Special Inspection at the Peace River Intake Pump Station in Arcadia, Florida

Condition Assessment and Repair Recommendations

FINAL
October 9, 2018

Peace River Manasota
Regional Water Supply Authority
Special Inspection at the Peace River Intake Pump Station in Arcadia, Florida

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Executive Summary

Between May 7 and 9, 2018, Jacobs conducted a dry inspection of the structural and mechanical aspects of the River Intake Pump Station internals. On July 18, 2018 an underwater inspection was performed on the intake debris screens, exterior river-adjacent concrete walls, and the steel sheet pile bulkhead wingwalls. The inspections were carried out per Work Order 18-23539 dated April 18, 2018.

The purpose of the inspections was to determine the overall condition of the mechanical and structural aspects of the structure not immediately visible to Authority staff and to identify items in need of repair and their estimated associated costs. The dry investigation included the interior elements of the 12 chambers. The pump intake station was last inspected in 2004.

The Peace River Intake Pump Station is in overall Fair condition due to heavy scaling and large spalls on the concrete chamber interiors, moderate corrosion on the sluice gates, minor leaking of the river intake sluice gates, minor corrosion on piping, corrosion on butterfly valve operator couplings, and severe corrosion of the intake debris screens.

The total estimated cost of both the recommended Routine and Priority Repairs to the Pump Station internals is $1,134,000.
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Acronyms and Abbreviations

**ADC**: Association of Diving Contractors

**ASCE**: American Society of Civil Engineers

**Authority**: Peace River Manasota Regional Water Supply Authority

**In**: inch

**Ft**: feet

**LF**: Linear Feet

**OSHA**: Occupational Safety and Health Administration

**Pump Station**: Peace River Intake Pump Station
1. Introduction

Between May 7 and May 9, 2018, Jacobs conducted a dry inspection of the inside of the Pump Station and subsequently on July 18, 2018 an underwater inspection for Peace River Manasota Regional Water Supply Authority (Authority) at the Peace River Intake Pump Station in Arcadia, Florida. The inspections were carried out per Work Order 18-23539 dated April 18, 2018.

1.1 Scope of Work

The dry investigation of the pump station comprised 12, 25-foot high chambers with a combined area of 2,730 square feet. The 12 chambers consist of four bays. Each bay contains a river intake chamber, a former screen chamber (now serving as a flow-through chamber), and a pump chamber. All appurtenances within the chamber below the chamber top deck (EL +10.00) were inspected.

The underwater inspection included two 25 ft long steel sheet pile bulkhead wing walls, four steel debris screens, and the submerged portions of the concrete fascia of the pump station.

1.2 Inspection Methodology

The dry investigation was performed by a three-person Confined Space Entry crew including two Entrants and one Attendant/Supervisor all of whom are currently registered professional engineers in the state of Florida. The chambers were categorized as a non-permit entry confined space, and the inspection team were all OSHA certified as confined space trained. Continuous fall protection and atmospheric monitoring were implemented during the inspection. No hazardous gases were observed throughout the entire inspection, and oxygen concentrations were always within acceptable limits. All accessible structural components were visually inspected and sonically sounded. The floor slab was obstructed by standing water and silt build-up and because a visual inspection was not possible, there was no evidence of deterioration.

The underwater inspection was performed by a three-person team including a Professional Engineer-Diver, a Dive Supervisor, and an Engineer. All diving operations were performed by commercially certified divers in accordance with OSHA and the Association of Diving Contractors (ADC) Standards. All accessible structural components were inspected and ultrasonic thickness measurements were taken along the steel sheet piling to quantify loss of cross-sectional area due to corrosion.

1.3 Rating Criteria

The general condition assessment ratings for the inspected structure are based on a six-point assessment scale developed by the American Society of Civil Engineers (ASCE).

