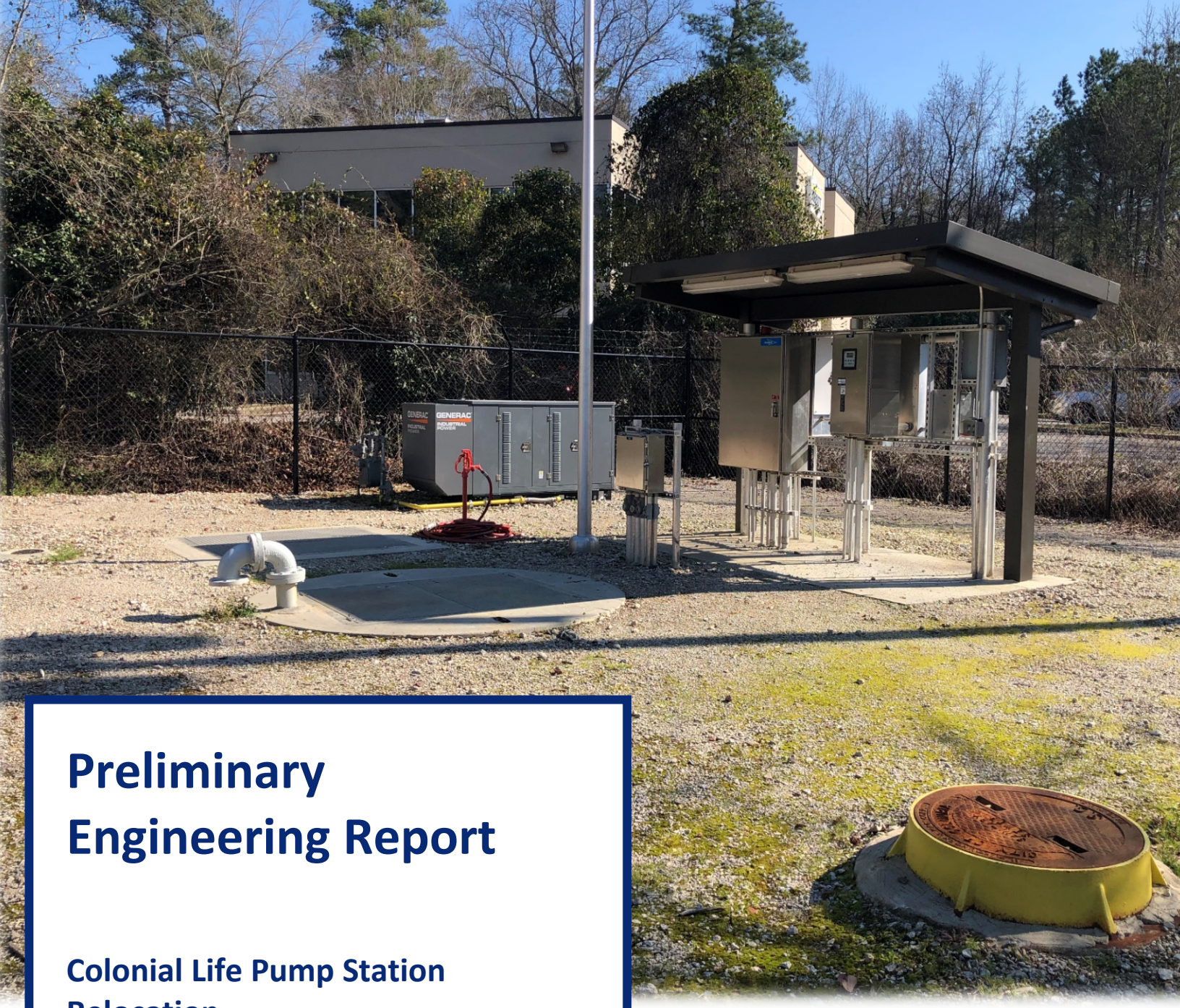

Preliminary Engineering Report

Colonial Life Pump Station Relocation

Updated August 27, 2020

City of Columbia
Columbia, South Carolina

CDM Smith
listen. think. deliver.

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Section 1
Introduction

1.1 Project Background

The Carolina Crossroads (CCR) I-20/26/126 Corridor Project is a South Carolina Department of Transportation (SCDOT) project and was developed to improve traffic congestion in the I-20/26/126 corridor while accounting for future traffic needs. Due to major road improvements, several utilities will be impacted and will need to be relocated to provide uninterrupted service. The Carolina Crossroads Impact Memo, also known as "The Memo," was published on March 15, 2019 and addressed the available solutions to relocating many of the City of Columbia's impacted utilities. Colonial Life Pump Station (CLPS), which pumps sewage from Lawand Drive, manifolding with the Three Rivers PS, before discharging to a gravity sewer and crossing under I-126, will be impacted by CCR. Only a portion of the conveyance system will need to be relocated, but the entire pump station shall be replaced. The existing Colonial Life Pump Station was originally built in 1977 using suction lift pumps and was rebuilt in 2017 (Figure 2-1) to accommodate submersible pumps.

This project only involves relocation of the domestic wastewater pump station, associated pipelines, and water, power, and gas services to the pump station; it does not include relocation of any other utilities.

1.2 Description

The Colonial Life Pump Station (Columbia Water Pump Station #120), currently located at 499 Lawand Drive, is located within the proposed SCDOT right-of-way for the CCR project. The I-126 Ramp D-B and the Colonial Life Spur Ramp A will run directly over the current site requiring the CLPS be relocated. Four relocation options were considered as described in The Memo:

- Option A includes moving the Colonial Life Pump Station to 521 Lawand Drive which would be a straightforward and simple relocation as it is only a few hundred feet from the current site.
- Option B includes moving the Colonial Life Pump Station across the street from Option A to NX 421 Arrowwood, this again would be a simple relocation.
- Option C involves moving the Colonial Life Pump Station to 433 Arrowwood this would locate the CLPS outside of the SCDOT right-of-way and limit conflicts during construction.
- Option D is an alternative to relocating the Colonial Life Pump Station and would involve replacing the current conveyance system with gravity sewer. This would eliminate the need of a pump station and any associated O&M required to run it.

The most viable/recommended option is Option B. It would relocate the Colonial Life Pump Station to a parcel of land that has already been acquired by the SCDOT and will limit the required

sewer relocation needed for the project. Option A was not selected because at the time of this evaluation, the SCDOT did not intend to acquire this parcel of land. Option C was not selected because the site is outside of the project area and would require more substantial gravity sewer replacement and force main relocation. Option D was not selected because of the costs associated with laying gravity pipe at the specified depth of bury of up to 40-feet.

1.3 Scope of Work

Relocation of the Colonial Life Pump Station to NX 421 Arrowood (Richland County Parcel Number: R07302-05-03).

