NEW BEDFORD PUMP STATION FLOOD-PROOFING PROJECT

FUNDED IN PART BY CZM COASTAL COMMUNITY RESILIENCE GRANT PROGRAM

FY 16 ENV 16 CZM 01

FORT TABER
The Southernmost prominent point of New Bedford projecting into Buzzards Bay surrounded by the New Bedford Outer Harbor to the east and Clark Cove Waters to the west

Department of Public Infrastructure
Ronald H. Labelle
Commissioner

Water
Wastewater
Highways
Engineering
Cemeteries
Park Maintenance
Energy

CITY OF NEW BEDFORD
Jonathan F. Mitchell, Mayor

October 31, 2016

Patricia Bowie, Coastal Resiliency Grant Program Coordinator
Massachusetts Office of Coastal Zone Management
251 Causeway Street, Suite 800
Boston MA 02114-2136

Dear Ms Bowie,

Herewith attached is the final summary report of the flood-proofing project involving nine pump stations in New Bedford. The "As-Built" drawings being submitted this day represent work completed up to the particular dates published on the drawings and should be considered final only for the purposes of closing out this flood-proofing project however the City of New Bedford will be continuing to use these drawings as a guide to continue work toward completion of all tasks associated with making the nine pump stations in the subject project as resilient as possible. In this way the project will be extended as funding and DPI labor resources become available.

This project was initiated with a given that four of the nine pump stations were considered to be critical namely those located at Howard Avenue, former Howland Street, Cove Road, and East Rodney French Boulevard and these were treated accordingly. The remaining five pump stations located at MacArthur Drive, Wamsutta Street, Coggeshall Street, Belleville Avenue, and Popes Island were considered as non-critical and the As-Built drawings are numbered to reflect the order of priority which the City applied to this project in general.

A revised profile and summary of work for each of the nine pump station sites is also submitted along with a cost summary of flood proofing work for each pump station as well as an overall project summary. This information is summarized on the attached spreadsheets. An attempt was made to address the pending work at each station with explanation concerning the reasons why some work was undertaken and other work was left incomplete or not undertaken. The City intends to continue resiliency work based on the tasks pending at each pump station and will attempt to accomplish as much as possible before the end of 2016.

Respectfully,

David Fredette

Cc: File

1105 Shawmut Avenue, New Bedford, MA 02746 Telephone 508-979-1550 Fax 1-508-961-3054
RONALDL@NEWBEDFORD-MA.GOV

BACKGROUND INFORMATION & EXISTING CONDITIONS

The original Belleville Avenue Pump Station located at 618 Belleville Avenue New Bedford MA was first constructed around 1916 and was substantially modified beginning in October 1977 to the present conditions.

Reference is made to the contract # 1design drawings dated October 1977 prepared by Camp Dresser & McKee covering the work performed in 1977 to 1978 to upgrade Belleville Avenue Pump Station

The Floor Plans at El 14.65 and 2.00 Sheet A-2 depicts the main working floor elevation of 14.65 based on the City Datum. The adjustment for the New Bedford Datum to NAVD-88 is an addition of 1.72 feet placing the main floor slab at Elevation 16.37 (NAVD-88).

RESILIENCY DESIGN

The benchmark at the southwest corner of the stair landing at the west elevation is at Elevation 16.13 as measured by recent instrument survey and corroborates reasonably well with the adjusted main floor elevation of 16.37 given that the dock area has a slope designed to pitch away from the building. Other benchmarks located at the dock on the north side and the stair landing at the south side all corroborate reasonably well with the adjusted main floor elevation.

The projected elevations of the maximum flood elevation are as follows:

With 0 FT Sea Level Rise	0.00
With 1 FT Sea Level Rise	0.00
With 2 FT Sea Level Rise	13.07
With 4 FT Sea Level Rise	17.73

The expected flood elevations with 0 FT and 1 FT sea level rise are well below finish grade surrounding the pump station therefore these will be incorporated into the design. The expected flood elevation with 2 feet of sea level rise is for the most part at or below finish grade but at the east elevation where the exterior finish grade is lower the Elevation 13.07 line is visible and appears to be just above the top of the pump station concrete foundation walls as visible in the east elevation view. The expected flood elevation with 4 feet of sea level rise is approximately 16 inches above the main floor slab. Therefore all four projected flood elevations will be considered.

All the entry doors are set with bottom at main floor slab elevation therefore these doors will be affected by the projected maximum flood elevation with 4 FT of sea level rise the worst case being approximately 1.5 feet of standing water. The City of New Bedford will plan to design for the 4 FT sea level rise and will implement measures to accommodate flood-proofing to at least the maximum flood elevation of 17.75

The design drawing depicts the maximum flood elevations of 17.73 and 13.07 with lines superimposed on the building façade. The depicted height of these flood elevations was confirmed by physical measurements in the field.

Flood-proofing the pump station structure and associated structures and appurtenances to elevation 17.73 the maximum expected flooding with 4 feet of sea level rise will be relatively straightforward. The pump station reinforced concrete foundation walls exist to the bottom of the main floor which consists of a reinforced concrete slab. Therefore there will be a need for evaluating the strength of the masonry walls above the main floor slab to determine their strength to resist the 1.5 feet of standing waters outside but more importantly the evaluation must include the capability of the walls against debris collision during standing water conditions especially due to the proximity of the pump station to the open waters of the Acushnet River less than 500 feet away to the east.

The design of the Belleville Avenue pump station incorporates a direct and open connection between the interior of the pump station structure and the wet well namely in the screen room. It is reasonable to assume that because of such a connection, the screen room could flood with a surcharged effluent inflow since the sewer collection system is known to be open to flood water intrusion at a number of locations. There is potential that the surcharged wet well can exceed general exterior flooding and result in higher than maximum projected flooding at elevation 17.73. Therefore there will be a need to evaluate the screen room walls as well as the floor hatch at the main floor elevation of 16.37 and the access Stair # 2 where there is one door at the bottom of the stairwell at the screen room floor Elevation 3.72 and no means at the top of the Stair # 2 to arrest interior flooding rising up from the screen room at the expected maximum flooding with 4 FT of sea level rise. There will be a need to evaluate how such interior flooding can be controlled in the event the influent sluice gate is inoperable and the screen room becomes flooded.

SHORT TERM GOALS

1. The entry doors are currently not flood-proof and the expected maximum flooding will reach up to 1.5 foot height on the doors. Since the doors are relatively new, if an adequate flood gasketing system can be found to suitably retro-fit the doors, the City will implement such measures along with a simple stop log system to above elevation 17.73 to be utilized to protect the doors from direct flood waters. In the event that an appropriate gasket system cannot be found the entry doors will be entirely replaced with new flood-proof doors including frames and in-fill grouting to render repairs to the door frame and surrounding building structure. The north dock double door will have to be specially treated to ensure that it can be maintained in watertight condition for flood waters at the exterior side of the door as this particular door with the overhead crane rail through the door will be more cost effective to refurbish rather than replace. The sliding door visible in the north elevation view to the left of the large double door with crane

will be removed and the opening filled with reinforced masonry to close off the opening. **(PENDING)**

2. Fabricate and install a new gasketing system for the hatch visible at the west elevation view at the main entrance stair landing. If an appropriate gasket system is not available, then a new flood-proof hatch will be installed at the same location. **(PENDING)**

3. Make provisions to remove a portion of the bottom of the louver at the south entrance visible at the south elevation view. As an alternate make provisions for stop log channels and stop logs and incorporate the entrance door into the stop log protection system. If a stop log system is used to protect the louver and entrance door then this door does not require replacement. **(PENDING)**

4. Make provisions to remove a portion of the bottom of the louver visible at the west elevation view. As an alternate make provisions for stop log channels and stop logs to protect this louver. **(PENDING)**

5. Install stop log channels and stop logs across the opening with the ornamental steel gate visible at the north elevation view. If the stop logs are placed across the entire masonry opening then the entry door at this location will be available for access to the pump station albeit over the stop log system. Since the expected height of the stop log system is approximately 1.5 feet there may be no need for an access ladder over the stop log system. **(PENDING)**

6. Refurbish the existing hose bibb visible at the west elevation view with new flood-proofing gasket as needed. **(PENDING)**

7. Construct a safe location within the pump station building at sufficient height above the highest projected flood level for the pump station operator to seek haven in the event of failure of any of the temporary flood mitigation measures. **(PENDING)**

8. Mount a story board to the existing masonry at the northwest corner of the pump station building using appropriate hardware to support and secure the story board. Mark the story board with available flood information including the maximum potential flood elevation 17.73 with 4 feet of sea level rise. **(PENDING)**

LONG TERM GOALS

1. Refurbish the sump pump system in the pump room with duplex submersible pumps capable of pumping against the additional head and potential volume expected during flood conditions. **(PENDING)**

SUMMARY OF WORK BELLEVILLE AVE. PUMP STATION

The Belleville Avenue Pump Station in the present condition is protected from flooding impact to approximately elevation 16.00 that being just below the main entrance floor with no significant openings or penetrations into the building below elevation 16.00. This level is nearly three feet above the maximum expected flooding level with 2 feet of sea level rise. The expectation of 4 feet of sea level rise is predicted to occur during the latter half of this century and at worst case condition would result in flooding to approximately 1.6 feet above the pump station main floor slab. Therefore, the City has chosen to take on the flood-proofing short term and long term goals at the Belleville Ave Pump Station internally with DPI performing the work as time permits and budget allows.

BACKGROUND INFORMATION & EXISTING CONDITIONS

The original Coggeshall Street Pump Station located at 200 Coggeshall Street New Bedford MA was first constructed around 1930 and was substantially modified with the addition of a new and larger wet well and pump chamber dry well adjoining the existing pump station structure and a new chemical pre-treatment system after May 1991. The improvements included a reconfigured larger size influent sewer main into a larger dual sump wet well system with bar screen and comminutor and incorporating sluice gates and other controls to enable bypass flow during maintenance operations. Two new larger sewer pumps were installed with a new sewer force main that is routed in a different direction to the sewer interceptor on Belleville Avenue. The old (existing) pump room was used to house the equipment for the sodium hypochlorite chemical injection system that was added to the Coggeshall Street pump station. The bottom of the old (existing) wet well was used to accommodate the new influent sewer main.

Reference is made to the contract # 6 Record Drawings dated January 1994 prepared by Camp Dresser & McKee covering the work performed in 1991 to about 1993 to construct the improvements to the Coggeshall Street Pump Station. The access hatch to the old wet well was replaced with a new hatchway and ladder and a new venting duct was added. The new 20" influent sewer main was placed in structural fill in the existing wet well north to south as a pass through to the new wet well structure. A concrete cover slab was placed over the partially filled existing wet well to bring the floor up to the same elevation as the new intermediate maintenance level in the new wet well structure. A 3FT by 7 FT pass through opening shown on the record drawing at the south wall of the former wet well was not cut through to the new wet well structure. The new 14 inch force main exits the west wall of the new pump chamber structure and is routed west directly to a connection at the sewer force main on Belleville Avenue.

The Contract # 6 Demolitions Plan Sheet M-4 depicts on the "Plan @ El 7.25 Detail" the main entrance floor elevation of 12.50 based on the City Datum. The adjustment for the New Bedford Datum to NAVD-88 is an addition of 1.72 feet placing the main entry floor slab at Elevation 14.22 (NAVD-88). The adjustment for the Control Room Slab at El 7.25 is an additional 1.72 feet placing the control room slab at Elevation 8.97 (NAVD-88).

RESILIENCY DESIGN

The benchmark at the main entrance to the east side north edge of the concrete stoop at door level is at Elevation 14.21 as measured by recent instrument survey and corroborates well with the adjusted main floor elevation of 14.22 given that the stoop has a slight slope designed to pitch toward the outside north edge of the entry way.

