure that the appropriate slopes and tolerances are met, and that the system is constructed according to the plans.

Another major concern on Don Pedro/Knight Island is the feasibility of the bridge crossings. It is very difficult to cross bridges with vacuum mains, and assuming it is even possible to do so, it would be very expensive to build. The pipe cannot be directionally drilled, and slope must be maintained while crossing the bridge and several lifts will be needed to step the pipe up and over the bridge while maintaining boat clearances. These additional lifts may also affect the feasibility of the vacuum station to transport the sewage efficiently. For the purpose of this analysis, we are assuming that it will be feasible however there is a risk that, with actual elevations and hard design, vacuum across the bridges may not work meaning that regardless of cost, one vacuum station to serve all of Don Pedro/Knight Island may not be feasible, and more stations will be necessary.

There are also a few challenges with constructing a vacuum station on a barrier island. When looking for a suitable site for a vacuum station it is important to consider the VE (velocity) FEMA flood zones and the Coastal Construction Control Line (CCCL). Building in the VE zone or west of the CCCL would be extremely difficult. It would be preferable to build a vacuum station in the AE FEMA flood areas in the easterly areas of the islands. Still the vacuum station design will be challenging and costly and maintaining the station will likely be higher than that of a station that is not on a barrier island.

5. DESIGN PARAMETERS

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

5.1 Low Pressure Collection System

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

Pipe Diameter	No. of Homes Served
2"	6
3"	60
4"	120
6"	280
8"	560

Additionally, a hydraulic analysis was performed using the Hazen-Williams approach to ensure that the system is appropriately sized for the Charlotte County approved LPS pumps. This hydraulic analysis was also used to do a comparative cost estimate for the additional cost required to assume the future flow from Knight Island. This pipe sizing analysis is located in Appendix G.

5.2 Vacuum Collection System

The following vacuum sewer design assumptions are based on GWE extensive experience with designing vacuum sewer systems:

- Valve Pit Ratio = 2.5:1 (homes/valve pit)
- Maximum Vacuum Line Length = 10,000 ft. from Vacuum Station
- Maximum ERC's Served by One Station:
    - Conventional (concrete/truss) = 2,500 ERC's

6. UNIT PRICES

Unit prices were developed for both collection systems based on averages from bids of similar systems. The averages of the bid tabulations and unit price assumptions are contained in Appendix A.

6.1 LOW PRESSURE SEWER COLLECTION UNIT PRICES

Unit prices for LPS were estimated using five bid tabulations from Charlotte County utility projects. Averages of the bids for the key elements were developed and unit prices were established as follows:

Low Pressure Sewer Master Unit Price List

Description	Unit	Unit Price
3" Low Pressure Sewer Main (PVC Pipe includes backfill)	LF	$ 20
4" Low Pressure Sewer Main (PVC Pipe includes backfill)	LF	$ 28
6" Low Pressure Sewer Main (PVC Pipe includes backfill)	LF	$ 30
8" Low Pressure Sewer Main (PVC Pipe includes backfill)	LF	$ 32
10" Low Pressure Sewer Main (PVC Pipe includes backfill)	LF	$ 50
12" Low Pressure Sewer Main (PVC Pipe includes backfill)	LF	$ 60
10" Dia. Directional Drill for Water Crossings (HDPE Pipe)	LF	$ 80
16" Dia. Directional Drill for Water Crossings (HDPE Pipe)	LF	$ 125
Main Line Road Crossings Trench Repair and Overlay - Asphalt Roads (PVC Pipe)	LF	$ 210
Open Cut Trench Repair and Overlay - Asphalt Roads (Service Laterals)	EA	$ 5,800
Open Cut Trench Repair - Shell Roads (Service Laterals)	EA	$ -
Restoration - Concrete Driveways	EA	$ 1,100
On-Lot Costs		
LPS Tank Package	ERC	$ 8,000
Pump, Crush and Fill Existing Septics	EA	$ 1,500
On Site Lateral Connection	EA	$ 1,000
Other Costs		
Miscellaneous (Mobilization / MOT / Bonds / Permits)		18%

The actual costs for the on-lot costs may vary from the proposed engineers estimate. The typical cost for Charlotte County Utilities to furnish and install the LPS tank package ranges from $4,800-$5,800. However, since most of this area is on a barrier island, the costs for transporting the materials and labor will likely be higher so an estimate of $10,500 was used for the LPS tank package, septic abandonment, and the on-site lateral connection.

6.2 Vacuum Sewer Collection Unit Prices

Unit prices for vacuum collection systems from similar septic to sewer projects in Sarasota, Charlotte and Martin County projects which were used as a basis. Average bid prices from the contractor's tabulation sheets were derived and unit prices based on the averages were developed as follows:

Vacuum Sewer Master Unit Price List

Description	Unit	Unit Price
Vacuum Station Building 600-1000 ERC's		
Building Site Work and Material - Install		$1,500,000
Pumps, Tank, and Controls - Material Only		$ 450,000
Total	EA	$1,950,000
Vacuum Main (4" PVC Pipe includes backfill)	LF	$ 35
Vacuum Main (6" PVC Pipe includes backfill)	LF	$ 45
S Gulf Blvd Bridge - Vacuum Main Crossing	EA	$ 250,000
S Gulf Blvd South Bridge - Vacuum Main Crossing	EA	$ 100,000
10" Dia. Directional Drill for Water Crossings (HDPE Pipe)	LF	$ 100
Force Main (6" PVC Pipe)	LF	$ 40
Force Main (8" PVC Pipe)	LF	$ 45
Valve Pits (2.5 ERC/1 VP)	EA	$ 7,500
3" Valve Pit Connections (PVC Pipe, 15'/ERC)	EA	$ 450
Gravity Laterals (PVC Pipe, 60' per VP @ $35/ft)	Valve Pit	$ 2,100
Air Terminals and 6" line	Valve Pit	$ 2,000
Main Line Road Crossings Trench Repair and Overlay - Asphalt Roads (PVC Pipe)	LF	$ 210
Open Cut Trench Repair and Overlay - Asphalt Roads (Service Laterals)	Valve Pit	$ 5,800
Open Cut Trench Repair - Shell Roads (Service Laterals)	EA	$ -
Restoration - Concrete Driveways	EA	$ 1,100
Vacuum Station Land	EA	$ 200,000
On-Lot Costs		
Pump, Crush and Fill Existing Septics	EA	$ 1,500
On Site Lateral Connection	EA	$ 1,000
Other Costs		
Additional Design Engineering - Vacuum Station	EA	$ 150,000
Additional Design Engineering - Profiles	EA	$ 100,000
Additional CEI - Vacuum Station	EA	$ 25,000
Additional CEI - Profiles and As-Builts	EA	$ 50,000
Miscellaneous (Mobilization / MOT / Bonds / Permits)		18%

7. ENGINEERING ECONOMICS METHODOLOGY

7.1 ESTIMATE OF BASE COSTS

A general conceptual layout was developed for each type of collection system for the service areas. LPS and vacuum concepts were developed, and specific quantities of key construction components were estimated.

Key construction components include the entire pipe system network, pump stations, septic tank abandonment, valve pits and force mains necessary. Key elements (pumps and equipment) have an operation and maintenance cost associated with them.

Soft costs such as surveying, easements, funding and legal are generally equivalent regardless of which type of collection system is selected and therefore for the purpose of this *comparative* analysis those costs were neglected.

Construction related costs such as mobilization, bonds, force mains, valves, pre-construction video and other incidental costs were estimated at 18% of the primary component costs based on prior bid analysis.

Therefore, the costs presented *cannot and should not be taken as the total project cost*. Only differential costs (primarily construction of the collection system elements and long-term O&M costs) are included for comparative purposes only, to determine the most appropriate system for the areas. Engineering, connection fees and other fees needs to be added to the costs presented.

Average construction unit prices used are based on previous experience and similar projects. Those average prices were then applied to the quantities for each type of system for the area size to develop an order of magnitude comparative cost.

7.2 OPERATION AND MAINTENANCE & PUMP REPAIR AND REPLACEMENT COSTS

Operation and maintenance (O&M) are dependent on the type of system. LPS generally has a higher O&M costs associated with the system because of the pump maintenance. The pumps need to be fixed or replaced every 5-10 years and since every ERC will have its own tank and pump package the costs are substantial.

For vacuum sewer, some vacuum energy is necessary to pull the sewage to the station. However, this added energy allows for smaller diameter pipes (since the velocity is much higher than LPS flow).

Operation and maintenance costs have been estimated for each system type that includes repair and replacement costs for pumps and components as well as electrical costs. The costs are averaged on an annual basis for the duration of the system life cycle. Operation and maintenance cost calculations for each area are found in Appendix C.

7.3 Life Cycle Present Worth Analysis

After the comparative construction costs and the O&M costs are developed for each system to serve the areas, a life cycle present worth analysis is conducted to provide an “apples to apples” analysis.

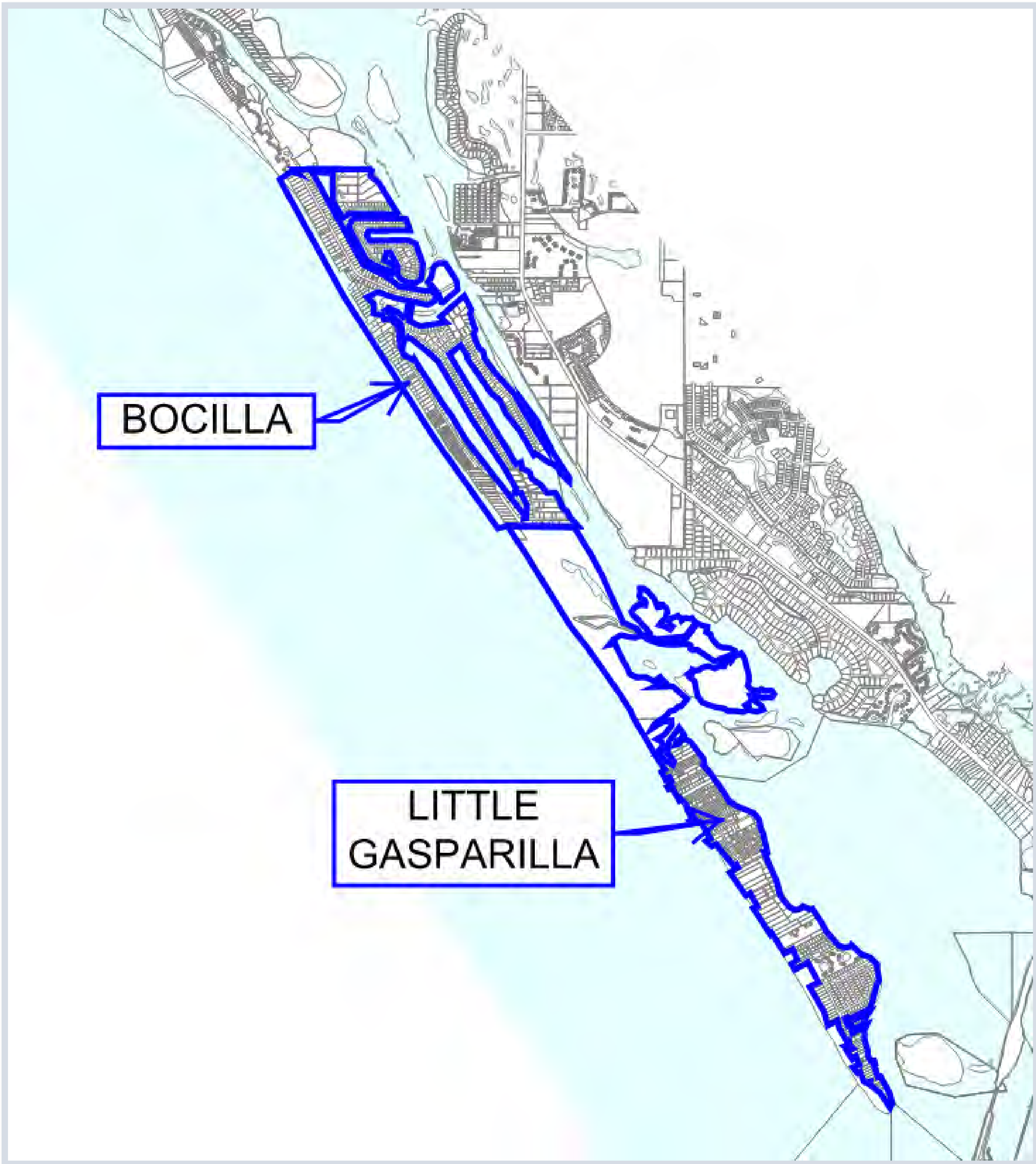
The annual uniform series of O&M costs are brought back to today’s value using an appropriate discount rate for today and the foreseeable future. Although the current rates of interest are approaching the zero bound, the discount rate for the cost of funds is assumed as an average of 5% over the time analysis of 40 years.

Salvage value of the components at the end of the time period is subtracted from the total base cost, and present value of O&M costs, to get total value of the system, which is used as a basis for ranking. The present worth analysis for each area can be found in Appendix D.

8. ENGINEERING ECONOMICS ANALYSIS

8.1 KEY MAP

The study area was partitioned into two areas, Don Pedro/Knight Island and Little Gasparilla Island, for the purpose of developing conceptual layouts and cost estimates.

