Wastewater Lift Station No. 10 Improvements Project

PRELIMINARY DESIGN REPORT

Prepared For:

City of Riviera Beach
Utility District

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CITY OF RIVIERA BEACH UTILITY DISTRICT
WASTEWATER LIFT STATION NO. 10 IMPROVEMENTS

TABLE OF CONTENTS

SECTION 6 – ELECTRICAL, INSTRUMENTATION, AND HVAC BASIS OF DESIGN

SECTION 7 – LIFT STATION SITE ALTERNATIVES

SECTION 8 – OPINION OF PROBABLE CONSTRUCTION COST

CITY OF RIVIERA BEACH UTILITY DISTRICT
WASTEWATER LIFT STATION NO. 10 IMPROVEMENTS PROJECT

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

SECTION 1

INTRODUCTION

1.1 Scope of Services

The purpose of this Preliminary Design Report is to provide a summary of the rehabilitation and design requirements associated with the City of Riviera Beach Utility District (RBUD) Lift Station No. 10 improvements. Specifically, evaluation of existing and future wastewater flows to be serviced by Lift Station No. 10 (LS 10); preliminary sizing and recommended layout of the proposed new LS 10; evaluation of the existing site and alternative sites for construction of the proposed new LS 10; and costs associated with each site alternative.

1.2 Background

RBUD has identified Wastewater Lift Station No. 10 as a facility requiring replacement to improve safety and reliability, and reduce operation and maintenance costs. Lift Station No. 10 is located in the eastern area of RBUD's Wastewater Service Area at 2801 Park Avenue, on Singer Island, between Yacht Harbor Drive and South Harbor Drive. Refer to **Figure 1-1** for a location map.

Lift Station No. 10 serves as the master lift station for the City of Riviera Beach's and the Town of Palm Beach Shores' wastewater collection systems on Singer Island. The existing duplex submersible lift station is located on City of Riviera Beach owned property adjacent to a seawall on the west property line and Park Avenue on the east property line. The lift station was constructed in 1992 placing the wet well approximately 4.5 feet from the newly constructed seawall.

Lift Station 10 is in need of major repairs. The lift station has been in operation for 18 years and the structural integrity of the wet well is questionable. LS 10 is experiencing saltwater intrusion, and inflow and infiltration (I&I) due to its close proximity to the sea wall and the high water table.

1.3 Project Description

The City of Riviera Beach Utility District has retained Barnes Ferland and Associates, Inc. (BFA) to provide engineering services associated with the evaluation, design, bidding, and construction of the Lift Station No. 10 Improvements project.

The overall improvements anticipated for this project are:

- New duplex submersible lift station on the existing site or relocated to a new site.
- Standby electrical power generator with fuel tank.
- Electrical and instrumentation system upgrade.
- Odor control system.

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Wastewater Lift Station 10 Improvements

LOCATION MAP

FIGURE 1-1

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SECTION 2

EXISTING CONDITIONS

2.1 Lift Station No. 10

Lift Station No. 10 serves as the master lift station for the City of Riviera Beach's and the Town of Palm Beach Shores' wastewater collection systems on Singer Island. LS 10 is located on property owned by the City of Riviera Beach located in the Yacht Harbor Estates subdivision, on Singer Island. The lift station site is a narrow parcel (25 feet by 142 feet) sandwiched between Park Avenue on the east and Lake Worth on the west. A sea wall with a 42-inch concrete cap is directly adjacent to the lift station property to the west and runs the entire length. The existing lift station is configured to provide 4.5 feet of clear space between the wet well and the sea wall.

Lift Station 10 is in need of major repairs. The lift station has been in operation for 18 years and the structural integrity of the wet well is questionable. LS 10 is experiencing saltwater intrusion, and inflow and infiltration (I&I) due to its close proximity to the sea wall and the high water table.

The existing duplex submersible lift station consists of two (2), fifty horsepower (50 HP) pumps capable of pumping 2,000 gallons of wastewater per minute. The wet well is 12 feet wide and 16 feet long and is sized to accommodate 3.0 feet of storage (4,309 gallons). The wet well is in poor condition. It has an interior coal tar coating that is badly deteriorated. There is a large amount of exposed concrete and much of the exposed concrete is spalling.

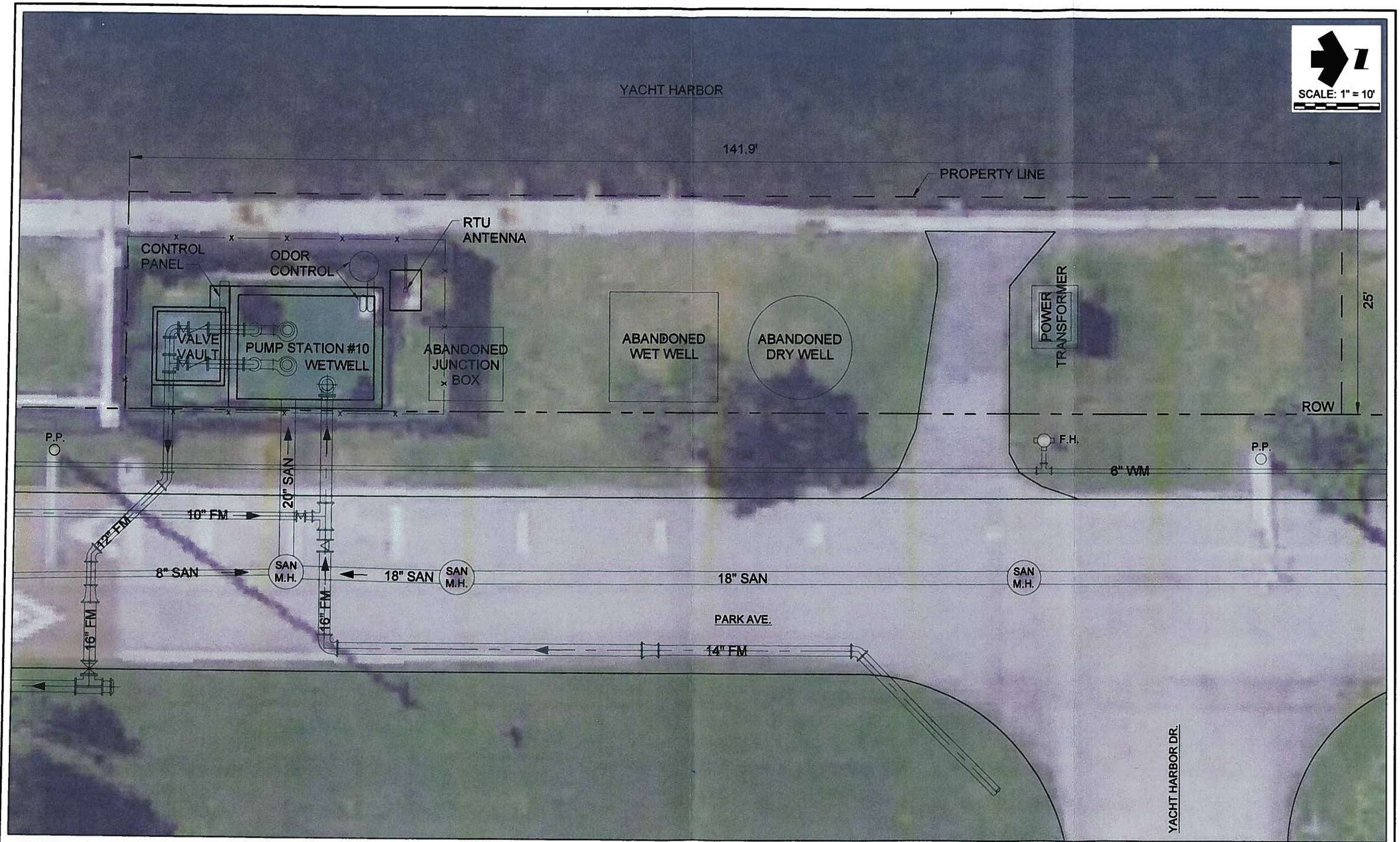
Ground water appears to be leaking into the wet well from a couple of locations. The wet well has two influent mains, a 16-inch ductile iron force main, and a 20-inch ductile iron gravity main, that are badly corroded. The grouting material in the annular space of the influent piping appears to be failing, and ground water is infiltrating into the wet well. Similarly, an abandoned 24-inch ductile iron pipe that previously connected the abandoned junction box to the wet well also shows signs of ground water infiltration at the jointing material. The ductile iron discharge piping and fittings for pumps nos. 1 and 2 are also badly corroded and need to be replaced.

From review of record drawings provided by RBUD, we have determined Lift Station No. 10 was originally built in 1985 and was most recently replaced in 1992. In 1992, the existing lift station was in a wet pit-dry pit configuration with a junction box. According to the record drawings, the wet well, dry well, and junction box were abandoned in-place. The wet well and dry well were filled with sand and compacted. In areas where compaction could not be accomplished (i.e. under ceilings) the void was filled with 2500 psi concrete. The entrance tubes to the wet well and dry well were removed to three feet below grade and also filled with sand. The junction box was not originally designated to be abandoned. Therefore, detailed notes were not provided concerning the procedure for its abandonment. It is assumed the concrete walls of the junction box were also removed to three feet below grade and the remaining structure filled with sand, similar to the other structures. It is strongly suggested that exploratory excavation or soft digs be performed in the area of the abandoned lift station to verify the validity of the above information. The existing site plan is shown in **Figure 2-1**.

