Appendix I Pump Station Technical and Detailed Report

This is a preliminary report subject to revision; it does not contain final conclusions of the United States Army Corps of Engineers.



This is a preliminary report subject to revision; it does not contain final conclusions of the United States Army Corps of Engineers.



Pre-Hurricane Katrina – View from Inlet Canal

4200 Jean Lafitte Pkwy. Chalmette, LA 70043 504.512.6331 Position: Latitude 29.966557° Longitude -89.975821°



PS1 Fortification

Pre-Hurricane Katrina – Arial view of pump station

Pump Station Description

Fortification is 1 of 8 pumping stations in St Bernard Parish owned and operated by the Lake Borne Basin Levee District. The station contains three vertical pumps that were installed in 1972 with a total pumping capacity of 980 cubic feet per second $(cfs)^1$. Two of the pumps are driven by diesel engines and one by an electric motor. The drainage water is supplied to the pumps from the Florida Walk canal and discharges through the interior back levee to the marsh known as

¹ The Pump Information Table contains more details about the individual pump data and is located at the beginning of this section.

Bayou Bienvenue. The individual pump discharges have a tainter gate installed to cut off water flow in either direction.

Pump Station Operation

Pump station operators will turn the pumps on as they are required to reduce the water elevation in the canal. The pumps are normally turned on when the water in the canal reaches approximately -6 feet (NGVD) and turned off when the water level reaches -6.5 feet (NGVD). When heavy rainfall events are expected the station operators will pump the canal down to an elevation of -8.5 feet (NGVD). If the water elevation on the discharge side of the pump station is predicted to exceed 3.5 feet (NGVD) the station operator closes the discharge tainter gates.

Fuel Endurance Calculation

Assumptions :

1) #2 Diesel fuel is used with an HHV rating of 140,000 btu/gal

2) Burn rate of 35 gph @ 500 kW with above HHV rating

3) Diesel engines are running at rated capacity

PS1 Fortification

3 pump drivers - 2 diesel and 1 electric. The diesels are rated at 1200 horsepower

The approximate burn rate for each diesel is then calculated:

$$R_{burn} \coloneqq \left(35 \frac{gal}{hr}\right) \cdot \frac{1200hp}{500kW} \qquad \qquad R_{burn} = 62.639 \frac{gal}{hr}$$

Fuel Capacity

4 - 5000 gallon tanks

2 - 110 gallon day tanks

Fuel Endurance

The time the 5000 gallon tanks will last is calculated:

$$t_1 := \frac{4.5000 \text{gal}}{2 \text{R}_{\text{burn}}}$$
 $t_1 = 159.645 \text{ hr}$

The time the 110 gallon tanks will last is calculated:

$$t_2 \coloneqq \frac{2 \cdot 110 \text{gal}}{2 \text{R}_{\text{burn}}} \qquad t_2 = 1.756 \text{ hr}$$

The approximate total continous run time for the pump station is:

$$T_t := t_1 + t_2$$

 $T_t = 161.402 \text{ hr}$
 $T_t = 6.725 \text{ day}$

Pump Curves

Pump capacity curves were obtained either from the parish or from the manufacturer of each pump. From these curves, a curve fit process was used to create new curves and equations.

Using drawings provided, assumptions were made regarding the dimensions of the pump station and the pump. Using these assumptions, the minor and friction losses were calculated in order to create the system curve. Two system curves were created due to the range of heads reported by the parish. The two curves represent the maximum and minimum operating heads reported.

Reverse Flow

The Engineering Hydraulics Design section of the US Army Corps of Engineers Portland District office performed analysis of reverse flow characteristics for each pump. The results are reverse flow rating curves that are attached to this section. The tables present the flow rates per individual pump. The detailed calculations, assumptions, and assumed dimensions are available upon request.

Katrina Event

8/28/05 -Operators pumped water in canal down to approximately 8.5 ft.

- 8/29/05 Operators evacuated pump station at approximately 1:15 am.
- **8/30/05** -Operators returned to the station at 10:00 am. Water was the same elevation on both sides of pump station.

9/01/05 -Both pumps running.

9/11/05 -Pump station back to normal operation.

Damage Report

The following information was obtained from the Project Information Report (PIR) for New Orleans District:

Pump Station 1 sustained relatively minor damage because its operating floor elevation is 16 feet N.G.V.D. Flooding from the storm flooded the lower level of the station but the flood waters were approximately three feet below the concrete operating floor level. Pump station equipment that was damaged includes an electric pump motor, generator, trash rack bearing and gear box, and lighting. The building sustained damage to the metal siding and roof. Additionally, the diesel engine cooling system developed a leak. Auxiliary equipment damage included flooding of a bobcat used to remove debris from the trash racks.



Post-Hurricane Katrina – View from the Inlet Canal

PS1 Fortification



Post-Hurricane Katrina – Arial view of the pump station



This is a preliminary report subject to revision; it does not contain final conclusions of the United States Army Corps of Engineers.

I-7



This is a preliminary report subject to revision; it does not contain final conclusions of the United States Army Corps of Engineers.



50'0" DISCHARGE STRUCTURE NOTE: PROPOSED METAL ROOF AND WALL SYSTEMS, INCLUDING CANOPIES AND PROPOSED WORK, ARE SHOWN SHADED AND SUPERIMPOSED ON EXISTING CRANE RUNWAY SUPPORT. LEFT ENDWALL PROPOSED WOFK IDENTICAL AS SHOWN BUT OPPOSITE HAND. Elev + 7.83 ; Eley. + 3.83 RIGHT ENDWALL ELEVATION SCALE: 1" = 1'-0" Exterior Wall RIGHT ENDWALL ELEVATION STATE OF LOUISIANA LOUISIANA DEPARTMENT OF PUBLIC WORKS METAL ROOF AND WALL SYSTEMS 50 FOR FORTIFICATION AND MERAUX PUMPING STATICI ST. BERNARD PARISH 6'-4 PREPARED BY LOUISIANA DEPARTMENT OF PUBLIC WORKS SUBMITTED BY DISTRIC ENGINEER APPROVED BY CHIEFENC ONG APPROVED BY By By JUNE 1975 DATED ____ -TRACED G.G PG.K. HECKED DETAILED BY 1-9 A.E.S. CHECKED G.G CHECKED SHEET 3 PPROVEC OF 9

St. Bernard Parish

PS 2 Guichard

PS2 Guichard



Pre-Hurricane Katrina – View from the south end

4201 Jean Lafitte Pkwy. Chalmette, LA 70043 504.512.6331 Position: Latitude 29.961649° Longitude -89.964442°



Pre-Hurricane Katrina – Arial view of pump station

Pump Station Description

I-10

Guichard is 1 of 8 pumping stations in St Bernard Parish owned and operated by the Lake Borne Basin Levee District. The station contains four horizontal pumps that were installed in the 1950's with a total pumping capacity of approximately 755 cubic feet per second (cfs)¹. All four pumps are driven by diesel engines. The drainage water is supplied to the pumps from the Florida Walk canal and discharges through the interior back levee to the marsh known as Bayou Bienvenue.

¹ The Pump Information Table contains more details about the individual pump data and is located at the beginning of this section.

There was not enough information available to determine the rated capacity for pump 3. It was assumed it would be similar to the pump 1 (42") based on the available information.

Pump Station Operation

This pump station was available but not used in the days before Hurricane Katrina.

Fuel Endurance Calculation

Assumptions:

1) #2 Diesel fuel is used with an HHV rating of 140,000 btu/gal

2) Burn rate of 35 gph @ 500 kW with above HHV rating

3) Diesel engines are running at rated capacity

PS 2 Guichard

4 pump drivers - All diesels

2 diesels are 800 hp, 1 diesel is 335 hp, and 1 is approximately 300 hp

The approximate burn rate for each diesel is then calculated at:

$$R1_{burn} := \left(35\frac{gal}{hr}\right) \cdot \frac{800hp}{500kW} \qquad R1_{burn} = 41.759\frac{gal}{hr}$$

$$R2_{burn} := \left(35\frac{gal}{hr}\right) \cdot \frac{335hp}{500kW} \qquad R2_{burn} = 17.487\frac{gal}{hr}$$

$$R3_{burn} := \left(35\frac{gal}{hr}\right) \cdot \frac{300hp}{500kW} \qquad R3_{burn} = 15.66\frac{gal}{hr}$$

Fuel Capacity

1 - 5,000 gallon tank

4 - 60 gallon day tanks

Fuel Endurance

The time the 5,000 gallon tank will last is calculated:

$$t_1 := \frac{500\text{Qal}}{\text{R1}_{\text{burn}} + \text{R2}_{\text{burn}} + \text{R3}_{\text{burn}}}$$
 $t_1 = 66.75 \,\text{hr}$

The time the 60 gallon tanks will last is calculated:

$$t_2 := \frac{4.60 \text{gal}}{\text{R1}_{\text{burn}} + \text{R2}_{\text{burn}} + \text{R3}_{\text{burn}}} \qquad t_2 = 3.204 \text{hr}$$

The approximate total continous run time for the station is:

$$T_t := t_1 + t_2$$

 $T_t = 69.95 \text{fm}$
 $T_t = 2.915 \text{day}$

Pump Curves

Pump curves were obtained from the manufacturer of the pumps. Serial numbers were unobtainable, and therefore only by making assumptions regarding the size and make of the pump as well as the similarity to that of PS 3 Bayou Villere and PS 5 E.J. Gore were any usable curves located. There was no usable information regarding pump 3, so it was assumed similar to

pump 1. From these curves, a curve fit process was used to create new curves and equations. From these curves, further assumptions were made regarding the dimensions of the pump station, pipe, and pumps so that friction and minor losses could be calculated. These calculations created the system curves. There are two curves using the maximum and minimum reported operating heads by the parish.

Reverse Flow

The Engineering Hydraulics Design section of the US Army Corps of Engineers Portland District office performed analysis of reverse flow characteristics for each pump. The results are reverse flow rating curves that are attached to this section. The tables present the flow rates per individual pump. The detailed calculations, assumptions, and assumed dimensions are available upon request.

<u>Katrina Event</u>

This station was designated as a backup and therefore was not used prior to Hurricane Katrina. After the hurricane the pump station could not be operated as the motors were overtopped with water.

Damage Report

The following information was obtained from the Project Information Report (PIR) for New Orleans District:

Pump Station 2 sustained substantial damage. With its operating floor at or near the natural ground elevation, the pump station was flooded to a depth of 6 to 7 feet. The four diesel engines were flooded along with control panels, compressors, motors, and vacuum pumps. The diesel fuel storage tank was moved off its concrete saddle foundation. All exterior and interior lighting was damaged. While the existing building was in poor condition prior to the storm, the wind and water caused additional damage to all four sides of the building and the building roof.



Post-Hurricane Katrina – View from the North



PS2 Guichard

Post-Hurricane Katrina – Arial view of the pump station



This is a preliminary report subject to revision; it does not contain final conclusions of the United States Army Corps of Engineers.

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PS 3 Bayou Villere

St. Bernard Parish



Pre-Hurricane Katrina - View to the North

3700 Bartolo Meraux, LA 70075 504.512.6331 Position: Latitude 29.951279° Longitude -89.934607°



PS3 Bayou Villere

Pre-Hurricane Katrina – Arial view of pump station

Pump Station Description

Bayou Villere is 1 of 8 pumping stations in St Bernard Parish owned and operated by the Lake Borne Basin Levee District. The station contains three horizontal pumps that were installed in the 1950's with a total pumping capacity of 800 cubic feet per second $(cfs)^1$. All three pumps are driven by diesel engines. The drainage water is supplied to the pumps from the Forty Arpent

¹ The Pump Information Table contains more details about the individual pump data and is located at the beginning of this section.

canal and discharges through the interior back levee to the marsh known as Bayou Villere. Pumps 1 and 2 have butterfly valves on the inlet piping leading to the pump to cut off water flow in either direction.

Pump Station Operation

This pump station is designated as a back up and therefore was not used in the days leading up to Hurricane Katrina.

Fuel Endurance Calculation

Assumptions:

1) #2 Diesel fuel is used with an HHV rating of 140,000 btu/gal

2) Burn rate of 35 gph @ 500 kW with above HHV rating

3) Diesel engines are running at rated capacity

PS 3 Bayou Villere

3 pump drivers - All diesels

Diesels are 800 hp

The approximate burn rate for each diesel is then calculated at:

$$R_{burn} := \left(35 \frac{gal}{hr}\right) \cdot \frac{800hp}{500kW} \qquad \qquad R_{burn} = 41.759 \frac{gal}{hr}$$

Fuel Capacity

1 - 2500 gallon tank

3 - 60 gallon day tanks

Fuel Endurance

The time the 2500 gallon tank will last is calculated:

$$t_1 := \frac{2500 \text{gal}}{3R_{\text{burn}}}$$
 $t_1 = 19.956 \text{hr}$

The time the 60 gallon tank will last is calculated:

$$t_2 := \frac{3 \cdot 60 \text{gal}}{3 \text{R}_{\text{burn}}} \qquad t_2 = 1.437 \text{hr}$$

The approximate total continous run time for the station is:

$$T_t := t_1 + t_2$$

 $T_t = 21.392ht$
 $T_t = 0.89 Iday$

Pump Curves

Pump capacity curves were obtained. From these curves, a curve fit process was used to create new curves and equations. During the data collection, only one pump serial number was found, so the others were assumed to be similar. Using manufacturer data and making assumptions regarding the dimensions of the pump station and pump, as well as other necessary assumptions, the minor and friction losses were calculated so that system curves could be created. Two curves were made due to the range of operating heads reported from the parish. The two curves represent the maximum and minimum operating heads reported.

Reverse Flow

The Engineering Hydraulics Design section of the US Army Corps of Engineers Portland District office performed analysis of reverse flow characteristics for each pump. The results are reverse flow rating curves that are attached to this section. The tables present the flow rates per individual pump. The detailed calculations, assumptions, and assumed dimensions are available upon request.

Katrina Event

This station was designated as a backup and therefore was not used prior to Hurricane Katrina. After the hurricane the pump station could not be operated as the motors were overtopped with water.

Damage Report

The following information was obtained from the Project Information Report (PIR) for New Orleans District:

Pump Station 3 sustained substantial damage. With its operating floor at or near the natural ground elevation, the pump station was flooded to a depth of 8 feet. The three diesel engines and hydraulic drives were flooded along with the vacuum pump system and ancillary equipment. The diesel fuel storage tank was moved off its foundation. All exterior and interior lighting was damaged. While the existing building was is poor condition prior to the storm, the wind and water caused additional damage to all four sides of the building.



Post-Hurricane Katrina – View to the South

PS3 Bayou Villere



Post-Hurricane Katrina – Arial view of the pump station



I-21



SINGLE STAGE FOR TWO STAGES MULTIPLY HEAD AND HORSEPOWER BY 20 AND EFFICIENCY BY 1.0 PERFORMANCE BASED ON PUMPING CLEAR COLD NON-AFRATED WATER, SPECIFIC GRAVITY 1.0, TEMPERATURE & DEGREES (FAHRENHEIT) OR LESS, AT SEA LEVEL, PER-FORMANCE MAY BE AFFECTED BY HIGHER TEMPERATURES, SPECIFIC GRAVITIES, ALTITUDES, AND SUMP CONDITIONS.

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Florida

DEERFIELD BEACH, FLORIDA 33441 U.S.A. ESTABLISHED 1926









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St. Bernard Parish

PS 4 Meraux

PS 4 - Meraux



Pre-Hurricane Katrina – View from Inlet Canal

3200 Guerra Dr. Violet, LA 70092 504.512.6331 Position: Latitude 29.921331° Longitude -89.891292°

Pre-Hurricane Katrina – Arial view of pump station

Pump Station Description

I-24

Meraux is 1 of 8 pumping stations in St Bernard Parish owned and operated by the Lake Borne Basin Levee District. The station contains three vertical pumps that were installed in 1972 with a total pumping capacity of 980 cubic feet per second $(cfs)^1$. Two of the pumps are driven by diesel engines and one by an electric motor. The drainage water is supplied to the pumps from the Forty Arpent canal and discharges through the interior back levee to the marsh known as

¹ The Pump Information Table contains more details about the individual pump data and is located at the beginning of this section.

Bayou Dupre. The individual pump discharges have a tainter gates installed to cut off water flow in either direction.

Pump Station Operation

Pump station operators will turn the pumps on as they are required to reduce the water elevation in the canal. The pumps are normally turned on when the water in the canal reaches approximately -6 feet (NGVD) and turned off when the water level reaches -6.5 feet (NGVD). When heavy rainfall events are expected the station operators will pump the canal down to an elevation of -8.5 feet (NGVD). If the water elevation on the discharge side of the pump station is predicted to exceed 3.5 feet (NGVD) the station operator closes the discharge tainter gates.

Fuel Endurance Calculation

Assumptions:

- 1) #2 Diesel fuel is used with an HHV rating of 140,000 btu/gal
- 2) Burn rate of 35 gph @ 500 kW with above HHV rating
- 3) Diesel engines are running at rated capacity

PS 4 Meraux

3 pump drivers - 2 are diesels and 1 is electric

The 2 diesels are 1200 hp

The approximate burn rate for each diesel is then calculated at:

$$R_{\text{burn}} := \left(35 \frac{\text{gal}}{\text{hr}}\right) \cdot \frac{1200\text{hp}}{500\text{kW}} \qquad \qquad R_{\text{burn}} = 62.639 \frac{\text{gal}}{\text{hr}}$$

Fuel Capacity

4 - 5000 gallon tanks

2 - 110 gallon day tanks

Fuel Endurance

The time the 5000 gallon tanks will last is calculated:

$$t_1 := \frac{4.500 \text{ (gal)}}{2 \text{R}_{\text{burn}}}$$
 $t_1 = 159.645 \text{ fm}$

The time the 60 gallon tanks will last is calculated:

$$t_2 := \frac{2 \cdot 110 \text{gal}}{2 \text{R}_{\text{burn}}}$$
 $t_2 = 1.75 \text{fm}$

The approximate total continous run time for the station is:

$$T_t := t_1 + t_2$$

 $T_t = 161.402hr$
 $T_t = 6.725day$

Pump Curves

Pump capacity curves were obtained either from the parish or from the manufacturer of each pump. From these curves, a curve fit process was used to create new curves and equations.