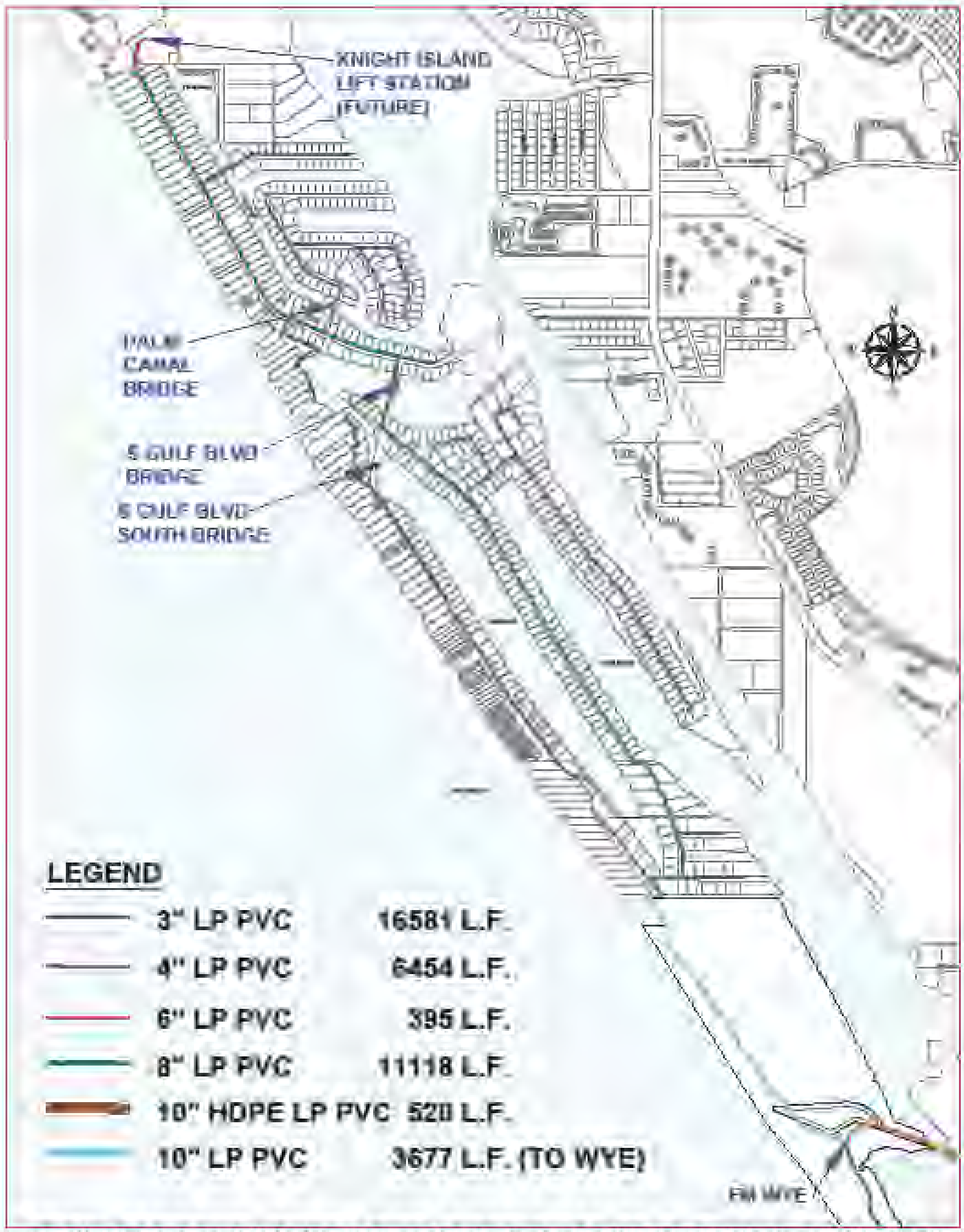


8.2 CONCEPTUAL LPS LAYOUT

Little Gasparilla Island:

(LGWU) AREA LOW PRESSURE CONCEPT

Don Pedro / Knight Island:



DON PEDRO / KNIGHT ISLAND AREA LOW PRESSURE CONCEPT

8.3 LPS Base Cost Estimate

Low Pressure Sewer Master Unit Price List			LGI / DON PEDRO / KNIGHT ISLAND	
Description	**Unit**	**Unit Price**	**Est. Qty**	**Total**
3" Low Pressure Sewer Main (PVC Pipe includes backfill)	LF	$ 20	34,096	$ 681,920
4" Low Pressure Sewer Main (PVC Pipe includes backfill)	LF	$ 28	9,494	$ 265,832
6" Low Pressure Sewer Main (PVC Pipe includes backfill)	LF	$ 30	9,020	$ 270,600
8" Low Pressure Sewer Main (PVC Pipe includes backfill)	LF	$ 32	15,325	$ 490,400
10" Low Pressure Sewer Main (PVC Pipe includes backfill)	LF	$ 50	3,677	$ 183,850
12" Low Pressure Sewer Main (PVC Pipe includes backfill)	LF	$ 60	4,250	$ 255,000
10" Dia. Directional Drill for Water Crossings (HDPE Pipe)	LF	$ 80	1,171	$ 93,680
16" Dia. Directional Drill for Water Crossings (HDPE Pipe)	LF	$ 125	700	$ 87,500
Main Line Road Crossings Trench Repair and Overlay - Asphalt Roads (PVC Pipe)	LF	$ 210	45	$ 9,450
Open Cut Trench Repair and Overlay - Asphalt Roads (Service Laterals)	EA	$ 5,800	48	$ 278,400
Open Cut Trench Repair - Shell Roads (Service Laterals)	EA	$ -	454	$ -
Restoration - Concrete Driveways	EA	$ 1,100	59	$ 64,900
On-Lot Costs				
LPS Tank Package	ERC	$ 8,000	1,251	$ 10,008,000
Pump, Crush and Fill Existing Septics	EA	$ 1,500	810	$ 1,215,000
On Site Lateral Connection	EA	$ 1,000	810	$ 810,000
Other Costs				
Miscellaneous (Mobilization / MOT / Bonds / Permits)		18%		$ 2,648,616
TOTAL				**$ 17,363,148**

Additionally, there is an existing wastewater treatment plant which currently treats the flow from the Hideaway Bay Beach Club and Placida Beach Condominiums. The mains have been sized to accommodate for these future flows. Any additional costs to upgrade or modify the "on-site" pipes to connect to the main or lift station pump upgrades at the treatment plant has not been included in this estimate and will need to be considered in a bulk sewer agreement.

8.4 Conceptual Vacuum Layout

Little Gasparilla Island:

Don Pedro / Knight Island:

DON PEDRO / KNIGHT ISLAND AREA VACUUM CONCEPT

8.5 VACUUM BASE COSTS ESTIMATE

Vacuum Sewer Master Unit Price List			LGI / DON PEDRO / KNIGHT ISLAND	
Description	**Unit**	**Unit Price**	**Est. Qty**	**Total**
Vacuum Station Building 600-1000 ERC's				
Building Site Work and Material - Install		$1,500,000		
Pumps, Tank, and Controls - Material Only		$ 450,000		
Total	EA	$1,950,000	2	$ 3,900,000
Vacuum Main (4" PVC Pipe includes backfill)	LF	$ 35	48,676	$ 1,703,660
Vacuum Main (6" PVC Pipe includes backfill)	LF	$ 45	20,292	$ 913,140
S Gulf Blvd Bridge - Vacuum Main Crossing	EA	$ 250,000	1	$ 250,000
S Gulf Blvd South Bridge - Vacuum Main Crossing	EA	$ 100,000	1	$ 100,000
10" Dia. Directional Drill for Water Crossings (HDPE Pipe)	LF	$ 100	1,873	$ 187,300
Force Main (6" PVC Pipe)	LF	$ 40	3,933	$ 157,320
Force Main (8" PVC Pipe)	LF	$ 45	25,460	$ 1,145,700
Valve Pits (2.5 ERC/1 VP)	EA	$ 7,500	501	$ 3,757,500
3" Valve Pit Connections (PVC Pipe, 15'/ERC)	EA	$ 450	501	$ 225,450
Gravity Laterals (PVC Pipe, 60' per VP @ $35/ft)	Valve Pit	$ 2,100	501	$ 1,052,100
Air Terminals and 6" line	Valve Pit	$ 2,000	501	$ 1,002,000
Main Line Road Crossings Trench Repair and Overlay - Asphalt Roads (PVC Pipe)	LF	$ 210	45	$ 9,450
Open Cut Trench Repair and Overlay - Asphalt Roads (Service Laterals)	Valve Pit	$ 5,800	48	$ 278,400
Open Cut Trench Repair - Shell Roads (Service Laterals)	EA	$ -	454	$ -
Restoration - Concrete Driveways	EA	$ 1,100	59	$ 64,900
Vacuum Station Land	EA	$ 200,000	2	$ 400,000
On-Lot Costs				
Pump, Crush and Fill Existing Septics	EA	$ 1,500	810	$ 1,215,000
On Site Lateral Connection	EA	$ 1,000	810	$ 810,000
Other Costs				
Additional Design Engineering - Vacuum Station	EA	$ 150,000	2	$ 300,000
Additional Design Engineering - Profiles	EA	$ 100,000	2	$ 200,000
Additional CEI - Vacuum Station	EA	$ 25,000	2	$ 50,000
Additional CEI - Profiles and As-Builts	EA	$ 50,000	2	$ 100,000
Miscellaneous (Mobilization / MOT / Bonds / Permits)		18%		$ 3,207,946
TOTAL				**$ 21,029,866**

8.6 Operation & Maintenance

Based on the operation and maintenance cost analysis (Appendix C), the O&M costs (including repair and replacement of pumps and controls) on a per year per ERC basis is significantly higher for a low pressure sewer system as compared to a vacuum sewer system. This price differential is attributed to the fact that LPS systems require a power input at every ERC, whereas a singular vacuum station supplies the power input needed for transporting the sewage from the ERCs.

Annual O&M Comparison		
LPS	$201	$/year/ERC
Vacuum	$95	$/year/ERC

8.7 Present Worth Analysis

The present worth analysis summarizes the base cost, the O&M cost, and the salvage value into a net present value which helps to determine which system will be the most affordable over the 40-year analysis period. This is reviewed below:

Present Worth Analysis					
Area	**System Type**	**Base Cost**	**Uniform Series Present Worth (O&M)**	**Present Worth of Salvage Value**	**Net Present Value**
LGI / Don Pedro / Knight Island	LPS	$17,363,148	$ 4,314,549	$ 222,925	$21,454,772
	Vacuum	$21,029,866	$ 2,030,520	$ 575,176	$22,485,210

The present worth analysis for the barrier islands, Little Gasparilla Island and Don Pedro/Knight Island areas, shows that LPS is the most cost effective wastewater collection system. The initial base costs for LPS are lower than vacuum, and although LPS has a high O&M cost, when the analysis was extended over a 40-year period at a 5% interest rate, LPS proved to still be the best choice.

9. OTHER CONSIDERATIONS

Financial impacts are certainly the significant part of determining which collection system would best serve the area. Still, in addition to the cost of installing, operating, and maintaining the selected system, there are other considerations which should be factored into the final selection. Some considerations have more merit than others and can be subjective depending on who is deciding. This is where engineering judgement comes in to weigh the following considerations before final selection is made.

9.1 BRIDGE CROSSINGS

There are a total of four bridges that must be crossed with vacuum mains to transport the sewage off the barrier islands. Bridge crossings with an LPS system is relatively simple, as the LPS main can be directionally drilled under the water. However, vacuum sewer mains cannot be directionally drilled and instead must use a series of lifts on piles to cross the bridge. This type of bridge crossing, if possible, would be extremely expensive and difficult to construct. At this stage, *we are not even certain that it is possible* to build these vacuum main bridge crossings to the required standards.

9.2 CORROSIVE ENVIRONMENT

Due to the corrosive nature of salt spray especially on the barrier islands, the costs for vacuum station maintenance would be significantly higher than typical vacuum stations inland. To help prevent corrosion, more costly stainless-steel materials of construction should be considered.

9.3 SHELL ROAD EROSION

On the barrier islands, most roads are shell or sand, rather of asphalt. This could be a problem for vacuum sewer maintenance as the valve pits can become exposed over time as the sand roads erode. Valve pits could be subject to impacts from be vehicles or grading operations. Similarly, in the event of a hurricane or strong storm, there is the possibility of washing out valve pits which can be costly to repair or replace.

Conversely, the shell roads are not a serious concern for LPS as the mains and the tanks are completely buried so there is less risk of damage.

9.4 DESIGN COSTS

It is important to note that for these specific project areas, specifically Don Pedro/Knight Island and Little Gasparilla, the cost to design a vacuum system will exceed that of an LPS system. There are critical design components for vacuum sewer such as maintaining the required minimum 0.2% slope, ensuring that the system does not exceed the maximum allowable head, and designing the vacuum station to withstand extreme conditions, for example. This drives up the cost for designing vacuum sewer significantly as opposed to LPS in which the design is not as critical.

9.5 LAND ACQUISITION FOR VACUUM STATION SITES

The acquisition of property to place new lift stations in developed areas can be problematic. Concerns about odor, landscaping, buffering, and noise are always an issue for the neighbors, and those concerns must be addressed for each site. Moreover, some properties may not allow the installation of a pump station without going through a special exception or rezone process that can take months. In addition, the time it takes to locate and purchase private lands can be significant.

For the vacuum station option, land for three vacuum stations is needed. However, if LPS is chosen, there is no need to purchase land assuming CCU will be constructing the master lift station in Cape Haze to receive all LPS flows. The time it takes to locate, purchase, and address all the issues with the neighbors can be substantial. Therefore, for these areas, the LPS option which requires no land purchase is preferable over multiple land purchases necessary to serve with vacuum.

9.6 KNIGHT ISLAND FLOW

A hydraulic analysis was performed to assess the difference in pipe sizes needed in order to account for the future flow from Knight Island. This was then converted to a cost estimate for the purpose of determining the approximate cost differential for the increased pipe sizes.