Existing pump data obtained from RBUD and from site review is summarized in **Table 2-1** below:

Table 2-1
Lift Station No. 10 Existing Facilities

Item	Description
Station Type	Submersible Duplex
Wetwell Dimensions	16' L x 12' W x 18.44' H
Pumps:	
Quantity	2 pumps
Capacity	2,000 gpm (each)
TDH	55 ft
Horsepower	50 HP (each)
Manufacturer/Model	Fairbanks–Morse /Model 5434M
Average Run Time	8 hr/day



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Wastewater Lift Station 10 Improvements

EXISTING SITE PLAN

FIGURE 2-1

SECTION 3

WASTEWATER FLOW PROJECTIONS

3.1 General

Proposed Lift Station No. 10 will be sized to pump wastewater from the City of Riviera Beach's and the Town of Palm Beach Shores' wastewater collection systems on Singer Island. The lift station will be sized to accommodate the existing flow, as well as, the increase in wastewater flow due to an estimated population growth over the next 20 years.

3.2 Historical Wastewater Flows

The RBUD automatically records LS 10 pump start times and run times on a daily basis. The data is reported in an "Activity Report". The start and run times for the lift station pumps can be utilized to determine the average daily flow being pumped from the lift station by multiplying the number of pump starts per day by the fixed working volume of wastewater stored and pumped from the wet well on every pump start. The working volume of the LS 10 wet well was calculated to be 4,309 gallons (calculated by measuring the dimensions of the wet well and the operational levels).

We have reviewed the LS 10 Activity Reports for all of 2009 and through September of 2010 as provided by the RBUD. As previously stated, utilizing the number of pump starts and the working wet well volume we have calculated the average daily wastewater flows pumped by LS 10. Our estimate of the historical average daily wastewater flows (gpd) passing through Lift Station 10 are presented in **Table 3-1**:

Table 3-1
Average Daily Wastewater Flows Pumped by Lift Station No. 10 (gpd)

Month	2009	2010
January	247,837	469,681
February	240,996	378,269
March	348,890	214,894
April	333,660	250,353
May	300,240	279,946
June	291,719	287,985
July	289,259	264,100
August	298,711	278,556
September	315,706	274,090
October	297,599	
November	442,247	
December	551,413	
Average	331,319	298,594

3.3 Population Projections

In order to project the additional wastewater flows that will occur in the Lift Station No. 10 service area due to expected population growth over the next 20 years (to the year 2030), it is first necessary to project the population growth over the same time-period. Population projections for the area of Riviera Beach served by Lift Station No. 10 were developed based on 2009 Palm Beach County population projections, which incorporate future land use, adopted redevelopment plans, new development approvals, and local planning forecasts from individual local governments within Palm Beach County.

The Palm Beach County population projections are derived from the 2009 Population Allocation Model prepared by the Palm Beach County Planning Division. The 2009 Population Allocation Model is based on the Bureau of Economic and Business Research (BEBR) 2009 projections for Palm Beach County. Planning level projections required by local municipalities for public services planning such as water and wastewater supply necessitate the allocation of countywide projections to smaller geographic areas. The methodology utilized by the Population Allocation Model allows for the distribution of BEBR projections to traffic analysis zones (TAZ).

To project the population of the Lift Station No. 10 service area, we overlaid the service area boundary and the TAZ data on a GIS map of the City of Riviera Beach. We then extracted only the population data for the Lift Station No. 10 service area for the years 2009 through 2030.

Table 3-2
Lift Station No. 10 Service Area Population Projections

Year	Population	Increase (%)	Year	Population	Increase (%)
2009	3169		2020	3425	1.87
2010	3,141	-0.9	2021	3,517	2.7
2011	3,187	1.5	2022	3,610	2.6
2012	3,191	0.1	2023	3,713	2.9
2013	3,195	0.1	2024	3,831	3.2
2014	3,265	2.2	2025	3,913	2.1
2015	3,267	0.1	2026	4,033	3.1
2016	3,269	0.1	2027	4,156	3.0
2017	3,272	0.1	2028	4,281	3.0
2018	3,310	1.2	2029	4,407	2.9
2019	3,362	1.6	2030	4,544	3.1

3.4 Wastewater Flow Projections

Future average daily wastewater flows can be projected by multiplying the above projected Lift Station No. 10 service area population projections by an acceptable daily per capita wastewater flow. The City of Riviera Beach has determined that a suitable daily per capita wastewater flow is at least 135 gallons per person per day as prescribed in the City's *2010 Comprehensive Plan, Objective 1.5 - Level of Service, Policy 1.5.1.* Similarly, the City currently utilizes a daily per capita water flow "Level of Service" of at least 195 gallons per person per day as prescribed in the Comprehensive Plan. The wastewater to water use ratio of these two numbers is 0.69. We understand these level-of-service values were first derived and utilized in a 1989 Comprehensive Plan. Recent evaluations performed by BFA on the City's historical 5-year water usage rates provide us the opportunity to update these values.

In a Technical Memorandum prepared by BFA entitled *Population Projections and Water Demand Analysis* dated December 28, 2010, we determined the City's historical finished water per capita use rate, calculated based on the 5-year average (from 2005 through 2009) of total annual finished water billed to customers was 164 gallons per person per day. Applying the wastewater to water use ratio of 0.69 to this more updated water use value, the updated wastewater use "Level of Service" value should be 113 gallons per day per person. We will project the future wastewater flows for Lift Station 10 utilizing this updated value.

The proposed Lift Station No. 10 design should be based on the projected 2030 wastewater flows. However, the design pumping capability of the lift station should be sized based on the peak design flow, which is calculated by multiplying the average daily wastewater flow by an acceptable Peaking Factor. A widely accepted suitable Peaking Factor for a lift station with average daily flows between 250,001 and 1,000,000 gallons per day is 3.0. The following **Table 3-3** depicts the average daily wastewater flows and the peak design flows for Lift Station No. 10 from 2009 to 2030 utilizing the population projections and a 113 gallons per person per day level of service.

Table 3-3
Lift Station No. 10 Service Area Wastewater Flow Projections

Year	Average Daily Flow (gpd)	Average Daily Flow (gpm)	Peak Design Flow (gpd)	Peak Design Flow (gpm)
2009	358,097	249	1,074,291	746
2010	354,933	246	1,064,799	739
2011	360,131	250	1,080,393	750
2012	360,583	250	1,081,749	751
2013	361,035	251	1,083,105	752
2014	368,945	256	1,106,835	769
2015	369,171	256	1,107,513	769
2016	369,397	257	1,108,191	770
2017	369,736	257	1,109,208	770
2018	374,030	260	1,122,090	779
2019	379,906	264	1,139,718	791
2020	387,025	269	1,161,075	806
2021	397,421	276	1,192,263	828
2022	407,930	283	1,223,790	850
2023	419,569	291	1,258,707	874
2024	432,903	301	1,298,709	902
2025	442,169	307	1,326,507	921
2026	455,729	316	1,367,187	949
2027	469,628	326	1,408,884	978
2028	483,753	336	1,451,259	1,008
2029	497,991	346	1,493,973	1,037
2030	513,472	357	1,540,416	1,070

The above table indicates that in the year 2030, the Lift Station No. 10 wastewater service area will generate an average daily wastewater flow of 513,472 gallons per day, which translates to a peak design flow of 1,070 gallons per minute.

To verify and calibrate the population wastewater flow projection method used to estimate the future wastewater demands of the LS 10 service area, the projected wastewater demand was compared to the actual wastewater flow pumped at Lift Station No. 10 during the years 2009 and 2010, refer to **Table 3-4**.

Table 3-4
Projected Wastewater Demand vs. Actual Wastewater Demand

Year	Average Daily Flow (gpd)	Average Daily Flow (gpm)	Peak Design Flow (gpd)	Peak Design Flow (gpm)	Average Daily Flow (gpd)	Average Daily Flow (gpm)	Peak Design Flow (gpd)	Peak Design Flow (gpm)
	PROJECTED WASTEWATER FLOWS				ACTUAL WASTEWATER FLOWS			
2009	358,097	249	1,074,291	746	331,319	230	993,957	690
2010	354,933	246	1,064,799	739	298,594	207	895,782	622

The projected average daily wastewater flow for Lift Station 10 during the years 2009 and 2010 is 358,097 gpd and 354,933 gpd, respectively. The actual average daily wastewater flow experienced in 2009 and 2010 are 331,319 gpd and 298,594 gpd, respectively. The range of variance between the population wastewater flow projection method and the actual wastewater flow pumped is under 20% (8% in 2009 and 18% in 2010). Therefore, the population wastewater flow projection method utilized to estimate future wastewater demand is within the range of acceptable variance and supports the assumption that the method used is reasonably accurate.

3.5 Pumping Requirements

Lift Station No. 10's wastewater service area was estimated to generate an average daily wastewater flow of 513,472 gpd, which translates to a peak design flow of 1,070 gpm in the year 2030. Standard engineering practices dictate that the proposed lift station be sized according to the peak design flow of the service area.

In accordance with Ten State Standards, submersible pump selection is based on the ability to move the peak design wastewater flow (1,070 gpm), while also providing a minimum scouring velocity of 2.0 fps in the discharge force main. The 16-inch discharge force main at LS 10 requires a minimum wastewater flow of approximately 1,400 gpm to meet a 2.24 fps velocity. Because the scouring velocity flow for the 16-inch discharge force main (1,400 gpm) is greater than the peak design wastewater demand (1,070 gpm) the pump selection should be based on the ability to move approximately 1,400 gpm of wastewater flow.