- The six-point condition ratings are:
  - 6 – Good: No problems or only minor problems noted. Structural elements may show some very minor deterioration, but no overstressing observed.
  - 5 – Satisfactory: Minor to moderate defects and deterioration observed, but no overstressing observed.
  - 4 – Fair: All primary structural elements are sound; but minor to moderate defects and deterioration observed. Localized areas of moderate to advanced deterioration may be present but do not significantly reduce the load bearing capacity of the structure.
  - 3 – Poor: Advanced deterioration or overstressing observed on widespread portions of the structure, but does not significantly reduce the load carrying capacity of the structure.
- **2 – Serious:** Advanced deterioration, overstressing, or breakage may have significantly affected the load bearing capacity of primary structural elements. Local failures are possible and loading restrictions may be necessary.

- **1 – Critical:** Very advanced deterioration, overstressing, or breakage has resulted in localized failure(s) of primary structural elements. More widespread failures are possible or likely to occur and load restrictions should be implemented as necessary.

- **Corrosion** is one of the most common deficiencies found on steel elements and the level of corrosion is defined as follows:
  - **Minor (or Light)** – A light surface corrosion with no apparent loss of section.
  - **Moderate** – Corrosion that is loose and flaking with some pitting. The scaling or exfoliation can be removed with some effort by use of a scraper or chipping hammer. The element exhibits measurable but not significant loss of section.
  - **Severe** – Heavy, stratified corrosion or corrosion scales with extensive pitting. Removal requires exerted effort and may require mechanical means. Significant loss of section.

- The damage grades used to describe concrete elements are based on a five-point assessment scale and are listed and defined below:
  - **No Damage:** Good original surface, hard material, sound.
  - **Minor:** Mechanical abrasion or impact dents up to 1 in. General cracks up to 1/16 in. and hairline corrosion cracks. Occasional corrosion stains or small pop-out corrosion spalls.
  - **Moderate:** Structural cracks up to 1/16 in. Corrosion cracks from 1/32 in. up to 1/4 in. wide. Chemical deterioration: Random cracks up to 1/16 in.; “Soft” concrete and rounding or erosion of corners up to 3 in. deep.
  - **Severe:** Structural cracks 1/16 in. to 1/4 in. and partial breakages (structural spalls). Corrosion cracks wider than 1/4 in. and open spalls (excluding pop-outs). Multiple cracking and disintegration of surface layer due to chemical deterioration.
  - **Extreme:** Structural cracks wider than 1/4 in. or complete breakage. Loss of bearing and displacement at connections. Complete loss of concrete cover due to corrosion of reinforcing steel with over 30 percent of diameter loss for any main reinforcing bar. Loss of concrete cover (exposed steel) due to chemical deterioration. Loss of over 30 percent of cross section due to any causes described above.

- **Chemical deterioration** in the above context can include sulfate attack, alkali-silica reaction, or ettringite distress.

- **Cracking of concrete elements,** defined as a separation into two or more parts as identified by the space between fracture surfaces, is categorized using the following assessment terms:
  - **Hairline** - Crack width less than 1/32 in.
  - **Fine** - Crack width between 1/32 in. and 1/16 in.
  - **Medium** - Crack width between 1/16 in. and 1/8 in.
  - **Wide** - Crack width greater than 1/8 in.

- The types of cracks identified could include overstressing, corrosion, and general cracking. An overstressing crack results from external loads which cause high internal stresses that exceed the strength of the concrete member. Corrosion cracks are the result of the expansion of chemical products generated by the corrosion of the steel reinforcement. General cracks typically include shrinkage, thermal and chemical reaction cracks caused by the expansion of concrete, which occurs during chemical reactions between concrete constituents, or these constituents and the environment.

- **A spall** is a roughly circular, oval, or elongated depression in the surface of a concrete element caused by separation of a portion of the surface concrete and is categorized using the following assessment terms:
  - **Small (pop-out)** - Less than 6 in. in diameter and 1 in. deep.
- Medium - Between 6 in. and 12 in. in diameter and up to 2 in. deep.
- Large - Over 12 in. in diameter and any depth.

- Scaling is the gradual loss of surface mortar and aggregates and is categorized using the following assessment terms:
  - Light Scaling - Loss of surface mortar up to 1/4 in. deep.
  - Medium Scaling - Loss of surface mortar between 1/4 in. and 1/2 in. deep, including loss between large aggregate.
  - Heavy Scaling - Loss of mortar greater than 1/2 in. deep significantly exposing large aggregate.