The projected elevations of the maximum flood elevation are as follows:

With 0 FT Sea Level Rise	0.00

With 1 FT Sea Level Rise	0.00
With 2 FT Sea Level Rise	9.37
With 4 FT Sea Level Rise	16.66

The expected flood elevations with 0 FT and 1 FT sea level rise are well below the exterior finish grade surrounding the pump station therefore these will be incorporated for purposes of improvements. The expected flood elevation with 2 FT sea level rise though well below exterior finish grade surrounding the pump station is approximately 25 inches above the control room floor slab of the old (existing) pump station drywell level. This elevation is below the level of the brick masonry which is founded on the top of the pump station reinforced concrete wall structure. The expected flood elevation with 4 FT sea level rise is approximately 30 inches above the main entry floor slab and 7.69 feet above the control room floor slab of the old (existing) pump station drywell. The expected flood elevation with 4 FT sea level rise is above the brick masonry level of the pump station building above therefore all four projected flood elevations will be considered in the design.

The main entry door is set with bottom at the main entry floor slab elevation therefore this door will be affected by the maximum expected flood elevation with 4 FT sea level rise the worst case being approximately 30” of standing water. The City of New Bedford will plan to replace the main entry door with a flood-proof door. The top of the new hatches over the pump station drywell and wet well structure are depicted on the Contract# 6 Plan Sheet M-2 at Elevation 12.25 based on City Datum and with the adjustment of 1.72 is equivalent to Elevation 13.97. Since this elevation is about 33” below the expected worst case flooding, the hatches will be replaced with flood-proof units. The same is true for the wet well entry hatches and they will also be replaced with flood-proof hatches.

The design drawing depicts the maximum flood elevation of 16.66 with 4 FT sea level rise with lines superimposed on the building façade. The depicted height of these flood elevations was confirmed by physical measurements in the field.

Flood-proofing the pump station structure and associated structures and appurtenances to elevation 16.66 the maximum expected flooding with 4 feet of sea level rise will be relatively straightforward. There will be a need for evaluating the strength of the masonry walls above the main entry floor slab elevation to determine their strength to resist the two feet of standing waters outside but more importantly the evaluation must include the capability of the walls to endure debris collision during standing water conditions especially due to the proximity of the pump station to the open waters of the Acushnet River less than a half mile away to the east. The former (existing) pump station building has a working floor level at Elevation 8.97 the former control room, providing sufficient head room to enable the addition of overhead cross bracing to strengthen the masonry walls.

The design of the Coggeshall Street pump station incorporates no direct and open connection between the interior of the pump station dry side structure and the wet well.

The Coggeshall Street Pump Station is the only major pump station in the city within the flood vulnerable zone with just two wastewater pumps. Most major pump stations have substantial influent flow and operate with three pumps using a rotating lead lag schedule generally running two pumps during heavy flows and the third pump being a spare in the event of a pump failure or being available during the occasional excess flow situations. The Coggeshall Street pump station requires operating two pumps in a rain event and in the event of a pump failure the station is at half capacity. It is noted that the repair or rebuild time a on a pump is typically several weeks.

SHORT TERM GOALS

1. The entry door is currently not flood-proof and the expected maximum flooding will reach up to 2.5 foot height on the door. Since the door is very old it will be beneficial to replace it with a flood-proof door.

   WORK COMPLETED: The wooden entry door was replaced with a flood resistant fiberglass door and then fit up with stop logs the top of which is set to elevation 20.2, well above the maximum expected flood elevation with 4 feet of sea level rise.

2. The glass block windows at all four sides are roughly 18 inches above the highest expected flood elevation. This height will make them vulnerable to debris collision meriting the need for some type of shielding. **(PENDING)**

3. The hatches at the dry well as well as at the wet well are deteriorated and not watertight. Since all the hatches are at an elevation below the highest expected flood level it is necessary to replace the hatches with watertight type preferably bolt down style hatches.

   WORK COMPLETED: The two hatches at the dry well ladder entry and equipment opening and the two hatches at the wet well stair entry and equipment opening were replaced with heavy duty flood-proof hatches. The hatch over the equipment opening at the wet well slab was installed with approximately four inches of overhang to the north, this over hang will be met with a formed and placed grout placement to support and seal the hatch flange framing and otherwise provide for a safe and suitable perimeter around the hatch frame.

4. The ventilation fan units for the dry well and wet well are below the maximum expected flood elevation. These will need to be raised and protected from debris collision.

   (PENDING) The City has a short term goal to raise the concrete duct and fan over the southwest corner of the dry well portion of the pump station and is considering eliminating the existing fan unit at the wet well slab and replacing it

with a new fan unit comparable to the dry well fan to be placed on a raised concrete duct.

5. The yard hydrant is intended to remain and will be inundated during maximum expected flood conditions. The hydrant will need to be provided with flood proof caps and will need protection from debris collision. **(PENDING)**

6. The hypochlorite system at this pump station has been taken out of service but the system's delivery pipes and vents remain. These components will require abandonment and removal to ground level by cutting and capping the pipes and securing the manhole covers from easy removal. Cutting and capping of chemical piping will also be necessary inside the pump station. **(PENDING)**

7. The ventilation duct mounted on top of the former wet well chamber near the northeast corner of the pump station building visible in the east elevation view has an opening the bottom of which is at the expected maximum flood elevation. This duct requires an extension to raise it vertically at least six inches above the maximum expected flood elevation of 16.66 and additional structural bracing needs to be added to protect the duct from debris collision. **(PENDING)**

8. The generator presently on site is the only means of back-up power available for the pump station and it is mounted on an exterior concrete pad that is approximately 4.5 feet lower than the maximum expected flood elevation. Raise the generator onto a structural steel and/or reinforced concrete pedestal so that the bottom of the generator base plate is above elevation 16.70. The pedestal must be sufficiently oversize to accommodate a catwalk around the entire generator and must be sufficiently sound to accommodate a substantial perimeter fence around the generator to provide some protection against floating debris collision. As an alternate to the need for raising the generator, consider purchasing and stacking two twenty foot long ISO shipping containers to be located and secured to a new structural slab with approximate dimensions of 10 FT X 22 FT. the elevation of the new concrete pad can remain the same as the existing and the bottom shipping container can be used for storage while it would be present to provide support for the top shipping container with the generator system inside. The engineering plan for securing the two shipping containers will require buoyancy computations assuming the bottom container to be inundated by at least five feet of water while remaining empty and watertight. The mounting hardware will also require sufficient strength to endure debris collision against the shipping containers. **(PENDING)**

9. Refurbish the sump pump system in the pump room with duplex submersible pumps capable of pumping against the additional head and potential volume expected during maximum expected flood conditions. **(PENDING)**

10. Make provisions for entry into the pump station building by other means than the main entry door since this door is expected to be secured against the maximum expected flooding elevation. This can be accomplished by means of a roof hatch or a gable end operable opening. Access must include a means for attaching a ladder to the building in order to reach the hatch or opening from a boat. **(PENDING)**

11. Construct a safe location within the pump station building at sufficient height above the highest projected flood level for the pump station operator to seek haven in the event of failure of any of the temporary flood mitigation measures. **(PENDING)**

12. Mount a story board to the northwest corner of the exterior masonry of the pump station building using appropriate hardware to support and secure the story board. Mark the story board with available flood information including the maximum expected flood elevation of 16.66 with 4 feet of sea level rise. **(PENDING)**

LONG TERM GOALS

1. Evaluate the strength of the masonry walls of the Coggeshall Street Pump Station to resist standing water of at least three feet of height against the masonry walls above the main entry floor slab. The evaluation would need to determine what modifications would be needed to enable the exposed wall surfaces to resist damage or failure in the event of a debris collision. The City believes that all four walls are equally vulnerable to debris collision but sufficient cross bracing installed at a height just below the windows will be fairly straightforward due to the headroom available above the control room floor at Elevation 8.97. **(PENDING)**

2. Coordinate the re-positioning of the existing step down transformer located on a concrete pad at the west boundary of the pump station site onto a new raised concrete pedestal to be constructed at the same location or immediately adjacent to the existing transformer or as recommended by the power company. The top of the pedestal is to be set above elevation 16.66 so that the bottom of the transformer will be placed above the highest projected flood height. **(PENDING)**

SUMMARY OF WORK COGGESHALL ST. PUMP STATION

Given that the flooding at maximum expected flood level is only 30 inches more or less above the main entry stoop to the pump station the City has undertaken flood proofing measures that are intended to achieve the maximum protection level. There is a need to evaluate the masonry walls above the reinforced concrete foundation walls of the pump station to ensure that the will resist upset due to standing flood waters. It is noted that should water levels approach the maximum expected elevation of 16.66 the pump station may be protected from flood water

intrusion but it will be quite vulnerable to moving debris in the flood waters with nothing to fend off collisions since the waters will be above the perimeter fence surrounding the pump station site.

The main entry door at the west side of the building into the dry well portion of the pump station was replaced with a more flood resistant fiberglass door then the entry opening was fitted up with stop logs to bring the flood protection level up to elevation 20.2 a full 3.5 feet higher than the maximum expected flood level with 4 feet of sea level rise. Since the glass block windows and the masonry walls offer less protection, the actual protection level is estimated to be at the bottom of the windows at approximately elevation 17.7 without taking into consideration further bracing at the interior of the masonry walls, especially with the relatively close proximity of the pump station to the Acushnet River.

The hatches at the dry well and wet well entry points outside of the pump station building were replaced with heavy duty flood proof hatches that bolt down to aid in sealing the opening. At the maximum expected flood level with 4 feet of sea level rise all of the hatches will be under flood waters so there will be no available entry to the wet well and the only access to the dry well will be at the main building entrance. There is room between the set of stop logs and the entry door for a person to climb over the stop log dam as long as the individual stop log pieces are placed to a height just sufficient to counter the flood waters. Such entry into the building is not recommended but is mentioned as a means of access for emergency purposes.

It is noted that the natural gas fired back-up generator located to the south side of the pump station is vulnerable to flooding and would be expected to be inoperable during a flooding condition exceeding elevation 12 more or less. The City has a short term goal to raise the generator to above the maximum expected flooding level a height change of approximately 4.7 feet to include some means of protecting the generator from debris collision. The intention is to enable the pump station to operate a long as possible with the understanding that the wet well is likely to be overwhelmed by flood waters and render pumping useless. The primary goal is to ensure that the pumping station will be intact and ready to resume pumping when the flood water recede sufficiently.

The costs for the flood-proofing improvements at the Coggeshall Street Pump Station are as follows:

New heavy duty flood proof aluminum hatches, one (42” X 42”) at the dry well ladder entrance, one (54” X 54”) at the dry well equipment access opening, one (36” X 102”) at the wet well stairway entry, and one (42” X 42”) at the wet well equipment access opening $9,738.96 and City Masonry installation work miscellaneous Materials (anchor bolts) $119.00, Labor $6,893.76, and Equipment $3,392.00 SUB-TOTAL $ 20,143.72

New flood resistant fiberglass door to replace the stainless steel entry door at north face of building Material $3,538, and Door Installation by Dupre Masonry Contractor $1,200.00, and new stop log system for main entry door at north face Material purchase $5,820, and City Masonry crew installation work Labor $1,292.58 and Equipment $636.00.

SUB-TOTAL $12,486.58

Contingency purchase of spare pump $19,954.00 (pump only), contingency purchase of pump controls $16,700, and contingency purchase of pump, motor starter & fittings $27,621.88 noting that portion of this figure representing the actual pump in the amount of $22,345.40 was purchased directly by the City and the invoice amount was used as part of the cash match.

SUB-TOTAL $64,275.88.

COGGESHALL STREET PROJECT TOTAL $ 96,906.18

BACKGROUND INFORMATION & EXISTING CONDITIONS

The original Cove Road Pump Station located at 1095 Cove Road New Bedford MA was first constructed around 1904 and was modified in June 1954 and most recently in 1995 to the present conditions.

The present existing structure was constructed new in 1995 at the City owned property located on Cove Road adjacent west of the original pump station structure. Therefore the Cove Road pump station is one of the newest in the city.

