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SECTION 01010
STATEMENT OF WORK

1.0 PROJECT OBJECTIVES

The Government seeks, through the solicitation and award of a Design Build Contract a permanent replacement for the current Interim Closure Structures (ICS) on the three outfall canals (London Ave, 17th Street and Orleans Ave Canals). The goal is to provide protection of the three outfall canals from the storm surge form Lake Pontchartrain, while not impeding the ability of the area's internal drainage system to function during normal conditions and hurricane events. This includes design and construction of permanent gated storm surge barriers and pump stations at the discharge end of each canal, with pumps having stand-alone power supply capacity that is sufficient to evacuate the drainage fed to the canals by pumping it to the elevated level of Lake Pontchartrain. The project will provide reliable, aesthetically pleasing flood control facilities in order to maintain safe canal levels during high lake surge conditions.

2.0 SCOPE

Unless otherwise indicated, the Design-Builder's scope includes all design, procurement, construction, testing, commissioning, startup, and related activities required to deliver the facilities and services specified in this RFP. Design efforts shall include any planning, data collection, and design analysis required to support the Design-Builder's design approach.

2.1 Facility Description

The exact design features of each PPS facility will be determined by the Design-Builder based on the design criteria in the RFP. Generalized features of each PPS facility shall be as described below:

1. Storm Surge Barrier
    a) Gated closure structures at each PPS that will allow the canals to be isolated from Lake Pontchartrain during periods of high lake level due to storm surge and also allow gravity flow of canal water to the lake during normal lake levels.
    b) Foundations, site development, utilities, and other features as identified in the RFP and as required by the Design-Builder's approach
    c) Transition walls and levees to tie the new PPS facilities into the existing hurricane line of protection to the design requirements provided in the RFP.
2. Outfall Canal Pumping
    a) Inlet structure for receiving and screening inlet flows from the respective canal
    b) Pump room to house pumping units designed in accordance with the structural requirements outlined in Article 5.5, Structural Design Criteria and other applicable criteria of the RFP.
    c) The pumping stations shall be designed to allow for future conversion of the present dual pumping system (current conditions) to gravity drainage to the lake front station (possible future conditions)
3. Reliable, Integrated Operation
    a) On-site power facilities to provide an independent power source for each PPS

b) Design and construction of all necessary auxiliary interior and exterior building spaces to support safe and reliable operation of all PPS equipment and systems during both normal and storm event conditions.
c) Monitoring and control systems that provide full local and remote monitoring and control of all pumps, gates, and related equipment. The system shall also monitor both the canal and lake water surface elevations and operate the gates and pumps in a manner to ensure that the water surface elevations remain below the safe water elevations (SWE) in each canal
d) All facilities shall be designed to withstand and to operate reliably under all conditions (lake conditions, wind speeds, rainfall, temperatures, etc) defined in this RFP
e) Facilities shall be stand-alone so that they can be reliably operated independently of any public utility.
f) Temporary facilities, utilities, and services as specified in this RFP

4. Aesthetically Compatible Facilities
   a) Facilities that minimize site footprint and visual impact (for both current and possible future conditions).
   b) Facilities that minimize noise, light, and emissions
   c) Facilities that incorporate local architectural themes and blend with surrounding communities

2.2 Site Survey

Design-Builder shall limit his field operations at the Project Site to remain within the Construction Limits, as shown in Appendix C. The Design-Builder shall establish a survey monument at each PPS in accordance with EM 1110-1-1002, Survey Markers and Monumentation.

2.2.1 Site Legal Survey

A site legal survey is not provided. Limits of construction shall be as indicated in Appendix C, Exhibit 1.

Design-Builder is responsible for obtaining any required site surveys in the field. Design-Builder shall establish and maintain a benchmark system that can be certified by the National Geodetic Survey (NGS).

2.2.2 Site Topographic Survey

Topographic surveys of the project site, in hard copy format, are included as Exhibit 2 in Appendix C. Electronic format is available for download from the project website. The Orleans survey was performed on June 15, 2009, by Lowe Engineering. The London survey was performed on June 17, 2009, by GCT, Inc. The 17th Street PPS site survey was performed on June 19, 2009, by Stockstill. The 17th Street canal survey was performed on June 18, 2009, by Chustz Surveying. Survey datum (horizontal and vertical) is defined on the Exhibit.

Design-Builder is responsible for verifying the adequacy and accuracy of the Survey in the field. In the event features not shown on the Survey are encountered by the Design-Builder, notify the Contracting Officer immediately before proceeding with work in that vicinity.

2.2.3 Site Bathymetric Survey

The bathymetric surveys of the project sites, in hard copy format, are included as Exhibit 3 in Appendix C. Electronic format is available for download from the project website. The PPS site surveys were performed on June 15, 2009, by ERDC. The 17th Street canal survey was performed on June 18, 2009, by Chustz Surveying. Survey datum (horizontal and vertical) is defined on the Exhibit.

Design-Builder is responsible for verifying the adequacy and accuracy of the Survey in the field. In the event features not shown on the Survey are encountered by the Design-Builder, notify the Contracting Officer immediately before proceeding with work in that vicinity.

2.2.4 Site Geotechnical Survey

The geotechnical surveys of the project sites, in hard copy format, are included as Exhibit 4 in Appendix C. Electronic format is available for download from the project website. The survey was performed on June 15, 2009, by FFEB/Stantec (JV). Survey datum (horizontal and vertical) is defined on the Exhibit.

There have been considerable additional investigations in the vicinity of the project site. This information can be found at the following website: https://ipet.wes.army.mil/. Any additional geotechnical data required by the Design-Builder shall be obtained by the Design-Builder at their own expense.

Design-Builder is responsible for verifying the adequacy and accuracy of the Survey in the field. The Design-Builder shall use the data determined by his own geotechnical investigation, the results of the Government subsurface investigation, and other existing relevant data (e.g. IPET) in preparing their Geotechnical Report for design.

The Design-Builder shall submit a project specific geotechnical report with the first interim design submittal (as defined in Section 01012 – Design After Award), certified by a professional geotechnical engineer in accordance with the Hurricane and Storm Damage Risk Reduction System (HSDRRS) Design Guidelines Section 8.0, Geotechnical Investigations and in accordance with ASTM D 3740. The report shall include a subsurface investigation and testing report and geotechnical design for the proposed structures, including a clear description of design assumptions and concise supporting calculations. The report shall also address geotechnical design issues during construction, such as dewatering and temporary retaining structure needs if required as well as any operational or maintenance considerations.

Geotechnical and soils investigations by the Government did not reveal any hazardous materials in the anticipated excavation areas; however, the Design-Builder shall confirm hazardous characteristics of excavated soils through proper testing, prior to starting excavation and periodically during excavation. If any hazardous soils are encountered, Design-Builder shall cease excavation operations in the area of hazardous soils and notify the Government immediately.

2.2.5 Additional Structure Survey

There are no additional structure surveys available. If any additional surveys are required by the Design-Builder they shall obtain them at their own expense.

2.3 Permitting

With the exception of permits already obtained by the Government as part of the IER process, Design-Builder shall be responsible for obtaining all site development, building, fire, chemical storage, air quality, storm water (rainwater), and other temporary construction permits required to

initiate and execute construction of the PPS sites and related facilities. This includes generation of all design and related information required to obtain the permits, completion of any forms or other paperwork, and payment of permitting fees.

The Government will work with local stakeholders to obtain any permanent operating or discharge permits, not previously obtained by the Government, required for long-term operation of the facilities. Design-Builder shall provide assistance, in the form of design documents and data, in obtaining these permits.

2.4 Utility Coordination and Relocation

The Design-Builder shall be responsible for coordinating and providing the onsite infrastructure for any incoming utility service required by their proposed solution. These services include, but are not limited to, water, sanitary sewer, electricity, and communications. Use of utility services shall be in compliance with other sections of the RFP with regard to operation during a storm event.

Any existing utilities within the area indicated as available for permanent works, and which require relocation, shall be relocated by the Design-Builder, except as indicated below. Final determination of utility relocation requirements will be made based on the final facility locations and details of the successful Design-Build team.

2.4.1 Relocation or Replacement of Existing 17th Street Marina Circulation Piping

There are two existing 60 inch lines within the available construction area for the 17th Street PPS. The lines serve as a means of recirculation water into/out of the adjacent marina to keep water in the marina from becoming stagnant. The Design-Builder shall be responsible for relocating the two pipes outside their work area and reconnecting the relocated piping at the appropriate interface points. At the Design-Builder's option, they may propose an alternate means of accommodating the recirculation flows. Alternate solutions must be approved by the appropriate authorities at the marina and submitted to the Government for review.

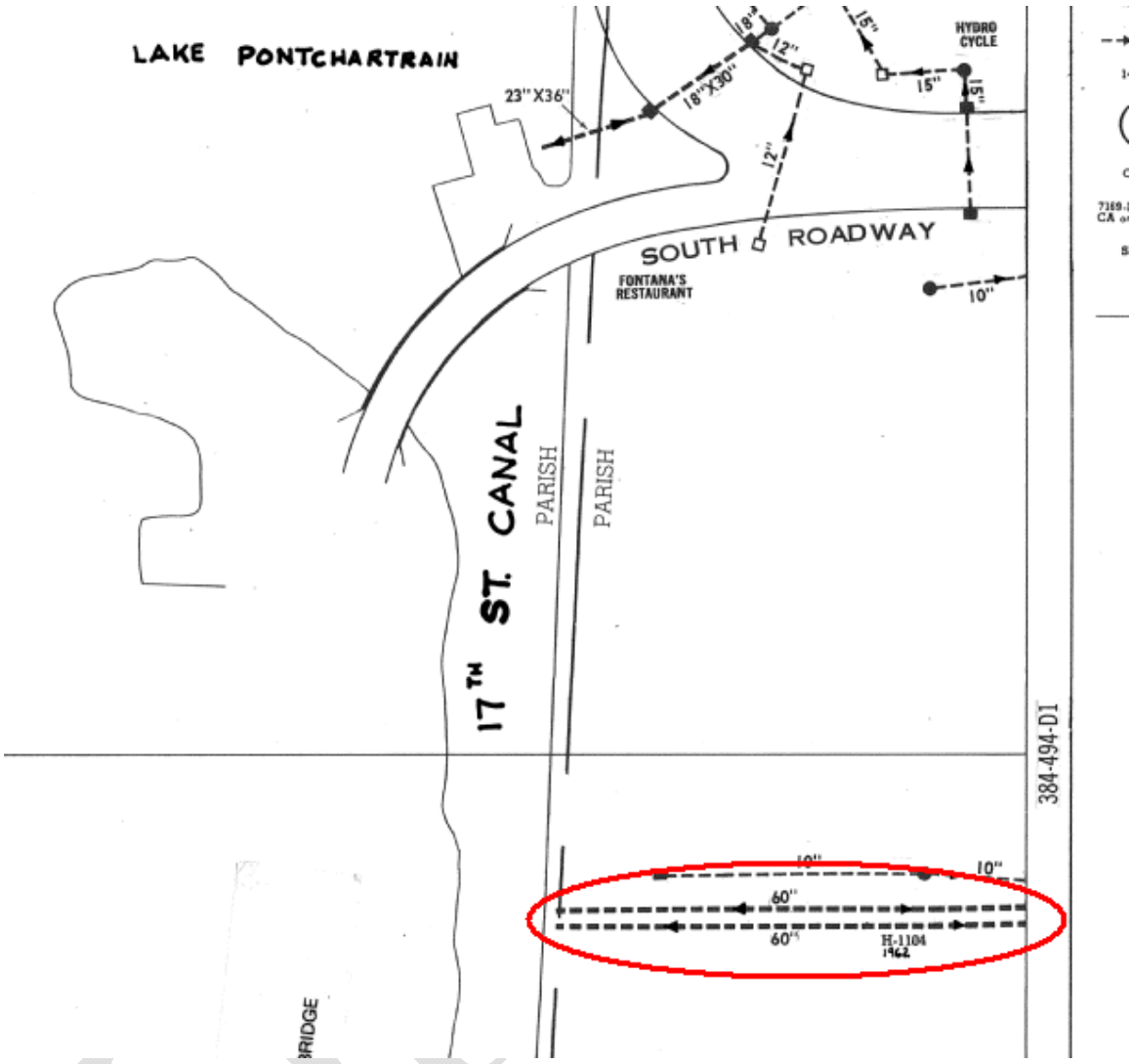

Figure 2.4.1. Existing 60" Recirculation Lines to be Relocated

2.5 Public Affairs

Design-Builder shall assist the Government in conducting and facilitating public affairs activities. Minimum requirements for public affairs work shall be as follows:

1. Identify a single point of contact, the Public Affairs Manager, within the Design-Builder's organization for Public Affairs requests, information, or assistance. The Public Affairs Manager shall be available as needed to support the Government's public affairs programs.
2. Develop a Public Affairs plan after award of contract. The plan shall be developed in conjunction with the Government's Public Affairs Office.
3. Make information available and supply technical support to the Government, when requested, to support Government public relations activities.

4. Provide public relations and technical support services to the Government for project review meetings with the public from notice to proceed until final completion (assume 6 total public project review meetings).
5. Provide public relations and technical support service to the Government for up to three (3) congressional committee inquiries or reviews.
6. Provide assistance to the Government for a pre-construction public outreach meeting.
7. Provide assistance to the Government for a public Open House at each PPS prior to final completion.
8. Assist the Government in updating and maintaining a public web-site (hosted and administered by the Government) that provides technical and progress information for the project.
9. Provide reasonable, limited, and controlled media access to the construction site for public affairs activities.

2.6 Web Based Information Management System

Design-Builder shall provide a web-based information management system to communicate and document project information for all phases of the project. As a minimum the web-based system shall include the following minimum features:

1. Accessible through the Internet using secured two or three part security (minimum of username and password).
2. Ability to upload, view, and edit (with check-in/check-out control) documents with security applied by role.
3. Ability to store documents for Government and local stakeholders (as designated by the Government) review
4. Ability to generate, track, and report on issues, requests for information (RFIs), and trends (potential changes)
5. Ability to store final construction documents and drawings
6. Ability to store final shop drawings and submittals
7. Ability to store design calculations and backup
8. Ability to store operations and maintenance manuals
9. Ability to store/display project schedules and completion status
10. Accessible through the Internet without the need for installation of executable files, drivers, or other software on the end-user machines.

3.0 FUNCTIONAL AND PERFORMANCE REQUIREMENTS

This section provides overall requirements, design criteria, and basis of design for the PPS facilities. Figure 3.0.1 and Figure 3.0.2 provide a graphical summary of key design criteria for both current and possible future operating conditions (which are also listed in the subsequent text). Note that minor variations in certain elevations may exist between sites. See text and tables in subsequent text for exact operating condition requirements. All elevations in Figure 3.0.1 and 3.0.2 and elsewhere in the RFP are provided in NAVD88 (2004.65), unless otherwise indicated.

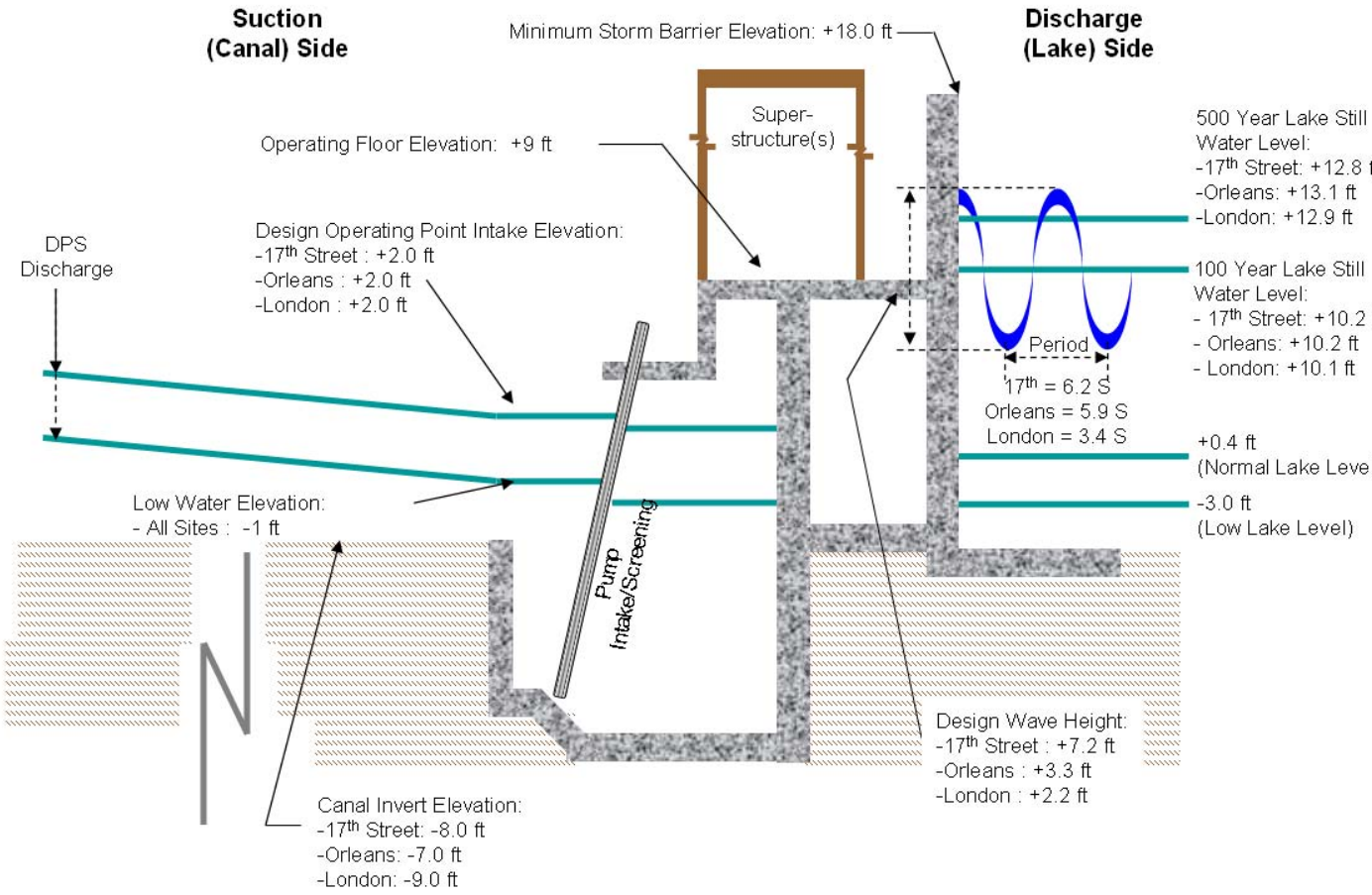

Figure 3.0.1 - Current Operating Conditions
(No Scale)

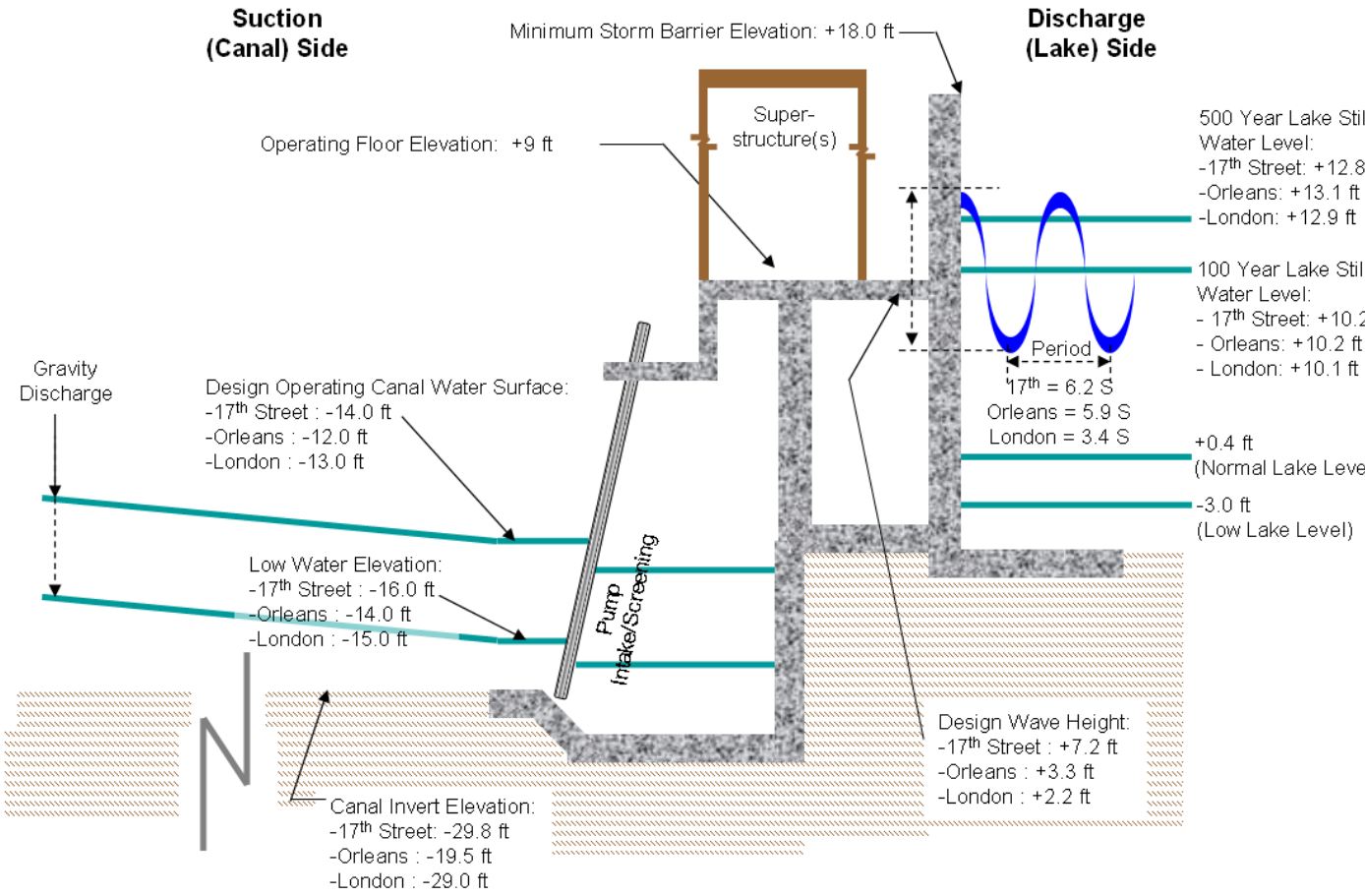

Figure 3.0.2 – Possible Future Operating Conditions
(No Scale)

3.1 General Requirements

The following list of general design criteria shall be used by the offeror in determining their technical approach. All elevations are provided in NAVD88 (2004.65).

1. The project shall be designed for the 1-percent-chance-annual-exceedance (100 yr) Hurricane Risk Reduction Level.
2. The design elevation for the line of protection in this area of Lake Pontchartrain is elevation +16.0. Because of Structural Superiority requirements (see Article 5.5.9), the PPS Storm Surge Barrier Elevation shall be at least El 18.0 feet.
3. Normal Lake Water Elevation = +0.4 ft
4. Low Lake Water Elevation = -3.0 ft
5. Design Storm Surge Static Lake Water Elevation (100 Year Still Water Lake Elevation):
   a) 17th Street = 10.2 ft
   b) Orleans Avenue = 10.2 ft

c) London Avenue = 10.1 ft

6. Design Wave Height (significant wave height). Note that these wave characteristics are only true for locations south of the Lake Shore Drive bridges on Orleans Avenue and London Avenue Canals.
   a) 17th Street = 7.2 ft
   b) Orleans Avenue = 3.3 ft
   c) London Avenue = 2.2 ft

7. Design Peak Wave Period:
   a) 17th Street = 6.2 seconds
   b) Orleans Avenue = 5.9 seconds
   c) London Avenue = 3.4 seconds

8. Minimum Pump Operating Floor Elevations:
   a) Minimum Pump Operating Floor Elevation = +9.0 ft
   b) Minimum Pump Operating Floor Equipment Pad Top Elevation = +9.5 ft or +0.5 ft above operating floor, whichever is higher

9. Minimum Generator Building Operating Floor Elevation:
   a) Minimum Generator Building Operating Floor Elevation = +4.0 ft
   b) Minimum Generator Building Operating Floor Equipment Pad Top Elevation = +5.5 ft or +1.5 ft above operating floor, whichever is higher

10. The flows which the Design-Builder is to maintain in the canals during the entire construction period are as follows:
    - 17th Street Canal: 10,500 cfs
    - Orleans Avenue Canal: 2,700 cfs
    - London Avenue Canal: 8,000 cfs

11. At all specified conditions, design life shall be as follows:
    Buried Facilities……..…100 years
    Levees and Floodwalls…….100 years
    Superstructures…….……..100 years
    Major Mechanical Systems
    Pumps & Drivers……..…35 years
    Gates…….50 years
    Generators……..…..35 years
    HVAC Equipment……..…...25 years
    Electrical Systems……..35 years
    Roofing Systems…….50 years
    Protective Coatings…….30 years

12. Safe Water Elevations (SWE) and Low Water Elevations (LWE) for Current Conditions shall be as follows. Safe water elevations are defined to equal maximum allowable canal water surface elevation at any point along the canal. Low water elevations are defined to equal minimum allowable canal water surface elevation at any point along the canal.
    i. 17th Street Canal:
       a) Current SWE: +10.0 ft from approximately 2,000 ft downstream of DPS6 to approximately Station 653+00; +8.0 ft from Station 653+00 to Lake Pontchartrain)
       b) Current LWE: -1 ft

ii. Orleans Canal:
    a) Current SWE: +8.0 ft
    b) Current LWE: -1 ft
iii. London Avenue Canal:
    a) Current SWE: +10.0 ft from DPS3 to Station 21+00; 8.0 ft from Station 21+00 to Lake Pontchartrain
    b) Current LWE: -1 ft

13. Design pumping station design operating capacities and maximum canal flow shall be as follows:
    a) 17th Street = 12,500 cfs
    b) Orleans Avenue = 2,700 cfs
    c) London Avenue = 9,000 cfs

14. Minimum invert elevation for pump discharge (at all sites for both current and possible future conditions) = +10.2

15. Dry Weather Flows (Possible Future Conditions only): The following dry weather flows shall be used for designing the pumping station adaptability features with consideration to Possible Future Conditions operations. No pumps are required under this contract, but Design-Builder shall design the pump station to accommodate future addition of dry weather flow pumps. Dry weather pumps shall be assumed to pump against the Normal Lake Level. Pumping stations shall be designed to allow the intake area for the dry weather pumps to be separately isolated and screened from any storm water pumps.