Assuming that the existing wastewater treatment facility is converted into a pump station, two scenarios were assessed:

1. Construct an LPS or Vacuum System – with Knight Island flow
2. Construct an LPS or Vacuum System – without Knight Island flow

There are additional costs for scenario 1 to upsize some mains from the island to the mainland. The hydraulic analysis for the pipe sizing is found in Appendix G. The estimated cost differential is assumed to be the same for either system and was determined as follows:

LPS/VACUUM MAIN SIZING									
Section	SCENARIO 1 - Assumes Knight Island Flow				SCENARIO 2 - Does Not Assume Knight Island Flow				Cost Differential
	Nominal Pipe Size (in)	Unit Price	Length of Main (ft)	TOTAL	Nominal Pipe Size (in)	Unit Price	Length of Main (ft)	TOTAL	
Knight Island Section 1	6	$ 30	400	$ 12,000	N/A	N/A	N/A	$ -	$ 12,000
Don Pedro / Knight Island Section 2	8	$ 32	2000	$ 64,000	4	$ 28	1400	$ 39,200	$ 24,800
Don Pedro / Knight Island Section 3	8	$ 32	2035	$ 65,120	6	$ 30	2035	$ 61,050	$ 4,070
Don Pedro / Knight Island Section 4	8	$ 32	2750	$ 88,000	6	$ 30	2750	$ 82,500	$ 5,500
Don Pedro / Knight Island Section 5	8	$ 32	5120	$ 163,840	8	$ 32	5120	$ 163,840	$ -
Don Pedro / Knight Island Section 6	10	$ 50	4060	$ 203,000	8	$ 32	4060	$ 129,920	$ 73,080
Little Gasparilla Section 1	4	$ 28	2080	$ 58,240	4	$ 28	2080	$ 58,240	$ -
Little Gasparilla Section 2	6	$ 30	2340	$ 70,200	6	$ 30	2340	$ 70,200	$ -
Little Gasparilla Section 3	8	$ 32	6050	$ 193,600	8	$ 32	6050	$ 193,600	$ -
Little Gasparilla Section 4	8	$ 32	5200	$ 166,400	8	$ 32	5200	$ 166,400	$ -
Section 11 - Wye to Future LS	12	$ 60	4930	$ 295,800	10	$ 50	4930	$ 246,500	$ 49,300
									$ 168,750

Force mains are sized to keep the velocities and friction low, so no additional master pump stations are necessary on the island. Force mains from the Don Pedro/Knight Island area are sized to also accept flow from the Knight Island WWTP. If the Knight Island flow is included, the mains must be upsized. The primary crossing from the island to the mainland should be a 12” PVC (open cut) and because HDPE is measured on the outside diameter (rather than the inside diameter) and 14” HDPE is difficult to find, the directional drilled pipe under the intercoastal is preliminary sized and priced as a 16”. Final hydraulic analysis may reduce this main size.

If flows from Knight Island Utilities is not included, then the crossing can be reduced to 10” PVC (open cut) and a 12” HDPE.

10. CONCLUSIONS

Based on the conceptual layout, financial analysis and additional considerations, the following conclusions are summarized.

10.1 Collection System Recommendation

Based on the study, vacuum sewer *in this instance on a barrier island* is not cost effective for several reasons:

1. The area is bisected with canals and bridges, so crossing is difficult and expensive. Because of the bridge crossings we are not even certain that the vacuum mains can cross them efficiently. Although we are assuming that it can be crossed, there is a risk on final design with accurate topo that it may not be feasible.

2. Much of the area is in a velocity zone so the vacuum station needs to be in an AE Flood zone.
3. Most of the streets are sand or shell subject to erosion from the elements and the traffic. Valve pits located in the shell roads will be subject to erosion around the pit or concrete collar and be subject to impacts from golf carts, and road regrading operations.

4. Another added benefit of selecting LPS is that for vacant lots, LPS tank packages can be installed as needed. In contrast, valve pits, even ones serving vacant lots, should be installed all at once which results in a higher initial cost and the potential for valve pits to remain unused for considerable time.

Therefore, LPS is the recommended wastewater collection technology to serve the barrier island areas, Don Pedro/Knight Island and Little Gasparilla. The analysis for this specific project has shown that the greatest advantages of LPS over vacuum sewer are that LPS is more cost effective, feasible to construct, and is more suitable for the conditions encountered on the barrier islands.

APPENDIX A: BID TABULATIONS AVERAGE PRICING

MASTER LOW PRESSURE BID AVERAGE PRICING

Item Description	Unit	UNDERGROUND UTILITY CONSTRUCTION & MAINTENANCE	RECLAIMED WATER, LOW PRESSURE SEWER, AND FORCE MAIN INSTALLATIONS	UTILITY IMPROVEMENTS - PARKSIDE C.R.A.	EAST/WEST SPRING LAKE WASTEWATER EXPANSION CONTRACT D	Average of Average Unit Prices	Price Used for Cost Estimate
4" Low Pressure Sewer Main (PVC Pipe)	LF	$ 12.18	$ 26.37	$ 29.06	$ 33.14	$ 25.19	**$ 28.00**
6" Low Pressure Sewer Main (PVC Pipe)	LF	$ 16.71		$ 41.82	$ 25.24	$ 27.93	**$ 30.00**
8" Low Pressure Sewer Main (PVC Pipe)	LF	$ 22.15	$ 32.09	$ 35.32	$ 29.60	$ 29.79	**$ 32.00**
4" Dia. Directional Drill for Water Crossings (HDPE Pipe)	LF	$ 34.70				$ 34.70	**$ 40.00**
6" Dia. Directional Drill for Water Crossings (HDPE Pipe)	LF	$ 48.76				$ 48.76	**$ 50.00**
8" Dia. Directional Drill for Water Crossings (HDPE Pipe)	LF	$ 63.79				$ 63.79	**$ 70.00**

MASTER VACUUM BID AVERAGE PRICING

Item Description	Unit	Golden Gate	Ackerman	El Jobean	O and P	N-2	Bell Shoals	Average of Average Unit Prices	Equivalent Unit Price	Price Used for Cost Estimate
3" PVC SDR-21 Vacuum Main	LF	$ 30.32	$ 28.01	$ 34.96	$ 20.67	$ 21.48		$ 27.09		
3" Valve Pit Connections (15')	EA								$ 406.29	**$ 450.00**
4" PVC SDR-21 Vacuum Main	LF	$ 30.58	$ 29.50	$ 39.96	$ 24.33	$ 26.00		$ 30.07		
6" PVC SDR-21 Vacuum Main	LF	$ 35.08	$ 33.75	$ 45.76	$ 32.67	$ 34.50		$ 36.35		
8" PVC SDR-21 Vacuum Main	LF	$ 41.53	$ 42.85	$ 53.51	$ 46.67	$ 43.50		$ 45.61		
Vaccum Main (4"-8")	LF								$ 37.35	**$ 40.00**
4" PVC SDR-21 Gravity Sewer Service Lateral	LF		$ 28.41	$ 30.67	$ 23.33	$ 22.98		$ 26.35		
6" PVC SDR-21 Gravity Sewer Service Lateral	LF		$ 34.18	$ 35.97	$ 28.00	$ 26.50		$ 31.16	$ 35.00	
6" Gravity Laterals (60'/valve pit)	Valve Pit								$ 2,100.00	**$ 2,100.00**
Dedicated Air Intake Terminal & 6" Grommet Purchase Material	EA	$ 291.63						$ 291.63	$ 291.63	
6" PVC SDR-21 Air Terminal Feeds (40')	EA			$ 32.19				$ 32.19	$ 1,287.50	
Dedicated Air Terminal Installation	EA	$ 230.36	$ 317.50	$ 475.50				$ 341.12	$ 341.12	
Air Terminals (Including 6" Line)	EA								$ 1,920.24	**$ 2,000.00**
Valve Pit 3042 H Purchase Material	EA	$ 4,348.81						$ 4,348.81		
Valve Pit 5442 H Purchase Material	EA	$ 4,690.75						$ 4,690.75		
Vacuum Valve Pit Assembly 3042 H Installation	EA	$ 1,788.39	$ 1,910.50	$ 1,889.25				$ 1,862.71		
Vacuum Valve Pit Assembly 5442 H Installation	EA	$ 2,067.14	$ 2,726.25	$ 2,649.13	$ 2,850.00			$ 2,573.13		
Vacuum Valve Pit Assembly 4830 Installation	EA				$ 1,416.67	$ 1,105.00		$ 1,260.83		
Vacuum Valve Pit Assembly 4842 Installation	EA				$ 1,566.67	$ 1,595.00		$ 1,580.83		
Valve Pits	EA								$ 6,211.53	**$ 6,250.00**
6" PVC C900/C905 DR18 Forcemain	LF	$ 32.59			$ 31.67	$ 25.00	$ 37.53	$ 31.70		
8" PVC C900/C905 DR18 Forcemain	LF	$ 57.71	$ 28.44		$ 40.67	$ 30.50	$ 51.85	$ 41.83		
Force Main 8"	LF									**$ 45.00**
Driveway Replacement - Concrete	SY	$ 63.45	$ 59.05	$ 61.53	$ 44.33	$ 40.75	$ 51.35	$ 53.41	$ 55.00	
Driveway Replacement - Asphalt	SY	$ 76.45	$ 80.45	$ 63.38	$ 46.00	$ 47.55		$ 62.77		
Concrete Driveway Replacement (20 SY/driveway)	EA								$ 1,100.00	**$ 1,100.00**
Open Cut Trench Repair	SY	$ 73.93	$ 61.20	$ 148.58				$ 94.57	$ 95.00	
Open Cut Trench Repair	LF				$ 46.33	$ 38.75		$ 42.54		
Open Cut Trench Repair Main Line (9 ft wide=1 SY/LF)	LF								$ 95.00	**$ 95.00**
Open Cut Trench Repair - Laterals (9ft/9*22 = 22 SY/crossing)	EA								$ 2,090.00	**$ 2,100.00**
Open Cut Trench Repair - Vacuum Sewer Laterals (9ft/9*10 = 10 SY/crossing)	Valve Pit								$ 950.00	**$ 950.00**
Open Cut Trench Repair - LPS Laterals (9ft/9*15 = 15 SY/crossing)	50% of ERCs								$ 1,425.00	**$ 1,425.00**
Mill and Resurface Trench (1")	SY								$ 10.00	**$ 10.00**
Mill and Resurface Trench (1", 150ft*22 ft wide/9*$10/SY)	EA								$ 3,666.67	
Mill and Resurface Trench (1", 100ft/9*$10/SY)	LF								$ 111.11	
Road Overlay (1", 20ft/9*$15/SY)	LF								$ 33.33	**$ 35.00**
5' Open Cut Trench Repair (LPS Main Line)	LF								$ 52.78	**$ 55.00**
10' Open Cut Trench Repair (Vacuum Main Line)	LF								$ 105.56	**$ 110.00**
Open Cut Trench Repair + Overlay (Service Lateral)	EA								$ 5,766.67	**$ 5,800.00**
Open Cut Trench Repair + Overlay (Main Line)	LF								$ 206.11	**$ 210.00**
Type S-1 Asphaltic Concrete, 1.50" Thickness	SY				$ 10.23	$ 11.50		$ 10.87	$ 15.00	$ 15.00
Limerock Base, 7" Thickness, LBR 100 Minimum	SY				$ 14.53	$ 15.00		$ 14.77		
Type 'B' Stabilization (12")	SY				$ 6.83	$ 5.50		$ 6.17		
	SY							$ 31.80	$ 35.00	
Shell Road Reconstruction (2SY/LF)									$ 40.00	**$ 40.00**
Total Road Reconstruction (2.44 SY/LF)+ stripe + signage + MOT	LF								$ 85.40	**$ 100.00**
Sod - Bahia	SY		$ 2.35	$ 3.49	$ 2.87	$ 2.25		$ 2.74		
Sod - Floratam	SY		$ 4.04					$ 4.04		
Sod - St. Augustine	SY				$ 4.00	$ 3.50		$ 3.75		
Sod - Various Types	SY	$ 5.71						$ 5.71	$ 6.00	
Restoration - Sod (150 SY/ERC)	ERC								$ 900.00	**$ 900.00**

APPENDIX B: LIFE EXPECTANCY OF COMPONENTS

LPS Components Life Expectancy	
Description	**Life Span**
LPS Main (PVC Pipe)	80
LPS Main (HDPE Directionally Drilled Water Crossing)	80
LPS Tank	40
Grinder Pump	7
On Site Lateral Connection	80

Vacuum Components Life Expectancy	
Description	**Life Span**
Vacuum Station Building	40
Vacuum Pumps	15
Sewage Pumps	15
Collection Tank	30
Control Panel	20
Vacuum Main (PVC Pipe)	80
Bridge Crossings - Vacuum Main	40
Force Main (PVC Pipe)	80
Force Main (HDPE Directionally Drilled Water Crossing)	80
Valve Pits	50
3" Valve Pit Connections (PVC Pipe)	80
Gravity Laterals (PVC Pipe)	80
Air Terminals and 6" line	50
On Site Lateral Connection	80

APPENDIX C: OPERATION AND MAINTENANCE COSTS

LGI / Don Pedro / Knight Island

connections 1251
EDU's 1251

ANNUAL O&M ESTIMATE
Future Sewer
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	0 system	=	0	hrs/yr
Grinder pumps	1.50 hrs/yr/GP	x	1,251 GP's	=	1877	hrs/yr
					1877	hrs/yr
				x	$20	/hr
				x	1.25	Overhead
					$46,925	/yr
				ROUND TO:	$46,900	/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	$1.00 /mo/EDU	x	1251 EDU	x	12 mo	=	$0	/yr
							$0	
Grinder Pumps	$1.00 /mo/EDU	x	1251 EDU	x	12 mo		$15,012	/yr
							$15,012	
						ROUND TO:	$15,000	/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	0 ea	=	$0	/yr
							$0	/yr
						ROUND TO:	$0	/yr
GRINDER PUMPS								
Rebuild pump core	$750 /ea	/	7 years	x	1,251 GP's	=	$134,036	/yr
Replace controls	$300 /ea	/	7 years	x	1,251 GP's	=	$53,614	/yr
Misc. Parts	$15 /yr	/	10 years	x	1,251 GP's	=	$1,877	/yr
							$189,527	/yr
						ROUND TO:	$189,500	/yr