Reference is made to the contract # 10 record drawings dated December 1999 prepared by Camp Dresser & McKee covering the work performed in 1995 to construct the new Cove Road Pump Station and demolish the original pump station structure. The existing sewer to the original pump station wet well entry manhole remains intact and the effluent was re-directed from the original wet well entry manhole to a new wet well entry manhole with a 24 inch connector pipe. A new 36 inch sewer is also connected to the new wet well manhole conveying the sewer flows from Cove Road west. A new 24 inch force main extends from the west side of the pump station structure and is routed north and east into Cove Road and further east to meet the existing interceptor at West Rodney French Boulevard.

The Structural Plan Sheet S-1 depicts the main working floor elevation of 9.50 based on the City Datum. The adjustment for the New Bedford Datum to NAVD-88 is an addition of 1.72 feet placing the main floor slab at Elevation 11.22 (NAVD-88).

RESILIENCY DESIGN

The benchmark near the interior corner at the east dock is at Elevation 11.21 as measured by recent instrument survey and corroborates well with the adjusted main floor elevation of 11.22 given that the dock area has a slope designed to pitch toward the edge of the dock.

The projected elevations of the maximum flood elevation are as follows:

With 0 FT Sea Level Rise	11.89
With 1 FT Sea Level Rise	12.51
With 2 FT Sea Level Rise	13.41
With 4 FT Sea Level Rise	15.12

The expected flood elevations with 0 FT sea level rise is approximately 8 inches above the main floor slab. The expected flood elevation with 1 foot of sea level rise is approximately 16 inches above the main floor slab, with 2 feet of sea level rise is approximately 26 inches above the main floor slab, and with 4 feet of sea level rise is approximately 48 inches above the main floor slab. Therefore all four projected flood elevations will be considered.

All the entry doors are set with bottom at main floor slab elevation therefore these doors will be affected by each projected maximum flood elevation with sea level rise the worst case being four feet of standing water. The City of New Bedford will plan to design for the 4 FT sea level rise and will implement measures to accommodate flood-proofing to at least the maximum flood elevation of 15.12

The design drawing depicts the maximum flood elevations of 15.12, 13.41, 12.51, and 11.89 with lines superimposed on the building façade. The depicted height of these flood elevations was confirmed by physical measurements in the field.

Flood-proofing the pump station structure and associated structures and appurtenances to elevation 15.12 the maximum expected flooding with 4 feet of sea level rise will be relatively straightforward. There will be a need for evaluating the strength of the masonry walls above the main floor slab to determine their strength to resist four feet of standing waters outside but more importantly the evaluation must include the capability of the walls against debris collision during standing water conditions especially due to the proximity of the pump station to the open waters of Clark Cove albeit lying on the outside of the hurricane barrier. It is noted that in a worst case scenario with Clark Cove waters toppling over the hurricane barrier it is likely that debris will also float over the barrier.

The design of the Cove Road pump station incorporates a direct and open connection between the interior of the pump station structure and the wet well namely in the screen room. It is reasonable to assume that because of such a connection, the screen room could flood with a surcharged effluent inflow since the sewer collection system is known to be open to flood water intrusion at a number of locations. There is potential that the surcharged wet well can exceed general exterior flooding and result in higher than maximum projected flooding at elevation 15.12. Therefore there will be a need to evaluate the screen room walls and the entry door to the screen room for interior flooding and the impact of such an event on the other portions of the pump station interior. It is noted that the exterior entry door to the screen room is visible in the east elevation as the double door with the large louver above the entry door. This door is the only access into the screen room and it is noted that a number of electrical devices such as light switches and electrical outlets are wall mounted below elevation 15.12. There is also HVAC equipment and screen machinery controls that are presently located below elevation 15.12. Recovery from severe flooding within the screen room will be a matter of waiting for the flooding to subside therefore the double wide entry door will need to be designed for exterior and/or interior flooding.

SHORT TERM GOALS

1. The entry doors are currently not flood-proof and the expected maximum flooding will reach up to four foot height on the doors. Since the doors are relatively new, if an adequate flood gasketing system can be found to suitably retro-fit the doors, the City will implement such measures along with a simple stop log system to above elevation

15.12 to be utilized to protect the doors from direct flood waters. In the event that an appropriate gasket system cannot be found the entry doors will be entirely replaced with new flood-proof doors including frames and in-fill grouting to render repairs to the door frame and surrounding building structure. The screen room double door will have to be specially treated to ensure that it can be maintained in watertight condition for flood waters at either exterior or interior side of the door. There will also be a need for an appropriate vision panel or monitor to enable the pump station operator to observe the level of flooding in the screen room.

WORK COMPLETED: Three of the four entry doors into the building were refurbished to provide for more flood resistance and the entry door to the wet well was replaced with a new fiberglass flood resistant door. All four entrances were fit up with stop logs to six foot height above the main slab level.

2. The generator room intake louver visible at the south elevation view is below the four projected flood elevations therefore a specialized scoop apparatus will need to be constructed that will allow no blockage of air volume intake when in use for flood protection. The scoop will be designed to have a rain-guard awning style cover and a removable outer panel that when in place will prevent flooding below elevation 15.12 and will otherwise protect the louver against debris collision. With the outer panel removed, the return to normal operations will allow air intake to occur at the elevation established for bottom of louver at approximately 11.4+/-. The City will develop a final design for the scoop apparatus at the time of construction. As an alternative, if this louver is not restricted by a maximum bottom elevation, a permanent duct work re-establishing the actual height of intake air to above 15.12 may be considered.

   WORK COMPLETED: After reviewing existing conditions at the Cove Road Pump Station it was concluded that in the event that the generator is required to operate during flooding conditions, a sufficient volume of make-up air will flow through the building if the interior doors to the control room and boiler room are left open and if necessary the entry door to the corridor leading to the control room as well. The main entry door would have to be opened and blocked to lodge against the stop logs to create the most opening possible since all exterior entry doors open outward. This method for make-up air enabled use of stop logs to provide flood protection for the louver located at the building's south wall.

3. Construct a concrete pedestal with pad in the same location as the existing generator radiator cooling system with the top of pad set to elevation 15.20. The pad will be sufficiently sized to accommodate the entire set of cooling system components along with a barricade protected walkway around the radiator system. The concrete support for the pad may be enclosed and filled and will incorporate a set of steps to access the pad level. **(PENDING)**

4. Relocate the generator electrical cooling radiator system onto the new concrete pad set to a height that will place the radiator system components above the highest projected flood elevation 15.12. This work will involve re-plumbing the supply and return piping as well as the controls and other attached appurtenances. This work will also involve raising the existing protective fencing with the top cover unit set to a new height that will clear the top of the radiator cooling system when repositioned. **(PENDING)**

5. Relocate the electrical panel visible in the south elevation to a new height above elevation 15.12. As an alternative the existing electrical panel may be placed into an oversized watertight panel at the same location intended to protect the existing electrical panel from water intrusion. **(PENDING)**

6. Relocate the gas meter assembly visible in east elevation with additional galvanized structural steel bracing to enable the gas meter components to be placed above elevation 15.12. Provide additional shielding to protect the gas meter components from debris collision in the event of projected maximum flooding to elevation 15.12 **(PENDING)**

7. Coordinate the re-positioning of the existing step down transformer onto a new raised concrete pedestal to be constructed at the same location or immediately adjacent to the existing transformer or as recommended by the power company. The top of the pedestal is to be set above elevation 15.12 so that the bottom of the transformer will be placed above the highest projected flood height. **(PENDING)**

8. Construct a means for access during highest projected flooding using a portable set of steps to get over the stop log walls into the entry way most likely to be accessible at the east dock south doorway. The steps will be designed with sufficient height to be placed completely over the stop log wall allowing a person on foot or in a boat to climb over the stop log wall. **(PENDING) An alternative means for access into the building will have to be developed since all four of the stop log sets were installed relatively tight to the door at each location. The most promising is an adjustment to the stop logs at the main entry door to the corridor leading to the control room. Placement of new rails set further away from the door would enable room for person access over the stop log set using a step ladder arrangement.**

9. Construct a safe location within the pump station building at sufficient height above the highest projected flood level for the pump station operator to seek haven in the event of failure of any of the temporary flood mitigation measures. **(PENDING)**

10. Mount a story board to the structural column at the northeast corner of the exterior of the pump station building at the east dock using appropriate hardware to support and secure the story board. Mark the story board with available flood information including the 1938 flood elevation of 11.40 measured at Wamsutta Street, potential flood elevation 11.89 with 0 foot of sea level rise, 12.51 with 1 foot of sea level rise, 13.41 with 2 feet of

sea level rise, and the potential maximum flood elevation 15.12 with 4 feet of sea level rise. **(PENDING)**

LONG TERM GOALS

1. Evaluate the strength of the masonry walls of the Cove Road Pump Station to resist standing water of at least four feet of height against the walls above the main floor slab. The evaluation would need to determine what modifications would be needed to enable the exposed wall surfaces to resist damage or failure in the event of a debris collision. The City believes that the most vulnerable walls include the south and east facing sections. The analysis may include consideration for extending the existing fence structure protecting the current location for the generator radiator cooling system to enclose the south and east facades. **(PENDING)**

2. Refurbish the sump pump system in the pump room with duplex submersible pumps capable of pumping against the additional head and potential volume expected during flood conditions. **(PENDING)**

SUMMARY OF WORK COVE ROAD PUMP STATION

The Cove Road Pump Station building consists of a brick and concrete block masonry structure above the reinforced concrete foundation walls and main slab. It is estimated that these walls will support limited standing still flood waters to at least the height of the maximum expected flood elevation with four feet of sea level rise. Therefore the City has chosen to set flood-proofing protection level to at least the maximum expected flood elevation of 15.12. The actual six foot height of the stop log sets above the main floor slab set the flood protection generally to elevation 17.2 and no other penetrations exist to be addressed.

Since the wet well inlet is connected directly to the sewer collection system the wet well and screen room would be subject to possible flooding. It is noted that there is an operable sluice gate that can throttle or shut off the incoming effluent flow preventing general flooding of the wet well while the pump station maintains pumping operation. Therefore the wet well and screen room are protected from flooding as long as the sluice gate is operable and functioning properly, in the event of failure with the gate open, flooding could occur and coincide with the exterior flood level thereby filling the wet well and screen room. It is noted that there are no penetrations between the wet well or screen room and the dry well portion of the pump station.

Building penetrations aside from the main entrance doors are well above the maximum expected flood level with the exception of a few minor small items including pipe penetrations at the radiator cooling system and the gas supply service piping. Achieving maximum flood

protection level was a matter of protecting the doors and louvers and this was accomplished with stop log sets for each door and louver.

The costs for improvements at the Cove Road Pump Station are as follows:

Weather stripping at six doors (one interior) $1,985, Purchase one fiberglass door to replace the wet well entry door $3,594, Installation of the fiberglass door by subcontractor Dupre Masonry $1,200, Purchase of Stop logs at four doors and two louvers $38,362, City Masonry work for installation of stop logs Labor $ 6,462.29, and Equipment $3,180.00.

COVE ROAD PROJECT TOTAL $ 54,783.29

BACKGROUND INFORMATION & EXISTING CONDITIONS

The East Rodney French Boulevard Pump Station located at 1699 East Rodney French Boulevard is the newest large pump station in the City of New Bedford MA and was constructed in 1998-1999 at the present site, a portion of the New Bedford Housing Authority parcel granted to the City of New Bedford for use in constructing the sewer pump station. The present pump station structure was constructed new at this property with no existing structures on the site.

Reference is made to the contract # 12 record drawings dated October 1998 prepared by Camp Dresser & McKee covering the work performed in 1998 to 1999 to construct the new East Rodney French Blvd Pump Station. A new force main and new sewer collection interceptor system was designed and constructed in conjunction with the construction of the pump station. The force main conveys effluent up to Brock Avenue which thereafter flows by gravity to the main sewer interceptor on West Rodney French Boulevard. The collection system improvements cover the area surrounding the pump station and a substantial stretch along East Rodney French Boulevard beyond the hurricane barrier and enabled the elimination of the Apponegansett Street pump station an antiquated pump station.