    17th Street Canal : 90-280 cfs

    Orleans Avenue Canal: 70-140 cfs

    London Avenue Canal: 80-240 cfs

16. Possible Future Conditions canal invert elevations upstream of canal transitions to pump station: In a separate future contract, the drainage canal will be deepened for Possible Future Condtions to allow gravity drainage to the pump station. For purposes of the design of the pump stations the following Possible Future Condition canal invert elevations should be considered (the actual elevations could be higher or lower based on the results of the physical intake model):

    17th Street Canal : -29.8 ft

    Orleans Avenue Canal: -19.5 ft

    London Avenue Canal: -29 ft

The PPS facilities shall be capable of discharging from the canals to Lake Pontchartrain the following ranges of flows and design conditions:

TABLE 3.1- 1A

PPS Operating Conditions (Current Conditions)

17th Street Canal				
Design Condition	**Flow (cfs)**	**PPS Outlet WSE (EL - ft)**	**Vertical Pump Sill Elevation (EL - ft)**	**PPS Intake WSE (EL – ft)**
PPS High Head Point	9,400	+12.8	--	-1.0
PPS Design Operating Point	12,500	+10.2	--	+2.0
PPS Low Head Point	12,500 or more	Zero Pool-to-Pool (PPS Outlet WSE to PPS Inlet WSE)		
Orleans Avenue				
Design Condition	**Flow (cfs)**	**PPS Outlet WSE (EL – ft)**	**Vertical Pump Sill Elevation (EL – ft)**	**PPS Intake WSE (EL – ft)**
PPS High Head Point	2,000	+13.1	--	-1.0
PPS Design Operating Point	2,700	+10.2	--	+2.0
PPS Low Head Point	2,700 or more	Zero Pool-to-Pool (PPS Outlet WSE to PPS Inlet WSE)		
London Avenue				
Design Condition	**Flow (cfs)**	**PPS Outlet WSE (EL – ft)**	**Vertical Pump Sill Elevation (EL – ft)**	**PPS Intake WSE (EL – ft)**
PPS High Head Point	6,800	+12.9	--	-1.0
PPS Design Operating Point	9,000	+10.1	--	+2.0
PPS Low Head Point	9,000 or more	Zero Pool-to-Pool (PPS Outlet WSE to PPS Inlet WSE)		

TABLE 3.1- 1B

Overall Pumping Capacity Criteria – Current Conditions

Canal	Overall Flow Range for PPS (Current Conditions)

17th Street Canal	500 to 12,500 cfs
Orleans Avenue Canal	500 to 2,700 cfs
London Avenue Canal	500 to 9,000 cfs

TABLE 3.1- 1C

Pumping Levels Operating Requirements – Current Conditions

	17th Street Canal	Orleans Avenue Canal	London Avenue Canal
Design Canal Water Surface Elevation	+2.0	+2.0	+2.0
Minimum Pumping Station Floor Elevation	+9.0	+9.0	+9.0
Station Invert Elevation	TBD by D-B	TBD by D-B	TBD by D-B
Gate Closure Elevation	+4.0	+4.0	+3.0
Station Discharge Pipe Invert Elevation	+10.2 (minimum)	+10.2 (minimum)	+10.2 (minimum)
Top of Gates – Determined by HSDRSDG with Minimum Value Given	EL +18.0 (Minimum)	EL +18.0 (Minimum)	EL +18.0 (Minimum)
Mean Lake Elevation	+0.4	+0.4	+0.4

TABLE 3.1- 2A

PPS Operating Conditions (Possible Future Conditions)

17th Street Canal				
Design Condition	**Flow (cfs)**	**PPS Outlet WSE (EL – ft)**	**Vertical Pump Sill Elevation (EL – ft)**	**PPS Intake WSE**

				(EL – ft)
PPS High Head Point	10,600	+12.8	--	-16.0
PPS Design Operating Point	12,500	+10.2	--	-14.0
PPS Low Head Point	12,500 or more	-3.0	--	-10.9
Orleans Avenue				
Design Condition	**Flow (cfs)**	**PPS Outlet WSE (EL – ft)**	**Vertical Pump Sill Elevation (EL – ft)**	**PPS Intake WSE (EL – ft)**
PPS High Head Point	2,300	+13.1	--	-14.0
PPS Design Operating Point	2,700	+10.2	--	-12.0
PPS Low Head Point	2,700 or more	-3.0	--	-9.4
London Avenue				
Design Condition	**Flow (cfs)**	**PPS Outlet WSE (EL – ft)**	**Vertical Pump Sill Elevation (EL – ft)**	**PPS Intake WSE (EL – ft)**
PPS High Head Point	7,700	+12.9	--	-15.0
PPS Design Operating Point	9,000	+10.1	--	-13.0
PPS Low Head Point	9,000 or more	-3.0	--	-10.4

TABLE 3.1- 2B

(Not Used)

TABLE 3.1- 2C

Pumping Levels Operating Requirements – Possible Future Conditions

	17th Street Canal	Orleans Avenue Canal	London Avenue Canal
Design Canal Water Surface Elevation	-14	-12	-13
Minimum Pumping Station Floor Elevation	+9.0	+9.0	+9.0
Station Invert Elevation	TBD by D-B	TBD by D-B	TBD by D-B
Station Discharge Pipe Invert Elevation	+10.2 (minimum)	+10.2 (minimum)	+10.2 (minimum)
Bottom of Gates in Open Position	Does Not Apply – Gates Fixed Closed	Does Not Apply – Gates Fixed Closed	Does Not Apply – Gates Fixed Closed
Top of Gates – Determined by HSDRSDG with Minimum Value Given	EL +18.0 (Minimum)	EL +18.0 (Minimum)	EL +18.0 (Minimum)
Mean Lake Elevation	+0.4	+0.4	+0.4

In typical Current Condition operating conditions, the PPS pump units will not be required to run and flow will be by gravity through the open gates. Operation of the PPS pump units will be required when lake surges require closure of the gates as determined by the Design-Builder, or when the gates are closed for any other reason. Design-Builder shall determine the basis, timing, and operating sequence for gate closure and pump operation based on their proposed technical approach.

The PPS facilities shall be designed to pass the indicated design flows without violating the SWE both when the gates are open (for lake water surface elevations at or below the gate closure elevation) and when the gates are closed and the pumps are operating.

Design-Builder shall be responsible for ensuring that their proposed design solution will meet all pump performance requirements including the specified wave conditions. Design-Builder shall coordinate wave impact with their selected pump supplier(s) and evaluate their selected equipment and operating scheme to ensure that the proposed solution will operate as required under the indicated wave conditions. Design-Builder shall ensure that there are no adverse operation or maintenance issues with their proposed solution with respect to wave activity associated with the indicated wave conditions.

3.2 Operating Criteria

Design-Builder's PPS facilities shall comply with the general operating criteria provided in the Articles below.

3.2.1 Maximum and Minimum Canal Water Elevation

Safe water elevation (SWE) is defined as the maximum allowable canal water surface elevation at any point along the canal. The pump stations shall be designed to prevent levels in the respective canal from exceeding the SWE. Operation of the pump stations (under Current Conditions) depends upon not exceeding the safe water elevations during any flow condition in the canals. The SWE to be maintained in each canal shall be as provided in Article 3.1.12, Safe Water Elevations (SWE) and Low Water Elevations (LWE).

Design-Builder shall provide level monitoring at the PPS intake that is interfaced with the respective PPS monitoring and control system. In addition, level monitoring shall be provided at each PPS site for monitoring lake level near the PPS. Water level monitoring equipment shall be as described in Article 5.11.3. The quantity of level monitoring stations shall be as required to implement the Design-Builder's operating strategy, but shall include as a minimum:

a) 17th Street –One at the PPS intake outside the trash screens, one at the PPS intake inside the trash screens, and one at lake
b) Orleans Avenue – One at the PPS intake outside the trash screens, one at the PPS intake inside the trash screens, and one at lake
c) London Avenue – One at the PPS intake outside the trash screens, one at the PPS intake inside the trash screens, and one at lake.

In addition to the SWE, each canal also has a defined low water elevation (LWE) defined as the minimum allowable canal water surface elevation along the canal. The PPS and related controls shall be designed to prevent levels in the respective canal from falling below the LWE.

3.2.2 Gate Closure Sequence

Under Current Condition operating requirements, maximum lake water surface elevation for gate closure shall be as defined in Table 3.1-1C. The Design-Builder shall ensure that their operating sequence (considering all startup activities) maintains SWE in the respective canal when the gates are closed at the gate closure elevations in Table 3.1-1C and canal flows are at the maximum values indicated in Article 3.1.13..

3.2.3 Controls

Control modes shall include local control (manual with hardwired safety interlocks) and remote control (both manual and automatic), with local hardwired safety interlocks. See Article 5.11.1 for additional definition on control modes. Operating and monitoring from remote sites shall be integrated into the PPS control and monitoring systems as indicated below.

- Each PPS shall include full monitoring and control of all equipment at the PPS to facilitate operation of the facilities in accordance with the RFP.
- It is not required that the control system be configured to allow control of one PPS facility from another PPS facility or any other remote location.
- It is not required that the control system be configured to allow monitoring or control of any DPS equipment. Interface to any existing DPS controls is not required.

- See Article 5.11 for more detail on minimum monitoring, control, and input/output (I/O) requirements.

A coordination meeting shall be conducted between the Design-Builder and the Government to determine the appropriate final control system design for the PPS facilities, and the required programming standards and requirements.

3.3 PPS General Design Criteria

PPS facility design shall comply with the following criteria:

1. Storm Surge Barrier

    a. Each PPS facility shall include a gated storm surge barrier that protects the respective canal from Lake Pontchartrain storm surges. Portions of the PPS that form the storm barrier shall be structurally independent from the other PPS facilities. All facilities not part of the storm surge barrier shall be located inside the line of protection provided by the barrier.

    b. PPS structures that form the storm surge barrier shall be designed to comply with the HSDRRS Design Guidelines.

    c. Storm Surge Barrier Elevation shall be at least El 18.0 feet.

    d. PPS pump discharge systems can be over or through the line of protection. However, solutions that utilize discharge pipes through the line of protection shall be designed to eliminate potential for seepage or infiltration at the penetration points and shall include piping joints designed to eliminate leakage risks within the line of protection.

    e. The maximum height of the gates and gate structures shall not exceed the height of the PPS superstructure defined in Article 5.4.1.

2. Outfall Canal Pumping

    a. Each of the PPS facilities will operate in series with the existing DPS pumping stations (located upstream of the PPS). The new PPS pumps shall be sized to pump the design operating capacities listed in Article 3.1. Either constant or variable speed pumping units may be considered for the new pumping stations.

    b. The pumping units shall be suitable for pumping storm water at the required head while not exceeding SWE within the canals. Pumping unit design shall be coordinated with design of inlet trash racks to ensure proper operation of the pumping units with any solids passed through the trash racks.

    c. Pumping unit drivers shall be selected to meet all specified Current Condition requirements. Drivers shall include any gear boxes, reducers, or similar devices required for proper operation. Drivers shall be electric motors – direct engine driven pumping units will not be acceptable.

    d. Pumping unit discharge shall be provided with back flow prevention as specified in Article 3.5. Pumping unit driver capacity shall be appropriate for starting the pumps at maximum pool to pool elevations considering all system losses.

e. The discharge side of each PPS pumping station shall be designed and constructed to maintain pumping capacity and reliability under the design values for storm surge, and wave action. The discharge piping shall be designed with appropriate protection from storm surge damage. Design-Builder shall be responsible for ensuring that the discharge piping and related components will not be damaged by the storm surge parameters defined in this RFP. Breakwaters shall not be used to mitigate wave or surge impacts.

f. PPS discharge velocities (both pump discharge and gate outlet) shall be coordinated with the outlet structure design to ensure that discharge energy is sufficiently dissipated to eliminate any erosion of the downstream canal or levees. Any structures installed to accomplish this shall have a design life of 100 years. Design-Builder shall produce models, based on their design, showing velocity and direction of post construction flows. Post construction velocities and directions for the 17th Street canal shall be controlled to prevent any cross flow velocities into the Coast Guard navigation channel (as indicated in Section 0100, Instructions to Offerors, Article 2.2, Figure 2.5-2A, 17th Street Canal) during both construction and permanent conditions. If necessary, a training wall shall be provided to ensure that flows are directed along the path of the canal and do not enter the navigation channel. Provisions shall cover bypass flows during construction, gravity flow through the permanent gates, and pump flows in both normal and storm event conditions. Training walls, if required, shall have a minimum top elevation of +10.2, with the final required top elevation determined by the Design-Builder based on their pump station configuration and discharge velocity modeling. Training walls shall be provided with coast guard approved permanent aids to navigation to clearly identify the wall under all specified lake elevations.

g. Design of the inlet and outlet transitions, including gate structures, shall be optimized to reduce the potential for silt accumulation. This shall include sloping of any vertical transition sections to minimize square corners that accumulate silt. Where silt accumulation can not be avoided, the Design-Builder shall provide procedures (including any special equipment required) for silt removal and any special provisions in their proposal that address silt accumulation.

h. All flow to be pumped by the PPS shall be screened before reaching the pumps. Bar screens (trash racks) shall be the method of screening. Trash racks shall be cleaned with low profile, climber-type screen cleaners. The maximum height of the trash rack assemblies shall not exceed the height of the PPS superstructure defined in Article 5.4.1. Trash racks and screen cleaners shall be as specified in Article 5.6.9.

i. The pumping units shall be either grease, oil, or water lubricated. Water lubricating systems shall not rely on potable water supplied by the local utility. Water lubricated units shall be provided with a water treatment system to treat canal water to lubrication water quality (as directed by pump supplier). Water treatment systems, for lubrication water shall be capable of providing lubrication quality water during a storm event. Design-Builder can install a well to provide service water, but shall be responsible for determining that water quality and well permit availability and timing are consistent with the project requirements. If a well is to be utilized, Design-Builder is responsible for ensuring that the well's aquifer is capable of delivering the required water capacities without excessive consolidation of subsurface soils or impacts to other infrastructure. Grease or oil

lubricated systems shall be designed as directed by the pump supplier.

j. Each PPS shall have sufficient layout room to dismantle one pumping unit for service inside the pumping station. This space shall be available without removal of installed structures or equipment. The space shall be designed with necessary structural support to accommodate the equipment to be serviced. The layout room shall include appropriate provisions to remove the largest serviceable components to trucks (DOT Class 8 vehicles).

k. The design minimum invert elevation of the discharge pipes shall be +10.2 feet. Discharge pipes with inverts below the design level of protection (+18.0 feet) shall be classified as "through the protective works" with regard to backflow prevention. Discharge pipes with inverts above the design level of protection (+18.0 feet) shall be classified as "over levee or floodwall" with regard to backflow prevention. Appropriate backflow prevention shall be provided based on the discharge classification. See Section 01010, Article 3.5 for backflow protection requirements.

l. The intake screens shall be provided with stop logs or bulkheads to permit isolation of the pump suction inlet and inlet screens. For installations where the screens have no components that can be serviced without removal of the screens, the stop logs or bulkheads can be configured to isolate only the pump intake. Suitable access platforms or roads shall be provided to allow for installation and removal of the stop logs or bulkheads..

m. If cooling grids are used as part of the design, they must be placed such that they do not disrupt flow conditions approaching the pump inlets.

n. The design of each PPS shall include adaptability provisions for Possible Future Condition operating requirements, including the following as a minimum:

    i. PPS pumping station inlet, intake area, and gate structure designed to accommodate Possible Future Condition pumps without structural modifications to the pumping station.

    ii. Plant layout to allow sufficient space for easy addition of future engine generator units and related fuel storage.

    iii. Plant layout to allow sufficient space for installation of increased horsepower motor units for Possible Future Condition pumps without modification of superstructure or substructures.

    iv. Site utilities to accommodate Possible Future Condition operating requirements, including ductbanks, cable trays, site drainage, dewatering/sump pumps, electrical bus capacity, etc.

    v. PPS pumping station layout to allow modification for installation of the Possible Future Condition dry weather flow pumps. Design flow ranges for dry weather flows under Possible Future Conditions are listed in Article 3.1.

    vi. Structural design calculations for static and dynamic load conditions to show that the PPS and decommissioned gates meets the stability requirements of the RFP under Possible Future operating conditions.

vii. Design of the approach structure to the PPS must allow for transition to Possible Future Condition canal depths without modification to approach/transition sidewalls.

viii. Design of the PPS inlet transitions, intake areas, and pump layout shall consider the Possible Future Condition requirement that the maximum average channel velocity in the individual pump bay upstream of the FSI entrance shall be 2 ft/sec at the minimum sump water level. Velocity shall be verified by physical modeling and CFD modeling. The PPS shall be designed to allow future FSI construction based on this requirement.

ix. A design that facilitates permanent decommissioning and closure of the Current Condition gates (as the gates will be fixed shut in Possible Future Condition operation).

x. Bridge crane rails and structural supports shall be designed to accommodate loads for the Possible Future Conditions, including increased pump driver sizes.

xi. Trash screens and rakes on the pump inlet bays shall be designed to operate properly at both Current Conditions and Possible Future Conditions, without modification or relocation. Screens shall extend the full depth of the intake bays. Rake mechanisms shall be capable of cleaning screens to the full depth of the intake bays.

xii. Pumps shall be designed such that pump shafts and columns (as applicable) can be used for both Current Conditions and Possible Future Conditions.

3. Reliable, Integrated Operation

a. All structures at each PPS, including all building superstructures, internal operating/maintenance areas, penetrations, interior and exterior operating components, and controls both local and remote shall remain intact and fully functional throughout a hurricane with wind loads as specified in the Structural Design Criteria (Article 5.5). Fully functional shall mean that all systems are functional at the capacities specified in Section 01010 throughout the storm period.

b. In addition, to any other facilities spaces described in the RFP, each PPS shall be provided with separate spaces for a control room, lunchroom, showers/locker, and toilets. Rooms shall be sized and fully equipped for their function, assuming a minimum of twelve (12) staff at each PPS for a five (5) day storm event. Each PPS shall be designed to provide adequate potable water and wastewater capacity for the entire five (5) day storm event and shall assume loss of all public utility services during that period. Wastewater systems shall be designed to drain to public utilities during non-storm conditions. Furnishings and appliances for the spaces shall be provided from the furnishings allowance on the bid form.

c. Pumps, gates, screens, valves, auxiliary systems, and other equipment shall be driven or powered entirely by onsite power sources. Pump drivers shall be electric motors. Other equipment may be driven by electric motor, hydraulic power, compressed air, or a combination of these sources. Hydraulic power packs and compressed air systems shall be electrically driven. Stations shall be

designed to operate at full capacity independent of all public utilities.

d. Each PPS facility shall be provided with a permanent means of dewatering all operating floors through permanent sumps and sump pumps.

e. Each PPS facility shall be provided with a method of isolating individual pump intake areas for maintenance as defined in Article 3.3.2.l. A permanent means of dewatering pump suction intake areas shall be provided to dewater the isolated space for maintenance.

f. Auxiliary systems that are required for the facility to operate at design operating capacity shall be designed such that failure of any single element in the auxiliary system can not prevent operation of the pumping station at design operating capacity. Auxiliary systems include, but are not limited to the following:

    i. Diesel engine generators and related electrical distribution equipment, busses, and switchgear.

    ii. Valve and gate operators.

    iii. Seal water and lubrication pumps and related piping.

    iv. Compressed air and hydraulic power systems, where required to actuate, start, or operate the PPS pumping units or gates.

    v. Trash rack/screen operators and automatic controls.

    vi. Equipment specific or overall facility controls, including PLC cabinets, HMI interfaces, and communication links.

g. Each PPS facility (both pumping station and engine generator facility) shall be provided with motor driven overhead crane/cranes, including electric-motor-driven equipment hoist, trolley, and bridge. Overhead cranes shall be capable of lifting the heaviest part of the pumping unit, motors, generators, auxiliary equipment, top ends of the engines, or similar sub-assembly based on recommendations of the equipment manufacturer for servicing the equipment. Crane rails and related structural components shall be designed for the Possible Future Condition operating requirements.

h. Layout of engines shall provide access to facilitate routine servicing of engines. Design-Builder shall consult with the engine manufacturer or their authorized service representative to determine the proper clearances. In addition, clearances shall incorporate any applicable industry standards or code for safety and maintenance clearances.

i. A central control room shall be provided for each PPS. The central control room shall permit monitoring and logging of all facility equipment and shall provide a link to remote control. All facility equipment shall be capable of operation either locally at manual control stations next to the equipment or remotely from the control room.

j. The central control room shall be a climate controlled area that permits visual observation of all pumping units. The control room shall contain all primary controls and communication equipment and shall be sound attenuated to permit

normal conversation with all pumping units operating.

k. A workroom and spare part storage room shall be provided at each PPS facility. The workroom shall be provided and equipped with machine tools as required to service station auxiliaries. A service air system shall be provided to support the use of air tools. Fixed air tool supply lines and connection points shall be provided throughout the workroom.

l. Fuel storage shall be provided with a capacity to supply the respective PPS at full load for five (5) days of continuous operation. Design-Builder shall provide the Government with a fuel management plan based on their specific fuel storage design. Outdoor fuel storage tanks shall be of double wall, ballistic resistant construction. Buried storage tanks shall be double wall type specifically designed for buried applications. Design-Builder is responsible for obtaining any permits required for above-ground or buried storage tanks. Fuel systems shall have adequate safety controls including automatic cut-off valves.

m. Fuel storage facilities shall be provided with fuel containment meeting all local and federal codes. Areas and buildings that store or house diesel or other fuel shall be configured so that fuel spills or leaks are contained and do not drain to a storm drain. This can be accomplished through double-wall containment, lined concrete containment areas, or other methods as determined by the Design-Builder.

n. Each engine generator shall be provided with a day tank with a capacity for four (4) hours of continuous operation. Redundant fuel transfer systems shall be provided to transfer fuel from the main storage tanks to the day tanks.

o. The design of each PPS shall allow the following operation and maintenance procedures to be performed as suggested by the manufacturers' recommendations. Routine maintenance will be required to take place with zero pool-to-pool elevations and the gates open. Pumping systems shall be designed to be tested in this environment without damage to any equipment.

    i. Start and run each pump for a minimum of one hour. Any facilities necessary to produce adequate pumping head to permit operation of the pump without cavitation, excessive vibration, wear, damage to the equipment, or excessive horsepower draw shall be permanently installed. Testing provisions shall allow testing of the conditions outlined in Table 3.1-1A.

    ii. Exercise each diesel fuel engine generator for a minimum of one continuous hour at full load. Load banks shall be permanently supplied at each station, if necessary for this procedure.

    iii. All facilities necessary for these procedures shall be permanently installed or furnished at each PPS

p. Bulkhead or stop log slots shall be placed on the inlet and outlet side of each gate to allow gates to be dewatered for maintenance. One complete set of suitable bulkheads or stop logs shall be provided.

4. Community Compatible Facilities

a. Each PPS facility shall be designed to minimize impact on the surrounding community and shall incorporate aesthetic features to reduce noise, light, and visual impact.

b. Each PPS facility shall be designed to minimize impacts to adjacent residential areas.

c. The pumping units and their drivers shall be enclosed in protected buildings designed according to Articles 5.4 and 5.5.

d. Engine generators shall be housed in a separate building designed according to Articles 5.4 and 5.5. The building shall be provided with a sound attenuated control room meeting the requirements for a central control room previously described (Section 01010, Article 3.3.3.i and 3.3.3.j). In addition, an enclosed walkway shall be provided between structures to allow safe access between structures during a hurricane.

e. Generator buildings (or any other adjacent structures not part of the pumping facility) shall be located inside the line of protection. Minimum operating floor elevation for these buildings shall be 2.5 feet above existing grade.

f. Generator buildings and engine generator configurations shall be designed to allow easy collection of used oil for disposal.

g. Fuel storage tanks shall be screened or otherwise hidden from view such that they can not be seen from offsite locations.

