



Pump Station Performance Report 2

IPET ERP Meeting
Vicksburg, Mississippi
March 9-10, 2006



Pump Stations

Summary of Accomplished Work

- Obtained available documents through the contracted Architecture-Engineering firm (CH2M Hill), Task Force Guardian, Task Force Hope, and the USACE New Orleans District.
- Completed approximately 90% of the work for St Bernard Parish and have submitted the information for St. Bernard Parish as the Technical Appendix I for Report 2.
- The remaining Parishes will be brought to the 90% level similarly to the work accomplished for St Bernard Parish.

St. Bernard Parish Pump Stations



Gulf Intracoastal Waterway

Lake Borgne

Mississippi River Gulf Outlet (MRGO)

Mississippi River

Jean Lafitte #6

Guichard #2

Fortification #1

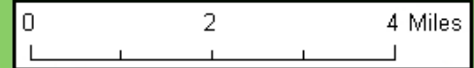
Bayou Ducros #7

Bayou Villere #3

Meraux #4

E.J. Gore #5

St. Mary #8



St. Bernard Pump Stations Interim Results



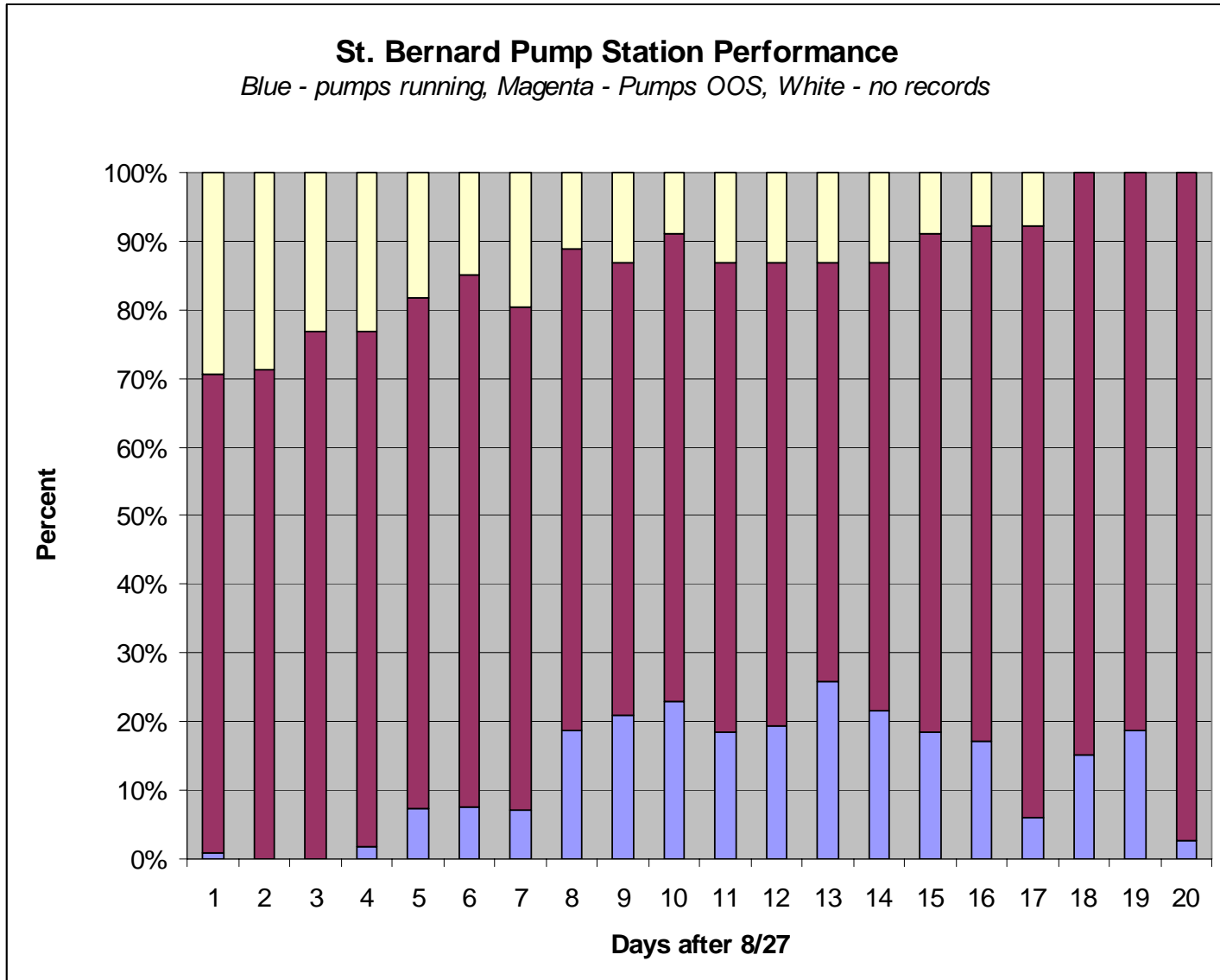
- Eight pump stations in St. Bernard Parish.
- Total discharge capacity of 6,960 cfs (cubic feet per second) to evacuate accumulated runoff from precipitation in a drainage area of 17,620 acres.
- All pumps are powered by diesel engines which are mechanically connected to the pumps.

St. Bernard Pump Stations Interim Results



- Five stations (representing 80% of total capacity) have operating floors approximately 12 feet above the natural ground surface which substantially reduced storm-induced damage.
- Stations #2, #3 and #5 were flooded to a depth of six to eight feet above the operating floor which destroyed the diesel engines, vacuum pumps, and many accessories.
- The three flooded stations accounted for 90% of the total estimated damage of \$10.7 million.