Using drawings provided, assumptions were made regarding the dimensions of the pump station and the pump. Using these assumptions, the minor and friction losses were calculated in order to create the system curve. Two system curves were created due to the range of heads reported by the parish. The two curves represent the maximum and minimum operating heads reported.

Reverse Flow

The Engineering Hydraulics Design section of the US Army Corps of Engineers Portland District office performed analysis of reverse flow characteristics for each pump. The results are reverse flow rating curves that are attached to this section. The tables present the flow rates per individual pump. The detailed calculations, assumptions, and assumed dimensions are available upon request.

Katrina Event

8/28/05 - Operators pumped water in canal down to approximately -8.5 feet (NGVD).

8/29/05 - Operators evacuated pump station at approximately 1:15 am.

9/03/05 - Operators returned to pump water down.

9/09/05 - Pump Station back to normal operation.

Damage Report

The following information was obtained from the Project Information Report (PIR) for New Orleans District:

Pump Station 4 sustained relatively minor damage because its operating floor elevation is 16 feet N.G.V.D. Flooding from the storm flooded the lower level of the station but the flood waters were approximately three feet below the concrete operating floor level. Pump station equipment that was damaged includes an air compressor, electomode heater, controller for compressed air dryer motor, and generator. The building sustained damage to metal siding and roof. Finally, one discharge flap gate was damaged and is not operational.



Post-Hurricane Katrina – View from the inlet canal

PS 4 - Meraux



Post-Hurricane Katrina – Arial view of the pump station



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This is a preliminary report subject to revision; it does not contain final conclusions of the United States Army Corps of Engineers.

-29



50'0" DISCHARGE STRUCTURE NOTE: PROPOSED METAL ROOF AND WALL SYSTEMS, INCLUDING CANOPIES AND PROPOSED WORK, ARE SHOWN SHADED AND SUPERIMPOSED ON EXISTING CRANE RUNWAY SUPPORT. LEFT ENDWALL PROPOSED WOFK IDENTICAL AS SHOWN BUT OPPOSITE HAND. Elev + 7.83 ; Eley. + 3.83 RIGHT ENDWALL ELEVATION SCALE: 1" = 1'-0" Exterior Wall RIGHT ENDWALL ELEVATION STATE OF LOUISIANA LOUISIANA DEPARTMENT OF PUBLIC WORKS METAL ROOF AND WALL SYSTEMS 50 FOR FORTIFICATION AND MERAUX PUMPING STATICI ST. BERNARD PARISH 6'-4 PREPARED BY LOUISIANA DEPARTMENT OF PUBLIC WORKS SUBMITTED BY DISTRIC ENGINEER APPROVED BY CHIEFENC ONG APPROVED BY CALL COS JUNE 1975 DATED ____ ------TRACED G.G PGK HECKED DETAILED BY I-30 A.E.S. CHECKED G.G CHECKED PPROVEC SHEET OF 9 SHELT A

St. Bernard Parish

PS 5 EJ Gore



Pre-Hurricane Katrina – View to the North

7701 East Judge Perez Dr. Violet, LA 70085 504.512.6331 Position: Latitude 29.961649° Longitude -89.964442°



Pre-Hurricane Katrina – Arial view of the pump station

Pump Station Description

EJ Gore is 1 of 8 pumping stations in St Bernard Parish owned and operated by the Lake Borne Basin Levee District. The station contains six horizontal pumps that were installed in the 1980's with a total pumping capacity of 665 cubic feet per second $(cfs)^1$ and are driven by diesel engines. The drainage water is supplied to the pumps from the Forty Arpent canal and discharges through the interior back levee to the marsh known as Bayou Dupre. All pumps are equipped flap gates.

¹ The Pump Information Table contains more details about the individual pump data and is located at the beginning of this section.

Pump Station Operation

Pump station operators will turn the pumps on as they are required to reduce the water elevation in the canal. The pumps are normally turned on when the water in the canal reaches approximately 0.0 feet (NGVD) and turned off when the water level reaches -0.5 feet (NGVD). When heavy rainfall events are expected the station operators will pump the canal down to an elevation of -3.0 feet (NGVD).

Fuel Endurance Calculation

Assumptions:

1) #2 Diesel fuel is used with an HHV rating of 140,000 btu/gal

2) Burn rate of 35 gph @ 500 kW with above HHV rating

3) Diesel engines are running at rated capacity

PS 5 EJ. Gore

6 pump drivers - All diesels

Diesels are 335 hp

The approximate burn rate for each diesel is then calculated at:

$$R_{\text{burn}} := \left(35 \frac{\text{gal}}{\text{hr}}\right) \cdot \frac{33 \text{Shp}}{500 \text{kW}} \qquad \qquad R_{\text{burn}} = 17.487 \frac{\text{gal}}{\text{hr}}$$

Fuel Capacity

1 - 20,000 gallon tank

5 - 50 gallon day tanks

1 - 75 gallon tank

Fuel Endurance

The time the 20,000 gallon tank will last is calculated:

$$t_1 := \frac{2000@al}{6R_{burn}}$$
 $t_1 = 190.62 \,\text{hr}$

The time the 50 gallon tanks will last is calculated:

$$t_2 := \frac{5 \cdot 50 \text{gal}}{6R_{\text{burn}}} \qquad t_2 = 2.383 \text{hr}$$

The time the 75 gallon tank will last is calculated:

$$t_3 := \frac{75\text{gal}}{6R_{\text{burn}}} \qquad t_3 = 0.715\text{hr}$$

The approximate total continous run time for the station is:

$$T_t := t_1 + t_2 + t_3$$

 $T_t = 193.719n$
 $T_t = 8.072day$

Pump Curves

I-32

Pump curves were obtained from both the parish and the manufacturer. From these curves, a curve fit process was used to create new curves and equations. Using this data as well as making assumptions regarding the dimensions of the pump and the pump station, minor and friction losses were accounted for. These calculations led to the creation of the system curves. Two

curves were made due to the range of operating heads provided by the parish. The two curves represent the maximum and minimum operating heads reported.

Reverse Flow

The Engineering Hydraulics Design section of the US Army Corps of Engineers Portland District office performed analysis of reverse flow characteristics for each pump. The results are reverse flow rating curves that are attached to this section. The tables present the flow rates per individual pump. The detailed calculations, assumptions, and assumed dimensions are available upon request.

Katrina Event

8/28/05 - Operators pumped water in canal down to approximately -3.0ft.

8/29/05 - Operators evacuated station at approximately 1:15 am.

8/30/05 - Motors were overtopped during storm. Pumps had not been repaired as of site visit.

Damage Report



Post-Hurricane Katrina – View to the North

The following information was obtained from the Project Information Report (PIR) for New Orleans District:

Pump Station 5 sustained substantial damage. With the operating floor at approximately 2 feet N.G.V.D, flood waters within the building reached a height of 5 approximately 6 feet. The hydraulic driven pumps were damaged along with the six diesel engines. The generator and the electric pump motor and its controller were flooded. The hydraulic oil tank is not on its foundation and is contaminated with salt water along with the fuel system. The trash rack bar screens are damaged along with the slope pavement adjacent to the discharge pipes. Building damage includes damage to the rollup door, roof, and building office and restroom facility.





| TYPE: AXIAL FLOW | PROPELLER DIA .: 42" |
|----------------------|-----------------------------|
| MODEL NO .: NC342P12 | SPEED (RPM): AS NOTED |
| INTAKE DIA.: 63" | DISCHARGE COLUMN DIA .: 42" |
| CURVE NO .: VS42P12 | Na: 11,800 CODE: .50 |

IT IS HEREBY CERTIFIED THAT THIS CURVE REPRESENTS THE TRUE PER-FORMANCE CHARACTERISTICS OF FORMANCE CHARACTERISTICS OF MODEL TEST AND CALCULATIONS IN ACCORDANCE WITH STANDARDS OF THE HYDRAULIC INSTITUTE. MAW PUMP CORPORATION CERTIFIED BY Available Upon Request Maw PUMP CORPORATION Destiled Bends, Florida

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PS 6 – Jean Lafitte



Pre-Hurricane Katrina – View from Inlet Canal

4200 Jean Lafitte Pkwy. Chalmette, LA 70043 504.512.6331 Position: Latitude 29.966557° Longitude -89.975821°



Pre-Hurricane Katrina – Arial view of pump station

Pump Station Description

Jean Lafitte is 1 of 8 pumping stations in St Bernard Parish owned and operated by the Lake Borne Basin Levee District. The station contains three vertical pumps that were installed in 1990 with a total pumping capacity of 945 cubic feet per second $(cfs)^1$ and are driven by diesel engines. The drainage water is supplied to the pumps from the Florida Walk canal and discharges through the interior back levee to the marsh known as Bayou Bienvenue.

¹ The Pump Information Table contains more details about the individual pump data and is located at the beginning of this section.
Pump Station Operation

Pump station operators will turn the pumps on as they are required to reduce the water elevation in the canal. The pumps are normally turned on when the water in the canal reaches approximately -6 feet (NGVD) and turned off when the water level reaches -6.5 feet (NGVD). When heavy rainfall events are expected the station operators will pump the canal down to an elevation of -8.5 feet (NGVD).

Fuel Endurance Calculation

Assumptions:

- 1) #2 Diesel fuel is used with an HHV rating of 140,000 btu/gal
- 2) Burn rate of 35 gph @ 500 kW with above HHV rating
- 3) Diesel engines are running at rated capacity

PS 6 Jean Lafitte

3 pump drivers - All diesels

Diesels are 335 hp

The approximate burn rate for each diesel is then calculated at:

$$R_{burn} := \left(35 \frac{gal}{hr}\right) \cdot \frac{335hp}{500kW} \qquad \qquad R_{burn} = 17.487 \frac{gal}{hr}$$

Fuel Capacity

1 - 20,000 gallon tank

5 - 50 gallon day tanks

1 - 75 gallon tank

Fuel Endurance

The time the 20,000 gallon tank will last is calculated:

 $t_1 := \frac{2000@al}{6R_{burn}}$ $t_1 = 190.62 hr$

The time the 50 gallon tanks will last is calculated:

$$t_2 := \frac{5 \cdot 50 \text{gal}}{6 \text{R}_{\text{burn}}} \qquad \qquad t_2 = 2.383 \text{hr}$$

The time the 75 gallon tank will last is calculated:

$$t_3 := \frac{75\text{gal}}{6R_{\text{burn}}} \qquad t_3 = 0.715\text{hr}$$

The approximate total continous run time for the station is:

$$T_t := t_1 + t_2 + t_3$$

 $T_t = 193.71$ m
 $T_t = 8.072$ day

Pump Curves

Pump capacity curves were obtained. From these curves, a curve fit process was used to create new curves and equations. Using this information and making assumptions about the pump and the pump station, friction and minor head losses were accounted for. These calculations led to the creation of the systems curves. Two curves were created due to the range of operation reported by the parish using only the maximum and minimum head required.

Reverse Flow

The Engineering Hydraulics Design section of the US Army Corps of Engineers Portland District office performed analysis of reverse flow characteristics for each pump. The results are reverse flow rating curves that are attached to this section. The tables present the flow rates per individual pump. The detailed calculations, assumptions, and assumed dimensions are available upon request.

Katrina Event

- 8/28/05 Operators pumped water in canal down to approximately -8.5 feet (NGVD).
- 8/29/05 Operators evacuated pump station at approximately 1:15 am.
- **8/30/05** Operators returned to the station at 10:00 am. Water was the same elevation on both sides of pump station.

9/11/05 - Pump station back to normal operation.

Damage Report

The following information was obtained from the Project Information Report (PIR) for New Orleans District:

Pump Station 6 sustained relatively minor damage because its operating floor elevation is 16 feet N.G.V.D. Flooding from the storm flooded the lower level of the station but the flood waters were approximately three feet below the concrete operating floor level. The building damage consists of damaged roof panels. Mechanical damage includes damage to the trash rack gear boxes, trash removal equipment, engine exhaust flappers, and sanitation plant. Electrical damage consists of damage to lighting and the remote engine alarm panel.



Post-Hurricane Katrina – View from the Inlet Canal



Post-Hurricane Katrina – Arial view of the pump station

PS 6 – Jean Lafitte



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MADE IN U.S.







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Pre-Hurricane Katrina – View from Inlet Canal

3701 Bartolo Dr. Meraux, LA 70075 504.512.6331 Position: Latitude 29.946969° Longitude -89.922244°



PS 7 – Bayou Ducros

Pre-Hurricane Katrina – Arial view of pump station

Pump Station Description

Bayou Ducros is 1 of 8 pumping stations in St Bernard Parish owned and operated by the Lake Borne Basin Levee District. The station contains three vertical pumps that were installed in 1992 with a total pumping capacity of 1000 cubic feet per second $(cfs)^1$ and are driven by diesel engines. The drainage water is supplied to the pumps from the Forty Arpent canal and discharges through the interior back levee to the marsh known as Bayou Ducros.

¹ The Pump Information Table contains more details about the individual pump data and is located at the beginning of this section.

Pump Station Operation

Pump station operators will turn the pumps on as they are required to reduce the water elevation in the canal. The pumps are normally turned on when the water in the canal reaches approximately -6 feet (NGVD) and turned off when the water level reaches -6.5 feet (NGVD). When heavy rainfall events are expected the station operators will pump the canal down to an elevation of -8.5 feet (NGVD).

Fuel Endurance Calculation

Assumptions:

1) #2 Diesel fuel is used with an HHV rating of 140,000 btu/gal

2) Burn rate of 35 gph @ 500 kW with above HHV rating

3) Diesel engines are running at rated capacity

PS 7 Bayou Ducros

3 pump drivers - All diesels

Diesels are 1020 hp

The approximate burn rate for each diesel is then calculated at:

$$R_{burn} := \left(35 \frac{gal}{hr}\right) \cdot \frac{1020hp}{500kW} \qquad \qquad R_{burn} = 53.243 \frac{ga}{hr}$$

Fuel Capacity

2 - 10,000 gallon tanks

2 - 300 gallon day tanks

Fuel Endurance

The time the 10,000 gallon tank will last is calculated:

$$t_1 := \frac{2 \cdot 10000 \text{gal}}{3 \text{R}_{\text{burn}}}$$
 $t_1 = 125.212 \text{hr}$

The time the 300 gallon tanks will last is calculated:

$$t_2 := \frac{2 \cdot 300 \text{gal}}{3 \text{R}_{\text{burn}}}$$
 $t_2 = 3.756 \text{hr}$

The approximate total continous run time for the station is:

$$T_t := t_1 + t_2$$

 $T_t = 128.969h$
 $T_t = 5.374day$

Pump Curves

Pump capacity curves were obtained. From these curves, a curve fit process was used to create new curves and equations. Using drawings and manufacturer data, assumptions regarding the pump station and the pump were made in order to determine the minor and friction losses in the system. These calculations created the system curves. Two curves were created in order to accommodate the range of operating heads provided by the parish. The maximum and minimum head values were used to generate these curves.

Reverse Flow

The Engineering Hydraulics Design section of the US Army Corps of Engineers Portland District office performed analysis of reverse flow characteristics for each pump. The results are reverse flow rating curves that are attached to this section. The tables present the flow rates per individual pump. The detailed calculations, assumptions, and assumed dimensions are available upon request.

Katrina Event

8/28/05 - Operators pumped water in canal down to approximately -8.5 feet (NGVD).

- 8/29/05 Operators evacuated pump station at approximately 1:15 am.
- 8/30/05 Operators returned to the station at 10:00 am. Water was the same elevation on both sides of pump station.
- 9/11/05 Pump station back to normal operation.

Damage Report

The following information was obtained from the Project Information Report (PIR) for New Orleans District:

Pump Station 7 sustained relatively minor damage because its operating floor elevation is 16 feet N.G.V.D. Flooding from the storm flooded the lower level of the station but the flood waters were approximately three feet below the concrete operating floor level. Bearing and gears for the trash racks were damaged. Auxiliary equipment damage included flooding of a bobcat used to remove debris from the trash racks, fuel tank, and sanitation plant. Pump damage consists of a broken drain line. Engine damage consists of damage to an engine cooling motor, radiator leak and remote engine alarm panel. Two areas had some erosion including scour behind the station and near the west end stairs.



Post-Hurricane Katrina – Erosion



Post-Hurricane Katrina – Arial view of the pump station

PS 7 – Bayou Ducros





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SUBJECT Pump Station #7 St. Bernard Parish





This is a preliminary report subject to revision; it does not contain final conclusions of the United States Army Corps of Engineers.

St. Bernard Parish



Pre-Hurricane Katrina – View from Inlet Canal

3616 Bayou Rd. Verret, LA 70085 504-682-0591

Position: Latitude 29.854064° Longitude -89.795715

Pump Station Description

St Mary is 1 of 8 pumping stations in St Bernard Parish owned and operated by the Lake Borne Basin Levee District. The station contains three vertical pumps that were installed in 1996 with a total pumping capacity of 835 cubic feet per second $(cfs)^1$ and are driven by diesel engines. The drainage water is supplied to the pumps from the Twenty Arpent canal and discharges through the hurricane protection levee to Lake Lery. The discharge pipes have check valves to prevent flow in the reverse direction.

Pump Station Operation

Pump station operators will turn the pumps on as they are required to reduce the water elevation in the canal. The pumps are normally turned on when the water in the canal reaches approximately 0.0 feet (NGVD) and turned off when the water level reaches -0.5 feet (NGVD). When heavy rainfall events are expected the station operators will pump the canal down to an elevation of -3.5 feet (NGVD).

Fuel Endurance Calculation

¹ The Pump Information Table contains more details about the individual pump data and is located at the beginning of this section.

