Town of Lake Park

Old Dixie Septic to Sewer Conceptual Report

Prepared for:

Lake Park Town Commission

Michael O'Rourke– Mayor
Kimberly Glas-Castro – Vice Mayor
John Linden - Commissioner
Mary Beth Taylor – Commissioner
Roger Michaud - Commissioner

Lake Park Town Hall
535 Park Avenue
Lake Park, FL 33403

April 11, 2022

Prepared by:

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Project No. 18187.27

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1. Purpose and Scope

Over the years, addressing Florida's environmental issues has become increasingly more important. Recently, State Representatives and Senators have been formally discussing the subject of converting existing septic systems to wastewater collection (i.e. Sewer) systems. In order to make this transformation more widespread and meaningful during the upcoming Legislative Session, discussions in Tallahassee included the possibilities of expanding mandatory conversion areas, providing additional funding sources and evaluating the costs/benefits.

The Lake Park Town Commission, in their capacity to strive to provide their landowners a better quality of life, acknowledges the importance of knowing the options of converting the Town's individual septic systems to a more complex sewer system. During their July 7, 2021 Commission meeting, the Town Commission directed Engenuity Group, Inc. to prepare a Conceptual Septic to Sewer Conversion Report for the last portion of Lake Park that remains on septic systems.

The scope of work involves understanding the current conditions and capacities, describing the sewer collection options, and calculating a conceptual opinion of cost. This planning document will assist in future deliberations moving forward.

2. Introduction

The Town of Lake Park is a small residential community located in the northern portion of Palm Beach County, north of Riviera Beach, and south of North Palm Beach. With a population of approximately 8,605 residents, the Town is approximately 1,500 acres in size and is bordered by the Intracoastal Waterway (Lake Worth Lagoon) to the East.

The majority of the land is built out, but new development and redevelopment is ongoing and dependent upon the economy.

As requested by the Town Commission of Lake Park, this Septic to Sewer Conceptual Report includes conceptual options for converting the Town's individual private systems to a more unified collection system. Also included are preliminary opinion of costs for converting to these systems along with various funding options for construction and maintenance.

It should be noted that this Report is prepared without the benefit of detailed soil analysis, permits or a final design. The conceptual layout of the proposed system was provided by Seacoast Utility Authority (SUA). Current economic conditions were used to prepare our opinion of costs. Final costs may vary substantially.

3. Existing Conditions and Environmental Concerns

Currently most landowners and residents are already provided with public sewer service by Seacoast Utility Authority (SUA). These systems are made up of a combination of gravity sewer, and low pressure. The area of concern in this Report focuses on the commercial/industrial properties along Old Dixie Highway, which own and maintain their own individual septic sewer systems, which include septic tanks and drain fields. The properties in question are the last of the remaining properties in Lake Park which are not connected to a wastewater collection system.

A total of 42 properties are analyzed as part of this study. The areas are separated into three sections, South-Section 1 (Tri City Industrial Park), Mid-Section 2 (Lake Park Public Works), and North-Section 3. Section 1 has the option to implement either a full low pressure sewer system or a combination gravity/low pressure sewer system. There is known groundwater contamination in Section 1. However, the groundwater in this area is anticipated to be low enough to not be an issue during construction as dewatering will likely not be required.

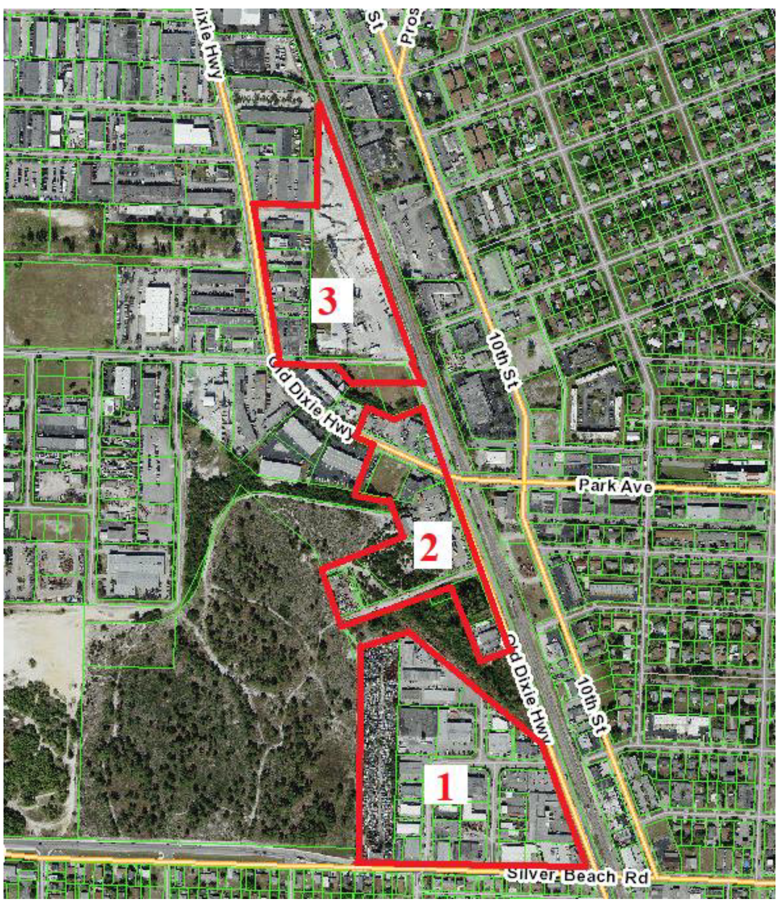

Figure 1 – Area Map

(South-Section 1)

(Mid-Section 2)

(North-Section 3)

4. Calculation of the Total Flows

Type of Property	Number of Properties	Calculated Flow (GPD)*	Measured Flow 2020(GPD)**
Commercial	**42**	**37,664**	**13,251**

* Calculated Flows per unit type were based on Seacoast Utility Authority standards of 0.1 gallons per day per square foot of building size.

**The measured flows are the actual water usages for the properties in question based on the Seacoast water bills over the previous year (2020).

See Appendix J for the estimated flow breakdown.

5. Capacity of Existing Treatment Plant

The Seacoast Utility Authority (SUA) PGA Regional Wastewater Treatment Facility is owned and operated by SUA. This facility services customers residing in Palm Beach Gardens, Lake Park, North Palm Beach, Juno Beach, and unincorporated areas within this region. Its projected flow in 2030 is 10 million gallons per day (MGD), however, it is permitted to treat up to 12 MGD. This facility treats the influent sewage into reclaimed water.

Based on the estimated flows, the PGA Regional Wastewater Treatment and Disposal Facility has sufficient capacity for the proposed conversion to a wastewater collection system.

6. Sewage Collection Options

6.1 Gravity Sewer System

A gravity sewer system is a system of pipes that are constructed by gravity (called laterals) from a building to a main gravity system. A gravity sewer system solely utilizes the energy created from the pipe ends being at different elevations. This creates a slope to transport sewage from the source to the main to then be transferred to the wastewater treatment plant via pump stations and force mains.

Within the municipal right-of–way, there will be a series of gravity mains and manholes usually located along the centerline of the roadways. Manholes are located approximately 400 feet apart. When the gravity system becomes too deep, a lift station is installed to mechanically move the wastewater. Lift stations pump into force mains, which are pressurized piping systems, which move the wastewater to other lift stations or to the treatment plant itself.

The gravity system would not have any mechanical parts located on the individual property. Improvements within the right-of-way would be the responsibility of the municipality or SUA. This system is more expensive and more intrusive in construction; however, long term maintenance is minimal for the landowner.

In a gravity sewer system where the roadways are to be removed and replaced, it is to the advantage of the municipality to upgrade any other existing utilities at the same time. Some of these improvements could be water main replacement, storm drainage upgrades, underground electric, telephone, cable, etc.

Appendices B, D, F, and H provide conceptual plans, images and estimated costs associated with sewer system options. Refer to Appendix A and K for a summary and comparison of all systems and Appendix L for informational technical facts from the Environmental Protection Agency (EPA).

6.2 Low Pressure Sewer System – Description and Brief History

A low pressure force main system starts with individual grinder stations at each home or building. The system is entirely under pressure from the private property to the collection system/ treatment facility. The grinder station can be physically adjacent to the building or placed near the road right of way (within the private property). It includes components like control panels, a small wet well, valves, and piping. Within the municipal right-of-way, a series of pressure pipes would be constructed.

This system is a mechanical system and would need more on-site maintenance than a gravity system mentioned in section 6.1. Grinder stations are "small lift stations" and typically require training and education to properly maintain and sustain, and are therefore typically maintained by private companies that provide this service. These stations also require connection the private property's electrical system for power.

Even though these private low-pressure stations are not owned or maintained by Seacoast Utilities, they will need to be permitted and meet SUA construction standards. Per the current SUA standards the approved pump station products are manufactured by Atlantic Environmental Systems, Inc, Southeastern Pump, and E-one W-Series (or approved equal). The pump stations will also be required to meet the Palm Beach County Health Department standards for commercial pump stations.

Appendices C, E, G, and I provide conceptual plans, images and estimated costs associated with low pressure sewer systems. Refer to Appendix A and K for a summary and comparison of all systems and Appendix L for informational technical facts from the Environmental Protection Agency (EPA).

6.3 Vacuum Sewer System

A vacuum system consists of a series of piping that is not under positive pressure like a force main or drinking water line. It is a system that utilizes negative pressure, like a vacuum cleaner, to move wastewater. This system begins at the house or building with a gravity lateral. The individual laterals usually connect to an on-site vacuum valve pit that is shared by one to four landowners. In the municipal right-of-way, vacuum lines are constructed. Ultimately these lines lead to a vacuum lift station facility prior to being transported to the wastewater treatment plant. The vacuum lift station facility can be as large as a 2,000 square foot single family house.

A vacuum sewer collection system is NOT being proposed in Lake Park, due to Seacoast Utilities not supporting this type of collection system.

7. Conceptual Plans of Town System for Old Dixie

There are two conceptual plans that are part of this report. The first proposed plan is a 'low pressure' sewer system with individual grinder stations placed at each property to be served. These pumps would discharge the sewage into the proposed low pressure force main discharge pipe in the public right of way. These force mains direct the sewage effluent back to the existing SUA collection system. The low pressure grinder pump stations would be privately owned and maintained.

The second proposed system is a combination gravity sewer system and low pressure system. The low pressure would remain for the proposed option for Sections 2 and 3, but Section 1 would be mostly served via a gravity collection system. This system would involve underground piping connecting to each property, which conveys the sewage effluent to the gravity main within the public right of way. From here the sewage flows to a central lift station that will ultimately be pumped out to the existing SUA collection system. The central lift station in this option would be owned and maintained by SUA.

8. Opinion of Capital Costs

The following table below depicts the conceptual cost of the conversion from septic tanks to both a gravity sewer system and a low-pressure sewer system.

Proposed Sewer System	Conceptual Construction Cost*
Gravity / Low Pressure Combination	$4.74 million
Low Pressure Only	$4.84 million
Vacuum	Not evaluated in this report

* Costs for re-routing of on-site sewer lines were based on septic tank location assumptions, and will need to be refined further after field locating the existing septic systems. In addition, SUA may impose additional fees for *Reservation Fees connections charges*.

* These cost estimates were calculated without the benefit of soil analysis, sub surface utility information, permits and a final design. The conceptual layouts in this area were provided by SUA. Current economic conditions were used to prepare our opinion of costs. Conceptual construction costs are an estimate and based on conceptual plans and current unit prices. Final costs may vary substantially.

9. Water Distribution Considerations

SUA currently owns the Water Distribution System and its appurtenances within the Town's municipal boundary. Currently, SUA provides the potable water for each connection within the study area. The request may be for domestic water or for irrigation purposes. SUA reads the meters and issues invoices directly to landowners.

If the Town proceeds with a gravity Septic to Sewer option, older water mains and other utilities may need to be replaced/upgraded simultaneously with the new sewer system in order to upgrade the area while the road work is ongoing. Doing this all-in-one project can save costs, versus replacing utilities in a piecemeal fashion as they become obsolete. Further investigation would be needed to determine the areas that would be affected.

10. Existing Utility Rates

SUA currently bills its customers for water and sewer via a meter system. Each bill is broken down into three categories: Water Service Charges, Sewer Charges, and Other Charges where applicable.

The Sewer connection fee charges are $1,200 for a 1.0 ERC (Equivalent Residential Connection) estimated usage for non-residential, per the below tables. The Sewer Charges category is billed the base monthly charge of $35.56 (for 5/8"x 3/4" meter), fixed monthly $2.04 point of service charge, and then a rate of $0.79 per thousand gallons of water metered for non-residential accounts. Monthly base facility charges are greater for larger water meters.

These numbers reflect the 2021/2022 fiscal year rates:

SEACOAST UTILITY AUTHORITY
RATE SCHEDULE
Effective Date October 1, 2021

Updated 12/1/21

	Single Family (per unit & includes POS)			(per unit & includes POS)			Non-Residential (per meter & includes POS)		
	Water	Sewer	**Total Base**	Water	Sewer	**Total Base**	Water	Sewer	**Total Base**
5/8":	$28.12	$19.24	**$51.67**	$11.70	$10.44	**$26.45**	$25.86	$35.56	**$65.73**
1":	$70.29	$19.24	**$93.84**	$11.70	$10.44	**$26.45**	$64.66	$88.89	**$157.86**
1 1/2":	$140.59	$19.24	**$164.14**	$11.70	$10.44	**$26.45**	$129.30	$177.78	**$311.39**
2":	$224.94	$19.24	**$248.49**	$11.70	$10.44	**$26.45**	$206.90	$284.45	**$495.66**

Point of Se Charge

Water	Sewer	**P.O.S**
$2.27	$2.04	**$4.31**

GALLONAGE CHARGE

Single Family

	Water	Sewer
1 - 6,000:	$2.59	$0.87
7,000 - 30,000:	$4.48	
31,000 + :	$5.42	

Multi-Family

	Water	Sewer
1 - 4,000:	$3.67	$0.87
5,000 - 20,000:	$5.00	
21,000 + :	$5.67	

Non-Residential

	Water	Sewer
1 - 6,000:	$2.07	$0.79
7,000 + :	$4.32	
	no cap	

SEWER ONLY MAXIMUM (per unit)

Single: 10,000 gallons $8.70
Multi: 6,000 gallons $5.22
Non-Residential: no cap

FIRELINE CHARGES

Fixed Monthly Charge = $28.12
(plus $5.67 per 1,000 gallons)

Sewer Maximum Rate (Residential only) $19.24 + $2.04 + $8.70 (.87x10k) = $29.98

EPOSITS

Water/Sewer

5/8":	$150.00
1":	$370.00
1 1/2":	$940.00
Multi & Mobile Homes:	$110.00
2":	$1,540.00
Comm. & Non Resid:	2 month average

Water Only

5/8":	$100.00
1":	$310.00
1 1/2":	$880.00
Multi & Mobile:	$80.00
2":	$1,480.00

Sewer Only

$60.00
Multi: $110.00

Interest Rate as of 6/1/21
0.27%

UTILITIES

Jupiter	741-2300
WPB	822-2222
Juno	626-3956
Riviera	845-4050
PBC	740-4600
FPL	697-8000
Teco Gas	877/832-6747

WATER QUALITY

Hardness	Medium, 5 - 6 grains per gallon or 80 - 100 mg/l or ppm
PH:	8.7 - 9.1 pH units
TDS	(total dissolved solids) 230 milligrams per liter
Sodium:	25 - 30 milligrams per liter
Pressure	57 psi - 65 psi is good pressure
Chlorine:	Yes
Fluoride:	Non added, small amt naturally occuring

If the Town proceeds with a septic to sewer conversion, wastewater rates will be added to the affected property's monthly utility bill.

11. Funding Options for Capital Costs

Funding for the Septic to Sewer project may be available by a variety of government funded loans and grants. The United States Department of Agriculture (USDA) also offers two loan/grant programs, the Water and Waste Disposal Loan and Grant Program as well as Technical Assistance and Training and Solid Waste Management Grant Programs. Also, the last option is the Clean Water State Revolving Fund which is issued to the state from the Environmental Protection Agency (EPA).

11.1 Loans

11.1.1 Clean Water State Revolving Fund (EPA Loan)

The Clean Water State Revolving Fund (CWSRF) is a low interest loan program in which the EPA issues grants that are to be utilized for various water and wastewater infrastructure projects. The loans are given directly to the state where they then have the ability to control and target priority sites to fund. There are eleven eligibility categories within the CWSRF including: centralized wastewater treatment, surface water protection and restoration, and contaminated sites. The proposed sewer system conversion falls under the centralized wastewater treatment category where a loan can be issued for the upgrade, repair, placement, or installation/construction of new pipes, pump stations, and force mains[1].

https://www.epa.gov/sites/production/files/2016-07/documents/overview_of_cwsrf_eligibilities_may_2016.pdf

11.1.2 USDA Loan/Grant

The USDA provides several options for loans and grants for waste water disposal. These consist of mostly long-term, low-interest loans. However, these USDA programs are limited to rural areas, which Lake Park will likely not qualify.

https://www.rd.usda.gov/programs-services/solid-waste-management-grants

11.2 Grants

11.2.1 Florida Section 319(h) Nonpoint Source Grant Program (Federal Clean Water Act Grants)

The Florida Section 319(h) Nonpoint Source Grant Program, or more commonly known as the 319 Grant Funds, has set its goal to reduce nonpoint source pollution from land use activities with a focus on septic to sewer conversions. Included in the EPA's definition of nonpoint sources, examples include bacteria and nutrients from livestock, pet wastes, and septic systems. This would make the Town of Lake Park a candidate for the future application periods.

11.2.2 Future Possibilities

Other grant or loan options with the more specific cause of septic conversion may be surfacing in the near future due to new state initiatives. The Governor's 2019 Executive Order focuses primarily on the improvement of Florida's water quality along with the following statement that he will "Direct DEP to establish a septic conversion and remediation grant program with a local government match requirement."

https://floridadep.gov/sec/sec/documents/executive-order-19-12

11.3 Bonds

Municipal bonds are used to raise money for capital projects like the Septic to Sewer Program. City governments can sell municipal bonds to investors. In Florida, this type of funding is, for the most part, exempt from federal and state taxes which make it attractive to investors. Municipalities usually pay back the debt over 20 to 30 years.

The Florida League of Cities, Inc. administers the Florida Municipal Loan Council (FMLC) that offers municipalities, of all sizes, a variety of funding options to finance capital projects. The FMLC has authorized and validated the issuance of up to $1.25 billion in revenue bonds. The FMLC is just one of several entities that can provide this type of funding.

11.4 American Rescue Plan Act (ARPA)

The American Rescue Plan Act (ARPA) was signed into law on March 11, 2021. This Act totals $ 65.1 billion dollars in aid to America's cities, towns and villages. Florida is likely to receive approximately $ 1.5 billion dollars in aid. The ARPA funding can be used for infrastructure improvements, and capital projects that are necessary for the health, safety and welfare of the public. There are restrictions associated with this relief money. However, a capital improvement plan for the wastewater distribution system appears to be a viable, qualifying project.

11.5 Summary of Financial Options

Based off of research and selection criteria of all of the above options, the most likely method of funding the proposed project may be through the Clean Water State Revolving Fund. This option is an EPA funded, low interest loan.

Further investigation will be necessary to determine specific funding sources and availability. The Florida Legislature may also fully fund several programs not currently funded at the time of this Report.

12. Conclusions and Recommendations

The Town of Lake Park has taken a proactive role in the pursuit of converting existing septic systems to sewer collection systems. They are accomplishing this by gaining knowledge of the options set forth in this Report, by seeking input from landowners, and by continuing the dialog between the Town and SUA.

Two systems, a gravity system combo and a low-pressure system have been introduced and compared in this report. Even though we listed another alternative, a vacuum system, we did not focus on this system as it did not appear to be a reasonable option or one that SUA is proposing to maintain in the future.

See Appendix A for a summary comparison of the proposed options. Conceptual construction costs for the options presented are an estimate and based on conceptual plans and current unit prices. Potential water, drainage, or other utility replacement costs are not contemplated in this report but should be analyzed further to fully understand the possibility of additional fiscal impacts.

Our Recommendation: Both the gravity and the low-pressure systems have their advantages and limitations. Both systems are good options based on the Town's conditions. The gravity / low-pressure combination system is the recommended option due to it having the lowest estimated construction and maintenance cost, as well as having the least amount of onsite maintenance required by landowners.

Appendices

A Systems Summary (2 Sheets)
B Conceptual Gravity Sewer Plans (3 Sheets)
C Conceptual Low Pressure System Plans (5 Sheets)
D Gravity Sewer System Image
E Low Pressure Sewer System Image
F Engineer's Opinion of Probable Cost – Onsite *Gravity Sewer System*
G Engineer's Opinion of Probable Cost – Onsite Low Pressure / Gravity *Sewer System*
H Engineer's Opinion of Probable Cost – Offsite *Gravity Sewer System*
I Engineer's Opinion of Probable Cost – Offsite *Low Pressure Sewer System*
J Engineer's Opinion of Total Per Property – *Gravity Sewer System*
K Engineer's Opinion of Total Per Property – *Low Pressure System*
L Property Information Summary
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Appendix A

Systems Summary

(2 Sheets)

Septic to Sewer Feasibility Report

April 2022
Project No. 18187.27

Summary of Estimated Costs -Low Pressure System

		Conceptual Capital Construction Cost[1]	Operation and Maintenance Estimated Annual Costs[2]	Annual Construction Cost - Amortized over 20 years at 4% interest rate	Total annual cost (Maintenance and amortized construction cost)	Average annual cost per property[3]
Proposed Alternatives	Proposed SUA Public System	~$1.04 million	Paid by SUA.	$75.6k	$75.6k	$1,800
	Proposed Onsite Private System (All 42 properties)	~$3.80 million	~$190k (paid by property owner)	$276k	$466k	$11,090
	Total	~$4.84 million	~$190k (paid by property owner)	$352k	$542k	$12,890

Systems Summary

[1] Cost does not include Seacoast Utilities fees for *reservation and administration charges*.

[2] Cost includes the following assumptions: SUA sewer base fee of $30 per month per property as well as usage fee of $0.79/1000 gallons, $1,000 per year per property for lift station maintenance, electricity costs, and 3% of construction cost for ongoing annual renewal and replacement costs.

[3] This cost is the total cost divided evenly over the 42 properties analyzed in this report, and is an average. This is an estimate of the annual total costs during a 20-year loan payback period. The actual cost to each property will vary per the enclosed detailed cost breakdowns – see Appendix J

Septic to Sewer Feasibility Report

February 2022
Project No. 18187.27

Summary of Estimated Costs -Gravity / Low Pressure Combination System

		Conceptual Capital Construction Cost[1]	Operation and Maintenance Estimated Annual Costs[2]	Annual Construction Cost Amortized over 20 years at 4% interest rate	Total annual cost (Maintenance and amortized construction cost)	Average annual cost per property[3]
Proposed Alternatives	Proposed SUA Public System	~$3.14 million	Paid by SUA.	$217k	$217k	$5,160
	Proposed Onsite Private System (All 42 properties)	~$1.60 million	~$60k (paid by property owner)	$116k	$176k	$4,190
	Total	~$4.74 million	~$60k (paid by property owner)	$333k	$393k	$9,350

[1] Cost does not include Seacoast Utilities fees for *reservation and administration charges*.

[2] Cost includes the following assumptions: SUA sewer base fee of $30 per month per property as well as usage fee of $0.79/1000 gallons, 2% of construction cost for ongoing annual renewal and replacement costs.

[3] This cost is the total cost divided evenly over the 42 properties analyzed in this report, and is an average. This is an estimate of the annual total costs during a 20-year loan payback period. The actual cost to each property will vary per the enclosed detailed cost breakdowns – see Appendix K

Appendix B

Conceptual Gravity Sewer Plans

(3 Sheets)

OLD DIXIE SEPTIC TO SEWER

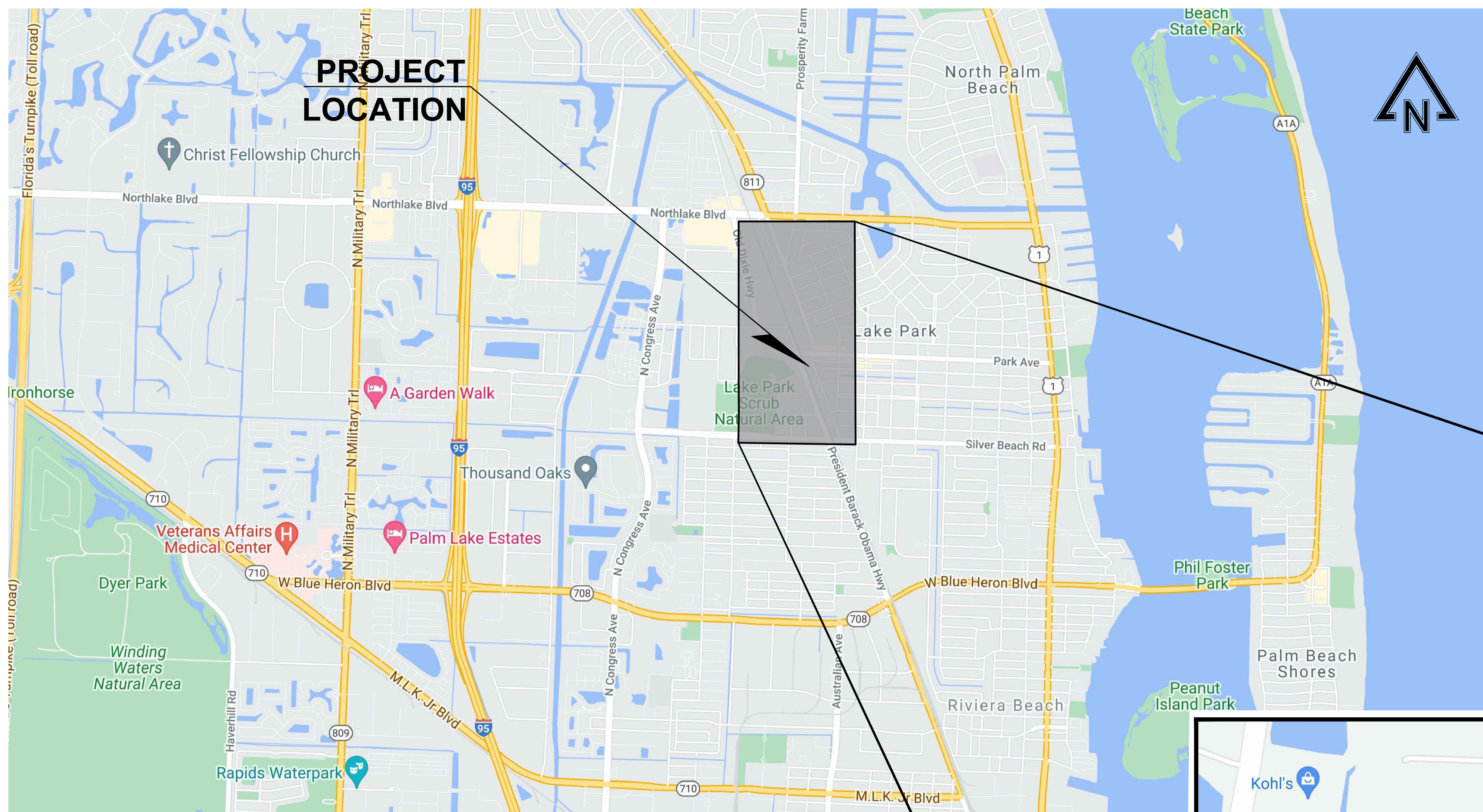
TOWN OF LAKE PARK, FL

CONCEPTUAL ENGINEERING PLAN -GRAVITY OPTION

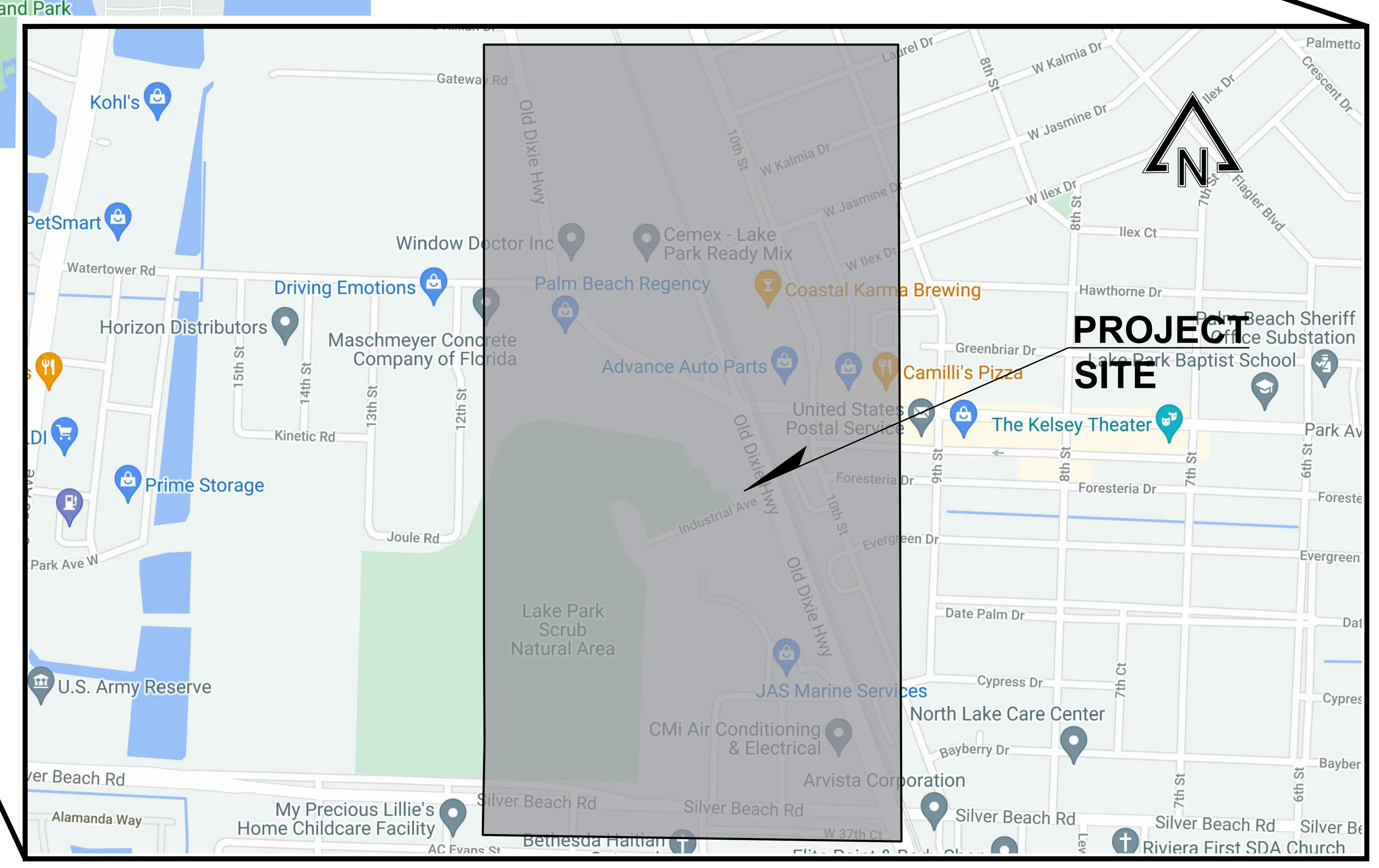
PREPARED FOR

TOWN OF LAKE PARK

9/20/21



VICINITY MAP
NTS



LOCATION MAP
NTS

SHEET INDEX:

1	COVER SHEET
2	ENGINEERING PLANS
3	DETAILS

TOTAL NO. OF SHEETS - 3

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9/20/21

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811 Know what's below. Call before you dig.