3.4 Modeling

Design-Builder shall perform both computer and physical modeling work as required in this RFP. Separate modeling shall be performed to demonstrate compliance with Current Condition operating requirements and to demonstrate compliance with the adaptability requirements for Possible Future Condition operating requirements.

3.4.1 Computer Models

Computational Fluid Dynamics (CFD) modeling may be used for the Intake Canal to verify if cross-flow velocity in front of the pump intake screens are within Hydraulic Institute Criteria. CFD modeling may be used for preliminary pump station studies. However CFD may not be used for final pump intake and pump discharge modeling. Physical models, as described elsewhere in this Section, shall be used for final pump intake and pump discharge modeling. Computational Fluid Dynamics (CFD) modeling may be used for the Intake Canal transition section to verify even distribution of flow into the inlet area in front of the pump intake screens and that design conditions are within Hydraulic Institute Criteria. However CFD shall not be used in lieu of a physical model for final pump intake and pump discharge modeling.

One-dimensional, unsteady numerical hydraulic modeling shall be performed for Current Conditions to demonstrate that each PPS and associated canal can operate at the capacities and within the safe water and low water elevations described in Article 3.1. For the scenarios described in Section 00110/00120, Tab C, the modeling shall demonstrate the proposed technical approach meets the operating criteria in Article 3.2. The model shall extend from Lake Pontchartrain to the existing DPS and shall include all structures that impact the conveyance of the canal. Data available for model development is included in Appendices A and C. A narrative

describing model boundary conditions, including inflow hydrographs, gate and pump operational rules, and model results shall be provided as described in Sections 01012 and 01330.

3.4.2 Physical Models

3.4.2.1 Station Physical Modeling.

For both Current Conditions and Possible Future Conditions, physical model studies shall be conducted on each PPS pumping station in accordance with Hydraulic Institute (HI) Standards. The pump intake physical model shall include all pumps, all intake screens, and an adequate approach channel length to insure proper flow distribution approaching the pump station. The pump discharge outlet physical model can be conducted of a single pump for each size of each manufacturer of pumping unit unless the discharge outlet design depends on multiple pumps working together. Physical Models shall be at an appropriate scale defined by the HI Standards and shall demonstrate that the intake meets HI standards for surface and submerged vortices, swirl angle, and time averaged velocity at a point. Models shall be configured to facilitate observation of both surface and underwater conditions. Physical Models shall demonstrate that the pumping station meets the minimum acceptance criteria of the Hydraulic Institute (ANSI/HI 9.8.5.6).

For pumping units that utilize a discharge siphon, the Discharge Outlet Physical Model shall demonstrate that the pump discharge outlet pipe/tunnel is self-priming without vacuum assist. For pumping units that utilize a free gravity discharge without the benefit of a siphon, the Discharge Outlet Physical Model shall demonstrate that the pump discharge outlet system shall meet the system curve for pump head. For both types of pumping units, the Discharge Outlet Physical Model shall demonstrate that: (1) the pump operation will not be adversely affected by the wave conditions described in Article 3.1 (items 6 and 7) causing fluctuations in head downstream of the structure and (2) the pumping station has adequate energy dissipation devices and/or channel bottom protection of the pumping station sub-structure and the canal.

Witnessed demonstration tests of the Physical Models showing acceptable performance shall be provided to the Contracting Officer or their designee. Demonstration tests shall be documented as defined for factory tests in Section 01640 – Startup, Testing, and Commissioning. A video tape with auditory commentary shall also be provided documenting the any and all testing. Physical pumping station model studies shall be conducted in accordance with the Hydraulic Institute Standards for Models.

3.4.2.2 Pump Unit Physical Modeling.

Prior to shipment, pumping units shall be either full scale performance tested or physical model tested in accordance with Hydraulic Institute Standards. One physical model test shall be made for each size and model of pump. All model tests shall be witnessed by the Government. No efficiency correction shall be permitted in scaling model pump performance to proto-type performance. Regardless of size, each pump will be field tested as defined in Section 01640 – Startup, Testing, and Commissioning.

Physical or computer modeling intended to supplement or replace factory requirements shall be clearly documented in Design-Builder's testing plans and shall require prior approval by the Government and be included as part of the overall testing requirements. Additional information regarding testing and related documentation shall be as defined in Section 01640 – Startup, Testing, and Commissioning.

3.5 Backflow Prevention

A suitable means shall be provided to prevent backflow in the pump discharge lines. In designing the pumping configurations, the practices outlined below shall be followed (in addition to any requirements defined in Section 01010, Article 3.3).

3.5.1. General. The basic requirement for pump discharge lines, in which backflow can occur without siphon action, shall be to provide two means of preventing backflow--one means for normal use and the other for emergency use in the event of failure of the normal method. The emergency method shall be a separate shutoff valve on the discharge line.

3.5.2. Over levee or floodwall. Discharge lines may be classified as over the levee or floodwall as described in Article 3.3.2.k.. All discharge lines of this type shall be provided with a valve located at the high point of the discharge lines to stopping backflow.

3.5.3. Tthrough protective works. Discharge lines may be classified as through the protective works as described in Article 3.3.2.k. Where discharge lines run through the protective works two (2) valves shall be placed at the high point of the discharge lines. The valves should be accessible at all flood levels and during hurricane events. The primary valve shall require motor operation, operable from the control room and the secondary valve shall be manual-operated. This second valve is a backup to the first valve for emergencies and to use as needed.

3.6 Hurricane Conditions

Each PPS shall be designed to safely and at full specified operability and functionality in hurricane conditions. Each PPS facility shall be designed and constructed to withstand wind loads described in section 5.4 – Structural Design, considering all appropriate factors and design considerations outlined in ASCE/SEI 7-05. These wind loads have environmental conditions consistent with a hurricane and the resulting physical harm that occurs from flying debris, high wind, and driving rain. Hurricane conditions must also consider the elevated lake surge conditions and the significant wave height conditions defined in Article 3.3. Each facility shall incorporate storm proofing design and construction necessary to ensure it complies with the following:

1. Structures including all penetrations, interior and exterior operating components including process, and controls both local and remote shall remain intact and fully functional throughout a hurricane with wind loads as specified in Table 5.4-4.
2. Facility is able to maintain full operation throughout the storm event. A fully operational facility is defined as continuously meeting the facility performance requirements as stated in other sections of this RFP. Failure of individual components that have redundancy shall be acceptable, provided the redundant equipment operates as intended.
3. Each facility is designed to withstand and remain fully functional at the elevated lake levels and wave conditions specified.
4. Each facility is designed to provide a safe interior working environment for operations and maintenance personnel during a storm event.
5. Each facility is designed to maintain reliable electrical power during a storm event.
6. Each facility is designed so that onsite operations personnel can safely operate all facility equipment from within the secure build space(s).

4.0 APPLICABLE GENERAL CRITERIA

The publications listed below form a part of this Request for Proposal to the extent referenced. The publications are referred to within the text by the basic designation only. This list may not be exhaustive and Design-Builder shall comply with all applicable federal, state, and local codes and

standards. The design and specification of all work shall be in accordance with all applicable laws and regulations of the State of Louisiana, and with the applicable local City and Parish ordinances and standards. Design criteria in this document shall be superseded when requirements of local or state codes are more stringent. Where no specific revision or date is given for a standard, the most current revision (at the time of the Design-Builder's proposal) shall apply.

4.1 Industry Criteria

Aluminum Association	Design Manual "Specifications for Aluminum Structures", 2000 Edition.
ACI 381-05	Building Code Requirements for Reinforced Concrete
ACI 350-06	Code Requirements for Environmental Engineering Concrete Structures" and Commentary (ACI 350R-06)
ACI 350.3-06	Seismic Design of Liquid Containing Structures and Commentary (ACI 350.3R-06)
ACI 350.4R-04	Design Considerations for Environmental Enginnering Concrete Structures.
ACI 351.3R-04	Foundations for Dynamic Equipment.
ACI 530-05	Building Code Requirements for Masonry Structures
AISC 360-05	Specification for Structural Steel Buildings
AISC	Steel Construction Manual, Thirteenth edition
ANSI/HI 2.1-2.5	American National Standard for Vertical Pumps for Nomenclature, Application, and Operations
ANSI/HI 2.6	American National Standard for Vertical Pump Tests
ANSI/HI 9.1-9.5	American National Standard for Pumps – General Guidelines for Types, Definitions, Application and Sound Measurement
ANSI/HI 9.8	American National Standard for Pump Intake Design
ARI Guideline K	Air-Conditioning and Refrigeration Institute – Guideline For Recovered Non-Flammable Fluorocarbon Refrigerants
ASCE/SEI 7-05	Minimum Design Loads for Buildings and Other Structures
ASME A13.1-96	Scheme for the Identification of Piping Systems

ASME B16.1-98	Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3-98	Malleable Iron Threaded Fittings
ASME B16.5-03	Pipe Flanges and Flanged Fittings
ASME B16.10-00	Face-to-face and End-to-end Dimensions of Valves
ASME B16.11-01	Forged Fittings, Socket-welding and Threaded
ASME B16.15-85	Cast Bronze Threaded Fittings
ASME B16.18-01	Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.22-01	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.28	Wrought Steel Buttwelding Short Radius Elbows and Returns
ASME B16.34-96	Valves, Flanged, Threaded and Welding End
ASME B16.36-96	Orifice Flanges
ASME B31.9-96	Building Services Piping
ASME B31.2-68	Fuel Gas Piping
ASME B31.3-04	Process Piping
ASME B36.10M	Welded and Seamless Wrought Steel Pipe
ASME B36.19M-04	Stainless Steel Piping
ASME PTC 10-97	Test code on Compressors and Exhausters
ASSE/SAFE A10.6	American Society of Safety Engineers – Safety Requirements for Demolition Operations
ASTM A 36	Standard Specification for Carbon Structural Steel
ASTM A53	Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless
ASTM A 135	Standard Specification for Electric-Resistance-Welded Steel Pipe
ASTM A 185	Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete

ASTM A 416	Standard Specification for Steel Strand, Uncoated Seven-Wire for Pre-stressed Concrete
ASTM A 500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A 992	Standard Specification for Structural Steel Shapes
ASTM B209	Standard Specification for Seamless Carbon-Molybdenum Alloy-Steel Boiler and Superheater Tubes
ASTM B211	Standard Specification for Aluminum-Alloy Bar, Rod, and Wire
ASTM B 429	Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM C 33	Standard Specification for Concrete Aggregates
ASTM C 150	Standard Specification for Portland Cement
ASTM C 330	Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C 1077	Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 3740	Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 77	Required Test Method for Inspection and Verification of Thermometers
ASTM F1155	Standard Practice for Selection and Application Of Piping System Materials
ASTM E 329	Standard Specification for Agencies Engaged in Construction the Inspection and/or Testing
ASHRAE 41.8	Standard Methods of Measurement of Flow of Gas Dye Dilution
ASHRAE 62	Ventilation for Acceptable Indoor Air Quality
AWS A2.4-98	Standard Symbols for Welding, Brazing and NDE.

AWS A3.0-01	Standard Welding Terms and Definitions.
AWS D1.1-96	Structural Welding Code.
DIPRA	(Ductile Iron Pipe Research Association) Publications: Various.
HI 1.1-1.2	Centrifugal Pumps for Nomenclature & Definitions
HI 1.3	Centrifugal Pumps for Design & Application
HI 1.4	Centrifugal Pumps for Installation, Operations and Maintenance
HI 1.6	Centrifugal Pump Tests
HI 7.1 - 7.5	Controlled Volume Metering Pumps – Nomenclature, Definitions, Applications & Operations
HI 9.6.1	Centrifugal and Vertical Pumps for NPSH Margin
HI 9.6.3	Centrifugal and Vertical Pumps for Allowable Operating Region
HI 9.6.4	Centrifugal and Vertical Pumps for Vibration Measurements and Allowable Values
HI 9.6.5	Centrifugal and Vertical Pumps for Condition Monitoring
MSS SP-58	Pipe Hangers and Supports – Materials, Design and Manufacture
MSS SP-69	Pipe Hangers and Supports – Selection and Application
MSS SP-89	Pipe Hangers and Supports – Fabrication and Installation Practices
NARA	US National Archives and Records Administration – 40 CFR 61, National Emission Standards for Hazardous Air Pollutants
NARA	US National Archives and Records Administration – 40 CFR 82, Protection of Stratospheric Ozone
NARA	US National Archives and Records Administration – 40 CFR 173.301, Shipment of Compressed Gases in Cylinders and Spherical Pressure Vessels
PCA Publication	“Rectangular Concrete Tanks”, 1994
PCA Publication	“Circular Concrete Tanks Without Prestressing”, 1993.

PCI	Design Handbook, “Precast and Prestressed Concrete”, 5th Edition

All design shall also meet the requirements of the following general industry organizations and their standards to the extent referenced and as incorporated by federal, state, regional, and local codes and laws:

AISC Steel Construction Manual, Thirteenth edition

Air Movement and Control Association (AMCA)

American Bearing Manufacturers Association (ABMA)

American Gas Association (AGA)

American Gear Manufacturers Association (AGMA)

American National Standards Institute (ANSI)

American Petroleum Institute (API)

American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)

American Society of Plumbing Engineers (ASPE) Handbooks

ASTM, Current Applicable Standards

American Water Works Association

International Building Code (ICC), Current Edition

IEEE, Current Standards

IES, Illuminating Engineering Society, Lighting Handbook

National Electrical Code (NEC), Current Edition

National Electrical Safety Code (NESC), Current Edition

National Fire Protection Association Recommended Practices (NFPA) and Manuals

National Institute of Standards and Technology (NIST)

Occupational Safety and Health Administration (OSHA) Standards Manual

PCA Publication, “Circular Concrete Tanks Without Prestressing”, 1993.

PCA Publication, “Rectangular Concrete Tanks”, 1994

PCI Design Handbook, “Precast and Prestressed Concrete”, 5th Edition.

Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

Steel Structures Painting Council (SSPC)

SMACNA standards

Standard Building Code, Current Edition

Underwriters' Laboratories (UL)

4.2 Corps Criteria

The publications listed below form a part of this Request for Proposal to the extent referenced. The publications are referred to within the text by the basic designation only.

1. USACE EM 385-1-1 (2008) – Safety and Health Requirements
2. Hurricane and Storm Damage Risk Reduction System Design Guidelines (HSDRRSDG), USACE-MVN, Latest Version.
3. EM 1110-2-2105 "Design of Hydraulic Steel Structures", Latest Version
4. EM 1110-1-1002 "Survey Markers and Monumentation", Latest Version

4.3 Stakeholder Criteria

Criteria from the project stakeholders have been incorporated into the relevant sections of this RFP. Stakeholder criteria has been incorporated from the following stakeholders :

- *Coastal Protection and Restoration Authority (CPRA) of Louisiana*
- *East Jefferson Levee District (EJLD)*
- *Jefferson Parish (JP)*
- *Sewerage and Water Board of New Orleans (SWBNO)*
- *Orleans Levee District (OLD)*
- *Southeast Louisiana Flood Protection Authority - East (SLFPAE)*

5.0 TECHNICAL CRITERIA

The Articles below describe minimum design criteria that must be utilized by Design-Builder for developing their proposed solution.

5.1 Civil and Site Design Criteria

Space available for PPS sites are shown in Appendix C.

The sites shall comply with the following design criteria:

1. **Geotechnical.** Geotechnical design criteria shall be as covered in Article 5.3, Geotechnical Design Criteria.

2. **Fencing.** Security fencing shall be as defined in Article 5.2.3, Fencing.

3. **Site Access.** Appropriate site access shall be provided to allow normal operational and maintenance access. Site access shall be designed to require exterior motorized traffic to access each site through a single primary entry gate. At least one additional access

location and gate shall be provided for secondary access. Additional gates may be provided, as required or to meet codes. Additional interior or exterior pedestrian access points may also be provided. All exterior access points shall be controlled through a manual locking and entry system. Site access security shall be as defined in Article 5.2, Security Design Criteria.

4. **Roads and Sidewalks.** Paved roads, sidewalks and stairs for access to all site facilities to allow safe operation and maintenance. Paving and sidewalks shall be designed as indicated in Table 5.1-1.

TABLE 5.1- 1

Site Roadways, Walkways, and Parking Design Criteria

Roadways, Walkways, and Parking	
Roadways	• Required geometric layout and structural pavement design shall be based on design vehicles including P, SU and WB-67 vehicles, all in accordance with LaDOTD standards, current edition. • In areas where truck parking and maneuvering is required, 8" minimum Portland cement concrete slabs shall be used.
Walkways	• Concrete walkways as required to allow reasonable pedestrian access to all facilities for normal operation and maintenance.
Parking	• At each site, provide a minimum of 8 parking stalls suitable for "P" design vehicles, including one ADA handicap parking stall.

5. **Site Lighting.** Outdoor lighting shall be provided at all facilities and roadways for security and night access. Designs shall be in accordance with IES standards, the NEC and Article 5.10.3, Lighting Requirements. Site lighting shall include separately switched "normal" and "storm event" lighting circuits. Normal site lighting shall be comprised of task and pole mounted cut-off lighting fixtures designed to reduce offsite light pollution. Normal site lighting shall include automatic ambient light controls to energize the lights at low ambient lighting. Normal site lighting will always be functional, unless the storm even lighting is energized. Storm event lighting shall include additional, higher power lighting that may be required to safely operate and maintain facilities during a storm event.

6. **Utilities.** Utilities shall be run underground throughout the site. Concrete ductbank shall be used for all power distribution.

7. **Substation Site.** Electrical substation sites shall be fenced separately with a separate entrance for the Power Company (for any portions of the substation requiring utility access). Berms or plantings shall be used to shield the substation from public view.

8. **Landscaping.** A low-maintenance landscaping plan shall be developed for review by the Government and conforming to City and Parish ordinances and standards. Xeriscaping principals shall be used to minimize the need for irrigation. Appropriate screening berms or plantings shall be provided along public frontage. Screening berms shall be coordinated with security requirements to ensure that site security is not compromised by berm design. Additional screening, if required, shall be provided to hide any outdoor fuel

storage tanks from public view.

9. **Site Drainage.** Storm (rainwater) drainage shall collect and divert rainwater off site to approved drainage ways and shall allow complete site access during hurricane conditions. Drainage design shall comply with all state and local flood control ordinances. Rainwater drainage design criteria shall meet requirements summarized in Table 5.1-2. Note that in Table 5.1-2, "storm" reference refer to rain events, tropical or otherwise.

TABLE 5.1- 2

Storm (Rainwater) Drainage Design Criteria

Design Element	Associated Requirement
Concrete-lined Channels	
Design storm frequency	10 years
Design storm duration	6 hours
Flowrate calculation method	Rational Method
Bottom width	Varies
Side slopes	4:1
Roadway Gutters	
Design storm frequency	10 years
Design storm duration	6 hours
Flowrate calculation method	Rational Method
Curb height	6 inches
Stormwater Conduits (if applicable)	
Design storm frequency	10 years
Design storm duration	6 hours
Flowrate calculation method	Rational Method

5.2 Security Design Criteria

5.2.1. General Requirements and Standards

This section covers general facility security design criteria. Additional criteria regarding electronic surveillance and security systems shall be as described in Article 5.10.4, Electrical Design Criteria – Security and Surveillance.

5.2.1.1 Applicable Standards

Applicable standards shall be as listed in Article 4.1, Industry Criteria and Article 4.2, Corps Criteria.

5.2.2. Access Control

A manual, lockable entrance gate shall be provided for the primary vehicle entry at each PPS site. Lockable pedestrian and vehicle gates shall be provided where other off-site access is required. All gates for each PPS shall be keyed alike, and all doors and entry ways at each PPS shall be keyed alike.

5.2.3 Fencing

Security fencing/walls, 8 feet high, around complete perimeter (as established by Design-Builder's layout) shall be provided. Perimeter fences and walls shall be located with set-backs. Fencing shall be US Army Corps of Engineers FE6-TBR-96 fence.

5.2.4 Intrusion Detection

Intrusion detection systems shall be as described in Article 5.10.4, Security and Surveillance.

5.2.5 Surveillance and CCTV Systems

CCTV systems shall be as described in Article 5.10.4, Security and Surveillance.

5.2.6 Bollards and Road Barriers

As far as possible, access routes shall be configured, using bends, landscaping, or bollards, to prevent vehicles from approaching gates or fences at velocities greater than 5 mph.

Bollards or vehicle barriers shall be provided as required, but as a minimum shall be required to protect all fuel storage and unloading facilities.

5.3 Geotechnical Design Criteria

5.3.1. Design-Builder Requirements for Independent Geotechnical Investigations

A preliminary geotechnical investigation has been done at the PPS sites. These Geotechnical Report(s) are provided with the Appendices of this RFP. Additional geotechnical information relevant to the project vicinity can be found at the following website: https://ipet.wes.army.mil/.

The Design-Builder shall produce their own final geotechnical investigation and report for use in finalizing requirements for foundation design, dewatering, and other design and construction activities for static and dynamic load conditions. The Design-Builder shall consider all drained, undrained, and intermediate conditions when evaluating the foundation analysis, design, and performance criteria. The site specific report shall consider the Design-Builder's proposed construction methods, construction sequences, and load conditions, as applicable. The site specific report shall be signed and sealed by a registered professional geotechnical engineer and submitted as defined in Article 2.2.4 Site Geotechnical Survey.

All geotechnical design work for facilities that form part of the permanent line of protection (the gated storm surge barrier and related levees and transitions) shall meet the requirements of the Hurricane and Storm Damage Risk Reduction System Design Guidelines (HSDRRSDG) for

geotechnical and structural design. Design standards referenced by the HSDRRSDG can be obtained at the following link: http://www.hnd.usace.army.mil/techinfo/

5.3.2 Site Access for Geotechnical Work

Access to each site for geotechnical exploration shall be planned/designed for safe entrance and exit and shall be coordinated with the Government according to USACE requirements (and any applicable local agency requirements). The sites shall be laid out so that vehicles do not cross over pipelines within the site, unless specific analysis has shown the loading of the pipe(s) to be safe. Access pathways for geotechnical equipment (i.e. truck mounted drill rigs, CPT rigs, pick up trucks, etc. shall be planned/constructed to minimize disturbance to existing vegetation and ground surface.

5.3.3 Excavation and Shoring

No excavation shall be performed until the area is thoroughly inspected by an independent underground utility locator company and all existing underground utilities, pipes or other obstructions are identified. All excavation, trenching, shoring, and cofferdam work shall be in accordance with applicable local and federal safety and design codes and standards. Design for all such work shall be performed and sealed by a professional engineer registered in the State of Louisiana. Design information shall be submitted as indicated in Section 01012, Design After Award. Design certifications, signed and sealed by the responsible professional engineer, shall be submitted for each unique excavation, trenching, shoring, or cofferdam design. Design certifications and related design and calculations shall be available at the project site throughout the project.

The Design-Builder shall be responsible for designing, providing, and maintaining all dewatering systems required to maintain the safety of the excavation and to provide a suitable working environment for construction. Approved dewatering permits shall be obtained in accordance with local, state, and federal law.

Cofferdam design shall provide for adequate working space and appropriate water-tightness. Steel used in the construction of cofferdams shall be designed in accordance with AISC standards. Required limiting values for critical design criteria shall be as listed on the cofferdam design Certification. Design-Builder shall use higher elevations if higher water and/or earth levels are likely on the cofferdam exterior or shall use higher loading if construction operations will impose higher loads. Materials need not be new, but all materials shall be undamaged and free from defects which impair the strength or suitability.

Excavation, shoring work and any fill required shall be in compliance with Design-Builder's geotechnical report and the requirements of Article 5.5, Structural Design Criteria.

5.3.4 Foundation Types, Loadings, and Range of Settlements

Design-Builder shall determine foundation types based on Design-Builder's geotechnical report and applicable sections of this RFP. All designs shall consider both Current Condition and Possible Future Condition operating requirements and shall consider the following:

1. Total and differential settlements consistent with the operating conditions of the facility
2. Long-term consolidation of the underlying sediments

3. Prevention of differential movements between adjacent facilities, roads, other flood control structures or utilities that jeopardize the operation or safety of the facilities
4. Accommodation of future ongoing subsidence and downdrag loads of the New Orleans area
5. Uplift forces for differential water loadings
6. Overturning and sliding stability
7. Seepage flows and piping
8. Dynamic foundation design for rotating equipment (at all expected frequencies and modes of movement per manufacturer or designer)

Foundations for structures that form part of the permanent line of protection (the gated storm surge barrier and related levees and transitions) shall meet the requirements of the HSDRRSDG for geotechnical and structural design criteria. Design standards referenced by the HSDRRSDG can be obtained at the following link: http://www.hnd.usace.army.mil/techinfo/

5.3.5 Levees, Floodwalls, and Transitions

Design and construction of levees, floodwalls, and transitions shall be by design builder in accordance with the Hurricane and Storm Damage Risk Reduction System Design Guidelines (HSDRRSDG) and the Design-Builder's geotechnical program. All construction work that will impact the existing hurricane protection system shall meet the requirements of the HSDRRSDG as identified in Section 01010 Article 4.2.