Assumptions:

- 1) #2 Diesel fuel is used with an HHV rating of 140,000 btu/gal
- 2) Burn rate of 35 gph @ 500 kW with above HHV rating
- 3) Diesel engines are running at rated capacity

PS 8 St Mary

3 pump drivers - All diesels

Diesels are 1020 hp

The approximate burn rate for each diesel is then calculated at:

$$R_{burn} := \left(35 \frac{gal}{hr}\right) \cdot \frac{1020hp}{500kW} \qquad \qquad R_{burn} = 53.243 \frac{gal}{hr}$$

Fuel Capacity

2 - 10,000 gallon tanks

2 - 300 gallon day tanks

Fuel Endurance

The time the 10,000 gallon tank will last is calculated:

$$t_1 := \frac{2 \cdot 10000 \text{gal}}{3 \text{R}_{\text{burn}}} \qquad t_1 = 125.212 \text{hr}$$

The time the 300 gallon tanks will last is calculated:

$$t_2 := \frac{2 \cdot 300 \text{gal}}{3 \text{R}_{\text{burn}}}$$
 $t_2 = 3.756 \text{hr}$

The approximate total continous run time for the station is:

$$T_t := t_1 + t_2$$

 $T_t = 128.969hr$
 $T_t = 5.374day$

Pump Curves

Pump capacity curves were obtained from the parish. These curves were recreated using a curve fit process. Analysis of the system necessitated the use of assumptions about the pump station and pump dimensions. These allowed for calculations regarding minor and friction losses. The system curves were created using these calculations. Two system curves were generated to accommodate the range of operation recorded by the parish, using maximum and minimum values of head.

Reverse Flow

The Engineering Hydraulics Design section of the US Army Corps of Engineers Portland District office performed analysis of reverse flow characteristics for each pump. The results are reverse flow rating curves that are attached to this section. The tables present the flow rates per individual pump. The detailed calculations, assumptions, and assumed dimensions are available upon request.

Katrina Event

8/28/05 - Operators pumped water in canal down to approximately -3.5 feet (NGVD).

8/29/05 - Operators evacuated pump station at approximately 1:15 am.

9/11/05 - Pump station back to normal operation.

Damage Report

The following information was obtained from the Project Information Report (PIR) for New Orleans District:

Pump Station 8 sustained relatively minor damage because its operating floor elevation is 16 feet N.G.V.D. Flooding from the storm flooded the lower level of the station but the flood waters were approximately eight feet below the concrete operating floor level. Building damage consists of loose roof panels, scour section near the discharge pipes, light fixtures, and the sewage aerator motor. Bearing and gears for the trash racks were damaged. Auxiliary equipment damage includes a front end loader used to remove debris from the trash racks.



Post-Hurricane Katrina – View from the Inlet Canal



CLEARPOIL CHARLS

This is a preliminary report subject to revision; it does not contain final conclusions of the United States Army Corps of Engineers.



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CUANT RINI CHAPIS

This is a preliminary report subject to revision; it does not contain final conclusions of the United States Army Corps of Engineers.



CLEVERBURT CHAPTS

This is a preliminary report subject to revision; it does not contain final conclusions of the United States Army Corps of Engineers.



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CLARFEINI CUARTS



CENWP-EC-HD

DRAFT

24 February 2006

MEMORANDUM FOR RECORD

SUBJECT 60% Draft Submission of Estimated Backflow Rating Curves for St. Bernard Parish, LA

Problem Statement: A post Katrina flood study is being conducted for a watershed in Jefferson Parish in New Orleans District. During the flood event, the pumps stopped operating and reverse flow discharged backwards through the pump station conduits. The needs of the study include an approximate rating curve for reverse flow through the pump station.

Objectives: Develop rating curve for reverse flow rate versus head differential and provide documentation of rating and methods used.

Assumptions: Many assumptions needed to be made in order to complete the draft backflow rating curves associated with this document. Assumptions made in developing the backflow rating curve estimates are listed in the Excel file worksheets for each unique pump and configuration. The most significant assumptions have been included in the rating curve worksheets attached to this memorandum and are summarized below.

• Data Assumptions:

Many of the pump stations in St. Bernard Parish only had very sketchy information on pumps, intakes and discharge pipes with regard to: elevations, sizes, cross-sections, bends, diffusers, lengths, pump intake grates, discharge pipe baffles etc. In addition, elevations of the pump station and system were not always available or there appeared to be inconsistencies between collected questionnaire responses, sketches and photos. Lack of data may contribute to significant uncertainty in the backflow rating curves. For pump stations 1 and 4, all that was missing was the width of the discharge channel (assumed to be 10 feet from photos). The minimum error margin for all calculations is $\pm 30\%$. The error margin will naturally increase for those cases where station data is missing and pertinent dimensions must be estimated.

• System Loss Assumptions:

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Intake, exit, bend, expansion, impeller and friction losses have been included for each unique pump and configuration. Some assumptions were made when system details were not available from the data (see above). The most significant loss was typically through the pump itself and is the largest cause of uncertainty. We currently estimate an error margin of $\pm 30\%$ related to the pump loss.

• Flow Control Assumptions: Conditions that trigger variations in flow control were estimated using the following criteria:

- Backflow starts when the lake or reservoir head (H1 at intake of backflow condition) is greater than the controlling crest of the discharge pipe. The first trigger point is that H1 must exceed this crest elevation to start flow.
- o Siphon flow starts with rising reservoir:
 - If there is no open air valve or vent, when H1 is greater than the controlling soffit of the discharge pipe. In this case the full flow rating curves ("If pipe primes, then full outlet control....") are applied. The full flow curve table is provided in a matrix of H1 and H2 (downstream water level at normal pump intake). The second trigger point is this H1 value that initiates siphon flow condition.¹
 - If an open air vent is available, siphon does not develop. The critical flow control shown on the left side of the rating curve ("Assuming the pipe never primes") controls. However, full flow will occur with an open air vent when certain H1 thresholds are exceeded (such that the soffit pressures exceed atmospheric pressure). The H1 thresholds are listed under respective tailwater levels in two rows beneath the full flow rating curve table.
- If siphon flow develops, then it will continue until either the pressure at the soffit of the crest pipe drops below -9.5 psi, or when H1 falls below with 1 foot of the top of the outlet to the lake (which acts as the intake in reverse flow conditions). The third trigger point is the estimated elevation at which the siphon breaks. If the siphon breaks, then critical flow controls.

Conclusions: Modifications could be made to the estimates if and when more detailed information becomes available to make more conclusive backflow rating curve assumptions. The CENWP-EC-HD will continue to seek data on pump loss coefficients.

The 60% reverse flow rating curves are attached in order of pump stations. The tables present the flow rates per individual pump. The detailed calculations, assumptions, and assumed dimensions are available upon request.

Steve Schlenker Karen Kuhn Hydraulic Engineers CENWP-EC-HD

¹ The threshold for which siphon flow develops is unpredictable and is dependent on conditions and system geometry. A momentary abrupt rise in the lake water surface could send a pulse that primes the conduit. On the other hand, minor cracks or air leaks in the conduit could also prevent or break the siphon before it would normally give way (3rd trigger point). The current H1 threshold values are based on EC-HD judgment—however the values are subject to change as more information is obtained.

St. Bernard Parish, #1 Fortifications Canal Pumping Station: 42 x 54 inches

| ENGINE PROJECT: #1/ Founda 40,000 gpn SUBJECT: | ERING DI St. Bernarc ation Canal I n (1 pump th Backflow Ra | ESIGN SH I Parish Pum Pumping Sta is size, 3 tot ating Curves | IEET p Stations tion-42x54 al in statior | " pump 1) | OFF COM CHE | ICE SYMBO IPUTED BY: CKED BY: S | L: CENWP- KK/SS JS/KAK | EC-HD DATE: 22 F WORKSHEI | eb 2006 ET: Rating Curve |
|--|---|---|---|--|---|---|------------------------------|---------------------------------|-----------------------------|
| Crest Eleva | tion (ft) = | 3.83 | | | | | | | |
| Trigger Poi | nts: | | | | | | | | |
| Flow starts | when H1 > | is greater | than | | | 3.83 | ft | crest of int | ake |
| Assume Ta | inter Gate I | eft Open | | | | | | | |
| | Pating Cu | rves for A | nnroy AC | 000 anm | Dumn (12 | X 54" dia | m nronell | or) | |
| | (accumed | Dumn #1 | for #11 | Cortificatio | n Conol D | | ation | | |
| Discharge | in CES for | • H1 & H2 | 101 # 11 | Fortificatio | ni Galiai P | uniping st | ation | | |
| Dissilargo | | | | | | | | | |
| | Rating | Curve | Per Pu | mp: Flo | ow Rate | e for H1 | versu | s H2 | |
| | | Elevation (| H2) at Bao | kflow Outle | et C3 | | | - | |
| | | -6 | -4 | -2 | 0 | 2 | 4 | 6 | |
| Н1 | | | | | | | | | |
| U/s | Above | | | | | | | | |
| Reservoir | Discharge | | | | | | | | |
| Elevation | Pipe Crest | H2 =-6 | H2 =-4 | H2 =-2 | H2 =0 | H2 =2 | H2 =4 | H2 =6 | |
| (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | |
| 3.00 | -0.83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 3.50 | -0.33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 4.00 | 0.17 | 17 | 2 17 | 17 | 17 | 17 | 17 | -00 | |
| 5.00 | 1.17 | 39 | 39 | 39 | 39 | 39 | 39 | -62 | |
| 5.50 | 1.67 | 66 | 66 | 66 | 66 | 66 | 66 | -44 | |
| 6.00 | 2.17 | 98 | 98 | 98 | 98 | 98 | 88 | 0 | |
| 6.50 | 2.67 | 134 | 134 | 134 | 134 | 132 | 98 | 44 | |
| 7.00 | 3.17 | 1/3 | 1/3 | 1/3 | 164 | 139 | 107 | 62 | |
| 7.50 | 4 17 | 215 | 210 | 191 | 170 | 145 | 124 | 88 | |
| 8.50 | 4.67 | 236 | 219 | 201 | 181 | 158 | 132 | 98 | |
| 9.00 | 5.17 | 240 | 224 | 206 | 186 | 164 | 139 | 107 | |
| 9.50 | 5.67 | 244 | 228 | 210 | 191 | 170 | 145 | 116 | |
| 10.00 | 6.17 | 248 | 232 | 215 | 196 | 175 | 152 | 124 | |
| 10.50 | 0.07 | 252 | 230 | 219 | 201 | 181 | 158 | 132 | |
| 11.50 | 7.67 | 250 | 240 | 224 | 200 | 100 | 170 | 145 | |
| 12.00 | 8.17 | 263 | 248 | 232 | 215 | 196 | 175 | 152 | |
| 12.50 | 8.67 | 267 | 252 | 236 | 219 | 201 | 181 | 158 | |
| 13.00 | 9.17 | 270 | 256 | 240 | 224 | 206 | 186 | 164 | |
| NOTES: 1 2 | Rating curv unknown w Loss and T | ve is accura vidth of disc rigger Point Pump loss Siphon flow Intake loss Exit Loss = Bend and e | te within harge cha Assumpti coefficient does not = expansion | ± 30% due innel ions: t = t start till H [*] 0.5 1.2 losses also | uncertainty 3.00 I > soffit of (grating eff incorporate | r of pump c pipe at cre ect) d | urve loss c st(Zt) | oefficient a | nd |
| 3 | Data Assun Data Needs | nptions: Tainter Gat Discharge (s: Discharge (| e Left ope Channel w Channel w | en iidth = 10 fe iidth | eet | | | | |
| 5 | Backflow p | revention: Available: | | Tainter Gat | e for <u>clos</u> ur | е | | | |

St. Bernard Parish, #1 Fortifications Canal Pumping Station: 94 x 128 inches

| PROJECT: #4 Meraux | St. Bernard | ESIGN SH Parish Pum Ition-94x128 | IEET p Stations " pumps | 22) | OFFIC COMP | OFFICE SYMBOL: CENWP-EC-HD COMPUTED BY: KK/SS DATE: 22 Feb 2006 WORKSHEET: Rating Curve | | | | | |
|-----------------------|------------------------|--|---|----------------------------|---------------|---|------------|--------------|----------|--|--|
| SUBJECT: | Backflow Ra | ating Curves | 3 total in stati | on) | CHEC | KED BY: SJS | S/KAK | | | | |
| Crest Fleva | tion (ft) - | 3 83 | | | | | | | | | |
| Trigger Poi | nts: | 5.05 | | | | | | | | | |
| Flow starts | when H1 > | is greater | than | | | 3.83 | ft | crest of wei | r | | |
| Assume Ta | inter Gate I | eft Open | | | | | | | | | |
| DRAFT | Rating Cu | irves for A | pprox 200 | ,000 gpm | Pump (94) | X128" dia | m propelle | er) | | | |
| | (assumed | Pump #2 | &3 for #4 | Meraux P | umping St | ation | • • | | | | |
| Discharge | e in CFS for | H1 & H2 | | | | | | | | | |
| | | Dating | Curvo | | n. Elov | v Data | for LI1 | | cL | | |
| | | Flevation (| H2) at Back | flow Outlet | тр. гюч Сз | VRALE | | | 12 | | |
| | | -6 | -4 | -2 | 0 | 2 | 4 | 6 | | | |
| H1 | Loval | | | | | | | | | | |
| 0/s Reservoir | Above | | | | | | | | | | |
| Elevation | Weir Crest | H2 =-6 | H2 =-4 | H2 =-2 | H2 =0 | H2 =2 | H2 =4 | H2 =6 | | | |
| (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | | | |
| 3.00 | -0.83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| 4.00 | 0.17 | 2 | 2 | 2 | 2 | 2 | 0 | -361 | | | |
| 4.50 | 0.67 | 17 | 17 | 17 | 17 | 17 | 17 | -312 | | | |
| 5.00 | 1.17 | 39 | 39 | 39 | 39 | 39 | 39 | -255 | | | |
| 5.50 6.00 | 2.17 | 00 98 | 98 | 00 98 | 00 98 | 00 98 | 00 98 | 081- | | | |
| 6.50 | 2.67 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | | | |
| 7.00 | 3.17 | 173 | 173 | 173 | 173 | 173 | 173 | 173 | | | |
| 7.50 | 3.67 4.17 | 215 | 215 | 215 | 215 | 215 | 215 | 215 | | | |
| 8.50 | 4.67 | 306 | 306 | 306 | 306 | 306 | 306 | 306 | | | |
| 9.00 | 5.17 | 355 | 355 | 355 | 355 | 355 | 355 | 355 | | | |
| 9.50 | <u>5.67</u> 6.17 | 405 | 405 | 405 | 405 | 405 | 405 | 405 | | | |
| 10.50 | 6.67 | 512 | 512 | 512 | 512 | 512 | 512 | 512 | | | |
| 11.00 | 7.17 | 567 | 567 | 567 | 567 | 567 | 567 | 567 | | | |
| 11.50 | 8.17 | 682 | 682 | 682 | 682 | 682 | 682 | 625 | | | |
| 12.50 | 8.67 | 741 | 741 | 741 | 741 | 741 | 741 | 650 | | | |
| 13.00 | 9.17 | 800 | 800 | 800 | 800 | 800 | 765 | 675 | | | |
| NOTES: 1 | Full flow Ratiming and | ating curve degree of s | is accurate siphoning de | within ± 30 eveloped | % due unc | ertainty of p | oump curve | loss coeffic | ient and | | |
| 2 | Loss and T | rigger Point Pump loss Siphon flov | t Assumptior coefficient = v does not s | ns: = tart till H1 : | 3.00 | ipe at crest | (7t) | | | | |
| | | Intake loss | = | 0.5 | 50 or p | | ~~~ | | | | |
| | | Exit Loss = | whomele - I- | 1.2 | orporetail | | | | | | |
| 3 | Data Assun | benu and e | expansion to | sses also in | corporated | | | | | | |
| | | Tainter Gat Discharge | te Left open gate width = | = 10 feet | | | | | | | |
| | Data M | | | | | | | | | | |
| 4 | Data Needs | s: Discharge | gate width | | | | | | | | |
| 5 | Backflow p | revention: | | | | | | | | | |
| | | Available: | | Tainter Gat | e for Closu | re | | | | | |