SUMMARY		
LABOR	$46,900	/yr
POWER	$15,000	/yr
EQUIPMENT REPLACEMENT (LIFT STATION)	$0	/yr
EQUIPMENT REPLACEMENT (GP'S)	$189,500	/yr
	$251,400	/yr
ANNUAL O&M	$201	/yr/EDU

LGI / Don Pedro / Knight Island

ANNUAL O&M ESTIMATE
Future Sewer
VACUUM SYSTEM

# connections	1251
# EDU's	1251

LABOR

Item	Labor effort		Quantity		Annual Labor
Vacuum Station	450 hrs/yr/station	x	2 station	=	900 hrs/yr
Piping	60 hrs/yr/system	x	2 system	=	120 hrs/yr
Valves	1.75 hrs/yr/valve	x	500 valves	=	876 hrs/yr
					1896 hrs/yr
				x	$20 /hr
				x	1.25 Overhead
					$47,400 /yr
				ROUND TO:	$47,400 /yr

POWER

Item	Unit cost		EDU		Duration		Annual Power
Vacuum Station							
Flat rate	$125.00 /mo	x	2 Vac Sta		12 mo		$3,000 /yr
Consumption	$2.50 /mo/EDU	x	1251 EDU	x	12 mo	=	$37,530 /yr
							$40,530
						ROUND TO:	$40,500 /yr

EQUIPMENT REPLACEMENT

Item	Replacement cost		Useful life		Quantity		Annual R&R
VACUUM STATION							
Vacuum Pumps	$26,000 /ea	/	15 years	x	8 pumps	=	$13,867 /yr
Sewage Pumps	$15,000 /ea	/	15 years	x	4 pumps	=	$4,000 /yr
Collection Tank	$50,000 /ea	/	30 years	x	2 ea	=	$3,333 /yr
Control Panel	$40,000 /ea	/	20 years	x	2 ea	=	$4,000 /yr
Misc. Equip	$3,000 /ea	/	15 years	x	2 ea	=	$400 /yr
							$25,600 /yr
						ROUND TO:	$25,600 /yr
VACUUM VALVES							
Vacuum Valves	$45 /ea	/	15 years	x	500 valves	=	$1,501 /yr
Controller	$45 /ea	/	10 years	x	500 valves	=	$2,252 /yr
Misc. Parts	$20 /ea	/	10 years	x	500 valves	=	$1,001 /yr
							$4,754 /yr
						ROUND TO:	$4,800 /yr

SUMMARY

LABOR	$47,400 /yr
POWER	$40,500 /yr
EQUIPMENT REPLACEMENT (STATION)	$25,600 /yr
EQUIPMENT REPLACEMENT (VALVES)	$4,800 /yr
	$118,300 /yr
ANNUAL O&M	$95 /yr/EDU

LGI / Don Pedro / Knight Island

ANNUAL O&M COMPARISON		
	VACUUM	LOW PRESSURE
# CONNECTIONS	1251 ea	1251 ea
# OF EDU'S	1251 ea	1251 ea
# UNITS	500 valves	1,251 GP's
# VACUUM OR LIFT STATIONS	2 ea	0 ea
LABOR	$47,400 /yr	$46,900 /yr
POWER	$40,500 /yr	$15,000 /yr
EQUIPMENT REPLACEMENT (Vac Sta/Lift Sta)	$25,600 /yr	$0 /yr
REBUILD/REPAIR FREQUENCY		
Rebuild/repair frequency (vacuum valve/wetwell pumps/GP core)	15 yrs	7 yrs
Rebuild/repair frequency (controllers/pump controls)	10 yrs	7 yrs
Rebuild/repair frequency (gravity wetwell)	n/a	20 yrs
Misc Spare parts frequency	10 yrs	10 yrs
EQUIPMENT REPLACEMENT (Valves/Grinder Pumps)	$4,800 /yr	$189,500 /yr
ANNUAL O&M	$118,335 /yr	$251,444 /yr
ANNUAL O&M per EDU	$95 /yr/EDU	$201 /yr/EDU

APPENDIX D: PRESENT WORTH ANALYSIS

Present Worth Analysis

Project	**LGI / Don Pedro / Knight Island**		**For Comparitive Analysis Only**
Planning Time Frame	40	years	*(Does not include all costs)*
Interest Rate	5.00	%	
ERC's (Build-Out)	1251	ERC's	LPS \$ 13,879 \$/build-out ERC
ERC's (Existing)	810	ERC's	Vac \$ 16,810 \$/build-out ERC

ASSUMES CCU LIFT STATION

System Type	Base 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)	Present Worth of Salvage Value	NET PRESENT VALUE	RANK
LPS	\$ 17,363,148	\$ -	\$ -	\$ -	\$ 17,363,148	\$ 251,444	17.16	\$ 4,314,549	\$ 1,569,391	0.14	\$ 222,925	\$ 21,454,772	1
Vacuum	\$ 21,029,866	\$ -	\$ -	\$ -	\$ 21,029,866	\$ 118,335	17.16	\$ 2,030,520	\$ 4,049,235	0.14	\$ 575,176	\$ 22,485,210	2

NPV = C+ USPW (O&M)-SPPW(S)

NPV Net Present Value

C Capital Cost

		n (years)	i %	(1+i)nth	i(1+i)nth	Present W factor
USPW (O&M)	Uniform Series Present Worth	40	0.05	7.040	0.352	17.159
equals	A(1+i)nth -1 / i(1+i)nth					

SPPW (S)

Single Payment Present Worth Salvage Value

FV*1/(1+i)nth

SPPW

0.142

Salvage Value

	Element	Life Span	Value New	40 Year Dep	Remaining Value
LPS	3" Low Pressure Sewer Main (PVC Pipe includes backfill)	80	\$ 681,920	\$ 340,960	\$ 340,960
	4" Low Pressure Sewer Main (PVC Pipe includes backfill)	80	\$ 265,832	\$ 132,916	\$ 132,916
	6" Low Pressure Sewer Main (PVC Pipe includes backfill)	80	\$ 270,600	\$ 135,300	\$ 135,300
	8" Low Pressure Sewer Main (PVC Pipe includes backfill)	80	\$ 490,400	\$ 245,200	\$ 245,200
	10" Low Pressure Sewer Main (PVC Pipe includes backfill)	80	\$ 183,850	\$ 91,925	\$ 91,925
	12" Low Pressure Sewer Main (PVC Pipe includes backfill)	80	\$ 255,000	\$ 127,500	\$ 127,500
	10" Dia. Directional Drill for Water Crossings (HDPE Pipe)	80	\$ 93,680	\$ 46,840	\$ 46,840
	16" Dia. Directional Drill for Water Crossings (HDPE Pipe)	80	\$ 87,500	\$ 43,750	\$ 43,750
	LPS Tank Package	40	\$ 10,008,000	\$ 10,008,000	\$ -
	On Site Lateral Connection	80	\$ 810,000	\$ 405,000	\$ 405,000
					\$ 1,569,391.00

Cost Estimates

Description	Qty	Unit Price	Total
3" Low Pressure Sewer Main (PVC Pipe includes backfill)	34,096	\$ 20	\$ 681,920
4" Low Pressure Sewer Main (PVC Pipe includes backfill)	9,494	\$ 28	\$ 265,832
6" Low Pressure Sewer Main (PVC Pipe includes backfill)	9,020	\$ 30	\$ 270,600
8" Low Pressure Sewer Main (PVC Pipe includes backfill)	15,325	\$ 32	\$ 490,400
10" Low Pressure Sewer Main (PVC Pipe includes backfill)	3,677	\$ 50	\$ 183,850
12" Low Pressure Sewer Main (PVC Pipe includes backfill)	4,250	\$ 60	\$ 255,000
10" Dia. Directional Drill for Water Crossings (HDPE Pipe)	1,171	\$ 80	\$ 93,680
16" Dia. Directional Drill for Water Crossings (HDPE Pipe)	700	\$ 125	\$ 87,500
Main Line Road Crossings Trench Repair and Overlay - Asphalt Roads (PVC Pipe)	45	\$ 210	\$ 9,450
Open Cut Trench Repair and Overlay - Asphalt Roads (Service Laterals)	48	\$ 5,800	\$ 278,400
Open Cut Trench Repair - Shell Roads (Service Laterals)	454	\$ -	\$ -
Restoration - Concrete Driveways	59	\$ 1,100	\$ 64,900
LPS Tank Package	1,251	\$ 8,000	\$ 10,008,000
Pump, Crush and Fill Existing Septics	810	\$ 1,500	\$ 1,215,000
On Site Lateral Connection	810	\$ 1,000	\$ 810,000
Miscellaneous (Mobilization / MOT / Bonds / Permits)		18%	\$ 2,648,616
		Total	**\$ 17,363,148**

Project **LGI / Don Pedro / Knight Island**

Salvage Value

Vacuum	Building Site Work and Material - Install	40	$ 3,000,000	$ 3,000,000	$ -
	Vacuum Main (4" PVC Pipe includes backfill)	80	$ 1,703,660	$ 851,830	$ 851,830
	Vacuum Main (6" PVC Pipe includes backfill)	80	$ 913,140	$ 456,570	$ 456,570
	S Gulf Blvd Bridge - Vacuum Main Crossing	40	$ 250,000	$ 250,000	$ -
	S Gulf Blvd South Bridge - Vacuum Main Crossing	40	$ 100,000	$ 100,000	$ -
	10" Dia. Directional Drill for Water Crossings (HDPE Pipe)	80	$ 187,300	$ 93,650	$ 93,650
	Force Main (6" PVC Pipe)	80	$ 157,320	$ 78,660	$ 78,660
	Force Main (8" PVC Pipe)	80	$ 1,145,700	$ 572,850	$ 572,850
	Valve Pits (2.5 ERC/1 VP)	50	$ 3,757,500	$ 3,006,000	$ 751,500
	3" Valve Pit Connections (PVC Pipe, 15'/ERC)	80	$ 225,450	$ 112,725	$ 112,725
	Gravity Laterals (PVC Pipe, 60' per VP @ $35/ft)	80	$ 1,052,100	$ 526,050	$ 526,050
	Air Terminals and 6" line	50	$ 1,002,000	$ 801,600	$ 200,400
	On Site Lateral Connection	80	$ 810,000	$ 405,000	$ 405,000
					$4,049,235.00

Cost Estimates

Vacuum Station Building 600-1000 ERC's	2	$1,950,000	$ 3,900,000
Vacuum Main (4" PVC Pipe includes backfill)	48,676	$ 35	$ 1,703,660
Vacuum Main (6" PVC Pipe includes backfill)	20,292	$ 45	$ 913,140
S Gulf Blvd Bridge - Vacuum Main Crossing	1	$ 250,000	$ 250,000
S Gulf Blvd South Bridge - Vacuum Main Crossing	1	$ 100,000	$ 100,000
10" Dia. Directional Drill for Water Crossings (HDPE Pipe)	1,873	$ 100	$ 187,300
Force Main (6" PVC Pipe)	3,933	$ 40	$ 157,320
Force Main (8" PVC Pipe)	25,460	$ 45	$ 1,145,700
Valve Pits (2.5 ERC/1 VP)	501	$ 7,500	$ 3,757,500
3" Valve Pit Connections (PVC Pipe, 15'/ERC)	501	$ 450	$ 225,450
Gravity Laterals (PVC Pipe, 60' per VP @ $35/ft)	501	$ 2,100	$ 1,052,100
Air Terminals and 6" line	501	$ 2,000	$ 1,002,000
Main Line Road Crossings Trench Repair and Overlay - Asphalt Roads (PVC Pipe)	45	$ 210	$ 9,450
Open Cut Trench Repair and Overlay - Asphalt Roads (Service Laterals)	48	$ 5,800	$ 278,400
Open Cut Trench Repair - Shell Roads (Service Laterals)	454	$ -	$ -
Restoration - Concrete Driveways	59	$ 1,100	$ 64,900
Vacuum Station Land	2	$ 200,000	$ 400,000
Pump, Crush and Fill Existing Septics	810	$ 1,500	$ 1,215,000
On Site Lateral Connection	810	$ 1,000	$ 810,000
Additional Design Engineering - Vacuum Station	2	$ 150,000	$ 300,000
Additional Design Engineering - Profiles	2	$ 100,000	$ 200,000
Additional CEI - Vacuum Station	2	$ 25,000	$ 50,000
Additional CEI - Profiles and As-Builts	2	$ 50,000	$ 100,000
Miscellaneous (Mobilization / MOT / Bonds / Permits)		18%	$ 3,207,946
		Total	**$ 21,029,866**