The levee tie-in shall be constructed to prevent cracking and internal erosion/piping. Horizontal joints shall not be chamfered in the contact areas between levee and concrete. The concrete surface in contact with the levee shall be battered 10V on 1H to ensure a firm contact with the fill. A properly graded filter drain shall be provided within the protected side of the levee adjacent to the concrete surface as a measure to arrest any potential internal erosion/piping along the interface.

Inlet and outlet transitions and any associated interfaces to existing levees and floodwalls shall be designed to eliminate or properly mitigate any potential for erosion or scouring of upstream or downstream sites based on changes to canal flows that may be caused by the PPS configuration.

5.4 Architecture and Interior Design Criteria

Design-Builder shall provide PPS facilities meeting the requirements of this section with regard to functionality, structural integrity, and physical durability. In addition, Design-Builder shall provide facilities that are aesthetically compatible with the surrounding architecture at each site. Design-Builder shall submit an architectural program for each site detailing the proposed construction. Preliminary architectural plans shall be submitted with the Design-Builder's proposal as described in Section 00110/00120 – Phase 2 of 2-Phase Design-Build Selection Procedures.

While no specific architectural plan is prescribed by the RFP, Design-Builder shall consider the following in developing their architectural approach:

1. Architectural and natural elements in surrounding neighborhoods.
2. Maintaining a theme between all structures at a respective site.
3. Consideration of historical architectural themes
4. Integration of secured public access facilities and features
5. Interfaces to maintain or coordinate with existing green spaces, walking paths, and similar features (in a manner that doesn't compromise public safety).

6. Building configuration and placement with regard to site activities and access for onsite personnel, maintenance equipment, and delivery vehicles.
7. Site utilization with regard to use or incorporation of existing terrain and vegetation into the facility design.
8. Visual control with regard to visual access and isolation between and among spaces and functions.
9. Building form with regard to shape, proportion and proper scale.
10. Interior facility and room layouts with regard to the intended function and safety.
11. Interior and exterior signage to support both local codes and operational effectiveness.
12. Durability and maintainability of interior and exterior finishes.

5.4.1. Building Height

Building height shall be minimized as much as practical without adversely affecting facility performance or maintenance access. Building height shall include the maximum height of any permanent building, plus any roof mounted equipment (except for antennae). Maximum building height (of any buildings at the respective PPS site) shall be as listed in Table 5.4-1 below:

Table 5.4-1
Maximum Building Heights

Location	Maximum Height of any Structure at Respective Site
17th Avenue	45 feet (per IER)
Orleans	45 feet (per IER)
London Avenue	45 feet (per IER)

5.4.2. Building and Overall Facility Footprint

Design-Builder's architectural approach shall minimize individual building and overall site footprint (area) for each site for both current and possible future conditions. Facilities shall be arranged for optimal operations and maintenance access and to optimize the use of available site area. Facilities shall be designed such that equipment removal of interior equipment is through overhead doors and does not require the use of roof mounted access hatches.

Where it does not adversely impact operability or maintainability, design-builder's site arrangement shall be configured to integrate into surrounding community architecture, landscape, and land elevations. Efforts should be made to minimize impacts to existing recreational and green space.

5.4.3. Construction Materials

Materials of construction shall be selected to meet the structural, storm-proofing, and local code requirements for each respective building. Additional consideration shall be given to interior and exterior construction materials to support aesthetic requirements, including visual impact, noise, neighborhood integration, maintainability, and sustainability.

5.4.4. Furnishings Allowance

Design-Builder shall include in their bid a furnishing allowance in the amount indicated in Section 00010, Bid Schedule. The allowance shall be administered as described in Section 01270A, Measurement and Payment. The allowance is intended to cover interior furnishings and amenities, generally for the non-process areas of the PPS facilities. Final selection of the items

to be furnished under the allowance will be determined by the Government, but will generally include the following:

1. Office furniture (desks, chairs, book cases, etc.)
2. Lunch/break room furnishings and appliances (tables, chairs, ice machines, refrigerator, microwave)
3. Miscellaneous amenities (wall clocks, window treatment, kitchenware, small applicances)

The allowance shall not be used for signage, wall or floor finishes, restroom fixtures, sinks, shower fixtures, or similar permanent items that are to be included with the construction cost of the PPS facilities.

5.5 Structural Design Criteria

This section describes the basis of structural design to be used for the PPS facility and related site structures. This shall include all building superstructure design, concrete structures and foundations, and miscellaneous site structures, such as equipment pads and piping supports.

Applicable standards shall be as listed in Article 4.1, Industry Criteria and Article 4.2, Corps Criteria. PPS facility components that form any portion of the storm surge barrier shall be designed to the structural superiority standards defined in Article 5.5.9.

5.5.1 Design Loads and Combinations

Structural Design Loads shall comply with the following criteria:

TABLE 5.5-1
Dead Loads Design Criteria

Equipment, tanks, silos, etc	Actual
Miscellaneous pipe load, apply as phantom load[1]	1 kip @ secondary beams or joists 2 kips @ primary beams
Bridge Crane or Monorail	Actual
Roof, superimposed	Actual, 15 PSF min.

[1]This applies to small (4 inch or smaller) miscellaneous piping carrying non-hazardous fluids at low pressures and temperatures. Pipe loads and pipe support requirements for other pipe shall be determined by the Design-Builder based on actual design conditions.

TABLE 5.5-2

Live Loads Design Criteria

Roof (minimum, unreduced)	50 PSF
Walkways, platforms, stairs	100 PSF
Operating Floors (All Operating Floors Except as Otherwise Required Below)	150 PSF or HS20-44, if applies
Pump break-down/maintenance floors (Erection Floors)	1000 PSF

Equipment and Storage Rooms	250 PSF
Control Room	200 PSF
Forebay Deck (Concrete or Grating)	300 PSF
Pumping Station Access	300 PSF
Electrical Floors	250 PSF
Bridge Crane or Monorail	Full Loaded Capacity and Test Load

TABLE 5.5-3
Impact Loads Design Criteria

Bridge Crane or Monorail	25% of the lifted load
Rotating and Reciprocating Equipment	50% of Rotating Equipment load

Impact loads shall be considered live loads and additive to crane and designated equipment loads. Equipment dynamic loads shall be considered in the design of the supporting structure according to the recommendations of section 5.5.3.

TABLE 5.5-4
Wind Loads Design Criteria

Design 3 second gust wind speed	191 MPH
Height and Exposure Coefficient	Exposure C
Occupancy Category	II

TABLE 5.5-5
Seismic Loads Design Criteria

Short period spectral acceleration(Ss)	0.12g
One second period spectral acceleration(S_1)	0.06g
Occupancy Category	III
Seismic Importance Factor	1.25
Total Seismic Dead Loads	Actual
Soil Class	Per geotechnical report

Seismic design parameters shall be confirmed with geotechnical report. Lateral seismic force on structures shall be determined based on the equivalent lateral force procedure.

TABLE 5.5-6
Miscellaneous Lateral Loads Design Criteria

Active earth pressure	Per Geotechnical Report
At-rest earth pressure	Per Geotechnical Report
Lateral Surcharge load from compaction (Decreases linearly at same rate as increase in earth pressure)	Per Geotechnical Report - 400 PSF minimum
Hydrostatic	63 PCF
Soil pressure for an HS20 surcharge	2-feet additional soil weight

The active pressure values shall only be used for site retaining walls free to rotate and deflect at the top.

TABLE 5.5-7
Boat/Barge Impact Loads Design Criteria

Design Basis	HSDRRSDG – Article 5.9
Impact Load	50 kip (pleasure craft or work boat loads)
Application of Load	For still water level (SWL), apply impact at 3-ft above SWL. For water to top of wall, apply impact at top of wall.
Wall Load Distribution	Boat impact loads shall be distributed over a 5 foot width plus the width gained along a 45-degree angle.
Foundation Load Distribution	Boat impact loads shall be distributed over the full width of the monolith foundation at the appropriate elevation.
Gate Load Distribution	Boat impact loads shall be distributed over a 5 foot width on the upper girder. No load is assumed on the lower girder(s).

Load Combinations

Steel structures and components shall be designed in accordance with the load combinations contained in the International Building Code, section 1605.3, “Load Combinations Using Allowable Stress Design”. Concrete for non-liquid containing structures shall be designed in accordance with the load combinations in ACI 318. Concrete for liquid containing structures and concrete structures exposed to brackish water shall be designed in accordance with the load combinations in ACI 350.

5.5.2 Liquid Containing Structures

Design Load Cases

Listed below is a summary of the loading assumptions and load factors that shall be used for design.

5.5.2.1 Service Water Condition. Maximum service water level while any adjacent structure is empty, ignore soil backfill loads, consider internal direct tensile forces in wall with ACI 350 environmental factor and cracking limits.

5.5.2.2 Maximum Overflow Water Condition. Maximum water level at flood/overflow elevation (highest water elevation that could occur hydraulically, i.e. not necessarily the top of structure wall) while any adjacent structure is empty, cracking limit not applicable, ignore soil backfill loads, consider internal direct tensile forces in wall but ignore ACI 350 environmental factor.

5.5.2.3 Seismic Water Condition. Maximum service water level while any adjacent structure is empty, ignore soil backfill loads, cracking limit not applicable, consider internal direct tensile forces in wall but ignore ACI 350 environmental factor, hydrodynamic pressure with its impulsive and convective components based on ACI 350.3-06 and ACI 350.3R.06.

5.5.2.4 Soil with Normal Groundwater Elevation. Maximum soil backfill height with at-rest pressure and groundwater elevation at its expected normal elevation, without internal liquid loads, a minimum soil pressure of 400 PSF for compaction decreasing linearly at the same rate as the increase in soil pressure, cracking limit applicable. For HS20-44 truckload, analyze for a 2-foot additional soil surcharge, not to be combined with the compaction surcharge. Use the worst case of the compaction and HS20-44 surcharge for design.

5.5.2.5 Flooded Soil Condition. Maximum soil backfill height with groundwater at the 100 year flood elevation, without internal liquid loads, a minimum soil pressure of 400 PSF for compaction decreasing linearly at the same rate as the soil pressure, cracking limit not applicable. For HS20-44 truckload, analyze for a 2-foot additional soil surcharge not to be combined with the compaction surcharge.

5.5.3 Structural Design Procedures

5.5.3.1 Building Structure Design. Building structures shall be designed based upon the loads, load combinations and requirements contained in the International Building Code. The additional concrete design requirements of ACI 350 shall not be considered applicable for building structures unless exposed to water or aggressive chemicals.

The support structure and foundation for the pumps and other vibrating equipment shall be designed to prevent detrimental vibrations in accordance with ACI 350.4R and ACI 350.3R. A dynamic analysis shall be conducted to determine support system natural frequency, and the structure shall be tuned such that the vibrating equipment shall operate without resonance with the structure. The dynamic analysis software shall be state of the art, quality assured, industry standard and subject to Government approval. The final analysis input and output files used to confirm the adequacy of the design of foundation, structural elements, appurtenances, and machine support systems shall be provided to the Government in hardcopy and digital format. In addition, a report summarizing the results, maximum vibration levels and design recommendations shall be prepared and submitted for review. The maximum vibration levels shall not exceed industry standards and maximum recommended by the equipment manufacturer. Stricter deflection criteria than the minimum required by IBC may be required to control vibrations.

Lateral seismic or wind loads shall be transferred to the foundation from their origin in a rational manner. The horizontal distribution of seismic or wind loads shall be based upon the assumption that the diaphragms are flexible for steel deck diaphragms, and rigid for concrete or horizontal

steel truss diaphragms. Where the diaphragm is assumed to behave in a flexible manner, the seismic or wind lateral load distribution shall be based upon the tributary area to the resisting elements. Where the diaphragm is assumed to behave as a rigid panel, the seismic or wind lateral load distribution is based on the relative rigidities of the resisting elements. The accidental torsion, as specified by the code shall be considered for seismic design.

Special inspection for reinforced masonry is required by the International Building Code, and so the full allowable stresses based on the code shall be utilized. The strength of the concrete masonry unit (CMU) units, mortar, and grout shall be verified by the "Unit Strength Method".

5.5.3.2 Rectangular Concrete Structures. Rectangular structure walls shall be analyzed as two way rectangular plates where the aspect ratio of length to height is 2:1 or less. The boundary conditions shall be chosen to give reasonably conservative results. If the aspect ratio exceeds 2:1, the wall shall be designed as a one way rectangular plate and the corners shall be investigated assuming a 2:1 aspect ratio.

5.5.3.3 Water Containment Structures. The design of water containment walls shall consider both flexure and tension in walls. The horizontal reinforcement shall be apportioned for 100 percent flexure steel plus 50 percent tension steel. (i.e., 50% of tension steel distributed to each face).

Direct tension in the foundation and top slabs due to internal water pressure shall be accounted for in the design of the slab horizontal reinforcing.

5.5.4 Cast-in-Place Concrete

Reinforced concrete structures shall be designed with the strength design method in accordance with “Building Code Requirements for Structural Concrete” (ACI-318), “Code Requirements for Environmental Engineering Concrete Structures” (ACI-350), and the IBC, as applicable. Additional codes, standards and procedures of ACI shall be used to supplement the code requirements.

Concrete shall be designed for a minimum 28 day compressive strength of 4000 PSI. Minimum concrete cover shall be in accordance with ACI-318 or ACI-350, as appropriate. Thickness of concrete elements (slabs, walls and beams) shall be determined based on loading and stability criteria. Minimum thickness criteria of ACI-318 and ACI 350 shall be followed. Further design criteria for concrete shall be as outlined elsewhere in this document.

5.5.4.1 Materials. The materials described below shall be specified and used as a basis for design.

1. **Reinforcing Steel.** Reinforcing steel shall meet the requirements of ASTM A615, Grade 60.
2. **Welded Wire Fabric.** ASTM A185, Grade 60.
3. **Cement.** Cement used in all concrete mixes shall be Portland cement meeting the requirements of ASTM C150, Type II unless other types are required based on corrosive conditions as determined in the geotechnical survey.
4. **Aggregates.** Fine aggregate shall be clean natural sand. Coarse aggregate shall be washed gravel or crushed stone. All aggregates shall meet the requirements of ASTM C33. Aggregates shall be demonstrated to be non-reactive in accordance with Appendix A-1 of ASTM C33.
5. **Admixtures.** Plasticizer and retarder shall be used when required to control setting time and to obtain optimum workability. Air entrainment of 4 to 6 percent by volume shall be used in all concrete mixes. The use of calcium chloride shall not be permitted.
6. **Water.** Clean water of potable quality shall be used in all concrete mixes.

5.5.4.2 Minimum Reinforcement. A minimum reinforcement for shrinkage and temperature shall be provided in accordance with ACI 350. A minimum reinforcement ratio of 0.5 percent shall be provided in basin walls and base slab with a basin dimension of 60 feet or more in any direction. Reinforcement ratios in the direction where the structure dimension is less than 60 feet shall be in accordance with ACI 350. Minimum size of shrinkage and temperature reinforcement shall be #5 and shall be divided equally between the two surfaces of the concrete section. Concrete sections greater than 24 inches thick may have minimum reinforcing based on a 24-inch thickness. The shrinkage and temperature reinforcement in the bottom of slabs reinforced top and bottom, in contact with the sub grade, may be reduced to one-half the value calculated.

5.5.5 Precast Concrete

5.5.5.1 Materials

The materials described below shall be specified and used as a basis for design.

1. **Reinforcing Steel.** Reinforcing steel shall meet the requirements of ASTM A615, Grade 60.
2. **Prestressing Strand.** ASTM A416, 7 wire strand, 250 KSI strength.
3. **Cement.** Cement used in all concrete mixes shall be Portland cement meeting the requirements of ASTM C150, Type I or III.
4. **Aggregates.** Fine aggregate shall be clean natural sand. Coarse aggregate shall be washed gravel or crushed stone. All aggregates shall meet the requirements of ASTM C33 or C330.
5. **Admixtures.** Per precast manufacturer
6. **Water.** Clean water of potable quality shall be used in all concrete mixes.

5.5.5.2 Precast Concrete Design. Precast concrete shall be designed for a 28 day compressive strength of 5000 PSI. For members subject to humid or aggressive exposure, the members shall be designed so that under dead load conditions, there is no flexural tension in the precompressed tensile zone, and additionally so that under dead plus live load conditions the stress in the precompressed tensile zone is limited to 6 x square root of f'c.

5.5.6 Masonry

Masonry shall be used for exterior walls of enclosed structures and used for interior walls of structures where required by code for fire rating, durability, or other considerations.

5.5.6.1 Materials

1.	CMU units, ASTM C90, Compressive strength	1,900 PSI
2.	Compressive strength of mortar, Type S	1,800 PSI
3.	Compressive strength of grout	2,000 PSI
4.	Masonry unit assembly, f'_m	1,500 PSI

5.5.6.2 Masonry Design. Masonry shall be designed for a design strength (f'_m) of 1500 PSI, using working stress design in accordance with ACI 530. All masonry shall be reinforced with vertical reinforcing spaced at maximum 4 foot center. Horizontal reinforcing shall consist of joint reinforcing spaced at 16 inches on center with bar reinforced bond beams at the top of the wall, at locations of lateral supports, above and below openings, and elsewhere as required. Where the

Design-Builder's approach requires exterior or interior masonry walls to be used as load bearing walls to support the roof superstructures, the masonry walls shall be appropriately designed to support the roof loads at all design conditions.

5.5.7 Structural Steel and Bar Joists

It is anticipated that building roof structures shall consist of steel wide flange shapes or bar joists with a steel roof deck. The use of structural steel shall be limited and shall not be used in areas subject to aggressive exposure. Rolled and built up structural steel design shall be in accordance with the AISC Specifications for Structural Steel Design. Cold formed sections shall be in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members. Loads shall be established based on code requirements, specified minimums and the service of structural element.

5.5.7.1 Structural Steel

1. Wide flange shapes, ASTM A992, Grade 50, F_y 50,000 PSI
2. Angles, channels and plates, ASTM A36, F_y 36,000 PSI
3. Pipe Sections, ASTM A53, Type E or S, F_y 35,000 PSI
4. Tube sections, ASTM A500, Type B or C, F_y 46,000 PSI

5.5.7.2 Bar Joists. K series open web joists designed by a steel bar joist manufacturer in accordance with the Steel Joist Institute (SJI) "Standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joist Girders". Joists shall have bridging designed by the bar joist manufacturer in accordance with SJI and OSHA requirements.

5.5.7.3 Steel Roof Deck. Galvanized steel, ASTM A446, Grade A; prefabricated side laps units, Type B wide rib, 20 gage minimum. Deck shall be attached to steel supports with self drilling screws or powder driven fasteners, and shall be attached at side laps with self drilling screws.

5.5.8 Miscellaneous Metals

5.5.8.1 Anchorage. Carbon steel anchor bolts or expansion anchors shall be used only in interior, dry areas. Anchors or expansion anchors in exterior, non-corrosive areas, and also structural column anchor bolts shall be required to be hot-dip galvanized (not zinc coated). Anchor bolts or expansion anchors in buried locations, locations subject to splashing, and submerged locations shall be stainless steel.

5.5.8.2 Gratings. Grating shall be either galvanized steel or aluminum except areas subject to splashing or corrosive conditions shall be aluminum. Fiberglass grating shall be required in areas where chemical or polymer exposure is a possibility. Grating shall be designed for a 100 PSF live load and shall also be selected to provide a deflection of not more than ¼" for the worst case of a 100 PSF uniform live load or a 300 pound concentrated load at midspan. Grating shall be designed in accordance with the National Association of Architectural Metal Manufacturers (NAAMM) standards. Grating exposed to traffic shall be designed for an HS20 truck loading.

5.5.8.3 Railing and Stairs and Miscellaneous. Handrails, ladders, ladder cages and toe plate shall conform to the requirements of the building code and the Occupational Safety and Health Administration (OSHA). Miscellaneous metals for platforms and stairways shall be designed for specified design loads.

Miscellaneous items shall be as follows:

1. Handrail – Steel ASTM A500 grade B, galvanized; or Aluminum ASTM B429 with anodized finish.
2. Ladders – Steel ASTM A36, galvanized, 1/4 inch minimum thickness; or aluminum ASTM B211 depending on exposure.
3. Toe Plate – Steel ASTM A36, galvanized; or Aluminum ASTM B209.
4. Stairs – Steel stringers with treads to be galvanized steel, or aluminum welded bar grating, serrated, with abrasive nosing for exterior treads. Stairs may also be cast-in-place concrete where more economical. In chemical containment areas stringers and treads shall be fiberglass.

5.5.9 Structural Superiority

Any PPS facilities, structures, civil works, or other components that form a structural portion of the storm surge barrier, or that will be located in areas subject to direct storm surge, shall include structural superiority design features as described below. Structural superiority is required to enhance the ability of the structure to survive potential overtopping events. Structural superiority refers to adding structure height to prevent overtopping of structures.

Structural superiority shall be included as follows:

1. Where structural superiority is required, tops of structures shall be a minimum of two (2) feet above the design grade of the adjacent levees/floodwalls. For this project, minimum structural superiority elevation shall be 18.0 feet.
2. Design of the transition from the top of the PPS structure(s) back to the design grade of the adjacent levees shall ensure that an overtopping event that scours the adjacent levees will not endanger the structure(s).
3. A minimum transition of 100 feet from the ends of the structure(s) to the design grade of the adjacent levees shall be provided.

5.6 Mechanical Design Criteria

5.6.1. References, Codes, Industry Standards and Regulations

Applicable standards shall be as listed in Article 4.1, Industry Criteria and Article 4.2, Corps Criteria.

5.6.2. General Design Requirements for Mechanical Equipment

All mechanical designs shall comply with the requirements of the Hydraulic Institute Standards, AWWA, AISI, ASTM, and API. Mechanical equipment redundancy shall be provided for all critical processes as specified elsewhere and so that the process operations may continue if individual equipment is out of service. A means of isolation shall be provided for all mechanical equipment to allow maintenance and testing to occur while remaining plant is in operation.

The following general design criteria shall apply to all mechanical equipment unless noted otherwise:

1. Freestanding and wall-hung equipment shall be anchored in place by methods that satisfy the building code and account for applicable seismic and wind conditions. Calculations shall be performed and signed and stamped for equipment weighing more than 400 pounds. Calculations shall analyze lateral and overturning forces and shall

include a factor of safety against overturning equal to 1.5. Calculations shall include the distribution of forces imposed on the supporting structure and anchors, verifying that each anchor can develop the required resistance forces. All piping, equipment, electrical and mechanical support systems shall be designed for seismic loading in accordance with the Building Code.

2. Wall-mounted equipment weighing more than 250 pounds or which is within 18-inches above the floor shall be provided with fabricated steel supports. Pedestals shall be of welded steel. If the supported equipment is a panel or cabinet or is enclosed with removable sides, the pedestal shall match the supported equipment in appearance and dimensions.

3. Mechanical equipment, tanks, control cabinets, enclosures, and related equipment shall be mounted on minimum 3.5-inch high concrete bases, unless otherwise indicated. The Design-Builder shall verify the size and weight of equipment foundation to insure compatibility with equipment. Cast iron or welded steel baseplates shall be provided for pumps, compressors, and other equipment. Each unit and its drive assembly shall be supported on a single baseplate of neat design. Baseplates shall have pads for anchoring all components, and adequate grout holes. Baseplates for pumps shall have a means for collecting leakage and a threaded drain connection. Baseplates shall be anchored to the concrete base with suitable anchor bolts and the space beneath filled with grout. Anchors shall be cast-in-place and not drilled in after construction of the supporting foundation.

4. Design-Buider shall furnish suitable anchor bolts for each item of equipment. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor bolts when the structural concrete is placed. Anchor bolt size and material shall be as recommended by the equipment manufacturer and as required to meet the design life requirements of this RFP.

5. All belt or chain drives, fan blades, couplings, and other moving or rotating parts shall be covered on all sides by a safety guard. Safety guards shall be UV and corrosion resistant materials meeting the design life requirements of the RFP. Each safety guard shall be reinforced or shaped to provide suitable strength to prevent vibration and deflection and shall comply with OSHA. Each guard shall be designed for easy installation and removal. All necessary supports and accessories shall be provided for each guard. All safety guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water.

6. Except where otherwise specified, structural and miscellaneous fabricated steel used in equipment shall conform to AISC standards. All structural members shall be designed for shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment shall be designed (thickness, coatings, etc.) to meet the design life requirements of Article 3.1.11, General Requirements. When dissimilar metal components are used, appropriate galvanic corrosion protection shall be provided as required by Article 5.12, Corrosion Control Design Criteria.

7. Lubrication facilities, where required, shall be convenient and accessible. Oil drains and fill openings shall be easily accessible from the normal operating area or platform. Drains shall allow for convenient collection of waste oil in containers from the normal operating area or platform without removing the unit from its normal installed position.

8. Equipment of similar function shall be of similar size, make, and model to the maximum extent practical while still meeting the relevant design criteria.