St. Bernard Parish, #2 Guichard and #3 Bayou Villere: 42 inch Pumps

| ENGINE PROJECT: Guichard # | ERING DE St. Bernard 2/ Bayou Ville | Parish Pump Parish Pump are #3 -42" p | EET Statio | ns Ipprox 50,00 | ((0 gpm | OFFICE SYN COMPUTED | IBOL: CEN\ BY: KK/SS | VP-EC-HD DATE: 2 WORKS | 2 Feb 2006 HEET: Ratir | ng Curve | |
|--|--|--|--|---|---|---|---|--|---|---|-----------------------------------|
| SUBJECT: | Backflow Ra | ting Curves | ampo a | .pp.ox 00,00 | (| CHECKED B | Y: SJS/KAK | Workto | | ig ourve | |
| Crest Eleva Trigger Poi Flow starts Siphon Flo If siphon fl | ation (ft) = ints: s when H1 > w starts with If no open If open ven low develops | 11 is greater to n rising H1 to air valve or t; see botto s, flow stops | than when: vent, v om of t s (appr | when H1 > able for wh rox.) when | Soffit = ien full flow H1 < | 11 14.5 / occurs 2 | ft ft | crest of cor assume sip assume dra | nduit hon starts awdown at | when H1 = intake ≈1 ft | Zt |
| DRAFT | Rating Cu (assumed | rves for A Pump #1 | oprox for Gu | 50,000 g uichard PS | om Pump \$#2 and p | (42" prope ossible pu | eller) mp(s) for | Bayou Vill | ere PS#3) |) | |
| Discharge | e in CFS for | HI&H2 | | If Pipe pri | mes then | full flow o | utlet cont | rol as siph | non: | | |
| Assuming Pipe never primes: -6 -3.16667 -0.33333 2.5 5.333333 8.166667 11 | | | | | | | | | | | |
| H1 U/s Reservoir Elevation (ft) | Level Above Discharge Pipe Crest (ft) | Q Flow Rate (cfs) | - | Primed Conduit, H2 =-6 (ft) | Primed Conduit, H2 =-3 (ft) | Primed Conduit, H2 =0 (ft) | Primed Conduit, H2 =3 (ft) | Primed Conduit, H2 =5 (ft) | Primed Conduit, H2 =8 (ft) | Primed Conduit, H2 =11 (ft) | |
| 8.00 | -3.00 | 0 | - | 113 | 101 | 87 | 71 | 49 | -12 | -52 | |
| 9.00 | -2.00 | 0 | ŀ | 117 | 105 | 92 | 77 | 58 | 28 | -43 | |
| 9.50 | -1.50 | 0 | | 119 | 107 | 95 | 80 | 62 | 35 | -37 | |
| 10.00 | -1.00 | 0 | - | 121 | 109 | 97 | 83 | 65 | 41 | -30 | |
| 10.50 | -0.50 | 0 | - | 123 | 112 | 102 | 65 88 | 69 72 | 40 51 | -21 | |
| 11.50 | 0.50 | 2 | | 126 | 116 | 104 | 91 | 75 | 55 | 21 | |
| 12.00 | 1.00 | 6 | | 128 | 118 | 106 | 93 | 78 | 59 | 30 | |
| 12.50 | 1.50 | 13 | - | 130 | 119 | 108 | 95 | 81 | 63 | 37 | |
| 13.00 | 2.00 | 21 | - | 132 | 121 | 110 | 98 100 | 84 | 66 70 | 43 | |
| 14.00 | 3.00 | 39 | - | 135 | 125 | 112 | 100 | 89 | 73 | 52 | |
| 14.50 | 3.50 | 48 | Ī | 137 | 127 | 116 | 105 | 91 | 76 | 56 | |
| 15.00 | 4.00 | 56 | - | 138 | 129 | 118 | 107 | 94 | 79 | 60 | |
| 15.50 | 4.50 | 65 72 | - | 140 | 130 | 120 | 109 | 96 | 82 | 64 | |
| 16.50 | 5.50 | 80 | - | 142 | 132 | 122 | 113 | 101 | 87 | 71 | |
| 17.00 | 6.00 | 87 | | 145 | 136 | 126 | 115 | 103 | 90 | 74 | |
| 17.50 | 6.50 | 94 | - | 146 | 137 | 127 | 117 | 105 | 92 | 77 | |
| 18.00 | 7.00 | 101 | L | 148 | 139 | 129 | 119 | 107 | 95 | 80 | |
| NOTES: 1 | Estimated H If Open Air Full flow Ra timing and | 11 required Valve ting curve i degree of s | for ful H1 > s accu iphonir | I flow if Op TW=-6 19 rate within ng develope | en Air Valve TW=-3 18 ± 30% du ed | e or vent: TW=0 17 e uncertain | TW=3 15 ty of pump | TW=5 14 curve loss | TW=8 12 coefficient a | TW=11 #NUM! and | |
| 2 | Loss and Tr | Pump loss of Siphon flow Intake loss Exit Loss = Bend and e | Assum coeffici does = xpansi | ent = not start til 0.5 1 on losses a | 3.00 I H1 > soffi Iso incorpo | it of pipe at rated | crest(Zt) | | | | |
| 3 | | Shape/leng Elevations a NOTE: Info | th/ang issume ormatic | le of: bend ed from info on regardin | s, pipes, ou ormation or g elevation | itlet, intake n questionna s for PS#2 a | assumed fi aire sheets and PS#3 a | rom Pump i for PS#2 & ire not cons | nfo in ques assumed s istent (vari | tionnaire ar imilarity to es by about | nd photos. PS#6. t 10 feet) |
| 4 | Data Needs | : Shape/leng Elevations f Pump info f Cover sheel Cover sheel | th/ang or ben or Pun : for PS Need p : for PS Questio More ir | le of: bend ds, pipes, p np #3 at G S#2 indicat bump diam S#3 indicat onnaire res nformation | s, pipes, ou pump, outle uichard PS# es pump # for pump # es 3 pumps ponses indi needed to | utlet, intake et, intake et #2; and for 3 is 75,000 #3 to estima © 50,000 cate 3 pum determine i | c. Pumps #1, gpm pump ate backflov & 75,000 & ps @ 60" p f curves giv | #2, #3 for . No other v curve. : 100,000 gj ropeller, 90 ven are usal | Bayou Ville usable info pm " intake, 60 ble for PS# | ere PS#3 given.)" discharge 3. | e column. |
| 5 | Backflow pr | evention: Available: Installed/us | ed: | PS#2 No f PS#3 Inta PS#2 n/a | loodgates; ke pipes to | No backflow pumps 1 a | v valves nd 2 have b | outterfly val | ves | | |
| | | | | PS#3 Not | ackstops/b | rakes insta | led to prev | ent reverse | rotation | | |

5 of 11

St. Bernard Parish, #2 Guichard and #3 Bayou Villere: 60 inch Pumps

| ENGINE PROJECT: Guichard # | ERING D St. Bernard 2/ Bayou Vill | ESIGN SHE I Parish Pump ere #3-60" pur | EET Stations nps appr 100,000 | (gpm | OFFICE SYN COMPUTED | IBOL: CEN BY: KK/SS | VP-EC-HD DATE: 2 WORKS | 2 Feb 2006 HEET: Ratir | ng Curve | | |
|---|--|---|--|---|--|---|--|---|---|--------------------------------|--|
| SUBJECT: | Backflow R | ating Curves | | 01 | CHECKED B | Y: SJS/KAK | | | .9 | | |
| Crest Eleva Trigger Poi Flow starts Siphon Flo If siphon fl | ation (ft) = ints: when H1 : w starts wit If no open If open ver | 11 > is greater th h rising H1 w air valve or v ht; see bottor s flow stops | han /hen: /ent, when H1 > n of table for wh (approx) when | Soffit = nen full flow | 11 16.0 / occurs 3 | ft ft | crest of co assume sip | nduit ohon starts | when H1 = intake ≈1 ft | Zt | |
| DRAFT | Rating Cu | urves for Ap | prox 100,000 | gpm Pump | o (60" diar | n propelle | r) | ou Villere | DS#3) | | |
| Discharge | e in CFS for | r H1 & H2 | | aiu F 3# 2 | and possi | | s) tor bay | ou villere | F 3# 3) | | |
| | | | If Pipe pr | imes then | full flow o | outlet cont | trol as sipl | non: | | | |
| Assuming Pipe never primes: Elevation (H2) at Backflow Outlet C3 | | | | | | | | | | | |
| | -6 -3.16667 -0.33333 2.5 5.333333 8.166667 11 | | | | | | | | | | |
| H1 U/s Reservoir | Level Above Discharge | Q Flow | Primed Conduit, | Primed Conduit, | Primed Conduit, | Primed Conduit, | Primed Conduit, | Primed Conduit, | Primed Conduit, | | |
| Elevation (ft) | Pipe Crest (ft) | Rate (cfs) | H2 = -6 | H2 = -3 (ft) | H2 = 0 | H2 = 3 | H2 =5 | H2 = 8 | H2 = 11 (ft) | | |
| 8.00 | -3.00 | 0 | 233 | 208 | 180 | 146 | 102 | -25 | -108 | | |
| 8.50 | -2.50 | 0 | 237 | 212 | 185 | 152 | 111 | 36 | -98 | | |
| 9.00 | -2.00 | 0 | 241 | 217 | 190 | 159 | 119 | 57 | -88 | | |
| 9.50 | -1.50 | 0 | 245 | 221 | 200 | 165 | 127 | 84 | - 76 - 62 | | |
| 10.50 | -0.50 | 0 | 253 | 230 | 205 | 176 | 141 | 95 | -44 | | |
| 11.00 | 0.00 | 0 | 256 | 234 | 209 | 181 | 148 | 105 | 0 | | |
| 11.50 | 0.50 | 2 | 260 | 238 | 214 | 187 | 154 | 114 | 44 | | |
| 12.50 | 1.50 | 16 | 268 | 242 | 223 | 197 | 167 | 122 | 76 | | |
| 13.00 | 2.00 | 27 | 271 | 250 | 227 | 202 | 172 | 137 | 88 | | |
| 13.50 | 2.50 | 41 | 275 | 254 | 231 | 206 | 178 | 144 | 98 | | |
| 14.00 | 3.00 | 55 | 278 | 258 | 236 | 211 | 183 | 150 | 108 | | |
| 15.00 | 4.00 | 86 | 285 | 265 | 244 | 220 | 193 | 163 | 124 | | |
| 15.50 | 4.50 | 102 | 288 | 269 | 248 | 224 | 198 | 168 | 132 | | |
| 16.00 | 5.00 | 118 | 292 | 272 | 251 | 229 | 203 | 1/4 | 139 | | |
| 17.00 | 6.00 | 148 | 298 | 279 | 259 | 233 | 200 | 185 | 152 | | |
| 17.50 | 6.50 | 162 | 302 | 283 | 263 | 241 | 217 | 190 | 159 | | |
| 18.00 | 7.00 | 176 | 305 | 286 | 266 | 245 | 221 | 195 | 165 | | |
| NOTES: 1 | Estimated If Open Air Full flow R timing and | H1 required f ⁻ Valve H ating curve is degree of sip | TW=-6 TW=-6 1 > 19 accurate within phoning develop | en Air Valvo TW=-3 18 ± 30% du ed | e or vent: TW=0 16 e uncertain | TW=3 15 ty of pump | TW=5 14 curve loss | TW=8 12 coefficient a | TW=11 #NUM! and | | |
| 2 | Loss and T | rigger Point <i>I</i> Pump loss co Siphon flow o Intake loss = Exit Loss = Bend and ex | Assumptions: pefficient = does not start til = 0.5 1 pansion losses a | 3.00 I H1 > soffi Iso incorpo | t of pipe at rated | crest(Zt) | | | | | |
| 3 | Data Assur | nptions: Shape/length Elevations as NOTE: Infor | n/angle of: bend ssumed from info mation regardin | s, pipes, ou ormation or g elevation | itlet, intake n questionn s for PS#2 | assumed fi aire sheets and PS#3 a | rom Pump i for PS#2 & ire not cons | nfo in ques assumed s sistent (vari | tionnaire an imilarity to l es by about | d photos. PS#6. 10 feet) | |
| 4 | Data Need | s: | , | | | | | | | | |
| | 4 Data Needs: Shape/length/angle of: bends, pipes, outlet, intake. Elevations for bends, pipes, pump, outlet, intake etc. Pump info for Pump #3 at Guichard PS#2; and for Pumps #1, #2, #3 for Bayou Villere PS#3 Cover sheet for PS#2 indicates pump #3 is 75,000 gpm pump. No other usable info given. Need pump diam for pump #3 to estimate backflow curve. Cover sheet for PS#3 indicates 3 pumps @ 50,000 & 100,000 gpm Questionaire responses indicate 3 pumps @ 60" propeller, 90" intake, 60" discharge column | | | | | | | | | | |
| 5 | Backflow p | Available: | PS#2 No f PS#3 Inta | loodgates; ke pipes to | No backflov pumps 1 a | w valves nd 2 have b | outterfly val | ves | | | |
| | | mstalleu/US6 | PS#3 Not | ackstops/b | rakes insta | lled to prev | ent reverse | rotation | | | |

St. Bernard Parish, #4 Meraux Pumping Station: 42 x 54 inches

| ENGINE PROJECT: #4 Meraux 40,000 gpn GUBJECT: | ERING DI St. Bernard Pumping S n (1 pump th Backflow Ra | ESIGN SH d Parish Purr tation-42x54 iis size, 3 tota ating Curves | IEET np Stations " pump al in station |) | OFF COM CHE | ICE SYMBO IPUTED BY: CKED BY: S | L: CENWP- KK/SS JS/KAK | '-EC-HD DATE: 22 Feb 2006 WORKSHEET: Rating Curve | | |
|---|---|---|---|---|--|---|------------------------------|---|--|--|
| rest Eleva | tion (ft) = | 3.83 | | | | | | | | |
| rigger Poi | nts: | | | | | | | | | |
| low starts | when H1 > | > is greater | than | | | 3.83 | ft | crest of intake | | |
| ssume Ta | inter Gate I | Left Open | | | | | | | | |
| DRAFT | Rating Cu | , Irves for A | pprox 40 | .000 apm | Pump (42 | X 54" dia | m propell | er) | | |
| | (assumed | Pump #1 | for #4 M | Meraux Pu | imning Sta | tion | 1 1 | | | |
| Discharge | in CFS for | ⁻ H1 & H2 | 101 // 11 | | inping ou | | | | | |
| 5 | Rating | Curve | Per Pu | mp: Flo | ow Rate | e for H1 | versu | s H2 | | |
| | | Elevation (| H2) at Bac | kflow Outle | et C3 | | | | | |
| | | -6 | -4 | -2 | 0 | 2 | 4 | 6 | | |
| H1 U/s | Level Above | | | | | | | | | |
| levation | Pipe Crest | H2 =-6 | H2 =-4 | H2 =-2 | H2 =0 | H2 =2 | H2 =4 | H2 =6 | | |
| (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | | |
| 3.00 | -0.83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 3.50 | -0.33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| 4.00 | 0.17 | 2 17 | 2 17 | 17 | 2 17 | 2 | 17 | -88 | | |
| 5.00 | 1.17 | 39 | 39 | 39 | 39 | 39 | 39 | -62 | | |
| 5.50 | 1.67 | 66 | 66 | 66 | 66 | 66 | 66 | -44 | | |
| 6.00 | 2.17 | 98 | 98 | 98 | 98 | 98 | 88 | 0 | | |
| 6.50 | 2.67 | 134 | 134 | 134 | 134 | 132 | 98 | 44 | | |
| 7.00 | 3.17 | 215 | 210 | 1/3 | 104 | 139 | 107 | 76 | | |
| 8.00 | 4.17 | 232 | 215 | 196 | 175 | 152 | 124 | 88 | | |
| 8.50 | 4.67 | 236 | 219 | 201 | 181 | 158 | 132 | 98 | | |
| 9.00 | 5.17 | 240 | 224 | 206 | 186 | 164 | 139 | 107 | | |
| 10.00 | 6.17 | 244 | 232 | 210 | 196 | 175 | 143 | 124 | | |
| 10.50 | 6.67 | 252 | 236 | 219 | 201 | 181 | 158 | 132 | | |
| 11.00 | 7.17 | 256 | 240 | 224 | 206 | 186 | 164 | 139 | | |
| 11.50 | /.6/ | 259 | 244 | 228 | 210 | 191 | 170 | 145 | | |
| 12.50 | 8.67 | 267 | 252 | 232 | 219 | 201 | 173 | 158 | | |
| 13.00 | 9.17 | 270 | 256 | 240 | 224 | 206 | 186 | 164 | | |
|)TES: 1 2 3 | Rating curv unknown w Loss and T Data Assur | ve is accura vidth of disc rigger Point Pump loss Siphon flow Intake loss Exit Loss = Bend and e nptions: | te within harge cha Assumpti coefficient does not = expansion | ± 30% due nnel ons: = start till H 0.5 1.2 losses also | 3.00 3 > soffit of (grating eff incorporate | / of pump ci pipe at cre rect) d | urve loss c st(Zt) | oefficient and | | |
| 4 | Data Need | Tainter Gat Discharge (s: Discharge (| te Left ope Channel w Channel w | en idth = 10 fe idth | eet | | | | | |
| 5 | Backflow p | revention: Available: | | Tainter Gat | te for closur | e | | | | |
St. Bernard Parish, #4 Meraux Pumping Station: 94 x 128 inches

| ENGINE PROJECT: #4 Meraux 200,000 gp SUBJECT: | ERING DI St. Bernard Pumpig Sta m (2 pump Backflow Ra | ESIGN SH Parish Pum Ition-94x128 os this size, ating Curves | IEET p Stations ' pumps 3 total in stati | on) | OFFIC COMP CHECH | OFFICE SYMBOL: CENWP-EC-HD COMPUTED BY: KK/SS DATE: 22 Feb 2006 WORKSHEET: Rating Curve CHECKED BY: SJS/KAK | | | | | | | | |
|---|---|---|---|------------------------------|------------------------|--|------------|--------------|----------|--|--|--|--|--|
| Crest Flova | tion (ft) - | 3 83 | | | | | | | | | | | | |
| Triggor Doi | ntc | 3.03 | | | | | | | | | | | | |
| Flow starts | IIIS: when H1 s | ic greater | than | | | 2 0 2 | f+ | creat of wal | r | | | | | |
| FIOW STALLS | when hi > | s greater | liidii | | | 3.03 | 11 | crest of wer | I | | | | | |
| Assume Ta | inter Gate L | eft Open | | | | | | | | | | | | |
| DRAFT | Rating Cu | irves for A | pprox 200 | ,000 gpm | Pump (94 | X128" dia | m propelle | er) | | | | | | |
| | (assumed | Pump #2 | &3 for #4 | Meraux P | umping St | ation | | | | | | | | |
| Discharge | in CFS for | H1 & H2 | | | | | | | | | | | | |
| | | - | - | _ | | . . | | | | | | | | |
| | | Rating | Curve p | per Pun | <u>p: Flov</u> | v Rate | for H1 | versus l | 12 | | | | | |
| | 1 | Elevation (| H2) at Backi | low Outlet | 0 | 2 | | | | | | | | |
| H1 | | -0 | -4 | -2 | 0 | 2 | 4 | 0 | | | | | | |
| U/s | Level | | | | | | | | | | | | | |
| Reservoir | Above | | | | | | | | | | | | | |
| Elevation | Weir Crest | H2 =-6 | H2 = -4 | H2 =-2 | H2 =0 | H2 = 2 | H2 = 4 | H2 = 6 | | | | | | |
| (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | | | | | | |
| 3.00 | -0.83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| 3.50 | -0.33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | |
| 4.00 | 0.17 | 2 | 2 | 2 | 2 | 2 | 0 | -361 | | | | | | |
| 4.50 | 0.67 | 17 | 17 | 17 | 17 | 17 | 17 | -312 | | | | | | |
| 5.00 | 1.17 | 39 | 39 | 39 | 39 | 39 | 39 | -255 | | | | | | |
| 5.50 | 1.67 | 66 | 66 | 66 | 66 | 66 | 66 | - 180 | | | | | | |
| 6.00 4 E0 | 2.17 | 98 | 98 | 98 | 98 | 98 124 | 98 | 124 | | | | | | |
| 7.00 | 2.07 | 134 | 134 | 134 | 134 | 134 | 134 | 134 | | | | | | |
| 7.00 | 3.67 | 215 | 215 | 215 | 215 | 215 | 215 | 215 | | | | | | |
| 8.00 | 4.17 | 259 | 259 | 259 | 259 | 259 | 259 | 259 | | | | | | |
| 8.50 | 4.67 | 306 | 306 | 306 | 306 | 306 | 306 | 306 | | | | | | |
| 9.00 | 5.17 | 355 | 355 | 355 | 355 | 355 | 355 | 355 | | | | | | |
| 9.50 | 5.67 | 405 | 405 | 405 | 405 | 405 | 405 | 405 | | | | | | |
| 10.00 | 6.17 | 458 | 458 | 458 | 458 | 458 | 458 | 458 | | | | | | |
| 10.50 | 6.67 | 512 | 512 | 512 | 512 | 512 | 512 | 512 | | | | | | |
| 11.00 | 7.17 | 507 624 | 507 | 507 624 | 507 624 | 507 | 507 624 | 507 | | | | | | |
| 12.00 | 8 17 | 682 | 682 | 682 | 682 | 682 | 682 | 625 | | | | | | |
| 12.50 | 8.67 | 741 | 741 | 741 | 741 | 741 | 741 | 650 | | | | | | |
| 13.00 | 9.17 | 800 | 800 | 800 | 800 | 800 | 765 | 675 | | | | | | |
| NOTES: 1 | Full flow Ratiming and | ating curve degree of s | is accurate siphoning de | within ± 30 veloped | % due unc | ertainty of j | oump curve | loss coeffic | ient and | | | | | |
| 2 | Loss and T | Pump loss Siphon flow Intake loss Exit Loss = | <pre>coefficient = / does not s =</pre> | tart till H1 = 0.5 1.2 | 3.00 > soffit of p | ipe at crest | (Zt) | | | | | | | |
| 3 | Data Assun | bend and e nptions: Tainter Gat Discharge (| expansion lo te Left open gate width = | sses also in • 10 feet | corporated | | | | | | | | | |
| 4 | Data Needs | 5: | | | | | | | | | | | | |
| | Discharge gate width | | | | | | | | | | | | | |
| 5 | Backflow p | revention | | | | | | | | | | | | |
| J | p | Available: | | Tainter Gat | e for Closu | re | | | | | | | | |
| | | | | | | | | | | | | | | |