St. Bernard Pump Stations Interim Results



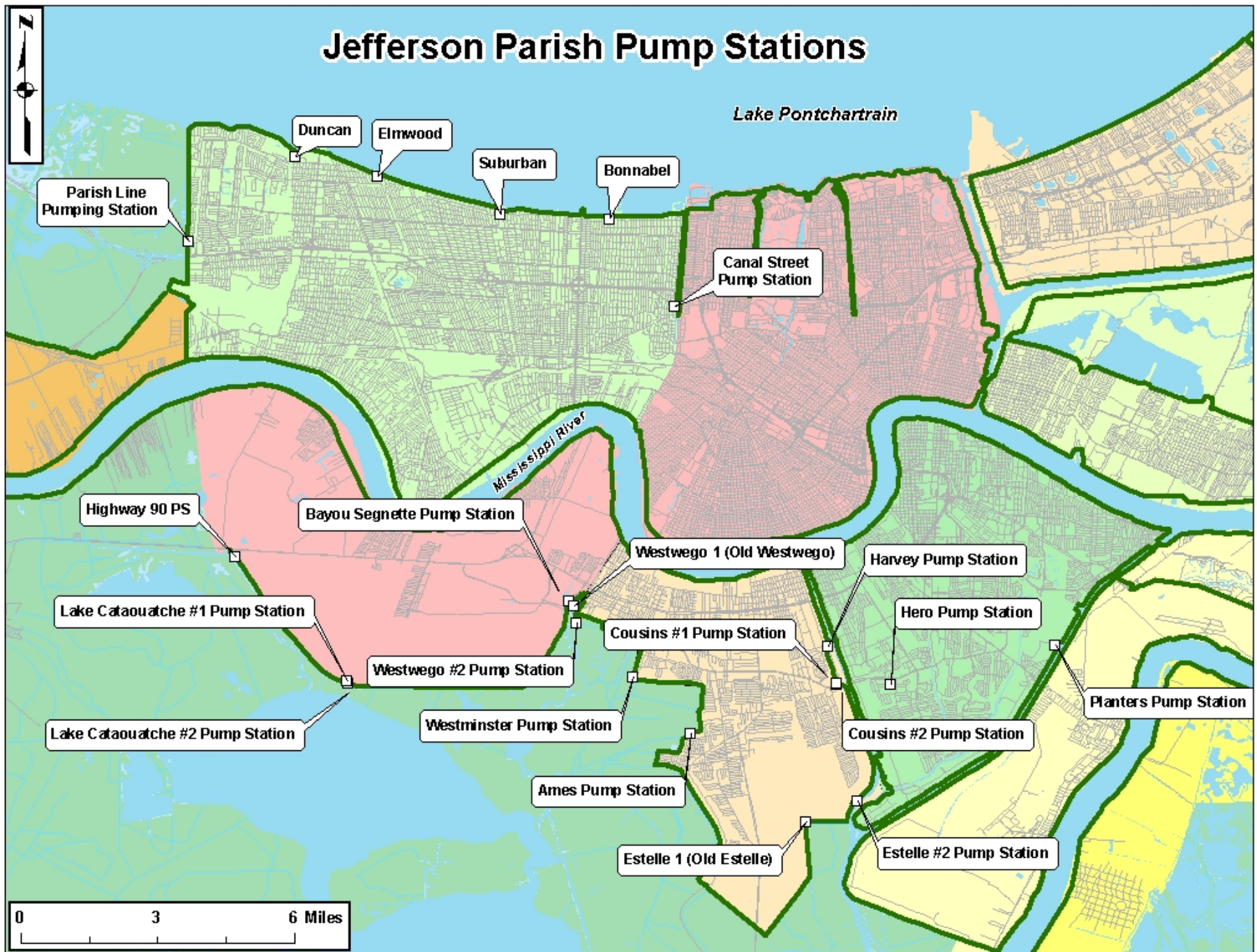
St. Bernard Pump Stations Interim Results

Recommendations and Improvements

- Repairs and refurbishments (Katrina and general)
- Backflow prevention
- SCADA, Remote Start Capability (2,3,5)
- Trash Rakes
- Safe house/shelter near pump stations
- Additional pump capacity at Station 5
- Fuel supply and replenishment
- Communications system upgrade



Jefferson Parish Pump Stations





Jefferson Parish Pump Stations



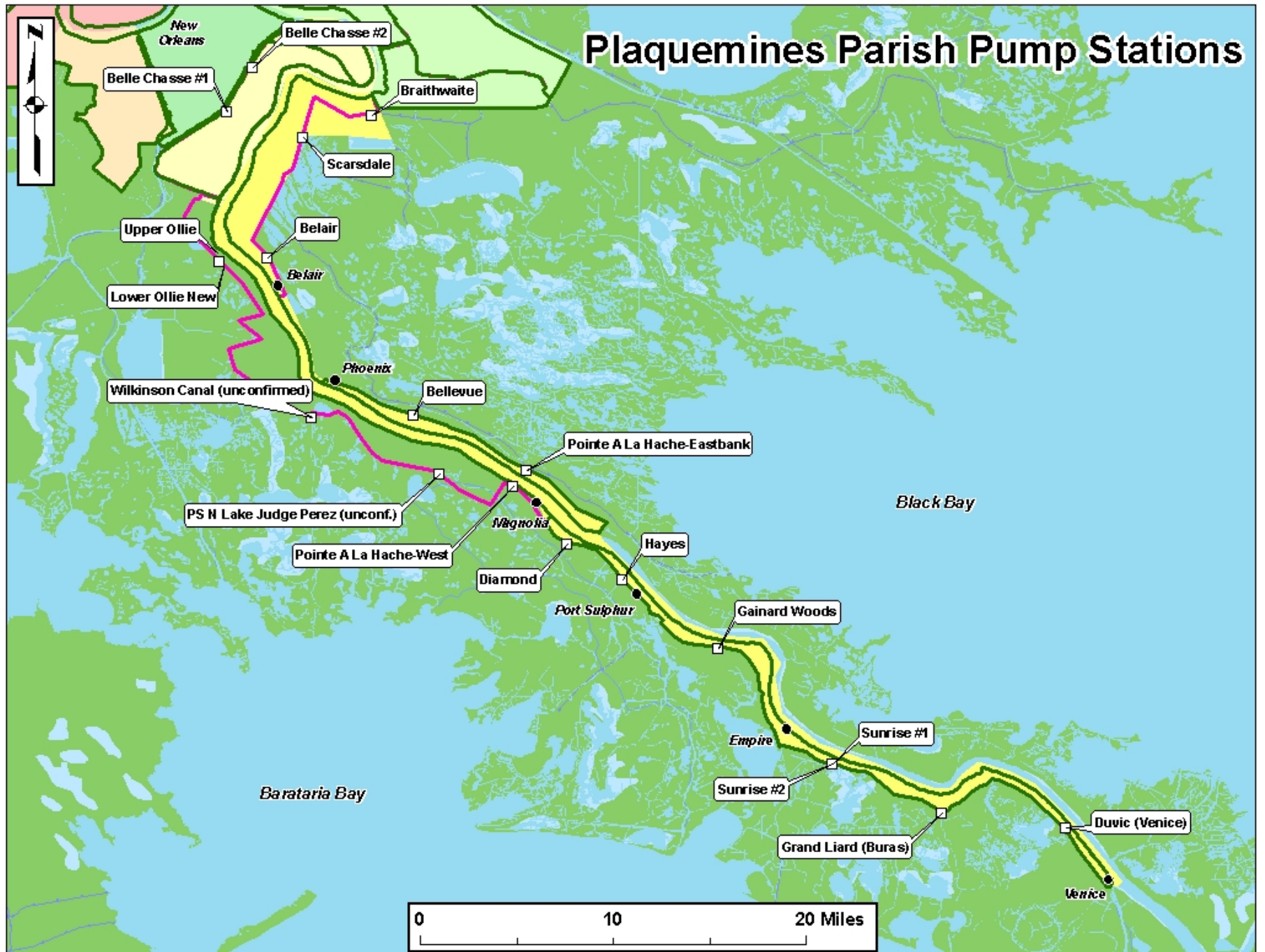
- Jefferson Parish has six pump stations on the East bank and twenty on the West bank.
- East bank stations have a total capacity of 20,835 cfs to drain an area of 29,300 acres.
- West bank stations have a total capacity of 23,354 cfs to drain an area of 44,200 acres.
- All stations use pumps directly connected to diesel engines.

Jefferson Parish Pump Stations



- No Jefferson Parish pump station was flooded during Katrina and, as a result, none experienced significant damage.
- The surface water level in Lake Ponchartrain exceeded the design level of the stations discharging to the lake thereby allowing reverse flow to occur.