The new location was evaluated for the following criteria:

- Capital, O&M and life cycle costs
- Hydraulic performance
- Public Impacts
- Access and O&M considerations
- Environmental Impacts

Section 2

Relocating Colonial Life Pump Station

2.1 Introduction & Overview

The recommended action for the Colonial Life Pump Station is to relocate it out of the impacted area to NX 421 Arrowwood (Parcel #R07302-05-03). The site is east of the current pump station site and inside the proposed SCDOT right-of-way. The site was selected because it presented minimal additional gravity sewer modifications, however the area will need to be cleared. The current Colonial Life Pump Station has a flow capacity of 230 gpm and receives flow from two 8-inch and one 12-inch gravity sewer lines. The proposed new Colonial Life Pump Station shall continue to serve the customers tied to these three gravity lines with the required flowrate assumed to be the same. The new pump station shall be designed and constructed per the City of Columbia Engineering Regulations, PART 3 (City of Columbia Standards). The standards are applicable to all pump stations that will be owned and maintained by the City. After construction and pipe relocation, the force main, gravity sewer and new Colonial Life Pump Station shall be deeded to the City of Columbia.

While this section summarizes some of the City Standards; the complete, updated version will be submitted with the packaged report or RFP package. Any other version of the City of Columbia Standards, other than those received with this report, are not to be used for design or construction of these utilities.

Figure 2-1 Existing CLPS to be Relocated

Figure 2-2 Proposed CLPS Site

2.2 Site Layout

2.2.1 Pump Station

The new pump station shall be relocated to NX 421 Arrowwood (Parcel #R07302-05-03) within a minimum site area of 60-feet x 60-feet with a minimum 20-foot wide permanent access easement centered along the access drive. The pump station shall be secured in a 6-foot tall standard galvanized fence with 8-gauge wire (not coated) and 3 stranded barbed wire. It shall include an 8-foot wide double swing gate with self-holding latches and recessed center latch point. The access drive to the pump station site shall be a minimum of 12-feet wide and paved to the fence line. A minimum of 6-inch crusher run stone shall be used inside the entirety of the pump station footprint and must have the ability to support vehicles up to 36,000 lbs. The pump station shall not be located within a flood zone but will remain accessible and operable in a 25-year flood.

The pump station shall be equipped with an alarm system and weather durable approved sign. A permanent canopy with switch operated, dual 48-inch LED lights shall cover the control panels located inside the pump station footprint. The canopy shall be coated with Tnemec medium bronze 85BR and shall be built on a minimum 6-inch thick pad. A 20-foot creosoted southern pine service/light pole with all-weather exterior light switches and exterior LED flood lights shall be installed at the pump station and shall provide light into the wet well access, valve vault access, and the control panels and electrical equipment. Flood lights shall be Philips Stonco GP Flood Series Floodlighting GP3 (Medium) LED with a gasketed covered and weatherproof plates. The control panels and a heavy-duty light switch shall be placed in a receptacle with gasketed cover and weatherproof plates near or on the light pole. A yard hydrant and post hydrant shall be provided on the site for wash down water. The metered service line serving the yard hydrant shall be protected with an RP-principal backflow preventor from the SCDHEC Approved List.

The Contractor shall provide supervisory control and data acquisition (SCADA) controls for the pump station in accordance with the City of Columbia Standards. This shall include a Remote Telemetry Unit (RTU) control panel that conforms to the standard provided for an under-100hp duplex pump station. The RTU shall include a programmable logic controller (PLC) for signal processing, a cellular modem for communication to the City SCADA system, and other supporting equipment in a NEMA 4X, 304 stainless steel enclosure, with aluminum solar shields if mounted in direct sunlight.

Pump controls for the station shall be provided in accordance with the City of Columbia Standards. This shall include, but not be limited to, a Pump Control Panel and station instrumentation that conforms to the standards. The Pump Control Panel shall include an electronic pump controller for automatic pump control, manual controls and indicators, motor starters, relays, circuit breakers, and other supporting equipment in a NEMA 4X, 304 stainless steel enclosure. Instrumentation shall include a submersible level transmitter and float level switches for pump control, which shall be wired back to the Pump Control Panel with intervening intrinsic safety barriers. The submersible level transmitter together with the pump controller shall constitute the primary automatic controls for the pumps. The float switches shall provide for independent secondary pump control in the event of failure of the primary controls.

2.2.3 Valve Vault

The valve vault shall be sized to build-out conditions and large enough (minimum 4-foot x 6-foot for a 6-inch discharge) to house the valves and appurtenances while not being deep enough to be classified as an enclosed space (less than 4-foot in depth). The vault hatch, made of traffic rated aluminum, shall span the entire length and width of the vault. A minimum 4-inch drain with a 1% slope from the vault to the wet well shall be installed to allow water to drain. A duckbill flap and a removable screen shall be installed on the end of the drainage line into the wet well to prevent continuous flow and reduce the infiltration of debris. The duckbill flap shall be fitted in a location that will not prevent the installation or removal of the pumps and shall be accessible from the wet well hatch.

Pressure gauges shall be installed by the Contractor in the valve vault for each of the pumps before the check valve and a pressure gauge shall be installed for the force main after both pump discharge lines combine into one. Refer to the City of Columbia Standards for proper valve vault layout. The pressure gauges shall be 4-inch quick disconnect Ashcroft or Wika filled with glycerin and accurate within 0.5% of the total scale range. Each pressure gauge shall be mounted with a saddle tap for a 1-inch stainless steel pipe with 2 ball valves mounted to an isolator ring. The pressure gauges shall be made of 316L stainless steel and have stainless steel shut-off ball valve with handle. All pressure gauges shall face upward.

Plug valves shall be used for force main flow control. Plug valves shall be Dezurik and include worm gear and hand wheel operation. Check valves shall be installed between the pump and the shut-off valve. Contractor shall arrange for and pay for an authorized supplier of the check valves to be on site during their installation so that they can set the valve weight and make adjustments to meet design criteria.

2.2.4 Force Main Connection

The new Colonial Life Pump Station shall be connected to the existing force main in Lawand Drive. The connection shall be made by cutting in a tee and two plug valves to facilitate operation of either pump station, independently. The force main shall be constructed to have a minimum 3-foot cover but shall not exceed 10-foot depth from the bottom of the pipe while complying with the SCDOT Accommodations Manual. The force main shall be designed to the City of Columbia Standards with a minimum flowrate of 2 feet/sec during design flow, while not exceeding 10 feet/sec. The force main shall be adequately sized to handle the designed peak flow of 230 gpm. The force main shall meet any additional requirements of SCDHEC standards for Wastewater Facility Construction R.61-67, and Ten State Standards. The force main shall also satisfy a leakage test in accordance with AWWA Standard C600.