1.4 Description of Structure

The Peace River Intake Pump Station (Pump Station) was constructed between 1979 and 1981 on the north bank of the Peace River and consists of a pump building situated over a steel sheet pile cofferdam wet well approximately 75 feet long by 36 feet wide.

An overall view of the Pump Station is presented in Figure 1. The orientation along the riverbank is such that the top corner of the photo is in the north direction and the roadside wall is facing northwest. For the sake of this report, the northwest wall will be referred to as our local north facing wall (Photo 1). All other locations will be referred to accordingly.

Figure 1: Aerial View of Peace River Intake Pump Station
2. Inspection Findings and Condition Assessment

The Peace River Intake Pump Station is in overall **Fair** condition due to heavy scaling with large spalls in the concrete chamber interiors, moderate corrosion on the sluice gates, minor leaking of the river intake sluice gates, minor corrosion on piping, corrosion on butterfly valve operator couplings, and severe corrosion of the intake debris screens.

2.1 Dry Inspection

Prior to the dry inspection, the sluice gates at the river intake were locked shut, and the water was drawn down with an external sump pump. The inspectors entered each chamber with a ladder, tripod connected to a full body harness, and calibrated atmospheric gas monitoring devices tethered to their belts. All levels of atmospheric testing were performed before and during inspection by the Attendant from the deck level before entry was allowed. The chambers numbers, 1 through 12, are referenced on Figure 2 below.

![Figure 2: General Plan. Note chamber designations in red.](image)

2.1.1 Chamber 1

The concrete is in overall moderate condition. Marine growth and barnacles covered concrete to 12 to 14 feet above bottom of chamber (Photos 2 and 3). Multiple spalls were found ranging from small to large. A large spall approximately 2” wide by 1” high by 1.4” deep was found on the north side of the east wall (Photos 4 and 5). Heavy scaling was observed on 10% of surfaces. Light to medium scale is estimated on over 40% of the surfaces; however, barnacle coverage made actual scaling undetectable by visual inspection. The estimate of scaling is based on what inspectors could determine visually and by sounding of concrete. The stainless-steel sluice gate was clean and in good condition (Photo 6). The pump column and pump were in good condition (Photo 7).

2.1.2 Chamber 2

The concrete is in overall moderate condition. Marine growth and barnacles covered concrete to 12 to 14 feet above bottom of chamber. Multiple spalls were found ranging from small to large. A large spall was found on the
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west side of the south wall (Photo 8). Heavy scaling was observed on 10% of surfaces (Photo 9). Light to medium scale is estimated on over 40% of the surfaces; however, barnacle coverage made actual scaling undetectable by visual inspection. The estimate of scaling is based on what inspectors could determine visually and by sounding of concrete. The iron sluice gate was covered in muck and moderately corroded (Photo 10, 11, and 12). The pump column and pump were in good condition.

2.1.3 Chamber 3

The concrete is in overall moderate condition. Marine growth and barnacles covered concrete to 12 to 14 feet above bottom of chamber (Photo 13). Multiple spalls were found ranging from small to large. A large spall approximately 11” wide by 4” high by 1.5” deep was found on the east side of the north wall (Photo 14). Heavy scaling was observed on 10% of surfaces. Light to medium scaling is estimated over 40% of the surfaces (Photo 15); however, barnacle coverage made actual scaling undetectable by visual inspection. The pump column had minor corrosion but had good connections between the flanges (Photo 16). The estimate of scaling is based on what inspectors could determine visually and by sounding of concrete. The iron sluice gate was covered in muck and moderately corroded (Photo 17).

2.1.4 Chamber 4

The concrete is in overall moderate condition and was soft in most areas. The interior wall on the west side was hard and in good condition. Marine growth and barnacles covered concrete to 12 to 14 feet above bottom of chamber. Multiple spalls were found ranging from small to large. A large spall was found on the north side of the east wall (Photo 18). Heavy scaling was observed on 10% of surfaces. Light to medium scale is estimated over 40% of the surfaces; however, barnacle coverage made actual scaling undetectable by visual inspection. The estimate of scaling is based on what inspectors could determine visually and by sounding of concrete. The pump column and pump column flanges appeared to be in good condition; however, there was evidence of minor seepage between the pump column flanges (Photo 19). The sluice gate was covered in muck but in good condition (Photo 20).