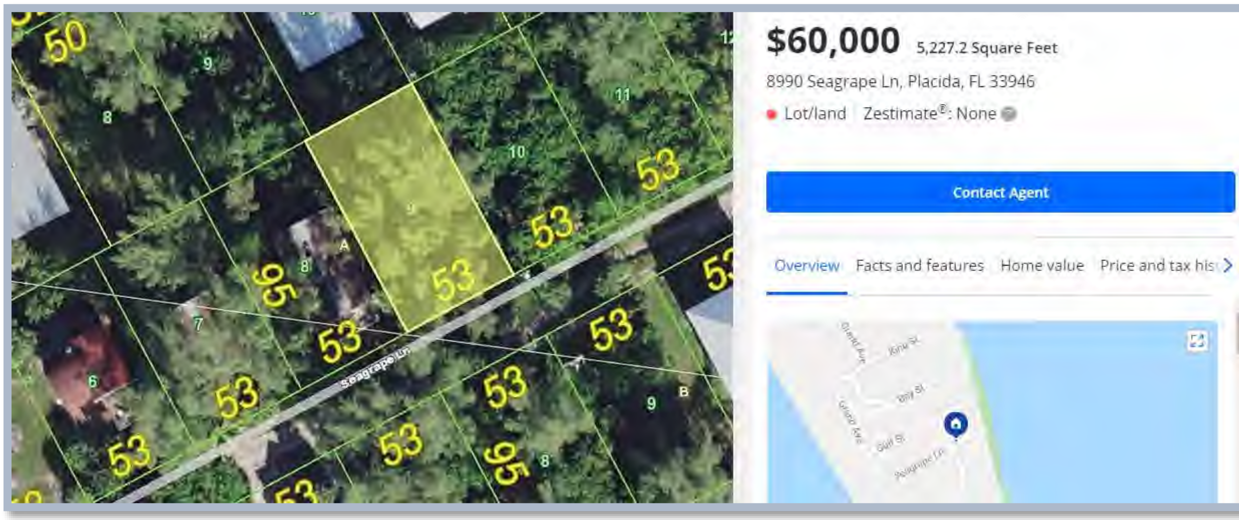
O & M Costs per Year

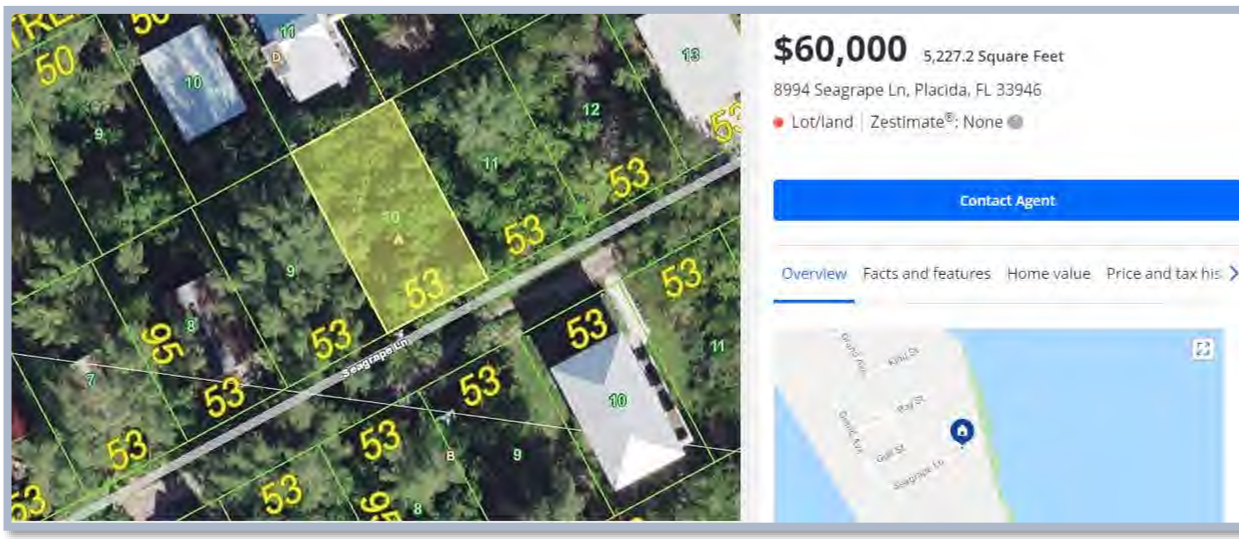
	Cost per EDU	EDU's	Cost/Year
LPS	$ 201	1251	$ 251,444
Vacuum	$ 95	1251	$ 118,335