2.2.5 Excavation, Trench Stabilization, and Back Filling

Excavation, trench construction, and backfilling shall be in accorance with the City of Columbia Standard Specifications and shall follow all applicable Occupation, Safetly and Health Administration (OSHA) requirements to include shoring vertical faces. Supports, both laterial and vertical, shall be provided for any existing stuctures and facilities.

2.3 Hydraulic Considerations

2.3.1 Pump Selection

The proposed new Colonial Life Pump Station shall have two identical Flygt submersible pumps that maintain an operating point at or near peak efficiency. Each pump shall be capable of handling the expected 230 gpm flow and designed to run no more than 6 cumulative hours a day, but no shorter than the manufacturers recommendation or for 1 minute (the longer of the two) each run. Pumps shall be capable of passing spheres of at least 3-inches in diameter. Pump suction and discharge openings shall be at least 4-inches in diameter. Each pump shall have a 3/8-inch PC 316 stainless steel lifting chain and hook on to one of the two Flygt stainless-steel plates with 4 hooks minimum on each of the opposite sides of the wet well access. The pump discharge stand must be anchor bolted to the wet well floor with cast in place J-type stainless steel anchors. See **Appendix C** for more PS details.

2.3.2 Wet Well

The wet well shall be about 20-feet deep or deeper, round, and 8-feet in diameter. It shall be located inside the Colonial Life Pump Station footprint in an easy access location for a vacuum or boom truck. The wet well hatch shall be aluminum double doors with spring assist by Halliday, Bilco, and shall be embedded in the top slab. The access hatch shall be large enough (minimum of 4-foot x 4-foot) to allow removal of pumps and easy access to guide rails and float hangers. Safety grating using hinged aluminum grating panels shall be installed inside the wet well. They shall be constructed from aluminum "I" bar construction and hold at least 300 lbs/ft^2. They shall include a positive latch for holding the grate open, spring assisted lifting handle, be lockable, have 316 stainless steel mounting hardware, and be coated in an orange powder finish.

Guide rails for the pumps can be welded to the wet well walls for up to 23-feet deep, but the extension rail can only be a maximum of 3-feet in length when added to the 20-foot section. If the wet well needs more than a 3-foot extension rail, an intermediate guide rail bracket shall be attached to the discharge pipe. Guide rails must accommodate spacing for build out conditions. The wet well shall also be constructed with a ductile iron vent with two 90-degree elbows and 24 mesh stainless steel screen coated with light grey 32GR Tnemec paint. All hardware shall be stainless steel.

The wet well floor shall have a minimum slope of 1/1 to the hopper at the bottom and shall be no larger than what is necessary for function and installation of the pump inlets. The interior, excluding the bottom, and all the exposed piping shall be coated with Raven 405 coating (minimum 120 mils).

See **Appendix C** for more details on the wet well.

2.4 Additional Evaluation Criteria

2.4.1 Construction Considerations

Trees and brush shall be cleared from the proposed Colonial Life Pump Station site and easements with additional clearing at the discretion of the SCDOT. In addition, the PS site shall be leveled to allow equipment and truck access.

During construction of the new Colonial Life Pump Station, the current pump station shall remain in operation. Bypass pumping or pumping and hauling may be required while making the connection to the existing force main. Bypass pumping and manhole plugs may also be used by the Contractor during the construction of the gravity sewer lines to divert the sewer temporarily. The Contractor shall provide a switch over procedure to the City for approval.

With the depth of the wet well being 20-feet or deeper, it is a likely that rock will be encountered. Rock shall need to be removed to a certain distance as laid out in the standards in **Section 3.2**.

2.4.2 Access and O&M

Access shall be maintained by the Contractor for the City of Columbia to both the proposed and existing pump stations during and after construction to permit any operation and maintenance needs. This includes providing enough space around the wet well to allow the installation and removal of the submersible pumps with subgrade sufficient to support a vehicle up to 36,000 lbs on the site.

All manholes shall remain accessible both during and after construction. They shall not be covered with debris/dirt or left open to the elements to accumulate water or debris inside the manhole. The new gravity sewer lines, new force main, and new pump station shall be monitored and maintained by the Contractor for the first 30 days of successful operation, after which the City will take over responsibilities. Both the gravity sewers and the manholes shall be constructed to the City of Columbia Standards. These conditions shall be met at all times in order to keep the pump stations operational at all times.

2.4.3 Environmental Planning and Permitting

In order to know the full extent and impacts of the Colonial Life Pump Station relocation project, permitting and regulatory requirements must be reviewed during final design and before construction. It is anticipated that certain permits will be needed due to the crossing of the creek and the construction of the proposed gravity sewer system.

The proposed gravity sewer crosses a low flow stream before entering the pump station. Due to this impact, a Section 401/404 permit from the USACE will likely be required. The USACE has provided guidance that the in-contract utility work associated with the project cannot be covered under the CCR permit. The CONTRACTOR shall be responsible for obtaining a separate NW permit on behalf of CoC for this work. An expedited permit may be required to facilitate the construction schedule.

A National Pollutant Discharge Elimination System (NPDES) construction storm water permit will need to be obtained. Permits may be required from both Richland County and City of Columbia as

each jurisdiction is impacted and each is classified as a Municipal Separate Storm Sewer System (MS4).

A Construction Permit for Water/Wastewater Facilities must be obtained from SCDHEC. Initial design calculations are provided herein (**Appendix B**), however final calculations need to be completed and submitted in compliance with R.61-67 and approved by the City. The City of Columbia will provide a service letter to use in procuring this permit stating that they agree to treat the wastewater and have the ability do so. The City will also provide a letter accepting responsibility for the O&M of the proposed Colonial Life Pump Station after 30 days of maintenance and successful operation from the Contractor has been accomplished as determined by the City. Anything else required in the construction permit shall be obtained by the Contractor.

Section 3

Recommended Design for Relocation

This section lists the recommendations for the new Colonial Life Pump Station, force main, and gravity sewers. Any deviations in design shall comply with the City of Columbia standards and shall be specifically noted by the Contractor and approved by the City. The City will review the plans during the design and after construction to ensure compliance with the standards prior to taking ownership.

3.1 Summary of Recommended Design

3.1.1 Gravity Sewer

All new gravity sewer lines shall be PVC unless otherwise specified. All three new gravity sewer lines shall converge at the proposed influent manhole inside the pump station limits. All sewer installation shall be performed by open cut unless agreed to in advance by the City. In unpaved areas along the gravity sewer, manholes shall be flat top instead of concentric and shall be installed 2-feet above the existing ground surface. Manholes shall remain flush to the surface along roads and on private property. See **Section 2.2.3** for further information about the excavation, trench, backfill, and dewatering.