5.6.3 Gate and Bulkhead Design Criteria

The PPS gate assemblies form a critical portion of the respective facility storm surge barrier. The gates and their structural and mechanical assemblies are considered part of the hurricane line of protection and are subject to the requirements of the HSDRRSDG and the structural superiority requirements defined in Article 5.5.9. Gate reliability and closure capability is essential for the PPS to meet the storm barrier protection requirements and should be considered critical in the design of the PPS.

5.6.3.1. Gates. Unless otherwise indicated, design and construction of gates shall comply with the following general design criteria:

1. Design-Builder shall have the option to consider a multiple gate arrangement in lieu of a single gate.
2. All proposed gate configurations shall include positive closure systems, with redundant closure methods as described in item 26 below.
3. Gates shall be designed to operate (open and close) and seal under the operating conditions specified in Articles 3.1 and 3.2. Gates shall be able to open and close under the respective canal flows identified in Article 3.1.
4. NOT USED.
5. Design analysis for gates shall be stamped by a licensed Professional Engineer licensed in the State of Louisiana.
6. For Load and Resistance Factor Design (LRFD), a reliability factor $\alpha = .85$ shall be used for the Canal Gate and all associated structural steel components.
7. For Allowable Stress Design (ASD), canal gates, and all associated structural steel components shall be considered a Type A Hydraulic Steel Structure (HSS. Materials shall be selected that will assure the minimum design life specified in Section 01010, Article 3.1.
8. Gate guides shall be made of corrosion resistance steel (CRES) steel plate where exposed and carbon steel plate and members for embedded parts.
9. Gate seals shall be selected based on industry standards for the type of gate selected, reliability and long service life and minimum effort to replace.
10. Gate fabrication facility shall be an AISC certified facility.
11. NOT USED.
12. At the Total Programmed Capacity (maximum DPS flow rate) of the respective canal, and with all gates at the respective PPS open, gates and related structures shall be designed to limit average velocity of total flow over the entire gate area to eliminate scouring or 12 ft/s, whichever is less.
13. Gates and related components shall be designed to the following maximum tolerances:
    - Straight Edge Check (all plate edges) - ± 0.5mm in 2000mm.
    - Bottom Seal Plate Alignment - ± 2.0mm over full length
    - Side Seal Plate Alignment - ± 2.0mm over full length
    - Horizontal Distance Between Side Seal Plates - ± 3.0mm
    - Roller Paths (with Respect to Vertical Plane) - ± 2.0mm from parallel
14. NOT USED.

15. If gate design incorporates wheels and rollers, CRES steel shall be used to fabricate these components. CRES steel for wheels and rollers shall conform to ASTM Designation A564, Type 630, Condition H1025. CRES steel for wheel and roller axles shall conform to ASTM Designation A564, Type 630, Condition H1150. CRES steel for miscellaneous wheel and roller parts shall conform to ASTM Designation A276, Type 304L. Components of the gate and its support frame/guides required to be of CRES steel shall conform to ASTM Designation A276, Type 304L. Regular bolts and cap screws for stainless steel shall conform to ASTM Designation A320, Class 1A. High-strength bolts and cap screws for stainless steel shall conform to ASTM Designation A320, Class2.
16. All embedded parts for supporting and sealing gates in both the first and second stage concrete shall be included. All the embedded parts shall be designed so they can be securely embedded in supporting reinforced cast-in-place concrete structure.
17. Design-Builder shall select appropriate coatings for exposed surfaces of the Canal Gate and its Support Framing and Guides that are not CRES steel. Coatings shall be selected based on environmental exposure and comply with the requirements of the Hurricane and Storm Damage Risk Reduction System Design Guidelines (HSDRRSDG) as identified in Section 01010, Article 4.2.
18. A gate operator shall be utilized to open/close each canal gate at all design conditions for the gate. The gate operator, consisting of hydraulic cylinders, hydraulic pumping units, piping, controls and accessories, shall be designed according to the applicable industry standards including National Fluid Power Association and Joint Industry Conference for Hydraulic Equipment standards.
19. The design pressure of hydraulic fluid in gate operator hydraulic systems (cylinders, piping, pumps etc.) shall be approximately 3,000-psi.
20. Gate operators shall be designed to open and close the Canal Gate for the operating conditions specified in Section 01010, Articles 3.1 and 3.2. Loads on the gate operator shall include all loads resisting gate movement including but not limited to unbalanced head, friction and wind on exposed areas of gate. Design wind loads shall be as defined in the structural design criteria section.
21. Hoist and gate shall be designed for condition of debris blocking gate and causing gate to rack without damage to gate and hoist.
22. Gate lowering and raising speed shall be selected with consideration of the time available for responding to decision to operate gate. Gates shall be designed to be completely opened or closed in no more than 30 minutes..
23. Appropriate protective devices (torque cutoffs, etc.) shall be provided to prevent damage to the gate or gate operator if debris blockage or other condition prevents gate closure.
24. NOT USED.
25. The gate structure shall be designed to minimize debris accumulation in the gate closure area. It is not required to design a gate and its hoist system to cut through debris that may have accumulated on water passageway floor. Debris should be considered a canal inspection maintenance issue. Prior to gate closing, the water passage floor should be checked for the presence of debris and the debris removed to permit gates to be lowered and sealed. Design-Builder shall identify and submit the methods or procedures for removal of debris (either built-in features that remove debris or description of activities that must be performed manually to remove debris).
26. Gate and hoist systems shall include provisions for emergency or back-up operation if the primary gate operator system fails. The backup system shall include provision for portable or temporary gate operation that does not rely on manual actuation. The backup

gate operator system shall be designed to completely open or close a gate in no more than 90 minutes.

27. Structural detailing has a significant impact on the susceptibility of the structure to corrosion. During the design process all necessary steps shall be taken to avoid using details that contribute to corrosion problems. Structural detailing practices must allow gate components to be accessible for inspection and maintenance.
28. Structural components shall be designed to tolerate corrosion or be protected against corrosion that may impair the serviceability or operability of the structure.
29. At a minimum, all structural steel shall conform to the acceptable material list below, subject to modification by Design-Builder to assure required design life. Request for substitutions shall be submitted to the USACE District for approval.

Structural Steel	
Shapes (W, WT)	ASTM A992
Shapes (S, M, HP, C)	ASTM A36 or ASTM A572 Grade 50.
Other Shapes (angles)	ASTM A36
Plates and Bars	ASTM A36 or ASTM A570, Grade 50.
Sheets	ASTM A1008 CS Type B or A1011 CS Type B.
Pipe	ASTM A53, Type E or S, Grade B; ASTM A500, Grade B or C; or ASTM A501.
Square and Rectangular Structural Tubing	ASTM A500, Grade B or C.
Bolts and Nuts	
Bolts, High Strength	ASTM A325, Type 1; with verification testing.
Nuts, Heavy-Hex	ASTM A563, grade and finish compatible with bolts.
Washers	
Flat, Hardened	ASTM F436, Type 1.
Lock	ANSI/ASME B18.21.1, helical spring type.
Beveled	ASTM F436.

5.6.3.2. Bulkheads and Stop Logs. Unless otherwise indicated, design and construction of bulkheads and stop log assemblies shall comply with the following general design criteria (references to bulkheads shall mean bulkheads or stop log assemblies):

1. Bulkheads and stop log assemblies shall be designed to seal under the operating conditions specified in Articles 3.1 and 3.2.
2. For bulkheads, Design-Builder shall address leakage testing, how to perform it, and how to make corrections if design leakage is exceeded.
3. Bulkhead design analysis for gates shall be stamped by a licensed Professional Engineer licensed in the State of Louisiana.
4. For Load and Resistance Factor Design (LRFD), a reliability factor $\alpha = .85$ shall be used for all associated structural steel components.
5. For Allowable Stress Design (ASD), bulkheads and all associated structural steel components shall be considered a Type A Hydraulic Steel Structure (HSS). Materials shall be selected that will assure the minimum design life specified in Section 01010, Article 3.1.
6. Bulkhead guides shall be made of corrosion resistance steel (CRES) steel plate where exposed and carbon steel plate and members for embedded parts.
7. Bulkhead seals shall be selected based on industry standards for the type of gate selected, reliability and long service life and minimum effort to replace.
8. Bulkhead fabrication facility shall be an AISC certified facility.
9. Bulkheads shall be designed for a maximum leakage rate of 0.1 gpm per foot of perimeter seal.
10. If bulkhead design incorporates wheels and rollers, CRES steel shall be used to fabricate these components. CRES steel for wheels and rollers shall conform to ASTM Designation A564, Type 630, Condition H1025. CRES steel for wheel and roller axles shall conform to ASTM Designation A564, Type 630, Condition H1150. CRES steel for miscellaneous wheel and roller parts shall conform to ASTM Designation A276, Type 304L. Components of the gate and its support frame/guides required to be of CRES steel shall conform to ASTM Designation A276, Type 304L. Regular bolts and cap screws for stainless steel shall conform to ASTM Designation A320, Class 1A. High-strength bolts and cap screws for stainless steel shall conform to ASTM Designation A320, Class2.
11. All embedded parts for supporting and sealing bulkheads in both the first and second stage concrete shall be included. All the embedded parts shall be designed so they can be securely embedded in supporting reinforced cast-in-place concrete structure.
12. Design-Builder shall select appropriate coatings for exposed surfaces of the bulkheads and their Support Framing and Guides that are not CRES steel. Coatings shall be selected based on environmental exposure and comply with the requirements of the Hurricane and Storm Damage Risk Reduction System Design Guidelines (HSDRRSDG) as identified in Section 01010, Article 4.2.
13. Bulkheads and stop logs shall be equipment with a lifting point to support placement and removal. Adjacent facilities shall be designed to allow placement of any temporary cranes or lifting devices needed to place the bulkheads and stop logs.
14. Structural detailing has a significant impact on the susceptibility of the structure to corrosion. The Design-Builder shall ensure that the detailing shall avoid conditions that contribute to corrosion. During the design process all necessary steps shall be taken to

avoid using details that contribute to corrosion problems. Structural detailing practices must allow gate components to be accessible for inspection and maintenance.

15. Structural components shall be designed to tolerate corrosion or be protected against corrosion that may impair the serviceability or operability of the structure.
16. At a minimum, all structural steel shall conform to the acceptable material list below, subject to modification by Design-Builder to assure required design life. Request for substitutions shall be submitted to the USACE District for approval.

Structural Steel	
Shapes (W, WT)	ASTM A992
Shapes (S, M, HP, C)	ASTM A36 or ASTM A572 Grade 50.
Other Shapes (angles)	ASTM A36
Plates and Bars	ASTM A36 or ASTM A570, Grade 50.
Sheets	ASTM A1008 CS Type B or A1011 CS Type B.
Pipe	ASTM A53, Type E or S, Grade B; ASTM A500, Grade B or C; or ASTM A501.
Square and Rectangular Structural Tubing	ASTM A500, Grade B or C.
Bolts and Nuts	
Bolts, High Strength	ASTM A325, Type 1; with verification testing.
Nuts, Heavy-Hex	ASTM A563, grade and finish compatible with bolts.
Washers	
Flat, Hardened	ASTM F436, Type 1.
Lock	ANSI/ASME B18.21.1, helical spring type.
Beveled	ASTM F436.

5.6.4. Pumps

5.6.4.1. Storm Water Pumps. Unless otherwise stated the main storm water pumps shall comply with the following general design criteria:

1. All pumps shall be designed for proper operation at the installed elevation, ambient temperatures, humidity range, power supply conditions, and service pressure-temperature ratings.
2. All pumps shall be designed for continuous operation unless otherwise noted.
3. All pumps shall have a minimum operating efficiency of 82% at the design operating point (the Peak Flow Design Operating Condition in Table 3.1-1A).
4. In abrasive services, bowl or line shaft bearings on vertical pumps shall be flushed by a screened or protected flushing water supply (where pump bearings are water lubricated).
5. Pump drivers shall be electric motors. Additional requirements for electric motors shall be as defined in Article 5.6.4.5 and in Article 5.10.
6. Electric motors shall have a 1.15 service factor, and shall comply with the latest ANSI, NEMA, and IEEE standards, as a minimum.
7. All pumps shall be non-overloading throughout the entire operating range and shall be sized so that the operating point will be in the mid-range of characteristic curves and reasonably close to maximum efficiency.
8. Impellers shall be dynamically balanced.
9. All pumps shall be provided with a corrosion resistance nameplate containing the manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity, head rating, and other relevant data.
10. The primary canal water pumps shall be defined as Seismic Performance Class III (Critical) equipment.
11. The primary canal pumps shall be capable of passing solids up to 10 inches in diameter.
12. Equipment wetted parts shall be suitable for any abrasive debris in the canal water, as indicated by Design-Builder's geotechnical or soils investigations. In lieu of providing materials designed to resist abrasion, the Design-Builder may provide intake structures or wetwells designed to settle out abrasive grit. Wetted parts shall include suitable materials or coatings to operate for the specified design life without deleterious effects.
13. Spare parts shall be as described in Article 5.13, Spare Parts and Special Tools Criteria
14. All major parts of the pumps shall be furnished with eye bolts, lifting lugs, or equivalent lifting provisions to facilitate handling during operations and maintenance.

Table 5.6-1A summarizes minimum mechanical design criteria for specific pump types.

Table 5.6-1A
Minimum Storm Water Pump Design Criteria

Description	Criteria	Reference	Comments
Horizontal Pumps			
Fluid Service	Canal Water		
Design pH	6 to 10		
Design Salinity	20 ppt		
Casing	Cast Iron or Ductile Iron	ASTM A48, Class 30, or ASTM A395	
Impeller	316 Stainless Steel or Bronze	AISI 316	
Wearing Rings	316 Stainless Steel	AISI 316	
Shaft	316 Stainless Steel or Series 400 Stainless Steel	AISI 316, AISI 400	Alternate materials will be considered if

			suitably coated.
Shaft Sleeve	Low Zinc Bronze	ASTM B62	
Vertical Pumps			
Fluid Service	Canal Water		
Design pH	6 to 10		
Design Salinity	20 ppt		
Pump Bowls	Cast iron	ASTM A48, Class 30	
Impellers	316 stainless steel	AISI 316	
Bowl Wearing Rings	316 stainless steel	AISI 316	
Impeller Wearing Rings	Stainless steel	AISI 316, AISI 400	
Lineshaft	Martensitic stainless steel shaft	AISI 410, AISI 416	Alternate materials will be considered if suitably coated.
Pump Barrel	Steel pipe or ductile iron pipe	AWWA C200, ANSI/AWWA C151/A21.51	
Concrete Volute Pumps			
Fluid Service	Canal Water		
Design pH	6 to 10		
Design Salinity	20 ppt		
Volute Casing	Reinforced concrete		
Casing Cover	D2 Ni Resist	ASTM-A 436 Type 2	
Impeller	CF3M	ASTM-A 743 Type 410	
Casing Wear Ring	CF3M	ASTM-A 743 Type 410	
Shafts / Shaft Sleeve	316 stainless steel	AISI 316	
Bearing Stool	Carbon steel	ASTM-A 107	
Coupling	Carbon steel	ASTM-A 107	
Drive Connection Type	Direct drive or offset with gearbox		

Where Design-Builder proposes to use pump types not listed in Table 5.6-1A, Design-Builder shall use similar appropriate design criteria as their basis, including materials of construction for similar equipment parts.

5.6.4.2. General Service Pumps. Unless otherwise stated the general service pumps (all pumps not covered by Article 5.6.4.1) shall comply with the following general design criteria:

1. All pumps shall be designed for proper operation at the installed elevation, ambient temperatures, humidity range, power supply conditions, and service pressure-temperature ratings.
2. All pumps shall be designed for continuous operation unless otherwise noted.
3. All pumps shall have a minimum operating efficiency of 82% at the rated condition.

4. In abrasive services, bowl or line shaft bearings on vertical pumps shall be flushed by a screened or protected flushing water supply (where pump bearings are water lubricated).
5. Pump drivers shall be electric motors. Additional requirements for electric motors shall be as defined in Article 5.6.4.5 and in Article 5.10.
6. Electric motors shall have a 1.15 service factor, and shall comply with the latest ANSI, NEMA, and IEEE standards, as a minimum.
7. All pumps shall be non-overloading throughout the entire operating range and shall be sized so that the operating point will be in the mid-range of characteristic curves and reasonably close to maximum efficiency.
8. Impellers shall be dynamically balanced.
9. All pumps shall be provided with a corrosion resistance nameplate containing the manufacturer's name, pump size and type, serial number, speed, impeller diameter, capacity, head rating, and other relevant data.
10. General service pumps for auxiliary services shall be defined as Seismic Performance Class II (Important) equipment.
11. Equipment wetted parts shall be suitable for the intended process fluid. Wetted parts shall include suitable materials or coatings to operate for the specified design life without deleterious effects.
12. Spare parts shall be as described in Article 5.13, Spare Parts and Special Tools Criteria
13. All major parts of the pumps shall be furnished with eye bolts, lifting lugs, or equivalent lifting provisions to facilitate handling during operations and maintenance.

Table 5.6-1B summarizes minimum mechanical design criteria for specific general service pump types.

Table 5.6-1B
Minimum General Service Pump Design Criteria

Description	Criteria	Reference	Comments
Vertical Pumps			
Fluid Service	Potable Water or Canal Water		
Design pH	6 to 10		
Design Salinity	20 ppt		For canal water only
Pump Bowls	Cast iron	ASTM A48, Class 30	
Impellers	316 stainless steel	AISI 316	Carbon steel is acceptable for clean water applications (filtered, low salinity)
Bowl Wearing Rings	316 stainless steel	AISI 316	Carbon steel is acceptable for clean water applications (filtered, low salinity)
Impeller Wearing Rings	Stainless steel	AISI 316, AISI 400	Carbon steel is acceptable for clean water applications (filtered, low salinity)
Lineshaft	Martensitic stainless steel shaft	AISI 410, AISI 416	Alternate materials will be considered if suitably coated.
Pump Barrel	Steel pipe or ductile iron	AWWA C200, ANSI/AWWA	

	pipe	C151/A21.51	
Horizontal Pumps			
Fluid Service	Potable Water or Canal Water		
Design pH	6 to 10		
Design Salinity	20 ppt		For canal water only
Casing	Cast Iron or Ductile Iron	ASTM A48, Class 30, or ASTM A395	
Impeller	316 Stainless Steel or Bronze	AISI 316	Carbon steel is acceptable for clean water applications (filtered, low salinity)
Wearing Rings	316 Stainless Steel	AISI 316	Carbon steel is acceptable for clean water applications (filtered, low salinity)
Shaft	316 Stainless Steel or Series 400 Stainless Steel	AISI 316, AISI 400	Carbon steel is acceptable for clean water applications (filtered, low salinity)
Shaft Sleeve	Low Zinc Bronze	ASTM B62	
Sump and Dewatering Pumps			
Fluid Service	Rain Water or Canal Water		
Design pH	6 to 10		
Design Salinity	20 ppt		For canal water only
Stator Housing and Pump Casing	Cast Iron	ASTM A48	
Impeller	Cast Iron	ASTM A48	
Shaft	316 stainless steel	AISI 316	
Mechanical Seals	Single type, with ceramic and carbon seal faces		
Coating	Epoxy primer and finish		
Accessories	Guiderail removal system		For submerged or pit mounted applications
Fuel Transfer Pumps			
Fluid Service	Diesel Fuel		
Design pH	8 to 10		
Pump Type	Motor driven gear pump		
Construction Material	316 stainless steel		
Seals / Glands	PTFE		

Where Design-Builder proposes to use pump types not listed in Table 5.6-1B, Design-Builder shall use similar appropriate design criteria as their basis, including materials of construction for similar equipment parts.

5.6.5. Valves

5.6.5.1. Storm Water Pump Discharge Valves. Unless otherwise stated valves used in the discharge piping of the main storm water pumps shall comply with the following general design criteria:

1. All valves shall be provided with a corrosion resistance nameplate containing the manufacturer's name, valve size and pressure rating, serial number, and other relevant data.
2. All exposed bolts, nuts, washers, and miscellaneous valve hardware for exposed valves shall be stainless steel.
3. Equipment wetted parts shall be suitable for any abrasive debris in the canal water, as indicated by Design-Builder's geotechnical or soils investigations. In lieu of providing materials designed to resist abrasion, the Design-Builder may provide intake structures or wetwells designed to settle out abrasive grit. Wetted parts shall include suitable materials or coatings to operate for the specified design life without deleterious effects.
4. All valve actuators or hand-wheels shall be located as to be easily accessed for operation.
5. Each valve (except self actuated valves such as check valves and pressure reducing valves) shall be provided with a valve actuator designed specifically for operating the respective valve under the design conditions. Actuators shall be properly sized for the valve size, torque requirements, flow conditions, and pressure conditions. Gear boxes and reducers shall be provided as needed. Actuator bodies and control housings shall be suitable for the environment in which they will be installed. Mechanical or automatic controls shall be provided as required by the RFP or as required to support the Design-Builder's proposed operating scheme.
6. Spare parts shall be as described in Article 5.13, Spare Parts and Special Tools Criteria

Table 5.6-2A summarizes minimum mechanical design criteria for specific valve types.

Table 5.6-2A
Minimum Valve Design Criteria

Description	Criteria	Reference	Comments
Gate Valves			
Fluid Service	Canal Water		
Design pH	6 to 10		
Design Salinity	20 ppt		Canal water
Body	Cast Iron or Ductile Iron, Epoxy Lined	ASTM A48, Class 30, or ASTM A395	
Disc	Cast Iron or Ductile Iron, Epoxy Lined	ASTM A48, Class 30, or ASTM A395	
Seats	Low Zinc Bronze	ASTM B62	
Shaft Stem	Series 316 or 400 Stainless Steel	AISI 316, AISI 400	
Check Valves			
Fluid Service	Canal Water		
Design pH	6 to 10		
Design Salinity	20 ppt		Canal water
Body	Cast Iron	ASTM A48, Class 30	
Disc	Cast Iron or Ductile Iron, Epoxy Lined	ASTM A48, Class 30, or ASTM A395	
Seats	316 Stainless Steel	AISI 316	

Where Design-Builder proposes to use valve types not listed in Table 5.6-2A, Design-Builder shall use similar appropriate design criteria as their basis, including materials of construction for similar equipment parts.

5.6.5.2. General Service Valves. Unless otherwise stated general service valves (all valves not covered by Article 5.6.5.1) shall comply with the following general design criteria:

1. All valves shall be provided with a corrosion resistance nameplate containing the manufacturer's name, valve size and pressure rating, serial number, and other relevant data.
2. All exposed bolts, nuts, washers, and miscellaneous valve hardware for exposed valves shall be stainless steel.
3. All exposed bolts, nuts, washers, and miscellaneous valve hardware for buried valves shall be dielectric coated carbon steel.
4. Equipment wetted parts shall be suitable for the intended process fluid. Wetted parts shall include suitable materials or coatings to operate for the specified design life without deleterious effects.
5. All valve actuators or hand-wheels shall be located as to be easily accessed for operation.
6. Each valve (except self actuated valves such as check valves and pressure reducing valves) shall be provided with a valve actuator designed specifically for operating the respective valve under the design conditions. Actuators shall be properly sized for the valve size, torque requirements, flow conditions, and pressure conditions. Gear boxes and reducers shall be provided as needed. Actuator bodies and control housings shall be suitable for the environment in which they will be installed. Mechanical or automatic controls shall be provided as required by the RFP or as required to support the Design-Builder's proposed operating scheme.
7. Spare parts shall be as described in Article 5.13, Spare Parts and Special Tools Criteria

Table 5.6-2A summarizes minimum mechanical design criteria for specific valve types.

Table 5.6-2A
Minimum Valve Design Criteria

Description	Criteria	Reference	Comments
Gate Valves			
Fluid Service	Canal Water or Potable Water		
Design pH	6 to 10		
Design Salinity	20 ppt		Canal water
Body	Cast Iron or Ductile Iron, Epoxy Lined	ASTM A48, Class 30, or ASTM A395	
Disc	Cast Iron or Ductile Iron, Epoxy Lined	ASTM A48, Class 30, or ASTM A395	
Seats	Low Zinc Bronze	ASTM B62	
Shaft Stem	Series 316 or 400 Stainless Steel	AISI 316, AISI 400	
Plug Valves			
Fluid Service	Canal Water or Potable Water		
Design pH	6 to 10		
Design Salinity	20 ppt		Canal water

Body	Cast Iron or Ductile Iron, Epoxy Lined	ASTM A48, Class 30, or ASTM A395	
Plug	Cast Iron or Ductile Iron, Epoxy Lined	ASTM A48, Class 30, or ASTM A395	
Seats	Nickel or 316 Stainless Steel	AISI 316	
Check Valves			
Fluid Service	Canal Water or Potable Water		
Design pH	6 to 10		
Design Salinity	20 ppt		Canal water
Body	Cast Iron	ASTM A48, Class 30	
Disc	Cast Iron or Ductile Iron, Epoxy Lined	ASTM A48, Class 30, or ASTM A395	
Seats	316 Stainless Steel	AISI 316	
Ball Valves, Plug Valves, Gates Valves, Check Valves			
Fluid Service	Diesel Fuel		
Body	Carbon Steel	ASTM A105	
Disc or Ball	Stainless Steel	AISI 316	
Seats	Teflon		

Where Design-Builder proposes to use valve types not listed in Table 5.6-2B, Design-Builder shall use similar appropriate design criteria as their basis, including materials of construction for similar equipment parts.