REVISIONS

NO.	DATE	REMARKS	BY

ADAM SWANEY, P.E.
NO. 72235

OLD DIXIE SEPTIC TO SEWER
TOWN OF LAKE PARK, FL
CONCEPTUAL ENGINEERING PLAN - GRAVITY
COVER

engenuity group inc.
A Higher Standard of Excellence
ENGINEERS • SURVEYORS • GIS MAPPERS
1280 N CONGRESS AVE, SUITE 101
WEST PALM BEACH, FLORIDA 33409
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WWW.ENGENUITYGROUP.COM CERTIFICATE OF AUTHORIZATION #7095

J:\Land Projects R2\18187.27 Lake Park Septic to Sewer\18187.27 CVR-GRAVITY.dwg DATE: 10/14/2021 8:51 AM

DATE	9/20/21
DRAWN	STAFF
PROJECT ENGINEER	ACS
PROJECT MANAGER	ACS
CHECKED	LT

SHEET NO. 1 / 3

JOB NO. 18187.01

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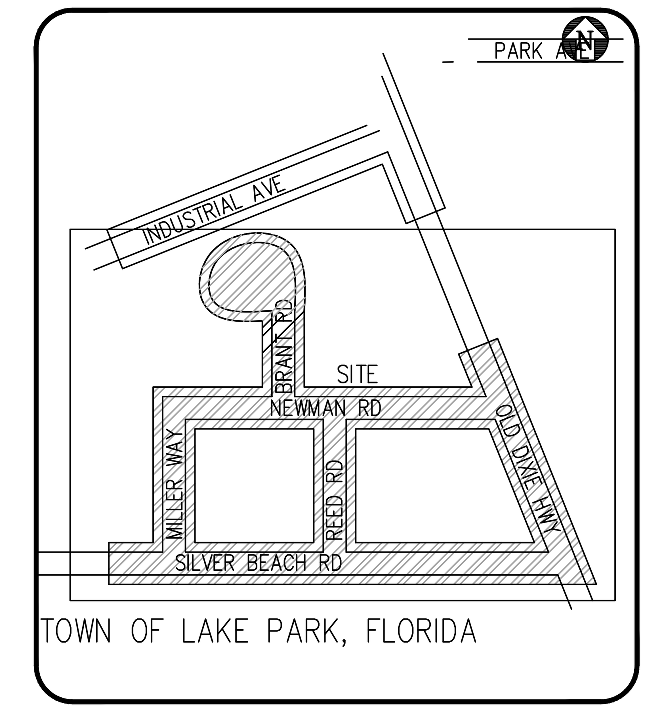
9/20/21, CONCEPTUAL

GRAPHIC SCALE

0 60 90 120

SCALE: 1" = 60'



LOCATION MAP

N.T.S.

LEGEND

⊡	PROPOSED GRINDER PUMP STATION
— — FM — —	EXISTING FORCE MAIN
— — WM — —	EXISTING WATER MAIN
— — — — —	PROPERTY LINE

NO.	DATE	REVISIONS REMARKS	BY

ADAM SWANEY, P.E. NO. 72235

OLD DIXIE SEPTIC TO SEWER
TOWN OF LAKE PARK, FL
CONCEPTUAL ENGINEERING PLAN - GRAVITY
SECTION 1 -TRI CITY INDUSTRIAL PARK

engenuity group inc. A Higher Standard of Excellence
ENGINEERS • SURVEYORS • GIS MAPPERS
1280 N CONGRESS AVE, SUITE 101
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PH (561)655-1151 • FAX (561)832-9390
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SHEET 2 OF 3

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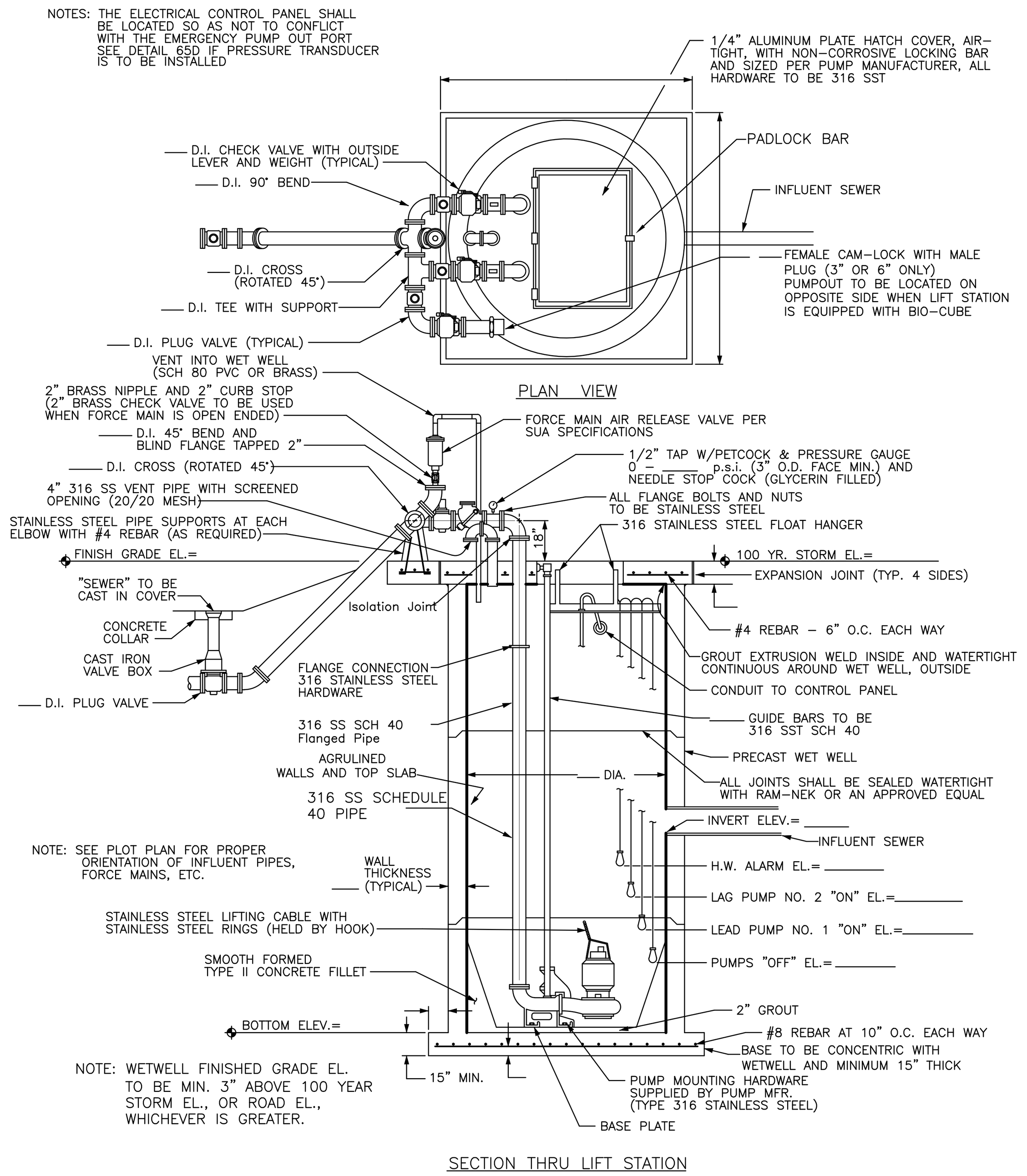
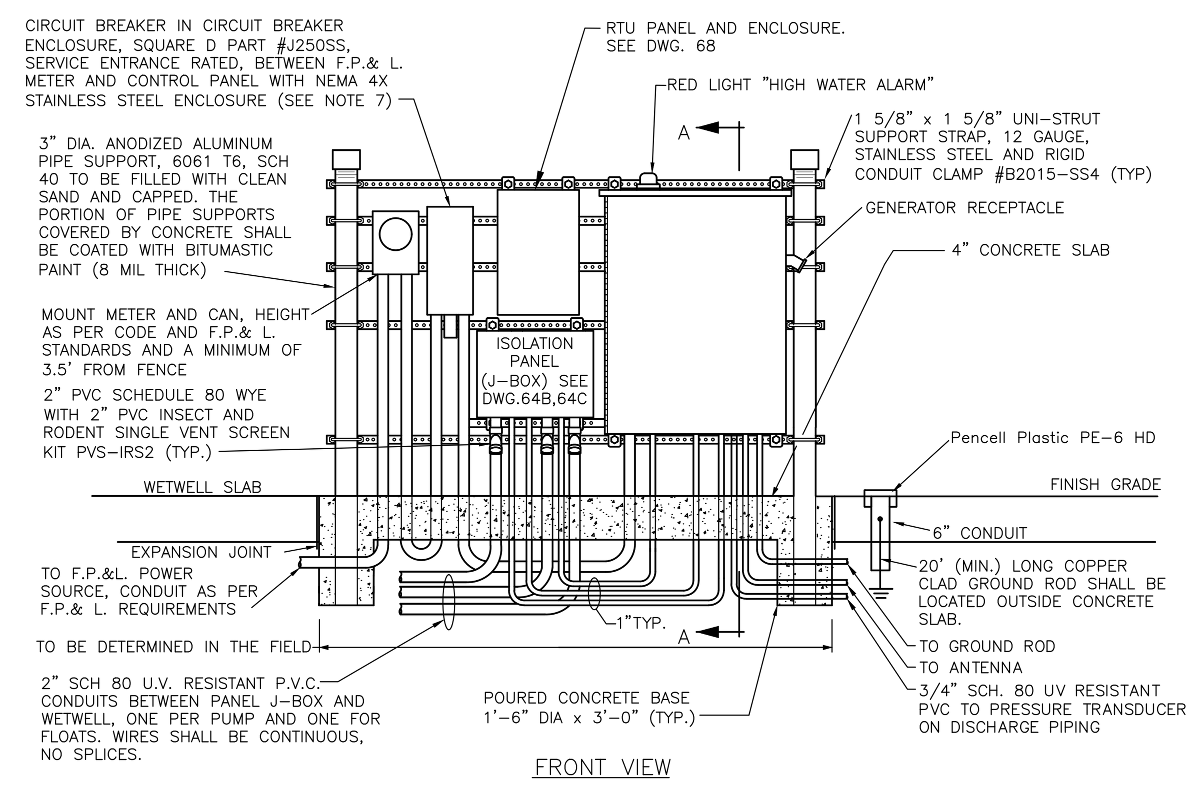
9/20/21, CONCEPTUAL

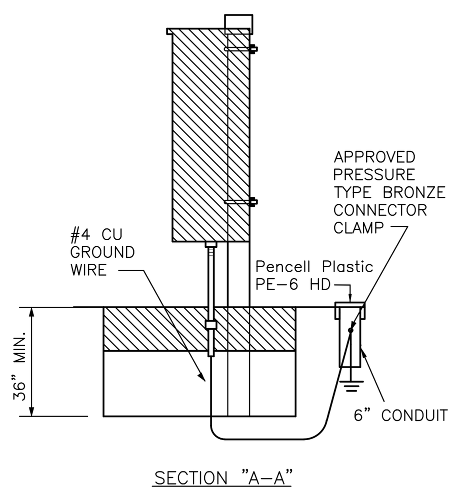
PLEASE REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS



Lift Station Detail

JANUARY 25, 2018 (Rev D-19)



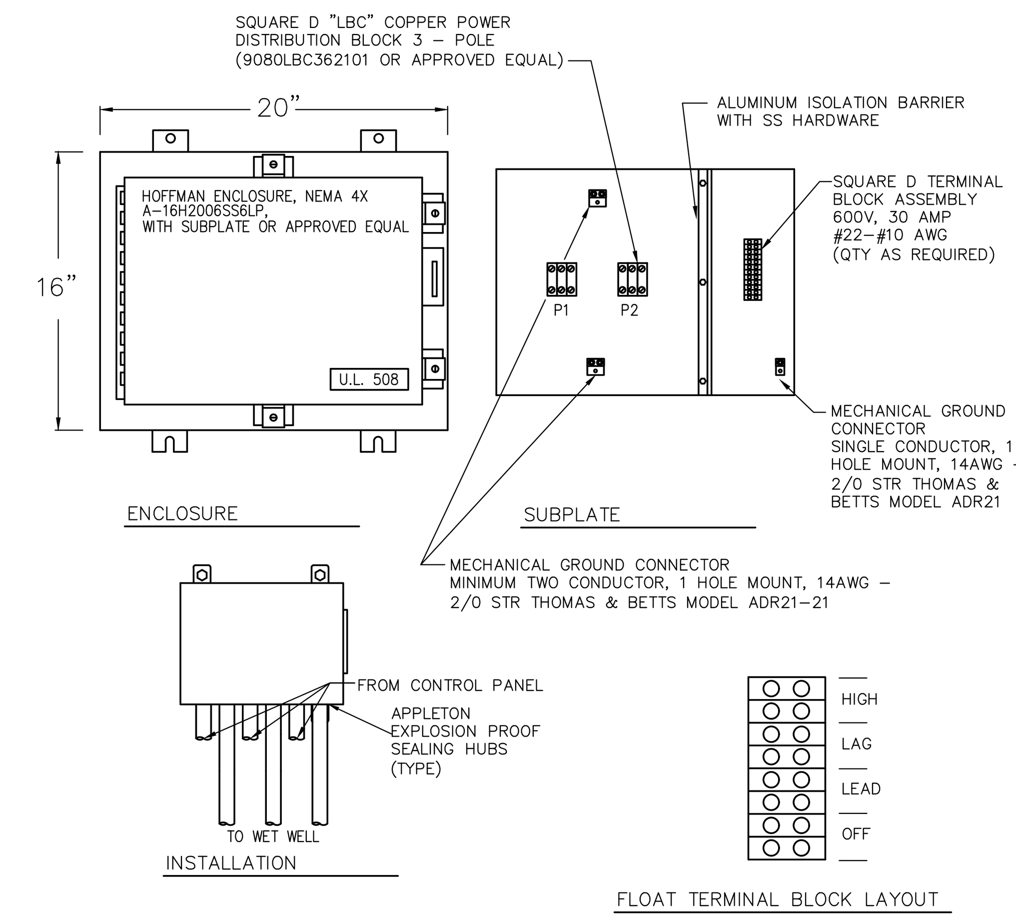


NOTES: (PLEASE REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS)

1. ALL CONDUIT SIZES INCLUDING F.P.& L. SHALL BE SIZED FOR TWICE THE INSTALLED H.P. AMPACITY UNLESS OTHERWISE INDICATED.
2. ALL CONDUCTORS SHALL BE COPPER.
3. ALL CONDUIT OPENINGS IN J-BOX AND CONTROL PANEL SHALL BE SEALED AIR TIGHT.
4. CONDUITS BETWEEN CONTROL PANEL AND ISOLATION PANEL SHALL HAVE SEALING HUBS, APPLETON ES150-100 OR EQUIVALENT, AT THE ISOLATION PANEL.
5. CONTROL PANEL AND ANTENNA GROUND RODS TO BE UL LISTED COPPER CLAD STEEL ¾" THICK,
6. ALL PVC CONDUIT TO BE SCH 80 UV RESISTANT.
7. FOR LIFT STATIONS UP TO 150 AMP:
   (a.) H()L36###(C) – MOLDED CASE CIRCUIT BREAKER, 3 POLE, 600 VAC FRAME, ### = CURRENT RATING (15-150 AMP)
   (b.) PDC3HD2 – POWER DISTRIBUTION CONNECTOR FOR H FRAME BREAKER (3 14-2AWG Cu)
   (c.) S37449 – H FRAME LONG LUG SHIELD
   FOR LIFT STATIONS OVER 150 AMP:
   (a.) J()L36###(C) – MOLDED CASE CIRCUIT BREAKER, 3 POLE, 600 VAC FRAME, ### = CURRENT RATING (150-250 AMP)
   (b.) PDC3JD20 – POWER DISTRIBUTION CONNECTOR FOR J FRAME BREAKER (2 14-1AWG AND 1 3-2/0 Cu)
   (c.) S37450 – J FRAME LONG LUG SHIELD

Lift Station Control Panel (Single Door)

AUGUST 26, 2020 (Rev D-20)



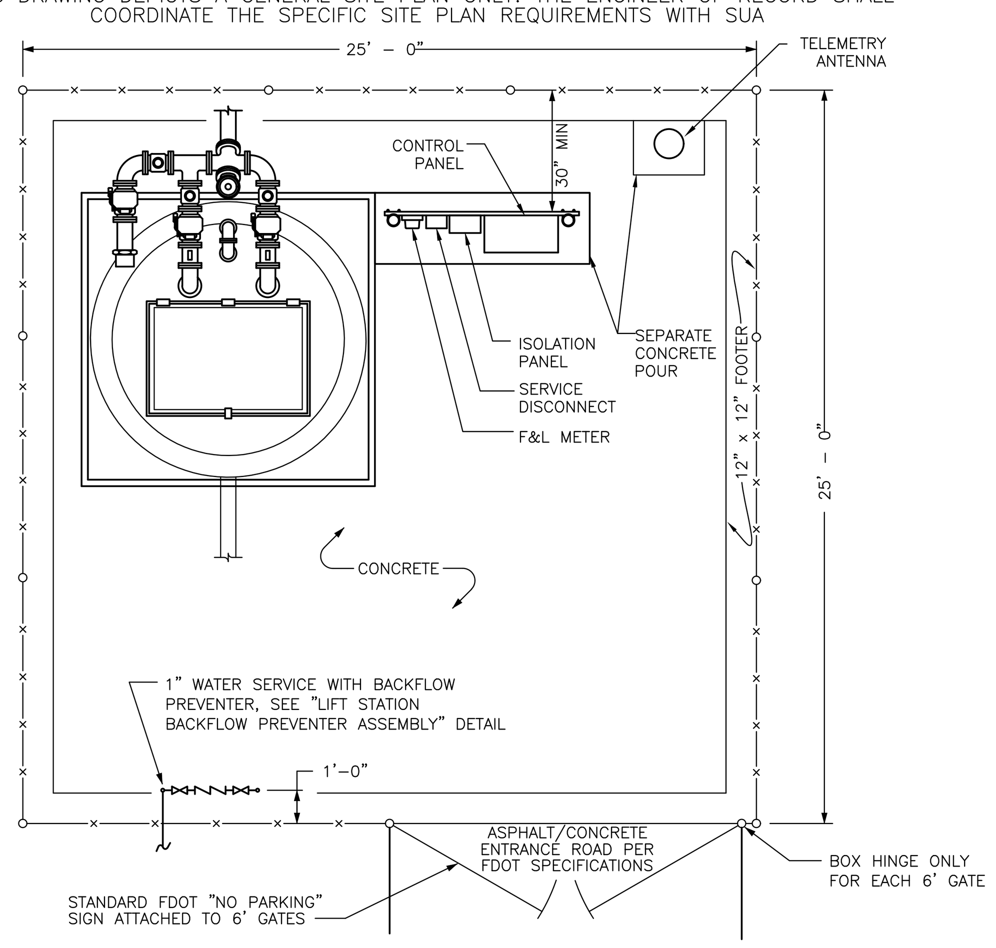
NOTES: (PLEASE REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS)

1. SHOWN FOR GENERAL ARRANGEMENT PROVIDE EQUIPMENT AS INDICATED PER NUMBER OF PUMPS.
2. JUNCTION BOX SHALL BE PROVIDED BY THE SAME MANUFACTURER AS THE CONTROL PANEL AND SHALL BE U.L. 508 LISTED.
3. ALL CONTROL CABLES SHALL HAVE A SERVICE LOOP WITHIN J BOX AND CONTROL PANEL.
4. JUNCTION BOX ENCLOSURE SHALL BE NEMA 4X AND MINIMUM 16"H x 20"W x 6"D.

Duplex Lift Station Control Panel Junction Box

AUGUST 26, 2020 (Rev D-18)

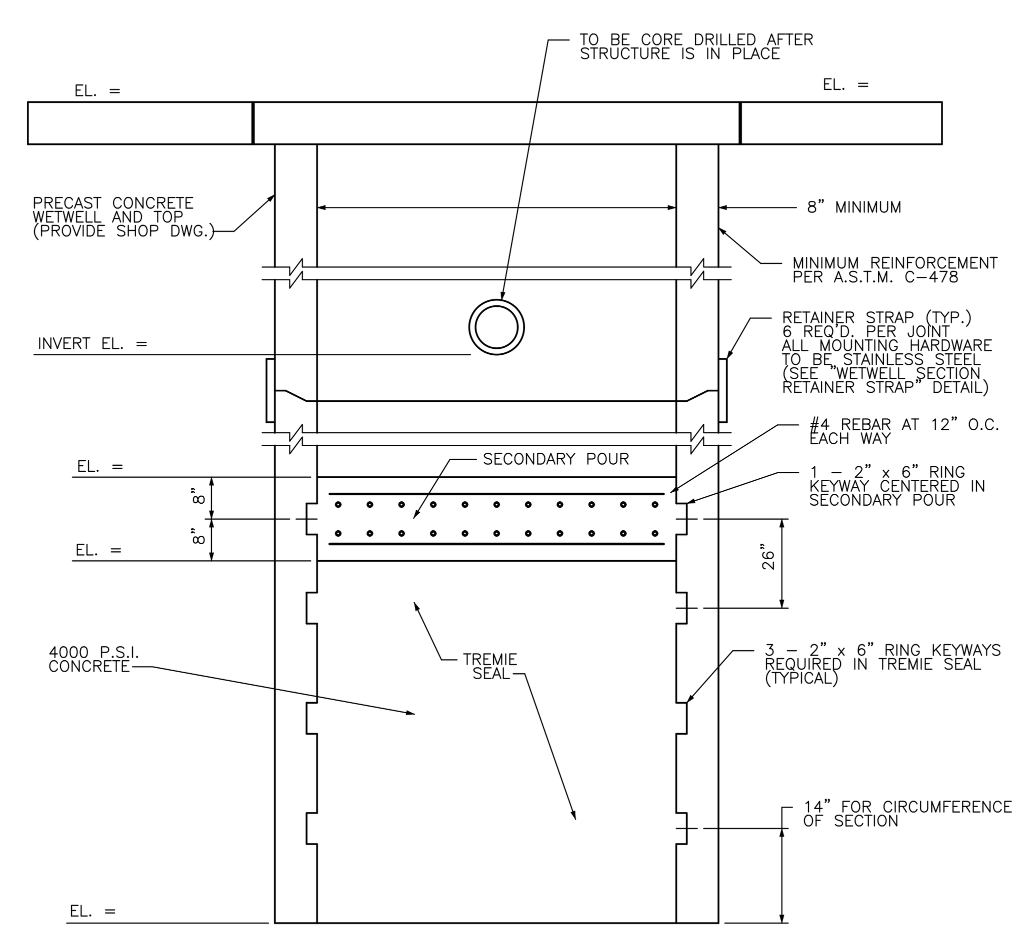
THIS DRAWING DEPICTS A GENERAL SITE PLAN ONLY. THE ENGINEER OF RECORD SHALL COORDINATE THE SPECIFIC SITE PLAN REQUIREMENTS WITH SUA



NOTES: (PLEASE REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS)
1. COLLECTOR MANHOLE SHALL NOT BE PLACED IN TRAVEL LANE OR AREAS THAT WOULD LIMIT ACCESS.
2. GROUND COVER WITHIN FENCED AREA SHALL BE 6" THICK CONCRETE (4000psi) WITH A 12" x 12" FOOTER AND 6" x 6" WIRE MESH AND BE SLOPED IN SUCH A WAY TO PROMOTE RUNOFF AND PREVENT PUDDLING. FIBER CONCRETE SHALL NOT BE ALLOWED AS AN ALTERNATIVE TO WIRE MESH.
3. LANDSCAPING SHALL BE A MINIMUM OF 2' FROM FENCE. TREE PLACEMENT AND LANDSCAPING SHALL CONFORM TO SUA SETBACK REQUIREMENTS AND BE APPROVED BY SUA.
4. FENCE SHALL BE INSTALLED PER DETAIL 17.