FDEP design criteria requires the proposed lift station to be able to pump the design peak flow or minimum scouring velocity flow with the largest pump out of service. The lift station system curve for the proposed 16-inch discharge force main was developed based on a minimum discharge scouring flow rate of 1,400 gpm. Based on the system curve, a design capacity of 1,400 gpm at 46 total dynamic head (TDH) was utilized for the pump selection. The pumps provided should have an operating curve similar to a Flygt Model NP3171.181. **Table 3-5** provides a summary of the design criteria for the proposed pumps. **Appendix A** contains the manufacture's pump curve and dimensional cut sheet for the selected Flygt pumps.

Table 3-5
Lift Station No. 10 Design Criteria

Parameter	Criteria
Type	Duplex Submersible
Wetwell Diameter	12 ft.
Qty. of Pumps	2
Design Capacity (ea. pump)	1,400 gpm @ 46 ft TDH
Horsepower	25 Hp
Phase/Voltage	3/460
Pump Discharge	6 inch

It is also crucial to evaluate the size and capacity of the existing downstream force main system to verify the existing system can accept the future additional flows. The existing discharge force main for LS 10 is a 16-inch cast iron main. A 16-inch force main is capable of carrying up to 4,500 gpm of wastewater flow at a velocity of approximately 7 feet per second (fps). The estimated peak design flow for the service area in 2030 is 1,070 gpm. The 16-inch force main is more than adequate to meet the needs for the LS 10 service area.

SECTION 4

REGULATORY DESIGN REQUIREMENTS

4.1 General

Design of the proposed RBUD Wastewater Lift Station No. 10 Improvements must take into consideration existing County, State and Federal regulations that govern the design, construction, operation and maintenance of the facility. The Florida Department of Environmental Protection and the City of Riviera Beach Utility District maintains regulatory jurisdiction over the project. The requirements of these agencies for permitting and construction of the proposed facility are summarized in the following sections.

4.2 Palm Beach County Health Department

The Florida Department of Environmental Protection (FDEP), through Section 403.021(2) of the Florida Air and Water Pollution Control Act has established standards and requirements for Florida wastewater facilities. In turn, the Palm Beach County Health Department (PBCHD) has been delegated as a local program by the FDEP to perform several functions in the domestic waste program including issuance and enforcement of construction permits for proposed domestic wastewater collection systems including wastewater lift stations. The primary chapter of the Florida Administrative Code (F.A.C.) under which FDEP through PBCHD regulates wastewater collection systems and transmission facilities in the State of Florida is Chapter 62-604.

Chapter 62-604 establishes the requirements for permitting, construction, operation, and maintenance of wastewater lift stations. This chapter also incorporates by reference certain outside design related standards such as Recommended Standards for Wastewater Facilities, 1997 Edition, published by Health Education Services, Inc., Health Education Services Division, also known as "Ten States Standards". The following will summarize the permit and design requirements for permitting a wastewater lift station.

4.2.1 Permit Requirements

Prior to construction of the proposed wastewater lift station, RBUD shall make application to the PBCHD for either a general or individual permit. For Lift Station No. 10, the appropriate permit is "general" based on the following information provided in Chapter 62-604.600 (6):

(a).....a general permit is hereby granted to any person for the construction of a wastewater collection/ transmission system that has been designed in accordance with the standards and criteria set forth in subsections 62-604.400(1) and (2), F.A.C., provided that:

1. Notice to the Department under subsection 62-4-530(1), F.A.C. is submitted on Form 62-604.300(8)(a) at least 30 days prior to initiating construction; and
2. The wastewater facility to which the system will be connected:

a. Has the capacity to receive the wastewater generated by the proposed collection system;

b. Is in compliance with the capacity analysis requirements of Rule 62-600.405, F.A.C.;

c. Is not under a Department Order associated with effluent violations or the ability to treat wastewater adequately; and

d. Will provide necessary treatment and disposal as required by Chapter 403, F.S. and applicable Department rules.

4.2.2 Design/Performance Considerations

Regulatory requirements related to design and performance considerations and applicable to Lift Station No. 10 are contained in numerous subsections of Chapter 62-604.400 and are summarized below.

4.2.2.1 Site Layout: Pump stations shall be designed and located on the site to minimize adverse affects resulting from odors, noise and lighting.

4.2.2.2 Flood Protection: The electrical and mechanical equipment must be protected from physical damage by the 100-year flood and must remain fully operational and accessible during the 25-year flood.

4.2.2.3 Security: New pumping stations must be enclosed with a fence or otherwise designed with appropriate features that discourage the entry of animals and unauthorized persons.

4.2.2.4 Standby Power: Pump stations that receive flow from one or more pump stations through a force main or pump stations discharging through pipes 12-inches or larger shall provide for uninterrupted pumping capabilities including an in-place emergency generator. The emergency system shall have sufficient capacity to start up and maintain the total rated running capacity of the station.

4.2.2.5 Lighting Protection: Pump stations shall be protected from lighting and transient voltage surges. As a minimum, stations shall be equipped with lightning arrestors, surge capacitors or other similar protection devices, and phase protection.

4.2.2.6 Force Mains: Branches of intersecting force mains shall be provided with appropriate valves such that one branch may be shut down for maintenance and repair without interrupting the flow of other branches.

4.3 National Pollutant Discharge Elimination System Permit

If a construction project disturbs more than one (1) acre, the entity that owns or operates the project must obtain a National Pollutant Discharge Elimination System (NPDES) stormwater permit and implement appropriate pollution prevention techniques to minimize erosion and sedimentation and properly manage stormwater during construction. FDEP is the jurisdictional agency responsible for this program. The necessary permit application form is FDEP Form No. 62-621.300(4)(a), entitled *Generic Permit for Stormwater Discharge from Large and Small Construction Activities*. It is expected that the construction of the proposed Lift Station No. 10 will temporarily disturb less than one (1) acre, therefore, an NPDES permit is not required.

SECTION 5

CIVIL AND MECHANICAL BASIS OF DESIGN

5.1 Site Location

Lift Station No. 10 is located in the eastern area of RBUD's Wastewater Service Area at 2801 Park Avenue, on Singer Island, between Yacht Harbor Drive and South Harbor Drive. The facility is located on a narrow parcel (25 feet by 142 feet) of land sandwiched between Lake Worth on the West and Park Avenue on the East. There appears to be sufficient property to construct the proposed lift station while keeping the existing lift station operational. Refer to **Figure 5-1.**

5.2 Flood Hazard

The site is approximately 7 feet above sea level. Based on the National Flood Insurance Program FIRM Map Community-Panel No. 125142 0003 D, dated 09/30/1982, the facility site is not located within the 100-year flood zone or any other special hazard zone.

5.3 Lift Station Facility Layout

5.3.1 General:

The proposed lift station facility has been laid out and sited specifically to address the need to keep the existing lift station in service during construction, access to the facility for normal operation and maintenance, clearance from Lake Worth and Park Avenue, the efficient use of available property, and the visual impact on the Yacht Harbor Estates residents. Refer to **Figure 5-1** for the proposed site plan.

In accordance with FAC 62-604.400(2) (d), pump stations shall be enclosed with a fence or otherwise designed with appropriate features to discourage the entry of animals and unauthorized persons. The facility will be enclosed on all sides with a 4-feet high chain link fence with a pedestrian gate secured with a chain and padlock.

5.3.2 Operation and Maintenance Considerations:

The proposed lift station facility will be sited along Park Avenue approximately 8-feet west of the edge of pavement. Access to all lift station equipment will be achieved from Park Avenue. Park Avenue is approximately 20-feet in width allowing maintenance vehicles to park on Park Avenue, parallel to LS 10 when needed. Additionally, if at any time closure of Park Avenue is required, the surrounding residents will not be overly impacted. Residents can utilize Yacht Harbor Drive and North Ocean Drive for access.

SCALE: 1" = 10'

LAKE WORTH

PROPERTY LINE

EXIST. ODOR CONTROL TO BE REMOVED

EXIST. ANTENNA AND CONC. BASE TO REMAIN

EXIST. WET WELL TO BE ABANDONED

PROP. GENERATOR SET w/ BELLY FUEL TANK

EXIST. VALVE VAULT TO BE ABANDONED

PROP. PUMP CONTROLS

PROP. DUPLEX LIFT STATION

PROP. PUMP OUT CONNECTION

PROP. CHAIN LINK FENCE

ABANDONED DRY PIT TO BE REMOVED

PROP. VALVE BOX

10"

10"

10"

ROW

ROW

P.P.

PROPOSED ODOR CONTROL

PROP. 16" FM

20" SAN

ABANONED JUNCTION BOX TO BE REMOVED

ABANDONED WET WELL TO BE REMOVED

PROP. 16"x12" REDUCER

PEDESTRIAN GATE

FUTURE PUMP AND PIPING

F.H.

6" WM

CONNECT TO EXIST. 10" FM

PROP. 10" FM

10" FM

PLUG EXIST. 20" SAN. SEWER

PROP. 20" FM

CONNECT TO EXIST. SAN. MH.

12" FM

SAN MH.

18" SAN

SAN MH.

18" SAN

SAN MH.

PARK AVE.

16" FM

CUT AND CAP EXIST. 16" FM

CONNECT TO EXIST. 16" FM

14" FM

CONNECT TO EXIST. 16" FM
REMOVE EXIST. CAP

PROP. 16" FM

YACHT HARBOR DR.

LEGEND

EXISTING LIFT STATION

PROPOSED LIFT STATION

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PROPOSED LIFT STATION 10 CONSTRUCTION PLAN

FIGURE 5-1

5.4 Lift Station Configuration

5.4.1 General:

Initially, the proposed lift station will be configured in a duplex submersible style using rail-mounted pumps. The lift station will be sized and configured to allow the addition of a third pump if needed in the future.