The recommended relocation of the existing gravity sewer pipes are as follows (**Figures 3-1, 3-2, and 3-3**):

3.1.1.1 Lawand Drive 8-inch Gravity Sewer

The existing 8-inch PVC sewer along Lawand Drive shall be replaced with a new 8-inch PVC gravity sewer line due to impacts from the proposed roadway project. The proposed alignment is shown on **Figure 3-1.** The inverts along this proposed relocation are lowered an additional foot from the existing line to allow for potential future connections to the homes upstream, if required to serve those homes due to loss of their existing septic systems from SCDOT right-of-way acquisition. At a minimum, the furthest manhole shall be relocated approximately 10-feet upstream from the existing MH (15958MH) on the existing 6-inch service line. The line shall start in a doghouse manhole placed on top of the current 6-inch service line serving SCDOT parcel 391 and travel southeast at a constant slope of 0.5% for approximately 830-feet. The line shall pass through two additional standard manholes and cross Lawand Drive before entering a proposed inside drop manhole installed on the existing 12-inch gravity line and from which flow shall be channeled to the new pump station. All services connected to the existing gravity sewer line shall be reconnected to the new proposed line.

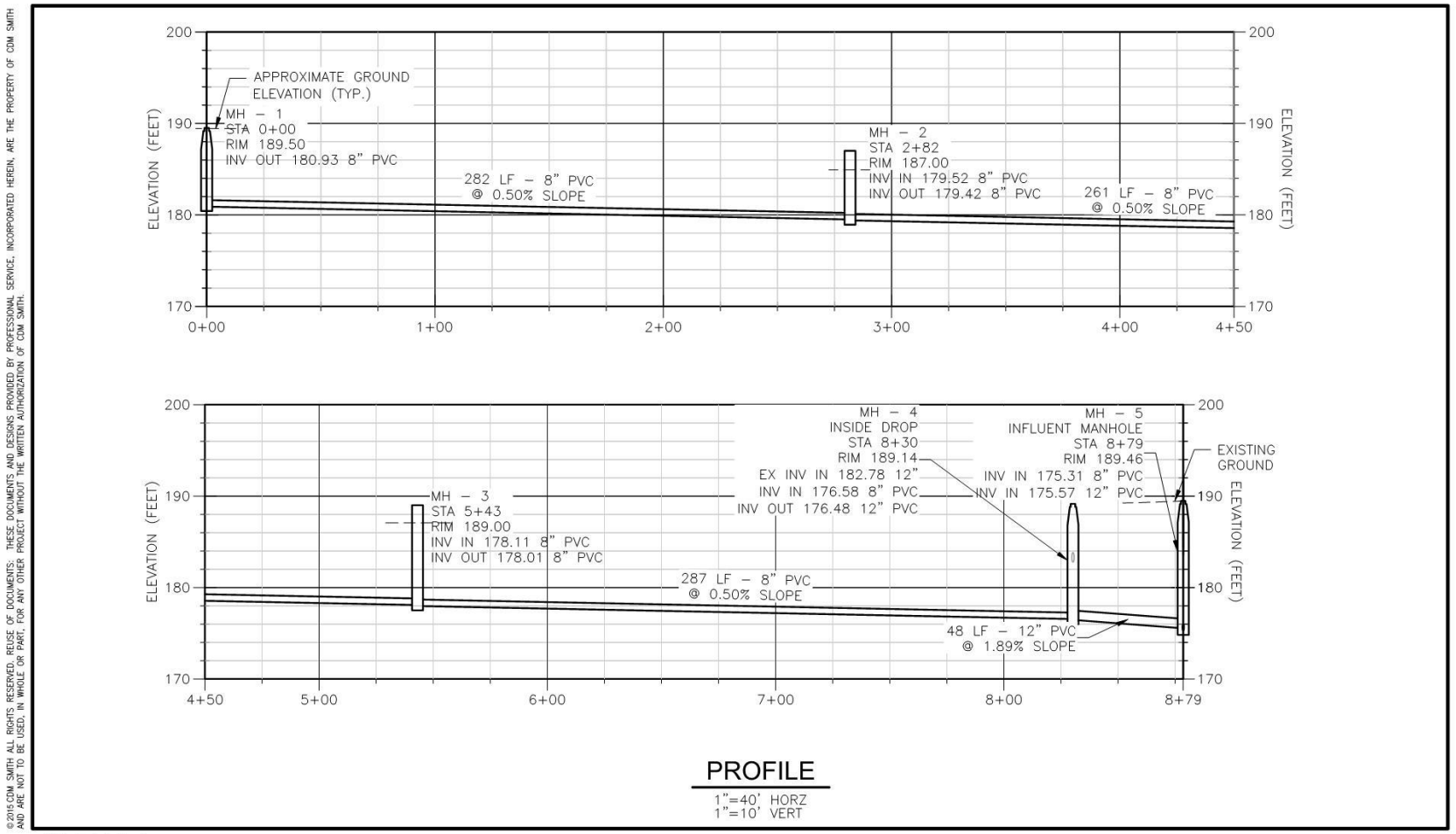
3.1.1.2 Arrowwood Road 8-inch Gravity Sewer

The existing 8-inch DIP gravity sewer from Arrowwood Drive will need to be relocated due to impacts from the proposed roadway project. The proposed replacement 8-inch gravity sewer line shall be relocated to approximately 40-feet inside the SCDOT right-of-way as shown on **Figure 3-2** and will gravity flow approximately 460-feet to the proposed relocated Colonial Life Pump Station. The sewer line shall begin in a doghouse manhole approximately 60-feet downstream of

S1058 (32166 MH) on the existing 8-inch gravity sewer line. The new sewer will leave the doghouse manhole at an approximate 10% slope to a second manhole. The gravity sewer will change to a 0.5% slope and cross under a ditch to a drop manhole. The gravity sewer will then drop approximately 13-feet to travel under the stream with a 0.4 % slope traveling to the influent manhole within the proposed Colonial Life Pump Station boundaries. The new 8-inch sewer shall be constructed from PVC except when crossing under the stream. The gravity sewer line will be DIP with restrained joints from the manhole upstream of the creek crossing to the manhole downstream of the creek crossing. The inside of the DIP pipe shall be coated with 40 mil of Protecto 401 ceramic epoxy liner and the outside shall be coated with 1 mil thick bituminous coating. Upon calculation, it was determined that this 8-inch sewer line will be the driving factor for the wet well depth.

3.1.1.3 Colonial Life 12-inch Gravity Sewer

The existing 12-inch gravity sewer in Lawand Drive shall remain in place upstream of the proposed pump station site as it is not impacted by the proposed SCDOT project and only requires re-routing it to the new pump station site. An inside drop manhole shall be installed approximately 260-feet downstream from 16347MH on top of the existing 12-inch line. The drop manhole will accept flow both from the existing 12-inch and new 8-inch gravity (Lawand Drive) sewer lines. After collecting in the drop manhole, the new 12-inch sewer will travel at a 4% slope to the new influent manhole inside the new pump station boundaries.