The Architectural Plan Sheet A-2 and Structural Plan Sheet S-1 depict the main working floor elevation of 9.00 based on the City Datum. The adjustment for the New Bedford Datum to NAVD-88 is an addition of 1.72 feet placing the main floor slab at Elevation 10.72 (NAVD-88).

RESILIENCY DESIGN

The benchmark near the interior corner at the east dock is at Elevation 10.69 by recent instrument survey and corroborates well with the adjusted main floor elevation of 10.72 given that the dock area has a slope designed to pitch toward the edge of the dock.

The projected elevations of the maximum flood elevation are as follows:

With 0 FT Sea Level Rise	11.39
With 1 FT Sea Level Rise	12.70
With 2 FT Sea Level Rise	13.52
With 4 FT Sea Level Rise	15.74

The expected flood elevations with 0 FT sea level rise is approximately 8 inches above the main floor. The expected flood elevation with 1 foot of sea level rise is approximately 24 inches above the main floor slab, with 2 feet of sea level rise is approximately 34 inches above the main floor slab, and with 4 feet of sea level rise is approximately 60 inches above the main floor slab. Therefore all four projected flood elevations will be considered.

All the entry doors are set with bottom at main floor slab elevation therefore these doors will be affected by each projected maximum flood elevation with sea level rise the worst case being five feet of standing water. The City of New Bedford will plan to design for the 4 FT sea level rise and will implement measures to accommodate flood-proofing to at least the maximum flood elevation of 15.74

The design drawing depicts the maximum flood elevations of 15.74, 13.52, 12.70, and 11.39 with lines superimposed on the building façade. The depicted height of these flood elevations was confirmed by physical measurements in the field.

Flood-proofing the pump station structure and associated structures and appurtenances to elevation 15.74 the maximum expected flooding with 4 feet of sea level rise will be relatively straightforward. There will be a need for evaluating the strength of the masonry walls above the main floor slab to determine their strength to resist five feet of standing waters outside but in the case of the East Rodney French Blvd pump station it may be more important to evaluate for debris collision during standing water conditions due to the proximity of the pump station to the open waters of New Bedford outer harbor albeit lying on the outside of the hurricane barrier.

The design of the East Rodney French Blvd pump station incorporates a direct and open connection between the interior of the pump station structure and the wet well namely in the screen room. It is reasonable to assume that because of such a connection, the screen room could flood with a surcharged effluent inflow since the sewer collection system is known to be open to flood water intrusion at a number of locations. There is potential that the surcharged wet well can exceed general exterior flooding and result in higher than maximum projected flooding at elevation 15.74. Therefore there will be a need to evaluate the screen room walls and the entry door to the screen room for interior flooding and the impact of such an event on the other portions of the pump station interior. It is noted that the exterior entry door to the screen room is visible in the east elevation as the double door with the large louver above the entry door. This door is the only access into the screen room and it is noted that a number of electrical devices such as light switches and electrical outlets are wall mounted below elevation 15.74. There is also HVAC equipment and screen machinery controls that are presently located below elevation 15.74. Recovery from severe flooding within the screen room will be a matter of waiting for the flooding to subside therefore the double wide entry door will need to be designed for exterior and/or interior flooding.

SHORT TERM GOALS

1. The entry doors are currently not flood-proof and the expected maximum flooding will reach up to five foot height on the doors. Since the doors are relatively new, if an adequate flood gasketing system can be found to suitably retro-fit the doors, the City will implement such measures along with a simple stop log system to above elevation 15.74 to be utilized to protect the doors from direct flood waters. In the event that an

appropriate gasket system cannot be found the entry doors will be entirely replaced with new flood-proof doors including frames and in-fill grouting to render repairs to the door frame and surrounding building structure. The screen room double door will have to be specially treated to ensure that it can be maintained in watertight condition for flood waters at either exterior or interior side of the door. There will also be a need for an appropriate vision panel or monitor to enable the pump station operator to observe the level of flooding in the screen room.

WORK COMPLETED: The four stainless steel entry doors into the building were refurbished to provide for more flood resistance. All four entrances were fit up with stop logs to six foot height above the main slab level. It is noted that on the As-Built sheet #4 dated September 20, 2016 the two entrance doors at the north side of the building were inadvertently supplied with individual stop log sets that proved to be unusable based on the intended method of installation. An alternate method of use for the support rails was applied and they were mounted in a new location to provide flood protection across the stair entryway thereby providing flood protection for both entrance doors with one set of stop logs but the required stop logs are longer and had to be special ordered and were not available at the time of this writing.

2. The generator room exhaust louver visible at the east elevation view extends below the four projected flood elevations therefore a specialized scoop apparatus will need to be constructed that will allow no blockage of air volume exhaust when in use for flood protection. The scoop will be designed to have a rain-guard awning style cover and a removable outer panel that when in place will prevent flooding below elevation 15.74 and will otherwise protect the louver against debris collision. With the outer panel removed, the return to normal operations will allow air exhaust to occur at the elevation established for bottom of louver at approximately 11.4+/-. The City will develop a final design for the scoop apparatus at the time of construction. As an alternative, if this louver is not restricted by a maximum bottom elevation, a permanent duct work re-establishing the actual height of exhaust air to above 15.74 may be considered.

   WORK COMPLETED: After reviewing existing conditions at the East Rodney French Boulevard Pump Station it was concluded that in the event that the generator is required to operate during flooding conditions, a sufficient volume of make-up air will flow through the building through the upper louvers. This will enable the use of stop logs to provide flood protection for the louvers located at the building's east and west walls.

3. Relocate the electrical panel visible in the west elevation to a new height above elevation 15.74. **(PENDING)**

4. Eliminate the fire alarm pull box visible in the west elevation. **(PENDING)**

5. Relocate the gas meter assembly visible in east elevation with additional galvanized structural steel bracing to enable the gas meter components to be placed above elevation 15.74. Provide additional shielding to protect the gas meter components from debris collision in the event of projected maximum flooding to elevation 15.74 **(PENDING)**

6. Refurbish the drain pipe visible in the east elevation with an interior in-line valve to close off during flooding. **(PENDING)**

7. The intake louver visible at the south elevation provides air flow into an interior corridor and indirectly into the generator room intake louver at a nearby wall. The louver extends below the four projected flood elevations therefore a specialized scoop apparatus will need to be constructed that will allow no blockage of air volume intake when in use for flood protection. The scoop will be designed to have a rain-guard awning style cover and a removable outer panel that when in place will prevent flooding below elevation 15.74 and will otherwise protect the louver against debris collision. With the outer panel removed, the return to normal operations will allow air intake to occur at the elevation established for bottom of louver at approximately 11.4+/-. The City will develop a final design for the scoop apparatus at the time of construction. As an alternative, if this louver is not restricted by a maximum bottom elevation, a permanent duct work re-establishing the actual height of intake air to above 15.74 may be considered.

   WORK COMPLETED: After reviewing existing conditions at the East Rodney French Boulevard Pump Station it was concluded that in the event that the generator is required to operate during flooding conditions, a sufficient volume of make-up air will flow through the building through the upper louvers. This will enable the use of stop logs to provide flood protection for the louvers located at the building's east and west walls.

8. Relocate existing electrical boxes and wiring visible in the south elevation to above 15.74 or refurbish to place within watertight boxes. (**PENDING)**

9. Construct a means for access during highest projected flooding using a portable set of steps to get over the stop log walls into the entry way most likely to be accessible at the east dock south doorway. The steps will be designed with sufficient height to be placed completely over the stop log wall allowing a person on foot or in a boat to climb over the stop log wall. **(PENDING) An alternative means for access into the building will have to be developed since all four of the stop log sets were installed relatively tight to the door at each location. The most promising is an adjustment to the stop logs at the main entry door to the corridor leading to the control room. Placement of new rails set further away from the door would enable room for person access over the stop log set using a step ladder arrangement.**

10. Construct a safe location within the pump station building at sufficient height above the highest projected flood level for the pump station operator to seek haven in the event of failure of any of the temporary flood mitigation measures. (**PENDING)**

11. Mount a story board to the structural column at the northeast corner of the exterior of the pump station building at the east dock using appropriate hardware to support and secure the story board. Mark the story board with available flood information including the 1938 flood elevation of 11.40 measured at Wamsutta Street, potential flood elevation 11.39 with 0 foot of sea level rise, 12.70 with 1 foot of sea level rise, 13.52 with 2 feet of sea level rise, and the potential maximum flood elevation 15.74 with 4 feet of sea level rise. (**PENDING)**

LONG TERM GOALS

1. Evaluate the strength of the masonry walls of the East Rodney French Blvd Pump Station to resist standing water of at least five feet of height against the walls above the main floor slab. The evaluation would need to determine what modifications would be needed to enable the exposed wall surfaces to resist damage or failure in the event of a debris collision. The City believes that the most vulnerable walls include the north and east facing sections. (**PENDING)**

2. Refurbish the sump pump system in the pump room with duplex submersible pumps capable of pumping against the additional head and potential volume expected during flood conditions. (**PENDING)**

SUMMARY OF WORK EAST RODNEY FRENCH BLVD P. S.

The East Rodney French Boulevard Pump Station building consists of a brick and concrete block masonry structure above the reinforced concrete foundation walls and main slab. It is estimated that these walls will support limited standing still flood waters to at least the height of the maximum expected flood elevation with four feet of sea level rise. Therefore the City has chosen to set flood-proofing protection level to at least the maximum expected flood elevation of 15.74. The actual six foot height of the stop log sets above the main floor slab set the flood protection generally to elevation 16.6 and no other penetrations exist to be addressed.

Since the wet well inlet is connected directly to the sewer collection system the wet well and screen room would be subject to possible flooding. It is noted that there is an operable sluice gate that can throttle or shut off the incoming effluent flow preventing general flooding of the wet well while the pump station maintains pumping operation. Therefore the wet well and screen room are protected from flooding as long as the sluice gate is operable and functioning

properly, in the event of failure with the gate open, flooding could occur and coincide with the exterior flood level thereby filling the wet well and screen room. It is noted that there are no penetrations between the wet well or screen room and the dry well portion of the pump station.

Building penetrations aside from the main entrance doors are well above the maximum expected flood level with the exception of a few minor small items including pipe penetrations at the generator drain and the gas supply service piping. Achieving maximum flood protection level was a matter of protecting the doors and louvers and this was accomplished with stop log sets for each door and louver.

The costs for improvements at the East Rodney French Boulevard Pump Station are as follows:

Weather stripping at six doors (one interior) $1,352, Purchase of stop logs at five doors and one louver $37,760, City Masonry work for installation of stop logs Labor $5,170.32, and Equipment $2,544.00.

EAST RODNEY FRENCH BLVD PROJECT TOTAL $ 46,826.32

HOWARD AVENUE PUMP STATION PROFILE PG 1

BACKGROUND INFORMATION & EXISTING CONDITIONS

The original Howard Avenue Pump Station located at 99 River Road New Bedford MA was constructed in1923.

The existing structure was modified in 1954 and the last improvement project was 1977. The Record Drawing A-1 of Contract # 2 entitled Howard Avenue Wastewater Pump Station Improvements dated Dec 12, 1989 with an original design drawing dated October 1977 indicated a Plan at Elevation 7.17 for the main floor slab which is representative of the floor slab elevation at the main entryway facing River Road. Note # 2 found on sheet G-1 states that the elevations are in reference to the City Datum and the conversion to USGS (NGVD-29) requires adding 2.55 feet to the New Bedford elevations. This places the main floor slab at Elevation 9.72 (NGVD-29). The adjustment for the New Bedford Datum to NAVD-88 is an addition of 1.72 feet placing the main floor slab at elevation 8.89 (NAVD-88) from previous surveys. This also represents a sea level rise of 0.83 feet equal to the difference in height between the two datums and equivalent to the rise in Mean Sea Level from 1929 to 1988. Refer to the design drawing for visual confirmation of the existing conditions of the pump station facades and appurtenant structures.

RESILIENCY DESIGN

The benchmark set at the main entrance stoop north side is 8.74 which corroborates within reason with the main floor elevation at 8.89 but indicates that the slab level is lower than previously measured.