The duplex lift station will use rail-mounted pumps with permanently mounted pump base and discharge piping. The two pumps will be constant speed. The facility includes above-grade discharge piping and emergency pump out connection, an odor control system, a standby power generator with belly fuel tank, and a SCADA tower.

5.4.2 Pumps:

The submersible pumps shall be able to "run dry", that is with liquid in the wet well only deep enough to submerge the bottom half of the pump's volute. Pump motors shall be explosion proof. Sufficient electrical/ control cable shall be attached to the pump such that no splicing is required between the pump and a junction box. A seal shall be supplied between a junction box and any panel or disconnect and between the wet well and junction box to isolate the junction box from the moisture and corrosive gases in the wet well. All pump spacings and related clearances in the wet well shall be in accordance with the manufacturer's recommendations and Hydraulic Institute standards for proper pump operation.

Dual type 316 stainless steel guide rail systems with type 316 stainless steel lifting chains shall be used for guiding submersible pumps to and from their anchorage/ hydraulic connection points. Guide rail supports shall be installed not more than 10 feet on center in accordance with the manufacturer's recommendations.

Lift Station No. 10's wastewater service area was estimated to generate an average daily wastewater flow of 513,472 gpd, which translates to a peak design flow of 1,070 gpm in the year 2030. In accordance with Ten State Standards, submersible pump selection is based on the ability to move the peak design wastewater flow (1,070 gpm), while also providing a minimum scouring velocity of 2.0 fps in the discharge force main. The 16-inch discharge force main at LS 10 requires a minimum wastewater flow of approximately 1,400 gpm to meet a 2.24 fps velocity. Because the scouring velocity flow for the 16-inch discharge force main (1,400 gpm) is greater than the peak design wastewater demand (1,070 gpm) the pump selection is based on the ability to move approximately 1,400 gpm of wastewater flow.

The selected pumps are based on a pump station capacity designed to provide the minimum scouring velocity in the discharge force main and meet the design peak flow with a single pump operating. The second pump will provide stand-by capacity in conformance with FDEP reliability criteria. Based on the system curve, a design capacity of 1,400 gpm at 46 total dynamic head (TDH) was utilized for the pump selection. The design will be based on two Flygt 6-inch NP3171.181 model pumps rated at 25 HP at 1755 rpm.

5.4.3 Wet Well:

The wet well shall have a circular configuration and be designed to withstand external horizontal loads imposed by saturated lateral earth pressures with ground water at finished grad while empty, and internal hydrostatic loads while the wet well is full of water with no external earth pressures. The top slab of the wet well shall be designed to support the dead load of the slab, plus a uniform live load of 250 psf. The top slab shall also be capable of supporting a concentrated live load at any location equal to the weight of the single largest submersible pump to be installed in the wet well.

Access hatches to the wet well shall be gasketed to prevent rain water from entering and odors from escaping. The frames and cover plates shall be designed for a uniform load of 250 psf and shall be fabricated from extruded aluminum trough flange with continuous anchor flange around the perimeter and aluminum checker plate respectively. All aluminum embedded in concrete shall be coated with a bituminous paint. The frames and cover plates shall be equipped with all Type 316 stainless steel hardware and accessories, including lift assist mechanisms. The access hatches shall be provided with a hasp and recessed, keyed padlock locking system. Pump access hatches shall be sized to provide manufacturer's recommended clearance on all sides of the pump as it is being removed. Sizing and placement of the hatches shall be in accordance with the pump manufacturer's minimum recommendations. The inside dimensions of the circular wet well will be approximately 12.0 feet in diameter and 18.75 feet deep.

5.4.4 Discharge Yard Piping:

The wet well discharge piping and fittings from each of the pump connections to outside the wet well shall be Type 316 Schedule 40 stainless steel with flanged joints and BUNA gaskets. The connections within the valve vault including check valves and isolation non-lubricated eccentric plug valves shall be ductile iron pipe with flanged joints. The remaining lift station discharge piping, including the emergency pump out connection shall be ductile iron pipe with restrained mechanical joints.

All above grade piping, fittings, and valves shall be flanged ductile iron and shall be supported by concrete pipe supports. The ductile iron pipe shall meet the requirements of AWWA C150 and C151. Flanges shall be in accordance with AWWA C115 (faced and drilled per ANSI B16.1 Class 125). Gaskets shall be specially designed combination ring and full face NSF Standard 61 Certified SBR black rubber per AWWA C111. Ductile iron pipe shall be pressure class 350, the exterior shall be painted with an industrial grade alkyd enamel, and the interior shall be epoxy-ceramic lined. Hardware for wet well piping, above grade piping and valves shall be stainless steel.

The buried force main piping shall be AWWA C150 and C151 ductile iron, pressure class 250, bell and spigot pipe with elastomeric gaskets and with restrained mechanical joint ductile iron fittings. The exterior shall be painted with asphaltic material in accordance with ANSI/AWWA A21.51/C151 and the interior shall be epoxy-ceramic lined.

All ductile iron fittings shall be compact fittings meeting the requirements of AWWA C153 and shall be lined with an epoxy- ceramic interior. Fitting sizes up to 24-inch shall be pressure rated to 350 psi. Fittings larger than 24-inch shall be pressure rated to 250 psi.

5.4.5 Valves:

Plug valves shall be non-lubricated full port eccentric style with elastomeric-coated plug in accordance with AWWA C504. The valve body, cover, plug, and seat ring shall be cast iron. The eccentric plug shaft shall be installed horizontally, with the plug stored in the top position when the valve is open to minimize potential for grit accumulation in the valve seat or shaft bearing. Above ground valves shall be flanged (ANSI B16.1 125lb. standard) and shall be gear actuated hand wheel operated. Underground valves shall have restrained mechanical joints and gear actuated 2-inch square operating nuts. Plug valves shall have a minimum pressure rating of 150 psi.

Check valves shall be outside lever and weight swing check style in accordance with AWWA C508 and have cast iron body with stainless steel or bronze body seat, stainless steel hinge shaft and cast iron disc with renewable rubber disc seat.

Sewage-type air release valve shall have a cast iron body and cover with stainless steel float and trim. The valve shall be directly tapped to the high point in the above grade piping and a full flow ball valve shall be installed under the air release valve for isolation and maintenance.

A reduced pressure system backflow preventer shall be installed on a 1½ potable water service connection to provide wash water through a hose bib at the wet well and to provide water to the odor control system. The backflow preventer will be installed in an above grade horizontal piping assembly that will include two isolation gate valves and test cocks for periodic inspection and maintenance of the device.

5.4.6 Odor Control System:

The lift station facility design includes the installation of a modular biofiltration system for odor and hydrogen sulfide control. The biofiltration system utilizes naturally occurring microorganisms to treat air containing hydrogen sulfide and other reduced sulfur compounds, and volatile organic compounds (VOC's). The system is composed of a control panel, blower, irrigation and humidification chamber, and biofilter vessel. The components are housed inside a fiberglass reinforced plastic cover.

Air from the wet well is drawn through above grade fiberglass reinforced duct piping to the system blower. The air is passed through the bottom of the humidification chamber where the air is saturated with water. The saturated air passes through the biofilter media bed where it is treated and released to the atmosphere. Weep hoses are provided at various heights along the filter be to provide substantial moisture control. Water is drained from the bottom of the reactor. A portion of the water is wasted to a drain pipe and redirected into the wet well, while the remainder is combined with fresh water and recycled back into the filter bed. This recycling of the wasted water provides nutrient return to the system and minimizes wastewater generation. The design will be based on an Envirogen Single H-120 modular odor control system and will be sized for a 99% removal of hydrogen sulfide (H_2S) with an average removal of 50 parts per million (ppm) and a peak removal of 100 ppm at six air changes per hour.

SECTION 6

ELECTRICAL, INSTRUMENTATION, AND HVAC BASIS OF DESIGN

6.1 Electrical System

As outlined in section 1 of this report, Lift Station No. 10 has been determined to require rehabilitation or replacement of all lift station components. This includes the electrical, emergency power systems and instrumentation components of this facility. The following provides an overview of the intended designs for the important project components.

6.2 FPL Service

The existing FPL service will remain energized and in service until the new station is completely operational.

It is anticipated that the existing FPL service point will be utilized to serve the new lift station electrical system. This will coordinated during the final design of this project.

6.3 Proposed Power Distribution

The electrical system for lift station no. 10 will be designed per Florida Department of Environmental Protection Notification/Application for Constructing a Domestic Wastewater Transmission System, NFPA 820 "Standard for Fire Protection in Wastewater Treatment and Collection Facilities" and the current edition of the National Electric Code (NEC).

The loads associated with the proposed Lift Station 10 facility will be served from a common power distribution system. The combined loads will total approximately 65 KVA of electrical load. This loading represents the ultimate loading that will be connected at this facility and, as such, will be used as the basis for sizing the normal and emergency power services for this facility.

It is proposed that a 200 amp, 480-volt FPL service be utilized to serve this new load. In the event that normal FPL power is lost, the emergency generator will be automatically started and brought on line to serve all station electrical requirements components. The new electrical equipment will be located rack mounted and installed outdoors.

The following provides an overview of the connected load for the new Lift Station No. 10.

Proposed Load Tabulation

Description			Load			Amps	
Wastewater Pumps	2	@	25	Hp	=	60	
Misc load			15	kVA	=	18	
				Connected Load:		78	Amps
Minimum Service Entrance Capacity =	78	+	.25	x 30	=	85.5	Amps

6.4 Distribution System Protection

All electrical equipment shall have adequate momentary and interrupting capacity to withstand fault currents that may occur at the point in the system where the equipment shall be applied. Ground fault protection on main breakers and feeder breakers shall be equipped with time delay setting and restraint systems, unless indicated otherwise on the design drawings.