CDM Smith

FIGURE No. 3-1
GRAVITY SEWER PROFILE - WEST
FEBRUARY 2020

Figure 3-1
Proposed Gravity Sewer Profile-8" PVC Along Lawand Drive.

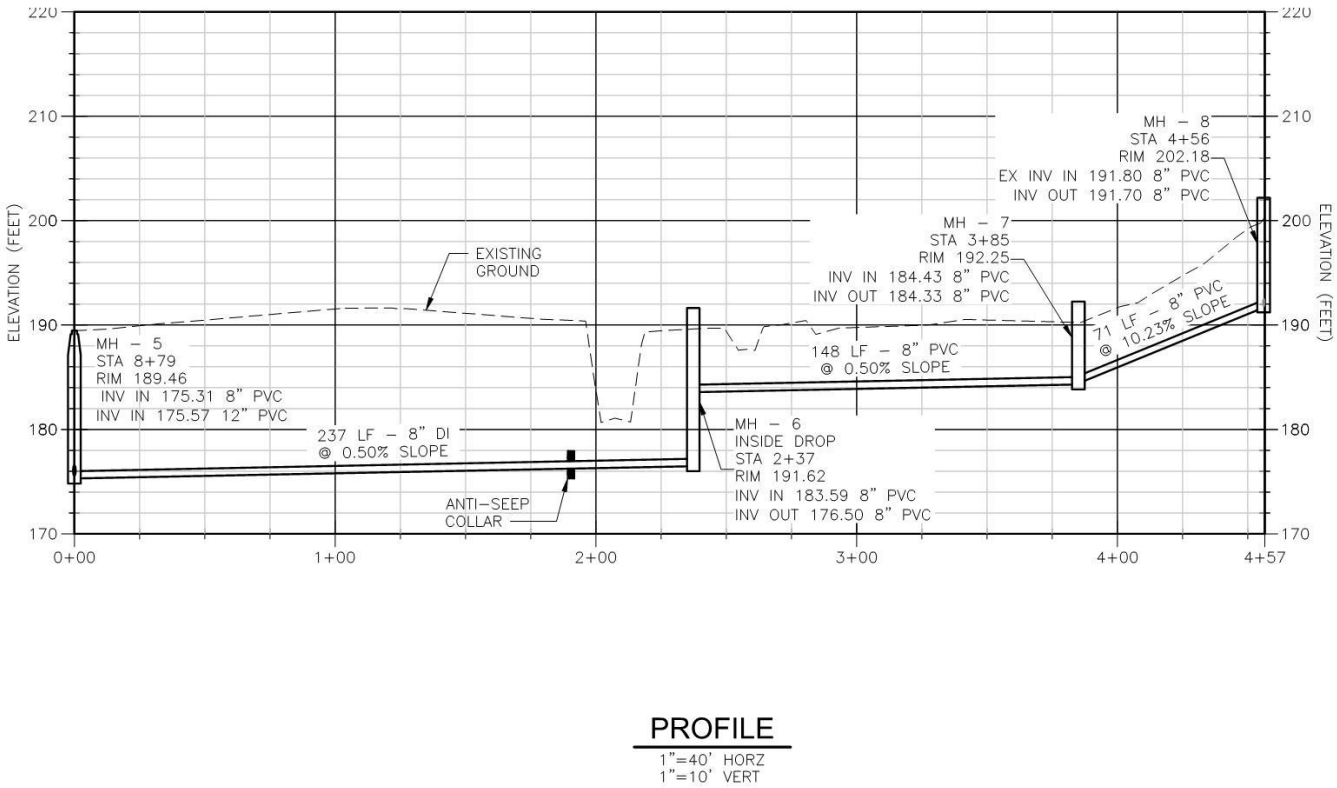


FIGURE No. 3-2
GRAVITY SEWER PROFILE - EAST
FEBRUARY 2020

Figure 3-2
Proposed Gravity Sewer-8" PVC Crossing the Stream

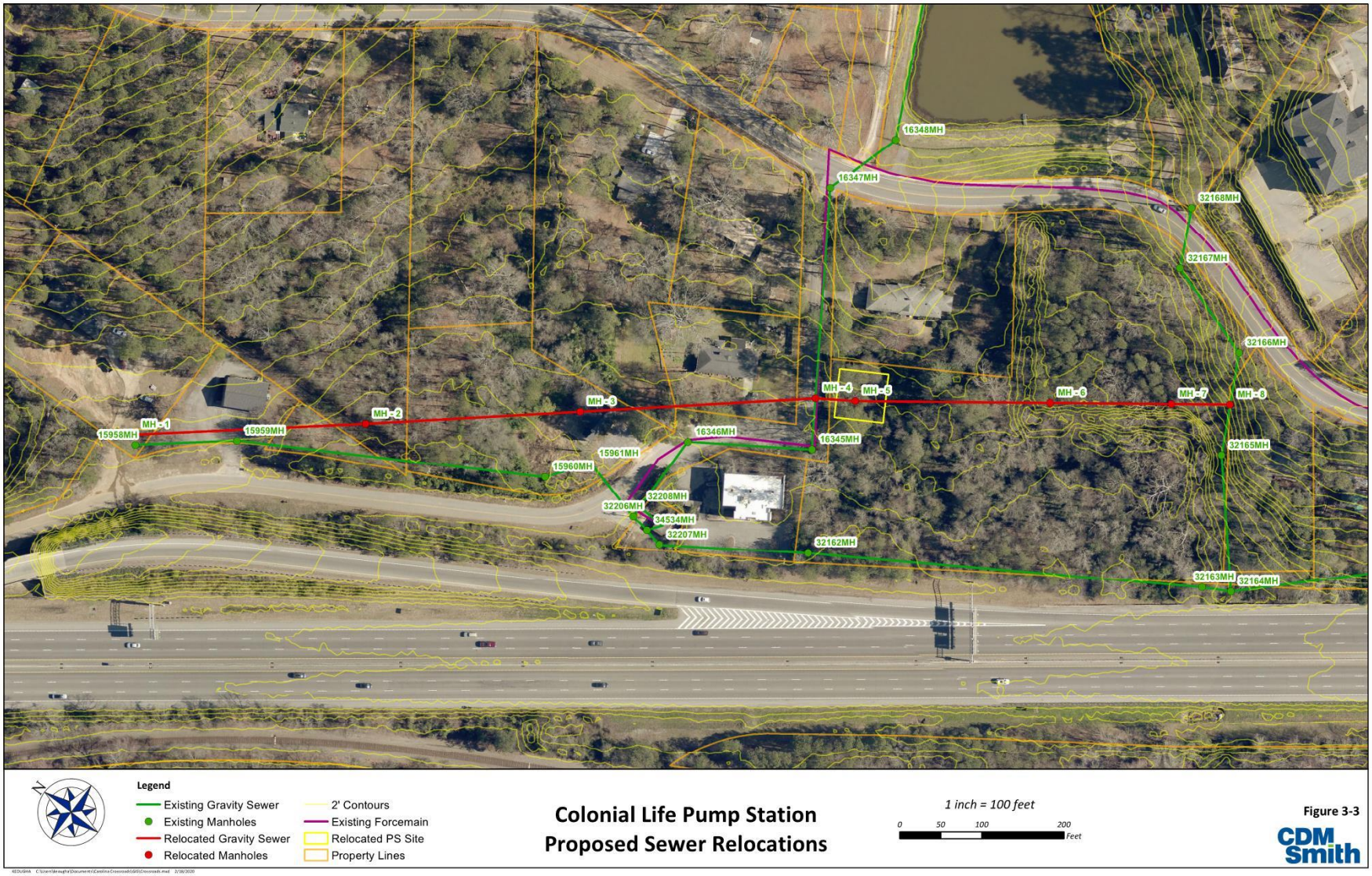


Figure 3-3
Aerial Overview of Proposed Gravity Sewer Relocations

3.1.2 Pump Station

The new pump station shall be laid out in a manner to provide the most efficiency and accessibility. See **Figure 3-4** for a schematic of the recommended replacement of the Colonial Life Pump Station. The double gates shall be positioned parallel to Lawand Drive and open to a 60-foot x 60-foot fenced pump station site. The gravity sewer will collect inside an influent manhole within the pump station site and gravity flow northeast into the wet well. The influent manhole is critical and cannot be removed through value engineering efforts. From the wet well, the sewage will pump through the valve vault and into the 6-inch ductile iron force main.

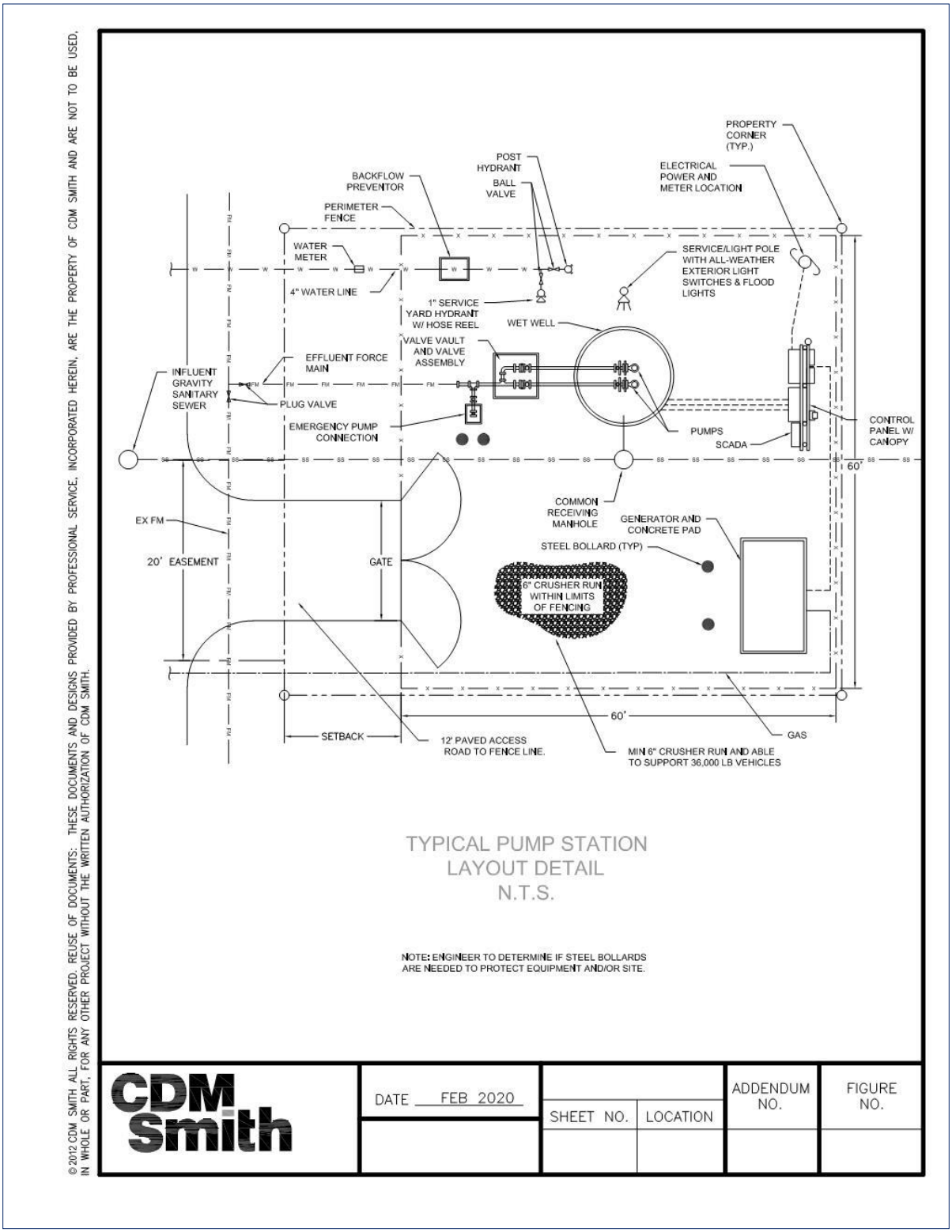


Figure 3-4
Proposed CLPS Layout

The existing pump station shall remain in operation until the proposed Colonial Life Pump Station is constructed and has been fully and successfully operational for 30 days. After this time, the existing pump station will be shut off and the City will be given two weeks to retrieve any equipment from the existing pump station that is salvageable. After those two weeks, any equipment left by the City will be property of the Contractor. Further decommissioning shall be the responsibility of the Contractor.

3.1.2.1 Existing Force Main and Pump Station

The existing 6-inch force main is routed approximately 3,800-feet along Lawand Drive, Arrowwood Road, and Gracern Road to the Three Rivers Pump Station. From there, flow from Colonial Life Pump Station joins flow from the Three Rivers Pump Station and continues eastward through the 8-inch Three Rivers Force Main. The 8-inch force main continues along Gracern Road approximately 2,400-feet and discharges into a manhole (STA 62+67 per the SCDOT as-builts). From there, flow is conveyed through 12-inch gravity sewer.