St. Bernard Parish, #5 E.J. Gore Pump Station

Flap gates on pipe exits prevent reverse flow through pumps.

St. Bernard Parish, #6 Jean Laffitte and #7 Bayou Ducros pumps

| ENGINE PROJECT: | ERING DI St. Bernard | ESIGN SH Parish Pump | EET Statio | ons | - (| OFFICE SYMBOL: CENWP-EC-HD COMPUTED BY: KK/SS DATE: 22 Feb 2006 | | | | | | | | | | | |
|----------------------------|---------------------------|---|--------------------------------------|---|---|--|--------------------------------|--------------|---------------|---------------|--|--|--|--|--|--|--|
| Jean Lafitte SUBJECT: | #6 & Bayou Backflow Ra | Ducros #7 ating Curves | | | C | CHECKED B | Y: SJS/KAK | WORKS | HEET: Ratir | ng Curve | | | | | | | |
| Crest Eleva Trigger Poi | ntion (ft) = | | | | | - | | | | | | | | | | | |
| low starts Siphon Flo | when H1 > w starts wit | י is greater ו h rising H1 ו | than when: | | | 5 | ft | crest of cor | nduit | | | | | | | | |
| ipiion no | If no open | air valve or | vent, | when H1 > | Soffit = | 11.0 | ft | assume sip | hon starts | when H1 = Zt | | | | | | | |
| f siphon fl | If open ver ow develop | nt; see botto s, flow stops | om of s (app | table for wh rox.) when | nen full flow H1 < | occurs 4 | ft | assume dra | awdown at | intake ?1 ft. | | | | | | | |
| ORAFT | Rating Cu | rves for Ea | ach P | ump (3 to | tal for eac | h pump st | ation) | | | | | | | | | | |
| Discharge | e in CFS for | H1 & H2 | | | | | | | | | | | | | | | |
| | | | | If Pipe pr | imes then | full flow c | outlet cont as function | rol as siph | non: | | | | | | | | |
| ssuming | Pipe neve | er primes: | | Elevation (| H2) at Back | flow Outlet | C3 | 01112 | 12 | | | | | | | | |
| | | | | -7.0 | -5.0 | -3.0 | -1.0 | 1.0 | 3.0 | 5.0 | | | | | | | |
| Н1 | Level | | | | | | | | | | | | | | | | |
| U/s | Above | ٥ | | Primed | Primed | Primed | Primed | Primed | Primed | Primed | | | | | | | |
| eservoir | Discharge | Flow | | Conduit, | Conduit, | Conduit, | Conduit, | Conduit, | Conduit, | Conduit, | | | | | | | |
| levation | Pipe Crest | Rate | | H2 =-7 | H2 =-5 | H2 =-3 | H2 =-1 | H2 =1 | H2 = 3 | H2 = 5 | | | | | | | |
| (ft) | (ft) | (cfs) | | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | | | | | | | |
| 5.00 E 45 | 0.00 | 0 | | 301 | 274 | 245 | 213 | 174 | 123 | 0 | | | | | | | |
| 5.45 | 0.45 | 2 | | 306 | 280 284 | 252 | 220 228 | 183 192 | 136 | 58 82 | | | | | | | |
| 6.35 | 1.35 | 14 | | 312 | 200 | 265 | 235 | 201 | 140 | 101 | | | | | | | |
| 6.80 | 1.80 | 25 | | 322 | 298 | 272 | 242 | 209 | 169 | 116 | | | | | | | |
| 7.25 | 2.25 | 37 | | 328 | 304 | 278 | 249 | 217 | 179 | 130 | | | | | | | |
| 7.70 | 2.70 | 51 | | 333 | 309 | 284 | 256 | 225 | 188 | 143 | | | | | | | |
| 8.15 | 3.15 | 65 | | 338 | 315 | 290 | 262 | 232 | 197 | 154 | | | | | | | |
| 8.60 | 3.60 | 80 | | 343 | 320 | 295 | 269 | 239 | 205 | 165 | | | | | | | |
| 9.05 | 4.05 | 95 | | 340 | 320 | 301 | 275 | 240 | 213 | 175 | | | | | | | |
| 9.95 | 4.95 | 125 | | 357 | 335 | 312 | 287 | 260 | 229 | 193 | | | | | | | |
| 10.40 | 5.40 | 139 | | 362 | 340 | 318 | 293 | 266 | 236 | 202 | | | | | | | |
| 10.85 | 5.85 | 154 | | 367 | 345 | 323 | 299 | 272 | 243 | 210 | | | | | | | |
| 11.30 | 6.30 | 167 | | 371 | 350 | 328 | 304 | 278 | 250 | 218 | | | | | | | |
| 12.20 | 0.75 | 181 | | 370 | 300 | 333 | 310 | 284 | 257 | 225 | | | | | | | |
| 12.20 | 7.65 | 206 | | 385 | 364 | 343 | 313 | 296 | 203 | 233 | | | | | | | |
| 13.10 | 8.10 | 219 | | 389 | 369 | 348 | 326 | 302 | 276 | 247 | | | | | | | |
| 13.55 | 8.55 | 231 | | 393 | 374 | 353 | 331 | 307 | 282 | 254 | | | | | | | |
| 14.00 | 9.00 | 242 | | 398 | 378 | 358 | 336 | 313 | 288 | 260 | | | | | | | |
| | Estimated I | H1 required | for fu | II flow if Op | en Air Valv | e or vent: | TW/_ 1 | T\\/_1 | TW/_2 | TW/-5 | | | | | | | |
| | If Open Air | Valve I | H1 > | 100=-7 | 100=-5 | 100 = - 3 | 11 | 9 | 7 | 5 | | | | | | | |
| IOTES: | | | | | | | | | | | | | | | | | |
| 1 | Full flow Ratiming and | ating curve i degree of s | s accu iphoni | irate within ng develop | ± 30% du ed | e uncertain | ty of pump | curve loss (| coefficient a | and | | | | | | | |
| 2 | Loss and T | rigger Point Pump loss c | Assur | nptions: ient = | 3 00 | | | | | | | | | | | | |
| | | Siphon flow Intake loss | does = | not start til 2 | I H1 > soffi (diffusion | it of pipe at chamber at | crest(Zt) normal exi | t) | | | | | | | | | |
| | | Exit Loss = | | 1 | | | | | | | | | | | | | |
| 3 | Data Assun | Bend and ex nptions: | xpans | ion losses a | lso incorpo | rated | | | | | | | | | | | |
| | | Shape/lengt Shape/lengt Pipe lengths Elevations it | th/ang th/ang s estir n msl | gle of diffus gle of 2nd b nated from and NGVD | er/baffle ba end based photos and are same | ised on pho on sketch a 1988 Desig | tos nd photos 3n Workshe | et. | | | | | | | | | |
| 4 | Data Needs | S: Shape/lengt | th/and | ale of diffus | er & detail | of baffle | | | | | | | | | | | |
| | | Detail of pu | mps i | ncl bend to | discharge p | pipe, impelle | er | | | | | | | | | | |

St. Bernard Parish, #8 St Mary pumps

| ENGINEERING DESIGN SHEET PROJECT: St. Bernard Parish Pump Stations St. Mary #8 | OFFICE SYMBOL: CENV COMPUTED BY: KK/SS | VP-EC-HD DATE: 22 Feb 2006 WORKSHEET: Rating Curve |
|--|---|--|
| SUBJECT: Backflow Rating Curves | CHECKED BY: SJS/KAK | |
| | | |
| Crest Elevation (ft) = 4.75 | | |
| Trigger Points: | | |
| Flow starts when H1 $>$ is greater than | 4.75 ft | crest of conduit |
| Siphon Flow starts with rising H1 when: | | |
| If no open air valve or vent, when H1 > Soffit = | 10.3 ft | assume siphon starts when H1 = Zt |
| If open vent; see bottom of table for when full flo | w occurs | |
| If siphon flow develops, flow stops (approx.) when H1 < | 4 ft | assume drawdown at intake ?1 ft. |
| | | |

DRAFT Rating Curves for Each Pump,108x66 Centrifual, approx 125,000 gpm, No. of Identical Pumps = 3

Discharge in CFS for H1 & H2

If Pipe primes then full flow outlet control as siphon: Primed Flow (full Outlet Control) as function of H2

As

| Assuming | g Pipe neve | er primes: | Elevation (H2) at Backflow Outlet C3 | | | | | | | | | | | |
|-----------|-------------|------------|--------------------------------------|----------|----------|----------|----------|----------|----------|--|--|--|--|--|
| | | | -7 | -5 | -3 | -1 | 1 | 3 | 5 | | | | | |
| H1 | Level | | | | | | | | | | | | | |
| U/s | Above | Q | Primed | Primed | Primed | Primed | Primed | Primed | Primed | | | | | |
| Reservoir | Discharge | Flow | Conduit, | Conduit, | Conduit, | Conduit, | Conduit, | Conduit, | Conduit, | | | | | |
| Elevation | Pipe Crest | Rate | H2 =-7 | H2 =-5 | H2 =-3 | H2 =-1 | H2 =1 | H2 = 3 | H2 =5 | | | | | |
| (ft) | (ft) | (cfs) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | (ft) | | | | | |
| 3.00 | -1.75 | 0 | 228 | 204 | 176 | 144 | 102 | 0 | -102 | | | | | |
| 3.50 | -1.25 | 0 | 233 | 210 | 184 | 153 | 114 | 51 | -88 | | | | | |
| 4.00 | -0.75 | 0 | 239 | 216 | 191 | 161 | 125 | 72 | -72 | | | | | |
| 4.50 | -0.25 | 0 | 244 | 222 | 197 | 169 | 135 | 88 | -51 | | | | | |
| 5.00 | 0.25 | 1 | 249 | 228 | 204 | 176 | 144 | 102 | 0 | | | | | |
| 5.50 | 0.75 | 4 | 255 | 233 | 210 | 184 | 153 | 114 | 51 | | | | | |
| 6.00 | 1.25 | 12 | 260 | 239 | 216 | 191 | 161 | 125 | 72 | | | | | |
| 6.50 | 1.75 | 22 | 265 | 244 | 222 | 197 | 169 | 135 | 88 | | | | | |
| 7.00 | 2.25 | 35 | 269 | 249 | 228 | 204 | 176 | 144 | 102 | | | | | |
| 7.50 | 2.75 | 49 | 274 | 255 | 233 | 210 | 184 | 153 | 114 | | | | | |
| 8.00 | 3.25 | 63 | 279 | 260 | 239 | 216 | 191 | 161 | 125 | | | | | |
| 8.50 | 3.75 | 78 | 283 | 265 | 244 | 222 | 197 | 169 | 135 | | | | | |
| 9.00 | 4.25 | 92 | 288 | 269 | 249 | 228 | 204 | 176 | 144 | | | | | |
| 9.50 | 4.75 | 107 | 292 | 274 | 255 | 233 | 210 | 184 | 153 | | | | | |
| 10.00 | 5.25 | 120 | 297 | 279 | 260 | 239 | 216 | 191 | 161 | | | | | |
| 10.50 | 5.75 | 134 | 301 | 283 | 265 | 244 | 222 | 197 | 169 | | | | | |
| 11.00 | 6.25 | 147 | 306 | 288 | 269 | 249 | 228 | 204 | 176 | | | | | |
| 11.50 | 6.75 | 159 | 310 | 292 | 274 | 255 | 233 | 210 | 184 | | | | | |
| 12.00 | 7.25 | 172 | 314 | 297 | 279 | 260 | 239 | 216 | 191 | | | | | |
| 12.50 | 7.75 | 183 | 318 | 301 | 283 | 265 | 244 | 222 | 197 | | | | | |
| 13.00 | 8.25 | 195 | 322 | 306 | 288 | 269 | 249 | 228 | 204 | | | | | |

Estimated H1 required for full flow if Open Air Valve or vent: TW = 3TW = 5

12 If Open Air Valve H1 > 8 6 #NUM! NOTES:

1 Full flow Rating curve is accurate within ± 30% due uncertainty of pump curve loss coefficient and timing and degree of siphoning developed

2 Loss and Trigger Point Assumptions:

Pump loss coefficient = 3.00 Siphon flow does not start till H1 > soffit of pipe at crest(Zt) Intake loss = 2 Exit Loss = 1 Bend and expansion losses also incorporated

3 Data Assumptions:

Shape/length/angle of diffuser/baffle based on photos for PS#6 and PS#8 (similar to PS#6 but longer pipe) Shape/length/angle of 2nd bend based on 1/2 dwg and photos (assumed similar to PS#6/7) Pipe lengths estimated from photos and 1988 Design Worksheet for PS#6 and photos for PS#8.

4 Data Needs:

Shape/length/angle of diffuser & detail of baffle Detail of pumps incl bend to discharge pipe, impeller