The projected elevations of the maximum flood elevation are as follows:

With 0 FT Sea Level Rise	0.53
With 1 FT Sea Level Rise	0.53
With 2 FT Sea Level Rise	19.03
With 4 FT Sea Level Rise	23.44

Since the expected flood elevations with 0 FT and 1 FT sea level rise is far lower than the main floor slab elevation at 8.74 these will be ignored. The 2 FT sea level rise maximum flood elevation at 19.03 is about 15 inches below the eave soffit of the roof which is at elevation 20.32 and the 4 FT sea level rise maximum flood elevation at 23.44 is just over 37 inches above the eave soffit. The design drawing depicts the maximum flood elevations of 19.03 and 23.44 with lines superimposed on the building façade. The depicted height of the 19.03 flood elevation was confirmed by physical measurements in the field while the depicted height of the 23.44 flood elevation was estimated with an attempt to show the approximate elevation on the chimney.

The City of New Bedford will plan to design for the 2 FT sea level rise and implement measures to accommodate about 10 feet of standing flood waters against the pump station building structure.

There are several ramifications that arise if the building will be inundated to ten foot height the most critical perhaps being the need for evaluating the buoyancy of the building where as the construction of the building above the in-ground concrete structures consists of masonry that may need to be mechanically anchored to the concrete floor slab and/or braced against flexing as a result of standing flood waters against the outside or worse as a result of debris collision. The underground reinforced concrete structures are not expected to be a problem with respect to buoyancy. The City will evaluate the existing conditions of the masonry and confirm whether or not mechanical fastening is feasible.

Flood-proofing to elevation 23.44 the maximum expected with 4 feet of sea level rise will be a challenge that will require substantial changes at the Howard Avenue Pump Station. The wood frame roof over the pump station structure is connected to the top of the masonry walls which are at approximately elevation 20.4 with customary anchor bolts. The roof is un-insulated and vented at the soffit eave therefore any flood waters higher than the top of the masonry walls will flow through the perforated metal covering the eave opening and will flood the interior of the pump station with relative ease and/or lift and otherwise destroy the roof. The City believes that countermeasures to flooding that exceeds elevation 20.3 should be taken into consideration in the latter half of the next century. Any expectation of flooding that may exceed elevation 20.3 merits contingency planning for replacement of key operational components at the pump station. These are listed as follows:

1. Pump Controls
2. Four electric pump motors
3. Generator
4. Heating system boiler
5. HVAC electric fan motors (6)
6. Electric Service

SHORT TERM GOALS

1. The three entry doors are currently not flood-proof and based on a flood-proofing level that will completely inundate the doorways these three doors will be entirely replaced with new flood-proof doors including frames and in-fill grouting to convert each door to a standard 6’-8” high door.

   WORK COMPLETED: The dry well entry door at the west wall was replaced with a flood resistant fiberglass door and fitted up with stop logs. The stainless steel door at stair entrance was left in place and fitted up with stop logs. The screen room

entry door was replaced with a flood resistant fiberglass door and otherwise left unchanged because of the potential for internal flooding due to the connection in the wet well with the collection system which is open to flood waters.

2. The seven window openings will remain intact and custom insert plugs with exterior gasketed flanges will be fabricated to fit to each window. The inserts will be designed to provide both flood protection and debris collision shielding. Each window insert will be secured in place using a minimum of six bolted dog anchors at the corners and vertical side midpoints consisting of threaded rods long enough to protrude to the exterior for connection to the window insert plug and able to be pulled with a snug fit into the window cavity and tightened against the interior masonry using a preplaced metal frame around the perimeter of the window opening or something comparable to this. All structural steel and hardware will be stainless steel with neoprene rubber gasketing unless a comparable design results in a more efficient and/or cost effective selection of materials.

   WORK COMPLETED: The flood-proofing of the seven windows were addressed by eliminating the louvers and related ducting at five windows and constructing masonry in-fill to completely block in the interior of each window essentially sealing it from flood waters from the inside similar to the other two windows already blocked in with masonry. Upon confirmation that additional bracing will be necessary, the interior side of the masonry fill at each window can be upgraded with appropriate bracing.

3. Fabricate and install an appropriately sized HVAC duct header and/or individual ducts that will interconnect each of the existing five louvered window openings to an appropriately sized main intake duct routed through the roof with an opening no lower than elevation 23.44. Where the window louver units are already closed by existing HVAC fan intake ductwork, provide a connection with a damper that can be opened as a bypass to the roof intake when needed. The building attic space may be used for routing the ductwork.

   WORK COMPLETED: New HVAC work was completed to address the venting for Pump Room # 1 as depicted on the As-Built sheet # 10 (Images #6 through #9) for HVAC work which replaced the louver at the north window of the east wall. New HVAC work was completed to address the venting in the Screen Room as depicted on the As-Built sheet # 10 (Images #12 through #16) which replaced the louver at the south window of the east wall and the east window of the south wall both associated with the screen room. A new through roof intake duct was installed to address the general air intake for the dry well area to replace the louver at the east window of the north wall as depicted on the As-Built sheet # 10 (Images #10 and #11). The louver at the west window of the south wall was disconnected and

permanently eliminated and an image of finished interior appears at the lower left corner of As-Built sheet # 1.

4. The two surface mounted hatches visible in the west elevation view on the surface of the large concrete slab area will be replaced with new flood-proof heavy duty hatches capable of maintaining positive watertight seal with a minimum of ten feet of direct standing flood waters over the hatches. This slab is the cover to the newer Pump Room # 2 and stairwell.

   WORK COMPLETED: New flood proof hatches were installed to replace the existing hatches which were removed. The new hatches are raised above the slab using a flange bolted and sealed to the slab surface with no change to the existing hatchway opening.

5. A local HVAC vendor will be contacted to obtain a proposal for re-routing the venting for the newer pump room and stairwell to a location within the existing pump station building that will accommodate new duct work ultimately having a penetration through the roof. The existing venting utilizes the fresh air louvered intakes from the two open grate sumps visible in the west elevation view on the large concrete slab area. This work must be completed before the two fresh air intakes can be closed off and abandoned. The HVAC portion of this work is most likely going to be outsourced.

   WORK COMPLETED: New HVAC work was subcontracted and completed to address the venting of Pump Room #2 which required substantial work because of the physical separation of the pump room from the original pump station building. The two ducted vent runs were ultimately connected to the building chimney at the abandoned boiler exhaust conduit as depicted on the As-Built sheet # 10 (Images #1 through #5).

6. The two open grate sumps visible in the west elevation view on the large concrete slab area are intended to be eliminated in conjunction with the elimination the two fresh air louvered intakes located in the sump wall below the top slab. Upon completion of the venting re-routing work, the louvers will be removed and the openings closed with reinforced concrete/grout fill. The sumps will then be filled with flowable fill and the top closed with reinforced concrete/grout fill to match the thickness of the top slab.

   WORK COMPLETED: The louvered openings in the sump walls were removed and eliminated in conjunction with the new HVAC work. These were closed with infill masonry then the pits were filled with concrete and finished to the slab surface.

7. The existing generator connection plug and panel visible in the west elevation view intended for use with an exterior mounted backup generator will be placed within a wall

mounted watertight panel intended for use only during non-flood events or limited flooding having no impact on the use of a trailer mounted generator and/or during flooding not expected to rise higher than the bottom of the watertight panel. **(PENDING)**

8. The existing generator exhaust pipe visible in the west elevation view will be modified with an extension and flap cover to raise the exhaust to above elevation 19.03. The exhaust pipe penetration will be refurbished to make provision for positive seal against leakage into the building at the wall thimble. The exposed exhaust pipe will be insulated and wrapped with waterproof shielding to avoid direct contact between potential flood waters and the exhaust pipe. **(PENDING)**

9. The existing small diameter vent pipe visible in the west elevation view above the generator connection will be extended to above elevation 19.03. **(PENDING)**

10. The existing fuel oil tank visible in the north elevation view will be relocated to the top of a concrete pedestal at the same location designed with a supported pad at a height to set the top of the tank containment at elevation 19.5. The design will also incorporate extended pedestal walls with the top set to elevation 23.5. As an alternate to solid concrete walls a comparable design will be considered with a larger concrete pad that will enable heavy duty fencing or a series of bollards to surround the fuel tank for debris collision protection. Access to the tank will be designed to be within the security fencing now existing at the site utilizing a ships ladder or comparable access way up to the tank for fueling and inspection. The City will also incorporate in the pedestal design a provision for future access to the pump station roof from the pedestal structure.

    (PENDING): The City of New Bedford is looking into the possibility of converting to gas powered back up generation which is now the only purposed for the fuel oil system. Conversion to gas will enable the City to completely eliminate the fuel oil system and all the associated components.

11. Re-route the fuel supply and return tubing lines from the new tank location and ensure that the building wall penetrations are sealed. Provide additional shielding for the fuel tubing using a 2” X 6” channel surface mounted to the building to cover the tubing runs or something comparable to this. **(PENDING): See comment at Item #10.**

12. Mount a story board to the southwest corner of the exterior of the pump station building using appropriate hardware to stand off the story board in order to allow it to extend above the eave soffit line. Mark the story board with available flood information including the 1938 flood elevation of 11.40 measured at Wamsutta Street, potential flood elevation 19.03 with 2 feet of sea level rise and potential maximum flood elevation 23.44 with 4 feet of sea level rise. **(PENDING)**

LONG TERM GOALS

1. Investigate the buoyancy characteristics of the pump station building during a condition where all penetrations are sealed against flood waters rising against the exterior of the building to an elevation of 19.03 and confirm the potential for the exterior masonry walls to fail and break apart due to movement from either debris collision or buoyancy forces. Include in this investigation sufficient study for potential wet well flooding that could result in pump station interior flooding to elevation 19.03 due to the open channel flow in the existing screen room as a consequence of the inundation of the collection system being subject to surge intrusion. In the event that the risk is present for these events, perform an analysis of the building exterior walls and affected interior walls for the minimum braced construction that would enable the walls to resist buoyancy forces. Determine if counter measures against buoyancy are feasible and reasonable in cost. **This analysis will be performed in conjunction with further study of the potential for flooding and the need for protection systems available against debris collision.**

2. If the findings indicate that the building is structurally unsound against the maximum expected flooding of 19.03 then determine to what elevation flooding can be accommodated with the projected countermeasures being contemplated. **(PENDING):**

3. Confirm sizing need for a natural gas fired generator in conjunction with the heating needs of the pump station. Make an informal request for gas service of appropriate size for the Howard Avenue pump station to include a gas fired backup generator. **(Inquiry is in progress)**

4. If adequate gas service is confirmed, make a formal request for natural gas service and implement the plumbing for the combined pump station heating service and the backup generator service. **(PENDING)**

5. Produce a design for conversion from oil fueled heating system and implement the conversion to a high efficiency gas fired boiler. Make appropriate improvements in the building heating system along with the boiler replacement. **(PENDING)**

6. Produce a design for conversion from oil fueled backup generator to gas fueled backup generator and implement the conversion. In addition to new gas plumbing to supply fuel, this work will most likely entail refurbishing the generator mounting pad and reconfiguring the electrical conduits and connections. **(PENDING)**

7. Upon completion and testing of the converted heating system and generator, eliminate and remove the entire oil fuel supply system including exterior tank and piping, interior day tank, and instrumentation and perform any cleanup and disposal associated with elimination of the oil fuel supply system. **(PENDING)**

8. Upon removal of the oil fired boiler and exhaust piping, convert the chimney into a roof access man-way by refurbishing the brick chimney and installing a secured roof hatch at the top of the chimney and an interior ladder. As an alternate scheme remove the chimney down to an appropriate height and build a sealed man-way at an appropriate location to gain access into the pump station interior stairwell at the northwest corner of the pump station building using a ladder down into the building. **Use of the chimney location for building access has been precluded due to the need for using the chimney for the Pump Room # 2 venting scheme. Therefore man-way access from the roof remains a pending need.**

9. Upon removal of the exterior fuel oil supply tank and piping, convert the tank support pedestal to a permanent secured access-way to the roof hatch by adding to the concrete pedestal and pad sufficient man-way catwalk to attain safe access the roof hatch. **(PENDING)**

10. Refurbish the sump pump systems in both pump rooms with duplex submersible pumps capable of pumping against the additional head and potential volume expected during flood conditions. **(PENDING)**

SUMMARY OF WORK HOWARD AVENUE PUMP STATION

Given that the flooding at maximum expected flood with 4 feet of sea level rise is well above the eave line at the roof, the City of New Bedford chose with this project to limit the improvements at the Howard Ave Pump Station to the level of flood protection that we can reasonably expect with the installation of stop logs at the appropriate doors. The stop log systems were ordered with six foot protected height which for practical purposes provides an expected protection level to elevation 14.6 a full three feet of height above the bottom of the window openings. This protection scheme is divided into dry well protection and wet well protection where flood proofing countermeasures are substantially more important to protecting the dry well from flooding because of the equipment content including electrical power distribution, pump controls and sensors, exposed wiring, back-up generator, lighting and other articles that if damaged or destroyed due to flooding would constitute a greater loss and delay in resuming pumping operations than what might have to be replaced if the wet well side of the pump station were flooded. The equipment within the wet well side includes the inlet screening machinery, which would be largely intact during a flood with a need to replace perhaps just the electric motor drive.