2.1.5 Chamber 5

The concrete is in overall moderate condition. Marine growth and barnacles covered concrete to 12 to 14 feet above bottom of chamber (Photo 21). Multiple spalls were found ranging from small to large. A large spall was found on the north side of the east wall (Photo 22). Heavy scaling was observed on 10% of surfaces. Light to medium scale is estimated over 40% of the surfaces; however, barnacle coverage made actual scaling undetectable by visual inspection. The estimate of scaling is based on what inspectors could determine visually and by sounding of concrete. Corrosion on butterfly valve operator couplings was evident. Photos show butterfly valve operator couplings before and after scraping (Photos 23, 24, and 25). The flow return valve operator coupling was relatively clean (Photo 26).

2.1.6 Chamber 6

The concrete is in overall moderate condition. Marine growth and barnacles covered concrete to 12 to 14 feet above bottom of chamber. Multiple spalls were found ranging from small to large. A large spall was found on the north side of the east wall (Photo 27). Heavy scaling was observed on 10% of surfaces. Light to medium scale is estimated over 40% of the surfaces; however, barnacle coverage made actual scaling undetectable by visual inspection. The estimate of scaling is based on what inspectors could determine visually and by sounding of concrete. Corrosion on butterfly valve operator couplings was evident. Sluice gate stem and gate tracks to Chamber 10 on the south wall was striated from heavy use but appeared to be in good condition (Photo 28). Sluice gates appeared to be in good condition (Photo 29).
2.1.7 Chamber 7

The concrete is in overall moderate condition. Marine growth and barnacles covered concrete to 12 to 14 feet above bottom of chamber. Multiple spalls were found ranging from small to large. A large spall was found on east side of north wall (Photo 30). Heavy scaling was observed on 10% of surfaces. Light to medium scale is estimated over 40% of the surfaces, however barnacle coverage made actual scaling undetectable by visual inspection. Estimate of scaling is based on what inspectors could determine visually and by sounding of concrete. 30” Piping and 30” Tees were heavily coated in muck but appeared to be in good condition underneath (Photo 31). Corrosion on butterfly valve operator couplings was evident. Sluice gates appeared to be in good condition. Moderate corrosion was evident on lower corner of sluice gate framing on south wall (Photo 32). Potentially dangerous wildlife was observed in chamber (Photo 33). Deteriorated concrete was noted at top slab opening (Photo 34).

2.1.8 Chamber 8

The concrete is in overall moderate condition. Marine growth and barnacles covered concrete to 12 to 14 feet above bottom of chamber (Photo 35). Multiple spalls were found ranging from small to large A large spall was found on north side of west wall (Photo 36). Heavy scaling was observed on 10% of surfaces. Light to medium scale is estimated over 40% of the surfaces, however barnacle coverage made actual scaling undetectable by visual inspection. Estimate of scaling is based on what inspectors could determine visually and by sounding of concrete. Heavy muck covered pipe supports and 30” piping and butterfly valves, but it appeared to be structurally sound underneath (Photos 37 and 38). Corrosion on butterfly valve operator couplings was evident. The iron sluice gate was covered in muck and moderately corroded (Photo 39).

2.1.9 Chamber 9

The concrete is in overall moderate condition. Marine growth and barnacles covered concrete to 12 to 14 feet above bottom of chamber. Multiple spalls were found ranging from small to large. Heavy scaling was observed on 10% of surfaces. Light to medium scale is estimated over 40% of the surfaces, however barnacle coverage made actual scaling undetectable by visual inspection. Estimate of scaling is based on what inspectors could determine visually and by sounding of concrete. The river intake sluice gate was moderately corroded and leaking slightly on the west corner (Photo 40). The sluice gate stem guide was covered in muck but appeared in good condition (Photo 41).