Typical Lift Station Site Plan

February 12, 2019 (Rev D-20)

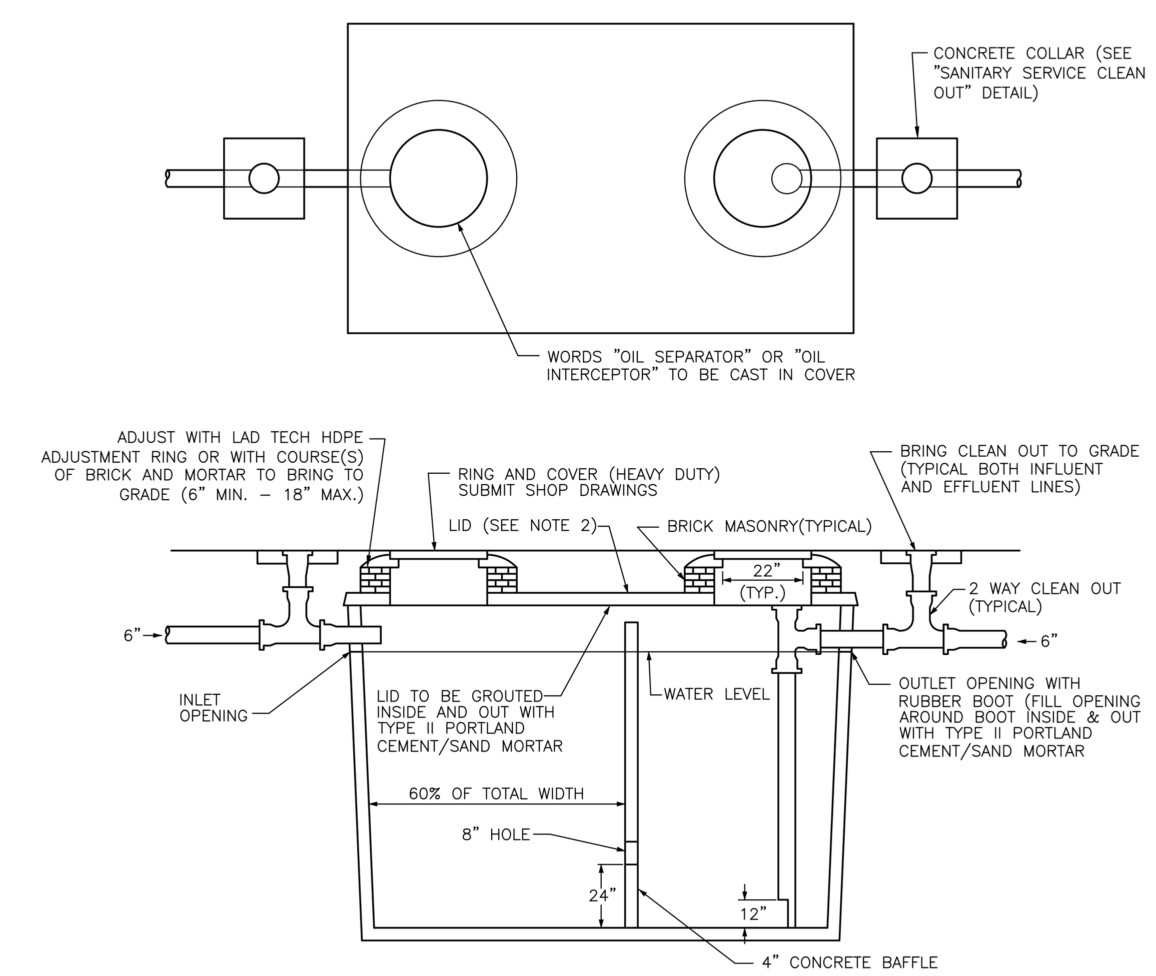


NOTES: (PLEASE REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS)

1. CONCRETE USED FOR TREMIE SEAL AND SECONDARY POUR MUST BE 4000 P.S.I. AT 28 DAYS WITH TYPE II PORTLAND CEMENT. SECONDARY POUR SHALL NOT OCCUR UNTIL WETWELL IS WATER TIGHT ON ALL SIDES AND BOTTOM.
2. MINIMUM OF FOUR 2" x 6" RING KEYWAYS REQUIRED WITH TOP KEYWAY CENTERED IN THE SECONDARY CONCRETE POUR.
3. TREMIE SEAL REQUIRED TO BE A MINIMUM OF 36" THICK AND SECONDARY CONCRETE POUR 16" THICK.
4. TREMIE SEAL TO CURE 48 HOURS PRIOR TO PUMPING OFF WATER TO PREPARE FOR SECONDARY CONCRETE POUR.
5. E.O.R. SHALL SUBMIT SIGNED AND SEALED BUOYANCY CALCULATIONS TO SUA FOR REVIEW AND APPROVAL.
6. WEIGHT OF TOP SLAB, SECONDARY CONCRETE POUR, PUMPS AND EXTERIOR SKIN FRICTION SHALL NOT BE INCLUDED IN BUOYANCY CALCULATIONS. GROUNDWATER SHALL BE CONSIDERED AT GROUND LEVEL FOR BUOYANCY CALCULATIONS UNLESS SPECIAL CONSIDERATIONS APPLY (ON COASTAL RIDGE, ETC.).

Wet Well Installation (Caisson Construction)

AUGUST 26, 2020 (Rev B-20)



NOTES: (PLEASE REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS)

1. SHOP DRAWINGS FOR PRECAST TANKS SHALL BEAR THE FOLLOWING STATEMENT:"THIS CONCRETE STRUCTURE MEETS OR EXCEEDS ALL THE REQUIREMENTS FOR GREASE INTERCEPTORS/SEPTIC TANKS AS IN THE FLORIDA ADMINISTRATIVE CODE, CHAPTER 10D-6 AND 64E-6, AND SUA "SPECIFICATIONS AND STANDARDS". THE SHOP DRAWINGS (3 COPIES MINIMUM) SHALL THEN BE SIGNED AND SEALED BY THE ENGINEER OF RECORD AND FORWARDED TO SUA FOR APPROVAL.
2. LID TYPES:
   A) 4" REGULAR LID
   B) 8" TRAFFIC BEARING LID
3. INTERIOR PIPING SHALL BE SOLVENT WELD PVC PIPE.
4. ALL TANKS IN TRAFFIC AREA SHALL BE H20 WHEEL LOAD BEARING.
5. INSPECTION OF TANK REQUIRED BY SUA PRIOR TO PLACEMENT.
6. INSPECTION OF TANK REQUIRED BY SUA AFTER TANK IS PIPED.

Oil Separator

AUGUST 26, 2020 (Rev B-18)

CONCEPTUAL
9/20/21

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NO. | DATE | REMARKS | BY

ADAM SWANEY, P.E. NO. 72235

OLD DIXIE SEPTIC TO SEWER
TOWN OF LAKE PARK, FL
CONCEPTUAL ENGINEERING PLAN - GRAVITY
DETAILS

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DRAWN	STAFF
PROJECT ENGINEER	ACS
PROJECT MANAGER	ACS
CHECKED	LT

SHEET 3 / 3
JOB NO. 18187.01

Appendix C

Conceptual Low Pressure System Plans

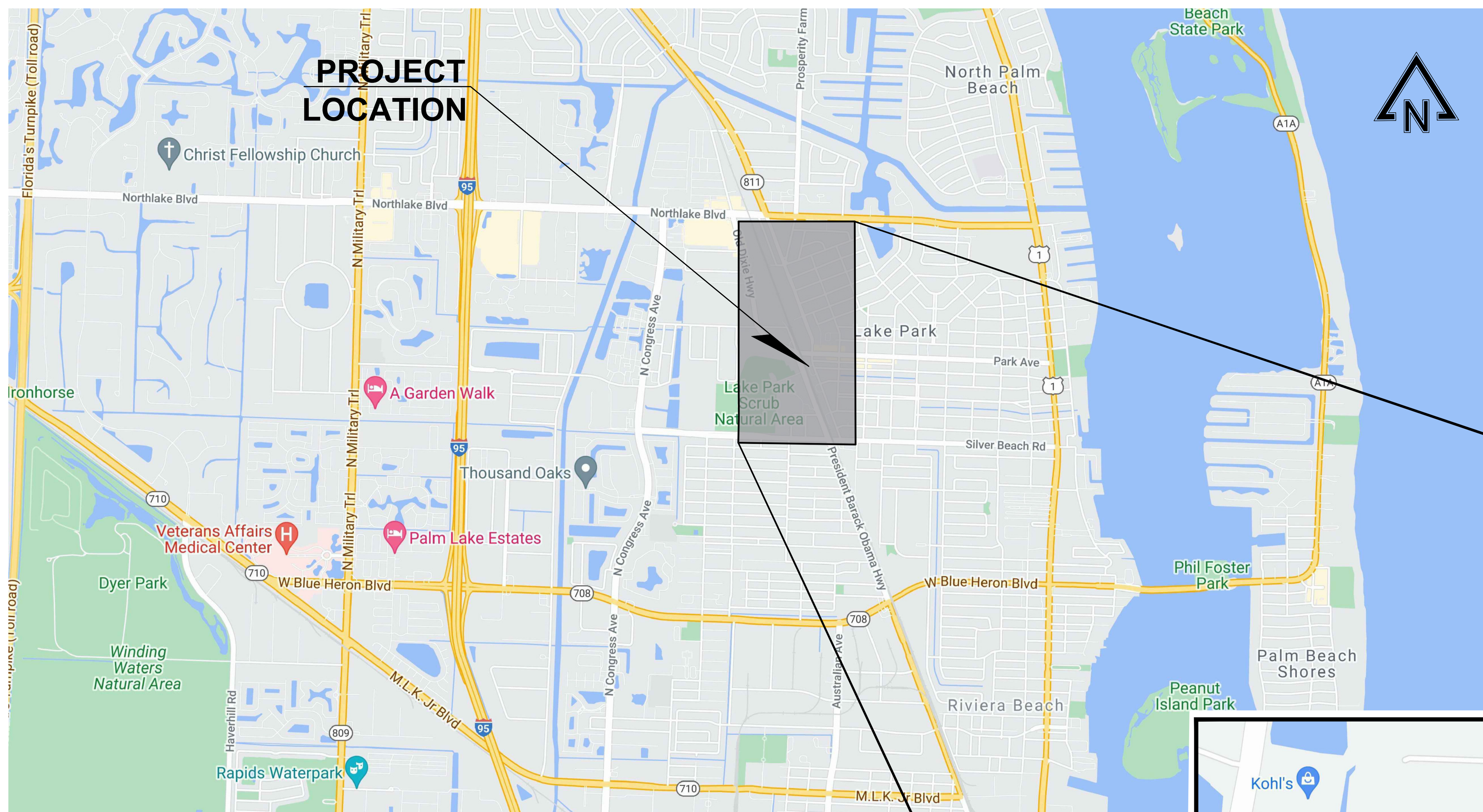
(5 Sheets)

OLD DIXIE SEPTIC TO SEWER
TOWN OF LAKE PARK, FL
CONCEPTUAL ENGINEERING PLAN - LOW PRESSURE OPTION

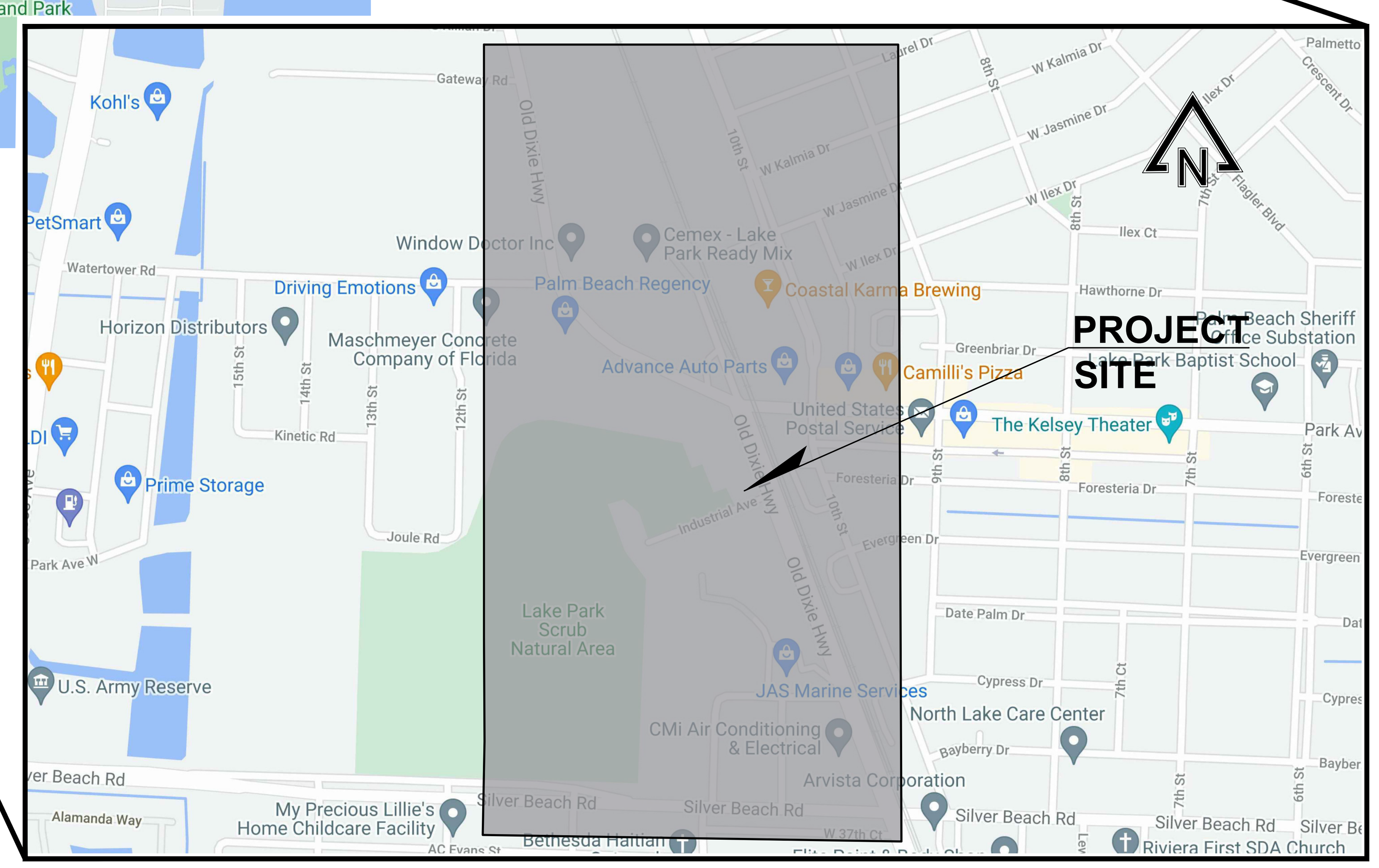
PREPARED FOR

TOWN OF LAKE PARK

9/20/21



VICINITY MAP
NTS



LOCATION MAP
NTS

SHEET INDEX:

TOTAL NO. OF SHEETS - 5

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OLD DIXIE SEPTIC TO SEWER
TOWN OF LAKE PARK, FL
CONCEPTUAL ENGINEERING PLAN - LOW PRESSURE
COVER

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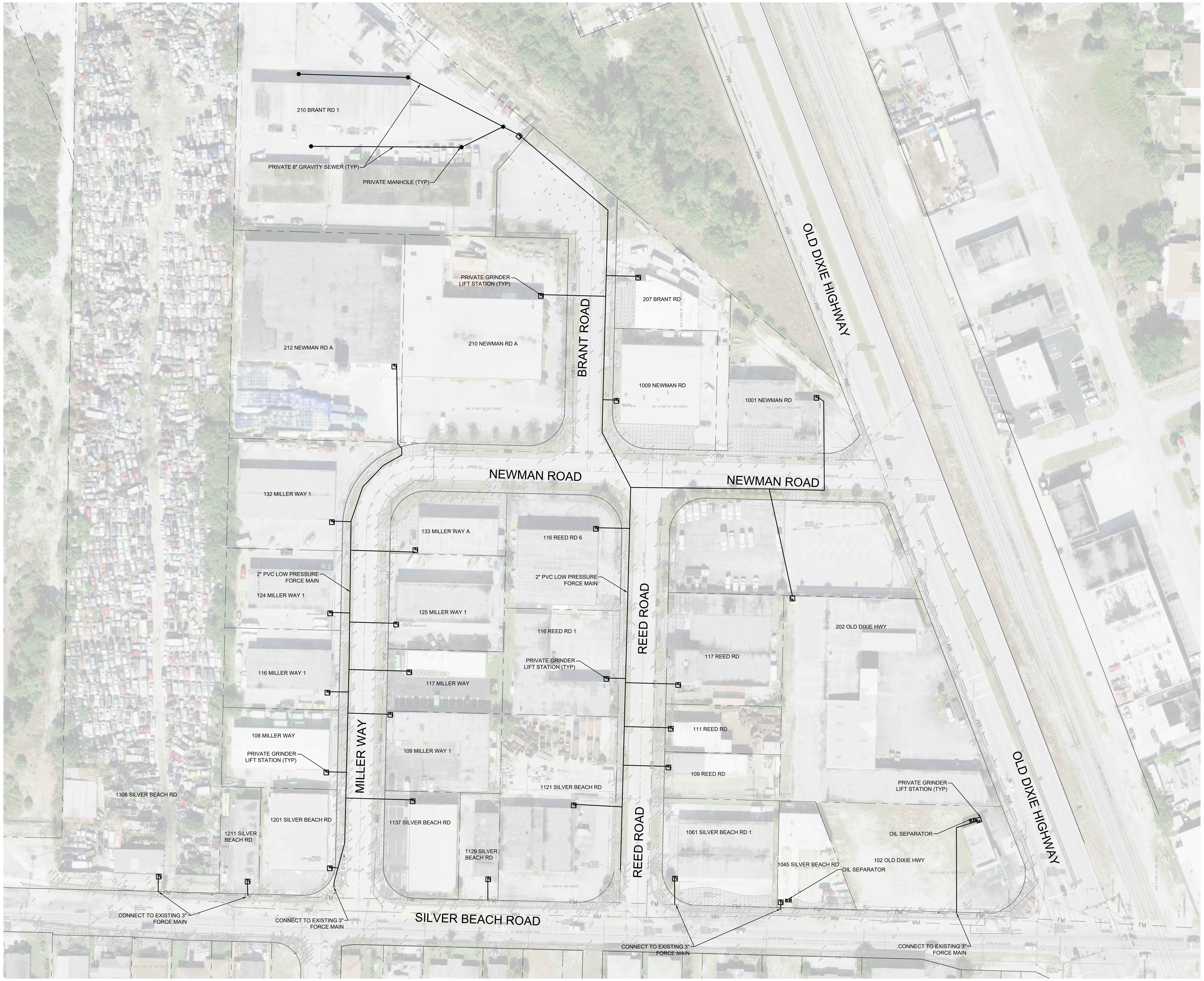
9/20/21, CONCEPTUAL



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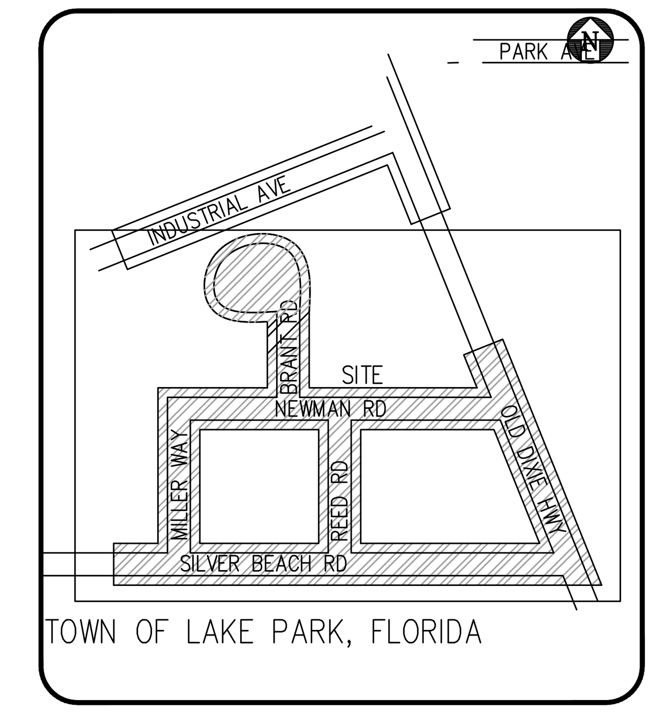
SCALE: 1" = 60'



LOCATION MAP
N.T.S.

LEGEND

⊡	PROPOSED GRINDER PUMP STATION
— — FM — —	EXISTING FORCE MAIN
— — WM — —	EXISTING WATER MAIN
— — — — —	PROPERTY LINE

CONCEPTUAL
9/20/21

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OLD DIXIE SEPTIC TO SEWER
TOWN OF LAKE PARK, FL
CONCEPTUAL ENGINEERING PLAN - LOW PRESSURE
SECTION 1-TRI CITY INDUSTRIAL PARK

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J:\Land Projects R2\18187.27 Lake Park Septic to Sewer\18187.27 Conceptual.dwg DATE: 10/14/2021 8:52 AM

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PROJECT ENGINEER	ACS
PROJECT MANAGER	ACS
CHECKED	LT

SHEET NO. 2 OF 5
JOB NO. 18187.01

GRAPHIC SCALE

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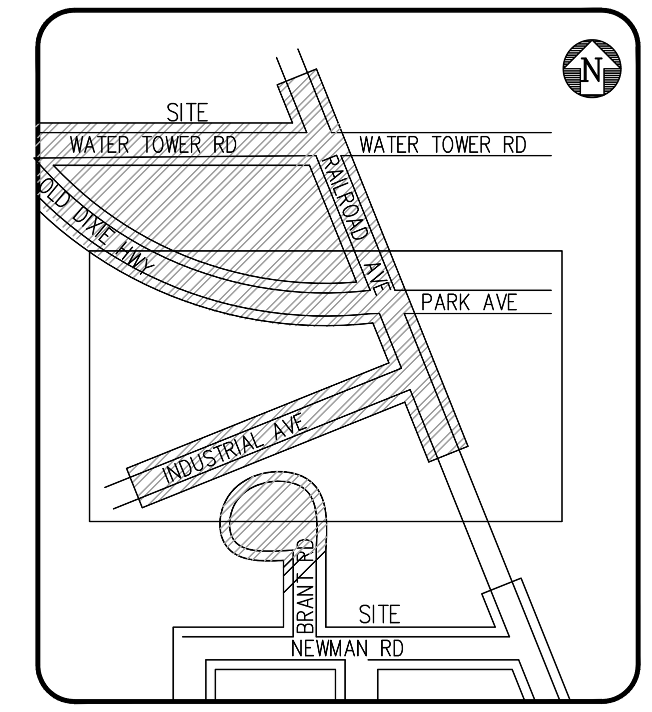
SCALE: 1" = 60'



LOCATION MAP
N.T.S.

LEGEND

◱	PROPOSED GRINDER PUMP STATION
— — FM — —	EXISTING FORCE MAIN
— — WM — —	EXISTING WATER MAIN
— — — —	PROPERTY LINE

CONCEPTUAL
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OLD DIXE SEPTIC TO SEWER
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CONCEPTUAL ENGINEERING PLAN - LOW PRESSURE
SECTION 2- LAKE PARK PUBLIC WORKS

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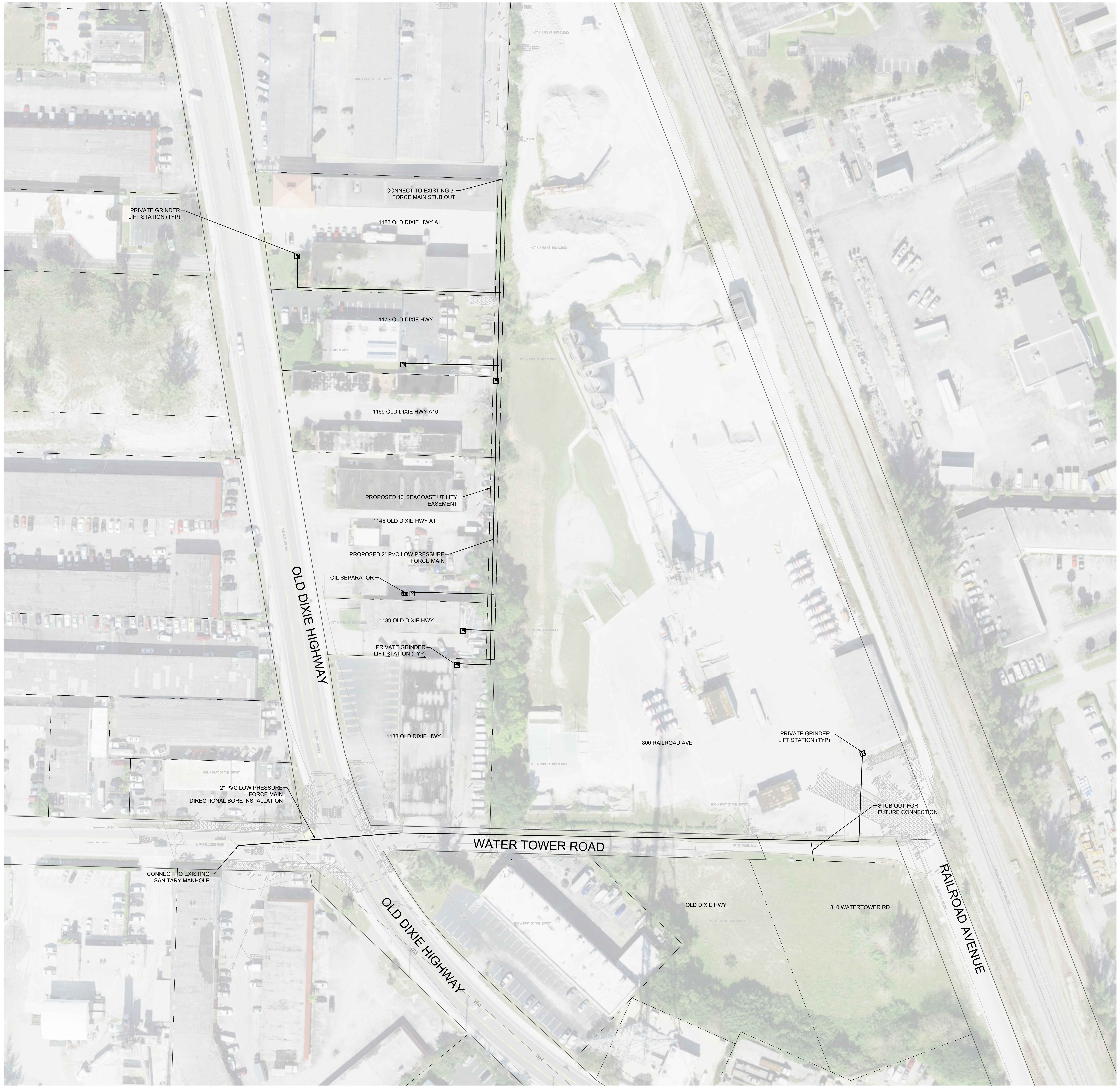

GRAPHIC SCALE

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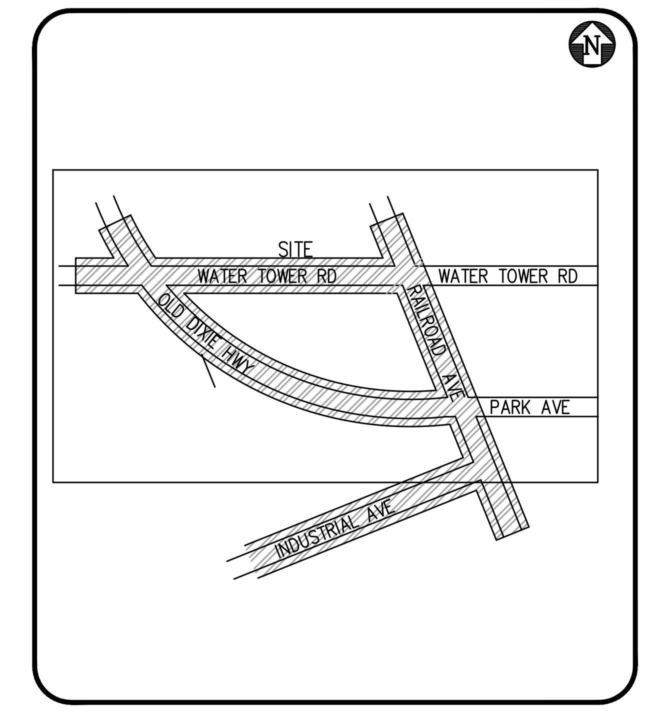
SCALE: 1" = 60'



LOCATION MAP

N.T.S.