Since the Howard Avenue pump station structure consists of brick and stone masonry above the reinforced concrete foundation walls and slabs there is concern that the brick and masonry walls will not support water flooding for greater than 50% of the wall height without further bracing. Flood protection is further limited by the fact that the exterior doors of the building all open outward so the two entry doors at the west wall would be restricted from

opening by the stop logs therefore the protection scheme at this pump station is intended to be an unmanned situation during flooding conditions until man-way access is obtained through the roof.

The Screen Room door does not have stop log protection because in the event of a flood the wet well and screen room is expected to fill in conjunction with the flood waters even if pumping continues due to the connection of the wet well to the collection system which is subject to flooding and would likely overwhelm the pumping capacity. Presently there is no inlet sluice gate that would enable the City to throttle the incoming wet well flow. There are no open penetrations between the wet well or Screen Room and the dry well portion of the pump station until reaching the height of the masonry walls at the eave line approximately elevation 20.4. Flood protection above this elevation is impractical without extraordinary flood-proofing countermeasures to raise the pump station walls a minimum of 4.4 feet to a height that would at least equal or exceed the elevation 23.44 expected maximum flood elevation with 4 feet of sea level rise. Therefore the City has disregarded the possibility of protecting the pump station to any higher level than the maximum expected flood elevation with 2 feet of sea level rise at elevation 19.03 and this can be achieved with additional bracing of walls and further improvements to protect the entry doors.

The costs for the improvements at the Howard Avenue Pump Station are as follows:

New HVAC Installation Subcontracted to DDS with the City purchasing the actual fan units independently and performing the demo work at the venting pits as well as the core drilling and masonry in-fill work.

DDS Subcontract $22,100, Fans $7540.54, Drill Rental $450, City Masonry work Core Drilling $8,981.36, Filling Vent Pits $ 1,297.40 SUB-TOTAL $40,369.30

Flood-Proofing Measures including new hatches at west side slab over Pump Room # 2 and two new flood resistant fiberglass doors and stop log systems.

Hatches $3160.78, Stop logs $11,720, Doors $7,856.00, Door installation by Dupre Masonry Contractor $2,400, City Masonry work Installing Hatches $2,571.44, Installing Stop Logs $1403.93 SUB-TOTAL $ 29,112.15

Building improvements including masonry in fill at five windows.

City Masonry work Brick In-Fill at windows SUB-TOTAL $ 20,625.76

HOWARD AVENUE PROJECT TOTAL $ 90,107.21

BACKGROUND INFORMATION & EXISTING CONDITIONS

The Howland Street Pump Station located at 111 MacArthur Drive New Bedford MA was constructed in 1954 and was added to the New Bedford wastewater collection system in conjunction with the wastewater improvement initiative that included the first wastewater treatment plant.

The present existing structure was constructed new at the property located at the southeast corner of the intersection of the former Howland Street and South Water Street. This project was undertaken to remove sewer flows into the harbor waters and redirect them to the main interceptor ultimately to be sent to the waste treatment plant. The construction of the John F. Kennedy Route 18 Highway (JFK) in the early 1970's changed the pump station locale substantially so that in the present day the pump station site is bordering the highway and the flows to this pump station are largely industrial. Howland Street no longer exists nor does South Water Street in this particular area therefore necessitating the change in address for the pump station.

Reference is made to the eight design drawings produced by Fay Spofford and Thorndike Engineers (FST) all dated June 1954. The existing 16 inch force main extends from the pump station site west under the JFK Highway and connects to an existing 12 inch force main from the former pump station on First Street that was abandoned in conjunction with the 1954 Howland Street pump station project. The FST design incorporated a Comminuter Chamber intended to reduce particle size of the sewer effluent prior to entering the wet well. The comminuter machinery has since been removed.

The Site Plan and Superstructure FST Sheet 5 depicts a finished floor elevation of 10.08 and an elevation of 7.5 on the controls access hatchway at the north side of the structure. Those elevations are noted to be in relation to the New Bedford City Datum as indicated by NOTES on FST Sheet 5. The conversion to NGVD-29 requires adding 2.55 feet to the New Bedford elevations. This adjustment places the main floor slab at Elevation 12.63 (NGVD-29) and the access hatchway at Elevation 10.05. The adjustment for the New Bedford Datum to NAVD-88 is an addition of 1.72 feet placing the main floor slab at Elevation 11.80 (NAVD-88) and the access hatchway at Elevation 9.22. The 0.83 FT difference between the NGVD-29 elevation adjustment and the NAVD -88 elevation adjustment represents the sea level rise of 0.83 feet during the past century. So for a given benchmark elevation on a structure that is not expected to move, the apparent change in elevation equals the difference in height between the two datums and represents the rise in Mean Sea Level from 1929 to 1988. Refer to the design drawing for visual confirmation of the existing conditions of the pump station facades and appurtenant structures.

RESILIENCY DESIGN

HOWLAND STREET PUMP STATION PROFILE PG 2

The benchmark at Elevation 9.14 set at the northwest corner of the access hatchway concrete wall by recent instrument survey corroborates well with the adjusted Elevation 9.22 depicted on the FST Sheet 5 drawing and indicates that there is good correlation between the work performed in 1954 and the recent elevations survey. The approximate top of the Comminutor Chamber Slab is 7.22 adjusted to NAVD-88.

The projected elevations of the maximum flood elevation are as follows:

With 0 FT Sea Level Rise	6.82
With 1 FT Sea Level Rise	8.70
With 2 FT Sea Level Rise	13.31
With 4 FT Sea Level Rise	15.11

The expected flood elevations with 0 FT sea level rise is relatively low on the pump station super-structure and is not expected to be a significant problem for the site.

The expected flood elevation with 1 foot of sea level rise is also relatively low on the pump station super-structure but based on the existing conditions this elevation of flooding will impact the Comminutor structure on the same site to the west of the pump station super-structure which is directly connected to the wet well therefore the 1 FT sea level rise and above will be considered.

The main floor slab is at elevation 11.8 +/- adjusted to NAVD-88 but the main entry door is set higher at Elevation 14.3 adjusted to NAVD-88 with exterior stairs up to the exterior platform at Elevation 14.3 +/- and interior stairs down to the main floor from the interior platform at Elevation 14.3 +/-. There is only one main entrance door to the pump station and one other significant opening, a louver located on the west wall the bottom of which happens to be just below the expected maximum flood elevation with 4 feet of sea level rise.

The design drawing depicts the maximum flood elevations of 15.11, 13.31, and 8.70 with lines superimposed on the building façade. The depicted height of these flood elevations was confirmed by physical measurements in the field.

The City of New Bedford will plan to design for the 4 FT sea level rise and will implement measures to accommodate flood-proofing to the maximum flood elevation of 15.11

Flood-proofing the pump station super-structure to elevation 15.11 the maximum expected flooding with 4 feet of sea level rise will be relatively straightforward. There appears to be no direct opening connection between the interior of the pump station super-structure and the wet well therefore it is reasonable to assume that by protecting the pump station super-structure to flood elevation 15.11 there is an expectation that the pumps and controls will be protected regardless of whether the wet well floods above the covers and hatches associated with the wet well. Recovery from severe flooding without flood water intrusion into the super structure will be a matter of waiting for the flooding to subside. Since there are presently no significant

machinery components within the comminutor and wet well structures there would be no need for contingency investment in components. It is also reasonable to disregard any significant flood-proofing work to mitigate flood water intrusion into the comminutor structure except that such measures will help to separate the sewer effluent from the cleaner flood waters.

It is noted that there is not back-up generator at this site and if flooding were to occur use of a portable generator would be limited to flooding that remained below the trailer level.

SHORT TERM GOALS

1. The entry door is currently not flood-proof and the expected maximum flooding will affect the bottom of the door to approximately 10 inches in height but the condition of the door and frame is such that replacement is the most cost effective flood-proofing approach. Therefore the entry door will be entirely replaced with a new flood-proof door including frames and in-fill grouting to render repairs to the door frame and surrounding building structure.

   WORK COMPLETED: The existing door remains and rather than replacing it the decision was made to make provisions for the relatively short height stop logs system to address the flooding issue.

2. The louver visible in the west elevation view will be relocated higher in order to get the bottom of the louver above the worse case flooding of Elevation 15.11. As an alternate this louver and the duct work associated with it may be considered for elimination in conjunction with a review and improvement of the building HVAC system.

   WORK COMPLETED: The existing louver was eliminated permanently and the opening was closed using in-fill masonry. An alternate venting scheme will be used.

3. Relocate the generator electrical connector and service wiring from the present location on the east wall to the west side of the pump station building. The new location will need to be set to an elevation above 15.11 and will need to be accessible from the proposed platform to be extended off the west side of the structure at the same elevation of the main entry landing (approximately Elevation 14.3). **(PENDING)**

4. Remove and replace the existing stair and landing with a new stair and landing oriented to the north rather than south and prepared to connect to a proposed 10 foot wide structural platform to be extended approximately 21 feet off the west side of the pump station super-structure. The platform height is intended to match the stairway landing at approximate Elevation 14.3. **(PENDING)**

5. Replace the wet well access man-way hatch at the north side of the pump station with a new flood-proof unit including a safe opening mechanism capable of being secured in

open position and a locking mechanism for security in closed position with full watertight seal. **(PENDING)**

6. Remove the comminutor mounting at the Comminutor Chamber and seal the remaining hole with grout. Use sufficient drilled dowels into the slab to preclude movement of the grout plug. **(PENDING)**

7. Refurbish the existing man-way access into the Comminutor Chamber with a new flood-proof hatch capable of being secured while either removing the existing man-way access ladder and rail system after it is refurbished to be easily removed and reattached, or made capable of being lifted out of the way while being hinged to the structure to be reset upon return to normal conditions. **(PENDING)**

8. Refurbish minor penetrations into the pump station super-structure at the east wall electrical and communications wire conduits and at the north wall electrical and communication wiring conduits. **(PENDING)**

9. Mount a story board to the southeast corner of the exterior of the pump station building using appropriate hardware to support and secure the story board. Mark the story board with available flood information including the 1938 flood elevation of 11.40 measured at Wamsutta Street, potential flood elevation 8.70 with 1 foot of sea level rise, 13.31 with 2 feet of sea level rise, and the potential maximum flood elevation 15.11 with 4 feet of sea level rise. **(PENDING)**

LONG TERM GOALS

1. The five glass block windows though above the maximum expected flood elevation are in the potential zone for debris collision therefore a custom permanent stainless steel frame will be fabricated and installed around each window designed to accept a bolt on aluminum plate shutter that will be installed in anticipation of a hurricane and otherwise stored at a secure location. **(PENDING)**