| Name Pump Capacity | | Capacity | Manufacture | Size | Model Number | Serial Number | Installed | Driver | Rated Pump Speed | Pump Type | Pump Elevation* | Pump Curve | Discharge Gates | Rated Head | Track Rack Design Head | Intake Location | Discharge Location | Intake water elevation at Start | Intake water elevation at Stop | Intake water elevation range | Water elevations that effects station | Bearing Lubrication | Backstops or brakes |
|--------------------|------------|-------------------|-----------------------------------|----------|-----------------|-------------------|-----------|------------------|------------------------|-----------------------|--------------------|---------------|--------------------|---------------|---------------------------|--------------------|-----------------------|---------------------------------------|--------------------------------------|------------------------------------|--|------------------------|------------------------|
| | | (cfs) | | (in) | | | (year) | Electric /Diesel | (rpm) | (Vertical/Horizontal) | (NGVD) | (yes/no) | (type) | (ft) | (ft) | | | (NGVD) | (NGVD) | (NGVD) | (NGVD) | (oil/water) | (yes/no) |
| Fortification #1 | 1 | 445 | Baldwin-Lima-Hamilton (Patterson) | 94 x 128 | AFV | ? | 1972 | Diesel | 212 | Vertical | -1.5 | yes | tainter gates | 19 | n/a | Florida Walk Canal | Bayou Bienvenue | -6.0 | -6.5 | 0.5 | 8 | Oil | No |
| | 2 | 90 | Baldwin-Lima-Hamilton (Patterson) | 42 x 54 | AFV | ? | 1972 | Electric 60 Hz | 505 | Vertical | -1.5 | yes | tainter gates | 20 | n/a | Florida Walk Canal | Bayou Bienvenue | -6.0 | -6.5 | 0.5 | 8 | Oil | No |
| | 3 | 445 | Baldwin-Lima-Hamilton (Patterson) | 94 x 128 | AFV | ? | 1972 | Diesel | 212 | Vertical | -1.5 | yes | tainter gates | 19 | n/a | Florida Walk Canal | Bayou Bienvenue | -6.0 | -6.5 | 0.5 | 8 | Oil | No |
| | Total | 980 | | | | | | | | | | | | | | | | | | | | | |
| Guichard #2 | 1** | 111 | M&W (MWI) | 42 | NC342P12 | ? | 1950's | Diesel | n/a | Horizontal | -8 | yes | none | n/a | n/a | Florida Walk Canal | Bayou Bienvenue | -6.0 | -6.5 | 0.5 | 4 | Oil | No |
| | 2** | 267 | M&W (MWI) | 60 | NC360P12 | ? | 1950's | Diesel | n/a | Horizontal | -8 | yes | none | n/a | n/a | Florida Walk Canal | Bayou Bienvenue | -6.0 | -6.5 | 0.5 | 4 | Oil | No |
| | 3** | 110 | ? | ? | ? | ? | 1950's | Diesel | n/a | Horizontal | -8 | yes | none | n/a | n/a | Florida Walk Canal | Bayou Bienvenue | -6.0 | -6.5 | 0.5 | 4 | Oil | No |
| | 4** | 267 | M&W (MWI) | 60 | NC360P12 | ? | 1950's | Diesel | n/a | Horizontal | -8 | yes | none | n/a | n/a | Florida Walk Canal | Bayou Bienvenue | -6.0 | -6.5 | 0.5 | 4 | Oil | No |
| | Total | 755 | | | | | | | | | | | | | | | | | | | | | |
| Bayou Villere #3 | 1** | 266 | M&\\/ (M\\/I) | 60 | NC360P12 | 2 | 1950's | Diesel | n/a | Horizontal | -8 | VAS | butterfly valve | n/a | n/a | Forty Ament Canal | Bayou Villere | -6.0 | -6.5 | 0.5 | 12 | Oil | Yes |
| Bayea Milere #e | 2** | 267 | M&W (MWI) | 60 | NC360P12 | 2 | 1950's | Diesel | n/a | Horizontal | -8 | ves | butterfly valve | n/a | n/a | Forty Arpent Canal | Bayou Villere | -6.0 | -6.5 | 0.5 | 12 | Oil | Yes |
| | 3*** | 267 | M&W (MWI) | 60 | NC360P12 | 2 | 1950's | Diesel | n/a | Horizontal | -8 | ves | none | n/a | n/a | Forty Arpent Canal | Bayou Villere | -6.0 | -6.5 | 0.5 | 12 | Oil | No |
| | Total | 800 | | 00 | 1100001 12 | • | 10000 | Dictor | 100 | Tonzontar | Ū | y 00 | none | 1#d | n/a | i ony rupone ound | Dayou villore | 0.0 | 0.0 | 0.0 | 12 | 01 | 110 |
| Meraux #4 | 1 | 445 | Baldwin-Lima-Hamilton (Patterson) | 94 x 128 | AFV | ? | 1972 | Diesel | 212 | Vertical | -1.5 | yes | floodgate | n/a | n/a | Forty Arpent Canal | Bayou Dupre | -6.0 | -6.5 | 0.5 | 16 | Grease | No |
| | 2 | 90 | Baldwin-Lima-Hamilton (Patterson) | 42 x 54 | AFV | ? | 1972 | Electric 60 Hz | 505 | Vertical | -1.5 | yes | floodgate | n/a | n/a | Forty Arpent Canal | Bayou Dupre | -6.0 | -6.5 | 0.5 | 16 | Grease | No |
| | 3 Total | 445 980 | Baldwin-Lima-Hamilton (Patterson) | 94 x 128 | AFV | ? | 1972 | Diesel | 212 | Vertical | -1.5 | yes | floodgate | n/a | n/a | Forty Arpent Canal | Bayou Dupre | -6.0 | -6.5 | 0.5 | 16 | Grease | No |
| E.J. Gore #5 | 1 | 111 | M&W (MWI) | 42 | NC342P12 | ? | 1980's | Diesel | n/a | Horizontal | -8 | yes | flap gates | n/a | n/a | Forty Arpent Canal | Bayou Dupre | 0.0 | -0.5 | 0.5 | 2 | Oil | No |
| | 2 | 111 | M&W (MWI) | 42 | NC342P13 | ? | 1980's | Diesel | n/a | Horizontal | -8 | yes | flap gates | n/a | n/a | Forty Arpent Canal | Bayou Dupre | 0.0 | -0.5 | 0.5 | 2 | Oil | No |
| | 3 | 111 | M&W (MWI) | 42 | NC342P14 | ? | 1980's | Diesel | n/a | Horizontal | -8 | yes | flap gates | n/a | n/a | Forty Arpent Canal | Bayou Dupre | 0.0 | -0.5 | 0.5 | 2 | Oil | No |
| | 4 | 111 | M&W (MWI) | 42 | NC342P15 | ? | 1980's | Diesel | n/a | Horizontal | -8 | ves | flap gates | n/a | n/a | Forty Arpent Canal | Bayou Dupre | 0.0 | -0.5 | 0.5 | 2 | Oil | No |
| | 5 | 111 | M&W (MWI) | 42 | NC342P16 | ? | 1980's | Diesel | n/a | Horizontal | -8 | ves | flap gates | n/a | n/a | Forty Arpent Canal | Bayou Dupre | 0.0 | -0.5 | 0.5 | 2 | Oil | No |
| | 6 | 110 | M&W (MWI) | 42 | NC342P17 | ? | 1980's | Diesel | n/a | Horizontal | -8 | yes | flap gates | n/a | n/a | Forty Arpent Canal | Bayou Dupre | 0.0 | -0.5 | 0.5 | 2 | Oil | No |
| | Total | 665 | | | | | | | | | | | | | | | | | | | | | |
| Jean Lafitte #6 | 1 | 315 | Patterson Pump Co. | 75 x 72 | AFV | 90PT-14688-90-G72 | 1990 | Diesel | 272 | Vertical | -8 | yes | none | 10.5 | n/a | Florida Walk Canal | Bayou Bienvenue | -6.0 | -6.5 | 0.5 | 9 | Grease | Yes |
| | 2 | 315 | Patterson Pump Co. | 75 x 72 | AFV | 90PT-14688-90-G72 | 1990 | Diesel | 272 | Vertical | -8 | yes | none | 10.5 | n/a | Florida Walk Canal | Bayou Bienvenue | -6.0 | -6.5 | 0.5 | 9 | Grease | Yes |
| | 3 | 315 | Patterson Pump Co. | 75 x 72 | AFV | 90PT-14688-90-G73 | 1990 | Diesel | 272 | Vertical | -8 | yes | none | 10.5 | n/a | Florida Walk Canal | Bayou Bienvenue | -6.0 | -6.5 | 0.5 | 9 | Grease | Yes |
| | Total | 945 | | | | | | | | | | | | | | | | | | | | | |
| Bayou Ducros #7 | 1 | 333 | Patterson Pump Co. | 75 x 72 | AFV | 90PT-14688-90-G73 | 1992 | Diesel | 272 | Vertical | -8 | yes | none | 10.5 | n/a | Forty Arpent Canal | Bayou Ducros | -6.0 | -6.5 | 0.5 | 16 | Grease | Yes |
| | 2 | 333 | Patterson Pump Co. | 75 X 72 | AFV | 90PT-14000-90-G73 | 1992 | Diesei | 272 | Vertical | -0 | yes | none | 10.5 | n/a | Forty Arpent Canal | Bayou Ducios | -6.0 | -0.5 | 0.5 | 10 | Glease | res |
| | Total | 334 1000 | Patterson Pump Co. | /5X/2 | AFV | 9021-14088-90-073 | 1992 | Diesei | 212 | ventical | -8 | yes | none | 10.5 | n/a | Fony Arpent Canal | Bayou Ducros | -0.0 | -0.0 | 0.5 | 10 | Grease | res |
| St. Mary #8 | 1 | 278 | ITT-AC | 108 x 66 | 115-143543 | 1-0840-70720-02 | 1996 | Diesel | 230 | Vertical | -9 (intake) | yes | none | 2.5 | n/a | Twenty Arpent Cana | Lake Lery | 0.0 | -0.5 | 0.5 | 8 | Grease | Yes |
| | 2 | 278 | ITT-AC | 108 x 66 | 115-143543 | 1-0840-70720-01 | 1996 | Diesel | 230 | Vertical | -9 (intake) | yes | none | 2.5 | n/a | Twenty Arpent Cana | Lake Lery | 0.0 | -0.5 | 0.5 | 8 | Grease | Yes |
| | 3 Total | 279 835 | ITT-AC | 108 x 66 | 115-143543 | 1-0840-70720-03 | 1996 | Diesel | 230 | Vertical | -9 (intake) | yes | none | 2.5 | n/a | Twenty Arpent Cana | Lake Lery | 0.0 | -0.5 | 0.5 | 8 | Grease | Yes |

* Elevations estimated by Bob Turner/Lake Borgne Levee District and from engineering plans (when available)

| - | | - | | | | | | | - /- / = | | | | | - /- / | - /- / | | | | | | |
|-------------------|--------------|----------|-------------|-------------|-------------|------------|--|----------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|------------|------------|------------|
| Pump Station | Pump | Capacity | 8/28/2005 | 8/29/2005 | 8/30/2005 | 8/31/2005 | 9/1/2005 | 9/2/2005 | 9/3/2005 | 9/4/2005 | 9/5/2005 | 9/6/2005 | 9/7/2005 | 9/8/2005 | 9/9/2005 | 9/10/2005 | 9/11/2005 | 9/12/2005 | 9/13/2005 | 9/14/2005 | 9/15/2005 |
| ••••• | | (cfs) | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop | Start Stop |
| Fortification #1 | 1 (East) | 577 | \sim | | | | NA | NR | NR | NR | NR | NR | NR | NR | 22:30 Run | Run 22:00 | NR | NR | | | |
| | 2 (Center) | 100 | \sim | | | | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | | | |
| | 3 (West) | 577 | >>> | \sim | \leq | \sim | 20:00 Run | Run 11:30 | 9:00 16:00 | 9:00 22:00 | NR | NR | NR | NR | NR | 20:30 22:00 | 23:00 Run | Run 1:40 | | | |
| | Total | 1254 | | | | | | | | | | | | | | | | | | | |
| Guichard #2 | 1 | 111 | NR | NR | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| • 4101141 4 # 2 | 2 | 223 | NR | NR | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 3 | 167 | NR | NR | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 4 | 223 | NR | NR | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | Total | 724 | | | 107 | 10/1 | 10. | 101 | 10. | 101 | 10. | 107 | 107 | 107 | 10/1 | 10.1 | 101 | 10.0 | 107 | 10.1 | 101 |
| _ | Total | 14-1 | | | | | | | | | | | | | | | | | | | |
| Bayou Villere #3 | 1 | n/a | NR | NR | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 2 | n/a | NR | NR | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 3 | n/a | NR | NR | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | Total | 500 | | | | | | | | | | | | | | | | | | | |
| Meraux #4 | 1 (East) | 557 | 19:05 20:25 | \sim | \sim | \sim | \sim | \sim | 9:20 16:20 | >>> | >>> | 4:30 Run | Run Run | Run Run | Run Run | Run 1:30 | | | | | |
| | 2 (Electric) | 89 | NR | >>> | \sim | 15~~~ | \sim | \sim | NR | >>> | \sim | NR | NR | NR | NR | NR | | | | | |
| | 3 (West) | 557 | NR | \sim | \sim | 15~~ | *≫ | 15~~ | NR | >>> | \sim | NR | NR | NR | NR | NR | | | | | |
| | Total | 1203 | 1 | | 1 | Ī | T and a second s | T and a second | | | | | | | | | | 1 | | | |
| 5 L Oana #5 | | 440 | | | - NIA | N1A | NIA | N14 | N1.4 | N14 | N1A | N1.4 | N I A | NIA | NIA | N14 | N14 | N 4 | NIA | N/A | N/A |
| E.J. Gore #5 | 1 | 110 | \sim | \sim | NA NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 2 | 110 | \sim | \sim | , NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 3 | 110 | \sim | \sim | NA NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 4 | 110 | \sim | \sim | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 5 | 110 | \sim | \sim | » NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | 6 | 110 | \sim | \sim | . NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA |
| | Total | 660 | | | | | | | | | | | | | | | | | | | |
| Jean Lafitte #6 | 1 | 334 | 16:00 16:45 | $\sim \sim$ | 14:45 22:00 | 6:00 20:00 | 6:00 Run | Run 6:00 | 8:00 19:30 | Run 14:00 | 7:30 22:00 | 22:00 Run | Run 1:00 | Run Run | Run Run | Run Run | Run 9:00 | 3:30 5:00 | | | |
| | | | | >>> | | | | | 20:30 Run | | | | 22:00 Run | | | | 11:30 13:30 | | | | |
| | | | | >>> | 2 | | | | | | | | | | | | 16:30 18:30 | | | | |
| | | | | >>> | > | | | | | | | | | | | | 22:30 0:00 | | | | |
| | 2 | 334 | 16:00 16:45 | | 14:45 22:00 | 6:00 20:00 | 6:00 Run | Run 6:00 | 8:00 19:30 | Run 14:00 | 7:30 22:00 | 22:00 Run | Run 1:00 | Run Run | Run Run | Run Run | Run 9:00 | 3:30 5:00 | | | |
| | | | | \sim | 7 | | | | 20:30 Run | | | | 22:00 Run | | | | 11:30 13:30 | | | | |
| | | | | \sim | 2 | | | | | | | | | | | | 16:30 18:30 | | | | |
| | | | | \sim | 2 | | | | | | | | | | | | 22:30 0:00 | | | | |
| | 3 | 334 | 16:00 16:45 | | 14:45 22:00 | 6:00 20:00 | 6:00 Run | Run 6:00 | 8:00 19:30 | Run 14:00 | 7:30 22:00 | 22:00 Run | Run 1:00 | Run Run | Run Run | Run Run | Run 9:00 | 3:30 5:00 | | | |
| | | | | >>> | | | | | 20:30 Run | | | | 22:00 Run | | | | 11:30 13:30 | | | | |
| | | | | >>> | | | | | | | | | | | | | 16:30 18:30 | | | | |
| | | | | >>> | ~ | | | | | | | | | | | | 22:30 0:00 | | | | |
| | Total | 1002 | | | 1 | | | | | | | | | | | | | | | | |
| Barran Diranaa #7 | 4 | 224 | 7.40 0.40 | ····· | | | | | 0.00 Dur | Dur 10:00 | Dura Dura | Dura Dura | Dura Dura | Dura Dura | Dura 0:00 | 0.20 10.00 | | | | | |
| Bayou Ducros #7 | 1 | 334 | 7:40 9:10 | \sim | | \sim | \sim | \sim | 8:00 Run | Run 16:00 | Run Run | Run Run | Run Run | Run Run | Run 0:00 | 8:30 12:00 | | | | | |
| | | | 17.00 17.45 | \sim | \sim | \sim | \sim | \sim | 4 | 16.00 Rull | | | | | | | | | | | |
| | 0 | 224 | 19.35 20.05 | \sim | \sim | \sim | \sim | \sim | 0.00 Dur | Dur 10.00 | Due Due | Dura Dura | Dura Dura | Dur Dur | D.u. 0.00 | 0.00 10.00 | | | | | |
| | 2 | 334 | 17:00 17:45 | \sim | \sim | \sim | \sim | \sim | 0.00 Rull | Run 10.00 | Run Run | Run Run | Run Run | Run Run | Run 0.00 | 0.30 12.00 | | | | | |
| | | | 17:00 17:45 | \sim | \sim | \sim | \sim | \sim | - | 18:00 Run | | | | | | | | | | | |
| | 2 | 224 | 7:40 0:10 | \sim | \sim | \sim | \sim | \sim | 9:00 Dun | Dup 16:00 | Dun Dun | Dun Dun | Dun Dun | Dun Dun | Dup 0:00 | 8:20 12:00 | | | | | |
| | 3 | 334 | 17:00 17:45 | \sim | \sim | \sim | \sim | \sim | 0.00 Run | Run 10.00 | Run Run | Run Run | Run Run | Run Run | Run 0.00 | 0.30 12.00 | | | | | |
| | | | 10:25 20:06 | \sim | \sim | \sim | \sim | \sim | • | 16.00 Rull | | | | | | | | | | | |
| | Total | 1000 | 19.55 20.05 | | | \sim | \sim | \sim | | | | | | | | | | | | | |
| | Iotai | 1002 | | <u> </u> | | | <u> </u> | | | <u> </u> | | | | | | | | | | | |
| St. Mary #8 | 1 | 279 | | | | | 15:45 Run | Run Run | Run Run | Run Run | Run Run | Run Run | Run Run | Run 20:00 | | 15:00 Run | Run 17:30 | 14:00 19:30 | 7:00 Run | Run Run | Run 1:00 |
| | 2 | 279 | 9:15 0:00 | | | | 15:45 Run | Run Run | Run Run | Run Run | Run Run | Run Run | Run Run | Run Run | Run 14:00 | 6:00 Run | Run 21:30 | 14:00 16:30 | 7:15 Run | Run Run | Run 3:00 |
| | 3 | 279 | | | | | | | 11:45 Run | Run Run | Run Run | Run Run | Run Run | Run Run | Run 14:00 | 6:00 Run | Run Run | Run Run | Run Run | Run Run | Run 6:00 |
| | Total | 837 | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |

Time in Local CST Day Light Savings Pumps Not Available NA No Reported Run Times NR Continued to Run Run Damaged/ Lost/ Unavaible Record Information was not obtained (Area considered Unwatered)



| 1 | St Bernard Parish Canal and Tide Level Readings ions 28 Aug-05 30 Aug-05 31 Aug-05 1-Sep-05 2-Sep-05 6-Sep-05 7-Sep-05 8-Sep-05 9-Sep-05 11-Sep-05 11-Sep-05 13-Sep-05 14-Sep-05 14-Sep | | | | | | | | | | | | | | 15 Son 05 | | | | | | | | | | | | | | |
|----------------------|---|---|-------|--|--|---|--|---|---|--|--|---|--|----------------|---|--|---|---|---------|--|---|-------|---|--|--|---|--|--|---|
| Pump Stations | 2:00 | e Time Gag | e 30 | Time Gage | 2:00 | e Gage | Time Gag | e Tin 2:0 | ne Gage 0 5.2 | Time Gage 2:00 4.2 | Ti 2: | ime Gage :00 2.5 | Time Gag 2:00 0.0 | le | Time Gage 2:00 -0.7 | 7-3ep-0. Time 2:00 | Gage | Time Gage | 3-0 | Time Gage | Time Gage 2:00 -0.8 | e | Time Gage 2:00 -6.8 | Time Gage | Time 2:00 | e Gage | Time Ga | ge Time G | age |
| PS 1 - Fortication | 6:00 10:00 11:00 12:00 22:00 6:00 11:00 11:00 12:00 22:00 6:00 11:00 12:00 12:00 12:00 22:00 | Canal 6:00 10:00 14:00 18:00 22:00 Tide 2:00 14:00 10:00 10:00 10:00 10:00 10:00 22:00 10:00 | Canal | 6:00 10:00 14:00 14:00 22:00 6:00 10:00 14:00 22:00 6:00 10:00 10:00 14:00 10:00 | Canal Canal 10:00 14:00 14:00 22:00 6:00 10:00 14:00 14:00 18:00 22:00 14:00 18:00 14:00 18:00 19:00 1 | | 6:00 6.3 10:00 6.0 18:00 5.0 22:00 5.8 10:00 6.0 10:00 6.0 10:00 6.0 10:00 6.0 10:00 6.0 10:00 6.0 10:00 6.0 2:00 5.8 2:00 5.8 | Canal 6:0 Canal 10:0 14:0 18:0 22:0 Tide 10:0 14:1 18:0 10:0 14:1 18:0 22:0 10:0 14:1 18:0 22:0 | 0 5.1 00 5.0 00 5.0 00 5.0 00 4.8 00 5.2 00 5.1 00 5.0 00 5.0 00 5.0 00 5.0 00 4.8 00 4.8 00 4.8 00 4.8 00 4.8 00 4.5 | Canal 6:00 3.9 10:00 3.0 18:00 2.9 22:00 2.5 6:00 3.9 10:00 3.8 10:00 3.8 10:00 3.8 18:00 2.9 22:00 2.5 22:00 2.5 200 2.5 10:00 3.8 18:00 2.9 22:00 2.5 | Canal 6: 10 14 18 22 7: 6: 6: 14 14 18 22 | :00 2.4 0:00 2.3 4:00 1.5 3:00 0.9 2:00 0.2 :00 2.5 :00 2.3 :00 2.4 :00 2.4 :00 2.3 :00 2.3 :00 2.3 :00 3.0 2:00 3.0 | 6:00 0.0 10:00 -0. 18:00 -0. 22:00 2.2 6:00 2.2 10:00 2.2 11:00 2.2 11:00 2.2 11:00 2.2 11:00 2.2 12:00 2.2 12:00 2.2 12:00 2.2 12:00 2.2 12:00 2.2 14:00 2.4 14:00 2.4 14:00 2.4 14:00 2.4 14:00 2.4 14:00 2.4 14:00 2.4 15:00 2.4 16:00 2.4 17:00 2.4 16:00 2.4 17:00 2.4 16:00 2.4 17:00 2.4 16:00 2.4 17:00 2.5 16:00 2.4 17:00 <th>Canal</th> <th>6:00 -0.8 10:00 -1.0 14:00 -1.1 18:00 -1.4 22:00 -1.6 2:00 2.8 6:00 2.9 10:00 2.9 14:00 3.0 18:00 3.0</th> <th>6:00 10:00 14:00 18:00 22:00 6:00 10:00 10:00 10:00 10:00 22:00 2:00 10:00 14:00 22:00 22:00</th> <th>-1.9 -1.9 -2.0 -2.1 -2.3 2.9 2.8 2.8 2.8 2.9 2.9 2.9 2.9 2.8</th> <th>Canal 6:00 -2.5 10:00 -2.6 18:00 -2.6 18:00 -2.7 22:30 3.0 6:00 3.0 6:00 3.0 10:00 2.7 18:00 2.7 18:00 2.5 22:30 2.1</th> <th>Canal ,</th> <th>6:00 10:00 14:00 22:00 6:00 10:00 14:00 14:00 14:00 18:00 22:00 14:00 18:00 18:00 18:00 18:00 19:0</th> <th>Canal 6:00 -1.1 10:00 -2.2 18:00 -3.5 22:00 -5.8 20:00 -2.2 10:00 2.2 10:00 2.2 18:00 2.2 18:00 2.2 18:00 2.2 18:00 2.2 18:00 2.2 18:00 2.2 18:00 2.2 18:00 2.2</th> <th>Canal</th> <th>6:00 -6.2 10:00 -6.2 18:00 - 2.0 22:00 2.0 6:00 1.9 10:00 1.9 10:00 1.9 114:00 - Tid 18:00 - 22:00 - 2.0</th> <th>e 1000 10:00 14:00 18:00 22:00 18:00 10:00 10:00 14:00 18:00 10:00 14:00 18:00 10:00 14:00 1</th> <th>6:00 Canal 10:00 14:00 18:00 22:00 6:00 10:00 14:00 18:00 22:00</th> <th></th> <th>anal 6:00 10:00 14:00 22:00 2:00 6:00 14:00 14:00 14:00 18:00 22:00</th> <th>Canal 10:00 10:00 18:00 22:00 22:00 10:00 14:00 18:00 14:00 18:00 22:00</th> <th>///////////////////////////////////////</th> | Canal | 6:00 -0.8 10:00 -1.0 14:00 -1.1 18:00 -1.4 22:00 -1.6 2:00 2.8 6:00 2.9 10:00 2.9 14:00 3.0 18:00 3.0 | 6:00 10:00 14:00 18:00 22:00 6:00 10:00 10:00 10:00 10:00 22:00 2:00 10:00 14:00 22:00 22:00 | -1.9 -1.9 -2.0 -2.1 -2.3 2.9 2.8 2.8 2.8 2.9 2.9 2.9 2.9 2.8 | Canal 6:00 -2.5 10:00 -2.6 18:00 -2.6 18:00 -2.7 22:30 3.0 6:00 3.0 6:00 3.0 10:00 2.7 18:00 2.7 18:00 2.5 22:30 2.1 | Canal , | 6:00 10:00 14:00 22:00 6:00 10:00 14:00 14:00 14:00 18:00 22:00 14:00 18:00 18:00 18:00 18:00 19:0 | Canal 6:00 -1.1 10:00 -2.2 18:00 -3.5 22:00 -5.8 20:00 -2.2 10:00 2.2 10:00 2.2 18:00 2.2 18:00 2.2 18:00 2.2 18:00 2.2 18:00 2.2 18:00 2.2 18:00 2.2 18:00 2.2 | Canal | 6:00 -6.2 10:00 -6.2 18:00 - 2.0 22:00 2.0 6:00 1.9 10:00 1.9 10:00 1.9 114:00 - Tid 18:00 - 22:00 - 2.0 | e 1000 10:00 14:00 18:00 22:00 18:00 10:00 10:00 14:00 18:00 10:00 14:00 18:00 10:00 14:00 1 | 6:00 Canal 10:00 14:00 18:00 22:00 6:00 10:00 14:00 18:00 22:00 | | anal 6:00 10:00 14:00 22:00 2:00 6:00 14:00 14:00 14:00 18:00 22:00 | Canal 10:00 10:00 18:00 22:00 22:00 10:00 14:00 18:00 14:00 18:00 22:00 | /////////////////////////////////////// |
| PS 2 - Guichard | Canal 2:00 6:00 10:00 14:00 18:00 22:00 2:00 7ide 14:00 10:00 10:00 10:00 10:00 22:00 2:00 10:00 2:00 14:00 10:00 14:00 10:00 14:00 10:00 10:00 14:00 10:00 10:00 10:00 14:00 10: | Canal 2:00 Canal 14:00 22:00 Tide 18:00 14:00 18:00 22:00 18:00 18:00 18:00 22:00 | Canal | 2:00 6:00 10:00 14:00 22:00 2:00 10:00 14:00 14:00 14:00 18:00 22:00 2:00 10:00 14:00 18:00 22:00 2:00 10 10:00 10 | Canal 2:00 6:00 14:01 14:01 22:00 2:00 10:00 14:01 14:00 18:00 2:00 2:00 | | 2:00 6:00 10:00 12:00 18:00 22:00 7 6:00 18:00 10:00 10:00 10:00 10:00 10:00 10:00 22:00 10:00 22:00 200 6:00 10:00 22:00 | Canal Canal Tide 200 200 200 200 200 200 200 200 200 20 | | 2:00 6:00 10:00 14:00 22:00 6:00 18:00 22:00 6:00 10:00 10:00 22:00 6:00 10:00 22:00 20:00 20:00 20:00 20:00 20:00 | Canal 22 66 10 14 18 22 66 10 14 18 22 | 00 00 00 00 000 00 <th>2:00 6:00 10:00 14:00 22:00 200 10:00 18:00 10:00 10:00 22:00 200 10:00 11:00 12:00 22:00 20:00 20:00 20:00 20:00 20:00</th> <th>Canal</th> <th>2:00 6:00 10:00 14:00 22:00 6:00 10</th> <th>Canal 2:00 6:00 10:00 14:00 22:00 6:00 10:00 14:00 18:00 22:00 10:00 14:00 10:000</th> <th>///////////////////////////////////////</th> <th>Canal 14:00 10:00 10:00 18:00 22:00 14:00 18:00 10:00 22:00 22:00</th> <th>Canal ,</th> <th>2:00 6:00 10:00 14:00 18:00 2:00 6:00 10:00 14:00 10:00 14:00 2:00 0 2:00 0 10:00 10</th> <th>2:00 6:00 10:00 18:00 22:00 6:00 14:00 14:00 Tide 14:00 18:00 22:00 22:00 200</th> <th>Canal</th> <th>2:00 6:00 10:00 14:00 22:00 6:00 10:00 20:00 10:00 11:00 11:00 12:00 10</th> <th>al 2:00 6:00 10:00 14:00 22:00 6:00 6:00 14:00 14:00 14:00 14:00 22:00 2:00 14:0</th> <th>Canal 2:00 6:00 14:00 14:00 22:00 2:00 6:00 10:00 14:00 18:00 22:00</th> <th></th> <th>anal 2:00 6:00 10:00 14:00 22:00 6:00 6:00 14:00</th> <th>Canal 2:00 Canal 6:00 10:00 16:00 22:00 2:00 6:00 10:00 10:00 10:00 10:00 10:00 10:00 18:00 22:00 2:00</th> <th>///////////////////////////////////////</th> | 2:00 6:00 10:00 14:00 22:00 200 10:00 18:00 10:00 10:00 22:00 200 10:00 11:00 12:00 22:00 20:00 20:00 20:00 20:00 20:00 | Canal | 2:00 6:00 10:00 14:00 22:00 6:00 10 | Canal 2:00 6:00 10:00 14:00 22:00 6:00 10:00 14:00 18:00 22:00 10:00 14:00 10:000 | /////////////////////////////////////// | Canal 14:00 10:00 10:00 18:00 22:00 14:00 18:00 10:00 22:00 22:00 | Canal , | 2:00 6:00 10:00 14:00 18:00 2:00 6:00 10:00 14:00 10:00 14:00 2:00 0 2:00 0 10:00 10 | 2:00 6:00 10:00 18:00 22:00 6:00 14:00 14:00 Tide 14:00 18:00 22:00 22:00 200 | Canal | 2:00 6:00 10:00 14:00 22:00 6:00 10:00 20:00 10:00 11:00 11:00 12:00 10 | al 2:00 6:00 10:00 14:00 22:00 6:00 6:00 14:00 14:00 14:00 14:00 22:00 2:00 14:0 | Canal 2:00 6:00 14:00 14:00 22:00 2:00 6:00 10:00 14:00 18:00 22:00 | | anal 2:00 6:00 10:00 14:00 22:00 6:00 6:00 14:00 | Canal 2:00 Canal 6:00 10:00 16:00 22:00 2:00 6:00 10:00 10:00 10:00 10:00 10:00 10:00 18:00 22:00 2:00 | /////////////////////////////////////// |
| PS 3 - Bayou Villere | Canal 2:00 6:00 10:00 14:00 18:00 22:00 0:00 Tide 14:00 14:00 10:00 1 | Canal 2:00 Canal 14:00 2:00 2:00 2:00 2:00 14:00 14:00 14:00 14:00 14:00 14:00 14:00 14:00 2:00 | Canal | 2:00 6:00 10:00 14:00 18:00 22:00 2:00 6:00 10:00 14:00 18:00 22:00 2:00 6:00 10:00 14:00 18:00 22:00 | Canal 2:00 6:00 14:0 14:0 18:0 22:0 Tide 6:00 10:0 14:0 18:0 22:0 | | 2:00 6:00 10:00 14:00 22:00 2:00 7:00 14:00 18:00 10:00 2:00 10:00 10:00 2:00 10:00 2:00 10:00 2:00 10:00 2:00 | 2:0 6:0 10:1 14:1 18:1 22:1 Tide 2:0 6:0 6:0 10:1 14:1 18:1 18:1 22:1 | | 2:00 6:00 10:00 14:00 2:00 6:00 2:00 6:00 10:00 10:00 2:00 6:00 10:00 10:00 2:00 6:00 10:00 2:00 | Canal 22 66 10 14 18 22 6 6 10 14 18 22 7 10 14 18 22 | .00 | 2:00 6:00 10:00 14:00 22:00 200 10:00 18:00 22:00 10:00 10:00 10:00 10:00 22:00 20:00 10:00 11:00 12:00 | Canal | 2:00 6:00 11:00 12:00 22:00 2:00 6:00 11:00 12:00 10:00 12:0 | Canal 2:00 6:00 10:00 14:00 22:00 7:00 14:00 18:00 22:00 14: | /////////////////////////////////////// | Canal 14:00 10:00 10:00 18:00 22:00 Tide 10:00 18:00 19:00 10 10:00 10 10:00 10 10 1 | Canal , | 2:00 6:00 10:00 14:00 18:00 2:00 6:00 10:00 14:00 18:00 2:200 10:00 14:00 12:00 | 2:00 6:00 10:00 18:00 22:00 6:00 18:00 10:00 10:00 10:00 10:00 10:00 10:00 2:00 6:00 10:00 18:00 22:00 | Canal | 2:00 6:00 10:00 14:00 22:00 6:00 6:00 10:00 114:00 114:00 10 | e e 2:00 6:00 10:00 14:00 2:00 6:00 10:00 14:00 10 | Canal 2:00 6:00 14:00 14:00 22:00 6:00 Tide 10:00 14:00 14:00 18:00 22:00 | | anal 2:00 6:00 10:00 14:00 22:00 6:00 14:00 14:00 14:00 14:00 14:00 18:00 22:00 | Canal 2:00 Canal 10:00 14:00 18:00 22:00 6:00 16:00 14:00 16:00 14:00 16:00 10:00 2:00 6:00 10:00 18:00 2:00 2:00 | /////////////////////////////////////// |
| PS 4 - Meraux | 2:00 6.5 6:00 6.5 10:00 7.5 14:00 7.6 22:00 8.3 200 8.3 10:00 0.6 10:00 0.6 10:00 0.6 10:00 0.6 10:00 0.6 11:00 0.6 11:00 0.6 12:00 0.6 13:00 0.6 22:00 0.6 | 2:00 Canal 14:00 14:00 22:00 22:00 Tide 10:00 14:000 | Canal | 2:00 6:00 10:00 14:00 18:00 22:00 6:00 10:00 14:00 14:00 12:00 6:00 10:00 14:00 12:00 6:00 14:00 18:00 22:00 22:00 | Canal 2:00 6:00 10:0 14:0 18:0 22:0 5:00 6:00 10:0 14:0 10:0 14:0 10:0 10:0 10:0 1 | | 2:00 6:00 10:00 14:00 22:00 6:00 14:00 10:00 12:00 2:00 10:00 12:00 2:00 10:00 18:00 22:00 | Canal 2:0 Canal 2:0 Tide 2:0 0:0 12:0 14:1 14:1 14:1 18:1 22:1 | | Canal 2:00 Canal 1:00 14:00 14:00 22:00 Canal 1:00 14:00 14:00 10:00 1 | Canal 22 Canal 10 14 18 22 10 10 14 18 22 10 14 18 22 10 14 18 22 10 14 18 22 10 14 14 18 22 14 14 18 22 14 14 18 22 14 14 18 22 14 14 18 22 14 14 18 22 14 14 14 18 22 14 14 18 22 14 14 18 22 14 14 18 22 14 14 18 22 19 14 14 18 22 19 14 14 18 22 19 14 14 18 22 19 14 14 18 18 19 19 19 19 19 19 19 19 19 19 | :00 | 2:00 6:00 10:00 14:00 18:00 22:00 6:00 71ide 14:00 18:00 22:00 2:00 10:00 11:00 12:00 | Canal | 2:00 6:00 10:00 14:00 2:5 22:00 2:00 6:00 14:00 14:00 14:00 14:00 14:00 22:00 | Canal 2:00 6:00 10:00 14:00 22:00 7:00 10:00 10:00 10:00 14:00 18:00 22:00 | 2.0 1.9 1.8 1.7 1.5 | 2:00 0.5 1:000 0.5 1:000 0.2 1:000 0.8 2:00 -0.8 2:00 -0.8 1:000 16:00 1:000 18:00 1:000 22:00 | Canal , | 2:00 6:00 -1.3 10:00 -1.9 14:00 -2.7 18:00 -3.7 22:00 5.5 2:00 6:00 14:00 14:00 22:00 | 2:00 7.0 6:00 10:00 14:00 22:00 2:00 10:00 14:00 14:00 18:00 22:00 11:00 10:00 12:00 10:00 10:00 10:00 10:00 10:00 11:00 12:00 | Canal | 2:00 6:00 10:00 14:00 18:00 22:00 6:00 10:00 114:00 10 | 2:00 6:00 10:00 14:00 22:00 2:00 6:00 6:00 6:00 10:00 10:00 2:00 2:00 2:00 2:00 2:00 2:00 2:00 | Canal 2:00 6:00 10:00 14:00 14:00 22:00 6:00 10:00 14:00 14:00 14:00 14:00 14:00 14:00 | | anal 2:00 4:00 14:00 14:00 2:00 6:00 14:00 1 | Canal 2:00 6:00 10:00 14:00 22:00 Tide 6:00 14:00 22:00 Tide 6:00 10:00 22:00 Tide 2:00 6:00 14:00 18:00 22:00 | /////////////////////////////////////// |