Plaquemines Parish Pump Stations

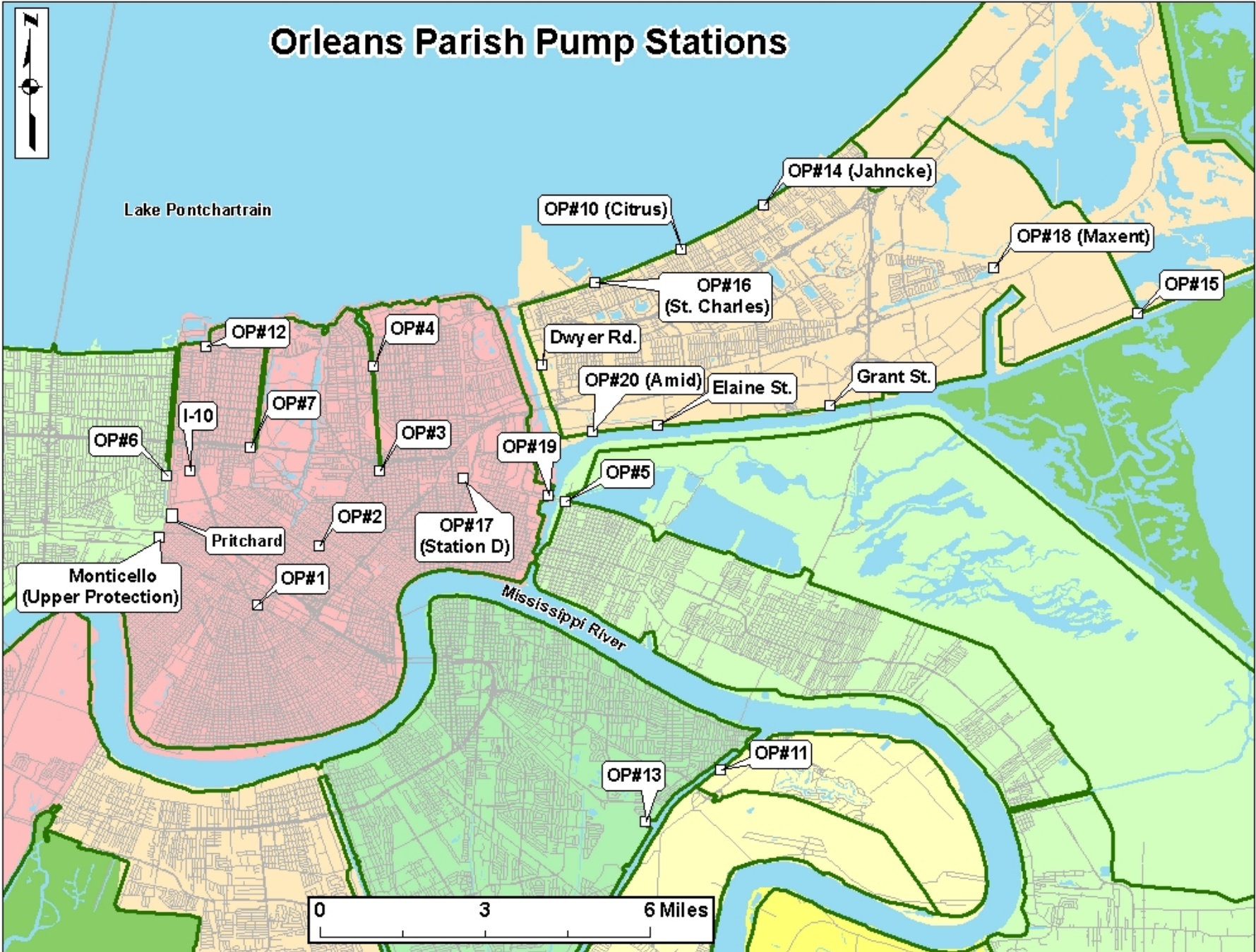


Plaquemines Parish Pump Stations

- There are 19 pump stations in Plaquemines Parish.
- Total discharge capacity of 13,680 cfs to evacuate accumulated precipitation in a drainage area of 55,000 acres. If all pumps were to operate at rated capacity, they could remove water at a rate of 0.25 inches per hour.
- Nine stations suffered significant damage – principally from flooding.



Orleans Parish Pump Stations



Orleans Parish Pump Stations



- Orleans Parish has 22 pump stations on the East bank and two on the West bank. Twelve of the East bank stations are located in the metropolitan area as well with the remaining ten located east of the Inner Harbor Navigation channel (Orleans east).
- All stations in the metropolitan area have pumps which are electrically driven – most by direct-drive 25 Hz motors. A central diesel-electric generating station provides 25 Hz electricity for these stations. All stations in Orleans east and the two on the west bank have pumps which are diesel driven.

Orleans Parish Pump Stations



- The pump stations and generating station in Orleans' metropolitan area suffered significant damage.
- Pump stations in the Orleans East area also were significantly damaged from flooding.
- Neither of the west bank stations experienced any flooding.

Status of Remaining Efforts



- The remaining Parishes will be brought to the 90% level similarly to the work accomplished for St Bernard Parish.
- Field information and documents collected for remaining parishes have been substantially completed with the exception of St. Charles Parish.
- Estimates of backflow will be prepared based on collected information and operation during Katrina will be reported.
- Meetings and coordination with parishes and ERP.





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 - Aerial view of pump station







St. Bernard Parish

PS 1 - Fortification



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 – Aerial 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

PS 1 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:

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

Fuel Capacity

- 4 - 5000 gallon tanks
- 2 - 110 gallon day tanks

Fuel Endurance

The time the 5000 gallon tanks will last is calculated:

$$t_1 := \frac{4 \cdot 5000gal}{2R_{burn}} \qquad t_1 = 159.645 \text{ hr}$$

The time the 110 gallon tanks will last is calculated:

$$t_2 := \frac{2 \cdot 110gal}{2R_{burn}} \qquad t_2 = 1.756 \text{ hr}$$

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

$$T_t := t_1 + t_2 \qquad T_t = 161.402 \text{ hr}$$

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

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



PSI Fortification

Post-Hurricane Katrina – Aerial view of the pump station

F-15915

REF. 51343-550 548x1-15-4

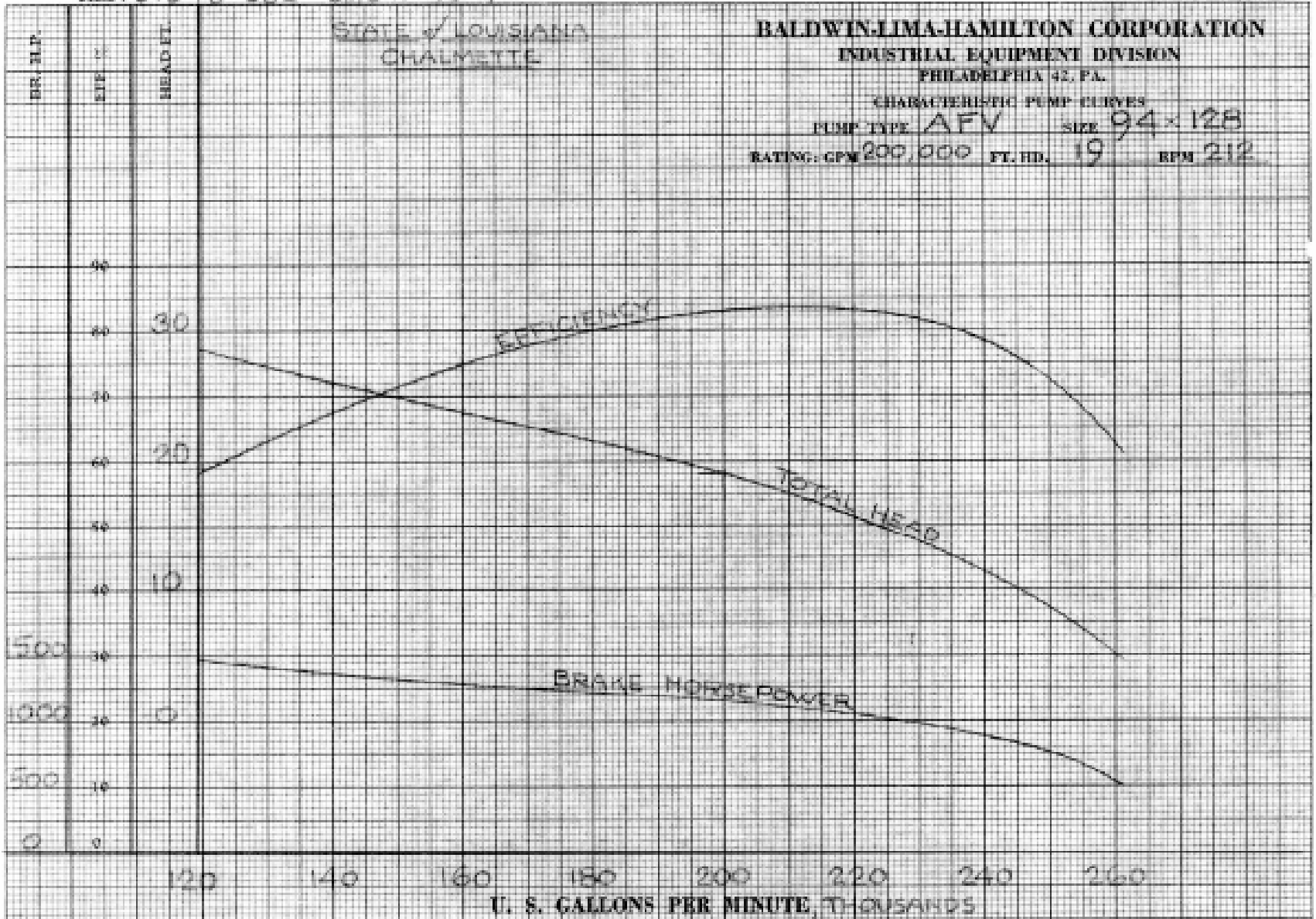
STATE OF LOUISIANA
CHALMETTE

BALDWIN-LIMA-HAMILTON CORPORATION
INDUSTRIAL EQUIPMENT DIVISION
PHILADELPHIA 42, PA.

CHARACTERISTIC PUMP CURVES

PUMP TYPE AFV SIZE 94 x 128

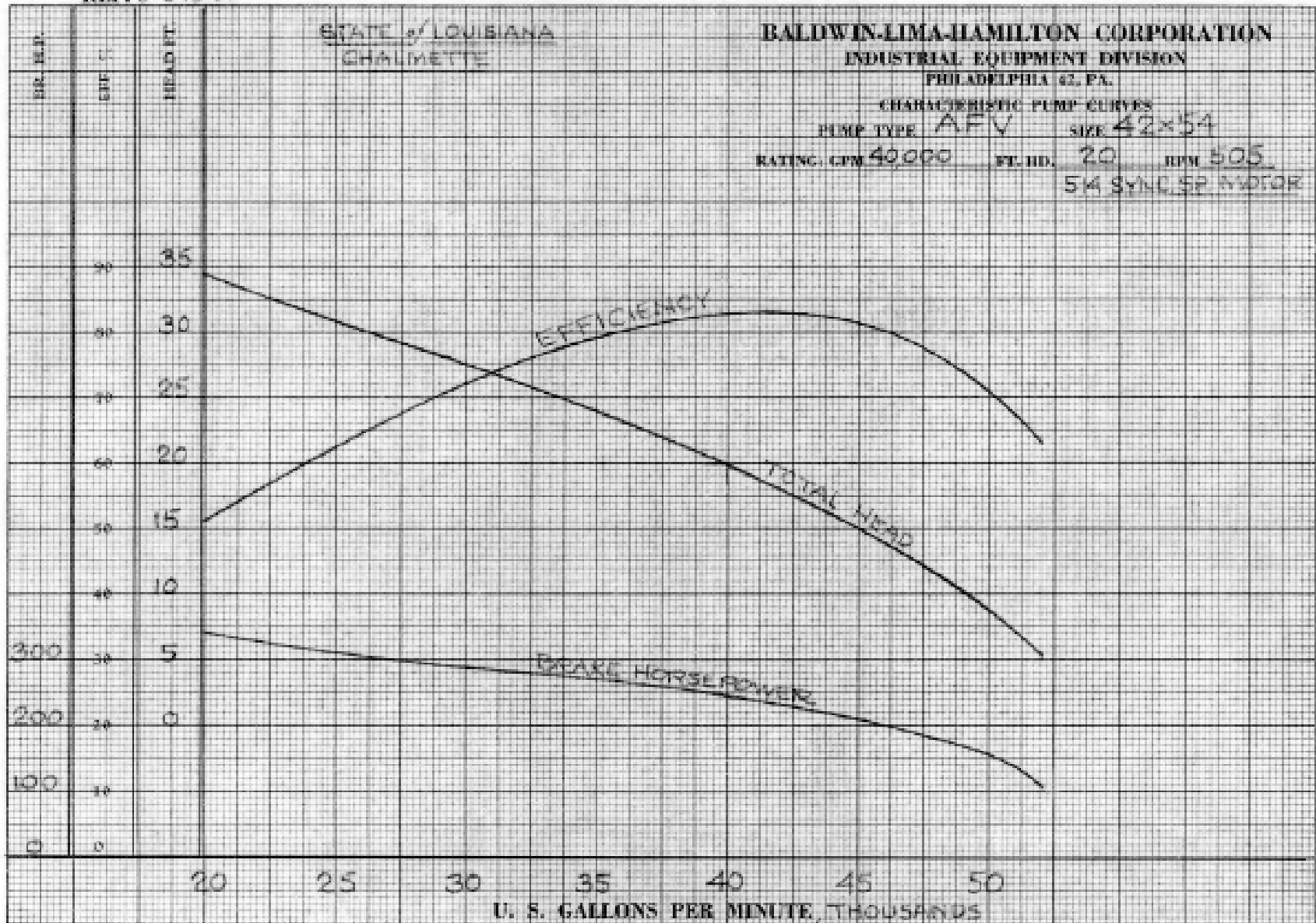
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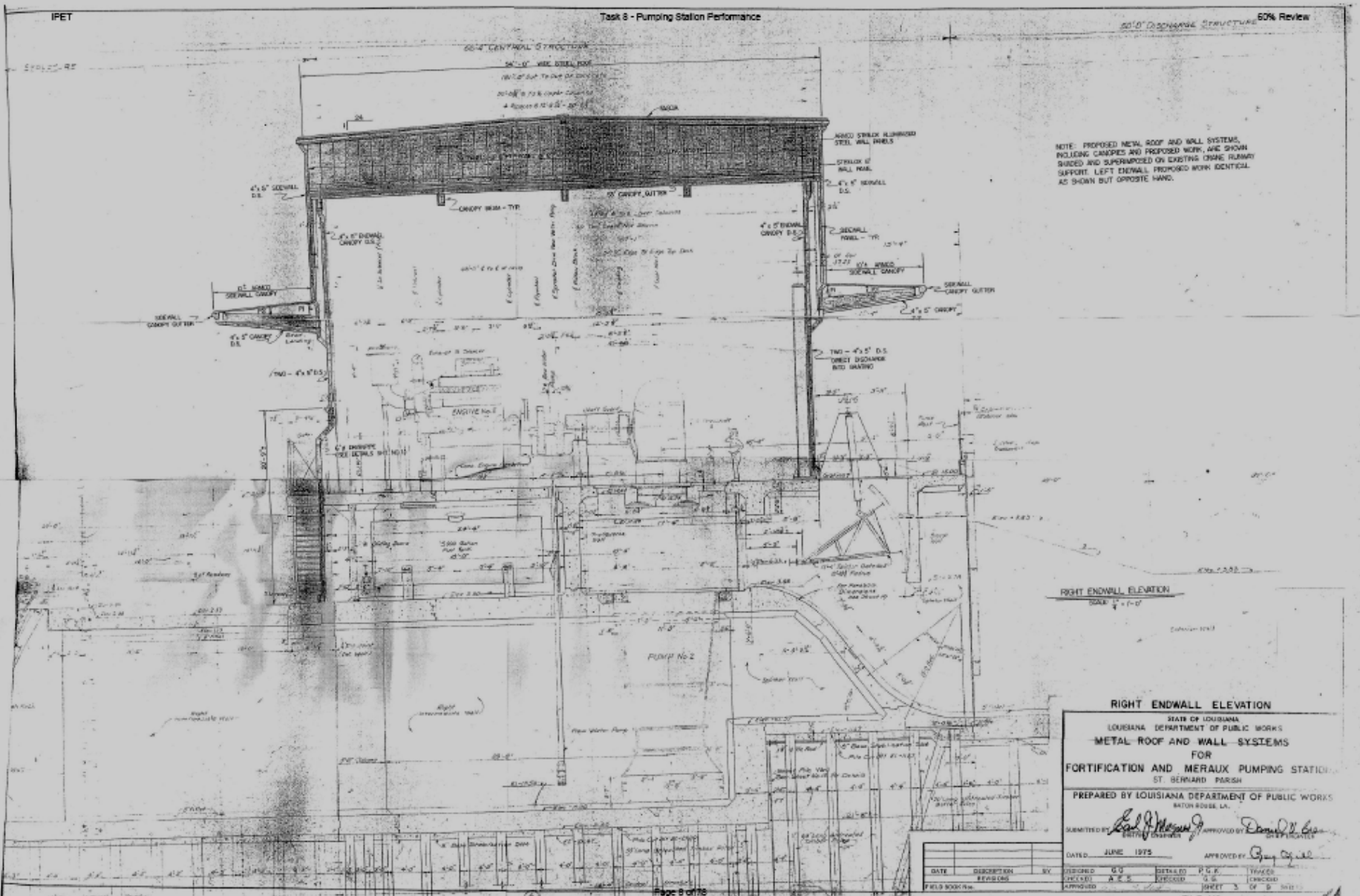
CURVE NO. F15915