2. Design and replace the existing glass block window at the south end of the west wall with a new stainless steel door panel and frame with gasketed flanges capable of sealing against the exterior surface when locked into closed position. Enlarge the opening at the top as needed to accommodate the proposed gantry beam that is to pass through the building wall above the center of the existing window opening. Make provision for the top of the door panel to seat against the bottom flange of the proposed gantry beam so that when the door is in open position the gantry beam is free and clear below. Provide a rain shield above the door and gantry beam attached to the pump station building in such a way with a sealed reglet so as to re-direct rain away from the door opening. **(PENDING)**

3. Design and construct a new 10 FT wide by 21 FT long structural platform to be positioned to align the south edge over the south wall of the pump station pump room and the west edge over the west wall of the pump station pump room. The north wall of the platform will be designed to be supported on a structural steel beam or grade beam that is to be supported primarily at the west all of the pump station underground structure and the west wall of the pump station super-structure. Make provisions on the surface of the concrete platform deck for tie downs for use to secure a portable trailer mounted generator to the platform capable of sustaining hurricane winds. **(PENDING)**

4. Fabricate and install an overhead gantry beam designed to carry a trolley hoist with a minimum one ton capacity and supported at the west wall of the pump station super-structure and at the west end of the exterior platform with a structural steel support frame. The gantry beam will be designed to cantilever at least eight feet beyond the west end of the exterior platform and will be set to an elevation that provides at least 14 feet of headroom above ground level to the bottom of the gantry beam. **(PENDING)**

5. Initiate a design for refurbishing the building HVAC system. Implement as needed with new roof penetrations that will replace the need for the louver located at the west wall. **(PENDING)**

6. Refurbish the sump pump system in the pump room with duplex submersible pumps capable of pumping against the additional head and potential volume expected during flood conditions. **(PENDING)**

SUMMARY OF WORK HOWLAND STREET PUMP STATION

The Howland Street Pump Station is a reinforced concrete structure that projects substantially above ground and is already in sound condition and able to resist flood waters without further bracing, therefore the City of New Bedford chose with this project to construct to achieve the maximum flood protection level of elevation 15.11 for the dry well side of the station.

The main entry door is in need of replacement however it was decided to keep it and place stop logs up to just above the maximum expected flood level. The only other opening of concern was the louver next to the main entry door and that was removed permanently and closed with infill masonry.

The wet well is directly connected to the collection system which is open to flooding and the amount of effort and flood-proofing countermeasures necessary to achieve a flood protected condition at the receiving chamber and wet well would be extraordinary. In addition there is no inlet sluice gate that can be used to control or throttle the actual wet well inlet flow. Therefore,

the City has chosen to not perform any significant improvements to protect the wet well and wet well receiving chamber from flooding.

The cost for the limited improvements at the Howland Street Pump Station is as follows:

New weather stripping at existing door, new stop logs at main entry, and eliminate the louver near main entry. Subcontract work on weather stripping $ 204.00, Purchase of Stop Logs $2,100.00, City Masonry work to remove the louver and In-Fill the opening with masonry $1,177.40, and install the stop logs $557.20.

HOWLAND STREET PROJECT TOTAL $ 4,038.60

BACKGROUND INFORMATION & EXISTING CONDITIONS

The MacArthur Drive Pump Station located at 249 MacArthur Drive is one of the older wastewater pump stations in the City of New Bedford MA. The parcel (Map 53 Lot 70) came under City of New Bedford ownership in April 1949 therefore the first construction of the pump station would have occurred after that date.

In the 1970's the Urban Renewal initiative that created the John F. Kennedy Highway resulted in the complete changing of the Front Street layout essentially eliminating the section of Front Street between Elm Street and Rodman Street in order to accommodate placement of the JFK highway. The sewer collection system underground was not eliminated or changed therefore the pump station site remained intact and has continued to operate from the early 1950's to the present day.

More recently, a revamp of the Route 18 JFK Highway resulted in the opening of Elm Street through to MacArthur Drive leaving the pump station prominently visible and now located on the north side of Elm Street and east of the north bound lane of Route 18. The new bridge carrying the east bound on-ramp traffic to Route 6 crosses over the pump station driveway off MacArthur Drive creating a more open perspective of the pump station site that was not possible prior to the recent major changes. The present pump station structure has undergone no substantial upgrades and the most recent repair work performed on the station was to replace through wall sleeves for one of the three suction pipes drawing effluent from the wet well. This work was accomplished in early 2014. The configuration of the influent piping and force main has not been changed since installation other than to place the sewer force main in a sleeve where it passes beneath the JFK Highway.

After some research at DPI there were no drawings found to reference concerning the MacArthur Drive Pump Station.

RESILIENCY DESIGN

The benchmark placed on the stair landing adjacent to the main door entry was set by instrument survey and represents an NAVD -88 elevation reference. In the absence of other corroborating information we have adopted this benchmark as the elevation reference

The projected elevations of the maximum flood elevation are as follows:

With 0 FT Sea Level Rise	0.00
With 1 FT Sea Level Rise	0.00
With 2 FT Sea Level Rise	9.23
With 4 FT Sea Level Rise	13.27

The expected flood elevations with 0 FT and 1 FT sea level rise are well below the exterior finish grade surrounding the pump station therefore these will be incorporated for purposes of

improvements. The expected flood elevation with 2 FT sea level rise though well below exterior finish grade surrounding the pump station is approximately 27 inches above the control room floor slab of the pump station drywell structure which is at approximate elevation 6.96. The design of the MacArthur Dr pump station is similar to the Coggeshall Street pump station where the main entry incorporates a small slab with a small bathroom off this level and a spiral stair down approximately7.2 feet to the control room level. The expected flood elevation with 2 FT of sea level rise is below outside finish grade but only by about a foot and the maximum expected flood elevation with 4 FT of sea level rise at 13.27 is coincident with the 4" jog in the brick masonry. The reinforced concrete pump station walls appear to rise to the entry way slab level at elevation 14.17 but at different thicknesses. The jog in the outside face masonry is believed to be representative of a reduction in concrete wall thickness of 4" to 5" Based on interior measurements the concrete pump station walls appear to extend at least to the entry slab level at elevation 14.17 therefore most of the risk for masonry construction collapsing is eliminated.

The main entry door is set with bottom at main entry floor slab elevation and this height is above the projected maximum flood elevation of 13.27 by 11inches at approximate elevation 14.17. The City of New Bedford will plan to design for the 4 FT sea level rise and will implement measures to accommodate flood-proofing to at least the maximum flood elevation of 13.27. The main entry door will be considered for refurbishment utilizing the existing wood door since the building has been declared of historic significance. It is expected that the door refurbishment will not be considered as a resiliency eligible task.

The design drawing depicts the maximum flood elevations of 13.27 with lines superimposed on the building façade. The depicted height of this flood elevation was confirmed by physical measurements in the field.

Flood-proofing the pump station structure and associated structures and appurtenances to elevation 13.27 the maximum expected flooding with 4 feet of sea level rise will be relatively straightforward. There will be a need for evaluating the strength of the masonry walls above the main floor slab to determine their strength to resist three feet of standing waters outside but in the case of the MacArthur Drive pump station it may be more important to evaluate for debris collision during standing water conditions due to the proximity of the pump station to the open waters of New Bedford inner harbor less than a half mile away albeit lying somewhat protected by highway bridge structures.

The design of the MacArthur Drive pump station does not incorporate a direct and open connection between the interior of the pump station structure and the wet well. After the replacement of the through wall sleeves in the pump room the dry well side of the pump station has been maintained in much better dry state.

SHORT TERM GOALS

1. The main entry door will be refurbished as a non-eligible activity. **(PENDING)**

2. The bottom of the exterior generator connector plug happens to be just below the maximum expected flood elevation and will require relocation in order to be useable during the maximum expected flood. The City is considering ways to establish a permanent back-up generator at this pump station and may take the external connector out of service. Should the decision be made to require use of a portable generator the City will plan to reposition the connector plug to an appropriate location and above Elevation 13.50. **(PENDING)**

3. The top of the wet well grated vent visible as an inset image at the south elevation view is below the maximum expected flood elevation. Extend a concrete chase the additional height necessary to set the top of the vent above elevation 13.27. **(PENDING)**

4. Replace the existing wet well man-way hatch visible in the south elevation view with a flood-proof unit. **(PENDING)**

5. Replace or refurbish the existing hose bibb visible at the west elevation view with a flood-proof unit. **(PENDING)**

6. Remove the existing vent piping from the abandoned fuel oil tank system and cap exposed pipe at finish grade. **(PENDING)**

7. Mount a story board to the brick masonry wall at the southwest corner of the exterior of the pump station building using appropriate hardware to support and secure the story board. Mark the story board with available flood information for the maximum expected flood elevation 13.27 with 4 feet of sea level rise. **(PENDING)**

8. Retro-fit a watertight hatch at two openings that connect between the wet well and dry well at the MacArthur Drive Pump Station suitable for flood protection with a head pressure design set to at least the maximum expected flood level. **(PENDING)**

LONG TERM GOALS

1. Evaluate the strength of the masonry walls of the East Rodney French Blvd Pump Station to resist standing water of at least five feet of height against the walls above the main floor slab. The evaluation would need to determine what modifications would be needed to enable the exposed wall surfaces to resist damage or failure in the event of a debris collision. The City believes that the most vulnerable walls include the north and east facing sections. **(PENDING)**

2. Refurbish the sump pump system in the pump room with duplex submersible pumps capable of pumping against the additional head and potential volume expected during flood conditions. **(PENDING)**

3. Replace the existing stair and landing structure with a new structure and rail having a removable section in front of the door. **(PENDING)**

SUMMARY OF WORK MACARTHUR DR PUMP STATION

Given that the flooding at maximum expected flood elevation 13.27 is actually below the existing top stair landing and door threshold into the building, there was no critical need for flood-proofing improvements to protect the dry well portion of the pump station. However, there are two penetrations from the wet well to the dry well that have loose covers intended for inspection that would not be suitable under significant wet well flood conditions. Therefore a task was added to the Short Term Goals to install watertight hatches at each of the two penetrations which will be handled by DPI as soon as possible.

Flood protection for the wet well was deemed unnecessary at this time due to the direct connection of the wet well with the collection system which is open to flooding. It is noted that there is no sluice gate available to control the influent flow.

The City has evaluated all the tasks associated with flood-proofing of the MacArthur Drive Pump Station and has undertaken none of those as of this writing but will attempt to get the tasks accomplished as soon as possible.

MACARTHUR DRIVE PROJECT TOTAL $ 0.00

BACKGROUND INFORMATION & EXISTING CONDITIONS

The Wamsutta Street Pump Station located at 38 Wamsutta Street was first constructed after June 1964 to about June 1965 based on the records of land taking for the pump station lot in April 1964 and design plans produced by Robert Charles Associates dated June 1, 1964. The pump station underwent a major upgrade beginning in June 1991 based on the design plans produced by Camp Dresser & McKee dated May 1991. Additional improvements have been made more recently by the Department of Public Infrastructure including the refurbishment of key suction line valves and conversion to submersible pumps along with updated controls and other building improvements.

Reference is made to the contract # 6 record drawings dated January 1994 prepared by Camp Dresser & McKee covering the work performed in 1991 to 1993 to construct the east addition over the existing wet well No 1 structure in order to provide a safe access into the wet well intermediate floor level as well as to make sheltered provisions for odor control measures. Other modifications executed in contract 6 made use of the original pump station structure which remains largely intact with numerous changes to various internal equipment layout and function.

The CDM Contract 6 Building Section Details Plan Sheet A-2 depicts the main working floor elevation of 5.5 based on the City Datum. The adjustment for the New Bedford Datum to NAVD-88 is an addition of 1.72 feet placing the main floor slab at Elevation 7.22 (NAVD-88).

RESILIENCY DESIGN

The benchmark at the southeast corner of the above ground wet well structure visible at the south elevation is at Elevation 7.125 by recent instrument survey and corroborates well with the adjusted elevation of 7.22 given for the original pump station floor elevation over which the addition was constructed at the east end of the building.