6.5 Panelboards

Lighting panels shall be mounted internal to the lift station control panel. Transformers to supply 208Y/120 volt requirements shall be dry type and suitable for the area in which they are to be located. Separate panelboards shall be provided to supply power to instruments and control panels where the equipment to be supplied requires a conditioned power supply. Each panelboard will be provided with a minimum of 20% spare breakers with spaces, bus work, and terminations to complete the standard size panel. Panelboard schedules shall show the circuit description, protective device trip rating, and number of poles, rating of main lugs or main circuit breaker. Where multiple instruments are connected to a single-branch circuit, a toggle switch shall be provided at each tap to allow each individual instrument to be disconnected from the branch circuit.

6.6 Raceways

Specific types of raceway shall be chosen for use in various locations in the facility, based on moisture, temperature, exposure to damage, corrosion, voltage and cost.

- Pump cables shall be installed in PVC conduit encased in a 2" concrete envelope. The PVC conduit shall transition to PVC coated GRS conduit 2 feet prior to the lift station control panel. EYSR seal offs shall be used as the sealing fitting that separates the classified from the non- classified locations.
- Exterior, underground, direct-buried conduit shall be schedule 80 PVC.
- PVC conduit runs shall use PVC coated galvanized steel elbows.
- The minimum diameter of conduit shall be ¾ inch.

6.7 Wire and Cable

Copper conductors shall be used throughout. Solid conductors shall be permitted for lighting and receptacle circuits. All other applications shall employ stranded conductors. The current-carrying capacity of conductors shall be based on 75°C insulation ratings. Conductors No. 6 AWG and smaller shall have THHN/THWN insulation, while larger conductors shall have XHHW insulation. Individual No. 14 AWG conductors shall be used for discrete control circuits, unless it is practical to use multi-conductor cables to group control circuits. Twisted, shielded pair control cable No. 16 AWG with an aluminum Mylar tape shield shall be used for analog signals.

6.8 Grounding

Load centers shall be bonded to a grounding electrode, which may consist of a building steel column that is bonded to the underground rebar, or a made electrode system (triad or connection to ground loop around the building) and the nearest available effectively grounded metal water pipe. In addition, ground rods shall be driven outside the building to supplement the ground electrode. Grounding electrodes of ground mats or embedded rods and cables shall have a maximum resistance to ground of 5 ohms.

The parts of all electrical equipment, devices, panelboards, and metallic raceways that do not carry current shall be connected to the ground conductors. The transformer neutrals of wye-connected transformers shall be solidly grounded through a grounding conductor connected to the grounding system. A ground wire shall be installed in all raceways that contain power conductors of any voltage.

6.9 Lightning Protection

A lightning protection system shall be provided and installed for the proposed Blower Building, and for all structures greater than 5 feet above grade level. They system shall be in compliance with provisions of Code for Lightning Protection Systems as adopted by the National Fire Protection Association and Lightning Protection Institute.

Lightning protection cable shall be Class I copper. Grounding counterpoise shall be as shown. Fittings and straps shall be cast copper. Air terminals shall be copper as required to match roof conductors, have proper base support for surface on which they are attached, and be securely anchored to this surface. Terminals shall project a minimum of 10 inches above the top of the object to which it is attached.

Roof conductors shall consist of copper that complies with the weight and construction requirements of the Code, and be coursed to interconnect with air terminals and, in general, provide a two-way minimum path to ground. Down conductors shall be copper, and concealed within the structure.

Ground connections shall be made in accordance with requirements of all applicable codes. Ground rods shall be placed in a minimum of 2 feet from building foundations. In addition to above artificial grounds, one down conductor of each two-path system shall be connected to a water piping system with approved water pipe type strap connector. All ground rods shall be 5/8-inches in diameter, with a minimum length of 20 feet copper weld type.

6.10 Plant Monitoring and Control System

The design for monitoring and control of lift station 10 will be directed towards providing the most reliable, operationally efficient system possible. Remote monitoring of the facility will be handled by the Data Flow RTU system.

Floats will be utilized as the method for pump control. Relays located in the lift station control panel will provide the required logic for station operation.

6.11 Standby Power System

While the availability of power from FPL is desirable and provides a level of reliability, a standby diesel generator will be included in the design. The generator will provide power to the new facility during those occasions when FPL power is unavailable.

The diesel generator would be connected to the LS #10 control panel through an automatic transfer switch. The generator's proposed size is 80 KW. This size will operate two (2) pumps whenever the FPL feeder has failed.

A 500-gallon base mounted fuel tank will be provided for the new generator. This will provide approximately 48 hours of fuel at fuel load with 33% spare capacity. See **Table 6-1** for tank sizing criteria.

Table 6-1
Riviera Beach Lift Station No. 10
Palm Beach County, Florida
Fuel Tank Calculations
DATE: March 28, 2011

Description:

The following provides the basis for and design of the fuel tank system for the above referenced facility.

A. Engine/Generator Data:

Make:	Cummins
Engine:	Model DSFAE
Size:	80KW/100KVA

B. Fuel Consumption:

Load:	100%
kW:	80 KW
Consumption (gal/hour):	6.9

C. Time Period (per NFPA 110):

# of hours	48

D. Minimum gallon requirement (with 133% spare capacity):

440.50 gallons

E. Fuel Tank Selected

500 gallons

Notes:
1 As per NFPA 110 Table 2-2.3, minimum time, in hours for which the emergency power system is designed to operate at its rated load without being refueled.

2 As per NFPA 110 3-4, 2.3 – The main fuel reservoir shall have a minimum capacity of at least 133% of that specified in Table 2-3.

SECTION 7

LIFT STATION SITE ALTERNATIVES

7.1 General

RBUD's Lift Station No. 10 site is located on a narrow parcel of land adjacent to Lake Worth in the Yacht Harbor Estates subdivision. The lift station is surrounded by residential homes to the north, south, and east. Construction activities required for the replacement of LS 10 will be an inconvenience to the surrounding residents and may interfere with their current lake view. The RBUD requested that other site alternatives be analyzed and evaluated.

7.2 Existing LS 10 Site

The most obvious location for the replacement of LS 10 is at its current location. The City of Riviera Beach owns the property where Lift Station No. 10 is currently located. The site is a narrow parcel (25 feet by 142 feet) of land sandwiched between Lake Worth on the West and Park Avenue on the East. There appears to be sufficient property to construct the proposed lift station while keeping the existing lift station operational. Refer to **Figure 5-1**.

Construction sequencing and construction activities will be moderately difficult. The wet well, dry well, and junction box abandoned-in-place in 1992 will need to be excavated and removed prior to construction of the proposed facilities. The existing lift station must remain operational during the removal of the abandoned facilities and the construction of the proposed facilities. As stated previously, the lift station property is adjacent to Lake Worth and a sea wall with a 42-inch concrete cap that runs the entire length of the RBUD property. At the closest point, there appears to be approximately 7 feet of clear space between the wet well, dry well and seawall. As indicated by the Record Drawings, the wet well and dry well are approximately 24 feet deep. Excavation to this depth and at the close proximity to the sea wall will require sheeting to be installed adjacent to the sea wall for an approximate 93 feet length. The required depth of the sheeting will be calculated by a Geotechnical Engineer during the design phase.

OSHA Standard 1926.652 requires the protection of employees in excavations. If an excavation is greater than 5 feet in depth, the vertical walls of the excavation are required to be sloped no steeper than 11/2:1 or other methods of safety must be utilized. This sloping requirement creates a minimum excavation from the side of the wet well or dry well of approximately 15 feet. The edge of pavement of Park Avenue is approximately 10 feet from the wet well and dry well. Therefore, it is assumed that Park Avenue will conflict with the construction activities and will be removed during excavation of the wet well and dry well.

Park Avenue will be required to be closed during construction activities for approximately 100 feet adjacent to LS 10 and south of Yacht Harbor Drive. The closure of Park Avenue during construction will not impact the surrounding residents. Residents north of Yacht Harbor Drive can utilize North Ocean Drive for access.

Upon removal of the wet well, dry well, and junction box, the proposed duplex submersible lift station can be constructed. The proposed wet well shall be twelve (12) feet in diameter and should be constructed to allow approximately 7 feet of clear space between the wet well and the sea wall. The existing influent 10-inch and 14-inch force mains can be extended and intercepted, respectively to direct the wastewater flow into the proposed wet well. There is an existing sanitary manhole that is located directly in front of and perpendicular to the proposed wet well. A 20-inch sanitary sewer can be core bored and connected into the existing manhole to route the gravity wastewater into the proposed wet well.

In accordance with Florida Administrative Code (FAC) 62-604.400(2)(a)1, an in-place emergency generator is required at LS 10. Preliminary sizing of the generator suggests the unit will be approximately 15'x6'x9' (LxWxH). The generator should be configured to run lengthwise in the east/west direction. This will minimize the obstruction of the Lake Worth view, in so far as possible, for the adjacent residences. **Figure 7-1** illustrates the proposed duplex submersible lift station configuration.

Additionally, because Lift Station No. 10 is within close proximity to residences, an odor control system is required to remove the hydrogen sulfide odor or "rotten egg" smell from the air. The proposed odor control equipment will also obstruct a portion of the Lake Worth view. The biofilter tank sits approximately 7½ feet above grade and has a width of approximately 6 feet.