5.6.6. Piping

5.6.6.1. Storm Water Pump Discharge Piping. Unless otherwise stated storm water pump discharge piping materials and design shall comply with the following general design criteria:

1. Piping and related pump systems shall be designed with a maximum suction velocity of 5 feet per second. Higher suction velocities shall be allowed in a bell or FSI suction if required by the design and as allowed by Hydraulic Institute standards.
2. Piping and related pump system shall be design with a maximum discharge velocity as allowed by Hydraulic Institute standards.
3. Pipe and fitting materials, wall thickness, pressure rating, and coating shall be selected to match the intended service and design life.
4. Pipes subject to vacuum or pressure conditions shall be provided with appropriate relief systems.
5. Piping shall be suitable for any abrasive debris in the canal water. Piping shall include suitable materials or coatings to operate for the specified design life without deleterious effects.
6. All exposed piping shall be either painted (steel and ductile iron piping) or provided with color coded tape markings to indicate the service of the pipe. Paint and tape color coding systems shall match the local stakeholder standards.

Pipeline materials shall be as indicated in Table 5.6-3A. Alternate materials may be considered if the Design-Builder can show suitability for intended service and required design life.

Table 5.6-3A

Pipeline Materials

Service or Process Fluid	Fluid Characterstics	Acceptable Materials	Comments
Canal Water	pH = 6.0 to 10.0 Salinity = 20ppt	Lined carbon steel (CS)	

5.6.6.2. General Service Piping. Unless otherwise stated general service piping materials and design shall comply with the following general design criteria:

1. Piping and related pump systems shall be designed with a maximum suction velocity of 5 feet per second.
2. Piping and related pump system shall be design with a maximum discharge velocity of between 8 and 10 feet per second.
3. Pipe and fitting materials, wall thickness, pressure rating, and coating shall be selected to match the intended service and design life.
4. Pipe cover for buried pipe shall be as required by the maximum expected surface load on the pipe, including mobile cranes for equipment service. Pipe cover for buried pipe shall be a minimum of four (4) feet in paved areas and a minimum of four (4) feet in unpaved areas.
5. Pipes subject to vacuum or pressure conditions shall be provided with appropriate relief systems.
6. Piping shall be suitable for the intended process fluid. Piping shall include suitable materials or coatings to operate for the specified design life without deleterious effects.
7. All exposed piping shall be either painted (steel and ductile iron piping) or provided with color coded tape markings to indicate the service of the pipe. Paint and tape color coding systems shall match the local stakeholder standards.

Pipeline materials shall be as indicated in Table 5.6-3B. Alternate materials may be considered if the Design-Builder can show suitability for intended service and required design life.

Table 5.6-3B
Pipeline Materials

Service or Process Fluid	Fluid Characterstics	Acceptable Materials	Comments
Canal Water	pH = 6.0 to 10.0 Salinity = 20ppt	Lined carbon steel (CS)	
Potable Water	pH = 6.0 to 8.0	Ductile iron pipe (DIP), Copper pipe (CU)	
Service Water (or Treated Canal Water)	pH = 6.0 to 10.0 Salinity = 20ppt	Lined carbon steel (CS), Ductile iron pipe (DIP)	
Hydraulic Fluid	TBD by Design-Builder	Stainless steel tubing (SS)	
Equipment Drains	pH = 6.0 to 10.0 Salinity = 20ppt	Galvanized steel pipe (GSP),	
Building Drains	pH = 6.0 to 10.0 Salinity = 20ppt	Cast-iron soil pipe (CISP)	
Diesel Fuel	--	Carbon steel (CS)	ASTM A53, Schedule 40
Compressed Air	N/A	Stainless steel tubing (SS)	
Rainwater	pH = 6.0 to 8.0	Reinforced concrete pipe (RCP),	
Sanitary Waste	--	Polyvinyl Chloride (PVC),	

		Acrylonitrile Butadiene (ABS)	
Fire water (ring main)	pH = 6.0 to 8.0	Ductile iron pipe (DIP)	
Fire Sprinklers	pH = 6.0 to 8.0	Galvanized steel pipe (GSP)	(If required)

5.6.7. Diesel Engine Generator Equipment

Unless otherwise stated all diesel engine generator units and design shall comply with the following general design criteria:

1. Each generator shall be a skid-mounted package unit, fully shop assembled, wired and tested, requiring no field assembly of critical moving parts.
2. Each diesel generator set shall be a standard product of the manufacturer.
3. All generators shall be located inside a separate building designed in accordance with Article 5.5, Structural Design Criteria.
4. Generator electrical output shall be coordinated with the associated power distribution design.
5. Each engine generator shall be designed for continuous duty.
6. Each generator shall be designed for a maximum noise level of 70 dBA at 25 feet.
7. Each engine generator shall be provided with appropriate exhaust systems to comply with both noise and emissions requirements.
8. Each engine generator shall be provided with a hospital grade muffler.
9. Engines shall be air or electric start. All generators 200KW and larger shall be air start. If electric start generators are provided, redundant starters and battery charging systems shall be provided. Electric start generators shall utilize 24 VDC batteries and starting systems.
10. Starting valves (air) shall be quick acting full-flow type with pressure regulator located directly above the starting valve.
11. Diesel fuel piping shall be provided with suitable containment to prevent fuel leaks into unprotected portions of the site.
12. Fuel day tanks shall be designed to ensure no loss of prime of the fuel pump and piping.
13. Fuel tank monitoring and leak detection shall be provided.
14. Engine generator equipment design shall be designed to facilitate ease of normal scheduled maintenance and lubrication.
15. Fuel tanks shall be double-wall construction or provided with other code compliant containment measures.
16. Engine generator exhaust configurations shall be designed to operate in the design wind loads indicated in the Structural Design Criteria and to prevent rain or moisture entry through the exhaust systems.
17. Each engine generator shall include interfaces to allow remote monitoring of critical generator performance.
18. Spare parts shall be as described in Article 5.13, Spare Parts and Special Tools Criteria.
19. Each engine-generator shall automatically start, synchronize, and connect to the electrical load when initiated from the automatic controls. Design-Builder shall coordinate all electrical switchgear, paralleling hardware, synchronization controls, and transfer switch hardware with the overall engine-generator and electrical distribution system design.

5.6.8. Compressed Air Equipment

Unless otherwise stated all compressed air systems and design shall comply with the following general design criteria:

1. Each compressor system shall include redundant compressor units, redundant pressure based controls, a receiver, air dryers (for services requiring instrument grade air), filters, pressure regulation devices, aftercoolers, instrumentation, interconnecting piping, and other equipment as required.
2. If the compressed air system is required for operation of the facility (i.e. for purposes other than service air for tools), air receivers shall be redundant.
3. Air receivers for valve or gate actuator service shall, as a minimum, be sized to allow one full open/close cycle of all connected gates and valves without available compressors.
4. Air receivers for diesel engine-generator starting service shall be sized to ensure that sufficient air is available to start all generators in a power outage (or to start a sufficient number of generators such that the compressed air system can be operated on generator power). Receivers shall be sized for a minimum of 5 consecutive starts with a 2 minute interval between starts.
5. Compressors shall be provided with sound attenuating enclosures meeting OSHA requirements.
6. Unloading or relief valves and piping shall be provided with a silencer or other means of reducing noise.
7. Compressor systems shall include integral and remote controls to maintain the required air pressure and to allow remote monitoring of system status.
8. Receivers shall be ASME code tanks.
9. Spare parts shall be as described in Article 5.13, Spare Parts and Special Tools Criteria.

5.6.9. Screening Equipment

Unless otherwise stated all intake screens and related design shall comply with the following general design criteria:

1. Each screen shall be designed of materials suitable for the design life requirements in the design operating conditions.
2. Each screen shall consist of a fixed trash rack and an automated cleaner mechanism.
3. The rack assembly and related structure shall be designed to withstand the differential loading of water in the pumping direction. This shall be considered as a fully plugged rack at the maximum upstream canal elevation (SWE) and minimum downstream elevation in the pump bay (empty pump bay).
4. Trash racks should have ample net area so that the velocity through the gross rack area does not exceed the flow ratings of the rack (as determine by the rack supplier). Bar spacing shall be coordinated with the pump manufacturer.
5. Screen cleaners shall be provided with manual operating controls and automatic level and headloss controls to initiate screen cleaning.
6. Screen cleaners shall be provided with protective interlocks to prevent damage from binding or overload of screen motors and related components.
7. Screen cleaners shall be climber type screens designed such that the entire screen/rack is cleaned in a single screening cycle. Screens that clean only a portion of the screening area in a single screening cycle are not acceptable.
8. Screen cleaners shall be operable during storm events in the design wind loads (design wind loads identified in Table 5.5-4).
9. Spare parts shall be as described in Article 5.13, Spare Parts and Special Tools Criteria.

5.6.10. Diesel Engine Pump Drivers

Direct drive diesel (or other fuel source) engine pump drivers shall not be utilized in the Design-Builder's solution.

5.7 Plumbing Design Criteria

5.7.1 Design Codes and Standards

Applicable standards shall be as listed in Article 4.1, Industry Criteria and Article 4.2, Corps Criteria.

5.7.2 General Design Criteria.

Unless otherwise stated all plumbing systems and related design shall comply with the following general design criteria:

1. All floor drains, bell-up drains, or funnel drains, connected to the sanitary drainage system shall be provided with traps and vents. Where individual vents cannot be provided for each trap due to physical constraints, a combination waste and vent system shall be utilized.
2. Piping runs shall be as short and direct as possible. Piping shall not be run through electrical rooms or above any electrical equipment, motors, or motor control centers. Piping shall be arranged to provide for access to equipment and valves to facilitate both normal maintenance of the equipment and removal of the equipment if needed for maintenance and inspection.
3. All low points shall be provided with a suitable drain, and piping systems shall be designed to provide complete drainage of piping and equipment. All high points of lines shall be provided with a valved manual vent.
4. All equipment and fixture piping shall be provided with isolation valves.
5. General floor drainage shall be provided in the process areas of the pump room. Floor drainage shall be provided in the toilet areas. Floor drainage below grade or that which shall not discharge by gravity shall be routed to a sump with a duplex submersible sewage type pump system. The submersible sewage pumps shall discharge to a gravity line that connects to the sanitary sewer.
6. Primary and secondary roof drainage systems shall be provided for all flat roofed areas. The primary systems shall consist of roof drains and interior piping which shall discharge above grade to splash blocks or to the below grade storm (rainwater) drainage system. The secondary system shall consist of overflow roof drains set at an elevation two inches above the primary roof drains.
7. Potable water systems shall be provided in accordance with local codes and standards, and as required to support the storm-proofing requirements. Protection of the potable water system shall be provided in accordance with local codes or standards.
8. Hose faucets shall be provided in unfinished and exterior areas that may require periodic washdown on intervals that allow a 50 ft hose to serve.
9. Cold water piping that is over equipment, walkways, ceiling spaces or other areas where condensate dripage would cause damage or be a nuisance, shall be insulated.
10. Before the potable water system is placed in operation, it shall be disinfected in accordance with the requirements of the local authority having jurisdiction.

5.7.3 Plumbing Design Conditions. Plumbing design conditions are listed in the following table.

SITE ELEVATION (2) Above sea level, ft	0.0
SITE LOCATION	

North Latitude, degrees	29.9
West Longitude, degrees	90.2
RAINFALL INTENSITY (1)	
Actual, inches/hour	4.5
Design, inches/hour	5.0
(1) The actual rainfall intensity rate is based on a 60 minute duration and 100 year return period. (2) Approximate elevation based available PPS sites. Design-Builder to design all systems to elevations based on final design of their PPS facilities.	

5.8 Heating, Ventilating and Air Conditioning (HVAC) Design Criteria

Applicable standards shall be as listed in Article 4.1, Industry Criteria and Article 4.2, Corps Criteria. All HVAC equipment and systems shall be designed for operation during a hurricane, with wind loads as defined in the Structural Design Criteria.

5.8.1 HVAC General Design Criteria

Unless otherwise stated all HVAC systems and related design shall comply with the following general design criteria:

1. Duct systems shall be designed and routed in a manner that shall facilitate proper support. Systems shall be arranged to provide access to dampers, coils, filters, etc., for maintenance and removal or replacement.
2. Internal acoustical duct liner shall be used as required to minimize equipment noise in the Control Room and any other sensitive areas.
3. Ducts shall be adequately reinforced to prevent pulsations and noise caused by duct pressure changes.
4. Duct systems shall be designed to withstand the maximum pressure (positive or negative) that may be imposed by any fan in the system. Duct materials shall be suitable for the specified design life at the ambient atmosphere.
5. To facilitate servicing, access doors shall be provided at filters, heating and cooling coils, and dampers.
6. Fire dampers must be provided in the ductwork to stop the spread of fire from one fire zone to another. Dampers shall meet NFPA requirements.
7. At air inlets and outlets, air distribution shall be as uniform as possible. The location of air distribution devices shall be coordinated with the architectural features of the space, the equipment layout, and the lighting layout.
8. Louvers shall be specifically designed hurricane or storm proof type louvers designed to operate in the design wind load (as defined in Table 5.5-4, Wind Loads Design Criteria), to survive hurricane blown debris, and resist water penetration in driving rain. All louvers shall be designed and arranged to minimize water penetration. Louvers shall be installed per manufacturer direction to maximize storm resistance features.
9. The air supply to all finished areas shall be filtered as well as all air passing through heating or cooling coils.
10. Insulation shall be provided on duct work for any applications where condensation on the interior or exterior of the duct could occur.
11. Ducts shall be supported as required by applicable SMACNA standards. Adequate support shall be provided to control movement and support the weight of the duct system.

12. Ventilation and air conditioning systems shall be designed following the procedures outlined in the ASHRAE handbooks, all equipment and system sizing shall be based on detailed heat-gain calculations and the following considerations:
    a. Solar gain
    b. Transmission gain
    c. Heat-producing devices
    d. Heat gain from people
    e. Heat gain from outdoor air used for ventilation (A/C design)
    f. Fan motor heat gain
13. Control systems shall be as simple as possible while providing all necessary functions for proper control. Electric or electronic control systems shall be used.
14. The central control room, toilets, spare parts storage, and workroom shall be air conditioned for space temperature control. A packaged air conditioning unit shall be provided. The unit shall be controlled by a room thermostat. The unit shall have electric heat and integral compressors and condensers for cooling.
15. The pump/electrical room and engine generator building shall be heated and intermittently ventilated. Heating shall be supplied by electric heaters, each controlled by a wall thermostat. The ventilation system shall consist of exhaust fans and wall mounted intake louvers for supply. The fans shall be thermostatically controlled.

5.8.2 HVAC Design Conditions. Ambient and indoor design conditions are listed in the following tables.

AMBIENT DESIGN TEMPERATURES (1)	
Winter, design dry bulb, F	30
Summer, design dry bulb/mean coincident wet bulb, F	92/78
CLIMATIC DATA	
Mean Daily Dry Bulb Temperature Range, F	15
No. of Hours between 55 F<Tdb<69 F from 8 am & 4 pm	749
DEGREE DAYS	
Heating (Base 65 F), F Days	1465
Cooling (Base 50 F), F Days	6956
(1) The winter and summer design temperatures are based on the ASHRAE frequency levels 99.6 percent and 1.0 percent, respectively, for New Orleans, LA.	

	Indoor Design Temperatures (F)				
	Summer	**Winter**		**Ventilation**	
	Setpoint	**Design**	**Setpoint**	**Requirements**	**Notes**
AREAS HEATED AND VENTILATED					
Pump/Electrical Room	104	60	55	6 AC/HR (I)	1
Workroom	104	60	55	6 AC/HR (1)	1
AIR CONDITIONED AREAS					
Control Room	78	72	68	20 CFM/person	2
Toilet	78	72	68	100 CFM	3
Spare Parts Storage	78	72	68	1 AC/HR	--
Diesel Engine	104	60	55	6 AC/HR (I)	1

	Indoor Design Temperatures (F)				
	Summer	Winter		Ventilation	
	Setpoint	Design	Setpoint	Requirements	Notes
Generator Building					

AC/HR—designates air changes per hour.
(C)--designates the ventilation system operates continuously.
(I)—designates the ventilation system operates intermittently.

Notes:

1. The ventilation system shall be sized on the more restrictive of the AC/hr listed or the airflow required to maintain the indoor design temperature based on the summer outside design temperature. Sizing shall consider all equipment and engines in the space.
2. Room shall be positively pressurized with respect to adjacent areas or rooms.
3. The exhaust rate shall be based on the most stringent requirement of: 0.5 CFM per square foot of floor area; 75 CFM per water closet or urinal; or 100 CFM minimum.
4. The ventilation rate shall be based on the exhaust requirement or as required by ASHRAE 62-1999 whichever is more stringent.

5.9 Fire Protection Design Criteria

Unless otherwise stated all fire protection systems and related design shall comply with the following general design criteria:

1. The fire protection system shall be designed and installed according to the requirements of NFPA as well as any requirements of local authorities having jurisdiction. The fire protection system shall consist of a backflow preventer, risers with required trim, siamese connection, and piping.
2. The fire protection system shall be designed to provide the required protection during a hurricane event, when no utility water sources are available. Suitable tanks and fire water pumps shall be provided to accommodate this condition. Treated canal water or well water may be used for this service if the Design-Builder can demonstrate proper treatment and reliable operation.
3. The water distribution system for fire fighting shall include all fire mains and hydrants as well as supplies to individual buildings as required.
4. Galvanized hanger assemblies shall be used for the support of galvanized steel piping systems.
5. An NFPA approved fire alarm panel shall be provided in each building of each facility.
6. Electrical rooms shall be designed such that water based fire suppression systems are not required. All critical electrical equipment shall be located in such rooms.

5.10 Electrical Design Criteria

5.10.1 General

This section presents the criteria for the design of the electrical power distribution systems for the project. Electric power for building use will be provided by **ENTERGY.** In general, the major power distribution panels shall be located within climate controlled structures. The intent will be

to provide a safe and reliable means to distribute power. The system shall be designed for ease of use and maintenance.

All electrical components shall be designed to achieve maximum efficiencies over the useful life of the equipment. All electrical equipment shall be designed with access, clearances, and dedicated space as defined by the NEC.

5.10.1.1 Codes and Standards.

Applicable standards shall be as listed in Article 4.1, Industry Criteria and Article 4.2, Corps Criteria. Unless otherwise noted in the list, Design-Builder shall utilize the latest revision of the listed standards in their design.

5.10.2 Major Electrical Equipment and Distribution

Electrical power distribution at each PPS facility shall consist of the following principal systems:

- Power system for storm pump operation
  - Diesel generators for powering the entire PPS load
  - Transformers/substations as needed
  - Switchgear and paralleling equipment
  - Motor control equipment
- Power system for building service loads
  - ENTERGY feed for normal service use
  - Automatic transfer switch to switch from ENTERGY feed to the onsite generation system for storm event use
  - Power distribution panels

The onsite power generation located at each of the three new PPS facilities shall be capable of powering the entire load at the respective PPS. Electrical power for building use shall be by utility feed (from Entergy) and backed up by the onsite generation system. All other loads shall be powered only from the local on-site power source provided by the Design-Builder.

The on-site power generation system design shall provide sufficient redundancy such that with the loss of 20% of the generating capacity, the respective pumping station shall have the capability to provide power to run the pumps at the design operating capacity. Design of the power generating and distribution system shall be such that diesel driven engine generating equipment shall not run for extended periods (except startup and shutdown) at less than 30% of full load under any pumping conditions, including testing and maintenance. Load banks may be used if required.

Three phase UPS systems shall be provided at each PPS for intermediate down time between loss of utility power and the availability of onsite power. This shall apply only to the limited loads that are utility powered (building services only). Backup time for the three phase UPS shall be determined by the Design-Builder based on the time required for their onsite power solution to produce stable power, but shall be a minimum of 5 minutes.

The storm pump power distribution system shall be primary and secondary selective. It shall be designed to provide sufficient redundancy so no single fault or loss of power shall disrupt more than one distribution bus. Buses shall be fully redundant so that loss of one bus does not prevent operation of the facility at the design operating capacity. In addition, loss of one bus shall not affect availability of power to building services. All pumps and process equipment shall be powered from the on-site generation substation. In the event of a storm emergency, all load, including building service, shall be powered from the on-site generation. Automatic transfer

switching shall be provided to switch building service load to on-site generation. Fuel for the generators shall be diesel. Diesel storage capacity shall be sized to run all pumps at the respective PPS, plus building service loads, for 5 days.

Building service power distribution system at each station shall receive one power feed from **ENTERGY**, for building power, at a voltage to be coordinated by the Design-Builder with ENTERGY. The Design-Builder is responsible for coordinating any final ENTERGY connections with ENTERGY. If the Entergy feeder is distributed overhead to the PPS site it shall transition underground prior to reaching the pumping station. Metering shall be at the incoming voltage level. This utility service shall be used for all building service loads under normal conditions. The utility service shall also power the equipment that will serve to start the on-site generators (battery chargers or air compressors, etc.). The power generation and electrical system shall be designed such that upon loss of utility power, the respective station power system can be started and all loads run from the onsite power system.

5.10.2.1 Distribution Voltage Selection. Standard grounded systems for plant voltages shall be used. One of the following voltages should be selected, depending on load characteristics and location:

1. 35,000 volts, grounded wye, 3-phase (low-impedance grounded)
2. 12,400 volts, grounded wye, 3-phase (low-impedance grounded)
3. 4,160 volts, grounded wye, 3-phase (low-impedance grounded)
4. 480/277 volts, solidly grounded wye, 3-phase
5. 208/120 volts, solidly grounded wye, 3-phase
6. 120/240 volts, solidly grounded, single-phase
7. 120 volts, solidly grounded, uninterrupted power supply (UPS)
8. 12 or 120 volts DC, emergency lighting

5.10.2.2 Utilization Voltages. The following equipment voltages shall be utilized:

1.	Fluorescent lighting	120 volts, single-phase
2.	Emergency lighting	12 or 120 volts DC
3.	High-press sodium lighting	120 or 208 volts, single-phase
4.	Incandescent lighting	120 volts, single-phase
5.	Convenience outlets	120 volts, single-phase
6.	UPS	120 volts, single-phase
7.	Motor control	120 volts, single-phase
8.	Motors, < 1/2 hp	120 volts, single-phase
9.	Motors, 1/2 to 300 hp	480 volts, three-phase
10.	Motors, > 600 hp	4,160 volts, three-phase

5.10.2.3 Voltage Drop. Steady-state voltage drop shall be calculated for all circuits from source to load. Calculations for motor circuits should be developed on the basis of an 80 percent power factor and motor efficiency based on horse power of motor. Design must not exceed the following total voltage drops from the source bus (excluding site distribution) to the feeder, branch circuit, and transformer:

1.	Interior lighting	3 percent
2.	Exterior/gallery lighting	5 percent
3.	Motors	5 percent
4.	Receptacles	3 percent
5.	Electrical heaters	4 percent

The voltage drop shall be calculated for starting the motor if the motor exceeds the serving transformer capacity.

5.10.2.4 Demand Factors. The design shall consider the following demand factors for sizing switchgear, panel boards, feeder breakers, feeder conductors, and transformers:

	Service	Demand Factor
1.	Lighting	1.0 x connected load
2.	Emergency lighting	1.0 x connected load
3.	Air conditioning equipment	0.8 x connected load
4.	Ventilation equipment	0.8 x connected load
5.	Pumps	1.0 x connected load
6.	Convenience receptacles	1.5 ampere, each
7.	Other Process loads	0.8 x connected load

The connected load shall be used for sizing all branch circuits.

5.10.2.5 Branch Circuits. Connected load and NEC requirements shall be used for sizing branch circuit breakers and conductors, except for motor loads. Designs shall follow these guidelines:

1. Wire sizes for branch circuits shall be as required by the NEC or other applicable local code.

2. Lighting and receptacle loads shall not be combined on the same branch circuit.

3. The number of convenience receptacles on any one branch circuit shall be limited to five duplex in process areas and six duplex in other areas.

4. Critical process instrumentation loads shall be connected to a UPS.

5. Maximum load on branch circuits shall not exceed 80%.
6. Normal voltage of branch circuits shall not exceed values permitted by NEC.

5.10.2.6 Distribution Equipment. All distribution switchgear and MCC units shall be "double ended", with each switchgear line or MCC shall having two main protective devices, one associated with each of two incoming main power supply circuits, and one bus tie switching device which allows the two halves of the main bus to be powered independently. Under normal operating conditions, the bus tie switch is open and each half of the bus is powered by one of the incoming power supply circuits. If necessary, the bus tie switch and one main protective device can be closed and the entire bus powered by the operative incoming main power supply circuit.

The two main supply circuit breakers and the bus tie circuit breaker shall be key-interlocked to prevent more than two of the three circuit breakers or switches being closed at any time.

Electrical loads shall be distributed evenly between the two buses.