The projected elevations of the maximum flood elevation are as follows:

With 0 FT Sea Level Rise	0.00
With 1 FT Sea Level Rise	2.13
With 2 FT Sea Level Rise	15.99
With 4 FT Sea Level Rise	23.53

The expected flood elevation with 0 FT sea level rise and 1 FT sea level rise is below existing exterior finish grade and will be incorporated in the final design. The expected flood elevation with 2 FT of sea level rise is approximately 105 inches almost nine feet above the main floor slab essentially just above the soffit of the roof as depicted on the design drawing. The expected flood elevation with 4 FT of sea level rise is well above the roof at 16.3 FT above the main floor slab as depicted on the design drawing with a

horizontal line approximating the height above the roof. Since the 4 FT sea level rise is expected to occur over the next century the additional two feet of sea level rise would be anticipated during the latter half century. Many more issues arise as a result of any flooding above the pump station building roof therefore the City of New Bedford intends to design and implement flood-proofing to accommodate the 2 foot sea level rise in this initial phase of improvements since that would be expected over the upcoming fifty years and the City will postpone resiliency improvements to the 4 FT sea level rise to a future time when the pump station would be expected to undergo substantial changes beyond flood resiliency.

Each of the two entry doors one at the west elevation and one at the south elevation are set with bottom at main floor slab elevation therefore these doors will be affected by the two projected flood elevations with sea level rise of 2 and 4 feet in each case the door will be completely inundated with the worst case having almost ten feet of water head above the top of the door. Since these doors must be designed for full inundation the higher head pressure condition will be used for design criteria in belief that there is most likely no significant change in design to accommodate the ten foot head pressure verses the two foot head pressure, the present design conditions. With respect to the door replacements, the City of New Bedford will plan to design for the 4 FT sea level rise and will implement measures to accommodate flood-proofing to at least the maximum flood elevation of 15.99

The design drawing depicts the maximum flood elevations of 15.99, and 23.53 with lines superimposed on the building façade. The depicted height of the 2 FT sea level rise flood elevation was confirmed by physical measurements in the field.

Flood-proofing the pump station structure and associated structures and appurtenances to elevation 15.99 the maximum expected flooding with 2 feet of sea level rise will be relatively straightforward. There will be a need for evaluating the strength of the masonry walls above the main floor slab to determine their strength to resist nearly nine feet of standing flood waters outside the pump station building. It is also important to evaluate for debris collision during standing water conditions due to the proximity of the pump station to the open waters of New Bedford inner harbor and the nearly direct access to the waterway.

The design of the Wamsutta Street pump station incorporates a direct and open connection between the interior of the pump station structure and the wet well at the odor control equipment room addition. It is reasonable to assume that because of such a connection, the odor control room could flood with a surcharged effluent inflow since the sewer collection system is known to be open to flood water intrusion at a number of locations. However the construction of the added odor control room was attached to the original pump station structure with no penetrations to the dry well side of the pump station therefore the flooding would be limited to the odor control room. An evaluation of the masonry wall separating the main pump station building from the added odor control room would be

needed to verify integrity of the dry well structure to protect the dry well side of the pump station. It is noted that a number of electrical devices such as light switches and electrical outlets are wall mounted below elevation 15.99 in the odor control room. Recovery from severe flooding within the odor control room will be a matter of waiting for the flooding to subside therefore the entry door will need to be designed for exterior and/or interior flooding.

It is noted that flooding that inundates the entry doors but does not exceed the height of the roof will prevent use of those doors for access to the pump station. If access to the pump station during flooding is essential then a roof hatch entry with appropriate protection and ladder access down into the pump station will be necessary. It is also noted that the natural gas fired generator located on the site has a base set at about the same elevation as the pump station main floor slab and would be subject to full exposure flooding. As the generator is the only back up power available for this pump station site it is critical that the generator be at least considered for resiliency protection as a short term goal.

Any expectation of flooding that may exceed elevation 16 or worse that exceeds the height of the roof will merit contingency planning for replacement of key operational components at the pump station. These are listed as follows:

1. Pump Controls
2. Two Sump Pumps
3. Generator (If not otherwise protected)
4. Electric Heaters
5. HVAC electric fan motors (3)
6. Electric Service

SHORT TERM GOALS

1. The entry doors are currently not flood-proof and the expected maximum flooding will reach up to nine foot height against the doors. These doors need to be replaced entirely including frame and be designed to endure at least ten feet of floodwater head above the door or 16.4 feet of head as measured from the bottom of door and remain nearly watertight. The entry door to the Wet Well # 1 odor control room has the potential for being flooded on the interior due to the exposure the wet well has to being surcharged by flood waters, therefore the door needs to be designed to accommodate flooding on either side.

   WORK COMPLETED: The existing double door at the west side was refurbished to make it more flood resistant and the door opening was fit up with stop logs. The entry door to the wet well at the south side was replaced with a flood resistant fiberglass door and the opening was fit up with stop logs.

This work is considered an interim step of flood-proofing leaving the dry well protected to elevation 12.8 and the wet well partially protected to elevation 13.2 pending elimination of the louver at the east face of the building and the raising of the four wet well vent pipes.

2. The louver visible at the east elevation view is below the expected flood level with 2 FT sea level rise. Reconfigure this louver by replacing it with a ducted vent through the roof of the odor control room and close in the opening in the east wall with infill masonry. **(PENDING)**

3. The four wet well ventilation pipes visible in the south elevation view provide ventilation to the wet well chambers and need to be extended such that the opening at the snorkel top will be set above the roof line. Refurbish the transducer electrical boxes by upgrading as needed to accessible watertight boxes capable of enduring at least 16 feet of flood water head. Since the four venting pipes would be subject to debris collision it will be necessary to provide some means of protection against destruction by collision with floating debris with a structural steel bracing system or relocation into a common protected chase that is armored with structural steel and/or reinforced concrete. **(PENDING)**

4. Eliminate the bathroom side vent visible at the south elevation near the entry door to the odor control room by re-directing the vent through the roof. This vent should be provided with an operable closure panel that can be locked into closed position to make it as water tight as possible in the event that flooding did occur over the roof. **(PENDING)**

5. Two venting penetrations exist through the roof over the dry well area, they are visible in the North and South Elevation views. These two ventilation features require protective measures against floating debris collision and should have provision for an operable closure panel that can be locked into closed position to make it as water tight as possible in the event that flooding did occur over the roof. **(PENDING)**

6. Replace the drain pipe visible in the south elevation at the southwest corner of the pump station building by cutting off interior roof plumbing and replacing it with exterior downspouts and plugging those pipes that penetrate the roof. The plugs shall endure at least six feet of flood water head. **(PENDING)**

7. Raise the generator onto a structural steel and/or reinforced concrete pedestal so that the bottom of the generator base plate is above elevation 15.99. The pedestal must be sufficiently oversize to accommodate a catwalk around the entire generator and must be sufficiently sound to accommodate a substantial perimeter fence around the generator to provide some protection against floating debris collision. As an

alternate to the need for raising the generator over nine feet consider purchasing and stacking two twenty foot long ISO shipping containers to be located and secured to a new structural slab with approximate dimensions of 10 FT X 22 FT and positioned with the southeast corner of the slab over the southeast corner of the Wet Well # 2. This construction may require removal of the overburden covering Wet Well # 2 and replacing with structural reinforced concrete and/or flowable fill to accommodate buoyancy restrictions. **(PENDING)**

8. Mount a story board to the northwest corner of the pump station structure with an offset bracket to accommodate the jog due to the roof edge. Mark the story board with available flood information including the 1938 flood elevation of 11.40 measured at Wamsutta Street, potential flood elevation 15.99 with 2 foot of sea level rise and the potential maximum flood elevation 23.53 with 4 feet of sea level rise. **(PENDING)**

9. Refurbish the sump pump system in the pump room with duplex submersible pumps capable of pumping against the additional head and potential volume expected during flood conditions. **(PENDING)**

LONG TERM GOALS

1. Evaluate the strength of the masonry walls of the Wamsutta Street Pump Station to resist standing water of at least nine feet of height against the walls above the main floor slab. The evaluation would need to determine what modifications would be needed to enable the exposed wall surfaces to resist damage or failure in the event of a debris collision. **(PENDING)**

2. Provide a sixty mil (60 mil) reinforced rubber liner over the existing dry well slab to include the sidewalls down at least six feet on the west and south sides and to at least two feet out away from the east wall along the top of the wet well structural top slab located at approximately 4 foot depth. Form and place a six inch (6”) protective wall against the west south and east sides to the top of the existing slab then provide a 4” thick reinforced concrete protective slab cover over the rubber and protective sidewalls. Provide a similar rubber membrane cover along the north edge of the existing slab glued to the slab cover membrane and mount to the south wall of the pump station building to the top of the main floor slab and terminate into a reglet at the bottom masonry joint. **(PENDING)**

SUMMARY OF WORK WAMSUTTA ST. PUMP STATION

Given that the flooding at maximum expected flood level is well above the existing roof of the pump station, the City has chosen to implement some flood-proofing countermeasures to achieve a specific flood protection level as an interim step toward a higher level to be achieved at a future date.

The main entry door at the west side of the building into the dry well portion of the pump station was refurbished to make it more flood resistant and stop logs were fitted up to bring the flood protection level up to elevation 12.85 almost a foot and a half higher than the historic flood elevation of 11.40 associated with the 1938 hurricane that inundated this area noting that the hurricane dike did not exist at that time. This flood protection measure is a full three feet lower than the predicted flood level with 2 feet of sea level rise at elevation 15.99 but in order to achieve higher protection level more extensive work would have to be performed including bracing at the interior of the masonry walls .

In addition to the new flood-proof hatch installed to replace the exterior wet well entry hatch, the wet well entry door at the south face of the building was replaced with a flood resistant fiberglass door and it was fit up with stop logs to bring the flood protection to elevation 13.2. In order to ensure that level of protection, the louver at the east wall also needs to be removed and replaced with a new through roof vent and the four wet well venting pipes located between the building and the generator need to be extended at least to above the 13.2 elevation. It is noted that the wet well is directly connected to the sewer collection system and therefore is subject to flooding through the wet well.

Since the expectation of a flood with 2 feet of sea level rise at an elevation of 15.99 exists, one of the contingency purchases was made to address the potential total loss of the Wamsutta Street Pump Station due to flooding into the dry well by waters higher than elevation 12.8. The pump controls purchased from Spartan Integrated Systems Inc was sized to handle the three pump configuration at Wasmutta St PS but it can also be used elsewhere as a contingency control panel for other pump stations. It is noted that the three pumps located at the Wamsutta Street Pump Station are submersible type and were installed within the past two years therefore they are most likely to survive any flooding event with no harm and be ready for resumed service as soon as the pump controls are replaced.

It is noted that the natural gas fired back-up generator located to the south side of the pump station is vulnerable to flooding and would be expected to be inoperable during a flooding condition exceeding elevation 8 more or less. The City has a short term goal to raise the generator to at least above the elevation of the flood protection achieved for the dry well portion of the pump station so that it can be operated under flood conditions but there has been discussion about long term goals of adding a second floor onto the pump station in

order to place critical controls and relocate the generator to above the currently expected flood level with 2 feet of sea level rise.

The costs for the flood-proofing improvements at the Wamsutta Street Pump Station are as follows:

New flood proof aluminum hatch at the south side wet well entry $ 3,925.91 and City Masonry installation work Labor $926.92, Equipment $477.00
SUB-TOTAL $5,329.83

New flood resistant fiberglass door to replace the stainless steel entry door at south face of building $2,914 and new weather stripping at this doors $214 and Door installation by Dupre Masonry Contractor $ 1,200 and new stop log system at this entry doors $5,670 and City Masonry crew installation work Labor $861.72, and Equipment $424.00
SUB-TOTAL $11,283.72

Refurbished main entry double door at the west face of building to make it more flood resistant with new weather stripping $214 and new stop log system $6,680, and City Masonry crew work Labor $1,292.58 and Equipment $ 636. SUB-TOTAL $8,822.58

Contingency purchase of pump, motor starter and & fittings SUB-TOTAL $28,157.83.

WAMSUTTA STREET PROJECT TOTAL $ 53,593.96