REF. 51343-550

F-15914



CURVE NO. F-15914



NOTE: PROPOSED METAL ROOF AND WALL SYSTEMS, INCLUDING CHANGES AND PROPOSED WORK, ARE SHOWN BOLD AND SUPERIMPOSED ON EXISTING ORIGIN DRAWING SUPPORT. LEFT ENDWALL PROPOSED WORK IDENTICAL AS SHOWN BUT OPPOSITE HAND.

RIGHT ENDWALL ELEVATION
SCALE 1/4" = 1'-0"

RIGHT ENDWALL ELEVATION
 STATE OF LOUISIANA
 LOUISIANA DEPARTMENT OF PUBLIC WORKS
METAL ROOF AND WALL SYSTEMS
 FOR
FORTIFICATION AND MERAUX PUMPING STATION
 ST. BERNARD PARISH
 PREPARED BY LOUISIANA DEPARTMENT OF PUBLIC WORKS
 BATON ROUGE, LA.
 SUBMITTED BY *Carl J. Mesinger* APPROVED BY *Donald D. Cox*
 DATE: JUNE 1975 APPROVED BY *Gregory J. [Signature]*

DATE	DISPOSITION	BY	DESIGNED	CHECKED	APPROVED	DRAWN	P. G. K.	TRACED
			G. S.	A. R. S.	G. S.	G. S.		

FIELD BOOK No. SHEET 3 OF 5

St. Bernard Parish**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°



PS 6 – Jean Lafitte

Pre-Hurricane Katrina – Aerial 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 8 Jean Lafitte

3 pump drivers - All diesels

Diesels are 335 hp

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

$$R_{burn} = \left(35 \frac{\text{gal}}{\text{hr}} \right) \frac{335 \text{hp}}{500 \text{kW}} \qquad R_{burn} = 17.48 \frac{\text{gal}}{\text{hr}}$$

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:

$$t_1 := \frac{20000 \text{gal}}{6R_{burn}} \qquad t_1 = 190.62 \text{hr}$$

The time the 50 gallon tanks will last is calculated:

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

The time the 75 gallon tank will last is calculated:

$$t_3 := \frac{75 \text{gal}}{6R_{burn}} \qquad t_3 = 0.719 \text{hr}$$

The approximate total continuous run time for the station is:

$$T_t := t_1 + t_2 + t_3 \qquad T_t = 193.719 \text{hr}$$

$$T_t = 8.072 \text{day}$$

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



PS 6 – Jean Lafitte

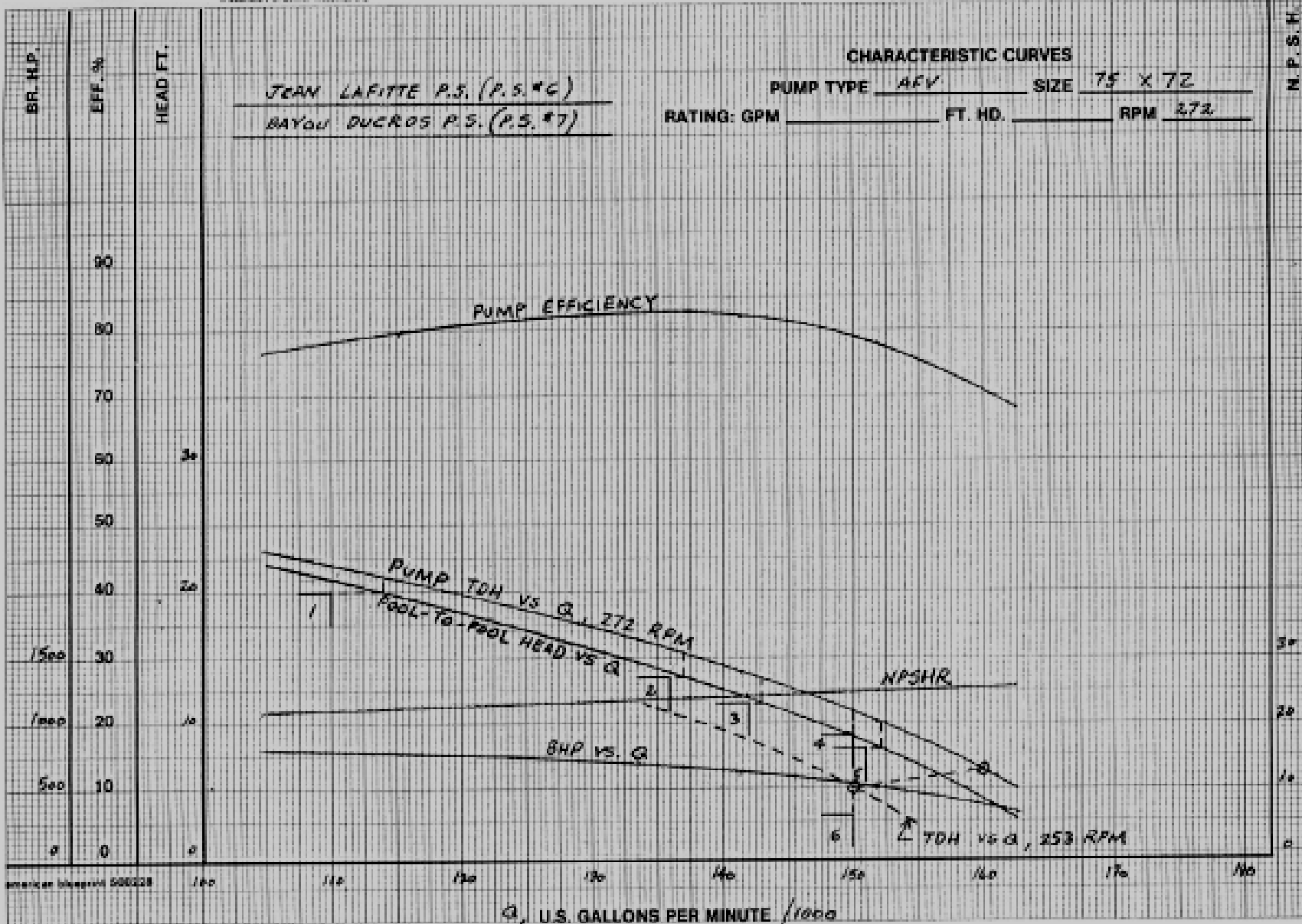
Post-Hurricane Katrina – Aerial view of the pump station