2.1.10 Chamber 10

The concrete is in overall moderate condition. Marine growth and barnacles covered concrete to 12 to 14 feet above bottom of chamber. Multiple spalls were found ranging from small to large. Heavy scaling was observed on 10% of surfaces. Light to medium scale is estimated over 40% of the surfaces, however barnacle coverage made actual scaling undetectable by visual inspection. Estimate of scaling is based on what inspectors could determine visually and by sounding of concrete. The river intake sluice gate did not appear to be leaking (Photo 42). About 36 inches of muck buildup was in the bottom of the chamber (Photo 43).

2.1.11 Chamber 11

The concrete is in overall moderate condition. Marine growth and barnacles covered concrete to 12 to 14 feet above bottom of chamber. Multiple spalls were found ranging from small to large. Heavy scaling was observed on 10% of surfaces. Light to medium scale is estimated over 40% of the surfaces, however barnacle coverage made actual scaling undetectable by visual inspection. Estimate of scaling is based on what inspectors could determine visually and by sounding of concrete. The river intake sluice gate was leaking significantly for the bottom four feet on each side (Photo 44). About 24 inches of muck buildup was in the bottom of the chamber.
2.1.12 Chamber 12

The concrete is in overall moderate condition. Marine growth and barnacles covered concrete to 12 to 14 feet above bottom of chamber. Multiple spalls were found ranging from small to large. Heavy scaling was observed on 10% of surfaces. Light to medium scale is estimated over 40% of the surfaces, however barnacle coverage made actual scaling undetectable by visual inspection. Estimate of scaling is based on what inspectors could determine visually and by sounding of concrete. The river intake sluice gate was not leaking significantly (Photo 45). About 24 inches of muck buildup was in the bottom of the chamber.

2.2 Underwater Inspection

The underwater inspection was performed by a three-person team including a Professional Engineer-Diver, a Dive Supervisor, and an Engineer. All diving operations were performed by commercially certified divers in accordance with OSHA and the Association of Diving Contractors (ADC) Standards. All accessible structural components were inspected and ultrasonic thickness measurements were taken along the steel sheet piling to quantify loss of cross-sectional area due to corrosion.

2.2.1 Wing Walls

The Wing Wall steel sheet piles are in overall fair condition. Typical conditions at the steel sheet piles include moderate loss of protective coating and moderate surface corrosion. Ultrasonic thickness readings taken at the steel sheet piles show a combined total average thickness of 0.295 inches. (21.3% loss) at the midpoint between the waterline and the mudline. Two lifting lug holes, presumably made during construction of the bulkhead are exposed at the tops of the sheet piles. The steel channel concrete cap is in overall good condition with its welds intact.

2.2.2 Concrete Fascia

The intake concrete fascia is in overall good condition with only minor deterioration in the form of small scaling.

2.2.3 Debris Screens

The Debris Screens are in overall poor condition due partial mudline obstruction at Intake 1, severe corrosion of all the vertical and horizontal steel bars, three broken vertical bars at Intake 2, six broken horizontal bars and two vertical bars at Intake 3, and seven broken horizontal bars and one broken vertical bar at Intake 4.
3. Conclusions and Recommendations

3.1 Types of Repairs

To help prioritize the maintenance and repair efforts, the repair recommendations provided herein are
designated as immediate, priority, maintenance, or safety and are listed and defined below:

- **Immediate** repairs require immediate action including possible closing of the structure or areas affected
  for safety reasons until interim remedial measures, such as shoring or removal of potentially unsafe
  structures (or elements), can be implemented. These closings or interim remedial actions, if any, always
  require immediate action upon discovery.

- **Priority** repairs indicate conditions for which no immediate action may be required, but further
  investigations, design and implementation of interim or long-term repairs should be undertaken on a
  priority basis, i.e., taking precedence over all other scheduled work. Priority repairs are considered
  necessary to prevent local failures or severe widespread deterioration and/or to prevent the deterioration
  from continuing to a point where the future repairs will be significantly more-costly. Unless otherwise
  indicated, it is reasonable practice to implement priority repairs within one year.

- **Maintenance** repairs are recommended in accordance with good engineering and industry practice. If
  maintenance repairs cannot be addressed with immediate repairs, they can be implemented as part of a
  scheduled maintenance program. Further postponement of these repairs to the next scheduled inspection
  will not compromise structural integrity or significantly increase the cost of their implementation.