Each main circuit breaker or protective device shall have solid-state, three-phase metering for volts, amps, kilowatts, and power factor. The metering system shall be capable of recording peak demand, fault data, and other data.

Multi-section distribution equipment shall be connected together with an equipment grounding conductor or an equivalent equipment grounding bus sized in accordance with NEC. For single-section distribution equipment, grounding conductors shall be connected to the equipment's grounding bus or to a grounding termination point.

The metering equipment shall provide a suitable output signal, which is field selectable for remote monitoring of any of the metering parameters recorded. The output signal shall be interfaced with the facility control system and configured for remote monitoring and alarming.

Transformers shall be fully redundant and sized to carry all essential and non-critical loads connected to both sides of the bus. Transformers shall have line surge protection, cooling fans, automatic fan controls, and temperature-sensitive alarms.

The following types of equipment shall be used for the medium and low-voltage distribution systems:

1. **Power Transformers:** Indoor type shall be cast coil dry type. Outdoor type shall be liquid-filled pad-mounted or substation class. Cooling fans or provision for fans shall be included on all power distribution transformers. Transformers with secondary voltages of 480 volt 3-phase shall be limited in size to 750 kVA, where possible, and specified with 5.75 percent impedance. Transformers that supply 208Y/120-volt lighting requirements and indoor transformers that supply 480Y/277-volt power distribution requirements shall be dry type and suitable for the area in which they are to be located.

2. **Medium Voltage Switchgear:** 15 kV class, indoor or outdoor non-walk-in, metal clad switchgear, 2-high construction with vacuum circuit breakers and copper bus shall be used.

3. **Medium Voltage Motor Control:** Draw-out type vacuum contactors with current limiting fuses in NEMA one gasketed enclosure for indoor application, two-high construction.

4. **Low Voltage Switchgear:** 600-volt, indoor or outdoor non-walk-in, metal clad switchgear.

5. **Low Voltage Switchboard:** 100 percent rated, insulated case, individually mounted circuit breakers with solid-state trip for mains and feeders 600 amperes and larger. Smaller feeder breakers shall be molded case with solid state trips.

6. **Low Voltage Motor Control Center:** Indoor, class II, type B wiring motor control center (MCC) shall be used. Supply circuit to MCCs shall be 480 volts, three-phase, 3-wire. Overloads shall be nonambient-compensated unless such compensation is needed, for instance, at submerged pumps. Provide a minimum of 10 percent spare space in each MCC for addition of future breakers or starters (in addition to any identified known future loads). Allow space for at least one future vertical section at each MCC.

7. **Low Voltage Motor Control Center Main Circuit Breakers:** 100 percent rated molded case with solid state trips.

8. **Low Voltage Motor Control Center Branch Circuit Breakers (other than combination motor starters):** molded case thermal magnetic.

9. **Low Voltage Feeder Circuit Breakers in MCCs and Power Distribution Panelboards,**

400-ampere and Larger: molded case solid-state trip, 100 percent rated. Smaller circuit breakers shall be molded case thermal magnetic.

10. Equipment shall have adequate momentary and interrupting capacity to withstand fault currents that may occur at the point in the system where the equipment is applied. Each circuit breaker that is located immediately downstream from the secondary main on a 480Y/277-volt secondary transformer shall be equipped with ground fault protection unless that circuit breaker is rated 200 amps or less. Each circuit breaker protecting a motor of 100 horsepower or more shall be equipped with ground fault protection. Ground fault protection on motors shall be instantaneous type and ground fault protection on main breakers and feeder breakers shall be equipped with time delay setting and restraint systems.
11. Distribution equipment shall be marked according to the NEC and such markings shall be plainly visible after installation. Marking shall also include common power bus current rating and short-circuit rating.

12. Magnetic only circuit breakers shall be provided as a branch circuit protection in motor starters for all motors 50 hp and smaller. Branch circuit protection for larger motors shall be provided by thermal magnetic breakers with adjustable magnetic trips.

13. Distribution panelboards shall be provided with main circuit breaker sized to match the supply transformer capacity.

14. Lighting panelboards shall be provided with main circuit breaker sized to match the lighting transformer capacity.

15. Panelboards shall be surface mounted in process areas and flush mounted in office or other finished areas.

16. Separate panelboards shall be provided to supply power to instruments and control panels where the equipment to be supplied requires a conditioned or UPS power supply.

17. Each panelboard shall have a minimum of 20 percent spare breakers with spaces, bus work, and terminations to complete the standard size panelboard.

18. Panelboard schedules shall show the circuit description, protective device trip rating, number of poles, rating of main lugs or main circuit breaker, neutral bus size, ground bus size, and interrupting rating of breakers. Computer-generated panelboard schedules shall be included in the design.

19. Design-Builder shall perform an arc flash study in accordance with IEEE standards.

5.10.2.7 Convenience Receptacles. Convenience receptacles for general service shall be as required by code, but shall be spaced not more than 40 feet apart inside all process building and 75 feet apart in outside process. In addition, provisions for receptacles at all air conditioning units and air handling units shall be made as required by NEC.

Outlets shall be GFCI type receptacles and shall be weatherproof type unless located 48 inches above the floor. All receptacles located outdoors shall be twist lock type.

5.10.2.8 Ground Fault. Ground fault systems shall be zero sequence type. Facilities shall be provided for testing the ground fault circuit by secondary current injection, with or without tripping and for indicating the occurrence of a ground fault. Current and time trip levels shall be

adjustable. In general, this means that ground fault shall have to be supplied external to the circuit breaker. Motor ground fault shall be an instantaneous trip.

5.10.2.9 Power Factor. Power factor correction parallel capacitors shall be applied to correct power factor to 95% at all motor starters for motors rated 100 hp and larger. Capacitors shall be installed at the motor where possible with connection between the motor starter contactor and the overload heaters. Capacitors shall not be applied where they shall be connected to a bus that also supplies adjustable frequency drives.

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

Underground circuits that are critical to operation of the respective PPS shall be routed in an underground duct bank consisting of concrete-encased, polyvinyl chloride (PVC). Adequate separation and interference protection shall be provided in duct banks. The following systems shall be grouped in separate ductbanks or otherwise separated to prevent electrical (signal) interference, induced currents, or other adverse effects:

1. Power wiring above 600 volts

2. Power and discrete control wiring below 600 volts

3. Process instrumentation analog and communication wiring, including 24-volt discrete signals, intrinsically safe circuits and LAN/WAN computer circuits shall be routed in steel conduit. Intrinsically safe circuits and computer circuits shall be carried through handholes and manholes in conduit.

Duct banks shall include a minimum of two spare conduits. Non-critical circuits can be installed in underground raceways that are not installed in a duct bank and shall be direct buried, schedule 40 PVC conduit.

Except as indicated below, all raceway sizing, selection, and installation shall be in accordance with the NEC or applicable local electrical code. Additional requirements shall be as listed below:

1. Raceways in duct banks shall not be smaller than 2-inches.

2. Raceways in walls and ceilings of control rooms, offices, and all areas with finished interiors shall be concealed.

3. The number of conduit bends shall be limited to an equivalent of 270 degrees on long runs.

4. Exterior, exposed conduit shall be PVC-coated rigid galvanized steel.

5. Interior, concealed conduit shall be electrical metallic tubing (EMT) in frame construction and finished ceiling spaces.

5.10.2.11 Cable. Cable selection and sizing shall be in accordance with the NEC and applicable local codes.

For all lighting and power wiring of 600 volts and below, use stranded copper conductors. Solid conductors shall be used for No. 10 AWG and smaller where required by wiring devices. Stranded conductors shall be used for other applications.

Instrument cable shall be twisted-shielded pair control cable with individual stranded copper conductors and an aluminum Mylar tape shield around the pair. Multi-pair cables shall be used where grouping of circuits is practical.

Special interconnecting cable for instruments, control system components, and other equipment shall be as recommended by the respective equipment supplier.

5.10.2.12 Grounding. Load centers shall be bonded to a grounding electrode, which may consist of a building steel column that is bonded to the underground rebar, or a made electrode system (triad or connection to ground loop around the building). In addition, ground rods shall be driven outside all buildings to supplement the ground electrode where the supply transformer size for that building exceeds 150 kVA.

Grounding electrodes of ground mats or embedded rods and cables shall be specified to have a maximum resistance to ground of 3 ohms. Use suitably sized copper conductors for interconnecting ground rods and connection to transformers and switchgear.

The parts of all electrical equipment, pump casings, devices, panelboards, and metallic raceways that do not carry current shall be connected to the ground conductors. The transformer neutrals of wye-connected transformers shall be solidly grounded through a grounding conductor connected to the grounding system.

A ground wire shall be installed in all raceways that contain power conductors at any voltage. The single exception is the medium voltage circuits that use shielded conductors or cable. These circuits shall not have a separate ground conductor in the conduit.

5.10.2.13 Electric Motors. The following articles cover both general purpose electric motors (for auxiliary service equipment) and stormwater pump service electric motors (for the primary PPS stormwater pumps).

5.10.2.13.1 General Purpose Electric Motors. General purpose electric motor requirements shall apply to all motors except those for the primary storm water pumps. The materials and methods of construction shall represent the current industry best practices, which shall be considered minimum standards for performance.

5.10.2.13.1.1. The motor shall have a continuous service factor of 1.15 times the nameplate horsepower with a one minute rating of 1.50 times the nameplate horsepower. The service factor will be available at 60 degree C rise by resistance with a 40 degree C ambient temperature.

5.10.2.13.1.2. The starting torque, breakdown torque and other characteristics shall be similar to NEMA Design “B” standards. Expected efficiences are full load 92%; ¾ load 92%; ½ load 91%; with a full load power factor of 88%. Minimum efficiency shall not be less than 90.5%.

5.10.2.13.1.3. The starting condition, KVA per horsepower, when started at full voltage shall conform to NEMA Code “E”.

5.10.2.13.1.4. The motors will be reduced voltage by primary reactor furnished by the Design-Builder. The Design-Builder shall be responsible for providing a recommended initial tap volts and time duration for operation of the most effective reactor based reduced voltage startup. The

Design-Builder shall evaluate 50%, 65%, and 80% tap settings for adequacy of acceleration torque. Design of the motor and driven equipment combination shall be based upon the worst case condition of either across the line or reduced voltage starting. Evaluation shall be part of the design submittals described in Section 01012, Design After Award.

5.10.2.13.1.5. Rotor construction shall be copper bar-type with brazed end rings.

5.10.2.13.1.6. Thrust bearings shall be Kingsbury Type or anti-friction spherical roller thrust bearing and lower guide bearing supplier from a common oil pot. The thrust bearing rating shall be adequate to satisfy the maximum combined motor and equipment requirement times a 1.25 factor.

5.10.2.13.1.7. The motor rotor shall be dynamically balanced by the two-plane method so that the peak-to-peak amplitude of the vibration produced by the residual unbalance, when measured at the plane of the motor bearings when the rotor is within the balancing machine is less than .0015 inches. The minimum bearing life for all motor bearings shall be a minimum B-10 bearing life of 100,000 hours.

5.10.2.13.1.8. A non-reverse mechanism shall be provided within the top shrouding of the motor frame wit the capability of withstanding a reverse torque that would results from the failure of the vacuum breaker system and a full siphon reverse flow at the design conditions. Drop-pawl types are not acceptable.

5.10.2.13.1.9. Motors shall be minimum open drip-proof design, but shall be designed for the intended operating environment. Motor ventilation openings shall have 316 stainless steel screens with $1/8^{th}$ inch mesh to prevent insect entry. The Class F insulation shall be completed with non-hygroscopic materials and bonded together with epoxy resins. Special fungus treatment shall be provided for all windings, connections, lashing, and other materials susceptible to fungus growth.

5.10.2.13.1.10. The motor shall be vertical or horizontal solid shaft with a machined rabbet fit of the motor base to the receiving motor mounting plate on the equipment.

5.10.2.13.1.11. The bearing oil pot shall be furnished with a sight level gauge and with an oil level switch, and three bearing temperature detectors. All leads shall be wired to a terminal block in the control terminal box.

5.10.2.13.1.12. Two resistance temperature detectors (RTDs) shall be provided for each set of coils in stator slots between coils, wired toa terminal block in the control terminal box. The sensing elements shall be resistance type, 3 wire, 10 ohms at 25 degrees C.

5.10.2.13.1.13. All screws, nuts, bolts, pins, studs, washers, and other similar fittings shall be 316 stainless steel. All metal surfaces both internal and external shall be painted or coated for maximum protection from corrosion.

5.10.2.13.1.14. A main terminal box shall be provided and shall be sized to house power factor correction capacitors (if required) and shall provide ample space to properly join and insulate motor leads, capacitor leads, and external leads with an appropriate entry point for the feeder leads based on the orientation of the motor and the maintenance access locations. The box shall be located to avoid interference with cooling air passages. The capacitors (where required) shall be grouped with an easily removable dust cover over the bushings and fuses. The placement of this cover shall conceal all exposed parts of the corrective capacitor system. The cover to the

terminal box shall be side hinged with two large captive thumb screw wing bolts to secure the cover closed. There shall also be a hasp for locking the cover.

5.10.2.13.1.15. Each motor shall be provided with a space heater. Space heaters shall be sized to prevent condensation, with a minimum temperature rise of 6 degrees C above ambient. Space heater shall be 110/220 volt type, built into the motor frame with leads wired to terminals in the control terminal box. Space heaters shall be powered from the building services power and shall be wired to run whenever the equipment is not operating.

5.10.2.13.1.16. The motor exterior shall be cleaned of grease, rust or scale and painted with the manufacturer's standard primer (one coat) and paint (two coats) for outdoor service (regardless of motor location). Color shall be manufacturer's standard.

5.10.2.13.1.17. The motor shall be designed to allow lifting with the overhead crane using wire rope slings without the use of spreaders or special rigging tools.

5.10.2.13.1.18. Each motor shall be provided with a control terminal box, sized to receive all motor mounted control device input conduit and wiring with bottom conduit entry. Internal barriers shall be provided to separate power wiring from lower power control wiring. The motor supplier shall route all motor mounted control device wiring, which terminates at the control terminal box, in flexible liquid tight conduit.

5.10.2.13.2. Stormwater Pump Service Electric Motors. General purpose electric motor requirements shall apply to motors for the primary storm water pumps. The materials and methods of construction shall represent the current industry best practices, which shall be considered minimum standards for performance.

5.10.2.13.2.1. The motor shall have a continuous service factor of 1.15 times the nameplate horsepower with a one minute rating of 1.50 times the nameplate horsepower. The service factor will be available at 60 degree C rise by resistance with a 40 degree C ambient temperature.

5.10.2.13.2.2. The starting torque, breakdown torque and other characteristics shall be similar to NEMA Design "B" standards. Expected efficiences are full load 92%; ¾ load 92%; ½ load 91%; with a full load power factor of 88%. Minimum efficiency shall not be less than 90.5%.

5.10.2.13.2.3. The starting condition, KVA per horsepower, when started at full voltage shall conform to NEMA Code "E".

5.10.2.13.2.4. The motors will be reduced voltage by primary reactor furnished by the Design-Builder. The Design-Builder shall be responsible for providing a recommended initial tap volts and time duration for operation of the most effective reactor based reduced voltage startup. The Design-Builder shall evaluate 50%, 65%, and 80% tap settings for adequacy of acceleration torque. Design of the motor and pump combination shall be based upon the worst case condition of either across the line or reduced voltage starting. Evaluation shall be part of the design submittals described in Section 01012, Design After Award.

5.10.2.13.2.5. Rotor construction shall be copper bar-type with brazed end rings.

5.10.2.13.2.6. Thrust bearings shall be Kingsbury Type or anti-friction spherical roller thrust bearing and lower guide bearing supplier from a common oil pot. The thrust bearing rating shall be adequate to satisfy the maximum combined motor and pump requirement times a 1.25 factor.

5.10.2.13.2.7. The motor rotor shall be dynamically balanced by the two-plane method so that the peak-to-peak amplitude of the vibration produced by the residual unbalance, when measured at the plane of the motor bearings when the rotor is within the balancing machine is less than .0015 inches. The minimum bearing life for all motor bearings shall be a minimum B-10 bearing life of 100,000 hours.

5.10.2.13.2.8. A non-reverse mechanism shall be provided within the top shrouding of the motor frame wit the capability of withstanding a reverse torque that would results from the failure of the vacuum breaker system and a full siphon reverse flow at the design conditions. Drop-pawl types are not acceptable.

5.10.2.13.2.9. Motors shall be minimum open drip-proof design, but shall be designed for the intended operating environment. Motor ventilation openings shall have 316 stainless steel screens with $1/8^{th}$ inch mesh to prevent insect entry. The Class F insulation shall be completed with non-hygroscopic materials and bonded together with epoxy resins. Special fungus treatment shall be provided for all windings, connections, lashing, and other materials susceptible to fungus growth.

5.10.2.13.2.10. The motor shall be vertical or horizontal solid shaft with a machined rabbet fit of the motor base to the receiving motor mounting plate on the equipment.

5.10.2.13.2.11. The bearing oil pot shall be furnished with a sight level gauge and with an oil level switch, and three bearing temperature detectors. All leads shall be wired to a terminal block in the control terminal box.

5.10.2.13.2.12. Two resistance temperature detectors (RTDs) shall be provided for each set of coils in stator slots between coils, wired toa terminal block in the control terminal box. The sensing elements shall be resistance type, 3 wire, 10 ohms at 25 degrees C.

5.10.2.13.2.13. All screws, nuts, bolts, pins, studs, washers, and other similar fittings shall be 316 stainless steel. All metal surfaces both internal and external shall be painted or coated for maximum protection from corrosion.

5.10.2.13.2.14. A main terminal box shall be provided and shall be sized to house power factor correction capacitors (if required) and shall provide ample space to properly join and insulate motor leads, capacitor leads, and external leads with an appropriate entry point for the feeder leads based on the orientation of the motor and the maintenance access locations. The box shall be located to avoid interference with cooling air passages. The capacitors (where required) shall be grouped with an easily removable dust cover over the bushings and fuses. The placement of this cover shall conceal all exposed parts of the corrective capacitor system. The cover to the terminal box shall be side hinged with two large captive thumb screw wing bolts to secure the cover closed. There shall also be a hasp for locking the cover.

5.10.2.13.2.15. Each motor shall be provided with a space heater. Space heaters shall be sized to prevent condensation, with a minimum temperature rise of 6 degrees C above ambient. Space heater shall be 110/220 volt type, built into the motor frame with leads wired to terminals in the control terminal box. Space heaters shall be powered from the building services power and shall be wired to run whenever the equipment is not operating.

5.10.2.13.2.16. The motor exterior shall be cleaned of grease, rust or scale and painted with the manufacturer's standard primer (one coat) and paint (two coats) for outdoor service (regardless of motor location). Color shall be manufacturer's standard.

5.10.2.13.2.17. The motor shall be designed to allow lifting with the overhead crane using wire rope slings without the use of spreaders or special rigging tools.

5.10.2.13.2.18. Each motor shall be provided with a control terminal box, sized to receive all motor mounted control device input conduit and wiring with bottom conduit entry. Internal barriers shall be provided to separate power wiring from lower power control wiring. The motor supplier shall route all motor mounted control device wiring, which terminates at the control terminal box, in flexible liquid tight conduit.

5.10.3 Lighting Requirements.

Lighting levels shall be provided following the suggested levels as stated in the Illuminating Engineering Society (IES) Lighting Handbook. In general, voltages for roadway fixtures shall be 480 volts, single phase. Interior fixtures shall be 120 volts, single phase. Lenses for outdoor lighting shall be storm-proof type. All exterior lighting fixtures, supports, poles, posts, or other related components shall be hurricane proof (designed to withstand and function in the design wind speeds indicated in Article 5.5, Structural Design Criteria).

Area lighting shall be as listed in Table 5.10-1. Alternate lighting types may be proposed, but lighting levels and functional requirements shall be maintained.

TABLE 5.10-1
Lighting Design Criteria

Location/Service	Lighting Selection	Required Lighting Level
Offices, laboratories, rest rooms, corridors, and control rooms	Parabolic reflector, fluorescent fixtures.	500 Lux
Lighting in shop areas, storage rooms, basement levels, and electrical rooms	Industrial fluorescent fixtures. These fixtures shall be pendant mounted where necessary due to ceiling height	750 Lux
Emergency and egress lighting shall be provided for temporary lighting during power outages in all enclosed structures.	Battery powered. These shall be part of the fluorescent lights when possible	10 Lux
In areas with ceilings above 12 feet. (pump rooms)	HID lights with metal halide lamps shall be provided. Selected fixtures shall be equipped with instant-on quartz lamps for immediate lighting of the area	150 Lux
Site Lighting For Storm Events	Roadway luminaries, utilizing HPS lamps, remote on/off/auto contactor with photocell control. Height and intensity shall be selected to minimize impact on neighboring property and prevent illumination outside of the facility boundaries.	100 Lux
Site Lighting For Normal Operation	Cutoff type fixtures, utilizing HPS lamps, remote on/off/auto contactor with photocell control. Additional switched task lighting for specific operation and maintenance areas. Cutoff fixtures shall be designed to prevent illumination outside of the facility boundaries.	20 Lux

5.10.4 Security and Surveillance

Electronic security and surveillance equipment shall be provided for each PPS site and all enclosed buildings. Physical security measures are covered in other sections. Site electronic security shall consist of video cameras. Video cameras shall be provided at the main entrance gates and as required to allow remote monitoring of the entire site. At a minimum, two pan-tilt-zoom (PTZ) cameras shall be provided for each PPS site. Additional cameras shall be provided if the site layout or configuration does not allow a single camera to clearly view the entire site. At least one PTZ camera shall be provided inside each PPS building that houses operating equipment to permit observation of critical equipment. Additional cameras shall be provided if necessary to permit observation of critical equipment. All video camera output shall be networked to display on a personal computer (PC) based display and control unit, located in the control room.

Building security shall consist of standard intrusion detection utilizing door and window switches and shall be connected to the plant alarm system. An NFPA approved supervised alarm panel shall be provided for each pumping station to monitor both intrusion detection and fire protection alarms. The alarm panel shall be capable of interfacing with both the control system and a remote third-party monitoring system. Final design of alarm panels shall be coordinated with the appropriate local fire and emergency response districts.

Final configuration and system design for security systems shall be coordinated with the Government for the respective facility. Security systems shall be capable of interfacing with the local stakeholder's existing monitoring systems.

5.10.5 Lightning Protection

A Lightning Risk Analysis shall be performed in accordance with NFPA. Lightning protection shall be provided for all buildings and structures requiring protection as identified by the risk analysis.

5.10.6 Uninterruptible Power Supply

As described in Article 5.10.2, a three-phase uninterruptable power supply (UPS) system shall be provided at each PPS facility to power building electrical loads when utility power is lost and building power is being transitioned to the on-site generated power distribution system. The facility UPS shall also provide backup power to the control system equipment (all station control system equipment except the individual PLC cabinets). At the Design-Builder's option, a separate UPS system can be provided for the main control system equipment.

Each PLC cabinet shall be provided with a separate, individual UPS for providing backup power to the PLC and related components in the PLC cabinet. PLC UPS systems shall be sized to provide 20 minutes of backup power at design load.

5.10.7 Duct Bank

Electrical underground duct bank, hand holes, and man holes shall be provided as required to distribute power and control circuits underground throughout the plant. Sizing, spacing, and coverage shall meet the requirements of the NEC. Precast boxes shall be allowed and shall be designed for the intended purpose, location, and structural loads. Duct banks shall slope away from structures such that drainage water collection remains in the man holes. Duct banks shall be constructed of schedule 40 PVC and encased in reinforced concrete.

5.10.8 Voice Communication Systems

5.10.8.1. Telephone System. Each PPS shall be provided with a standard telephone system for communication between the station and outside phone systems. The telephony system shall include a minimum of one handset and the necessary network/support hardware to interface the phone with the local phone utility. Design-builder shall coordinate requirements with local carriers to provide a minimum of two different service connections to support the telephony system.

5.10.8.2. Intercommunication System. Each PPS shall be provided with an intercom system for internal facility communication and notification. The system shall include internal speakers, handsets, controllers, cabling, and auxiliary systems as require to implement a working system. The system shall include speakers and handsets in all PPS buildings (pumping station, generator building, etc.). The system shall include controls to interface the following external inputs to the intercom system for broadcast over the intercom speakers:

- Telephone ringer for incoming calls
- Any door or gate access bells (door bells, pushbutton on front gate, etc.)