LEGEND

(symbol)	PROPOSED GRINDER PUMP STATION
— — FM — —	EXISTING FORCE MAIN
— — WM — —	EXISTING WATER MAIN
— — — —	PROPERTY LINE

CONCEPTUAL
9/20/21

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OLD DIXE SEPTIC TO SEWER
TOWN OF LAKE PARK, FL
CONCEPTUAL ENGINEERING PLAN - LOW PRESSURE
SECTION 3

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PROJECT MANAGER	ACS
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SHEET NO. 4 OF 5

JOB NO. 18187.01

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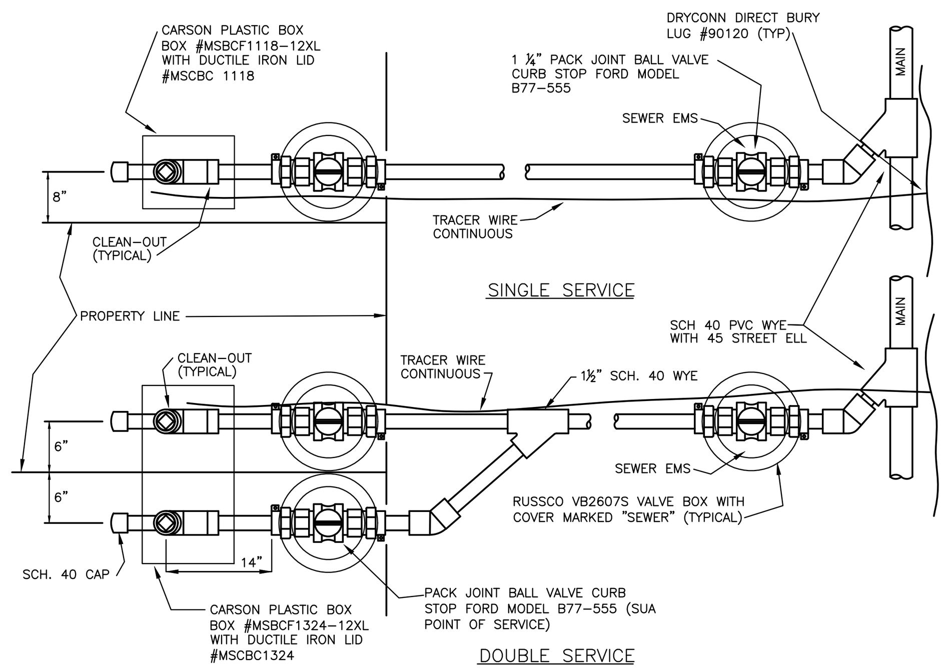
9/20/21, CONCEPTUAL

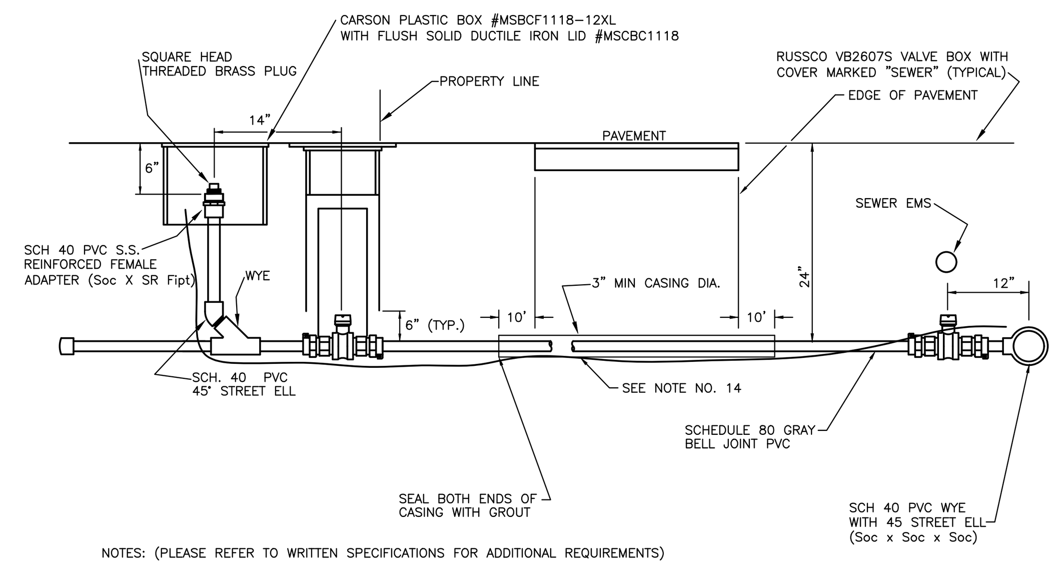


NOTES: (PLEASE REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS)

1. SERVICE PIPE FITTINGS AND VALVES FOR SIMPLEX STATION SHALL BE 1¼" AND FOR DUPLEX STATION SHALL BE 1½" SCHEDULE 80 GRAY BELL JOINT PVC, 400 PSI (CHARLOTTE PIPE). NO SLIP X SLIP COUPLINGS ALLOWED.
2. SERVICE FITTINGS SHALL BE SPEARS MANUFACTURING COMPANY OR EQUAL, SCHEDULE 40 PVC. NO DWV FITTINGS, SCHEDULE 40 MALE ADAPTERS, SLIP COUPLINGS, SLIP BUSHINGS, OR SCHEDULE 80 PVC FITTINGS ARE ALLOWED.
3. VALVE BOXES REQUIRED FOR BALL VALVE AT TEE NEXT TO MAIN ON SHORT SIDE SERVICES UNLESS SPECIFICALLY INDICATED AND NOTED ON THE PLANS.
4. TRACER WIRE TO BE #6 AWG, STRANDED COPPER, TYPE THHN WITH GREEN INSULATION. USE 11" CABLE TIES TO CONNECT TO PVC PIPE AND FITTINGS. TRACER WIRE SHALL WRAP AROUND AND TERMINATE INSIDE CLEAN OUT BOX WITH ENOUGH SLACK TO EXTEND 2-3' ABOVE GRADE.
5. PVC PRIMER AND CEMENT SHALL BE OATEY MEDIUM-BODIED.
6. CURB STOPS SHALL BE FULL PORT BALL VALVES WITH PACK JOINT FOR PVC PIPE BOTH ENDS, FORD METER BOX COMPANY MODEL B77-555.
7. SHORT SIDE SINGLE SERVICE MAY REQUIRE ONLY ONE BALL VALVE. LONG SIDE SINGLE SERVICE REQUIRES TWO BALL VALVES.
8. ZIP TIE TRACER WIRE TO PIPE EVERY 5'.

Low Pressure Sewer Service

AUGUST 26, 2020 (Rev B-18)

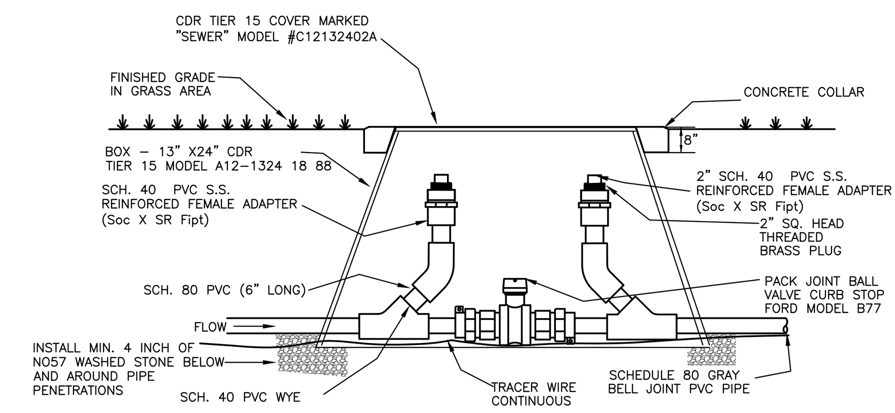


NOTES: (PLEASE REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS)

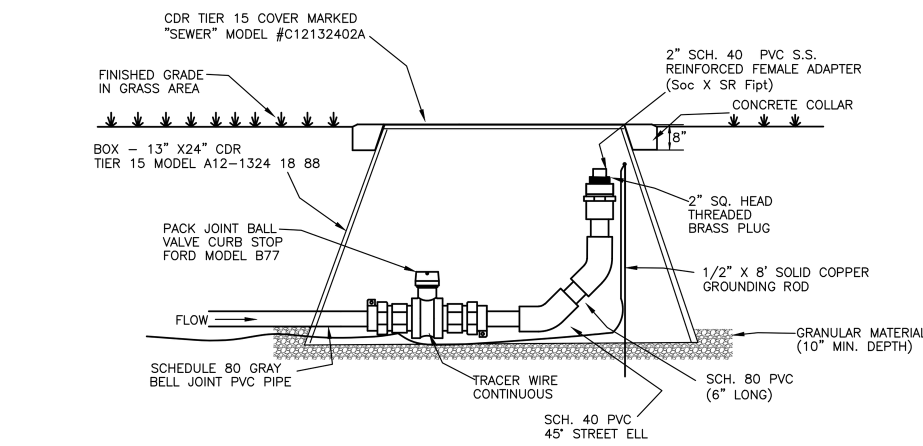
1. CASINGS SHALL BE REQUIRED FOR ALL LONG SIDE SERVICES.
2. SUCCESSIVE SERVICE LINES OFF THE LOW PRESSURE FORCE MAIN SHALL BE SPACED A MINIMUM OF 18" APART.
3. WHERE NO SIDEWALK EXISTS, VALVE BOXES SHALL BE SET TO CONFORM TO FINISH GRADE.
4. SERVICE PIPE SHALL BE SCHEDULE 80 GRAY BELL JOINT PVC, 400 PSI (CHARLOTTE PIPE). NO SLIP X SLIP COUPLINGS ALLOWED.
5. SERVICE FITTINGS SHALL BE SPEARS MANUFACTURING COMPANY ONLY, SCHEDULE 40 PVC. NO DWV FITTINGS, SCHEDULE 40 MALE ADAPTERS, SLIP COUPLINGS, SLIP BUSHINGS, OR SCHEDULE 80 PVC FITTINGS ARE ALLOWED.
6. VALVE BOXES NOT REQUIRED FOR BALL VALVE AT TEE NEXT TO MAIN ON LONG SIDE SERVICES UNLESS SPECIFICALLY INDICATED AND NOTED ON THE PLANS.
7. CONTRACTOR SHALL UTILIZE FULL LENGTHS OF BELL JOINT PIPE WHENEVER POSSIBLE UNDER ROAD CROSSINGS.
8. PLUGS SHALL BE SCHEDULE 40 RED BRASS, SOLID TYPE WITH SQUARE HEAD.
9. TRACER WIRE TO BE #6 AWG, STRANDED COPPER, TYPE THHN WITH GREEN INSULATION. USE 11" CABLE TIES TO CONNECT TO PVC PIPE AND FITTINGS. TRACER WIRE SHALL WRAP AROUND AND TERMINATE INSIDE CLEANOUT BOX WITH ENOUGH SLACK TO EXTEND 2-3' ABOVE GRADE.
10. PVC PRIMER AND CEMENT SHALL BE OATEY MEDIUM BODIED.
11. THREAD SEALING COMPOUND - PTFE PASTE SHALL BE LA-CO SLIC-TITE OR HERCULES REAL-TUFF.
12. CURB STOPS SHALL BE FULL PORT BALL VALVES WITH PACK JOINT FOR PVC PIPE BOTH ENDS, FORD METER BOX COMPANY MODEL B77-555.
13. SERVICE CASING SHALL NOT BE INSTALLED BY WATER JETTING UNDER ROADWAY.
14. GALVANIZED CASING REQUIRED FOR ANY INSTALLATION REQUIRING A JACK AND BORE, SCHEDULE 40 PVC MAY BE USED FOR AN OPEN CUT INSTALLATION WITH THE APPROVAL OF SUA, CASING SHOULD EXTEND TEN (10) FEET BEYOND EDGE OF PAVEMENT AND SIZED AS FOLLOWS:
    A.) 2" MAIN USE 4" CASING
    B.) 3" MAIN USE 6" CASING
15. ALL OTHER UTILITIES SHALL BE LOCATED 4' MINIMUM CLEAR OF ALL LOW PRESSURE MAINS AND SERVICES.
16. ZIP TIE TRACER WIRE TO PIPE EVERY 5'.

Low Pressure Sewer Service Installation

AUGUST 26, 2020 (Rev B-18)



In-Line Cleanout Port and Main Line Valve



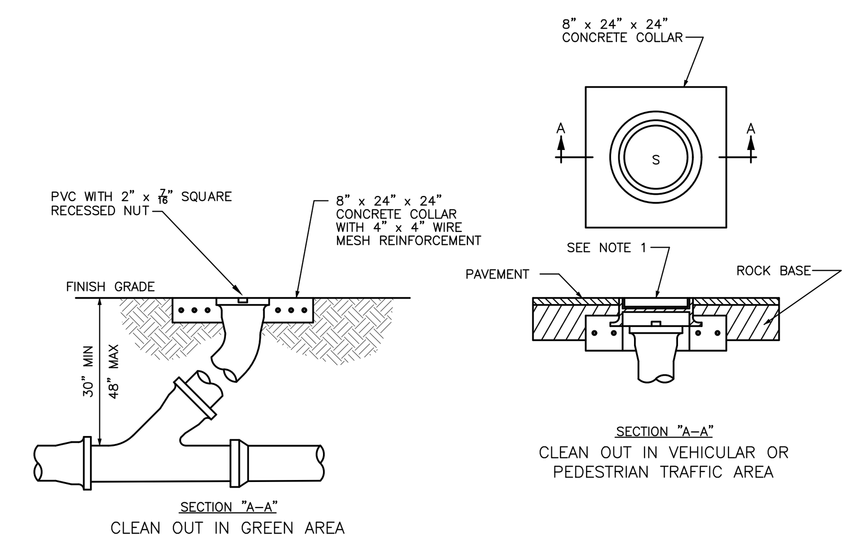
Terminal Cleanout Port and Main Line Valve

NOTES: (PLEASE REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS)

1. MAINLINE VALVES SHALL BE FULL PORT BALL VALVES WITH PACK JOINT FOR PVC PIPE BOTH ENDS, FORD METER BOX B77
2. PIPE AND FITTING SIZE WILL BE DETERMINED BY PROJECT FLOW CALCULATIONS.
3. DEPTH SHALL BE 24" UNLESS OTHERWISE REQUIRED BY ROAD PERMITTING AGENCY.
4. ZIP TRACER WIRE TO PIPE EVERY 10'.

Low Pressure Sewer Cleanout Port with Valve

JANUARY 25, 2019 (Rev C-19)

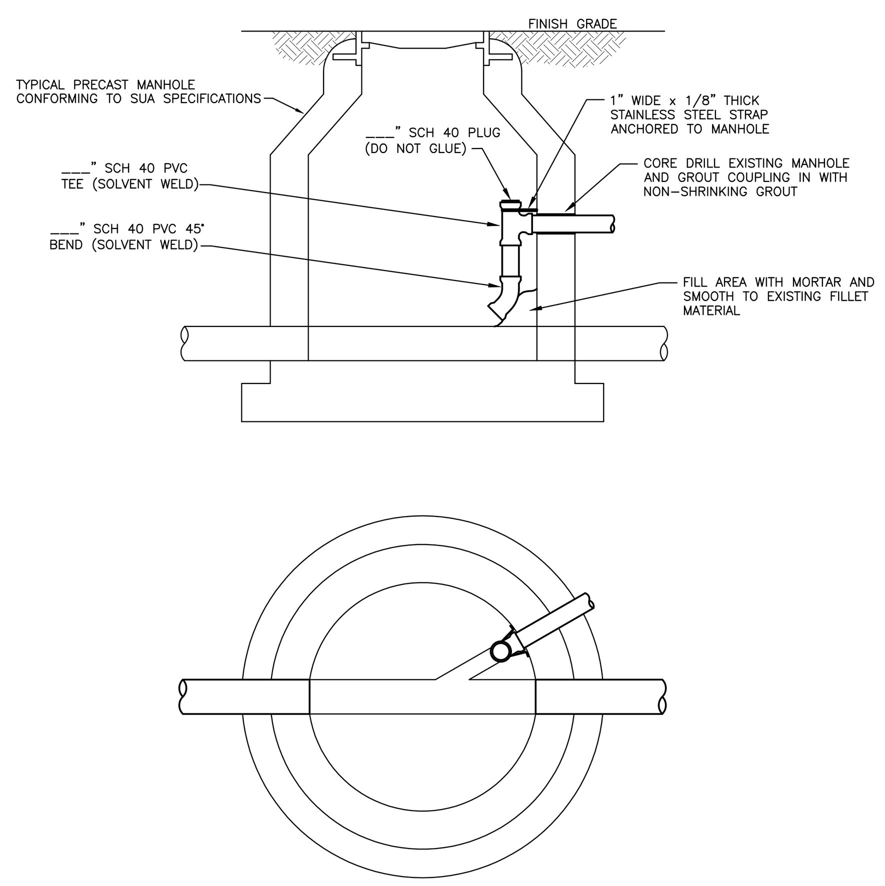


NOTES: (PLEASE REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS)

1. U.S. FOUNDRY NO. 7621 REVERSIBLE HANDHOLE RING AND COVER OR APPROVED EQUAL SHALL BE USED, COVER TO BE CAST WITH "S" IN THE CENTER.
2. CLEAN OUT REQUIRED ON ALL SERVICES AT PROPERTY LINE OR EASEMENT LINE WHERE APPLICABLE.
3. STANDARD WYE SHALL BE USED AT CLEAN OUT.

Sanitary Service Clean Out

AUGUST 26, 2020 (Rev C-20)

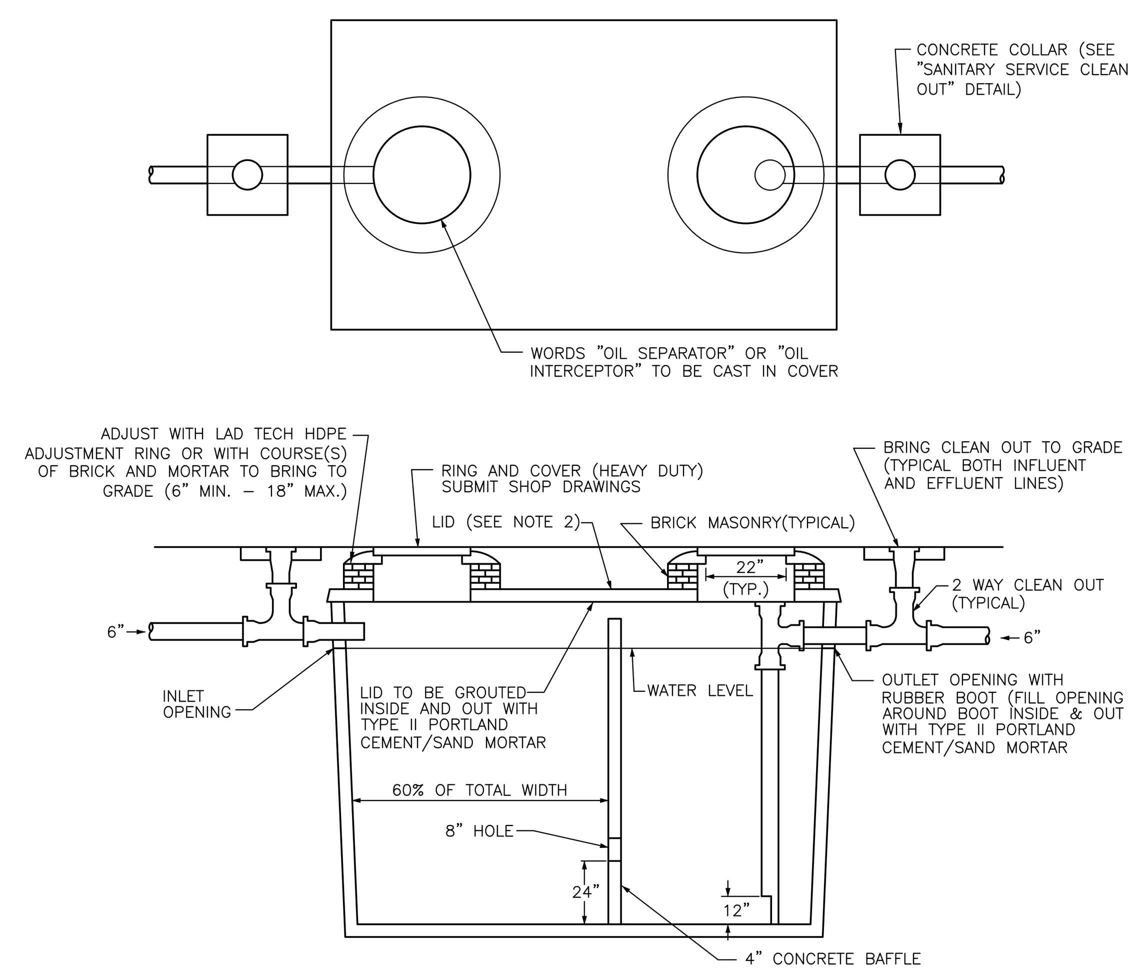


NOTES: (PLEASE REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS)

1. NO INSIDE DROP IS PERMITTED IN A MANHOLE WITH MORE THAN TWO INVERTS.
2. INTERIOR OF MANHOLE SHALL BE COATED IN ACCORDANCE WITH THE AUTHORITY'S MINIMUM CONSTRUCTION STANDARDS AND SPECIFICATIONS.

Low Pressure Force Main into Manhole Connection

AUGUST 26, 2020 (Rev A-15)



NOTES: (PLEASE REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS)

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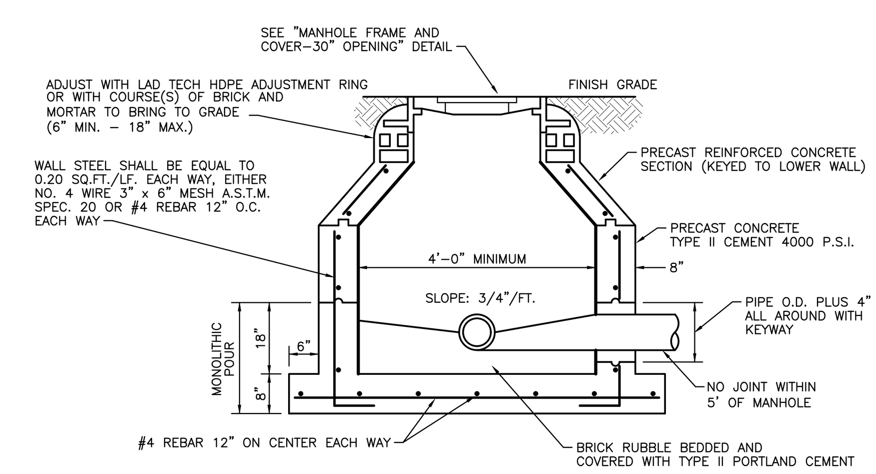
2. LID TYPES:
    A) 4" REGULAR LID
    B) 8" TRAFFIC BEARING LID
3. INTERIOR PIPING SHALL BE SOLVENT WELD PVC PIPE.
4. ALL TANKS IN TRAFFIC AREA SHALL BE H2O WHEEL LOAD BEARING.
5. INSPECTION OF TANK REQUIRED BY SUA PRIOR TO PLACEMENT.
6. INSPECTION OF TANK REQUIRED BY SUA AFTER TANK IS PIPED.

Oil Separator

AUGUST 26, 2020 (Rev B-18)

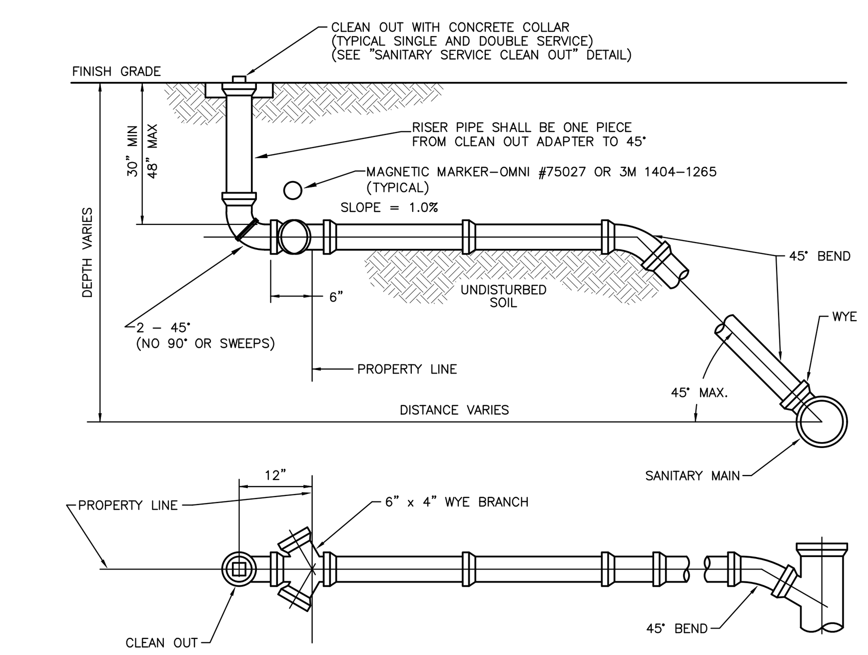


NOTES: (PLEASE REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS)

1. MANHOLES SHALL CONFORM TO A.S.T.M. C478.(MIN.)
2. WALL REINFORCEMENTS A.S.T.M. DESIGNATION A185-64.(LATEST REVISION)(MIN.)
3. IF TWO CAGES OF WIRE MESH ARE USED, ONE SHALL BE POSITIONED 3" FROM THE INSIDE SURFACE AND ONE 3" FROM THE OUTSIDE SURFACE. IF A SINGLE CAGE OR REBAR IS USED, IT SHALL BE CENTERED WITHIN WALL THICKNESS. NO EXPOSED STEEL SHALL BE PERMITTED.
4. LIFT HOLES THROUGH PRECAST STRUCTURE ARE PERMITTED.
5. A MINIMUM OF SEVEN DAYS CURE TIME IS REQUIRED PRIOR TO DELIVERY.
6. ALL PIPE HOLES SHALL BE PRECAST OR CORE DRILLED. OVERSIZED HOLES WILL BE REJECTED.
7. ANY VISIBLE REINFORCING WIRE, STEEL OR HONEYCOMBS SHALL BE CAUSE FOR REJECTION.
8. SEE TECHNICAL SPECIFICATIONS FOR BEDDING REQUIREMENTS.
9. "RAM-NEK" OR APPROVED EQUAL AT ALL RISER JOINTS (1/2" THICK WITH WIDTH AT LEAST 1/2 THE WALL THICKNESS) WITH GROUT ON INSIDE AND OUTSIDE.
10. ALL OPENINGS SHALL BE SEALED USING ONLY TYPE II PORTLAND CEMENT/SAND MORTAR AND POTABLE WATER FOR MUD WORK ON JOINTS, LIFTING HOLES, INVERTS, ETC. WHEN AN ACCELERATOR IS NECESSARY, "ANTI HYDRO" IS THE ONLY PRODUCT APPROVED.
11. BRICK MASONRY CONSTRUCTION TO BE STUCCOED WITH 3/4" TYPE II CEMENT INSIDE AND OUTSIDE, AND INSIDE TO BE COATED WITH TWO COATS OF KOPPERS 300 OR APPROVED EQUAL.
12. A FLOW CHANNEL SHALL BE CONSTRUCTED INSIDE MANHOLE TO DIRECT INFLUENT INTO FLOW STREAM, AND COATED WITH TWO COATS OF KOPPERS 300 OR APPROVED EQUAL
13. INTERIOR OF ALL SANITARY MANHOLES SHALL HAVE AGRU SURE GRIP CONCRETE PROTECTIVE LINER INSTALLED AT THE TIME OF MANUFACTURING. SEE "AGRU SURE GRIP LINER DETAILS" DRAWING FOR ADDITIONAL AGRU SURE GRIP REQUIREMENTS.

Standard Precast Manhole

AUGUST 26, 2020 (Rev B-18)



NOTES: (PLEASE REFER TO WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS)

1. THE END OF EACH SERVICE CONNECTION SHALL BE MARKED WITH A 2" x 2" TREATED WOOD STAKE AND AN E.M.S. SANITARY SEWER MARKER.
2. EACH SERVICE CONNECTION SHALL BE PLUGGED WATERTIGHT WITH AN APPROVED CAP OR PLUG.
3. CUT OFF BELL END WHEN USING FERNCO COUPLING FOR VCP (FOR EXISTING SERVICES ONLY)
4. FOR PVC INSTALLATIONS, CONNECT TO EXISTING "BELL END" AND CONNECT OPPOSITE END WITH PVC TO PVC KNOCK ON SLEEVE.
5. SOLIDLY TAMP BACKFILL AT LEAST ONE FOOT ABOVE TOP OF PIPE. SERVICES UNDER PAVED AREAS SHALL BE BACKFILLED TO THE SAME SPECIFICATIONS AS SHOWN ON "PAVEMENT REPLACEMENT" DETAIL.
6. CONTRACTOR SHALL MARK ON A CLEAN SET OF PLANS THE FINAL STATIONING OR DISTANCE AND DIRECTION FROM MANHOLE TO EACH SERVICE LATERAL AND GIVE TO ENGINEER FOR RECORD DRAWING PURPOSES.
7. ANY DEVIATION FROM THESE METHODS MUST BE APPROVED BY SUA.
8. THE USE OF UNNECESSARY FITTINGS ON THE CUSTOMERS LINE TO REDUCE EXCAVATION EFFORTS WILL BE CAUSE FOR REJECTION.
9. THE USE OF 90° SWEEPS ON THE CUSTOMERS LINE IN LIEU OF 45° BENDS WILL REQUIRE AN ADDITIONAL CLEAN OUT AS SHOWN ON "SANITARY SERVICE CLEAN OUT DETAIL". THE CLEAN OUT SHALL BE ON THE HOUSE SIDE OF THE TOP SWEEP WITHIN 2' OF THE SWEEP.

Sewer Service Connection (Wye Branch)

AUGUST 26, 2020 (Rev A-15)

CONCEPTUAL
9/20/21

ADAM SWANEY, P.E., PROFESSIONAL ENGINEER LICENSE NO. 72235. THIS DOCUMENT HAS BEEN ELECTRONICALLY SIGNED AND SEALED BY ADAM SWANEY, P.E. USING A SHA-1 AUTHENTICATION CODE. PRINTED COPIES OF THIS DOCUMENT ARE NOT CONSIDERED SIGNED AND SEALED AND THE SHA-1 AUTHENTICATION CODE MUST BE VERIFIED ON ANY ELECTRONIC COPIES.

Know what's below. Call before you dig.