PATTERSON PUMP COMPANY
 A Subsidiary of Dresser Industries, Inc.

CURVE NO. XC-576-44-01

REF.



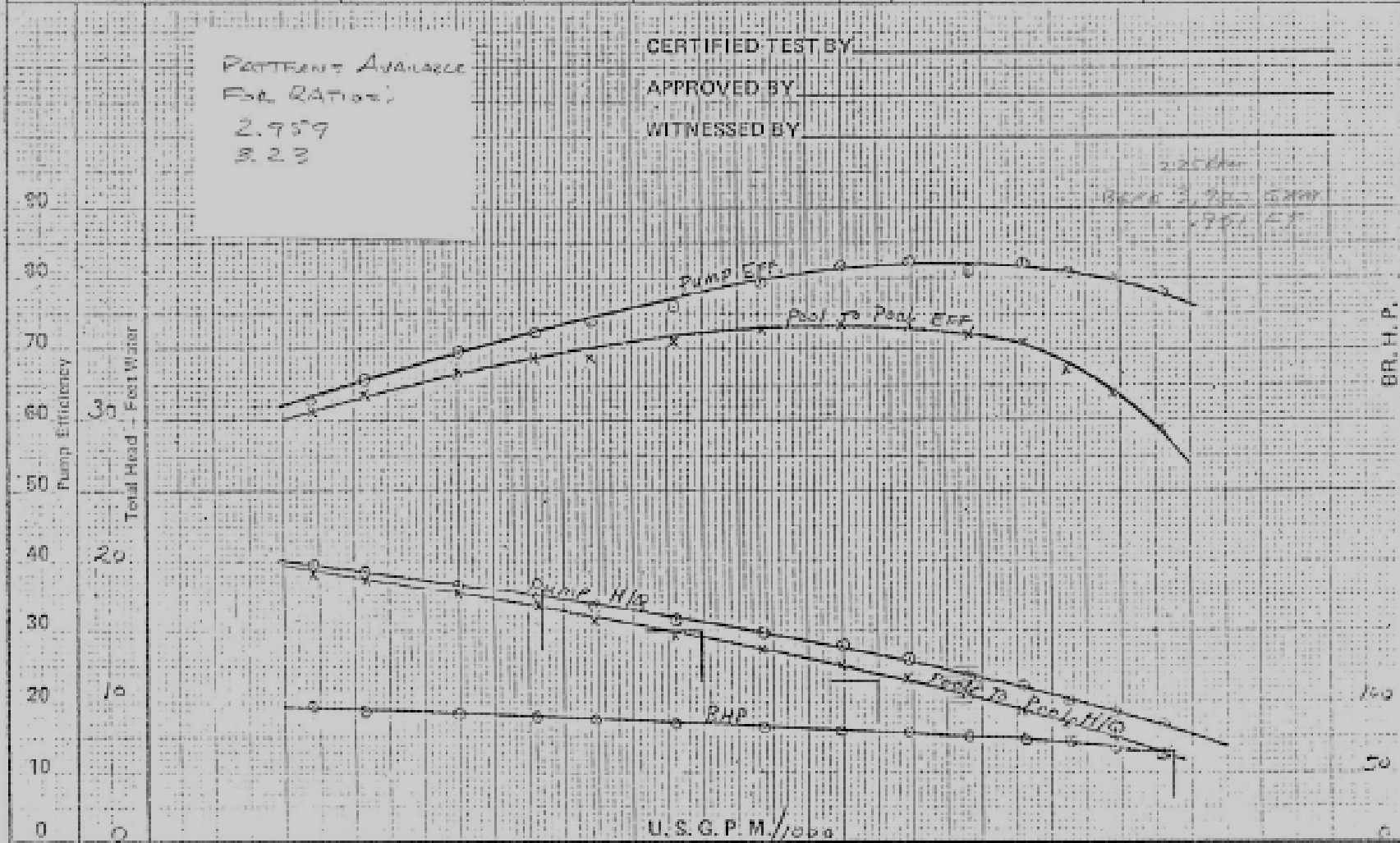
Sold To: _____ Date 10-9-83 Tested By BW Serial No. K-624

Job Driver:	HP		Motor Turbine Engine	GPM		Imp. Part:	<u>B-75249</u>	Pump Type:	<u>AFV</u>
Test Driver:	HP	<u>DC DRUG</u>	Motor Dyn.	Fe. Hd.		Imp. Diam.:	<u>19.25" ^{19.1"} _{19.6"}</u>	Size:	<u>24</u>
Motor Eff'y:	<u>—</u>	Test Speed:	<u>779</u>	Rated Speed:	<u>779</u>	No. Stages:	<u>1</u>	Test No.:	

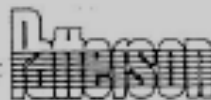
PERCENTAGE ADVANCE
 FOR RATIO:
2.959
3.23