The existing force main shall be utilized for the proposed relocated Colonial Life Pump Station. A new 6-inch DIP force main shall travel from the valve box and tie into the existing 6-inch force main in Lawand Drive by cutting-in a tee. Two plug valves shall be installed; one on the new force main before the tee connection and one upstream of the tee on the existing line. The valves will allow continuous operation of the existing pump station while the proposed site is being constructed and commissioned. The valve on the existing force main shall be permanently closed and abandoned once the original pump station is decommissioned.

3.1.2.2 Hydraulic Model Development

CDM Smith completed a desktop hydraulic evaluation of the existing pump station using WaterGEMS v8i. This evaluation is conceptual and only considered a high head design condition to compare alternatives. The hydraulic model utilized the following parameters:

- Suction water surface elevation range – 172.00 feet to 175.00 feet
- Discharge water surface elevation – 193.11 feet
- Hazen-Williams C factor of 120
- One duty pump, one standby pump

The pump curves (Flygt 3153 with 9.4-inch impellers) of the pumps in the existing pump station were also input into the model. Approximately 300 gpm of flow is conveyed to the discharge manhole using the existing pump curves. Factors that contribute to the variance between existing pump station capacity and proposed pump station capacity include the reduction in force main length by approximately 40-feet and the conservative losses used in development of the model.

The results of the WaterGEMS model demonstrate that a pump rated for 230 gpm at 66-feet of total dynamic head will convey the required flow from the proposed new location of the Colonial Life Pump Station to the discharge manhole. The system is pumping to an intermediate high point at 225.00-feet in an existing air release manhole. A system curve is shown in **Figure 3-5**

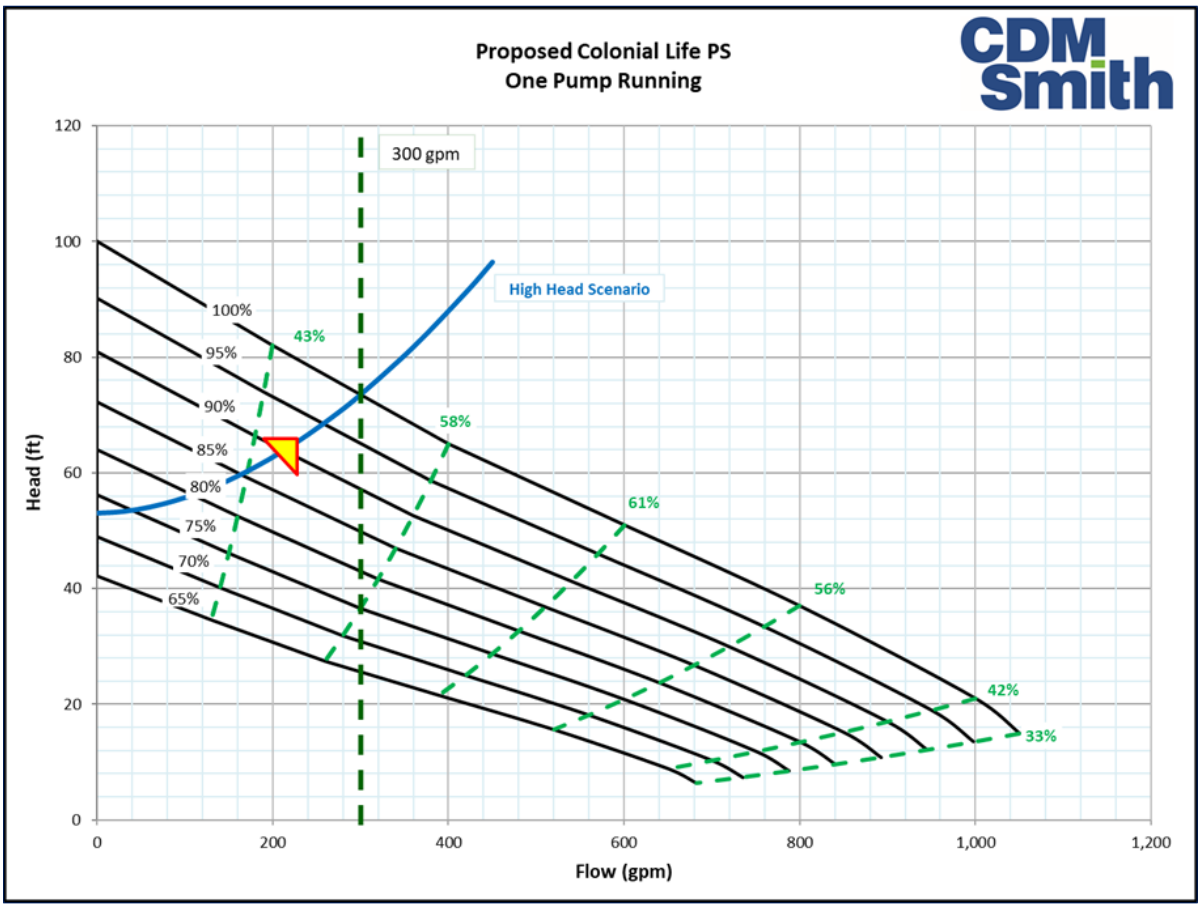


Figure 3-5
Proposed Colonial Life Pump Station System Curve

3.1.2.3 Proposed Pump Station

At 230 gpm, flow in the existing 6-inch force main from the proposed location of the Colonial Life Pump Station to the tie-in from the Three Rivers Pump Station will have a velocity of approximately 2.7 feet/sec. At approximately 470 gpm, flow in the existing 8-inch force main from the tie-in from the Three Rivers Pump Station to the discharge manhole will have a velocity of approximately 3.0 feet/sec. Upsizing the existing force main is not recommended.

Preliminary pump selections rated for 230 gpm at 66-feet of head include Flygt 3153, the same model as the pumps in the existing Colonial Life Pump Station. The preliminary pump selection is rated for 12 horsepower. The exact pump selection will occur during final design, with an emphasis on the pump being properly sized and the most efficient pump possible.

Preliminary evaluation of the proposed pump station yields the following elevations and set points based on an invert into the wet well at 175.58-feet:

- Bottom of wet well – 170.00 feet

- Bottom of pump – 170.30 feet
- Pump off elevation – 172.00 feet
- Pump on elevation – 174.00 feet

3.2 Geotechnical Considerations

The relocation includes construction of a new eight-foot-diameter wet well bearing 20 to 25-feet below existing grade, however the geotechnical considerations sized for a maximum ten-foot-diameter wet well.

3.2.1 Preliminary Foundation Recommendations

Based on the proposed project site layout, anticipated dimensions, depth, and loads, it is recommended the wet well be constructed on a mat foundation bearing on partially weathered rock or bedrock. The mat foundation may be designed for a maximum allowable bearing pressure of 4,000 pounds per square foot. Assuming site preparation recommendations are followed, settlement of the structure under the anticipated loads and designed as recommended above, is expected to be less than 0.5-inches.