NO.	DATE	REMARKS	BY

REVISIONS

ADAM SWANEY, P.E.
NO. 72235

OLD DIXE SEPTIC TO SEWER
TOWN OF LAKE PARK, FL
CONCEPTUAL ENGINEERING PLAN - LOW PRESSURE DETAILS

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engenuity group inc.
ENGINEERS • SURVEYORS • GIS MAPPERS
1280 N CONGRESS AVE, SUITE 101
WEST PALM BEACH, FLORIDA 33409
PH (561)655-1151 • FAX (561)832-9390 •
WWW.ENGENUITYGROUP.COM CERTIFICATE OF AUTHORIZATION #7095

J:\Land Projects R2\18187.27 Lake Park Septic to Sewer\18187.27 Conceptual.dwg DATE: 10/14/2021 8:52 AM

DATE	9/20/21
DRAWN	STAFF
PROJECT ENGINEER	ACS
PROJECT MANAGER	ACS
CHECKED	LT

SHEET NO. 5 / 5

JOB NO. 18187.01

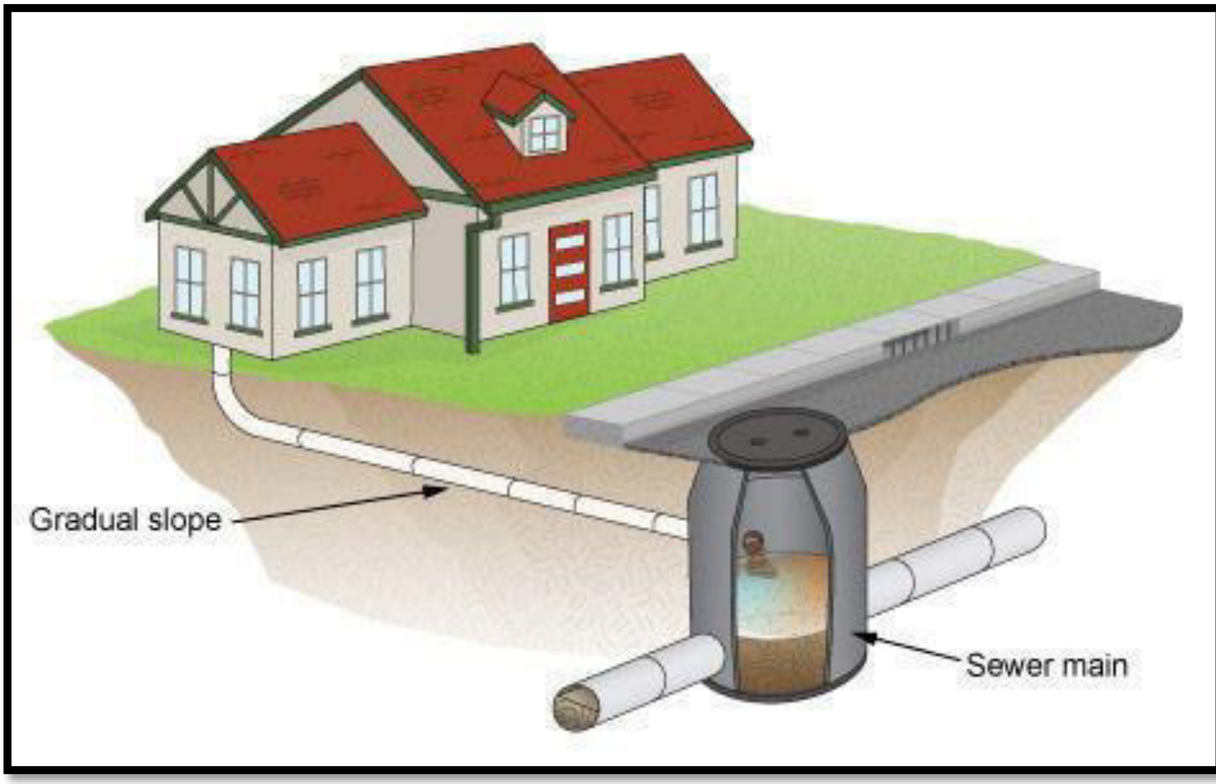
PLOT: 10/19/2021 10:22:29 AM

9/20/21, CONCEPTUAL

Appendix D

Gravity Sewer System Image

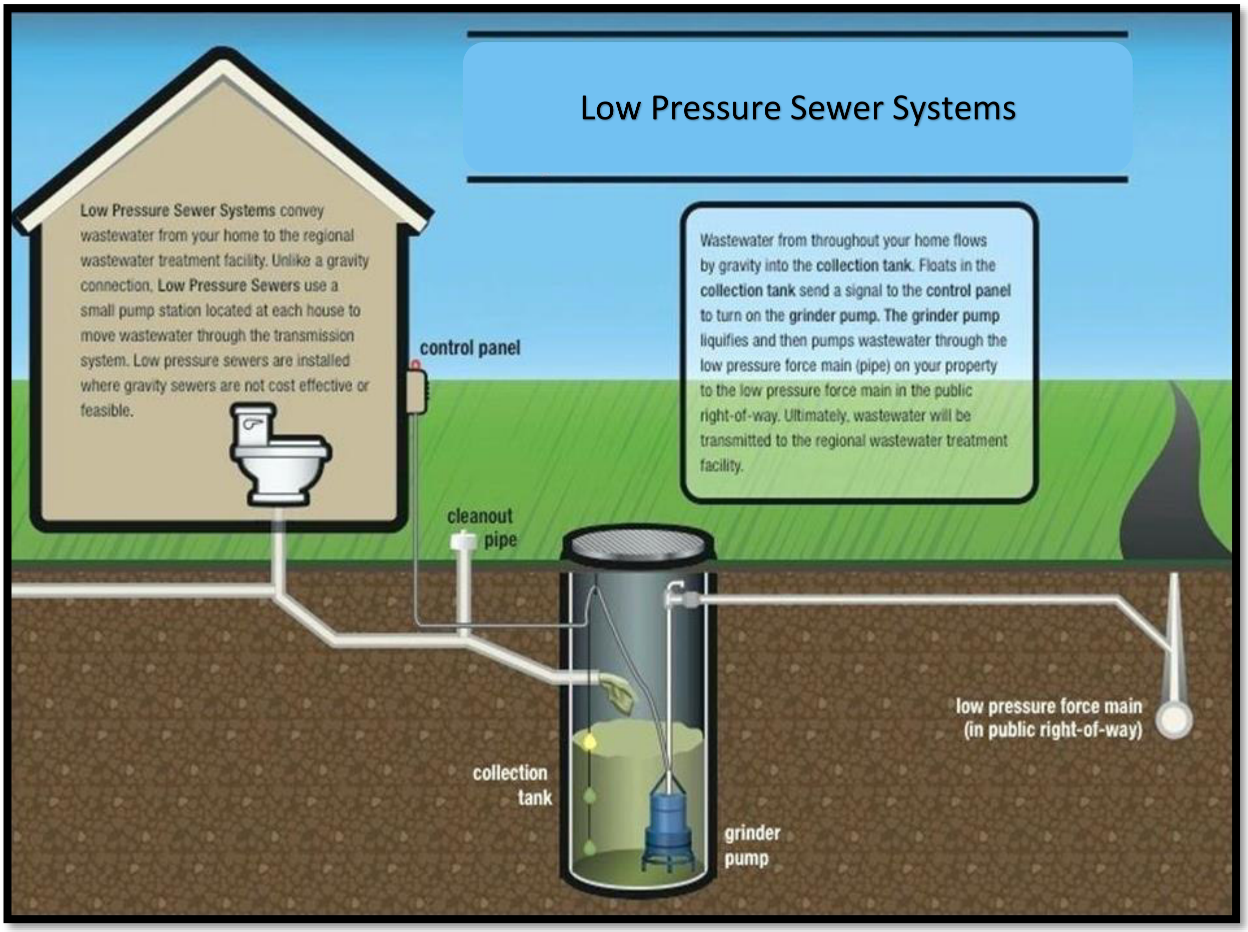
Gravity Sewer System Image



Appendix E

Low Pressure Sewer System Image

Low Pressure Sewer System Image



Appendix F

Engineer's Opinion of Probable Cost

Low Pressure Sewer System

TOWN OF LAKE PARK
ENGINEER'S OPINION OF PROBABLE COST
LOW PRESSURE SEWER SYSTEM
JOB NO. 18187.27
April 2022

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	Address: 640 Old Dixie (Lake Park Public Works)				
Item	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total Amount**
1	Private Grinder Station	1	EA	$ 45,000.00	$ 45,000.00
2	2" Low Pressure Force Main	25	LF	$ 25.00	$ 625.00
3	Pavement, Restoration, Sub-grade, Sub-base, Asphalt	250	SQ YD	$ 50.00	$ 12,500.00
4	6" PVC Service Lateral (including connection to exisitng, cleanouts, bends)	334	LF	$ 45.00	$ 15,030.00
5	Abandon Septic tank & drainfield assuming each building has one)	3	EA	$ 2,500.00	$ 7,500.00
6	Connection Fee (Assumming 1 ERCs Equivalent)	1	EA	$ 1,200.00	$ 1,200.00
7	Sodding Restoration	50	SQ YD	$ 5.00	$ 250.00
8	Electrical service connection	1	LS	$ 3,000.00	$ 3,000.00
9	Water connection for hose bib	1	LS	$ 1,500.00	$ 1,500.00

Subtotal			$ 86,605.00
Mobilization, Demobilization, MOT, Bonds & Insurance (10%)	1	LS	$ 8,660.50
Contingency (25%)	1	LS	$ 21,651.25
Legal, Engineering, Administration (20%)	1	LS	$ 17,321.00
TOTAL			**$ 134,237.75**

Note: Estimated costs are based on conceptual plans and unit costs at the time of this report. It was assumed that septic tanks are located in the same locations as the grinder stations in the conceptual plans. These locations will need to be verified in the final design in order to finalize pricing estimates.

TOWN OF LAKE PARK
ENGINEER'S OPINION OF PROBABLE COST
LOW PRESSURE SEWER SYSTEM
JOB NO. 18187.27
April 2022

	Address: 210 Brant Road				
Item	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total Amount**
1	Private Grinder Station	1	EA	$ 45,000.00	$ 45,000.00
2	2" Low Pressure Force Main	10	LF	$ 25.00	$ 250.00
3	Pavement, Restoration, Sub-grade, Sub-base, Asphalt	750	SQ YD	$ 50.00	$ 37,500.00
4	6" PVC Service Lateral (including connection to exisitng, cleanouts, bends)	800	LF	$ 45.00	$ 36,000.00
5	Abandon Septic tank & drainfield assuming each building has one)	5	EA	$ 2,500.00	$ 12,500.00
6	Connection Fee (Assumming 1 ERCs Equivalent)	1	EA	$ 1,200.00	$ 1,200.00
7	Sodding Restoration	50	SQ YD	$ 5.00	$ 250.00
8	Electrical service connection	1	LS	$ 3,000.00	$ 3,000.00
9	Water connection for hose bib	1	LS	$ 1,500.00	$ 1,500.00

Subtotal			$ 137,200.00
Mobilization, Demobilization, MOT, Bonds & Insurance (10%)	1	LS	$ 13,720.00
Contingency (25%)	1	LS	$ 34,300.00
Legal, Engineering, Administration (20%)	1	LS	$ 27,440.00
TOTAL			**$ 212,660.00**

Note: Estimated costs are based on conceptual plans and unit costs at the time of this report. It was assumed that septic tanks are located in the same locations as the grinder stations in the conceptual plans. These locations will need to be verified in the final design in order to finalize pricing estimates.

TOWN OF LAKE PARK
ENGINEER'S OPINION OF PROBABLE COST
LOW PRESSURE SEWER SYSTEM
JOB NO. 18187.27
April 2022

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	Address: All Properties Without Oil Interceptor with exception of 210 Brant Road, and 640 Old Dixie				
Item	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total Amount**
1	Private Grinder Station	1	EA	$ 45,000.00	$ 45,000.00
2	2" Low Pressure Force Main	50	LF	$ 25.00	$ 1,250.00
3	Pavement, Restoration, Sub-grade, Sub-base, Asphalt	25	SQ YD	$ 50.00	$ 1,250.00
4	6" PVC Service Lateral connection (including connection to existing, cleanouts, bends)	1	EA	$ 750.00	$ 750.00
5	Abandon Septic tank & drainfield assuming each building has one)	1	EA	$ 2,500.00	$ 2,500.00
6	Connection Fee (Assumming 1 ERC Equivalent)	1	EA	$ 1,200.00	$ 1,200.00
7	Sodding Restoration	25	SQ YD	$ 5.00	$ 125.00
8	Electrical service connection	1	LS	$ 1,500.00	$ 1,500.00
9	Water connection for hose bib	1	LS	$ 1,500.00	$ 1,500.00

Subtotal				$ 55,075.00
Mobilization, Demobilization, MOT, Bonds & Insurance (10%)	1	LS		$ 5,507.50
Contingency (25%)	1	LS		$ 13,768.75
Legal, Engineering, Administration (20%)	1	LS		$ 11,015.00
TOTAL				**$ 85,366.25**

Note: Estimated costs are based on conceptual plans and unit costs at the time of this report. It was assumed that septic tanks are located in the same locations as the grinder stations in the conceptual plans. These locations will need to be verified in the final design in order to finalize pricing estimates.

Electrical cost is assumed and will need to be verified w/ individual site analysis bby FPL/construction.

TOWN OF LAKE PARK
ENGINEER'S OPINION OF PROBABLE COST
LOW PRESSURE SEWER SYSTEM
JOB NO. 18187.27
April 2022

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	Address: Oil Seprator properties (102 OLD DIXIE HWY, 1045 SILVER BEACH RD, 1101 OLD DIXIE HWY 1107 OLD DIXIE HWY A,1145 OLD DIXIE HWY A1)				
Item	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total Amount**
1	Private Grinder Station	1	EA	$ 45,000.00	$ 45,000.00
2	2" Low Pressure Force Main	50	LF	$ 25.00	$ 1,250.00
3	Pavement, Restoration, Sub-grade, Sub-base, Asphalt	25	SQ YD	$ 50.00	$ 1,250.00
4	6" PVC Service Lateral connection (including connection to existing, cleanouts, bends)	1	EA	$ 750.00	$ 750.00
5	Oil Separator	1	EA	$ 5,000.00	$ 5,000.00
6	Abandon Septic tank & drainfield assuming each building has one)	1	EA	$ 2,500.00	$ 2,500.00
7	Connection Fee (Assumming 1 ERC Equivalent)	1	EA	$ 1,200.00	$ 1,200.00
8	Sodding Restoration	25	SQ YD	$ 5.00	$ 125.00
9	Electrical service connection	1	LS	$ 1,500.00	$ 1,500.00
10	Water connection for hose bib	1	LS	$ 1,500.00	$ 1,500.00

Subtotal			$ 60,075.00
Mobilization, Demobilization, MOT, Bonds & Insurance (10%)	1	LS	$ 6,007.50
Contingency (25%)	1	LS	$ 15,018.75
Legal, Engineering, Administration (20%)	1	LS	$ 12,015.00
TOTAL			**$ 93,116.25**

Note: Estimated costs are based on conceptual plans and unit costs at the time of this report. It was assumed that septic tanks are located in the same locations as the grinder stations in the conceptual plans. These locations will need to be verified in the final design in order to finalize pricing estimates.

Appendix G

Engineer's Opinion of Probable Cost

Low Pressure / Gravity Sewer Combination System

TOWN OF LAKE PARK
ENGINEER'S OPINION OF PROBABLE COST
GRAVITY SEWER SYSTEM
JOB NO. 18187.27
April 2022

	Address: 210 Brant Road				
Item	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total Amount**
1	Pavement, Restoration, Sub-grade, Sub-base, Asphalt	750	SQ YD	$ 50.00	$ 37,500.00
2	6" PVC Service Lateral (including connection to exisitng, cleanouts, bends)	800	LF	$ 45.00	$ 36,000.00
3	Abandon Septic tank & drainfield assuming each building has one)	5	EA	$ 2,500.00	$ 12,500.00
4	Connection Fee (Assumming 1 ERCs Equivalent)	1	EA	$ 1,200.00	$ 1,200.00
7	Sodding Restoration	50	SQ YD	$ 5.00	$ 250.00

Subtotal			$ 87,450.00
Mobilization, Demobilization, MOT, Bonds & Insurance (10%)	1	LS	$ 8,745.00
Contingency (25%)	1	LS	$ 21,862.50
Legal, Engineering, Administration (20%)	1	LS	$ 17,490.00
TOTAL			**$ 135,547.50**

Note: Estimated costs are based on conceptual plans and unit costs at the time of this report. It was assumed that septic tanks are located in the same locations as the grinder stations in the conceptual plans. These locations will need to be verified in the final design in order to finalize pricing estimates.

TOWN OF LAKE PARK
ENGINEER'S OPINION OF PROBABLE COST
GRAVITY SEWER SYSTEM
JOB NO. 18187.27
April 2022

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Address: Gravity served properties in Section 1 without oil Seperator
(exept 210 Brant Road and 202 Old Dive)

Item	Description	Quantity	Unit	Unit Cost	Total Amount
1	Pavement, Restoration, Sub-grade, Sub-base, Asphalt	25	SQ YD	$ 50.00	$ 1,250.00
2	6" PVC Service Lateral connection (including connection to existing, cleanouts, bends)	1	EA	$ 750.00	$ 750.00
3	Abandon Septic tank & drainfield assuming each building has one)	1	EA	$ 2,500.00	$ 2,500.00
4	Connection Fee (Assumming 1 ERC Equivalent)	1	EA	$ 1,200.00	$ 1,200.00
5	Sodding Restoration	25	SQ YD	$ 5.00	$ 125.00

Subtotal			$ 5,825.00
Mobilization, Demobilization, MOT, Bonds & Insurance (10%)	1	LS	$ 582.50
Contingency (25%)	1	LS	$ 1,456.25
Legal, Engineering, Administration (20%)	1	LS	$ 1,165.00
TOTAL			**$ 9,028.75**

Note: Estimated costs are based on conceptual plans and unit costs at the time of this report. It was assumed that septic tanks are located in the same locations as the grinder stations in the conceptual plans. These locations will need to be verified in the final design in order to finalize pricing estimates.

TOWN OF LAKE PARK
ENGINEER'S OPINION OF PROBABLE COST
GRAVITY SEWER SYSTEM
JOB NO. 18187.27
April 2022

	Address: 202 Old Dixie						
Item	**Description**	**Quantity**	**Unit**	**Unit Cost**		**Total Amount**	
1	Pavemet, Restoration, Sub-grade, Sub-base, Asphalt	120	SQ YD	$	50.00	$	6,000.00
2	6" PVC Service Lateral (including connection to existing cleanouts, bends)	140	LF	$	45.00	$	6,300.00
3	Abandon Septic tank & drainfield assuming each building has one)	1	EA	$	2,500.00	$	2,500.00
4	Connection Fee (Assumming 1 ERC Equivalent)	1	EA	$	1,200.00	$	1,200.00
5	Sodding Restoration	25	SQ YD	$	5.00	$	125.00
4							
	Subtotal					$	16,125.00
	Mobilization, Demobilization, MOT, Bonds & Insurance (10%)	1	LS			$	1,612.50
	Contingency (25%)	1	LS			$	4,031.25
	Legal, Engineering, Administration (20%)	1	LS			$	3,225.00
	TOTAL					**$**	**24,993.75**

Note: Estimated costs are based on conceptual plans and unit costs at the time of this report. It was assumed that septic tanks are located in the same locations as the grinder stations in the conceptual plans. These locations will need to be verified in the final design in order to finalize pricing estimates.

TOWN OF LAKE PARK
ENGINEER'S OPINION OF PROBABLE COST
GRAVITY SEWER SYSTEM
JOB NO. 18187.27
April 2022

Address: Oil Seprator properties (102 OLD DIXIE HWY, 1045 SILVER BEACH RD)					
Item	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total Amount**
1	Pavement, Restoration, Sub-grade, Sub-base, Asphalt	25	EA	$ 50.00	$ 1,250.00
2		1	EA	$ 750.00	$ 750.00
3	Oil Separator	1	EA	$ 5,000.00	$ 5,000.00
4	Abandon Septic tank & drainfield assuming each building has one)	1	EA	$ 2,500.00	$ 2,500.00
5	Connection Fee (Assumming 1 ERC Equivalent)	1	EA	$ 1,200.00	$ 1,200.00
6	Sodding Restoration	25	SQ YD	$ 5.00	$ 125.00

Subtotal			$ 10,825.00
Mobilization, Demobilization, MOT, Bonds & Insurance (10%)	1	LS	$ 1,082.50
Contingency (25%)	1	LS	$ 2,706.25
Legal, Engineering, Administration (20%)	1	LS	$ 2,165.00
TOTAL			**$ 16,778.75**

Note: Estimated costs are based on conceptual plans and unit costs at the time of this report. It was assumed that septic tanks are located in the same locations as the grinder stations in the conceptual plans. These locations will need to be verified in the final design in order to finalize pricing estimates.

Appendix H

Offsite Engineer's Opinion of Probable Cost

Gravity Sewer System

Preliminary Cost Estimate
Lake Park Old Dixie Highway Sewer System

PART I - PUBLIC UTILITIES PORTION

Section 1 - Tri-City Industrial Park

Item	Number	Unit	Unit Cost	Cost
Miller Way				
2-Inch PVC Low Pressure Force Main	410	LF	$14	$5,740
In-Line Cleanout Port & Main Line Valve	1	LS	$2,000	$2,000
Terminal Cleanout Port and Main Line Valve	1	LS	$1,000	$1,000
8" PVC Gravity Main (0 - 6 feet)	520	LF	$80	$41,600
4' Diameter Sanitary Sewer Manhole 0' to 6' deep	3	EA	$7,500	$22,500
6" PVC C-900 Gravity Service Lateral - 0' to 6' deep	330	LF	$60	$19,800
Miscellanious Restoration	1	LS	$4,000	$4,000
Roadway Restoration	1,390	SY	$75	$104,250
Contaminated Groundwater Dewatering/Treatment	2	Weeks	$4,000	$8,000
Reed Road				
8" PVC Gravity Main (0 - 6 feet)	510	LF	$80	$40,800
4' Diameter Sanitary Sewer Manhole 0' to 6' deep	3	EA	$7,500	$22,500
6" PVC C-900 Gravity Service Lateral - 0' to 6' deep	270	LF	$60	$16,200
Miscellanious Restoration	1	LS	$4,000	$4,000
Roadway Restoration	1,370	SY	$75	$102,750
Contaminated Groundwater Dewatering/Treatment	2	Weeks	$4,000	$8,000
Newman Road				
4" DIP Main	350	LF	$35	$12,250
8" PVC Gravity Main (0 - 6 feet)	450	LF	$80	$36,000
8" PVC C-900 Gravity Sanitary Sewer Main 6' to 8' deep	100	LF	$90	$9,000
4' Diameter Sanitary Sewer Manhole 0' to 6' deep	1	EA	$7,500	$7,500
4' Diameter Sanitary Sewer Manhole 6' to 8' deep	1	EA	$8,500	$8,500
6" PVC C-900 Gravity Service Lateral - 0' to 6' deep	120	LF	$60	$7,200
Miscellanious Restoration	1	LS	$5,000	$5,000
Pavement Restoration	1,740	SY	$75	$130,500
Contaminated Groundwater Dewatering/Treatment	1	Week	$4,000	$4,000

Preliminary Cost Estimate
Lake Park Old Dixie Highway Sewer System

Brant Road				
4" DIP Main	320	LF	$35	$11,200
8" PVC Gravity Main (6-8 feet)	450	LF	$90	$40,500
4' Diameter Sanitary Sewer Manhole 6' to 8' deep	2	EA	$8,500	$17,000
6" PVC C-900 Gravity Service Lateral - 6' to 8' deep	120	LF	$65	$7,800
Miscellanious Restoration	1	LS	$4,000	$4,000
Roadway Restoration	1,270	SY	$75	$95,250
Contaminated Groundwater Dewatering/Treatment	1	Week	$4,000	$4,000
Lift Station Allowance				
Duplex Lift Station	1	LS	$500,000	$500,000
Contaminated Groundwater Dewatering/Treatment	3	Weeks	$4,000	$12,000
Subtotal				**$1,314,840**

General Conditions (3%)	*$40,000*
Mobilization, Bonds, and Insurance (3%)	*$40,000*
Overhead (8%)	*$106,000*
Subtotal	*$1,500,840*
Profit (15%)	*$226,000*
Subtotal	*$1,726,840*
Contingency (30%)	$519,000
Total Construction Cost	$2,245,840
Technical Services (15%)	$337,000
Total Project Cost	**$2,582,840**

**** For Section 2, use $289,100 (Low Pressure Cost)***

**** For Section 3, use $272,700 (Low Pressure Cost)***

Total of all 3 sections = $3,144,640

Appendix I

Offsite Engineer's Opinion of Probable Cost

Low Pressure Sewer System

LOW PF

Preliminary Cost Estimate
Lake Park Old Dixie Highway Sewer System

PART I - PUBLIC UTILITIES PORTION

Section 1 - Tri-City Industrial Park

Item	Number	Unit	Unit Cost	Cost
Miller Way				
2" PVC Main	550	LF	$14	$7,700
In-Line Cleanout Port & Main Line Valve	1	LS	$2,000	$2,000
Terminal Cleanout Port and Main Line Valve	1	LS	$1,000	$1,000
Double Service - Short Side	2	LS	$1,600	$3,200
Double Service - Long Side	2	LS	$2,000	$4,000
Single Service - Short Side	1	LS	$1,200	$1,200
Single Service-Long Side	2	LS	$1,600	$3,200
Driveway Restoration	200	SY	$50	$10,000
Sodding Restoration	400	SY	$5	$2,000
Miscellanious Restoration	1	LS	$10,000	$10,000
Reed Road				
2" PVC Main	550	LF	$14	$7,700
In-Line Cleanout Port & Main Line Valve	1	LS	$2,000	$2,000
Terminal Cleanout Port and Main Line Valve	1	LS	$1,000	$1,000
Double Service - Short Side	1	LS	$1,600	$1,600
Double Service - Long Side	1	LS	$2,000	$2,000
Single Service - Short Side	1	LS	$1,200	$1,200
Single Service-Long Side	1	LS	$1,600	$1,600
Driveway Restoration	200	SY	$50	$10,000
Sodding Restoration	400	SY	$5	$2,000
Miscellanious Restoration	1	LS	$10,000	$10,000
Brant Road				
2" PVC Main	475	LF	$14	$6,650
In-Line Cleanout Port & Main Line Valve	1	LS	$2,000	$2,000
Terminal Cleanout Port and Main Line Valve	1	LS	$1,000	$1,000
Double Service - Long Side	1	LS	$2,000	$2,000
Pavement Restoration	40	SY	$75	$3,000
Driveway Restoration	150	SY	$50	$7,500
Sodding Restoration	200	SY	$5	$1,000
Miscellanious Restoration	1	LS	$10,000	$10,000

Preliminary Cost Estimate
Lake Park Old Dixie Highway Sewer System

Newman Road				
2" PVC Main	450	LF	$14	$6,300
In-Line Cleanout Port & Main Line Valve	2	LS	$2,000	$4,000
Terminal Cleanout Port and Main Line Valve	2	LS	$1,000	$2,000
Single Service-Long Side	3	LS	$1,600	$4,800
Pavement Restoration	280	SY	$75	$21,000
Driveway Restoration	75	SY	$50	$3,750
Sodding Restoration	490	SY	$5	$2,450
Miscellanious Restoration	1	LS	$12,000	$12,000
Old Dixie Highway (Assumed that easements are obtained from PBC and Lake Park)				
2" PVC Main	500	LF	$14	$7,000
In-Line Cleanout Port & Main Line Valve	1	LS	$2,000	$2,000
Terminal Cleanout Port and Main Line Valve	1	LS	$1,000	$1,000
Single Service - Short Side	2	LS	$1,200	$2,400
Pavement Restoration	40	SY	$75	$3,000
Driveway Restoration	50	SY	$50	$2,500
Sodding Restoration	250	SY	$5	$1,250
Sidewalk Restoration	300	SY	$40	$12,000
Miscellanious Restoration	1	LS	$10,000	$10,000
Silver Beach Road				
2" PVC Main	250	LF	$14	$3,500
Terminal Cleanout Port and Main Line Valve	1	LS	$1,000	$1,000
Single Service - Short Side	5	LS	$1,200	$6,000
Driveway Restoration	150	SY	$50	$7,500
Sodding Restoration	50	SY	$5	$250
Sidewalk Restoration	25	SY	$40	$1,000
Miscellanious Restoration	1	LS	$7,500	$7,500
LOW PRESSURE FORCE MAIN CONSTRUCTION SUBTOTAL				**$240,800**

General Conditions (3%)	*$8,000*
Mobilization, Bonds, and Insurance (3%)	*$8,000*
Overhead (8%)	*$20,000*
Subtotal	*$276,800*
Profit (15%)	*$42,000*
Subtotal	*$318,800*
Contingency (30%)	$96,000
Total Construction Cost	$414,800
Technical Services (15%)	$63,000
Total Section 1 Project Cost	**$477,800**