- **Safety** repairs, although non-structural by nature, should be addressed along with an immediate repair
  schedule to minimize possible accidents and injuries to facility personnel.

The following repairs are recommended for each of the inspected structures:

3.1.1 Routine Repairs

- Barnacles and muck should be removed from the interior walls of the pump station.
- 10% of surface area should be patched.
- Metal hardware including sluice gate stems, stem guides, pipe supports, etc. should be cleaned of corrosion,
  and a protecting coating should be applied as applicable to the material being cleaned.
- Tracks for sluice gates should be smoothed as practical to facilitate water tightness and ease of operation to
  minimize ongoing maintenance.
- Pipes, joints and fittings should be cleaned and repainted with corrosion resistance sealer. Any bolts discovered
  to be damaged or missing should be replaced in kind.
- Bolts should be replaced as required.
- The four intake debris screens should be replaced in-kind or replaced with stainless steel material.
- Evaluate each of the butterfly valves to determine if they are necessary for operation of the pump station. For
  the valves that are no longer necessary for operation of the pump station, consider replacing the butterfly
  valves with 30” pipe spool pieces. For the valves that are necessary for the operation of the pump station,
  either repair by replacing the couplings that connect the butterfly valve stems to the valve operators or
  completely replacing the butterfly valves.
3.2 Repair Procedures

3.2.1 Demolition

1. Drain the chamber to be repaired.
2. Remove existing equipment and pipe supports as needed prior to concrete preparation.
3. Remove and dispose of all deteriorated concrete including loose, spalled, delaminated, soft, or cracked material.

3.2.2 Preparation:

1. Remove loose, delaminated, soft, or unsound concrete by high pressure water blast, chipping or other means until sound concrete is encountered and no further rust scale is found on reinforcing steel.
2. Remove rust scale from reinforcing steel and complete structural or reinforcing steel corrosion repairs as necessary. For repairs deeper than 3" anchoring systems should be considered if reinforcing is not available within repair area to anchor the repair.
3. Saw cut perimeter of repair area to a minimum depth of 3/8" (10mm) and chip to saw cut to achieve a straight sided repair. Shape of the repair area is to be as close to square as practical. Straight sided repairs are best achieved by saw cutting ¼" deeper than the maximum sized aggregate but the depth of saw cut must be adjusted to ensure that no reinforcing steel is cut.
4. Remove dust, micro fractured particles and foreign material from repair area by 3500 psi pressure washing or other suitable means necessary to clean surface and obtain desired bond.
5. Remove concrete on underside of reinforcing to provide a minimum of 1" (25mm) clear between the reinforcing and sound concrete. Cut out damaged reinforcing and splice new reinforcing to sound existing reinforcing.
6. Cracks less than 1/16"-width, to be repaired by resin injection.

3.3 Recommended Repairs to be performed in next 12 months

3.3.1 Clean barnacles and debris from interior walls

Barnacles and debris are obstructing the concrete surface from the floor slab to 12 to 14 feet high in the chambers. The barnacles should be scraped clean, and concrete surfaces should be assessed and properly sealed.

Total Area to be cleaned and sealed:

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<th>Wall Height</th>
<th>Wall Area</th>
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<td>650 LF</td>
<td>13 FT</td>
<td>8450 SF</td>
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3.3.2 Repair spalls and soft concrete from interior chamber walls

No exposed reinforcing was identified during the inspection. Repair of spalls and soft concrete should be to 1-inch deep minimum in concrete and patched as outlined in section 3.2 along perpendicular cuts to surface.

Total Volume of spall and soft concrete repair (80 Locations):

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<th>Wall Height</th>
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3.3.3 Replace 30” Butterfly Valves, or Operator Couplings, or Replace Valves with Spool Pieces

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3.3.4 Repair Gate Tracks

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3.3.5 Clean and paint pipes, joints and fittings

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3.3.6 Remove corroded bolts from chamber walls and patch

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3.3.7 Replace Intake Debris Screens

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<th>No. of Screens</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 EA</td>
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</table>