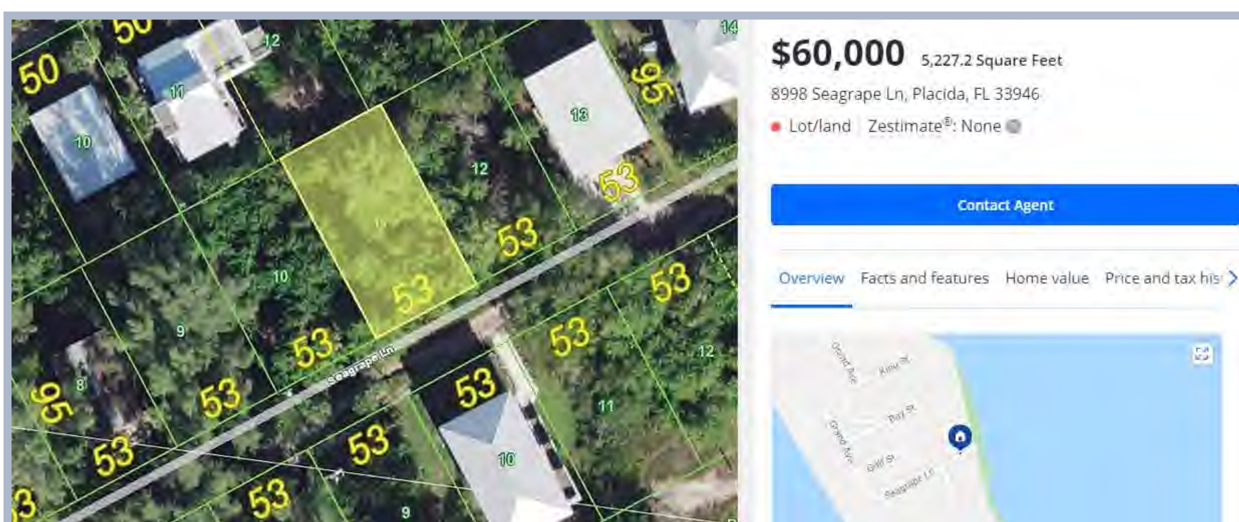
GWE # 6374.20

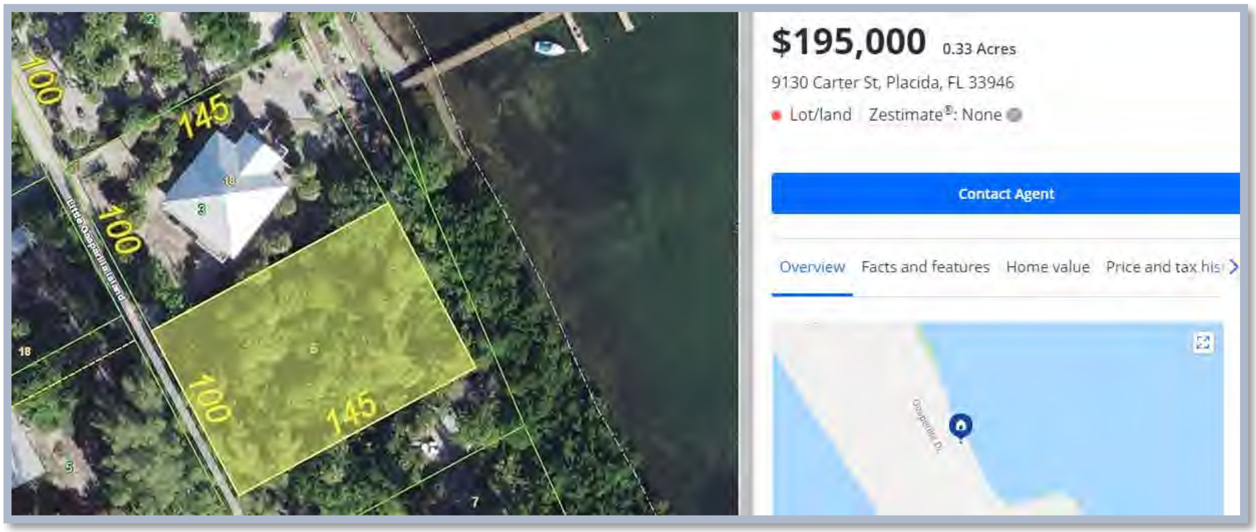
APPENDIX E: PROPERTY COST ESTIMATES

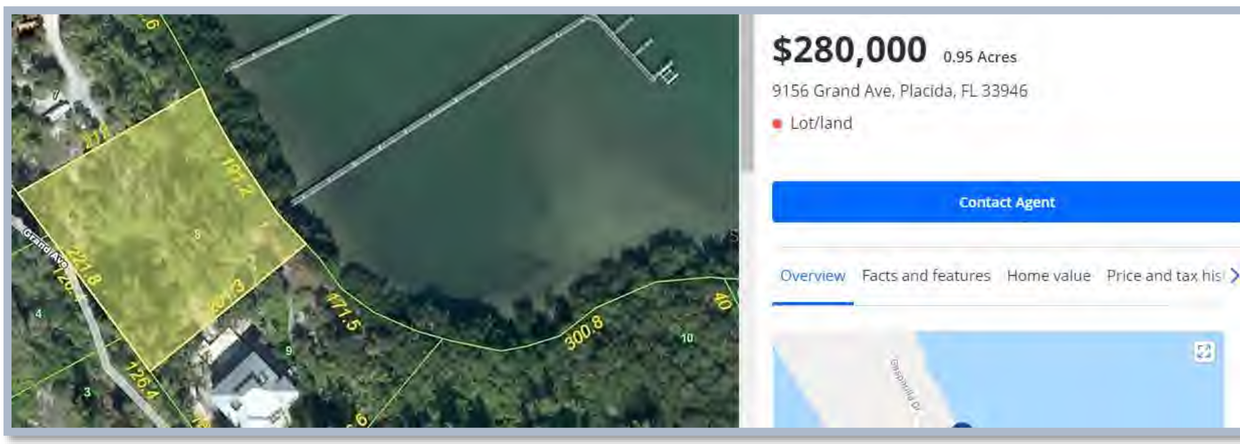
Little Gasparilla Island



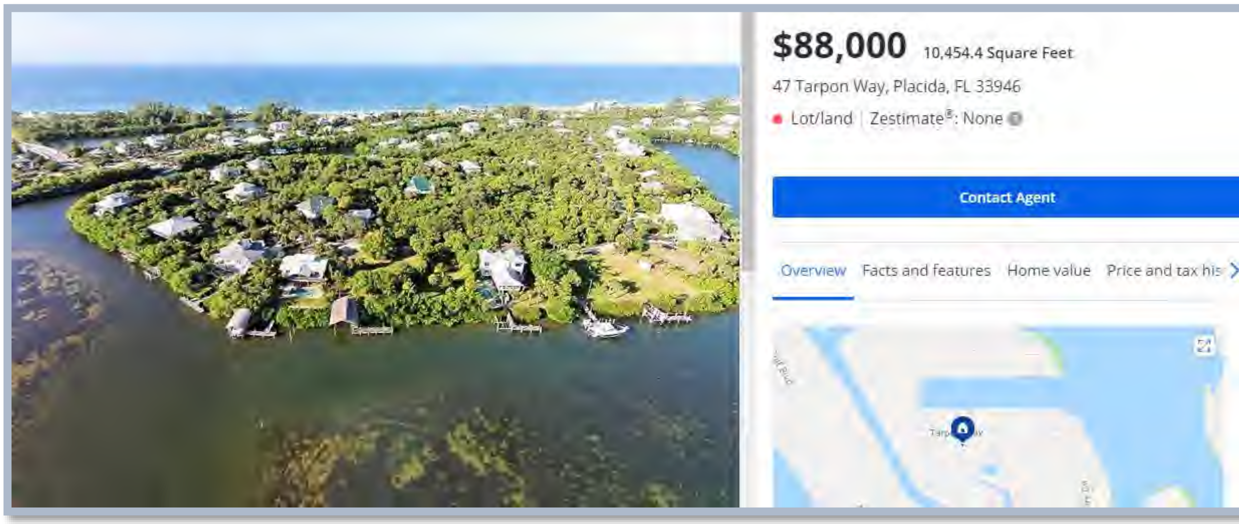


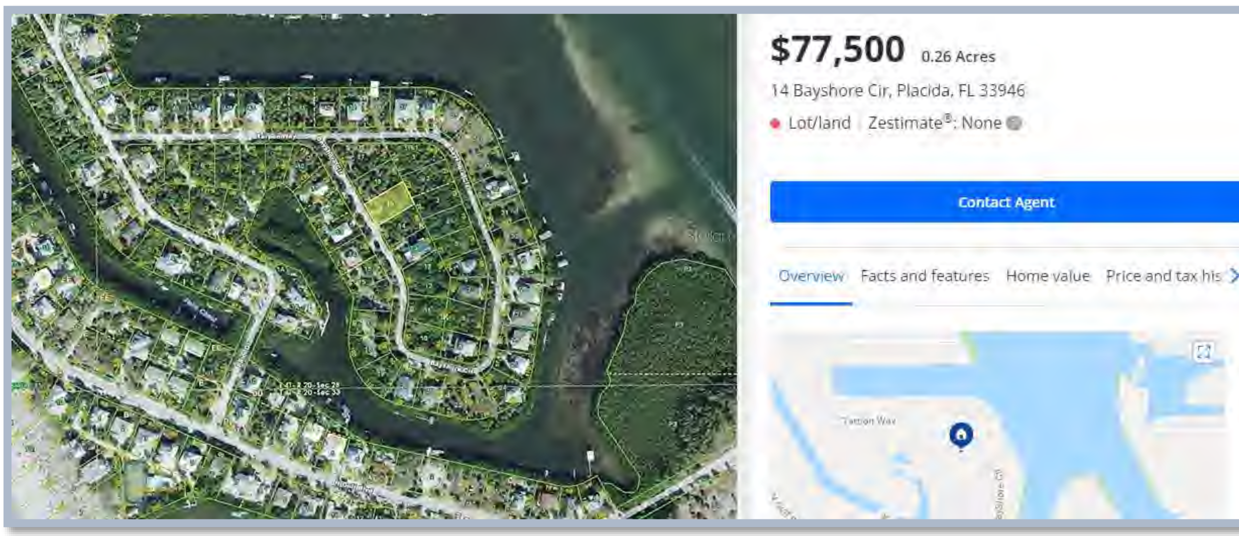


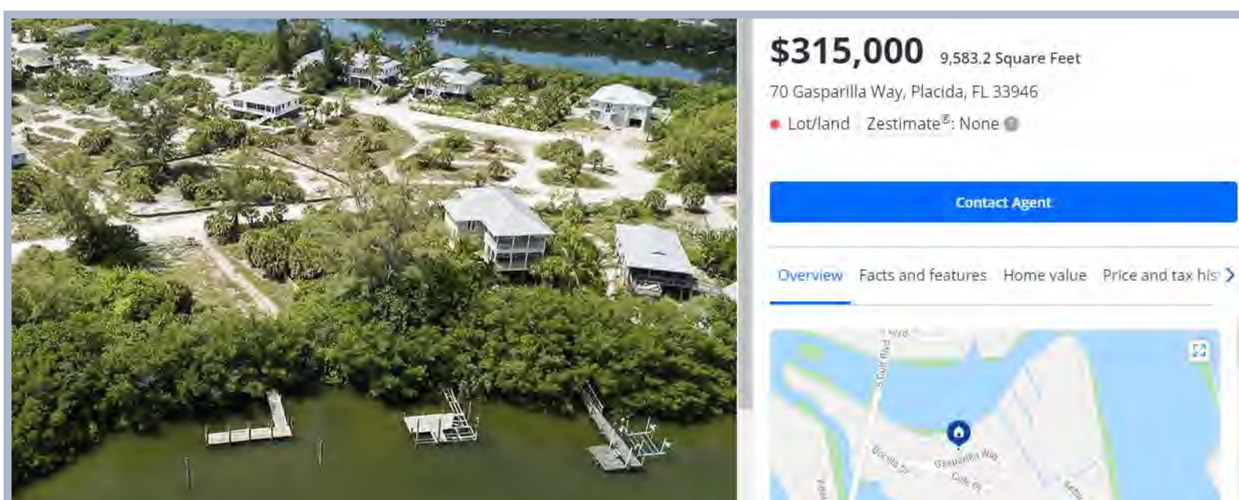

$195,000 0.33 Acres
9130 Carter St, Placida, FL 33946
Lot/land Zestimate®: None
Contact Agent
Overview
Facts and features
Home value
Price and tax his
100
145
100
100
145


$280,000 0.95 Acres
9156 Grand Ave, Placida, FL 33946
Lot/land
Contact Agent
Overview
Facts and features
Home value
Price and tax his
221.8
171.5
300.8