Preliminary Cost Estimate
Lake Park Old Dixie Highway Sewer System

Section 2 - Town of Lake Park Public Works Area

Item	Number	Unit	Unit Cost	Cost
2-Inch PVC Low Pressure Force Main	2,450	LF	$14	$34,300
In-Line Cleanout Port & Main Line Valve	6	LS	$2,000	$12,000
Terminal Cleanout Port and Main Line Valve	1	LS	$1,000	$1,000
Single Service - Short Side	2	LS	$1,200	$2,400
Core Through Existing Manhole	1	LS	$7,500	$7,500
Driveway Restoration	140	SY	$50	$7,000
Sodding Restoration	1,470	SY	$5	$7,350
Sidewalk Restoration	400	SY	$40	$16,000
Roadway Restoration	500	SY	$75	$37,500
Miscellanious Restoration	1	LS	$20,000	$20,000
LOW PRESSURE FORCE MAIN CONSTRUCTION SUBTOTAL				**$145,100**

General Conditions (3%)	*$5,000*
Mobilization, Bonds, and Insurance (3%)	*$5,000*
Overhead (8%)	*$12,000*
Subtotal	*$167,100*
Profit (15%)	*$26,000*
Subtotal	*$193,100*
Contingency (30%)	$58,000
Total Construction Cost	$251,100
Technical Services (15%)	$38,000
Total Section 2 Project Cost	**$289,100**

Preliminary Cost Estimate
Lake Park Old Dixie Highway Sewer System

Section 3 - Commercial Area on Old Dixie, North of Water Tower Road

Item	Number	Unit	Unit Cost	Cost
2-Inch PVC Low Pressure Force Main	1,900	LF	$14	$26,600
In-Line Cleanout Port & Main Line Valve	2	LS	$2,000	$4,000
Terminal Cleanout Port and Main Line Valve	1	LS	$1,000	$1,000
Double Service - Short Side	3	LS	$1,600	$4,800
Single Service - Short Side	4	LS	$1,200	$4,800
Core Through Existing Manhole	2	LS	$7,500	$15,000
Sodding Restoration	2,400	SY	$5	$12,000
Driveway Restoration	140	SY	$50	$7,000
Roadway Restoration	500	SY	$75	$37,500
Miscellanious Restoration	1	LS	$24,000	$24,000
LOW PRESSURE FORCE MAIN CONSTRUCTION SUBTOTAL				**$136,700**

General Conditions (3%)	*$5,000*
Mobilization, Bonds, and Insurance (3%)	*$5,000*
Overhead (8%)	*$11,000*
Subtotal	*$157,700*
Profit (15%)	*$24,000*
Subtotal	*$181,700*
Contingency (30%)	$55,000
Total Construction Cost	$236,700
Technical Services (15%)	$36,000
Total Section 3 Project Cost	**$272,700**

PART I - PUBLIC UTILITIES PORTION TOTAL **$1,039,600**

Appendix J

Engineer's Opinion of Total Per Property

Gravity Sewer System

TOWN OF LAKE PARK
ENGINEER'S OPINION OF PROBABLE COST
GRAVITY/LOW PRESSURE - TOTAL COST SUMMARY BY PROPERTY
JOB NO. 18187.27
APRIL 2022

Property	Address	*Estimated Onsite Cost	*Estimated Offsite Cost	*Total
	SOUTH - SECTION			
1	1306 SILVER BEACH RD	$ 9,029.00	$ 89,063.45	$ 98,092.45
2	1211 SILVER BEACH RD	$ 9,029.00	$ 89,063.45	$ 98,092.45
3	1201 SILVER BEACH RD	$ 9,029.00	$ 89,063.45	$ 98,092.45
4	108 MILLER WAY	$ 9,029.00	$ 89,063.45	$ 98,092.45
5	116 MILLER WAY 1	$ 9,029.00	$ 89,063.45	$ 98,092.45
6	124 MILLER WAY 1	$ 9,029.00	$ 89,063.45	$ 98,092.45
7	132 MILLER WAY 1	$ 9,029.00	$ 89,063.45	$ 98,092.45
8	212 NEWMAN RD A	$ 9,029.00	$ 89,063.45	$ 98,092.45
9	210 NEWMAN RD A	$ 9,029.00	$ 89,063.45	$ 98,092.45
10	210 BRANT RD 1	$ 135,548.00	$ 89,063.45	$ 224,611.45
11	207 BRANT RD	$ 9,029.00	$ 89,063.45	$ 98,092.45
12	1009 NEWMAN RD	$ 9,029.00	$ 89,063.45	$ 98,092.45
13	1001 NEWMAN RD	$ 9,029.00	$ 89,063.45	$ 98,092.45
14	133 MILLER WAY A	$ 9,029.00	$ 89,063.45	$ 98,092.45
15	125 MILLER WAY 1	$ 9,029.00	$ 89,063.45	$ 98,092.45
16	117 MILLER WA	$ 9,029.00	$ 89,063.45	$ 98,092.45
17	109 MILLER WAY 1	$ 9,029.00	$ 89,063.45	$ 98,092.45
18	1137 SILVER BEACH RD	$ 9,029.00	$ 89,063.45	$ 98,092.45
19	1129 SILVER BEACH RD	$ 9,029.00	$ 89,063.45	$ 98,092.45
20	1121 SILVER BEACH RD	$ 9,029.00	$ 89,063.45	$ 98,092.45
21	116 REED RD 1	$ 9,029.00	$ 89,063.45	$ 98,092.45
22	116 REED RD 6	$ 9,029.00	$ 89,063.45	$ 98,092.45
23	1061 SILVER BEACH RD 1	$ 9,029.00	$ 89,063.45	$ 98,092.45
24	109 REED RD	$ 9,029.00	$ 89,063.45	$ 98,092.45
25	111 REED RD	$ 9,029.00	$ 89,063.45	$ 98,092.45
26	117 REED RD	$ 9,029.00	$ 89,063.45	$ 98,092.45
27	202 OLD DIXIE HWY	$ 24,994.00	$ 89,063.45	$ 114,057.45
28	1045 SILVER BEACH RD	$ 16,779.00	$ 89,063.45	$ 105,842.45
29	102 OLD DIXIE HWY	$ 16,779.00	$ 89,063.45	$ 105,842.45
	Total SOUTH - SECTION	**$ 419,825.00**	**$ 2,582,840.00**	**$ 3,002,665.00**

***Refer to Appendix H for Breakdown of Estimated Offsite Cost, and Appendix G for onsite costs.**

***Estimated Costs Includes Mobilization, Demobilization, MOT, Insurance, Continency, Legal, Engineering, & Administration**

TOWN OF LAKE PARK
ENGINEER'S OPINION OF PROBABLE COST
GRAVITY/LOW PRESSURE - TOTAL COST SUMMARY BY PROPERTY
JOB NO. 18187.27
APRIL 2022

	MID-SECTION	*Estimated Onsite Cost	*Estimated Offsite Cost	Total
1	410 OLD DIXIE HWY	$ 85,366.00	$ 48,183.33	$ 133,549.33
2	1215 INDUSTRIAL AVE	$ 85,366.00	$ 48,183.33	$ 133,549.33
3	640 OLD DIXIE HWY	$ 134,238.00	$ 48,183.33	$ 182,421.33
4	700 OLD DIXIE HWY 101	$ 85,366.00	$ 48,183.33	$ 133,549.33
5	1107 OLD DIXIE HWY A	$ 93,116.00	$ 48,183.33	$ 141,299.33
6	1101 OLD DIXIE HWY	$ 93,116.00	$ 48,183.33	$ 141,299.33
	Total MID-SECTION	$ 576,568.00	$ 289,100.00	$ 865,668.00

***Refer to Appendix I for Breakdown of Estimated Offsite Cost, and Appendix F for onsite cost.**

***Estimated Costs Include Mobilization, Demobilization, MOT, Insurance, Continency, Legal, Engineering, & Administration**

	NORTH-SECTION	*Estimated Onsite Cost	*Estimated Offsite Cost	Total
7	1133 OLD DIXIE HWY 1	$ 85,366.00	$ 38,957.14	$ 124,323.14
8	1145 OLD DIXIE HWY A1	$ 93,116.00	$ 38,957.14	$ 132,073.14
9	1183 OLD DIXIE HWY A1	$ 85,366.00	$ 38,957.14	$ 124,323.14
10	1173 OLD DIXIE HWY	$ 85,366.00	$ 38,957.14	$ 124,323.14
11	1169 OLD DIXIE HWY A10	$ 85,366.00	$ 38,957.14	$ 124,323.14
12	1139 OLD DIXIE HWY	$ 85,366.00	$ 38,957.14	$ 124,323.14
13	800 RAILROAD AVE	$ 85,366.00	$ 38,957.14	$ 124,323.14
	Total NORTH - SECTION	$ 605,312.00	$ 272,700.00	$ 878,012.00

***Refer to Appendix I for Breakdown of Estimated Offsite Cost, and Appendix F for onsite cost.**

***Estimated Onsite Cost Included with Mobilization, Demobilization, MOT, Insurance Continency, Legal, Engineering & Administration**

	GRAND TOTAL (ALL 3 SECTION)	**$ 1,601,705.00**	**$ 3,144,640.00**	**$ 4,746,345.00**

Notes: (2) Number of units are an estimate only. Costs are based on conceptual plans and unit costs at the time of this report.

Appendix K

Engineer's Opinion of Total Per Property

Low Pressure Sewer System

TOWN OF LAKE PARK
ENGINEER'S OPINION OF PROBABLE COST
LOW PRESSURE SEWER SYSTEM - TOTAL COST SUMMARY BY PROPERTY
JOB NO. 18187.27
APRIL 2022

Property	Address	*Estimated Onsite Cost	*Estimated Offsite Cost	Total
	SOUTH - SECTION			
1	1306 SILVER BEACH RD	$ 85,366.00	$ 16,475.86	$ 101,841.86
2	1211 SILVER BEACH RD	$ 85,366.00	$ 16,475.86	$ 101,841.86
3	1201 SILVER BEACH RD	$ 85,366.00	$ 16,475.86	$ 101,841.86
4	108 MILLER WAY	$ 85,366.00	$ 16,475.86	$ 101,841.86
5	116 MILLER WAY 1	$ 85,366.00	$ 16,475.86	$ 101,841.86
6	124 MILLER WAY 1	$ 85,366.00	$ 16,475.86	$ 101,841.86
7	132 MILLER WAY 1	$ 85,366.00	$ 16,475.86	$ 101,841.86
8	212 NEWMAN RD A	$ 85,366.00	$ 16,475.86	$ 101,841.86
9	210 NEWMAN RD A	$ 85,366.00	$ 16,475.86	$ 101,841.86
10	210 BRANT RD 1	$ 212,660.00	$ 16,475.86	$ 229,135.86
11	207 BRANT RD	$ 85,366.00	$ 16,475.86	$ 101,841.86
12	1009 NEWMAN RD	$ 85,366.00	$ 16,475.86	$ 101,841.86
13	1001 NEWMAN RD	$ 85,366.00	$ 16,475.86	$ 101,841.86
14	133 MILLER WAY A	$ 85,366.00	$ 16,475.86	$ 101,841.86
15	125 MILLER WAY 1	$ 85,366.00	$ 16,475.86	$ 101,841.86
16	117 MILLER WA	$ 85,366.00	$ 16,475.86	$ 101,841.86
17	109 MILLER WAY 1	$ 85,366.00	$ 16,475.86	$ 101,841.86
18	1137 SILVER BEACH RD	$ 85,366.00	$ 16,475.86	$ 101,841.86
19	1129 SILVER BEACH RD	$ 85,366.00	$ 16,475.86	$ 101,841.86
20	1121 SILVER BEACH RD	$ 85,366.00	$ 16,475.86	$ 101,841.86
21	116 REED RD 1	$ 85,366.00	$ 16,475.86	$ 101,841.86
22	116 REED RD 6	$ 85,366.00	$ 16,475.86	$ 101,841.86
23	1061 SILVER BEACH RD 1	$ 85,366.00	$ 16,475.86	$ 101,841.86
24	109 REED RD	$ 85,366.00	$ 16,475.86	$ 101,841.86
25	111 REED RD	$ 85,366.00	$ 16,475.86	$ 101,841.86
26	117 REED RD	$ 85,366.00	$ 16,475.86	$ 101,841.86
27	202 OLD DIXIE HWY	$ 85,366.00	$ 16,475.86	$ 101,841.86
28	1045 SILVER BEACH RD	$ 93,116.00	$ 16,475.86	$ 109,591.86
29	102 OLD DIXIE HWY	$ 93,116.00	$ 16,475.86	$ 109,591.86
	Total SOUTH - SECTION	$ 2,618,408.00	$ 477,800.00	$ 3,096,208.00

***Refer to Appendix I for Breakdown of Estimated Offsite Cost, and Appendix F for onsite cost.**

***Estimated Costs Include Mobilization, Demobilization, MOT, Insurance, Continency, Legal, Engineering, & Administration**

TOWN OF LAKE PARK
ENGINEER'S OPINION OF PROBABLE COST
LOW PRESSURE SEWER SYSTEM - TOTAL COST SUMMARY BY PROPERTY
JOB NO. 18187.27
APRIL 2022

	MID-SECTION	*Estimated Onsite Cost	*Estimated Offsite Cost	Total
30	410 OLD DIXIE HWY	$ 85,366.00	$ 48,183.33	$ 133,549.33
31	1215 INDUSTRIAL AVE	$ 85,366.00	$ 48,183.33	$ 133,549.33
32	640 OLD DIXIE HWY	$ 134,238.00	$ 48,183.33	$ 182,421.33
33	700 OLD DIXIE HWY 101	$ 85,366.00	$ 48,183.33	$ 133,549.33
34	1107 OLD DIXIE HWY A	$ 93,116.00	$ 48,183.33	$ 141,299.33
35	1101 OLD DIXIE HWY	$ 93,116.00	$ 48,183.33	$ 141,299.33
	Total MID-SECTION	$ 576,568.00	$ 289,100.00	$ 865,668.00

***Refer to Appendix I for Breakdown of Estimated Offsite Cost, and Appendix F for onsite cost.**

***Estimated Costs Include Mobilization, Demobilization, MOT, Insurance, Continency, Legal, Engineering, & Administration**

	NORTH-SECTION	*Estimated Onsite Cost	*Estimated Offsite Cost	Total
36	1133 OLD DIXIE HWY 1	$ 85,366.00	$ 38,957.14	$ 124,323.14
37	1145 OLD DIXIE HWY A1	$ 93,116.00	$ 38,957.14	$ 132,073.14
38	1183 OLD DIXIE HWY A1	$ 85,366.00	$ 38,957.14	$ 124,323.14
39	1173 OLD DIXIE HWY	$ 85,366.00	$ 38,957.14	$ 124,323.14
40	1169 OLD DIXIE HWY A10	$ 85,366.00	$ 38,957.14	$ 124,323.14
41	1139 OLD DIXIE HWY	$ 85,366.00	$ 38,957.14	$ 124,323.14
42	800 RAILROAD AVE	$ 85,366.00	$ 38,957.14	$ 124,323.14
	Total NORTH - SECTION	$ 605,312.00	$ 272,700.00	$ 878,012.00

***Refer to Appendix I for Breakdown of Estimated Offsite Cost, and Appendix F for onsite cost.**

***Estimated Onsite Cost Included with Mobilization, Demobilization, MOT, Insurance Continency, Legal, Engineering & Administration**

	GRAND TOTAL (ALL 3 SECTION)	**$ 3,800,288.00**	**$ 1,039,600.00**	**$ 4,839,888.00**

Notes: Number of units are an estimate only. Costs are based on conceptual plans and unit costs at the time of this report.

Appendix L

Property Information Summary

TOWN OF LAKE PARK
PROPERTY INFORMATION
JOB NO. 18187.27
SEPTEMBER 2021

Property	Address	PCN	Zoning	2020 Taxes Paid	Actual usage (Average Gallons per Month in 2020 (in thousands)	Building Size (SF)	Gallons Per Day (0.1 GPD per SF)	ERCs
	SOUTH - SECTION			$ -				
1	1306 SILVER BEACH RD	36434220000007170	CLIC	$ 31,209.00	0	1,860	186	1
2	1211 SILVER BEACH RD	36434220070040060	CLIC	$ 5,447.00	0	3,000	300	1
3	1201 SILVER BEACH RD	36434220070040070	CLIC	$ 11,289.00	17.7	8,440	844	1
4	108 MILLER WAY	36434220070040050	CLIC	$ 9,310.00	1	6,000	600	1
5	116 MILLER WAY 1	36434220070040040	CLIC	$ 9,392.00	5.6	5,250	525	1
6	124 MILLER WAY 1	36434220070040030	CLIC	$ 11,713.00	5.6	5,250	525	1
7	132 MILLER WAY 1	36434220070040020	CLIC	$ 13,058.00	2.5	7,200	720	1
8	212 NEWMAN RD A	36434220000005110	CLIC	$ 43,254.00	5.4	30,400	3040	1
9	210 NEWMAN RD A	36434220000005120	CLIC	$ 41,617.00	73.9	20,750	2075	1
10	210 BRANT RD 1	36434220070040010	CLIC	$ 56,866.00	73.9	33,600	3360	1
11	207 BRANT RD	36434220070010010	CLIC	$ 9,119.00	2.6	4,369	436.9	1
12	1009 NEWMAN RD	36434220070010020	CLIC	$ 18,932.00	5.1	10,000	1000	1
13	1001 NEWMAN RD	36434220070010030	CLIC	$ 14,116.00	2.3	6,480	648	1
14	133 MILLER WAY A	36434220070030010	CLIC	$ 9,587.00	0.8	4,500	450	1
15	125 MILLER WAY 1	36434220070030011	CLIC	$ 11,863.00	0.6	6,000	600	1
16	117 MILLER WA	36434220070030031	CLIC	$ 14,140.00	21.1	4,048	404.8	1
17	109 MILLER WAY 1	36434220070030040	CLIC	$ 11,886.00	7.4	6,195	619.5	1
18	1137 SILVER BEACH RD	36434220070030050	CLIC	$ 14,321.00	24.9	6,600	660	1
19	1129 SILVER BEACH RD	36434220070030070	CLIC	$ 6,015.00	2.9	2,400	240	1
20	1121 SILVER BEACH RD	36434220070030080	CLIC	$ 17,602.00	4.1	7,680	768	1
21	116 REED RD 1	36434220070030120	CLIC	$ 15,268.00	2.2	8,280	828	1
22	116 REED RD 6	36434220070030130	CLIC	$ 18,024.00	2.2	9,300	930	1
23	1061 SILVER BEACH RD 1	36434220070020050	CLIC	$ 13,967.00	2.4	8,760	876	1
24	109 REED RD	36434220070020041	CLIC	$ 7,929.00	1.7	3,432	343.2	1
25	111 REED RD	36434220070020032	CLIC	$ 6,416.00	4.2	2,160	216	1
26	117 REED RD	36434220070020020	CLIC	$ 19,629.00	1.1	11,588	1158.8	1
27	202 OLD DIXIE HWY	36434220070020010	CLIC	$ 41,492.00	16.2	26,906	2690.6	1
28	1045 SILVER BEACH RD	36434220000005100	CLIC	$ 6,693.00	1.9	3,836	383.6	1
29	102 OLD DIXIE HWY	36434220000005080	CLIC	$ 8,818.00	44.9	1,431	143.1	1
	MID-SECTION							
30	410 OLD DIXIE HWY	36434220000007010	CLIC	$ 16,082.00	16.6	6,060	606	1
31	1215 INDUSTRIAL AVE	36434220000007040	CLIC	$ 6,678.00	0.0	2,923	292.3	1
32	640 OLD DIXIE HWY	36434220000007191	CSV	$ -	11.7	10,235	1023.5	1
33	700 OLD DIXIE HWY 101	36434220000007100	CLIC	$ 27,954.00	4.7	13,124	1312.4	1
34	1107 OLD DIXIE HWY A	36434220000007120	CLIC	$ 23,639.00	5.9	8,750	875	1
35	1101 OLD DIXIE HWY	36434220000007153	CLIC	$ 7,867.00	2.1	5,888	588.8	1
	NORTH-SECTION							
36	1133 OLD DIXIE HWY 1	36434220110000010	C4	$ 3,696.00	16.4	12,200	1220	1
37	1145 OLD DIXIE HWY A1	36434220000003110	C4	$ 24,651.00	6.7	11,362	1136.2	1
38	1183 OLD DIXIE HWY A1	36434220000003151	C4	$ 43,432.00	13.4	24,742	2474.2	1
39	1173 OLD DIXIE HWY	36434220000003152	C4	$ 13,670.00	19.1	4,700	470	1
40	1169 OLD DIXIE HWY A10	36434220000003140	C4	$ 17,693.00	3.3	8,575	857.5	1
41	1139 OLD DIXIE HWY	36434220000003130	C4	$ 9,404.00	7.7	4,200	420	1
42	800 RAILROAD AVE	36434220000003200	C4	$ 61,653.00		8,168	816.8	1
	TOTAL			**$ 755,391.00**	**441.7**	**376,642**	**37,664**	

Appendix M

Septic to Sewer Alternative Comparison

Septic to Sewer Alternative Comparison

April, 2022
Project No. 18187.27

Existing Conditions

		Conceptual Construction Cost	Disruption During Construction	Landowner Maintenance Obligation	Re-development Opportunity	Current Challenges
Existing Systems	Existing Septic (42 Units)	N/A	N/A	Moderate	Limited, due to lower capacity of septic systems,	Routine maintenance of existing septic system and drain field

Summary of Options

		Estimated Conceptual Construction Cost	Disruption During Construction	Landowner Maintenance Obligation	Re-development Opportunity	Future Challenges to Landowner
Proposed Alternatives	Proposed Gravity/ Low Pressure Combination System	$4.70 million	High	Low	Greater potential	Routine maintenance of onsite pump stations where proposed.
	Proposed Low Pressure System	$4.84 million	Low	Moderate	Greater potential	Routine maintenance of onsite pump stations where proposed.

Appendix N

EPA Fact Sheets for Force Mains, Lift Stations and Low Pressure Systems

United States Environmental Protection Agency | Office of Water Washington, D.C. | EPA 832-F-00-071 September 2000

Wastewater Technology Fact Sheet
Sewers, Force Main

DESCRIPTION

Force mains are pipelines that convey wastewater under pressure from the discharge side of a pump or pneumatic ejector to a discharge point. Pumps or compressors located in a lift station provide the energy for wastewater conveyance in force mains. The key elements of force mains are:

1. Pipe.
2. Valves.
3. Pressure surge control devices.
4. Force main cleaning system.

Force mains are constructed from various materials and come in a wide range of diameters. Wastewater quality governs the selection of the most suitable pipe material. Operating pressure and corrosion resistance also impact the choice. Pipeline size and wall thickness are determined by wastewater flow, operating pressure, and trench conditions.

Common Modifications

Force mains may be aerated or the wastewater chlorinated at the pump station to prevent odors and excessive corrosion. Pressure surge control devices are installed to reduce pipeline pressure below a safe operating pressure during lift station start-up and shut-off. Typically, automatically operated valves (cone or ball type) control pressure surges at the pump discharge or pressure surge tanks. Normally, force main cleaning includes running a manufactured "pigging" device through the line and long force mains are typically equipped with "pig" insertion and retrieval stations. In most cases, insertion facilities are located within the lift station and the pig removal station is at the discharge point of the force main. Several launching and retrieval stations are usually provided in long force mains to facilitate cleaning of the pipeline.

APPLICABILITY

Force mains are used to convey wastewater from a lower to higher elevation, particularly where the elevation of the source is not sufficient for gravity flow and/or the use of gravity conveyance will result in excessive excavation depths and high sewer pipeline construction costs.

Ductile iron and polyvinyl chloride (PVC) are the most frequently used materials for wastewater force mains. Ductile iron pipe has particular advantages in wastewater collection systems due to its high strength and high flow capacity with greater than nominal inside diameters and tight joints. For special corrosive conditions and extremely high flow characteristics, polyethylene-lined ductile iron pipe and fittings are widely used.

Cast iron pipe with glass lining is available in standard pipe sizes, with most joints in lengths up to 6.1 meters (20 feet). Corrosion-resistant plastic lined piping systems are used for certain waste carrying applications. Polyethylene-lined ductile iron pipe and fittings known as "poly-bond-lined" pipe is widely used for force mains conveying highly corrosive industrial or municipal wastewater.

The types of thermoplastic pipe materials used for force main service are PVC, acrylonitrile-butadiene-styrene (ABS), and polyethylene (PE).

The corrosion resistance, light weight, and low hydraulic friction characteristics of these materials offer certain advantages for different force main applications, including resistance to microbial attack. Typically, PVC pipes are available in standard diameters of 100 to 900 mm (4 to 36 inches) and their laying lengths normally range from 3 to 6 meters (10 to 20 feet). The use of composite material pipes, such as fiberglass reinforced mortar pipe ("truss pipe"), is increasing in the construction of force mains. A truss pipe is constructed on concentric ABS cylinders with annular space filled with cement. Pipe fabricated of fiberglass reinforced epoxy resin is almost as strong as steel, as well as corrosion and abrasion resistant.

Certain types of asbestos-cement pipe are applicable in construction of wastewater force mains. The advantage of asbestos-cement pipes in sewer applications is their low hydraulic friction. These pipes are relatively lightweight, allowing long laying lengths in long lines. Asbestos-cement pipes are also highly corrosion resistant. At one time it was thought that many asbestos containing products (including asbestos-cement pipe) would be banned by the Environmental Protection Agency. However, a court ruling overturned this ban and this pipe is available and still used for wastewater force main applications (Sanks, 1998).

Force mains are very reliable when they are properly designed and maintained. In general, force main reliability and useful life are comparable to that of gravity sewer lines, but pipeline reliability may be compromised by excessive pressure surges, corrosion, or lack of routine maintenance.

ADVANTAGES AND DISADVANTAGES

Advantages

Use of force mains can significantly reduce the size and depth of sewer lines and decrease the overall costs of sewer system construction. Typically, when gravity sewers are installed in trenches deeper than 6.1 meters (20 feet), the cost of sewer line installation increases significantly because more complex and costly excavation equipment and trench shoring techniques are required. Usually, the diameter of pressurized force mains is one to two sizes smaller than the diameter of gravity sewer lines conveying the same flow, allowing significant pipeline cost reduction. Force main installation is simple because of shallower pipeline trenches and reduced quantity of earthwork. Installation of force mains is not dependent on site specific topographic conditions and is not impacted by available terrain slope, which typically limits gravity wastewater conveyance.

Disadvantages

While construction of force mains is less expensive than gravity sewer lines for the same flow, force main wastewater conveyance requires the construction and operation of one or more lift stations. Wastewater pumping and use of force mains could be eliminated or reduced by selecting alternative sewer routes, consolidating a proposed lift station with an existing lift station, or extending a gravity sewer using directional drilling or other state-of-the art deep excavation methods.

The dissolved oxygen content of the wastewater is often depleted in the wet-well of the lift station, and its subsequent passage through the force main results in the discharge of septic wastewater, which not only lacks oxygen but often contains sulfides. Frequent cleaning and maintenance of force mains is required to remove solids and grease buildup and minimize corrosion due to the high concentration of sulfides.

Pressure surges are abrupt increases in operating pressure in force mains which typically occur during pump start-up and shut-off. Pressure surges may have negative effects on force main integrity but can be reduced by proper pump station and pipeline design.

DESIGN CRITERIA

Force main design is typically integrated with lift station design. The major factors to consider in analyzing force main materials and hydraulics include the design formula for sizing the pipe, friction losses, pressure surges, and maintenance. The Hazen-Williams formula is recommended for the design of force mains. This formula includes a roughness coefficient C, which accounts for pipeline hydraulic friction characteristics. The roughness coefficient varies with pipe material, size, and age.

Force Main Pipe Materials

Selection criteria for force main pipe materials include:

1. Wastewater quantity, quality, and pressure.

2. Pipe properties, such as strength, ease of handling, and corrosion resistance.

3. Availability of appropriate sizes, wall thickness, and fittings.

4. Hydraulic friction characteristics

5. Cost.

Ductile iron pipe offers strength, stiffness, ductility, and a range of sizes and thicknesses and is the typical choice for high-pressure and exposed piping. Plastic pipe is most widely used in short force mains and smaller diameters. Table 1 lists the types of pipe recommended for use in a force main system and suggested applications.

Velocity

Force mains from the lift station are typically designed for velocities between 0.6 to 2.4 meters per second (2 to 8 feet per second). Such velocities are normally based on the most economical pipe diameters and typical available heads. For shorter force mains (less than 610 meters or 2,000 feet) and low lift requirements (less than 9.1 meters or 30 feet), the recommended design force main velocity range is 1.8 to 2.7 meters per second (6 to 9 feet per second). This higher design velocity allows the use of smaller pipe, reducing construction costs. Higher velocity also increases pipeline friction loss by more than 50 percent, resulting in increased energy costs. To reduce the velocity, a reducer pipe or a pipe valve can be used. Reducer pipes are often used because of the costly nature of pipe valves. These reducer pipes, which are larger in diameter, help to disperse the flow, therefore reducing the velocity.