3.4 Cost Estimate for Recommended Repairs

An opinion of probable cost to perform the repairs listed above is estimated to be $1,134,000. This estimate is considered to be a Class III estimate per AACEI guidelines and has an accuracy range of -20 percent to +30 percent. A detailed breakdown of the cost estimate is discussed in Appendix A.
Photo 1: Aerial View of Peace River Intake Pump Station

Photo 2: Chamber 1 Marine and Barnacle Growth on Concrete
Photo 3: Chamber 1 Marine and Barnacle Growth on Concrete

Photo 4: Chamber 1 Large Spall on the North Side of the East Wall
Photo 5: Chamber 1 Large Spall on the North Side of the East Wall

Photo 6: Chamber 1 Stainless-Steel Sluice Gate
Photo 7: Chamber 1 Pump Column

Photo 8: Chamber 2 Large Spall on the West Side of the South Wall
Photo 9: Chamber 2 Heavy Scaling on Walls

Photo 10: Chamber 2 Sluice Gate
Photo 11: Chamber 2 Sluice Gate

Photo 12: Chamber 2 Sluice Gate
Photo 13: Chamber 3 Marine Growth and Barnacles on Concrete Walls

Photo 14: Chamber 3 Large Spall on East Side of the North Wall
Photo 15: Chamber 3 Light to Medium Scaling

Photo 16: Chamber 3 Pump Column
Photo 17: Chamber 3 Iron Sluice Gate

Photo 18: Chamber 4 Large Spall on the North Side of the East Wall
Photo 19: Chamber 4 Pump Column Flange Connection

Photo 20: Chamber 4 Sluice Gate
Photo 21: Chamber 5 Marine Growth and Barnacles Covering Concrete

Photo 22: Chamber 5 Large Spall on the North Side of the East Wall
Photo 25: Chamber 5 Butterfly Valve Operator Coupling After Scraping

Photo 26: Chamber 5 Flow Return Butterfly Valve Operator Coupling
Photo 27: Chamber 6 Large Spall on the North Side of the East Wall

Photo 28: Chamber 6 Sluice Gate Stem and Gate Tracks to Chamber 10
Photo 29: Chamber 6 Sluice Gate and Piping

Photo 30: Chamber 7 Large Spall on East Side of North Wall
Photo 31: Chamber 7 Piping and Fittings

Photo 32: Chamber 7 Corrosion of Southern Sluice Gate Frame
Photo 33: Chamber 7 Snake

Photo 34: Chamber 7 Top Slab Opening
Photo 35: Chamber 8 Marine Growth and Barnacles Covering Concrete

Photo 36: Chamber 8 Large Spall on North Side of West Wall
Photo 37: Chamber 8 Heavy Muck Covering Pipe Support

Photo 38: Chamber 8 Heavy Muck Covering Butterfly Valve
Photo 39: Chamber 8 Iron Sluice Gate

Photo 40: Chamber 9 River Intake Sluice Gate
Photo 41: Chamber 9 Sluice Gate Stem Guide

Photo 42: Chamber 10 River Intake Sluice Gate
Photo 43: Chamber 10 Muck Buildup at the Bottom of the Chamber

Photo 44: Chamber 11 River Intake Sluice Gate
Photo 45: Chamber 12 River Intake Sluice Gate
Appendix A – Basis of Estimate
Special Inspection at the Peace River Intake Pump Station in Arcadia, Florida

Condition Assessment and Repair Recommendations

Basis of Estimate Class 3

TO: Peace River Manasota Regional Water Supply Authority

FROM: Jorge Abisambra

DATE: August 8, 2018

PROJECT NUMBER: 705078

This memorandum presents a Class 3 cost estimate for the Routine Repair Recommendations for the Peace River Intake Pump Station in Arcadia, Florida.

Detailed description of the recommended repairs is to be found in the Condition Assessment and Repair Recommendations report, dated August 8, 2018.

The purpose of this estimate is to provide the stakeholders with a cost that would allow them to have budget for their decision-making process.

The estimate presented in Table 1 is a Class 3 estimate, as defined by the Association for the Advancement of Cost Engineering International (AACE), see Appendix C for additional details. The accuracy of a Class 3 estimate is in the range of -20% to +30%. For this class, a contingency of 20% is recommended and is included in the total cost.