Don Pedro / Knight Island

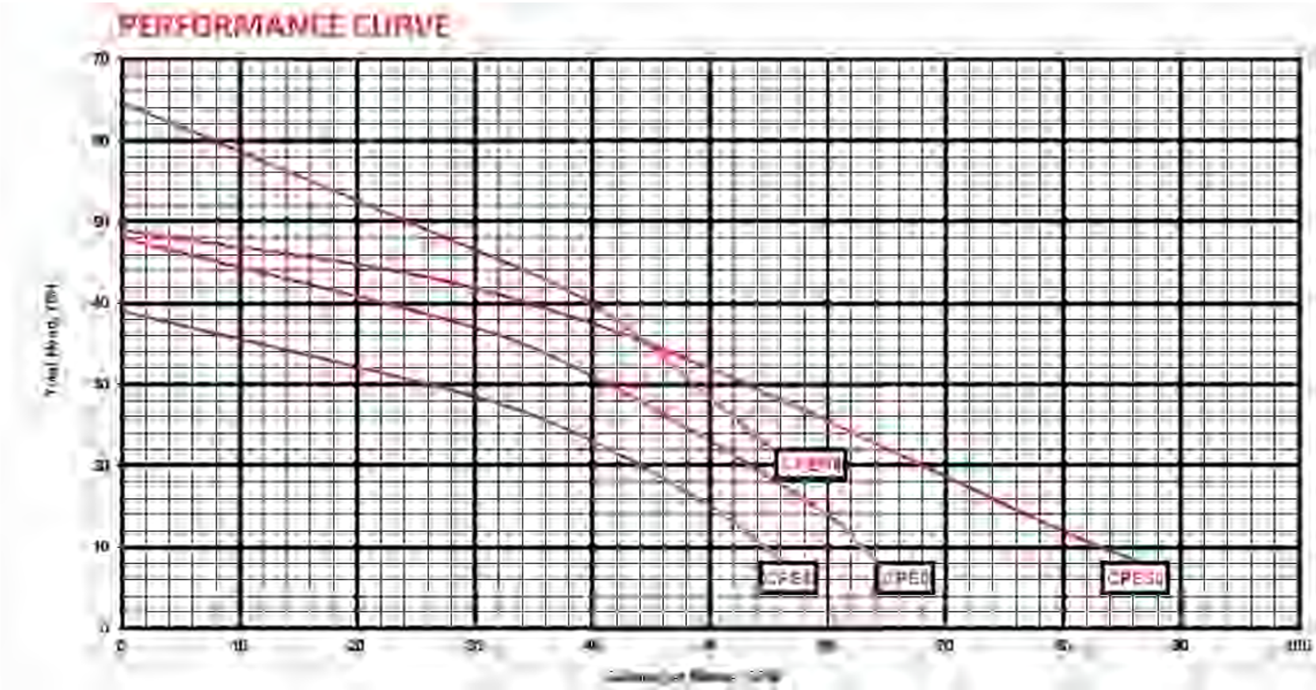




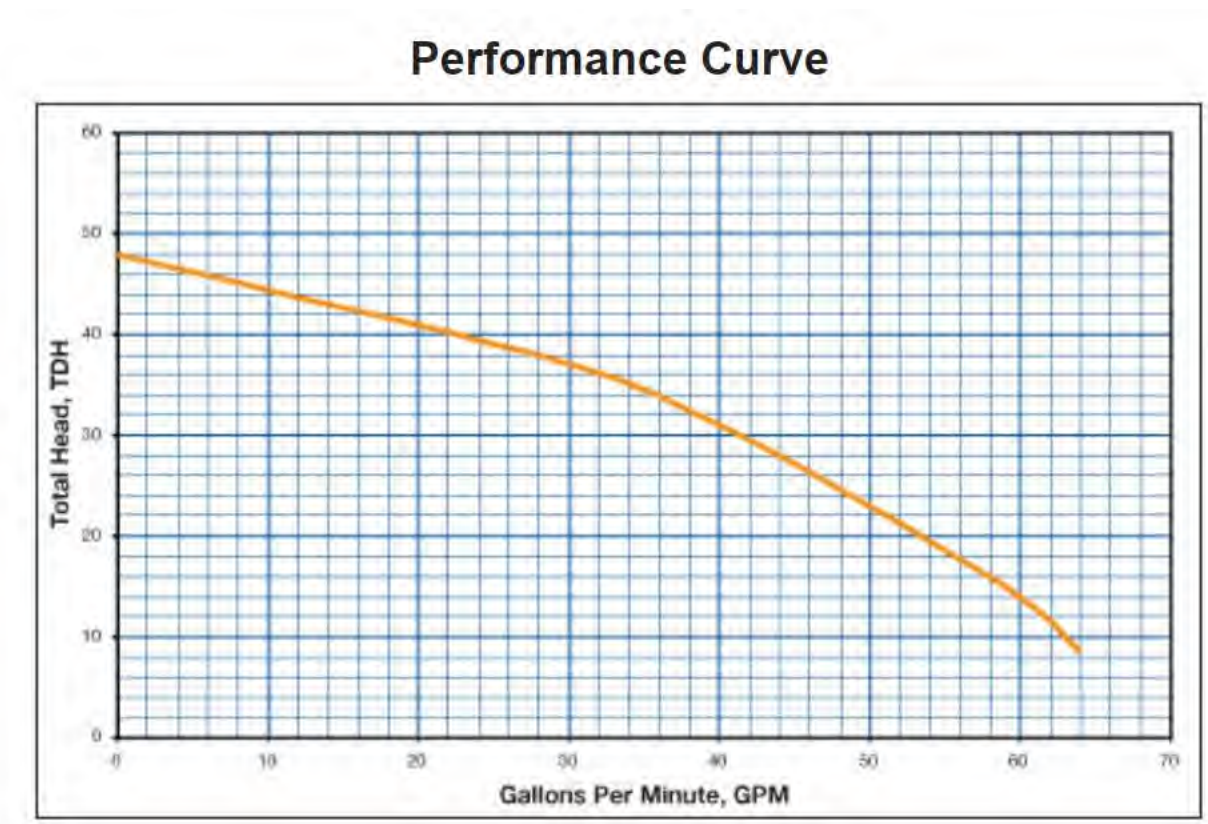


APPENDIX F: PUMP PERFORMANCE CURVES

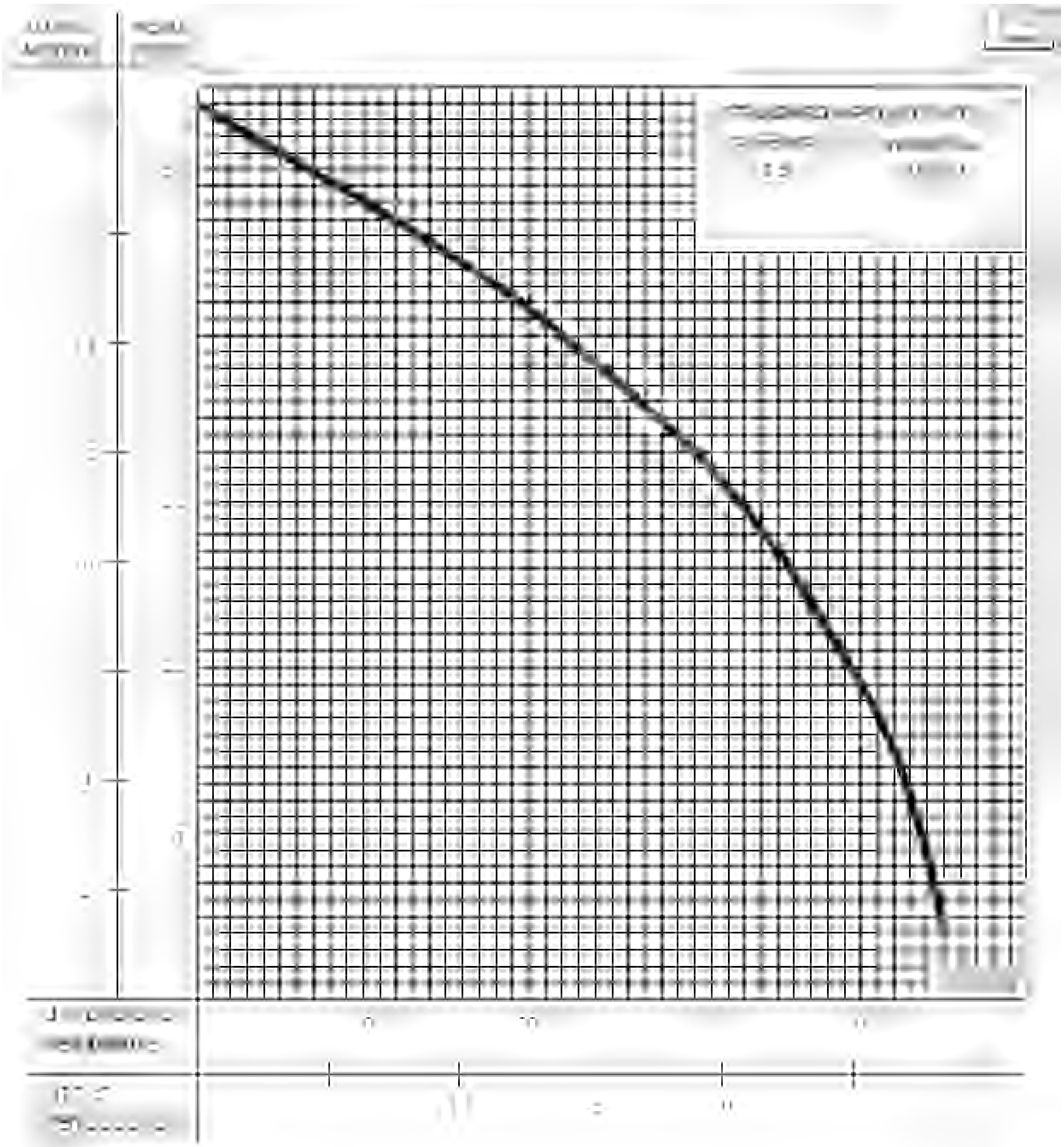
Champion Pump Company, Inc. – CPE5



Milwaukee Pump Company – MP-E5



Barnes – EHV512



APPENDIX G: HYDRAULIC ANALYSIS RESULTS

PRELIMINARY LOW-PRESSURE SEWER SYSTEM PIPE SCHEDULE AND ZONE ANALYSIS OF BOCILLA / LITTLE GASPARILLA FUTURE SEWER

SCENARIO 1: Pipe Sizing Analysis With Flow from Knight Island

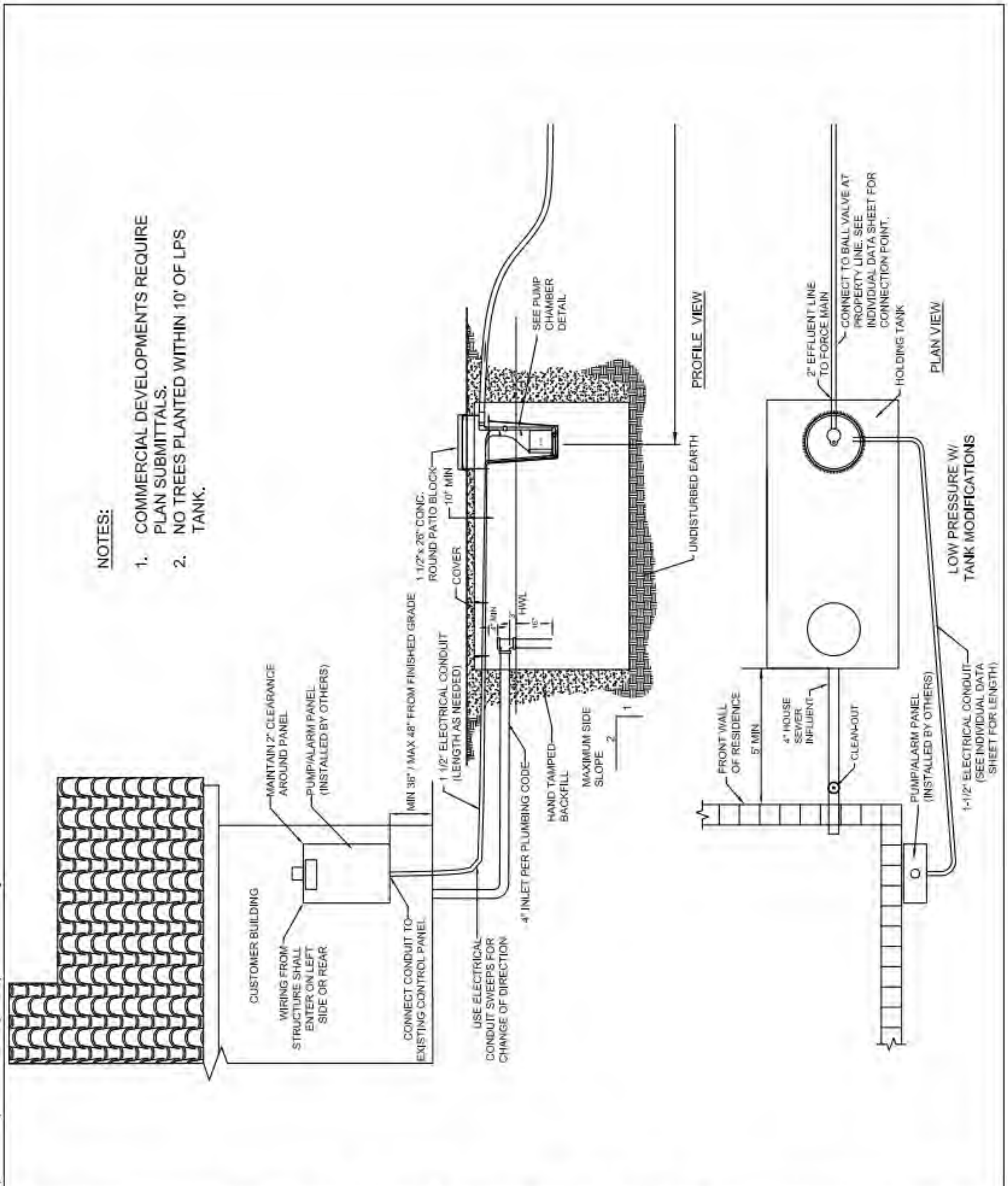
SECTION	CUMU. ERCs (BUILD OUT)	ACCUM. PUMPS IN SECTION	GAL/DAY PER CORE	MAX FLOW PER CORE	ASSUMED MAX SIMULTANEOUS PUMPS OPERATING	CUMU. MAX FLOW (gpm)	NOMINAL PIPE SIZE (in)	INNER PIPE DIAMETER (in)	MAX VELOCITY (FPS)	LENGTH OF MAIN THIS ZONE (ft)	FRICTION LOSS FACTOR (FT/100 FT)	FRICTION LOSS THIS SECTION	ACCUM. FRICTION LOSS (ft)	STATIC HEAD (ft)	MISC. LOSSES (ft) * Assumes 5% of friction loss	TOTAL DYNAMIC HEAD (ft)	PRESSURE (psi)
Knight Island Section 1						250	6	6.07	2.78	2000	0.42	8.4	41.6	2	2.1	45.6	19.8
Bocilla Section 1	540	540	200	12.5	21	262.5	8	7.98	1.68	2000	0.12	2.4	38.3	3	1.9	43.2	18.7
Bocilla Section 2	759	759	200	12.5	28	350	8	7.98	2.24	2035	0.21	4.2	33.1	2	1.7	36.8	15.9
Bocilla Section 3	816	816	200	12.5	30	375	8	7.98	2.40	2750	0.23	6.5	28.9	2	1.4	32.4	14.0
Bocilla Section 4	1032	1032	200	12.5	36	450	8	7.98	2.89	5120	0.33	16.9	22.5	2	1.1	25.6	11.1
Bocilla Section 5	1189	1189	200	12.5	41	512.5	10	10.02	2.09	4060	0.14	5.6	5.6	2	0.3	7.9	3.4
Little Gasparilla Section 1	40	40	200	12.5	6	75	4	4.03	1.89	2080	0.33	6.9	37.8	2	1.9	41.7	18.0
Little Gasparilla Section 2	295	295	200	12.5	14	175	6	6.07	1.94	2340	0.22	5.1	30.9	2	1.5	34.4	14.9
Little Gasparilla Section 3	660	660	200	12.5	25	312.5	8	7.98	2.00	6050	0.17	10.1	25.8	2	1.3	29.1	12.6
Little Gasparilla Section 4	700	700	200	12.5	26	325	8	7.98	2.08	5200	0.18	9.4	15.6	2	0.8	18.4	8.0
Section 11 - Wye to Future LS	1889	1889	200	12.5	62	775	12	11.94	2.22	4930	0.13	6.3	6.3	2	0.3	8.6	3.7

PRELIMINARY LOW-PRESSURE SEWER SYSTEM PIPE SCHEDULE AND ZONE ANALYSIS OF BOCILLA / LITTLE GASPARILLA FUTURE SEWER

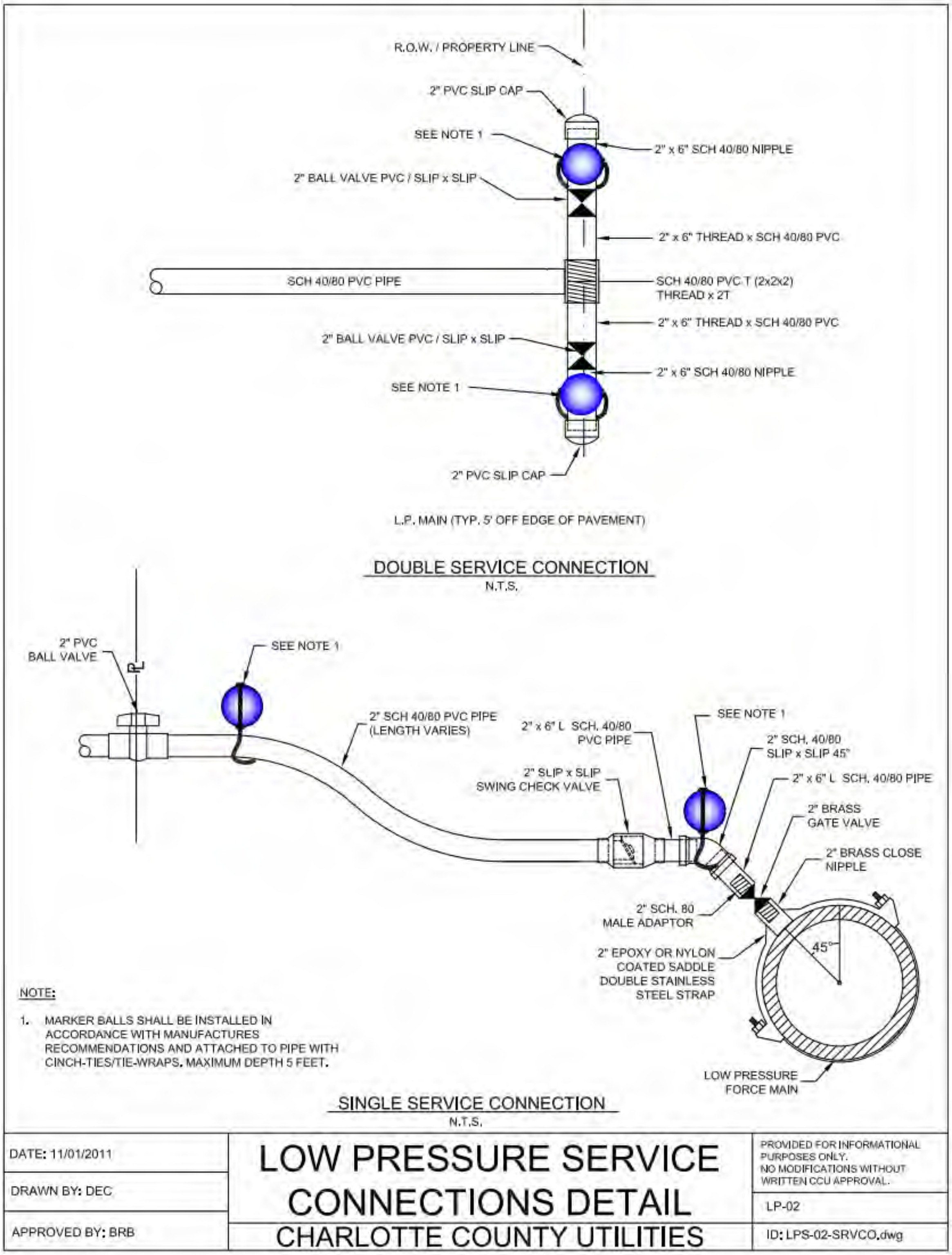
SCENARIO 2: Pipe Sizing Analysis Without Flow from Knight Island

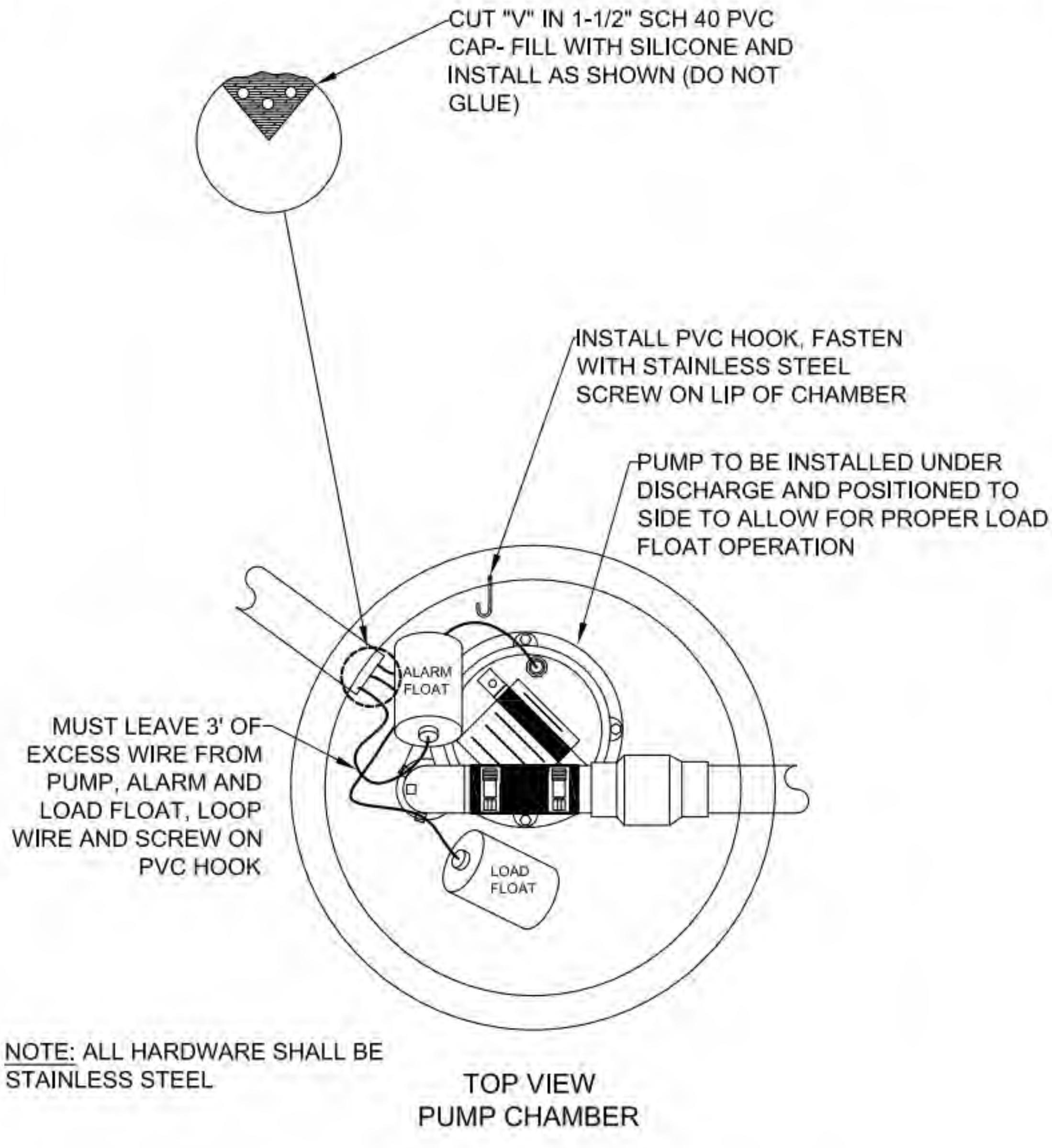
SECTION	CUMU. ERCs (BUILD OUT)	ACCUM. PUMPS IN SECTION	GAL/DAY PER CORE	MAX FLOW PER CORE	ASSUMED MAX SIMULTANEOUS PUMPS OPERATING	CUMU. MAX FLOW (gpm)	NOMINAL PIPE SIZE (in)	INNER PIPE DIAMETER (in)	MAX VELOCITY (FPS)	LENGTH OF MAIN THIS ZONE (ft)	FRICTION LOSS FACTOR (FT/100 FT)	FRICTION LOSS THIS SECTION	ACCUM. FRICTION LOSS (ft)	STATIC HEAD (ft)	MISC. LOSSES (ft) * Assumes 5% of friction loss	TOTAL DYNAMIC HEAD (ft)	PRESSURE (psi)
Bocilla Section 1	40	40	200	12.5	6	75	4	4.03	1.89	1400	0.33	4.7	28.8	2	1.4	32.3	14.0
Bocilla Section 2	259	259	200	12.5	13	162.5	6	6.07	1.80	2035	0.19	3.9	24.2	2	1.2	27.4	11.9
Bocilla Section 3	316	316	200	12.5	15	187.5	6	6.07	2.08	2750	0.25	6.8	20.3	2	1.0	23.3	10.1
Bocilla Section 4	532	532	200	12.5	21	262.5	8	7.98	1.68	5120	0.12	6.2	13.5	2	0.7	16.2	7.0
Bocilla Section 5	689	689	200	12.5	26	325	8	7.98	2.08	4060	0.18	7.3	7.3	2	0.4	9.7	4.2
Little Gasparilla Section 1	40	40	200	12.5	6	75	4	4.03	1.89	2080	0.33	6.9	40.3	2	2.0	44.3	19.2
Little Gasparilla Section 2	295	295	200	12.5	14	175	6	6.07	1.94	2340	0.22	5.1	33.4	2	1.7	37.1	16.0
Little Gasparilla Section 3	660	660	200	12.5	25	312.5	8	7.98	2.00	6050	0.17	10.1	28.3	2	1.4	31.7	13.7
Little Gasparilla Section 4	700	700	200	12.5	26	325	8	7.98	2.08	5200	0.18	9.4	18.2	2	0.9	21.1	9.1
Section 10 - Wye to Future LS	1389	1389	200	12.5	47	587.5	10	10.02	2.39	4930	0.18	8.8	8.8	2	0.4	11.2	4.9