The maximum force main velocity at peak conditions is recommended not to exceed 3 meters per second (10 feet per second). Table 2 provides examples of force main capacities at various pipeline sizes, materials, and velocities. The flow volumes may vary depending on the pipe material used.

TABLE 1 CHARACTERISTICS OF COMMON FORCE MAIN PIPE MATERIALS

Material	Application	Key Advantages	Key Disadvantages
Cast or Ductile Iron, Cement Lined	High pressure Available sizes of 4-54 inches	Good resistance to pressure surges	More expensive than concrete and fiberglass
Steel, Cement Lined	High pressure All pipe sizes	Excellent resistance to pressure surges	More expensive than concrete and fiberglass
Asbestos Cement	Moderate pressure For 36-inch + pipe sizes	No corrosion Slow grease buildup	Relatively brittle
Fiberglass Reinforced Epoxy Pipe	Moderate pressure For up to 36-inch pipe sizes	No corrosion Slow grease buildup	350 psi max pressure
Plastic	Low pressure For up to 36-inch pipe sizes	No corrosion Slow grease buildup	Suitable for small pipe sizes and low pressure only

Source: Sanks, 1998.

TABLE 2 FORCE MAIN CAPACITY

Diameter (inches)	Velocity = 2 fps gpm	lps	Velocity = 4 fps gpm	lps	Velocity = 6 fps gpm	lps
6	176	11	362	22	528	33
8	313	20	626	40	626	60
10	490	31	980	62	1,470	93
18	1,585	100	3,170	200	4,755	300
24	2,819	178	5,638	356	8,457	534
36	6,342	400	12,684	800	19,026	1,200

Source: Metcalf and Eddy, 1981.

Vertical Alignment

Force mains should be designed so that they are always full and pressure in the pipe is greater than 69 kiloPascals (10 pounds per square inch) to prevent the release of gases. Low and high points in the vertical alignment should be avoided; considerable effort and expense are justified to maintain an uphill slope from the lift station to the discharge point. High points in force mains trap air, which reduces available pipe area, causes non-uniform flow, and creates the potential for sulfide corrosion. Gas relief and vacuum valves are often installed if high points in the alignment of force mains cannot be avoided, while blowoffs are installed at low points.

Pressure Surges

The possibility of sudden changes in pressure (pressure surges) in the force main due to starting and/or stopping pumps (or operation of valves appurtenant to a pump) must be considered during design. The duration of such pressure surges ranges between 2 to 15 seconds. Each surge is site specific and depends on pipeline profile, flow, change in velocity, inertia of the pumping equipment, valve characteristics, pipeline materials, and pipeline accessories. Critical surges may be caused by power failure. If pressure surge is a concern, the force main should be designed to withstand calculated maximum surge pressures.

Valves

Valves are installed to regulate wastewater flow and pressure in the force mains. Valves can be used to stop and start flow, control the flow rate, divert the flow, prevent backflow, and control and relieve the pressure. The number, type, and location of force main valves depends on the operating pressures and potential surge conditions in the pipeline. Although valves have a lot of benefits, the costliness of them prevents them from being used extensively.

PERFORMANCE

Force main performance is closely tied to the performance of the lift station to which it is connected. Pump-force main performance curves are used to define and compare the operating characteristics of a given pump or set of pumps along with the associated force main. They are also used to identify the best combination of performance characteristics under which the lift station-force main system will operate under typical conditions (flows and pressures). Properly designed pump-force main systems usually allow the lift station pumps to operate at 35 to 55 percent efficiency most of the time. Overall pump efficiency depends on the type of pumps, their control system, and the fluctuation of the influent wastewater flow.

OPERATION AND MAINTENANCE

The operation of force main-lift station systems is usually automated and does not require continuous on-site operator presence. However, annual force main route inspections are recommended to ensure normal functioning and to identify potential problems.

Special attention is given to the integrity of the force main surface and pipeline connections, unusual noise, vibration, pipe and pipe joint leakage and displacement, valving arrangement and leakage, lift station operation and performance, discharge pump rates and pump speed, and pump suction and discharge pressures. Depending on the overall performance of the lift station-force main system, the extent of grease build-up and the need for pipeline pigging are also assessed.

If there is an excessive increase in pump head and the headloss increase is caused by grease build-up, the pipeline is pigged. Corrosion is rarely a problem since pipes are primarily constructed of ductile iron or plastic, which are highly resistant to corrosion. Buildup can be removed by pigging the pipeline.

COSTS

Force main costs depend on many factors including:

1. Conveyed wastewater quantity and quality.
2. Force main length.
3. Operating pressure.
4. Soil properties and underground conditions.
5. Pipeline trench depth.
6. Appurtenances such as valves and blowoffs.
7. Community impacts.

These site and system specific factors must be examined and incorporated in the preparation of force main cost estimates.

Construction Costs

Unit force main construction costs are usually expressed in $ per linear foot of installed pipeline and costs typically include labor and the equipment and materials required for pipeline installation. Table 3 unit pipeline construction costs for ductile iron and plastic (PVC) pipes used for force main construction. These costs are base installation costs and do not include the following:

1. General contractor overhead and profit.
2. Engineering and construction management.
3. Land or right-of-way acquisition.
4. Legal, fiscal, and administrative costs.
5. Interest during construction.
6. Community impacts.

All unit pipeline costs are adjusted to 1999 dollars.

TABLE 3 CONSTRUCTION COSTS FOR DUCTILE IRON AND PLASTIC PIPES

Pipe Diameter (inches)	Ductile Iron Pipe ($/linear foot)	PVC Pressure Pipe ($/linear foot)
8	23	15
10	29	20
12	36	26
14	46	33
16	53	41
18	66	48
20	72	56
24	84	65
30	142	90
36	190	135

Source: James M. Montgomery Consulting Engineers, 1998.

Operation and Maintenance Costs

Force main operation and maintenance costs include labor and maintenance requirements. Typically, labor costs account for 85 to 95 percent of total operation and maintenance costs and are dependent on the force main length. The maintenance costs usually vary from $7 to $20/meter ($2 to $6/linear foot), depending on the size and number of appurtenances installed on the force main. An internal inspection using TV equipment can be completed, if visual inspection is not sufficient. TV inspection can be costly, ranging from $1,000 to $11,450 per mile with an average cost of $4,600 per mile (WERF, 1997; Arbour and Kerri, 1997).

Table 4 summarizes force main construction costs from several projects, adjusted to 1999 dollars.

TABLE 4 FORCE MAIN CONSTRUCTION COSTS

Project/ Location	Force Main Average Capacity (mgd)	Construction Costs ($US/linear foot)
Compton, CA	8	70
Oceanside, CA	18	85
Eugene, OR	12	90
CMCWD I, CA	42	510
CMCWD II, CA	30	260
Goleta, CA	56	365
Gillette, WY	30	120

Source: James M. Montgomery Consulting Engineers, 1998.

REFERENCES

Other Related Fact Sheets

Sewers, Lift Stations
EPA 832-F-00-073
September 2000

Pipe Construction and Materials
EPA 832-F-00-068
September 2000

Sewer Cleaning and Inspection
EPA 832-F-99-031
September 1999

Other EPA Fact Sheets can be found at the following web address:
http://www.epa.gov/owmitnet/mtbfact.htm

1. Arbour, R. and K. Kerri, 1997. *Collection Systems: Methods for Evaluating and Improving Performance*. Prepared for the EPA Office of Wastewater Management by the California State University, Sacramento, CA.

2. Bethany R. B. May 1994. *Pressure Reducing Stations – A Key to Networked Interceptor System Operations*. Operations Forum,Vol. 11, No. 5, 8-12.

3. Casada, Don. May 1998. *Pump Optimization for Changing Needs*. Operations Forum. Vol. 9, No. 5, 14-18.

4. Huges D. M. and R.G. Cornforth. May 1997. *The Importance of Surge Protection in Avoiding Pump Station Failures*. Operations Forum,Vol. 14, No. 5, 25-28.

5. Horton A. M. October 1996. *Protective Linings for Ductile Iron Pipe in Wastewater Service.* In Proceedings of the Water Environment Federation. 69th Annual Conference & Exposition, Dallas, Texas, Vol. 3.

6. Jackson J. K. May 1996. *Variable Speed Pumping Brings Efficiency to Pump Systems*. Operations Forum, Vol. 13, No. 5, 21-24.

7. James M. Montgomery Consulting Engineers, 1988. "Sewerage System Preliminary Cost Estimating Curves."

8. Metcalf & Eddy Inc., 1981. *Wastewater Engineering: Collection and Pumping of Wastewater*, McGraw Hill Book Company.

9. Moody T. C. October 1998. *Optimizing Force Main Odor Control Chemical Dosage: A Tale of Two Systems.* In Proceedings of the Water Environment Federation, 71st Annual Conference, Orlando, Florida, Vol. 2.

10. Paschke N.W. May 1997. *Pump Station Basics – Design Considerations for a Reliable Pump Station*. Operations Forum, Vol. 14, No. 5 15-20.

11. Prasuhn, A.L. 1987. *Fundamentals of Hydraulic Engineering*, Holt, Rinehart and Winston, New York.

12. Robinson, P. E., Aguiar G., Grant M. October 1995. *Fast Tracking the Critical Dade County Cross Bay Transmission Line.* In Proceedings of the Water Environment Federation. 68th Annual Conference & Exposition, Miami Beach, Florida, Vol. 3.

13. Sanks R. L., Tchobanoglous G., Newton D., Bosserman, B.E., Jones, G. M. 1998. *Pump Station Design*, Butterworths, Boston.

14. Seigal S.E. May 1994. *Upgraded to the World's Largest. Dry-Pit/Submerged Pumps Make the Grade*. Operations Forum, Vol. 11, No. 5, 24-28.

15. Smith E. C. July 1994. *Don't Lose the Pump Efficiency Game*. Operations Forum,Vol. 11, No. 7, 18-21.

16. U.S. Environmental Protection Agency. October 1985. *Design Manual. Odor and Corrosion Control in Sanitary Sewerage Systems and Treatment Plants*. EPA/625/1-85/018.

17. Water Environment Federation. 1994. Existing Sewer Evaluation and Rehabilitation. Manual of Practice No. FD6.

18. Water Environment Federation. 1985. *Operations and Maintenance of Wastewater Collection Systems. Manual of Practice No. 7*.

19. Water Environment Federation. 1992. *Wastewater Collection Systems Management. Manual of Practice No. 7*.

20. Water Environment Research Federation (WERF), 1997. *Benchmarking Wastewate Operations - Collection, Treatment, and Biosolids Management*. Project 96-CTS-5.

21. Workman G., and M.D. Johnson. October 1994. *Automation Takes Lift Station to New Heights.* Operations Forum, Vol. 11, No. 10, 14-16.

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United States Environmental Protection Agency
Office of Water Washington, D.C.
EPA 832-F-00-073 September 2000

Collection Systems Technology Fact Sheet
Sewers, Lift Station

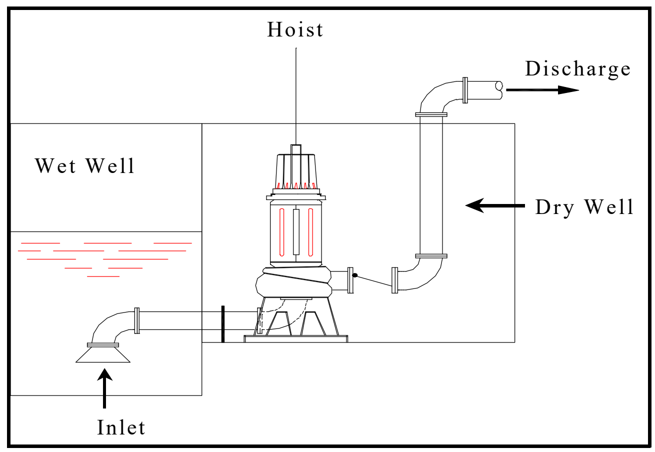
DESCRIPTION

Wastewater lift stations are facilities designed to move wastewater from lower to higher elevation through pipes. Key elements of lift stations include a wastewater receiving well (wet-well), often equipped with a screen or grinding to remove coarse materials; pumps and piping with associated valves; motors; a power supply system; an equipment control and alarm system; and an odor control system and ventilation system.

Lift station equipment and systems are often installed in an enclosed structure. They can be constructed on-site (custom-designed) or pre-fabricated. Lift station capacities range from 76 liters per minute (20 gallons per minute) to more than 378,500 liters per minute (100,000 gallons per minute). Pre-fabricated lift stations generally have capacities of up to 38,000 liters per minute (10,000 gallons per minute). Centrifugal pumps are commonly used in lift stations. A trapped air column, or bubbler system, that senses pressure and level is commonly used for pump station control. Other control alternatives include electrodes placed at cut-off levels, floats, mechanical clutches, and floating mercury switches. A more sophisticated control operation involves the use of variable speed drives.

Lift stations are typically provided with equipment for easy pump removal. Floor access hatches or openings above the pump room and an overhead monorail beam, bridge crane, or portable hoist are commonly used.

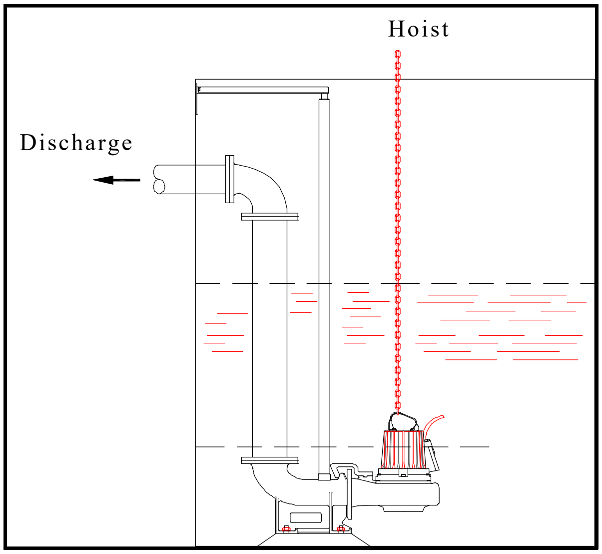
The two most common types of lift stations are the dry-pit or dry-well and submersible lift stations. In dry-well lift stations, pumps and valves are housed in a pump room (dry pit or dry-well), that is easily accessible. The wet-well is a separate chamber attached or located adjacent to the dry-well (pump room) structure. Figures 1 and 2 illustrate the two types of pumps.



Source: Qasim, 1994.

FIGURE 1 DRY-WELL PUMP

Submersible lift stations do not have a separate pump room; the lift station header piping, associated valves, and flow meters are located in a separate dry vault at grade for easy access. Submersible lift stations include sealed pumps that operate submerged in the wet-well. These are removed to the surface periodically and reinstalled using guide rails and a hoist. A key advantage of dry-well lift stations is that they allow easy access for routine visual inspection and maintenance. In general, they are easier to repair than submersible pumps. An advantage of submersible lift stations is that they typically cost less than dry-well stations and operate without frequent pump maintenance. Submersible lift stations do not usually include



Source: Qasim, 1994.

FIGURE 2 WET-WELL SUBMERSIBLE

large aboveground structures and tend to blend in with their surrounding environment in residential areas. They require less space and are easier and less expensive to construct for wastewater flow capacities of 38,000 liters per minute (10,000 gallons per minute) or less.

APPLICABILITY

Lift stations are used to move wastewater from lower to higher elevation, particularly where the elevation of the source is not sufficient for gravity flow and/or when the use of gravity conveyance will result in excessive excavation depths and high sewer construction costs.

Current Status

Lift stations are widely used in wastewater conveyance systems. Dry-well lift stations have been used in the industry for many years. However, the current industry-wide trend is to replace dry-well lift stations of small and medium size (typically less than 24,000 liters per minute or 6,350 gallons per minute) with submersible lift stations mainly because of lower costs, a smaller footprint, and simplified operation and maintenance.

Variable speed pumping is often used to optimize pump performance and minimize power use. Several types of variable-speed pumping equipment are available, including variable voltage and frequency drives, eddy current couplings, and mechanical variable-speed drives. Variable-speed pumping can reduce the size and cost of the wet-well and allows the pumps to operate at maximum efficiency under a variety of flow conditions. Because variable-speed pumping allows lift station discharge to match inflow, only nominal wet-well storage volume is required and the well water level is maintained at a near constant elevation. Variable-speed pumping may allow a given flow range to be achieved with fewer pumps than a constant-speed alternative. Variable-speed stations also minimize the number of pump starts and stops, reducing mechanical wear. Although there is significant energy saving potential for stations with large friction losses, it may not justify the additional capital costs unless the cost of power is relatively high. Variable speed equipment also requires more room within the lift station and may produce more noise and heat than constant speed pumps.

Lift stations are complex facilities with many auxiliary systems. Therefore, they are less reliable than gravity wastewater conveyance. However, lift station reliability can be significantly improved by providing stand-by equipment (pumps and controls) and emergency power supply systems. In addition, lift station reliability is improved by using non-clog pumps suitable for the particular wastewater quality and by applying emergency alarm and automatic control systems.

ADVANTAGES AND DISADVANTAGES

Advantages

Lift stations are used to reduce the capital cost of sewer system construction. When gravity sewers are installed in trenches deeper than three meters (10 feet), the cost of sewer line installation increases significantly because of the more complex and costly excavation equipment and trench shoring techniques required. The size of the gravity sewer lines is dependent on the minimum pipe slope and flow. Pumping wastewater can convey the same flow using smaller pipeline size at shallower depth, and thereby, reducing pipeline costs.

Disadvantages

Compared to sewer lines where gravity drives wastewater flow, lift stations require a source of electric power. If the power supply is interrupted, flow conveyance is discontinued and can result in flooding upstream of the lift station, It can also interrupt the normal operation of the downstream wastewater conveyance and treatment facilities. This limitation is typically addressed by providing an emergency power supply.

Key disadvantages of lift stations include the high cost to construct and maintain and the potential for odors and noise. Lift stations also require a significant amount of power, are sometimes expensive to upgrade, and may create public concerns and negative public reaction.

The low cost of gravity wastewater conveyance and the higher costs of building, operating, and maintaining lift stations means that wastewater pumping should be avoided, if possible and technically feasible. Wastewater pumping can be eliminated or reduced by selecting alternative sewer routes or extending a gravity sewer using direction drilling or other state-of-the-art deep excavation methods. If such alternatives are viable, a cost-benefit analysis can determine if a lift station is the most viable choice.

DESIGN CRITERIA

Cost effective lift stations are designed to: (1) match pump capacity, type, and configuration with wastewater quantity and quality; (2) provide reliable and uninterruptible operation; (3) allow for easy operation and maintenance of the installed equipment; (4) accommodate future capacity expansion; (5) avoid septic conditions and excessive release of odors in the collection system and at the lift station; (6) minimize environmental and landscape impacts on the surrounding residential and commercial developments; and (7) avoid flooding of the lift station and the surrounding areas.

Wet-well

Wet-well design depends on the type of lift station configuration (submersible or dry-well) and the type of pump controls (constant or variable speed). Wet-wells are typically designed large enough to prevent rapid pump cycling but small enough to prevent a long detention time and associated odor release.

Wet-well maximum detention time in constant speed pumps is typically 20 to 30 minutes. Use of variable frequency drives for pump speed control allows wet-well detention time reduction to 5 to 15 minutes. The minimum recommended wet-well bottom slope is to 2:1 to allow self-cleaning and minimum deposit of debris. Effective volume of the wet-well may include sewer pipelines, especially when variable speed drives are used. Wet-wells should always hold some level of sewage to minimize odor release. Bar screens or grinders are often installed in or upstream of the wet-well to minimize pump clogging problems.

Wastewater Pumps

The number of wastewater pumps and associated capacity should be selected to provide head-capacity characteristics that correspond as nearly as possible to wastewater quantity fluctuations. This can be accomplished by preparing pump/pipeline system head-capacity curves showing all conditions of head (elevation of a free surface of water) and capacity under which the pumps will be required to operate.

The number of pumps to be installed in a lift station depends on the station capacity, the range of flow and the regulations. In small stations, with maximum inflows of less than 2,640 liters per minute (700 gallons per minute), two pumps are customarily installed, with each unit able to meet the maximum influent rate. For larger lift stations, the size and number of pumps should be selected so that the range of influent flow rates can be met without starting and stopping pumps too frequently and without excessive wet-well storage.

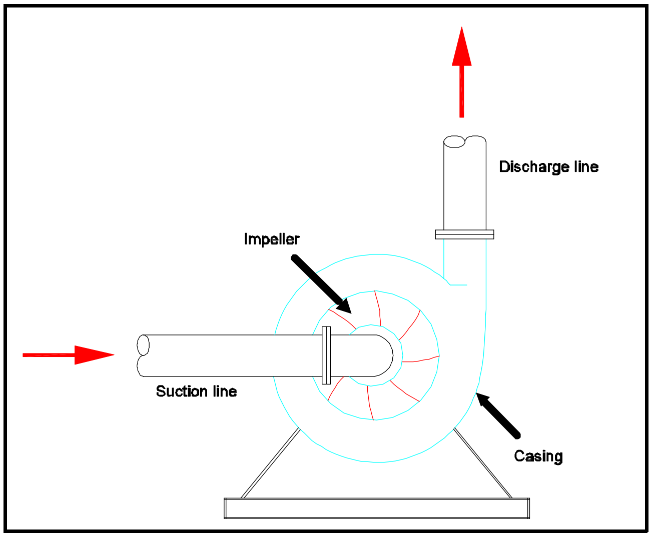
Depending on the system, the pumps are designed to run at a reduced rate. The pumps may also alternate to equalize wear and tear. Additional pumps may provide intermediate capacities better matched to typical daily flows. An alternative option is to provide flow flexibility with variable-speed pumps.

For pump stations with high head-losses, the single-pump flow approach is usually the most suitable. Parallel pumping is not as effective for such stations because two pumps operating together yield only slightly higher flows than one pump. If the peak flow is to be achieved with multiple pumps in parallel, the lift station must be equipped with at least three pumps: two duty pumps that together provide peak flow and one standby pump for emergency backup. Parallel peak pumping is typically used in large lift stations with relatively flat system head curves. Such curves allow multiple pumps to deliver substantially more flow than a single pump. The use of multiple pumps in parallel provides more flexibility.

Several types of centrifugal pumps are used in wastewater lift stations. In the straight-flow centrifugal pumps, wastewater does not change direction as it passes through the pumps and into the discharge pipe. These pumps are well suited for low-flow/high head conditions. In angle-flow pumps, wastewater enters the impeller axially and passes through the volute casing at 90 degrees to its original direction (Figure 3). This type of pump is appropriate for pumping against low or moderate heads. Mixed flow pumps are most viable for pumping large quantities of wastewater at low head. In these pumps, the outside diameter of the impeller is less than an ordinary centrifugal pump, increasing flow volume.

Ventilation

Ventilation and heating are required if the lift station includes an area routinely entered by personnel. Ventilation is particularly important to prevent the collection of toxic and/or explosive gases. According to the Nation Fire Protection Association (NFPA) Section 820, all continuous ventilation systems should be fitted with flow detection devices connected to alarm systems to indicate ventilation system failure. Dry-well ventilation codes typically require six continuous air changes per hour or 30 intermittent air changes per hour. Wet-wells typically require 12 continuous air changes per hour or 60 intermittent air changes per hour. Motor control center (MCC) rooms should have a ventilation system adequate to provide six air changes per hour and should be air conditioned to between 13 and 32 degrees Celsius (55 to 90 degrees F). If the control room is combined with an MCC room, the temperature should not exceed 30 degrees C or 85 degrees F. All other spaces should be designed for 12 air changes per hour. The minimum temperature should be 13 degrees C (55 degrees F) whenever chemicals are stored or used.



Source: Lindeburg, revised edition 1995.

FIGURE 3 CENTRIFUGAL ANGLE-FLOW PUMP

Odor Control

Odor control is frequently required for lift stations. A relatively simple and widely used odor control alternative is minimizing wet-well turbulence. More effective options include collection of odors generated at the lift station and treating them in scrubbers or biofilters or the addition of odor control chemicals to the sewer upstream of the lift station. Chemicals typically used for odor control include chlorine, hydrogen peroxide, metal salts (ferric chloride and ferrous sulfate) oxygen, air, and potassium permanganate. Chemicals should be closely monitored to avoid affecting downstream treatment processes, such as extended aeration.

Power Supply

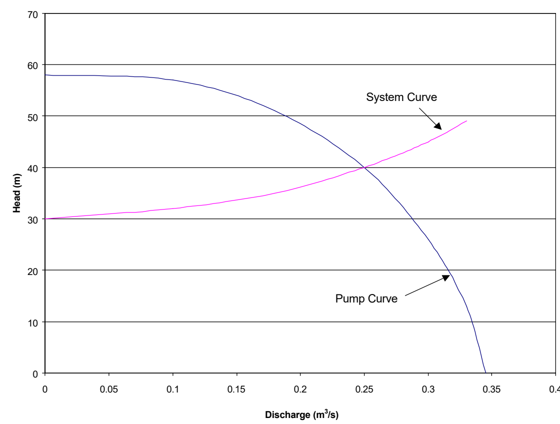
The reliability of power for the pump motor drives is a basic design consideration. Commonly used methods of emergency power supply include electric power feed from two independent power distribution lines; an on-site standby generator; an adequate portable generator with quick connection; a stand-by engine driven pump; ready access to a suitable portable pumping unit and appropriate connections; and availability of an adequate holding facility for wastewater storage upstream of the lift station.

PERFORMANCE

The overall performance of a lift station depends on the performance of the pumps. All pumps have four common performance characteristics: capacity, head, power, and overall efficiency. Capacity (flow rate) is the quantity of liquid pumped per unit of time, typically measured as gallons per minute (gpm) or million gallons per day (mgd). Head is the energy supplied to the wastewater per unit weight, typically expressed as feet of water. Power is the energy consumed by a pump per unit time, typically measured as kilowatt-hours. Overall efficiency is the ratio of useful hydraulic work performed to actual work input. Efficiency reflects the pump relative power losses and is usually measured as a percentage of applied power.

Pump performance curves (Figure 4) are used to define and compare the operating characteristics of a pump and to identify the best combination of performance characteristics under which a lift station pumping system will operate under typical conditions (flows and heads). Pump systems operate at 75 to 85 percent efficiency most of the time, while overall pump efficiency depends on the type of installed pumps, their control system, and the fluctuation of influent wastewater flow.

Performance optimization strategies focus on different ways to match pump operational characteristics with system flow and head requirements. They may include the following



Source: Adapted from Roberson and Crowe, 1993.

FIGURE 4 PUMP PERFORMANCE CURVE

options: adjusting system flow paths installing variable speed drives; using parallel pumps installing pumps of different sizes trimming a pump impeller; or putting a two-speed motor on one or more pumps in a lift station. Optimizing system performance may yield significant electrical energy savings.

OPERATION AND MAINTENANCE

Lift station operation is usually automated and does not require continuous on-site operator presence. However, frequent inspections are recommended to ensure normal functioning and to identify potential problems. Lift station inspection typically includes observation of pumps, motors and drives for unusual noise, vibration, heating and leakage, check of pump suction and discharge lines for valving arrangement and leakage, check of control panel switches for proper position, monitoring of discharge pump rates and pump speed, and monitoring of the pump suction and discharge pressure. Weekly inspections are typically conducted, although the frequency really depends on the size of the lift station.

If a lift station is equipped with grinder bar screens to remove coarse materials from the wastewater, these materials are collected in containers and disposed of to a sanitary landfill site as needed. If the lift station has a scrubber system for odor control, chemicals are supplied and replenished typically every three months. If chemicals are added for odor control ahead of the lift station, the chemical feed stations should be inspected weekly and chemicals replenished as needed.

The most labor-intensive task for lift stations is routine preventive maintenance. A well-planned maintenance program for lift station pumps prevents unnecessary equipment wear and downtime. Lift station operators must maintain an inventory of critical spare parts. The number of spare parts in the inventory depends on the critical needs of the unit, the rate at which the part normally fails, and the availability of the part. The operator should tabulate each pumping element in the system and its recommended spare parts. This information is typically available from the operation and maintenance manuals provided with the lift station.

COSTS

Lift station costs depend on many factors, including (1) wastewater quality, quantity, and projections; (2) zoning and land use planning of the area where the lift station will be located; (3) alternatives for standby power sources; (4) operation and maintenance needs and support; (5) soil properties and underground conditions; (6) required lift to the receiving (discharge) sewer line; (7) the severity of impact of accidental sewage spill upon the local area; and (8) the need for an odor control system. These site and system specific factors must be examined and incorporated in preparing a lift station cost estimate.

Construction Costs

The most important factors influencing cost are the design lift station capacity and the installed pump power. Another cost factor is the lift station complexity. Factors which classify a lift station as complex include two or more of the following: (1) extent of excavation; (2) congested site and/or restricted access; (3) rock excavation; (4) extensive dewatering requirements, such as cofferdams; (5) site conflicts, including modification or removal of existing facilities; (6) special foundations, including piling; (7) dual power supply and on-site switch stations and emergency power generator; and (8) high pumping heads (design heads in excess of 200 ft).