The replacement of LS 10 at its current location will marginally obstruct the view of Lake Worth from the adjacent residences. The RBUD has anticipated that the required in-place emergency generator, the required odor control system, the required fencing, and proposed landscaping will raise some objections from the adjacent homeowners. The required generator will sit approximately 11.5 feet above the crown of Park Avenue road for a length of approximately 6.0 feet and the odor control equipment will sit approximately 10.0 feet above the crown of Park Avenue road for a length of approximately 6.0 feet. In accordance with FAC 62-604.400(2) (d), pump stations shall be enclosed with a fence or otherwise designed with appropriate features to discourage the entry of animals and unauthorized persons. The existing lift station has a 4 feet, chain link fence surrounding the lift station. The proposed lift station will have the same. Additionally, lift stations located in residential areas utilize landscaping to provide a buffer or screen of the lift station and its equipment. These measures are twofold, to provide safety and camouflage the lift station for the surrounding homeowners. Because LS 10 is located in front of Lake Worth, the measures will also obstruct the view towards Lake Worth from the residential properties. With this in mind, the RBUD has requested that we look at other potential site locations. Refer to **Figure 7-2**.

7.3 Site Alternative No. 2

A second alternative site location is the purchase of the adjacent home at 1201 Yacht Harbor Drive. This residence is located directly across the street from the existing lift station, runs the length of the lift station property, faces the existing lift station, and has their view obstructed to the greatest degree by the proposed lift station improvements.

The 1201 Yacht Harbor Drive property is approximately 11,210 square feet with a single-family residential dwelling. The property is large enough that it can accommodate the proposed LS 10 improvements without demolishing the existing dwelling. However, the RBUD may wish to demolish the open porch and finished garage to allow for construction of LS 10 in the rear of the property.

Constructing the LS 10 replacement in the rear of the property will hide the lift station from the surrounding residential area.

Because this property is located directly across Park Avenue from the existing LS 10, additional wastewater piping or redirection of wastewater flow will not be necessary.

Currently, the 1201 Yacht Harbor Drive homeowners have this residence for sale. The property is listed with Illustrated Properties, phone (561) 840-0101 for $465,000.

7.4 Site Alternative No. 3

The third site alternative selected is a vacant lot located on the southeast corner of the Lake Drive and Blue Heron Blvd. intersection; refer to **Figure 7-2**. The lot is approximately 24,894 square feet and is sub-divided into three individual parcels. The property is owned by Southland Corporation and was purchased in 1987 for $475,000. The Palm Beach County Property Appraiser currently estimates the market value to be $598,389. A single parcel would be large enough to accommodate the proposed lift station and the required appurtenances.

The advantages of this alternative are that the lift station would no longer be located within a residential subdivision, therefore homeowner complaints and dissatisfaction would no longer be an issue. In addition, the view of Lake Worth would no longer be impaired by a lift station. This site is located on a commercial corridor off Blue Heron Boulevard.

The largest and most prohibitive disadvantage of this site alternative is that a portion of the existing wastewater gravity sanitary sewer on Park Avenue and Blue Heron Boulevard will need to be rerouted to redirect the wastewater flow. For approximately 1,075 feet along Park Avenue from the existing LS 10 site south to Blue Heron Blvd; and 630 feet along Blue Heron Boulevard to the proposed lift station site alternative no. 3, new 18-inch/20-inch gravity sanitary sewer will need to be constructed to redirect the wastewater flow in a southerly direction. The depth of installation of the redirected gravity sewer ranges from 10 to 20 feet in depth. A significant amount of by-pass pumping will be required during construction of the replacement sanitary sewers.

Construction activities will require Park Avenue to be closed from approximately Harbor Drive South to Blue Heron Boulevard. Residents of the Yacht Harbor Estates subdivision can utilize Lake Drive and North Ocean Drive for access.

Blue Heron Boulevard (State Road 708) is owned and maintained by the Florida Department of Transportation (FDOT). Installation of any utility within their right-of-way (ROW) requires the FDOT's permission. An FDOT right-of-way utilization permit will be required. It is highly unlikely that the FDOT will allow Blue Heron Boulevard to be open-cut; therefore, construction of the gravity sanitary sewer will need to occur within the utility corridor.

7.5 Recommendations

We have reviewed the three site alternatives for Lift Station No. 10, as requested by the RBUD. We have found that the current Lift Station No. 10 site (Site Alternative 1) is large enough to accommodate the suggested improvements without the need to acquire additional property, allows for the progress of construction activities with minimal difficulty, will be the least disruptive to the surrounding residential area, and is the most economical. Refer to the following *Opinion of Probable Construction Cost* section.

SCALE: 1" = 10'

LAKE WORTH

PROPERTY LINE

EXIST. ANTENNA AND CONC. BASE TO REMAIN

PROP. GENERATOR SET w/ BELLY FUEL TANK

PROP. PUMP CONTROLS

PROP. DUPLEX LIFT STATION

PROP. PUMP OUT CONNECTION

PROP. CHAIN LINK FENCE

PROP. VALVE BOX

10"

10"

10"

ROW

ROW

PROPOSED ODOR CONTROL

P.P.

PROP. 16" FM

20" SAN

FUTURE PUMP AND PIPING

PROP. 16"x12" REDUCER

PEDESTRIAN GATE

F.H.

8" WM

CONNECT TO EXIST. 10" FM

PROP. 10" FM

10" FM

PROP. 20" FM

PLUG EXIST. 20" SAN. SEWER

CONNECT TO EXIST. SAN. MH.

14" SAN

SAN MH.

18" SAN

SAN MH.

18" SAN

SAN MH.

PARK AVE.

CONNECT TO EXIST. 16" FM

CUT AND CAP EXIST. 16" FM

14" FM

CONNECT TO EXIST. 16" FM REMOVE EXIST. CAP

PROP. 16" FM

YACHT HARBOR DR.

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BFA Environmental Consultants
Barnes, Ferland and Associates, Inc.
Engineering Buisness No. 6899

Wastewater Lift Station 10 Improvements

PROPOSED LIFT STATION 10 SITE PLAN

FIGURE 7-1

BFA Environmental Consultants
Barnes, Ferland and Associates, Inc.
Engineering Buisness No. 6899

Wastewater Lift Station 10 Improvements

ALTERNATIVE SITE LOCATION MAP

FIGURE 7-2

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SECTION 8

OPINION OF PROBABLE CONSTRUCTION COST

8.1 Planning Cost Estimate

The purpose of this section of the Preliminary Design Report is to provide a preliminary opinion of probable construction cost associated with the construction of the proposed Lift Station No. 10.

A summary of the planning level costs, including construction cost, general conditions (bonds, insurance, etc.) costs, project contingency, and related technical services for the three site alternatives is presented in **Table 8-1** for the construction of the proposed Lift Station No. 10. All construction costs are in December 2010 dollars.

These cost estimates are based upon:

- Recent bid prices for similar projects;
- Planning level vendor quotes for proposed equipment;
- Recent cost estimates for similar projects in Florida;
- Standard cost data from industry publications as contained in Means publications; and
- Standard allowances for items such as electrical, instrumentation, yard piping, and site work.

The total estimated construction cost for the proposed Lift Station No. 10 is as follows:

Site Alternative No. 1..... approximately **$774, 194**.

Site Alternative No. 2..... approximately **$1,112,899**.

Site Alternative No. 3..... approximately **$1,360,791**.

TABLE 8-1
Proposed Lift Station No. 10 Construction Cost Estimate

Item No.	Description	Estimated Cost Site 1	Estimated Cost Site 2	Estimated Cost Site 3
1	Mobilization/ Demobilization	$34,000	$25,500	$45,500
2	General Requirements	$10,000	$10,000	$10,000
3	Site Survey, Field Engineering and Record Drawings	$4,000	$4,000	$4,000
4	Clearing and Grubbing	$0	$0	$2,000
5	Sheeting	$136,710	$0	$0
6	Property Acquisition	$0	$465,000	$271,270
7	Concrete Wet Well Construction	$42,000	$42,000	$42,000
8	Submersible Pumps and Accessories	$60,000	$60,000	$60,000
9	Odor Control System	$89,400	$89,400	$89,400
10	Emergency Generator, Fuel Tank and Piping	$42,000	$42,000	$42,000
11	Electrical: Controls & RTU	$52,000	$52,000	$52,000
12	Electrical: Materials and Instrumentation	$82,000	$82,000	$82,000
13	Yard Piping, Valves and Fittings	$71,815	$71,815	$52,895
14	Yard Concrete	$4,103	$4,103	$4,103
15	Sanitary Sewer Improvements	$0	$0	$298,200
16	Bypass Pumping	$0	$0	$60,000
17	Asphalt Roadway Removal and Replacement	$12,042	$12,042	$58,050
18	Yard Stone with Geofabric	$910	$910	$910
19	Chain Link Fence (4 ft.)	$1,472	$2,208	$2,208
20	Sodding	$372.50	$372.50	$372.50
21	Erosion and Sedimentation Control	$187.50	$187.50	$187.50
22	Removal of Existing Structures	$30,200	$6,200	$6,200
	Subtotal	**$673,212**	**$967,738**	**$1,183,296**
	Construction Contingency (15%)	**$100,981.80**	**$145,160.70**	**$177,494.40**
	Total Project Cost	**$774,193.80**	**$1,112,898.70**	**$1,360,790.40**