APPENDIX H: CHARLOTTE COUNTY LPS STANDARD DETAILS



DATE: 11/01/2011	TYPICAL LPS TANK W/ MODIFICATIONS	PROVIDED FOR INFORMATIONAL PURPOSES ONLY. NO MODIFICATIONS WITHOUT WRITTEN CCU APPROVAL.
DRAWN BY: DEC		LP-01
APPROVED BY: BRB	CHARLOTTE COUNTY UTILITIES	ID: LPS-01-TMODS.dwg


R.O.W. / PROPERTY LINE
2" PVC SLIP CAP
SEE NOTE 1
2" x 6" SCH 40/80 NIPPLE
2" BALL VALVE PVC / SLIP x SLIP
2" x 6" THREAD x SCH 40/80 PVC
SCH 40/80 PVC PIPE
SCH 40/80 PVC T (2x2x2)
THREAD x 2T
2" x 6" THREAD x SCH 40/80 PVC
2" BALL VALVE PVC / SLIP x SLIP
2" x 6" SCH 40/80 NIPPLE
SEE NOTE 1
2" PVC SLIP CAP
L.P. MAIN (TYP. 5' OFF EDGE OF PAVEMENT)
DOUBLE SERVICE CONNECTION
N.T.S.
2" PVC
BALL VALVE
SEE NOTE 1
2" SCH 40/80 PVC PIPE
(LENGTH VARIES)
2" x 6" L SCH. 40/80
PVC PIPE
SEE NOTE 1
2" SCH. 40/80
SLIP x SLIP 45°
2" SLIP x SLIP
SWING CHECK VALVE
2" x 6" L SCH. 40/80 PIPE
2" BRASS
GATE VALVE
2" BRASS CLOSE
NIPPLE
2" SCH. 80
MALE ADAPTOR
45°
2" EPOXY OR NYLON
COATED SADDLE
DOUBLE STAINLESS
STEEL STRAP
NOTE:
1. MARKER BALLS SHALL BE INSTALLED IN
ACCORDANCE WITH MANUFACTURES
RECOMMENDATIONS AND ATTACHED TO PIPE WITH
CINCH-TIES/TIE-WRAPS. MAXIMUM DEPTH 5 FEET.
LOW PRESSURE
FORCE MAIN
SINGLE SERVICE CONNECTION
N.T.S.
DATE: 11/01/2011
DRAWN BY: DEC
APPROVED BY: BRB
LOW PRESSURE SERVICE
CONNECTIONS DETAIL
CHARLOTTE COUNTY UTILITIES
PROVIDED FOR INFORMATIONAL
PURPOSES ONLY.
NO MODIFICATIONS WITHOUT
WRITTEN CCU APPROVAL.
LP-02
ID: LPS-02-SRVCO.dwg



DATE: 11/01/2011	TYPICAL PUMP CHAMBER	PROVIDED FOR INFORMATIONAL PURPOSES ONLY. NO MODIFICATIONS WITHOUT WRITTEN CCU APPROVAL.
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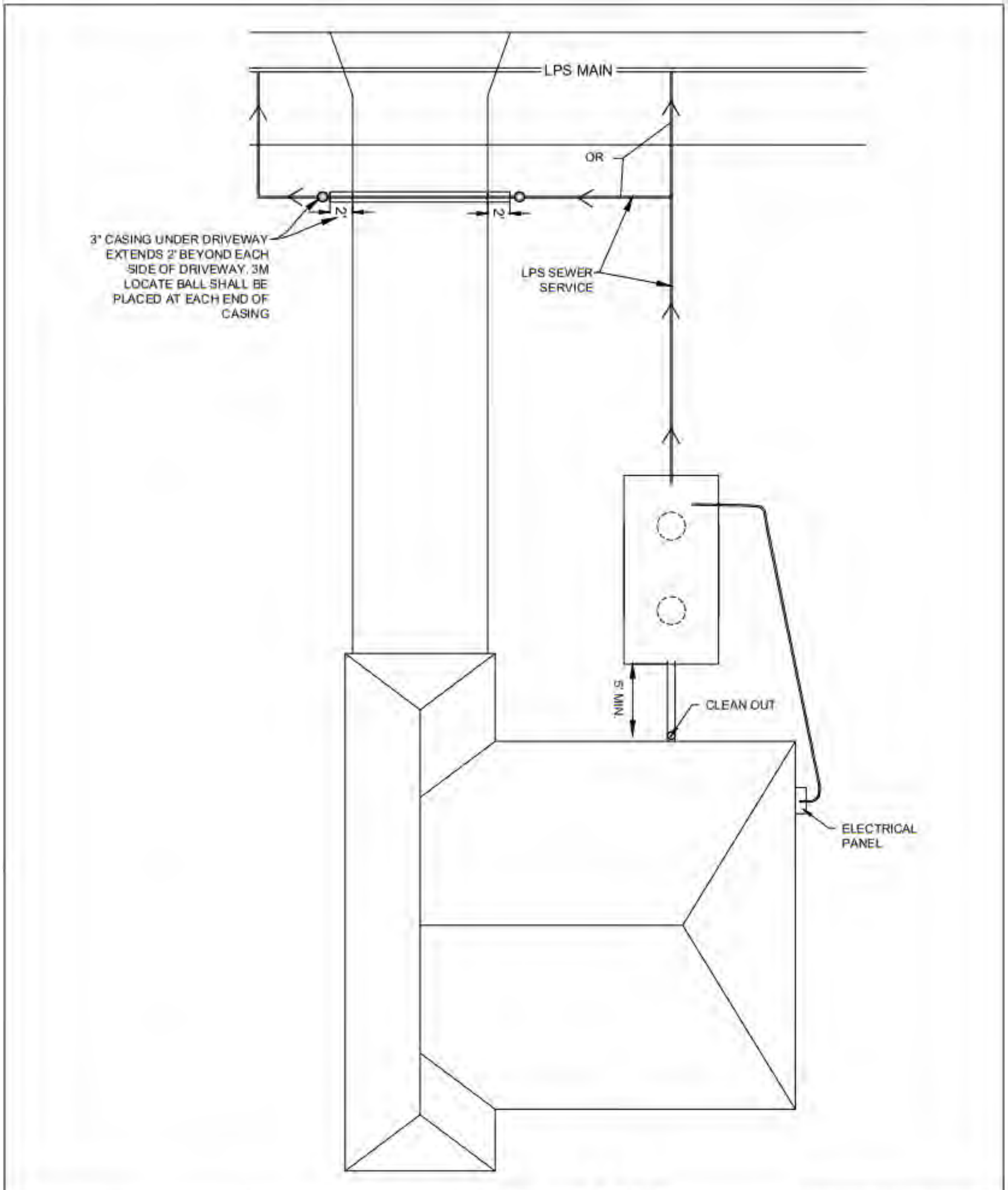
APPROVED BY: BRB	CHARLOTTE COUNTY UTILITIES	ID: LPS-04-PCH.dwg



DATE: 11/01/2011	TYPICAL TANK INSTALLATION	PROVIDED FOR INFORMATIONAL PURPOSES ONLY. NO MODIFICATIONS WITHOUT WRITTEN CCU APPROVAL.
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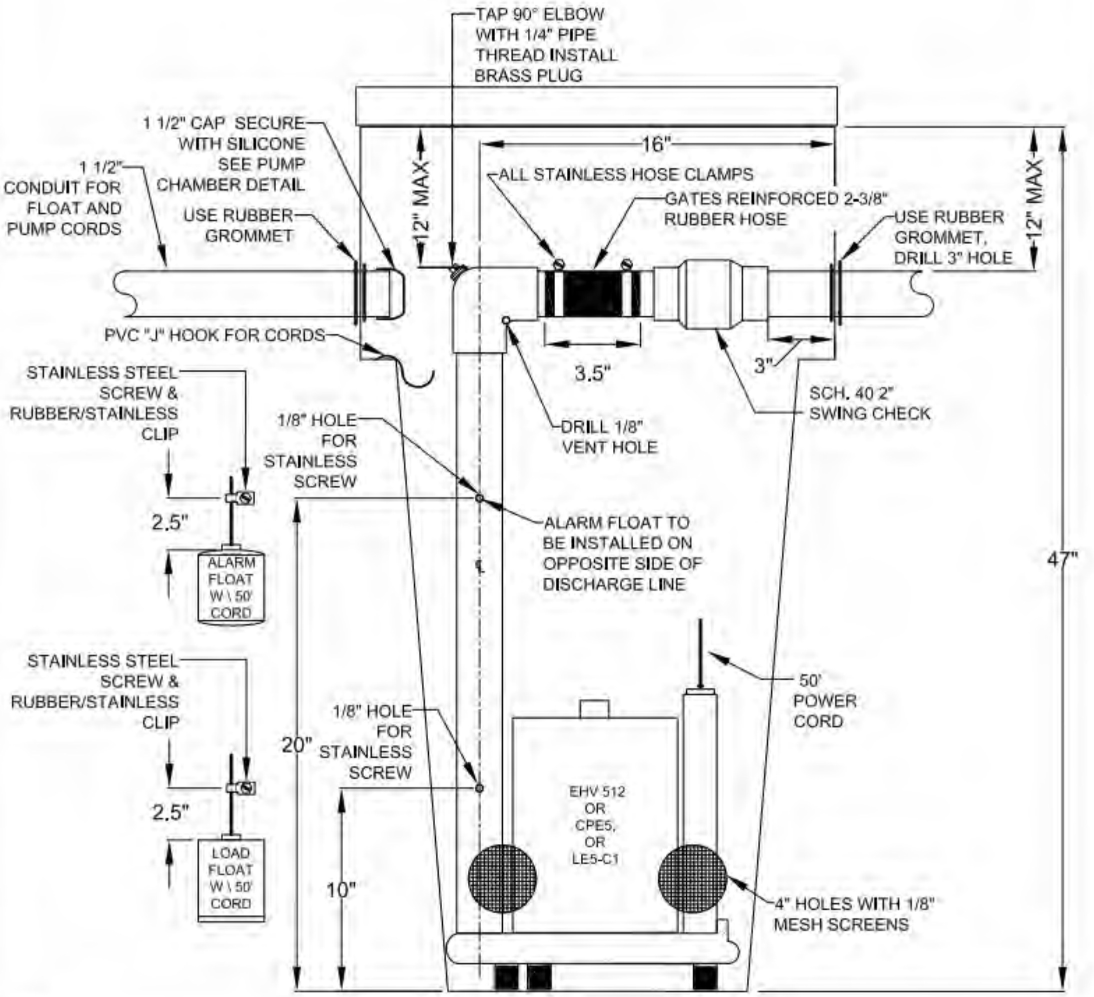
APPROVED BY: BRB	CHARLOTTE COUNTY UTILITIES	ID: LPS-05-TYPINST.dwg



NOTES:

1. FIBERGLASS AND CONCRETE LPS TANK APPLICATIONS, IF RISER IS INSTALLED ALL PLUMBING SHALL BE MOVED TO WITHIN 12" OF BOTTOM OF LID.
2. ALL HARDWARE SHALL BE STAINLESS STEEL

SIDE VIEW
PUMP CHAMBER

DATE: 11/01/2011	FIBERGLASS/CONCRETE LOW PRESSURE SEWER PUMP CHAMBER	PROVIDED FOR INFORMATIONAL PURPOSES ONLY. NO MODIFICATIONS WITHOUT WRITTEN CCU APPROVAL.
DRAWN BY: DEC		LP-06
APPROVED BY: BRB	CHARLOTTE COUNTY UTILITIES	ID:LPS-06-FLOAT.dwg