CERTIFIED TEST BY _____
 APPROVED BY _____
 WITNESSED BY _____

2.25
3.25
3.25



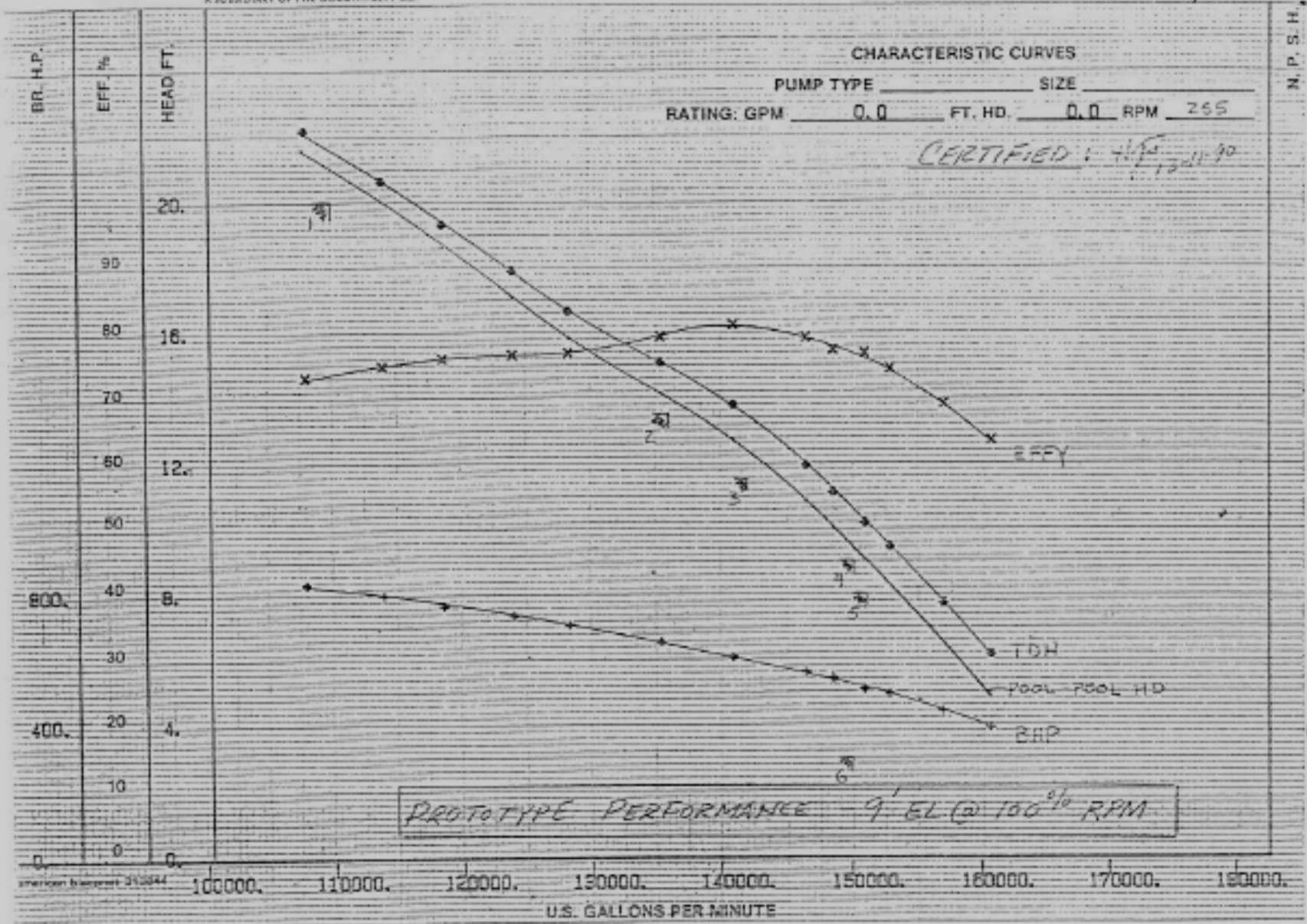
BR.H.P.



PATTERSON PUMP COMPANY
A SUBSIDIARY OF THE COLEMAN-KELVEY CO.

CURVE NO. B544
PROTOTYPE

REF.



N. P. S. H.

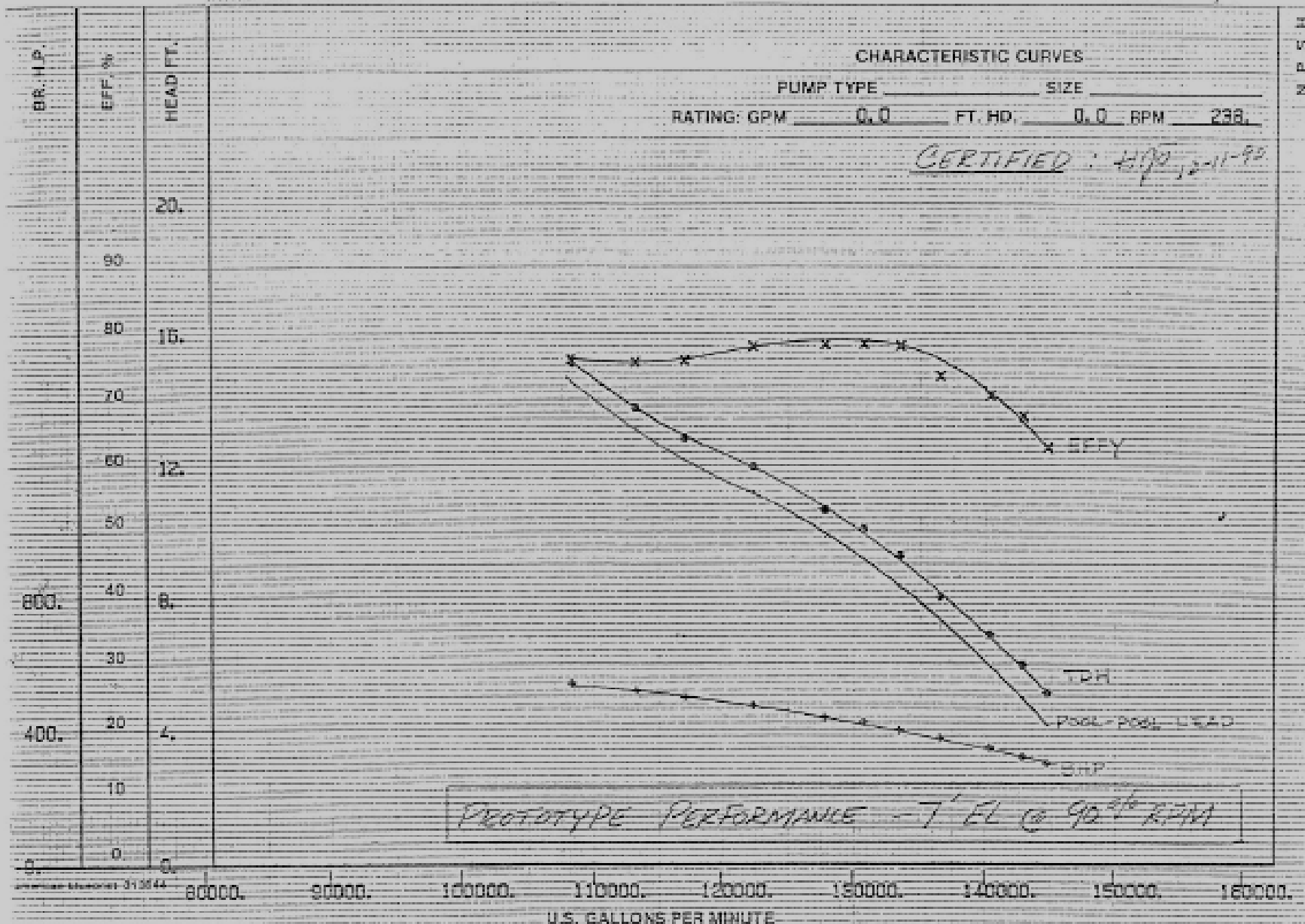
PAGE 53 D



PATTERSON PUMP COMPANY
A MEMBER OF THE KORMAN-ALTY CO.

CURVE NO. B53
PROTOTYPE

REF.



AL-2



PATTERSON PUMP COMPANY
A SUBSIDIARY OF THE GORMAN-RUMFORD CO.