Table 1. Class 3 cost estimate.

<table>
<thead>
<tr>
<th>Low Range</th>
<th>ESTIMATE</th>
<th>High Range</th>
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<tbody>
<tr>
<td>-20%</td>
<td>Total (Rounded)</td>
<td>+30%</td>
</tr>
<tr>
<td>$907,000</td>
<td>$1,134,000</td>
<td>$1,474,000</td>
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</table>

The cost estimate is based on the following:

- Bid Items, quantities, takeoffs, and allowance related items were developed by the estimator.
- Crews work 5 days at 10 hours each day.
- Costs are provided to the approximate mid-point of construction in 2020 dollars.
The following markups were applied:

<table>
<thead>
<tr>
<th>Markup*</th>
<th>PCT</th>
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<tbody>
<tr>
<td>Overhead &amp; Profit:</td>
<td>18.0%</td>
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<tr>
<td>Indirect &amp; General Conditions:</td>
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<tr>
<td>Contractor’s Own Contingency:</td>
<td>3.0%</td>
</tr>
<tr>
<td>Permits &amp; Licenses:</td>
<td>0.0%</td>
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<tr>
<td>Bond:</td>
<td>1.2%</td>
</tr>
<tr>
<td>Sales Tax:</td>
<td>6.0%</td>
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</table>

*Markups are included in unit prices

The following are key exclusions:

- Access restrictions
- Permits
- PS&E or other owner related costs
- Hazardous or contaminated material disposal
- Change order expenses

The cost estimate in Table 1 is based on what is known now about the site conditions and project requirements, and what is expected to occur in the future. Materials and energy costs may change and could have significant effects on this estimate. Therefore, this estimate should be viewed from that perspective. If more than 90 days have passed, or there have been changes in the materials and energy costs, this estimate should be updated.

Disclaimer: The opinions of cost (estimate) shown, and any resulting conclusions on project financial or economic feasibility or funding requirements, have been prepared for guidance in project evaluation and implementation from the information available at the time the opinion was prepared. The final costs of the project and resulting feasibility will depend on actual labor and material costs, competitive market conditions, actual site conditions, final project scope, implementation schedule, continuity of personnel and engineering, and other variable factors. The recent increases or decreases in material pricing may have a significant impact which is not predictable and careful review or consideration must be used in evaluation of material prices. As a result, the final project costs will vary from the opinions of cost presented herein. Because of these factors, project feasibility, benefit/cost ratios, risks, and funding needs must be carefully reviewed prior to making specific financial decisions or establishing project budgets to help ensure proper project evaluation and adequate funding.
### Estimation

**Peace River Pump Station Information**

#### Jorge Abisambra

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Units</th>
<th>Unit Price</th>
<th>Estimate Total</th>
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<tr>
<td>110</td>
<td>Mobilization &amp; Demobilization</td>
<td>1.000</td>
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<td>Environmental</td>
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<tr>
<td>210</td>
<td>Clean Barnacles &amp; debris from interior walls</td>
<td>8,450,000</td>
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<td>4.37</td>
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<td>310</td>
<td>Repair spalls from interior chamber walls</td>
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<td>CY</td>
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<td>Repair gate tracks</td>
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<td>610</td>
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<td>710</td>
<td>Remove corroded bolts from chamber walls &amp; patch</td>
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<td>Item</td>
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<tr>
<td>------</td>
<td>------------------------------------------</td>
<td>----------</td>
<td>-------</td>
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<td>----------------</td>
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<tr>
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***Subtotal

$59,000

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Estimate Total

$1,134,000

**Notes:
AACE – Classification System

Construction Cost Estimate Accuracy Ranges

Class 5
0%-2%

Class 4
1%-15%

Class 3
10%-40%

Class 2
30%-70%

Class 1
50%-100%

Project
Definition
3%-5%

Schematic
Design
15%-20%

Design Development
35%-45%

Construction Documents
90%-100%

Nominal Level of Design Detail

Estimate Amount

AACE 18-R-87
Cost Estimate Classification System

Estimate Amount

-50%

-30%

+30%

+50%

>+100%

>-100%

AACE – Classification System

CH2M HILL