Mechanical, electrical, and control equipment delivered to a pumping station construction site typically account for 15 to 30 percent of total construction costs. Lift station construction has a significant economy-of-scale. Typically, if the capacity of a lift station is increased 100 percent, the construction cost would increase only 50 to 55 percent. An important consideration is that two identical lift stations will cost 25 to 30 percent more than a single station of the same combined capacity. Usually, complex lift stations cost two to three times more than more simple lift stations with no construction complications.

Table 1 provides examples of complex lift stations and associated construction costs in 1999 dollars.

TABLE 1 LIFT STATION CONSTRUCTION COSTS

Lift Station	Design Flowrate (MGD)	Construction Costs (1999 $US)
Cost curve data[1]	0.5	$134,467
Cost curve data[1]	1	$246,524
Cost curve data[1]	3	$392,197
Valencia, California[2]	6	$1,390,000
Sunneymead, California[2]	12	$3,320,000
Sunset/Heahfield, California[2]	14	$2,600,000
Springfield, Oregon Terry Street Pumping Station[2]	20	$5,470,000
Detroit, Michigan[2]	750	$128,800,000

Source: [1]Qasim, 1994 and [2] James M. Montgomery Consulting Engineers, 1998.

Operation and Maintenance Costs

Lift station operation and maintenance costs include power, labor, maintenance, and chemicals (if used for odor control). Usually, the costs for solids disposal are minimal, but are included if the lift station is equipped with bar screens to remove coarse materials from the wastewater. Typically, power costs account for 85 to 95 percent of the total operation and maintenance costs and are directly proportional to the unit cost of power and the actual power used by the lift station pumps. Labor costs average 1 to 2 percent of total costs. Annual maintenance costs vary, depending on the complexity of the equipment and instrumentation.

REFERENCES

Other Related Fact Sheets

Small Diameter Gravity Sewer
EPA 832-F-00-038
September 2000

In-Plant Pump Stations
EPA 832-F-00-069
September 2000

Other EPA Fact Sheets can be found at the following web address:
http://www.epa.gov/owmitnet/mtbfact.htm

1. Casada, Don. *Pump Optimization for Changing Needs*. Operations Forum. Vol. 9, No. 5, 14-18, May 1998.

2. Cavalieri R.R. and G. L. Devin. *Pitfalls in Wet Weather Pumped Facilities Design.* In Proceedings of the Water Environment Federation, 71st Annual Conference, Orlando, Florida, Vol. 2, 719-729, October 1998.

3. Gravette B. R. *Benefits of Dry-pit Submersible Pump Stations*. In Proceedings of the Water Environment Federation, 68th Annual Conference, Miami Beach, Florida, Vol. 3, 187-196, October 1995.

4. Graham B, J., Pinto T.G., and T. Southard. *Backyard Pumping Stations – The Low-pressure Grinder Systems That Call Old Septic Tanks Home.* Operations Forum,Vol. 10, No. 5, 25-29, May 1993.

5. Jackson J. K. Variable Speed Pumping Brings Efficiency to Pump Systems. Operations Forum, Vol. 13, No. 5, 21-24, May 1996.

6. James M. Montgomery Consulting Engineers, 1988. "Sewerage System Preliminary Cost Estimating Curves."

7. Lindeburg, Michael R. *Civil Engineering Reference Manual*, 6th ed., Professional Publications, Inc., revised edition 1995.

8. Makovics J. S. and M. Larkin. *Rehabilitating Existing Pumping Systems: Trips, Traps and Solutions*. Operations Forum, Vol. 9, No. 5, 10-17, May 1992.

9. Metcalf & Eddy Inc., *Wastewater Engineering: Collection and Pumping of Wastewater*, McGraw Hill Book Company, 1981.

10. National Fire Protection Association. *National Fire Codes.* Volume 7, Section 820. Quincy, Massachusetts, 1995.

11. Paschke N.W. *Pump Station Basics – Design Considerations for a Reliable Pump Station*. Operations Forum, Vol. 14, No. 5, 15-20, May 1997.

12. Public Works Journal. *The 1997 Public Works Manual*. April 15, 1997.

13. Qasim, Syed R. *Wastewater Treatment Plants - Planning Design, and Operation*. Technomic Publishing Company, Inc., 1994.

14. Russell Edward. *Screw-Pump Preservation.* Operations Forum, Vol. 9, No. 5, 18-19, May 1992.

15. Sanks R. L., Tchobanoglous G., Newton D., Bosserman, B.E., and Jones, G. M. *Pump Station Design*, Butterworths, Boston, 1998.

16. Schneller T. M. *Pumping it Up? Practical Means For Evaluating Lift Station Fitness*. In Proceedings of the Water Environment Federation, 68th Annual Conference, Miami Beach, Florida, Vol. 3, 155-166 October 1995.

17. Smith E. C. *Don't Lose the Pump Efficiency Game*. Operations Forum, Vol. 11, No. 7, 18-21, July 1994.

18. U.S. Environmental Protection Agency. *Design Manual. Odor and Corrosion Control in Sanitary Sewerage Systems and Treatment Plants*. EPA/625/1-85/018, October 1985.

19. Water Environment Federation. *Existing Sewer Evaluation and Rehabilitation. Manual of Practice No. FD6*, 1994.

20. Water Environment Federation. *Operations and Maintenance of Wastewater Collection Systems. Manual of Practice No. 7*, 1985.

21. Water Environment Federation. *Wastewater Collection Systems Management. Manual of Practice No. 7*, 1992.

22. Workman G. and M.D. Johnson. *Automation Takes Lift Station to New Heights*. Operations Forum, Vol. 11, No. 10, 14-16, October 1994.

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Wastewater Technology Fact Sheet
Sewers, Pressure

DESCRIPTION

Conventional Wastewater Collection System

Conventional wastewater collection systems transport sewage from homes or other sources by gravity flow through buried piping systems to a central treatment facility. These systems are usually reliable and consume no power. However, the slope requirements to maintain adequate flow by gravity may require deep excavations in hilly or flat terrain, as well as the addition of sewage pump stations, which can significantly increase the cost of conventional collection systems. Manholes and other sewer appurtenances also add substantial costs to conventional collection systems.

Alternative

Alternative wastewater collection systems can be cost effective for homes in areas where traditional collection systems are too expensive to install and operate. Pressure sewers are used in sparsely populated or suburban areas in which conventional collection systems would be expensive. These systems generally use smaller diameter pipes with a slight slope or follow the surface contour of the land, reducing excavation and construction costs.

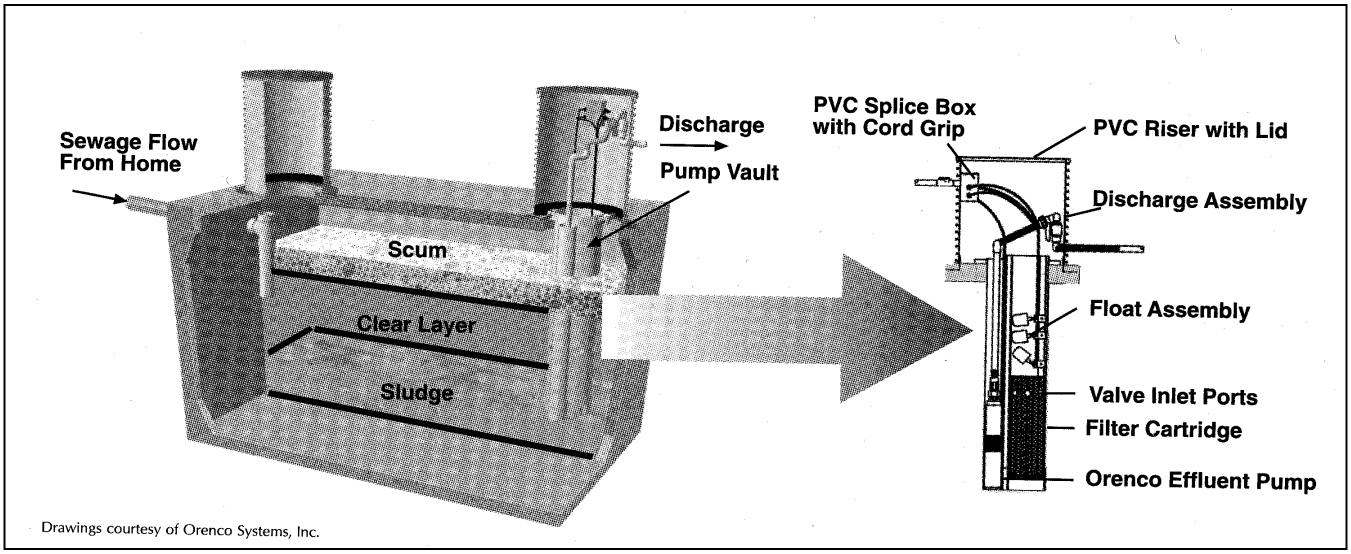
Pressure sewers differ from conventional gravity collection systems because they break down large solids in the pumping station before they are transported through the collection system. Their watertight design and the absence of manholes eliminates extraneous flows into the system. Thus, alternative sewer systems may be preferred in areas that have high groundwater that could seep into the sewer, increasing the amount of wastewater to be treated. They also protect groundwater sources by keeping wastewater in the sewer. The disadvantages of alternative sewage systems include increased energy demands, higher maintenance requirements, and greater on-lot costs. In areas with varying terrain and population density, it may prove beneficial to install a combination of sewer types.

This fact sheet discusses a sewer system that uses pressure to deliver sewage to a treatment system. Systems that use vacuum to deliver sewage to a treatment system are discussed in the *Vacuum Sewers* Fact Sheet, while gravity flow sewers are discussed in the *Small Diameter Sewers* Fact Sheet.

Pressure Sewers

Pressure sewers are particularly adaptable for rural or semi-rural communities where public contact with effluent from failing drain fields presents a substantial health concern. Since the mains for pressure sewers are, by design, watertight, the pipe connections ensure minimal leakage of sewage. This can be an important consideration in areas subject to groundwater contamination. Two major types of pressure sewer systems are the **septic tank effluent pump (STEP)** system and the **grinder pump (GP)**. Neither requires any modification to plumbing inside the house.

In STEP systems, wastewater flows into a conventional septic tank to capture solids. The liquid effluent flows to a holding tank containing a pump and control devices. The effluent is then pumped and transferred for treatment. Retrofitting existing septic tanks in areas served by septic tank/drain field systems would seem to present an opportunity for cost savings, but a large number (often a majority) must be replaced or expanded over the life of the system because of insufficient capacity, deterioration of concrete tanks, or leaks. In a GP system, sewage flows to a vault where a grinder pump grinds the solids and discharges the sewage into a pressurized pipe system. GP systems do not require a septic tank but may require more horsepower than STEP systems because of the grinding action. A GP system can result in significant capital cost



Source: C. Falvey, 2001.

FIGURE 1 TYPICAL SEPTIC TANK EFFLUENT PUMP

savings for new areas that have no septic tanks or in older areas where many tanks must be replaced or repaired. Figure 1 shows a typical septic tank effluent pump, while Figure 2 shows a typical grinder pump used in residential wastewater treatment.

The choice between GP and STEP systems depends on three main factors, as described below:

Cost: On-lot facilities, including pumps and tanks, will account for more than 75 percent of total costs, and may run as high as 90 percent. Thus, there is a strong motivation to use a system with the least expensive on-lot facilities. STEP systems may lower on-lot costs because they allow some gravity service connections due to the continued use of a septic tank. In addition, a grinder pump must be more rugged than a STEP pump to handle the added task of grinding, and, consequently, it is more expensive. If many septic tanks must be replaced, costs will be significantly higher for a STEP system than a GP system.

Downstream Treatment: GP systems produce a higher TSS that may not be acceptable at a downstream treatment facility.

Low Flow Conditions: STEP systems will better tolerate low flow conditions that occur in areas with highly fluctuating seasonal occupancy and those with slow build out from a small initial population to the ultimate design population. Thus, STEP systems may be better choices in these areas than GP systems.

APPLICABILITY

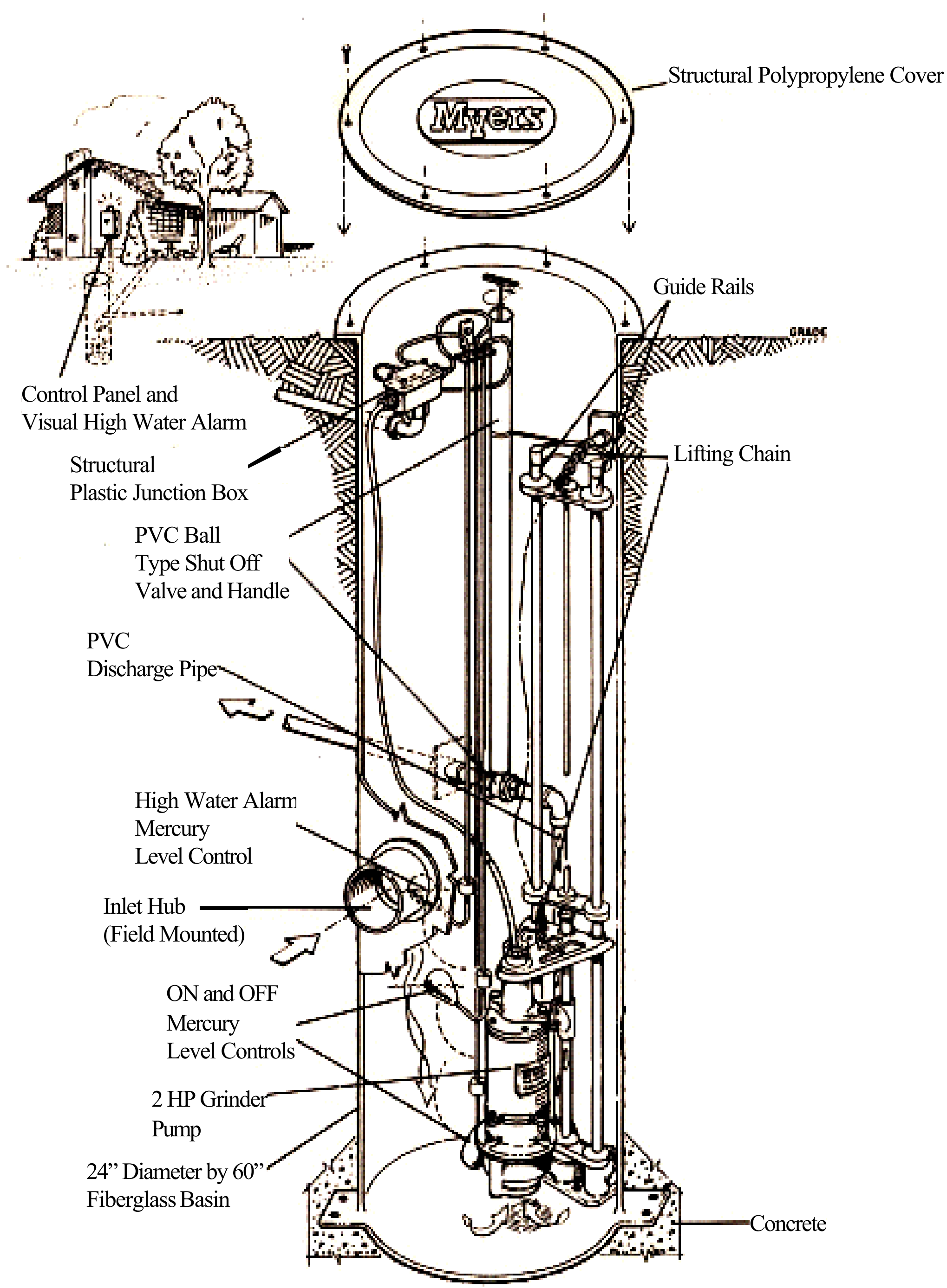
Pressure sewer systems are most cost effective where housing density is low, where the terrain has undulations with relatively high relief, and where the system outfall must be at the same or a higher elevation than most or all of the service area. They can also be effective where flat terrain is combined with high ground water or bedrock, making deep cuts and/or multiple lift stations excessively expensive. They can be cost effective even in densely populated areas where difficult construction or right of way conditions exist, or where the terrain will not accommodate gravity sewers.

Since pressure systems do not have the large excess capacity typical of conventional gravity sewers, they must be designed with a balanced approach, keeping future growth and internal hydraulic performance in mind.

ADVANTAGES AND DISADVANTAGES

Advantages

Pressure sewer systems that connect several residences to a "cluster" pump station can be less expensive than



Source: F.E. Meyers Company, 2000.

FIGURE 2 TYPICAL GRINDER PUMP

conventional gravity systems. On-property facilities represent a major portion of the capital cost of the entire system and are shared in a cluster arrangement. This can be an economic advantage since on-property components are not required until a house is constructed and are borne by the homeowner. Low front-end investment makes the present-value cost of the entire system lower than that of conventional gravity sewerage, especially in new development areas where homes are built over many years.

Because wastewater is pumped under pressure, gravity flow is not necessary and the strict alignment and slope restrictions for conventional gravity sewers can be relaxed. Network layout does not depend on ground contours: pipes can be laid in any location and extensions can be made in the street right-of-way at a relatively small cost without damage to existing structures.

Other advantages of pressure sewers include:

Material and trenching costs are significantly lower because pipe size and depth requirements are reduced.

Low-cost clean outs and valve assemblies are used rather than manholes and may be spaced further apart than manholes in a conventional system.

Infiltration is reduced, resulting in reductions in pipe size.

The user pays for the electricity to operate the pump unit. The resulting increase in electric bills is small and may replace municipality or community bills for central pumping eliminated by the pressure system.

Final treatment may be substantially reduced in hydraulic and organic loading in STEP systems. Hydraulic loadings are also reduced for GP systems.

Because sewage is transported under pressure, more flexibility is allowed in siting final treatment facilities and may help reduce the length of outfall lines or treatment plant construction costs.

Disadvantages

Requires much institutional involvement because the pressure system has many mechanical components throughout the service area.

The operation and maintenance (O&M) cost for a pressure system is often higher than a conventional gravity system due to the high number of pumps in use. However, lift stations in a conventional gravity sewer can reverse this situation.

Annual preventive maintenance calls are usually scheduled for GP components of pressure sewers. STEP systems also require pump-out of septic tanks at two to three year intervals.

Public education is necessary so the user knows how to deal with emergencies and how to avoid blockages or other maintenance problems.

The number of pumps that can share the same downstream force main is limited.

Power outages can result in overflows if standby generators are not available.

Life cycle replacement costs are expected to be higher because pressure sewers have a lower life expectancy than conventional systems.

Odors and corrosion are potential problems because the wastewater in the collection sewers is usually septic. Proper ventilation and odor control must be provided in the design and non-corrosive components should be used. Air release valves are often vented to soil beds to minimize odor problems and special discharge and treatment designs are required to avoid terminal discharge problems.

DESIGN CRITERIA

Many different design flows can be used in pressure systems. When positive displacement GP units are used, the design flow is obtained by multiplying the pump discharge by the maximum number of pumps expected to be operating simultaneously. When centrifugal pumps are used, the equation used is $Q = 20 + 0.5D$, where Q is the flow in gpm and D is the number of homes served. The operation of the system under various assumed conditions should be simulated by computer to check design adequacy. No allowances for infiltration and inflow are required. No minimum velocity is generally used in design, but GP systems must attain three to five feet per second at least once per day. A Hazen-Williams coefficient, (C) = 130 to 140, is suggested for hydraulic analysis. Pressure mains generally use 50 mm (2 inch) or larger PVC pipe (SDR 21) and rubber-ring joints or solvent welding to assemble the pipe joints. High-density polyethylene (HDPE) pipe with fused joints is widely used in Canada. Electrical requirements, especially for GP systems, may necessitate rewiring and electrical service upgrading in the service area. Pipes are generally buried to at least the winter frost penetration depth; in far northern sites insulated and heat-traced pipes are generally buried at a minimal depth. GP and STEP pumps are sized to accommodate the hydraulic grade requirements of the system. Discharge points must use drop inlets to minimize odors and corrosion. Air release valves are placed at high points in the sewer and often are vented to soil beds. Both STEP and GP systems can be assumed to be anaerobic and potentially odorous if subjected to turbulence (stripping of gases such as H_2S).

PERFORMANCE

STEP

When properly installed, septic tanks typically remove about 50 percent of BOD, 75 percent of suspended solids, virtually all grit, and about 90 percent of grease, reducing the likelihood of clogging. Also, wastewater reaching the treatment plant will be weaker than raw sewage. Typical average values of BOD and TSS are 110 mg/L and 50 mg/L, respectively. On the other hand, septic tank effluent has virtually zero dissolved oxygen.

Primary sedimentation is not required to treat septic tank effluent. The effluent responds well to aerobic treatment, but odor control at the headworks of the treatment plant should receive extra attention.

The small community of High Island, Texas, was concerned that septic tank failures were damaging a local area frequented by migratory birds. Funds and materials were secured from the EPA, several state agencies, and the Audubon Society to replace the undersized septic tanks with larger ones equipped with STEP units and low pressure sewerage ultimately discharging to a constructed wetland. This system is expected to achieve an effluent quality of less than 20 mg/L each of BOD and TSS, less than 8 mg/L ammonia, and greater than 4 mg/L dissolved oxygen (Jensen 1999).

In 1996, the village of Browns, Illinois, replaced a failing septic tank system with a STEP system discharging to low pressure sewers and ultimately to a recirculating gravel filter. Cost was a major concern to the residents of the village, who were used to average monthly sewer bills of $20. Conditions in the village were poor for conventional sewer systems, making them prohibitively expensive. An alternative low pressure-STEP system averaged only $19.38 per month per resident, and eliminated the public health hazard caused by the failed septic tanks (ICAA, 2000).

GP Treatment

The wastewater reaching the treatment plant will typically be stronger than that from conventional systems because infiltration is not possible. Typical design average concentrations of both BOD and TSS are 350 mg/L (WPCF, 1986).

GP/low pressure sewer systems have replaced failing septic tanks in Lake Worth, Texas (Head, et. al., 2000); Beach Drive in Kitsap County, Washington (Mayhew and Fitzwater, 1999); and Cuyler, New York (Earle, 1998). Each of these communities chose alternative systems over conventional systems based on lower costs and better suitability to local soil conditions.

OPERATION AND MAINTENANCE

Routine operation and maintenance requirements for both STEP and GP systems are minimal. Small systems that serve 300 or fewer homes do not usually require a full-time staff. Service can be performed by personnel from the municipal public works or highway department. Most system maintenance activities involve responding to homeowner service calls usually for electrical control problems or pump blockages. STEP systems also require pumping every two to three years.

TABLE 1 RELATIVE CHARACTERISTICS OF ALTERNATIVE SEWERS

Sewer Type	Slope Requirement	Construction Cost in Rocky, High Groundwater Sites	Operation and Maintenance Requirements	Ideal Power Requirements
Conventional	Downhill	High	Moderate	None*
Pressure				
STEP	None	Low	Moderate-high	Low
GP	None	Low	Moderate-high	Moderate

* Power may be required for lift stations
Source: Small Flows Clearinghouse, 1992.

The inherent septic nature of wastewater in pressure sewers requires that system personnel take appropriate safety precautions when performing maintenance to minimize exposure to toxic gases, such as hydrogen sulfide, which may be present in the sewer lines, pump vaults, or septic tanks. Odor problems may develop in pressure sewer systems because of improper house venting. The addition of strong oxidizing agents, such as chlorine or hydrogen peroxide, may be necessary to control odor where venting is not the cause of the problem.

Generally, it is in the best interest of the municipality and the homeowners to have the municipality or sewer utility be responsible for maintaining all system components. General easement agreements are needed to permit access to on-site components, such as septic tanks, STEP units, or GP units on private property.

COSTS

Pressure sewers are generally more cost-effective than conventional gravity sewers in rural areas because capital costs for pressure sewers are generally lower than for gravity sewers. While capital cost savings of 90 percent have been achieved, no universal statement of savings is possible because each site and system is unique. Table 1 presents a generic comparison of common characteristics of sanitary sewer systems that should be considered in the initial decision-making process on whether to use pressure sewer systems or conventional gravity sewer systems.

Table 2 presents data from recent evaluations of the costs of pressure sewer mains and appurtenances (essentially the same for GP and STEP), including items specific to each type of pressure sewer. Purchasing pumping stations in volume may reduce costs by up to 50 percent. The linear cost of mains can vary by a factor of two to three, depending on the type of trenching equipment and local costs of high-quality backfill and pipe. The local geology and utility systems will impact the installation cost of either system.

The homeowner is responsible for energy costs, which will vary from $1.00 to $2.50/month for GP systems, depending on the horsepower of the unit. STEP units generally cost less than $1.00/month.

Preventive maintenance should be performed annually for each unit, with monthly maintenance of other mechanical components. STEP systems require periodic pumping of septic tanks. Total O&M costs average $100-200 per year per unit, and include costs for troubleshooting, inspection of new installations, and responding to problems.

Mean time between service calls (MTBSC) data vary greatly, but values of 4 to 10 years for both GP and STEP units are reasonable estimates for quality installations.

TABLE 2 AVERAGE INSTALLED UNIT COSTS FOR PRESSURE SEWER MAINS & APPURTENANCES

Item	Unit Cost ($)
2 inch mains	9.40/LF
3 inch mains	10.00/LF
4 inch mains	11.30/LF
6 inch mains	15.80/LF
8 inch mains	17.60/LF
Extra for mains in asphalt concrete pavement	6.30/LF
2 inch isolation valves	315/each
3 inch isolation valves	345/each
4 inch isolation valves	440/each
6 inch isolation valves	500/each
8 inch isolation valves	720/each
Individual Grinder pump	1,505/each
Single (simplex) package pump system	5,140/each
package installation	625 - 1,880/each
Automatic air release stations	1,255/each

Source: U.S. EPA, 1991.

REFERENCES

Other Related Fact Sheets

Other EPA Fact Sheets can be found at the following web address:

http://www.epa.gov/owm/mtb/mtbfact.htm

1. Barrett, Michael E. and J. F. Malina, Jr., Sep. 1, 1991. *Technical Summary of Appropriate Technologies for Small Community Wastewater Treatment Systems*, The University of Texas at Austin.

2. Barrett, Michael E. and J. F. Malina, Jr., Sep. 1, 1991. *Wastewater Treatment Systems for Small Communities: A Guide for Local Government Officials*, The University of Texas at Austin.

3. Earle, George, 1998. *Low Pressure Sewer Systems: The Low Cost Alternative to Gravity Sewers.*

4. Falvey, Cathleen, 2001. *Pressure Sewers Overcome Tough Terrain and Reduce Installation Costs.* Small Flows Quarterly, National Small Flows Clearinghouse.

5. F.E. Meyers Company, 2000. Diagram of grinder pump provided to Parsons Engineering Science.

6. Gidley, James S., Sep. 1987. *Case Study Number 12: Augusta, Maine, Grinder Pump Pressure Sewers.* National Small Flows Clearinghouse.

7. Head, Lee A., Mayhall, Madeline R.,Tucker, Alan R., and Caffey, Jeffrey E., 2000. *Low Pressure Sewer System Replaces Septic System in Lake Community.* http://www.eone.com/sewer/resources/resource01/content.html

8. Illinois Community Action Association, 2000. *Alternative Wastewater Systems in Illinois.* http://www.icaanet.com/rcap/aw_pamphlet.htm.

9. Jensen, Ric., August 1999. *Septic Tank Effluent Pumps, Small Diameter Sewer, Will Replace Failing Septic Systems at Small Gulf Coast Community.* Texas On-Site Insights, Vol.8, No.3. http://twri.tamu.edu/./twripubs/Insights/v8n3/article-1.html.

10. Mayhew, Chuck and Richard Fitzwater, September 1999. *Grinder Pump Sewer System Saves Beach Property.* Water Engineering and Management.

11. Parker, Mike A., 1997. *Step Pressure Sewer Technology Package*. National Small Flows Clearinghouse.

12. Texas On-Site Insights, Volume 7, Number 2. *Grinder Pumps, Small Diameter Sewer, Replacing Failing On-Site Systems Near Lake Worth*. 1998. http://twri.tamu.edu/./twripubs/Insights/v7n2/article-5.html.

13. U.S. EPA, 1980. *Design Manual: Onsite Wastewater Treatment and Disposal Systems*. EPA Office of Water. EPA Office of Research & Development. Cincinnati, Ohio. EPA 625/1-80/012.

14. U.S. EPA, 1989. *Alternative Sewers Operation and Maintenance Special Evaluation Project*. USEPA & Office of Water. Cincinnati, Ohio.

15. U.S. EPA, 1991. *Design Manual: Alternative Wastewater Collection Systems.* EPA Office of Water. EPA Office of Research & Development. Cincinnati, Ohio. EPA 625/1-91/024.

16. U.S. EPA, 1992. *Summary Report Small Community Water and Wastewater Treatment*. EPA Office of Research and Development. Cincinnati, Ohio.

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