CURVE NO. 8522
PROTOTYPE

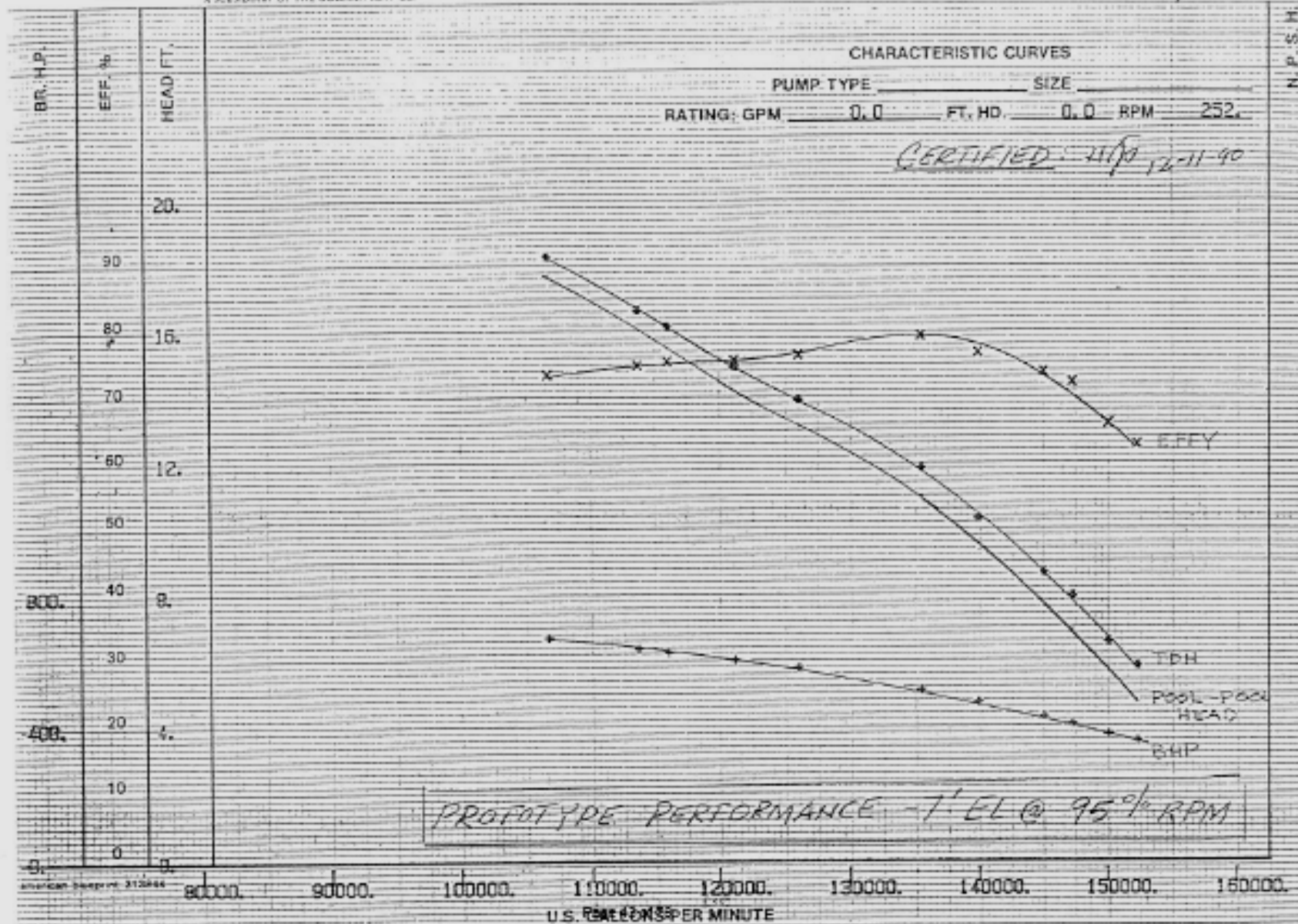
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CHARACTERISTIC CURVES

PUMP TYPE _____ SIZE _____

RATING: GPM 0.0 FT. HD. 0.0 RPM 252

CERTIFIED: H/P 12-11-90



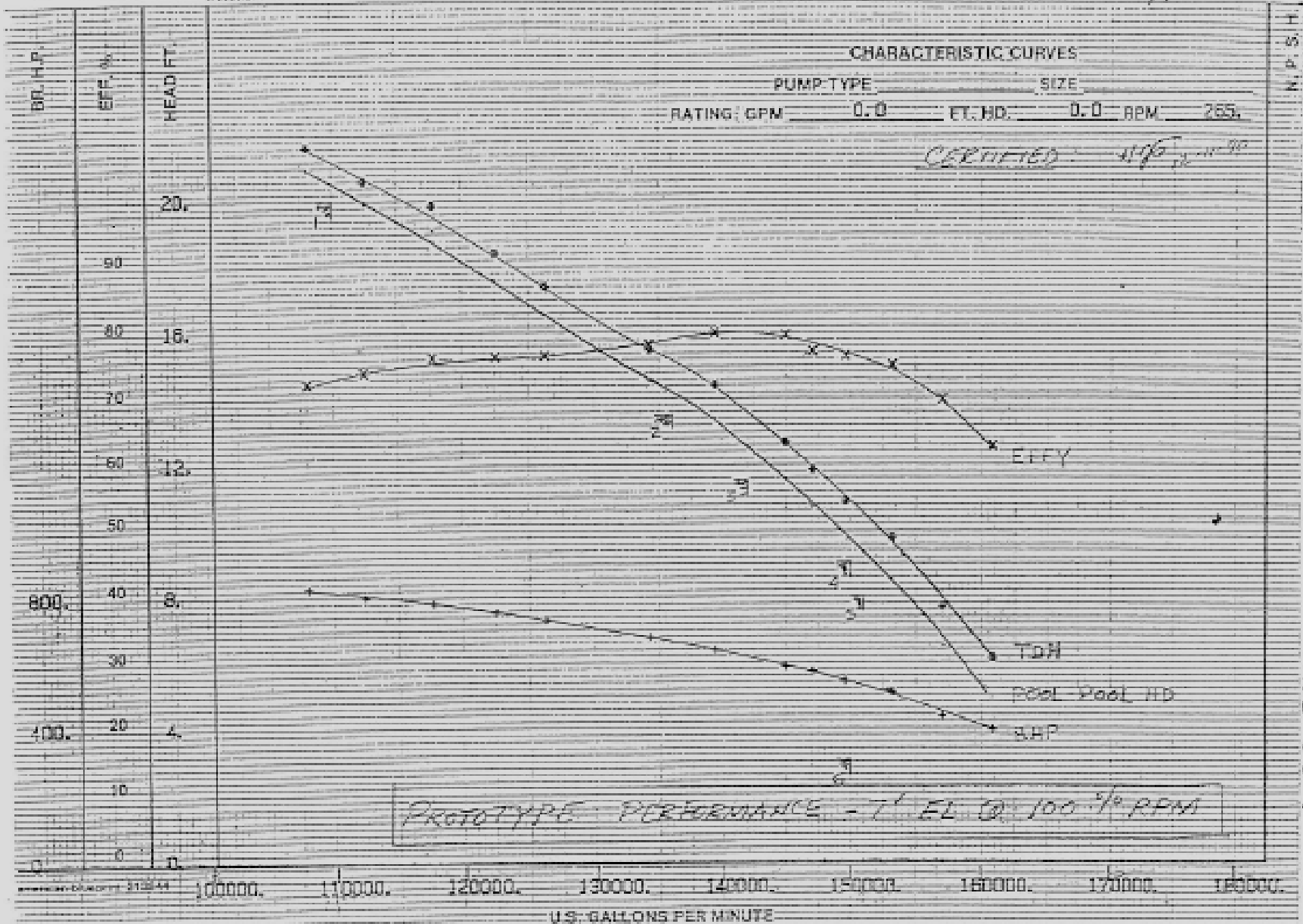
N.P.S.H.



PATTERSON PUMP COMPANY
A SUBSIDIARY OF THE GORMAN-RUFF CO.

REF.

PROTOTYPE



H. S. P. H.

PAGE 53A