Appendix A

Proposed Lift Station 10 System Curves and Pump Curve Information

FLYGT

PERFORMANCE CURVE

PRODUCT	TYPE
NP3171.181	MT

DATE	PROJECT	CURVE NO	ISSUE
2010-08-02	FLYGT US Catalog	63-436-00-3030	4

	1/1-LOAD	3/4-LOAD	1/2-LOAD
POWER FACTOR	0.87	0.83	0.74
EFFICIENCY	88.0 %	89.5 %	90.0 %
MOTOR DATA	---	---	---

RATED POWER	25	hp
STARTING CURRENT ...	180	A
RATED CURRENT ...	30	A
RATED SPEED	1755	rpm
TOT.MOM.OF INERTIA ...	0.14	kgm2
NO. OF BLADES	2	

IMPELLER DIAMETER: 234 mm

MOTOR #	STATOR	REV
25-14-4AA	7 YSER	11

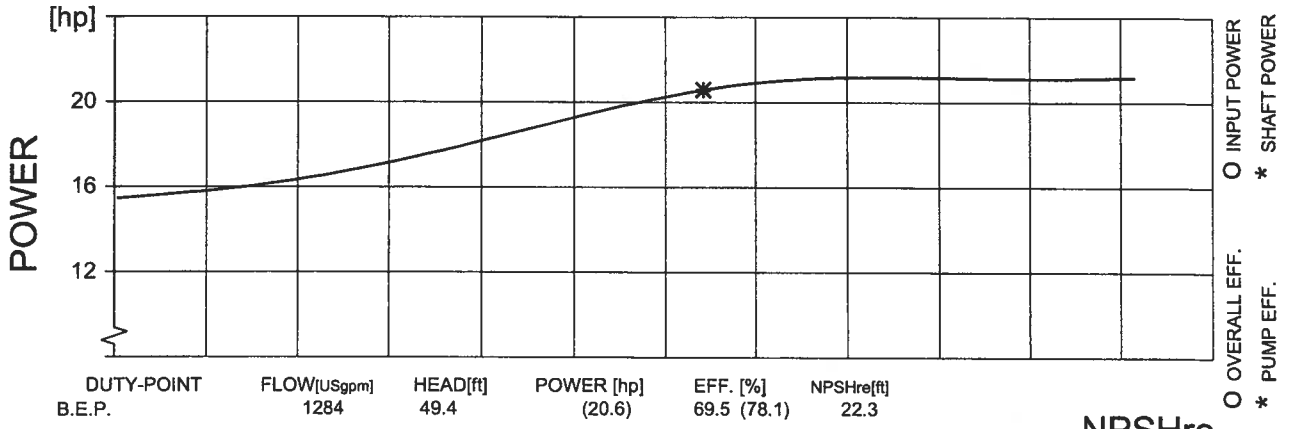
FREQ.	PHASES	VOLTAGE	POLES
60 Hz	3	460 V	4

GEARTYPE	RATIO
---	---

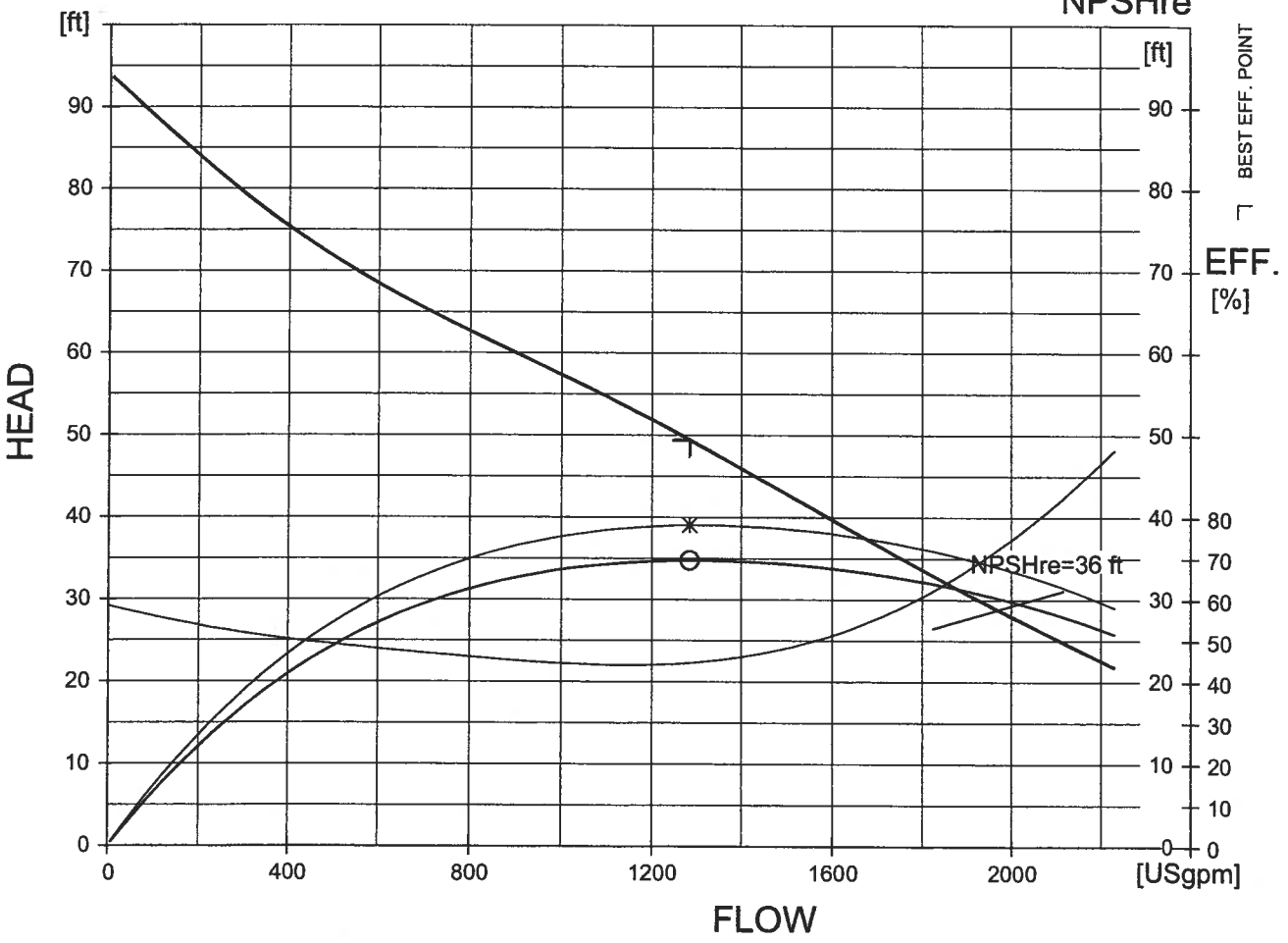
COMMENTS: NEMA Code Letter: G

INLET/OUTLET: -/ 6 inch

IMP. THROUGHLET: ---



DUTY-POINT	FLOW[USgpm]	HEAD[ft]	POWER [hp]	EFF. [%]	NPSHre[ft]
B.E.P.	1284	49.4	(20.6)	69.5 (78.1)	22.3