| PS 5 - E.J. Gore | Canal 2:00 6:00 10:00 14:00 22:00 2:00 7ide 6:00 10:00 14:00 14:00 14:00 14:00 22:00 2:00 2:00 2:00 14:00 2:00 2:00 14:00 2:00 2:00 2:00 14:00 2:00 2:00 2:00 14:00 2:00 2:00 14:00 2:00 | Canal 2:00 Canal 14:00 14:00 22:00 7:00 10:00 14:000 | Canal | 2:00 6:00 10:00 14:00 18:00 22:00 6:00 10:00 10:00 10:00 11:00 | Canal 2:00 6:00 10:00 22:00 2:00 6:00 10:01 14:01 14:01 14:01 14:01 14:02 14:02 14:02 14:02 14:02 14:02 14:02 14:02 14:02 14:02 14:02 14:02 14:02 14:02 10:0 | | 2:00 6:00 10:00 14:00 2:00 2:00 10:00 10:00 10:00 10:00 11:00 12:00 11:00 12:00 14:00 12:00 | Canal 2:0 6:0 10:1 14:1 14:1 14:2 2:0 6:0 6:0 10:1 14:1 18:1 14:1 18:1 18:1 22:1 14:1 18:1 22:1 14:1 18:1 22:1 14:1 18:1 14:1 14:1 14:1 14:1 14:1 14 | | Canal 2:00 2:00 10:00 14:00 2:00 2:00 10:00 14:00 14:00 14:00 14:00 14:00 2:00 | Canal 22 66 14 18 22 23 63 7 14 18 22 | :00 | Canal 2:00 6:00 14:00 22:00 7:00 14:00 14:00 14:00 14:00 14:00 14:00 14:00 14:00 22:00 | Canal | 2:00 6:00 10:00 14:00 2:00 6:00 10:00 10:00 14:00 10:00 14:00 12:00 2:00 10:00 14:00 14:00 14:00 14:00 14:00 14:00 14:00 10:00 | Canal 2:00 6:00 10:00 14:00 18:00 22:00 6:00 10:00 18:00 22:00 22:00 | /////////////////////////////////////// | Canal 2:00 4:00 10:00 14:00 2:00 2:00 2:00 14:00 1 | Canal , | 2:00 6:00 10:00 14:00 14:00 22:00 6:00 10:00 14:00 14:00 10:00 10:00 10:00 11:00 10:00 | 200 200 Canal 6:00 14:00 22:00 2:00 2:00 Tide 10:00 18:00 2:00 2:00 2:00 2:00 2:00 18:00 2:00 | Canal | 2:00 6:00 10:00 14:00 22:00 2:00 10:00 10:00 14:00 14:00 14:00 14:00 14:00 12:00 | al 2:00 10:00 14:00 2:00 2:00 0:00 14:00 2:00 0 0 0 0 0 0 0 0 0 0 0 0 | Canal 2:00 6:00 10:00 14:00 18:00 22:00 6:00 10:00 10:00 14:00 14:00 14:00 14:00 14:00 14:00 | | anal 2:00 6:00 10:00 14:00 2:00 6:00 6:00 14:00 18:00 22:00 18:00 22:00 | Canal 2:00 6:00 10:00 14:00 22:00 2:00 6:00 Tide 10:00 18:00 22:00 2:00 10:00 2:00 2:00 2:00 10:00 18:00 22:00 | /////////////////////////////////////// |
| PS 6 - Jean Lafitte | Canal 2:00 6:00 14:00 6:1 22:00 7:2 22:00 7:6 10:00 14:00 1.1 18:00 1.5 22:00 1.5 | 2:00 8.4 Canal 14:00 14:00 22:00 2:00 20 Tide 10:00 14:00 14:00 2:00 20 | Canal | 2:00 6:00 10:00 13.3 14:00 13.3 18:00 13.3 22:00 6:00 10:00 13.3 14:00 13.0 10:00 13.0 10:00 13.0 10:00 13.0 10:00 13.0 10:00 13.0 10:00 13.0 10:00 13.0 10:00 10:00 13.0 10:00 10:00 10:00 10:00 10:00 10:00 13.0 10:00 13.0 10:00 13.0 10:00 13.0 13.0 10:00 13.0 | Canal Canal Tide Tide Canal 22:00 6:00 18:00 22:00 18:00 10:00 14:00 14:00 14:00 14:00 14:00 14:00 14:00 14:00 14:00 10 | 0 0 13.3 0 7.5 0 7.2 0 6.9 0 6.7 13.3 0 13.3 0 13.3 0 13.3 0 13.3 0 13.3 0 13.3 0 13.3 0 13.3 0 13.3 0 13.3 0 13.3 0 7.5 0 6.9 0 6.7 1 1 1 1 1 1 1 1 1 1 1 1 1 | Canal 2:00 Canal 2:00 10:00 13: 14:00 13: 12:00 13: 14:00 13: 13: 2:00 13: 13: 13: 13: 13: 13: 14:00 13: 13: 13: 13: 13: 13: 13: 13: | Canal 2:0 3 3 3 3 3 3 3 3 3 3 3 3 3 | 0 13.3 0 13.3 00 13.3 00 13.3 00 13.3 00 13.3 00 13.3 00 13.3 00 13.3 00 5.6 00 5.1 00 4.9 00 4.7 00 4.5 00 4.3 | Canal 2:00 13.3 6:00 13.3 10:00 13.3 14:00 13.3 2:00 13.3 2:00 13.3 2:00 4.2 6:00 4.0 10:00 3.8 14:00 3.8 14:00 3.6 14:00 3.5 | Canal 22 63 10 10 14 18 22 23 63 14 18 22 14 18 22 | :00 13.3 :00 13.3 :00 13.3 :00 13.3 :00 13.3 :00 13.3 :00 13.3 :00 3.4 :00 3.4 :00 3.2 :00 3.1 3:00 3.0 :00 3.0 | Canal 2:00 13. 6:00 13. 10:00 13. 14:00 12. 22:00 12. 2:00 2.1 10:00 2.1 14:00 2. | Canal Canal | 2:00 12.8 6:00 12.6 14:00 12.4 14:00 12.4 18:00 12.2 22:00 12.2 2:00 12.2 2:00 2.8 6:00 3.0 10:00 3.0 14:00 3.0 18:00 3.0 22:00 2.8 | Canal 2:00 6:00 10:00 14:00 22:00 2:00 6:00 10:00 14:00 18:00 22:00 | 12.2 12.2 12.2 12.1 12.0 11.8 2.8 2.8 2.8 3.0 3.0 2.8 | 2:00 11.6 6:00 11.3 10:00 11.3 14:00 11.3 2:00 11.3 2:00 11.3 2:00 11.3 2:00 11.0 2:00 11.0 2:00 10.0 2:00 0.2 1:00 2.7 1:00 2.8 6:00 2.8 1:00 2.7 1:00 2.8 1:00 2.8 1:00 2.8 1:00 2.8 2:00 2.4 | Canal , | 2:00 11.0 6:00 10.6 10:00 10.3 14:00 10.2 22:00 -0.5 2:00 2.2 6:00 2.2 6:00 2.4 14:00 2.3 18:00 2.2 22:00 2.1 | Canal 2:00 -0.8 6:00 -1.1 10:00 -2.5 14:00 -2.5 22:00 -5.8 2:00 -2.1 10:00 -2.1 10:00 -2.1 14:00 -2.3 18:00 -2.3 22:00 -2.1 | Canal | 2:00 -6.0 6:00 -6.2 10:00 6.9 14:00 7.4 22:00 6.0 2:00 2.0 10:00 2.1 14:00 2.2 10:00 2.1 14:00 2.0 18:00 2.0 18:00 2.0 19:00 1.9 | 2:00 6.7 6:00 6.7 10:00 22:00 18:00 2:00 2:00 1.9 6:00 1.9 14:00 1.9 14:00 1.9 2:00 1.9 2:00 1.9 2:00 1.9 14:00 1.9 14:00 1.9 14:00 1.9 14:00 1.9 12:00 1.9 | Canal 2:00 6:00 14:00 18:00 22:00 6:00 14:00 14:00 14:00 14:00 18:00 22:00 | | 2:00 6:00 4:00 14:00 14:00 22:00 2:00 6:00 10:00 14:00 14:00 14:00 14:00 18:00 2:00 6:00 12:00 18:00 22:00 18:00 | Canal 2:00 6:00 14:00 18:00 22:00 Tide 18:00 14:00 14:00 14:00 14:00 14:00 22:00 | /////////////////////////////////////// |
| PS 7 - Bayou Ducros | 2:00 -6: 6:00 -7: 14:00 -7: 18:00 -7: 2:00 -8: 2:00 -8: 2:00 -8: 2:00 -8: 2:00 -8: 2:00 -8: 2:00 -8: 2:00 -114:00 14:00 2.0 | Canal 2:00 6:00 10:00 14:00 22:00 7:00 14:00 18:00 22:00 10 | Canal | 2:00 6:00 10:00 14:00 18:00 22:00 6:00 10:00 14:00 18:00 22:00 6:00 10:00 | Canal 2:00 6:00 10:0 18:0 22:00 6:00 2:00 6:00 10:0 10:0 14:0 18:0 22:0 | | Canal 2:00 10:00 14:00 22:00 Tide 14:00 14:00 14:00 14:00 10:00 10:00 10:00 10:00 10:00 22:00 | Canal 2:0 6:0 10:1 14:1 8:1 22:0 6:0 10:1 14:1 18:1 22:1 10:1 14:1 18:1 22:1 14:1 18:1 22:1 14:1 18:1 14:1 14:1 18:1 14:1 14:1 14 | | Canal 2:00 2:00 1:000 14:00 2:00 2:00 1:000 1:000 2:00 1:000 1:000 1:000 1:000 1:000 1:000 2:00 2:00 1:0 | Canal 22 63 10 14 18 22 63 10 10 14 18 22 | 00 -1.3 1:00 -1.4 1:00 -1.4 1:00 -1.4 1:00 -1.5 1:00 | 2:00 -1. 6:00 -1. 10:00 -1. 14:00 -1. 12:00 -1. 12:00 -1. 2:00 -1. 11:00 -1. 2:00 -1. 2:00 -1. 11:00 -1. 2:00 -1. 2:00 -1. 11:00 -1. 2:00 -1. 2:00 -1. | Canal | 2:00 -2.1 6:00 -2.2 10:00 -2.4 14:00 -2.4 18:00 -2.5 22:00 -2.6 2:00 6:00 14:00 18:00 22:00 | Canal Canal 14:00 18:00 22:00 2:00 6:00 10:00 14:00 18:00 22:00 | -2.7 -3.0 | Canal 2:00 14:00 2:00 0.07 10:00 0.4 14:00 0.2 2:00 0.6 2:00 0.7 0.4 14:00 0.2 2:00 0.4 14:00 0.2 2:00 0.4 14:00 0.4 14:00 0.2 2:00 0.4 14:00 0.2 10:00 0.4 14:00 0.2 10:00 0.4 14:00 0.2 10:00 0.4 14:00 0.2 10:00 0.4 14:00 0.2 10:00 0.4 14:00 0.2 2:00 0.6 10:00 0.7 10:00 0.4 14:00 0.2 10:00 0.4 14:00 0.2 10:00 0.4 14:00 0.2 10:00 0.4 14:00 0.2 10:00 0.4 14:00 0.2 10:00 0.4 10:00 0.4 10:00 0.4 10:00 0.4 10:00 0.4 10:00 0.5 2:00 10:00 10:00 0.5 10:00 0.5 10:00 0.5 10:00 0.5 10:00 0.5 10:00 | Canal , | 2:00 -0.9 6:00 -1.3 10:00 -2.0 14:00 -2.8 18:00 -4.0 22:00 -5.8 2:00 -6:00 10:00 10:00 14:00 22:00 | Canal 22:00 -5.8 6:00 -6.0 10:00 -6.5 14:00 -6.6 18:00 -6.4 22:00 -6.2 2:00 -6.2 10:00 -6.2 10:00 -6.2 2:00 -6.2 2:00 -6.2 2:00 -6.2 2:00 -6.2 10:00 -6.5 10:00 -6.2 10:00 | Canal | 2:00 -6.1 6:00 -6.0 10:00 -2.00 22:00 -2.00 10:00 Tid 14:00 Tid 12:00 Tid 12:00 Tid | e 14:00 e.0 | Canal 2:00 6:00 10:00 14:00 18:00 2:00 6:00 10:00 14:00 14:00 18:00 22:00 | | 2:00 6:00 14:00 14:00 22:00 6:00 14:00 14:00 14:00 18:00 22:00 | Canal 2:00 6:00 14:00 14:00 22:00 10:00 14:00 10:00 14:00 18:00 22:00 | /////////////////////////////////////// |
| PS 8 - St. Mary | Canal 2:00 6:00 -0.1 10:00 -1.1 14:00 -1.2 2:00 -3.3 2:00 Tide 10:00 14:00 18:00 2:00 | 2:00 Canal 18:00 22:00 14:00 14:00 16:00 22:00 6:00 10:00 14:00 22:00 22:00 22:00 22:00 22:00 | Canal | 2:00 6:00 10:00 14:00 22:00 6:00 10:00 14:00 14:00 14:00 22:00 14:00 | Canal 2:00 6:00 10:0 14:00 22:0 6:00 6:00 10:00 14:00 18:0 18:0 22:0 | | Canal 2:00 10:00 14:00 2:00 4.0 4.0 4.0 4.0 4.0 4.0 4.0 4 | Canal 2:0 6:0 14:1 18: 22:0 7 Tide 10:1 14:1 18: 22:0 6:0 10:1 14:1 18: 22:0 22:0 22:0 22:0 22:0 22:0 22:0 22 | 0 3.9 0 3.8 0 3.6 0 3.3 0 3.3 0 3.3 0 3.3 0 3.1 0 0 0 0 0 0 0 0 0 0 0 0 0 | Canal 2:00 6:00 14:00 18:00 2:00 7:00 14:00 18:00 14:00 18:00 | Canal 22: 63: 10: 14: 18: 22: 64: 14: 14: 18: 22: 10: 14: 14: 14: 14: 14: 14: 14: 14: 14: 14 | :00 5.7 :00 5.7 :00 5.5 :00 5.5 :00 5.5 :00 0 :00 0 :00 0 :00 0 :00 0 :00 0 :00 0 :00 0 :00 0 :00 0 | Canal 2:00 5.0 6:00 5.1 10:00 5.2 14:00 5.1 22:00 5.0 2:00 5.0 2:00 5.0 10:00 14:00 18:00 12:00 14:00 12:00 | Canal | 2:00 4.9 6:00 4.8 10:00 4.8 14:00 4.5 22:00 4.5 2:00 6:00 10:00 14:00 14:5 2:00 6:00 10:00 14:00 22:00 22:00 | Canal 2:00 6:00 10:00 14:00 22:00 2:00 10:00 14:00 14:00 18:00 22:00 | 4.4 4.2 4.2 4.1 4.0 3.9 | 2:00 3.8 6:00 3.7 10:00 3.6 2:00 3.4 2:00 3.4 14:00 1.5 12:00 3.4 14:00 1.6 14:00 1.6 14:00 1.6 12:00 1.6 | Canal , | 2:00 3.3 6:00 3.2 10:00 3.1 14:00 3.1 18:00 3.0 22:00 3.0 22:00 10:00 10:00 14:00 22:00 10:00 | Canal 2:00 2:9 6:00 2:8 10:00 2:7 14:00 2:6 18:00 2:5 22:00 2:3 7:00 10:00 14:00 18:00 14:00 18:00 22:00 | Canal | 2:00 2.1 6:00 2.0 10:00 1.9 14:00 1.8 18:00 1.7 2:00 1.7 2:00 1.7 10:00 14:00 Tid 18:00 Tid | e 2:00 1.7 6:00 1.7 10:00 1.6 14:00 1.5 22:00 1.4 2:00 1.4 10:00 1.4 2:00 1.4 10:00 1.4 2:00 1.4 10:00 1.4 10:00 1.4 10:00 1.5 10:00 1.7 10:00 1.7 10:00 1.7 10:00 1.6 10:00 1.7 10:00 1.6 10:00 1.7 10:00 1.6 10:00 1.5 10:00 1.7 10:00 1.6 10:00 1.5 10:00 1.6 10:00 1.5 10:00 1.4 10:00 1.4 10:00 1.5 10:00 1.4 10:00 1.4 10:00 1.5 10:00 1.4 10:00 1.4 10:00 1.5 10:00 1.4 10:00 1.4 10:00 1.4 10:00 1.5 10:00 1.4 10:00 1.4 10:00 1.5 10:00 1.4 10:00 1.4 10: | Canal 2:00 6:00 10:00 22:00 2:00 Tide 6:00 10:00 14:00 18:00 2:00 2:00 2:00 2:00 2:00 2:00 2:00 | 0 1.4 0 1.4 0 1.3 0 1.2 0 1.2 0 1.1 0 1.2 0 1.1 T | 2:00 0. 6:00 0. 14:00 0. 14:00 0. 22:00 -1 22:00 -1 10:00 -0 22:00 -1 10:00 -0 22:00 -1 10:00 -0 22:00 -1 10:00 -0 22:00 -1 10:00 -0 22:00 -1 10:00 -0 10:00 -0 22:00 -1 10:00 -0 22:00 -1 10:00 -0 22:00 -1 10:00 -0 22:00 -1 10:00 -0 22:00 -1 10:00 -0 10:00 -0 22:00 -1 10:00 -0 10:00 -0 22:00 -1 10:00 -0 22:00 -1 10:00 -0 22:00 -1 10:00 -0 22:00 -1 10:00 -0 22:00 -1 10:00 -0 10:00 -0 22:00 -1 10:00 -0 10:00 -0 | 8 4 4 4 Canal 10:00 14:00 12:00 Tide 10:00 10:00 14:00 10:00 14:00 10:00 14:00 10:00 14:00 10:00 14:00 10 10:00 10 | -2.3 |

Readings were extracted from Operatings Logs aquired by IPET Task 8 for each pump station where available.