5.10.8.3. Radio Communication. Design-Builder shall furnish and install, at each PPS site, a radio, antennae, and related infrastructure to interface with the SWBNO existing radio systems. Each PPS shall include both trunking and VHF radio equipment configured to communicate with the existing SWBNO systems. Final radio design parameters shall be coordinated with the SWBNO during detailed design, and shall be based on the following:

- Existing Trunking Radio Information
    - Radio Type: Licensed Trunking System
    - Radio Operating Frequency: 856.7875 MHz to 860.7875 MHz (5 dedicated channels) and 856.8125 MHz to 860.8125 MHz (5 dedicated channels)
    - Main Site Location: LAT – 29-59-22; LON – 090-04-05
    - Secondary Site Location: LAT – 29-58-27; LON – 090-08-36
    - Antennae Height: EL. 450 feet (at both main and secondary site)
- Existing VHF Radio Information
    - Radio Type: Licensed VHF
    - Radio Operating Frequency: 154.10 MHz
    - Main Site Location: LAT – 29-59-27; LON – 090-07-44
    - Antennae Height: EL. 150 feet
- Required at each PPS Site
    - Radio Type: Trunking Radio System and VHF radio system (using existing SWBNO licensing – Design-Builder to work with SWBNO to amend license appropriately).
    - Antennae: 1 each –VHF antennae and Trunking System antennae
    - Antennae Mount Type: As required – shall be designed to withstand the design wind loads.
    - Antennae Height: As required for line of site to main or secondary site.
- Each site shall also be provided with a portable emergency radio (Kenwood model 2160)

5.11 Instrumentation & Controls Design Criteria

This section describes the basis of instrumentation & controls design to be used for the PPS facilities.

The Design-Builder shall be responsible for designing and implementing a comprehensive instrumentation and control system that fully integrates with the related equipment.

5.11.1 Operation of the PPS Facilities

TABLE 5.11-1A
General Control System Design Criteria

Operation of the PPS Facilities	The PPS facilities shall be designed to be operated in both local mode at the equipment and remotely through the control system. Automated modes of operation shall be available through the control system that shall allow operation with minimal operator supervision. However, the system shall be designed so that any automatic controls can be disabled such that the facility can be operated in remote manual mode (manually controlled through the control system). Requirements for any automated modes of control shall be coordinated with the Government.
Local Control	Local control, in the way of hand switches, levers, control stations, or similar panel mounted controls, shall be provided for all equipment. A selector switch shall be provided to allow selection of local or remote control. In local, the local switches or controls shall operate the equipment. In remote, the equipment shall be operated from the facility control system.
Local Safety Interlocks	Equipment interlocks required to protect personnel or equipment shall be provided as recommended by the equipment supplier or as required by standard engineering design practice. These interlocks shall be hardwired and shall operate to protect the system when the system is operating in any control mode. Safety interlocks shall not be programmed in PLCs or similar microprocessor based components.
Remote Monitoring	The ability to monitor the facility from a remote site or sites by means of wired or wireless communication channels shall be required.
Remote Control	The ability to remotely control (start/stop) the pumping units and operate the gates (open/close) shall be provided. This shall include operation of any auxiliary systems that are required to operate the pumping units or gates.

Remote monitoring and control locations shall be as shown in Article 3.2.3. and as indicated in Table 5.11-1C below.

Minimum I/O requirements shall be as shown in Table 5.11-1B. Additional I/O shall be provided as required for proper operation of the equipment, for safety interfaces, alarming, collection of relevant data (operation, maintenance, performance, etc.), and equipment or personnel protection.

TABLE 5.11-1B
Minimum Control System I/O Criteria

At Each PPS		
Equipment/Area	**Discrete I/O**	**Analog I/O**
Each storm surge pump	In remote, Running, Failed, Temperature alarm(s), Vibration alarm	Discharge pressure, discharge flow, power draw, speed (if variable)
Intake screens	In remote, running, failed, high differential	Screen differential
Each gate	In remote, fully open, fully closed, failed	Gate position
Auxiliary pumps & equipment	In remote, Running, Failed	As required
Diesel generators	In remote, running, failed, As recommended by mfr	Day tank level, As recommended by mfr
Diesel tanks	Leak alarm	Level
Valves and gates (if actuated)	In remote, fully open, fully closed, failed	Position
Switchgear and major electrical gear	Switch or breaker position, faults	Voltage, current, power, etc. for each bus
Automatic transfer switches and paralleling gear	Switch or breaker position, faults	
Other equipment and systems	Operating status, failure status	As recommended by mfr
General PPS I/O	Intrusion alarm, flood alarm	Suction side level, discharge side level Wind speed Wind Direction Rain Gage (collected real-time, reported as running daily total, reset daily with daily total

		stored)
Canal I/O		Canal elevations as described in Article 5.11.3
Local Control		

TABLE 5.11-1C
Operator Interface Locations & Function

17th Street PPS	
Operator Interface Location (QTY)	**Functionality[2]**
PPS Pumping Station Control Room (2)	Monitor, Control, Historical Data Storage
PPS Engine Generator Building[1] Control Room (1)	Monitor, Control
Upstream DPS Stations (1 at each)	Monitor
London Avenue PPS	
Operator Interface Location (QTY)	**Functionality[2]**
PPS Pumping Station Control Room (2)	Monitor, Control, Historical Data Storage
PPS Engine Generator Building[1] Control Room (1)	Monitor, Control
Upstream DPS Stations (1 at each)	Monitor
Orleans Avenue PPS	
Operator Interface Location (QTY)	**Functionality[2]**
PPS Pumping Station Control Room (2)	Monitor, Control, Historical Data Storage
PPS Engine Generator Building[1] Control Room (1)	Monitor, Control
Upstream DPS Stations (1 at each)	Monitor

[1]If PPS includes any other separate buildings with operating equipment, at least one operator interface shall be provided in those buildings.

[2]Functionality relative to all equipment and systems at the PPS. Monitoring at DPS includes monitoring of PPS equipment and systems only.

5.11.2 Control System Architecture

The design criteria shall be as presented in Table 5.11-2.

TABLE 5.11-2
System Architecture Design Criteria

Programmable Logic Controllers	
Processors	Each PLC shall be a redundant intelligent process controller that can perform both data acquisition and process control functions. The PLC shall be able to communicate with the database host computer or other PLC's via wired or wireless connections. I/O expansion shall be available at the interface to the PLC. A separate redundant PLC is required at each PPS site.
Database Host Computer	Each PPS shall be provided with a redundant database server (or servers) that manages the process database and interfaces with both the PLC network and the operator interface (OI) computers (operates PLC drivers, stores real-time data, processes interface between data and the OI computers). If allowed by the system architecture, the database host computer may also serve as the historical data collection computer for the system, If necessary a separate historical data collection computer shall be provided.
Software/Programming Tools	The programming tools shall be of the PLC vendor's own design. Third party programming and documentation packages are not acceptable.
Cabinets	AC unit (if not located in a controlled environment), Fan, heater, and compact lighting fixture activated shall be included. All cabinets shall be located indoors in controlled environment but they shall also be able to work in uncontrolled environment in case of hurricane situation. Each PLC shall have a dedicated uninterruptible power supply (UPS).
Operator Interface (OI)	Each PPS shall be provided with a minimum of two (2) OI computers in control room (2 in pumping station control room and 2 in generator building control room). Each operator interface shall be a personal computer with graphical interface and control software which is compatible with the database host computer and the PLCs. The operator interface shall utilize graphical user interface (GUI) for control screens and shall be a standard product of a recognized software supplier regularly engaged in manufacture and sale of operator interface software. The software shall allow for secure access to all monitoring and control functions

	required to properly operate the facilities..
Terminal Blocks	IO shall be terminated in fused terminal blocks to allow convenient troubleshooting.
Spare Wired Terminals	Provided in each cabinet to facilitate future expansion (10%).
Convenience Receptacles	Ground-fault interrupter type shall be included in each PLC cabinet.
Separation of Power Cable and Signal Wires	120 VAC control cable shall be physically separated from 4-20 mA signals as much as practicable inside control cabinets.
Plant Control Network	A redundant network shall be provided and shall include at least two communication paths between PLC cabinets and Control room operator workstations within each PPS site.
Communication Devices for Remote Site/Sites Monitoring	Wired or wireless communication devices shall be provided for remote site/sites monitoring and control. Redundant links shall be provided. At least one of those links shall be independent of any third-party communication provider.

5.11.3 Plant Instrumentation

Instrumentation shall be provided as required for proper implementation of Design-Builder's technical approach and for necessary safety, maintenance, and monitoring of supplied systems. Instrumentation shall be selected for proper operation in the intended service and operating environment. Similar instruments shall be from the same manufacturer and series at each of the PPS sites. Weather instrumentation (rain gage, wind speed, and wind direction) shall be provided at each PPS and interfaced to the control system. Weather instrumentation shall be suitable for operation during hurricane conditions and shall be located to accurately measure the respective parameter.

Analog instruments shall be provided with a dedicated calibration and troubleshooting device (one of each type calibration device required) or be provided as HART compatible. Handheld communication devices shall be provided in adequate number to allow routine plant maintenance (minimum of one of each type per PPS site).

Instruments shall be installed with isolation valves for isolation of single instruments. Instruments shall be grouped into local arrangements to allow easier maintenance and troubleshooting. Instruments with gauges, displays, or read-outs shall be installed so that the displayed values can be easily read from the operating floor level.

Level instrumentation used for monitoring lake or canal level shall be non-contact type and shall be designed for operation in Current Condition operating requirements. The level instrumentation provided shall be suitable for Possible Future Conditions with only minor recalibration needed (it is understood that the instrument may require physical reinstallation under Possible Future Conditions, but should be designed with a range appropriate for both

stated conditions). The quantity of level monitoring devices required for each canal shall be as required to support the Design-Builder's operating plan and controls and as defined in Section 01010, Article 3.2.1. Level devices selected shall be suitable for outdoor operation and shall give reliable readings in all ambient operating conditions. Appropriate communication links shall be used to interface the level instrument readings with the PPS controls. Communication links shall update level values with a maximum update rate of 5 seconds. Suitable installation conditions (installation location, stilling wells, etc.) shall be provided to minimize level reading fluctuations from transient conditions caused by waves, wind, pump discharge, or similar water surface action.

5.11.4 Control System Programming, Testing and Training

5.11.4.1 Control System Programming

The Design-Builder shall be responsible for complete programming and configuration of all control system components to form a fully functional control system capable of monitoring, alarming, and controlling all facility equipment. Programming work provided by the Design-Builder shall include the following as a minimum:

1. Preparation of a control system programming plan, including programming standards.
2. Administration of coordination meetings between the Design-Builder, the Government, and operational stakeholders to review programming activities.
3. Design of all control system, input/output, operator interface, and communication systems necessary to implement the control system.
4. Programming of all PLCs for the required I/O interfaces, control algorithms, and monitoring/alarming functions.
5. Programming of all operator interface computers for the required monitoring and control interfaces, including integration of operator interface databases with PLC data.
6. Programming of any data exchange logic and memory mapping required to interface the control systems with the remote monitoring sites.
7. Complete documentation, testing, and training for control system programming activities.

5.11.4.2 System Factory and Field Tests

A factory acceptance test of the control system shall be performed prior to its shipment to the job site. This test shall verify that control logic is operating as intended. Once the system is assembled in the field, additional functional and performance testing shall be performed to document proper operation of all control system functions. Additional requirements regarding system testing shall be as defined in Section 01640 – Startup, Testing, and Commissioning.

5.11.4.3 Training. Training shall be provided to operations staff on the operation and maintenance of the Instrumentation and Control Systems provided. Training shall be divided into appropriate sections for various needs. Additional training requirements shall be as defined in Section 01664 – Training.

5.11.5 Instrumentation and Control System Supplier and Equipment Requirements

Equipment and software furnished under this section shall be designed, coordinated, and supplied by a single manufacturer or supplier, hereinafter referred to as the System Integrator

(SI). The SI shall be regularly engaged in the business of supplying computer-based monitoring, control, and data acquisition systems. The Design-Builder shall utilize the services of the SI to coordinate all control system related items, to check-out and calibrate instruments, and to perform all control system testing, training, and startup activities specified to be provided.

The SI shall have the following minimum qualifications:

1. The supplier shall maintain a design office staffed with qualified technical design personnel.
2. The supplier shall maintain competent and experienced service personnel to service the hardware and software furnished for this project.
3. The SI shall have a minimum of five (5) years of experience in the design, coordination, and supply of the type of system proposed for this project.

Instrumentation and control system equipment and software furnished under this section shall conform to the following minimum requirements:

1. Equipment and software furnished shall be from a recognized industry supplier with at least 10 years experience providing the type of equipment and software proposed.
2. Equipment and software furnished shall have service and support resources available within a two hour drive from the project site.
3. Equipment and software furnished shall be a standard product of the equipment supplier and not be a custom product. The equipment can contain custom configuration or setup, as long as the base equipment is a standard product.
4. All communications between and among instrumentation and control system equipment shall be a recognized standard protocol.

5.12 Corrosion Control Design Criteria

1. Equipment, piping and structures shall be protected with protective coatings for corrosion protection that provide the minimum life expectancy specified in Article 3.1 of this Section. Cathodic protection shall be added to provide additional corrosion protection where required by the service conditions (based on Design-Builder's technical solution and the relevant potential for corrosion on buried and submerged components).

2. Determine corrosiveness of the soils and groundwater as needed to support corrosion control design.

3. Determine the storm water and brackish water chemical concentrations as needed to support corrosion control design.

4. Immersion service exposure to seawater or brackish water

a. Pump columns shall be provided with galvanic anodes to provide additional corrosion protection for the maximum concentration of saltwater to which it will be exposed .

b. Gates shall be protected with galvanic anodes for additional corrosion protection or special protective coatings for the maximum concentration of saltwater to which it will be exposed.

5. Piping and equipment within buildings shall be coated with appropriate protective coatings such as epoxy for corrosion protection with a minimum expected coating life as specified in Article 3.1 of this Section.

6. Any piping or equipment exposed to sunlight shall be coated with protective coatings suitable for UV exposure with a minimum expected coating life of 10 years before recoating. Some piping such as stainless steel does not need coating protection from UV exposure. Any non-metallic piping material not designed for exposure to UV shall be coated accordingly.

7. Concrete -Type II or Type V cement shall be used where soil, ground water or liquid exposure conditions are considered corrosive to concrete.

8. Corrosion control systems shall be applied such that normal maintenance of the protected equipment is not impeded.

9. All iron and steel surfaces of the equipment shall be protected with suitable protective coatings applied in the shop. Surfaces of the equipment that will be inaccessible after assembly shall be protected for the life of the equipment. Coatings shall be suitable for the environment where the equipment is installed. Exposed surfaces shall be finished, thoroughly cleaned, and filled as necessary to provide a smooth, uniform base for painting. Electric motors, speed reducers, starters, and other self-contained or enclosed components shall be shop primed or finished with an epoxy or polyurethane enamel or universal type primer suitable for top coating in the field with a universal primer and aliphatic polyurethane system.

10. Equipment surfaces to be coated after installation shall be prepared for painting as recommended by the paint manufacturer for the intended service, and then shop painted with one or more coats of a universal primer. Machined, polished, and nonferrous surfaces which are not to be painted shall be coated with rust-preventive compound as recommended by the equipment manufacturer

5.13 Spare Parts and Special Tools Criteria

For each PPS, provide an adequate supply of spare parts including, but not limited to, the following items:

1. Two complete sets of all air and oil filters required by the engines
2. One set of pump bowl and lineshaft bearings for each size and model of pump
3. One spare thrust bearing for each size and model of pump
4. Sufficient grease and oil for two changes for all equipment supplied including pumps, motors, gear reducers, and small engines. This does not include grease and oil for engine driven pumps or diesel engine generators.
5. Engine driven pumps and diesel engine generators shall be fully serviced, including lubrication and oil change following testing as described in Section 01640 – Startup, Testing, and Commissioning.
6. One set of bearings for engines and engine generators.
7. One set of belts or chains of each type required for any belt of chain driven equipment.
8. One set of air filters of each type required for HVAC equipment and compressed air equipment.
9. One set of each type of special filter or cartridge required for any air drying equipment.
10. Manufacturer's recommended spare parts for all other critical mechanical equipment. Critical equipment is defined as any auxiliary mechanical equipment that must be operable in order for the pumping units to operate.

11. One of each type of miscellaneous valve used on the project. Miscellaneous valves are defined as valves with diameter less than 4".
12. One spare level instrument (element, transmitter, and interconnecting cable) for the type used to monitor canal elevation.
13. At least one complete set of replacement components of each size and type for the following:
    a. Power and control fuses
    b. Primary and secondary fuses for potential transformers and control power transformers
    c. Indicating lights
    d. Rectifier and inverter semiconductors for adjustable frequency drives (AFDs)
    e. One of each type of replaceable printed circuit board (as a minimum provide for AFDs, PLCs, valve actuators, communication systems, UPS systems, security systems, and packaged unit controls for screens, hydraulic systems, and air compressors).
    f. One spare PLC processor of each type used.
    g. One spare Input/Output board of each type used.
    h. One spare PLC communications module of each type used.
    i. One spare PLC power supply module of each type used.
    j. One spare power monitoring and protective relay unit of each type used.

For each pumping station, provide an adequate supply of any special tools that are required for maintenance of the equipment provided, including, but not limited to, the following items:

1. Two sets of any special tools required for maintaining pumps, motors, and engines including lifting beams and special harnesses, as required.
2. One programming device of each type for instruments, valves, or other programmable equipment.
3. One diagnostic device of each type for equipment or controls that require such a device for maintenance and troubleshooting.
4. One laptop computer for programming the control system, complete with one licensed copy of all software needed to troubleshoot or modify the control system code.
5. 10 sets of any special keys or wrenches required to access enclosures or panels.

Design-Builder shall submit a list of spare parts and special tools with the draft and final O&M manuals. The list shall include quantities, manufacturer, and model numbers.

5.14 Environmental Design Criteria

This Article covers environmental design criteria for the completed facilities. Environmental criteria and mitigation for the construction period are covered in Article 5.15.

5.14.1 Noise

Facility interior noise thresholds shall be in accordance with applicable OSHA regulations for workplace noise limits. Exterior noise allowable shall be in accordance with the noise guidelines of Appendix D – Individual Environmental Report #5. Operating noise level shall be determined by Design-Builder as part of the Performance Testing by continuous recording of noise levels at a minimum of six (6) locations at each PPS property line throughout the Performance Testing period for the respective PPS. If the noise testing indicates that noise exceeds the IER #5 guidelines for noise, the Design-Builder shall make corrections to the facility and re-test. Noise shall conform to the New Orleans Municipal Code for sound attenuation.

5.14.2 Air Quality

The facilities shall be designed to be in compliance with the Clean Air Act and other local and regional air quality regulations, whichever is most stringent and with the requirements of Appendix D – Individual Environmental Report #5.

5.14.3 Energy Efficiency

Building design and equipment selection shall be made to maximize energy efficiency. Where it does not interfere with the ability of the PPS to meet primary performance criteria, Design-Builder shall consider the requirements of relevant section of the Energy Policy Act of 2005 with regard to building energy efficiency.

5.15 Construction Related Criteria

5.15.1 Traffic Control

Design-Builder shall be responsible for traffic control on each site, including coordination with local traffic authorities for access to/from public roadways. Design-Builder shall be responsible for providing approved signage and qualified flag-persons, traffic controllers, and automatic traffic signals (where required).

Design-Builder traffic control plans shall maintain two-way traffic on all adjacent public roads. A waiver may be granted by the Government for specific short-term activities allowing additional lane closures, but shall not be assumed in Design-Builder's schedule.

Design-Builder shall coordinate working hours for on-site staff to minimize disruptions to local traffic. As much as practical, Design-Builder shall situate primary access roads away from heavily traveled surface streets.

Design-Builder shall coordinate security requirements with traffic control plans to maintain orderly access to and from the site by shift workers, Government personnel, and deliveries.

Traffic control shall be in accordance with all applicable local ordinances. Additional requirements shall be as defined in Section 01500A, Temporary Construction Facilities.

Design-Builder shall be responsible for restoring roads in the vicinity of each construction site to pre-construction condition. This shall include roads that are immediately adjacent to work areas and that are used by the Design-Builder for truck/heavy equipment access to the sites.

5.15.2 Work Hours and Shifts

Work hours and shifts shall be as defined in Section 01100, General Provisions.

5.15.3 Environmental Constraints and Criteria during Construction

Design-Builder shall comply with all local, regional, state, federal, and project specific environmental requirements during construction. General environmental constraints shall include, but not be limited to, erosion control, storm water containment, emissions and dust control, hazardous materials management, vibration control, noise abatement, and project induced settlement or displacement of existing facilities by construction activities. Additional environmental requirements and restrictions shall be as defined in Section 01352, Environmental

Protection and Section 01356, Procedures for Preparation of the Storm Water Pollution Prevention Plan (SWPPP) and Execution of Notice of Intent (NOI).

Design-Builder shall monitor noise and vibration at the site boundaries and record measured values to show compliance with the local codes and standards. See Section 01100 for additional requirements. The Government may also conduct independent environmental assessment (for noise, vibration, dust, etc.) to ensure compliance with all local requirements. If Design-Builder or Government's assessments indicate non-compliance with applicable local codes or requirements, work suspected of contributing to the non-compliance shall be immediately stopped and the Design-Builder shall prepare a compliance plan for submission to the Government. Design-Builder shall resume work only after the mitigation measures identified in the plan are in place.

Design-Builder shall implement the IER #5 recommendations regarding protective measures for manatees during construction. Other project specific requirements shall be implemented as identified in the project IER (IER #5), included in Appendix D.

5.15.4 Security During Construction

Design-Builder is responsible for security of each site from site mobilization through Government acceptance of the facilities. During this period, Design-Builder shall be responsible for controlling site access and security of personnel, equipment, and property on site. At least one dedicated security personnel shall be at each site 24 hours per day, 7 days per week.

5.15.5 Construction Constraints

The Articles below describe fixed construction constraints that the Design-Builder shall consider when planning their project approach and schedule.

5.15.5.1 Operation of the ICS Facilities

The Government operates and will continue to operate the existing ICS facilities during construction of the PPS work. Government will coordinate any testing or scheduled operation of the ICS facilities with Design-Builder's construction activities as much as possible.

5.15.5.2 Demolition of the ICS Facilities

Each interim closure structure (ICS) must remain in service and capable of full operation until the respective PPS facility is turned over and accepted by the Government as complete (final completion for pumping station facility).

The ICS facilities will be demolished under a separate contract after the PPS facilities are turned over to the Government.

5.15.5.3 Closure of the Temporary By-Pass Channels

Each new facility requires a temporary by-pass channel as described elsewhere. This by-pass channel must remain in service and capable of passing the full by-pass flows until the respective PPS facility is turned over and accepted by the Government as complete (final completion for pumping station facility).

If the Design-Builder can demonstrate that the gate closure structure portion of a PPS facility is complete (through completion of all required testing and demonstration) and that the Design-

Builder's construction sequence will not require closure of the gates prior to final completion, the Design-Builder may request a waiver to allow closure of the respective by-pass channel. In this instance, the completed permanent gate structure shall be fixed open to allow full by-pass flows through the facility.

5.15.5.4 Coast Guard Coordination

The 17th Street Canal PPS location is adjacent to a U.S. Coast Guard facility. Design-Builder shall coordinate construction activities and temporary construction facilities with Coast Guard requirements. Design-Builder shall ensure that access into and out of the Coast Guard facility is maintained at all times. Temporary construction bypasses shall be configured such that any cross flow velocities into the Coast Guard traffic lanes are acceptable to the Coast Guard.

5.15.5.5 Orleans Levee District Permitting and Potential Restrictions

Design-Builder is advised that Orleans Levee District (OLD) requires special permitting for construction activities adjacent to the Mississippi River and flood control structures on the east bank of Orleans Parish.

Design-Builder shall investigate the permitting requirements and restrictions and include any potential impact from obtaining necessary permits and complying with any related restrictions in their cost and schedule offering.

5.15.5.6 Protection of Equipment During Construction

Design-Builder shall be responsible for protection of all permanent equipment and materials during construction, including protection of installed equipment from hurricane damage during construction. Design-Builder shall sequence the construction, include temporary facilities, or secure other means to prevent damage or submersion of equipment and materials during hurricane or other storm events during construction. Replacement of any equipment damaged by hurricanes prior to acceptance of the facilities by the Government shall be the Design-Builder's responsibility.

6.0 Demolition

It is not anticipated that any significant demolition will be required by the Design-Builder. This Article provides general demolition requirements in the event that minor demolition of existing structures is required to complete the Design-Builder's work.

6.1 References for Demolition Work

Industry and Government references related to the demolition work shall be as indicated in Article 4.1 and 4.2 of this Section. These references form a part of the demolition work to the extent referenced.

6.2 Demolition Requirements and Criteria

6.2.1 General Demolition Requirements

Demolition is to be performed in a manner that maximizes salvage and recycling of materials. Remove rubbish and debris from the project site; do not allow accumulations. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23,

Demolition, 29 CFR 1926 (with particular emphasis on Subpart T – Demolition), and other applicable Sections. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the "Contract Clauses," conform to the safety requirements contained in ASSE/SAFE A10.6. Furnish timely notification of demolition to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Demolition

All demolition work shall be subject to the Construction Related Criteria in Section 01010, Article 5.15. Prevent the spread of dust and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to flooding or pollution.

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract.

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

Use of explosives will not be permitted.

Class I and Class II ozone depleting substances (ODS) are defined in Section, 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting ARI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling. Recovered ODS shall be removed from Government property and disposed of in accordance with 40 CFR 82. Products, equipment and appliances containing ODS in a sealed, self-contained system (e.g. residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82.

END OF SECTION