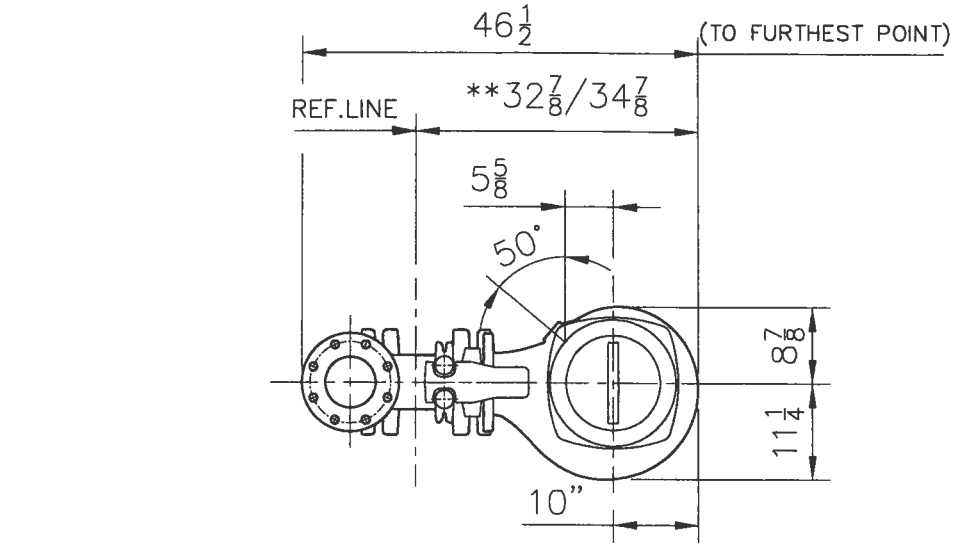


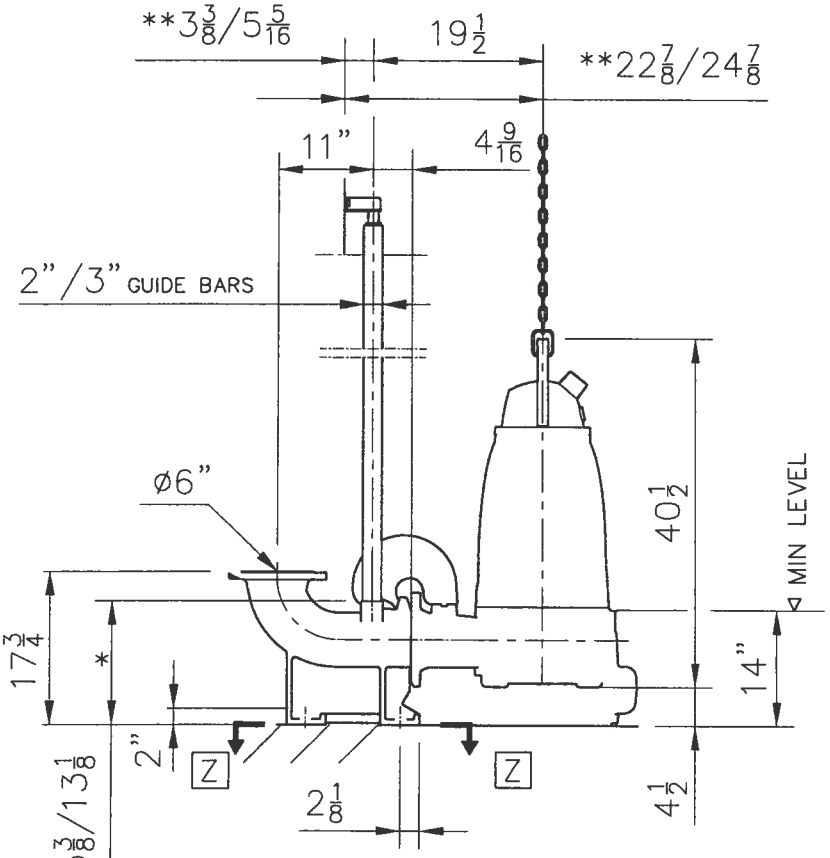
FLYPS 3.1.6.3 (20060531)

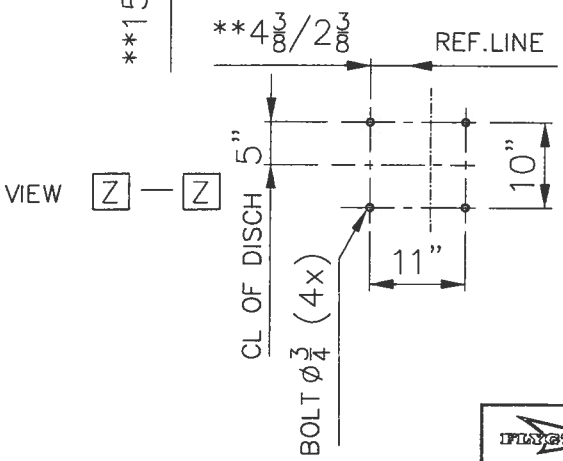
NPSHre = NPSH3% + min. operational margin

Performance with clear water and ambient temp 40 °C

FLYGT CURVE







2" guidebars for a new installation
3" guidebars for retrofit

* DIMENSION TO ENDS OF GUIDE BARS
**DIMENSIONS FOR 2"/3" GUIDE BARS

Weight (lbs)	
Pump with cooling jacket	Disch
730	175
Pump without cooling jacket	
665	

FLYGT AUTOCAD DRAWING	Denomination: Dimensional drwg NP, FP 3171 MT ø6"	Drawn by NK	Checked by	Date 081013
		Scale		Reg no 5399
		6599500		13

ITT
Water & Wastewater

FP/NP-3171

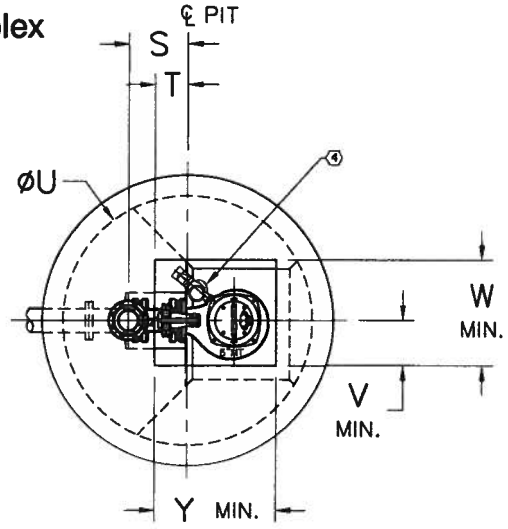
Lift Station Dimensions

Issued: 2/09 | Supersedes: 2/08

NOTES:

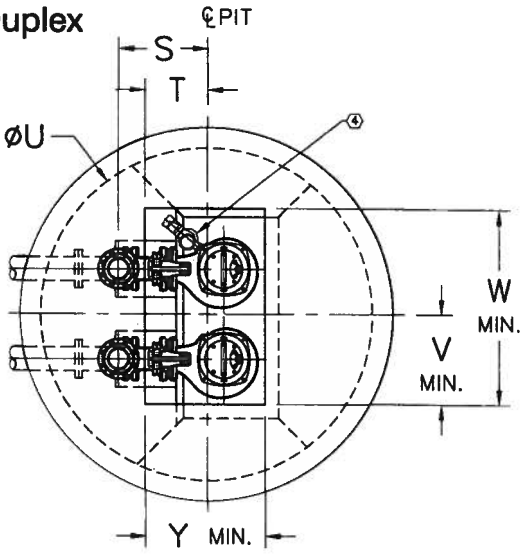
1. CONFIGURATION AND DIMS. SHOWN ARE SUGGESTED REQUIREMENTS ONLY. ALL DETAILS, INCLUDING SIZING OF PIT, TYPE, LOCATION AND ARRANGEMENT OF VALVES AND PIPING, ETC. ARE TO BE SPECIFIED BY THE CONSULTING ENGINEER AND ARE SUBJECT TO THEIR APPROVAL.
2. REFERENCE GENERIC DUPLEX LIFT STATION LAYOUT FOR ELEVATION VIEW.
3. LOCATE ANCHOR BOLTS USING INSIDE EDGE OF CLEAR OPENING AND PUMP CENTERLINE AS REFERENCE POINT. BOLT LOCATIONS MUST BE HELD TO MAINTAIN EXACT POSITION OF PUMP TO CLEAR OPENING.
4. ITT FLYGT MIX-FLUSH VALVE.

Simplex

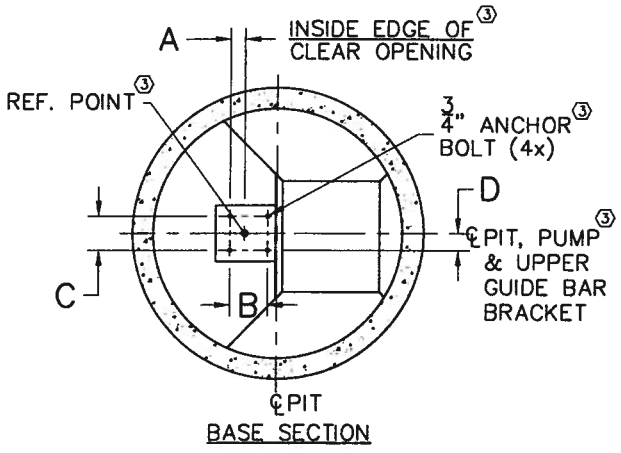


TOP VIEW

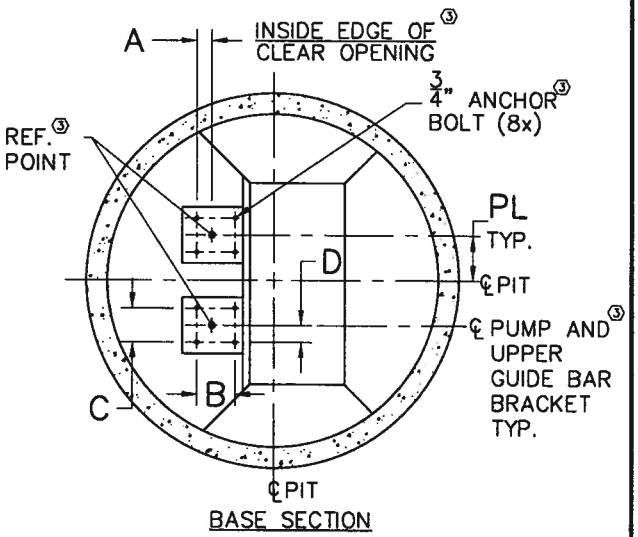
Duplex



TOP VIEW



BASE SECTION



BASE SECTION

ALL DIMENSIONS ARE IN INCHES

MODEL	NOM. SIZE	VERSION	GUIDE BAR SIZE	SIMPLEX										DUPLEX						
				A	B	C	D	S	T	U	V	W	Y	S	T	U	PL	V	W	Y
NP	4"	SH	2"	2¾	9⅞	8	4	19¾	13¼	72	9½	27½	32	22¼	15¾	84	13	22½	53½	32
NP	4"	SH	3"	⅞	9⅞	8	4	19¾	15¼	72	9½	27½	34	22¼	17¾	84	13	22½	53½	34
FP/NP	4"	HT	2"	2¾	9⅞	8	4	19¾	13¼	72	12	29½	33	22¼	15¾	84	13	25	55½	33
FP/NP	4"	HT	3"	⅞	9⅞	8	4	19¾	15¼	72	12	29½	35	22¼	17¾	84	13	25	55½	35
FP/NP	6"	MT	2"	4⅜	11	10	5	17	9⅜	72	13	30½	35	25¾	18⅜	96	13	26	56½	35
FP/NP	6"	MT	3"	2⅜	11	10	5	17	11⅜	72	13	30½	37	25¾	20⅜	96	13	26	56½	37
NP	10"	LT	2"	16⅛	19¾	10	5	23¾	13	96	17½	37	43	28⅜	17⅞	120	22	39½	81	43
NP	10"	LT	3"	14⅛	19¾	10	5	23¾	14⅞	96	17½	37	45	28⅜	19½	120	22	39½	81	45