It shall be noted that the foundation design for the wet well shall be considered preliminary, and the final foundation design shall be the responsibility of the Design Engineer's Geotechnical Engineer following the completion of the additional subsurface investigation discussed below.

3.2.2 Design Groundwater Elevation

Based on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), the project site is located outside the 500-year flood zone. For the purposes of design, we recommend a design groundwater level of 5-feet below existing grade based on the groundwater levels observed in the existing test boring W-23 provided by SCDOT.

3.2.3 Lateral Loads on Below-Grade Walls

Below-grade portions of structures that are fixed against rotation at the top or will not sufficiently rotate enough shall be designed for at-rest pressures from soil and groundwater based on equivalent fluid unit weight of 60 pounds per cubic foot above the design groundwater level and 90 per cubic feet below the design groundwater level.

In addition to these pressures, a lateral pressure equal to 0.5 times surface vertical surcharge loads from building foundations, slabs, traffic. or other loads shall be applied over the full height of all walls. To eliminate the surcharge loading from adjacent building foundations on walls, the buildings shall be separated such that a line extending at least 2-feet beyond the edge of the foundation, then outward and downward at a slope of one horizontal to one vertical (1H:1V) does not intersect the adjacent structure. Walls to which vehicles can reasonably be expected to approach within a distance equal to half the wall height shall be designed for a minimum temporary uniform vertical surcharge of 300 pounds per square foot. Earthquake induced pressures developed in accordance with the Building Code shall be included in the design of all below grade walls.

3.2.4 Unbalanced Lateral Loads

Unbalanced lateral loads shall be designed to be resisted by friction on the bottom of the shallow foundations. For purpose of design, a coefficient of friction of 0.35 shall be considered between the concrete and the underlying structural fill or crushed stone. However, should lateral loads exceed the friction available, the surplus loads may be resisted by passive pressures on the foundations, provided the structure is appropriately designed for the pressures. Passive resistance up to a maximum equivalent fluid pressure of 150 pounds per square foot may be used provided the walls are backfilled with structural fill that is compacted to a density of at least 95% of the maximum dry density as determined by ASTM D698. The resistance from the upper 2-feet of soil should be neglected, due to surface effects and potential for disturbance due to frost action and other factors. Frictional resistance shall be assumed to be mobilized first and to its full capacity before any passive pressure is developed.

3.2.5 Resistance to Buoyancy

Any structures that extend below the design groundwater level shall be designed to resist hydrostatic pressures from the design groundwater level referenced above using the dead weight of the structure plus weight of fill placed directly over the structure and extension to the structure foundations. For purposes of design against uplift, the material used as backfill shall be assumed to have a total unit weight, in place, of 120 pounds per square foot. A factor of safety of at least 1.25 shall be used to evaluate uplift resistance for the design groundwater level.

3.2.6 Earthquake Considerations

For the purposes of determining design earthquake forces the structures in accordance with the Code the site shall be considered as Site Class “C”. Therefore, the spectral accelerations shall be modified for Site Class C when determining the design earthquake response accelerations and seismic design category for the seismic analysis at the site.

3.2.7 Additional Subsurface Investigation

The preliminary foundation design recommendations herein have been developed using available test boring W-23 from the nearby SCDOT project. Due to this test boring being conducted approximately 225-feet west of the proposed pump station, one test boring shall be conducted within the footprint of the wet well to evaluate the design groundwater level recommendations and support site-specific foundation design. We recommend the test boring be conducted to a depth of approximately 30-feet below ground surface (ft-bgs) if bedrock is not encountered or a minimum of 2-feet below the bottom of the wet well if bedrock is encountered. The test boring log shall be submitted to the City of Columbia for review as part of the required plan review process.

3.3 Structural Design Recommendations

The structural design of the pump station wet well and valve vault structures identified in other sections of this preliminary design report shall be designed in accordance with this section and the City of Columbia Standards.

The 2018 IBC is the governing code for this project and is applicable to new structures. Process structures shall conform to the provisions of ACI 350 in addition to the local building code. If

guidelines or directions included in this document are in conflict with the governing code or codes, the more stringent criteria shall be used.

3.3.1 Design Loads

Numerical values for the dead load (those resulting from the weight of all fixed construction) of well-defined components of a structure shall be used as documented in ASCE 7, AISC Manual of Steel Construction, CRSI Handbook, and Manufacturers catalogs for fabricated components. Floor live loads (all loads other than dead loads) applicable to the project are for unrestricted vehicular areas which shall conform to AASHTO HS20. For a more comprehensive list, refer to ASCE 7 and ACI 350. In addition to a mechanism's static dead load, design shall be performed for other effects, such as those due to operation, maintenance and malfunction such as for required maintenance procedures, such as removal of a large component and placing it temporarily on the adjacent structure. Static loads shall be increased for the effects of impact in accordance with the AASHTO Specification for vehicular loads and 20% of the operating weight (minimum) or manufacturer's recommendation for light machinery supports, shafts or motor drives.

Design shall be performed for liquid loads assuming liquid surface at the maximum working level using normal allowable stresses, or the load factor for a live load, as appropriate. In addition, design shall be performed assuming the liquid surface at the maximum possible level under surcharge conditions using an increase in allowable stresses, or the load factor for a dead load, as appropriate. 7.3.5 External Earth and Groundwater Loads

Earth and groundwater loads shall be developed from the following criteria in accordance with the project geotechnical report and the governing code. Earth load design shall be performed for ground surface at finish grade. Substructures shall be designed to permit the external excavation to be backfilled after the construction of the ground level slab. Groundwater load *design shall be performed for groundwater* acting laterally, downward and upward, *5-feet below ground surface or a 100-year flood elevation of 171.3-feet, whichever is higher* for normal allowable stresses or load factors, as appropriate. *D*esign groundwater elevation shall be established at finish grade for the valve vault.

Table 3-1 outlines the equivalent fluid pressures that will be used in preliminary design for well-graded, granular, mineral soils with a moist unit weight of 120 pcf, unless otherwise recommended by the geotechnical report. Soil pressures for final design shall be developed in accordance with the geotechnical report. Design for cantilevered and top-supported walls of environmental engineering structures shall be performed for at-rest soil pressures.

Table 3-1 Equivalent Fluid Pressures Used in Preliminary Design

Pressure Condition	Pressure Coefficient	Equivalent Lateral Fluid Pressure	
		Above Groundwater	Below Groundwater
At-rest[1]	0.50	60 pcf	90 pcf
Active[1]	0.33	40 pcf	80 pcf
Passive[2]	N/A	150 pcf	150 pcf

1 Minimum
2 Maximum

Walls to which vehicles can reasonably be expected to approach within a distance equal to half the wall height shall be designed for a uniform surcharge of 300 pounds per square foot.

Design shall be performed for combinations of loads, along with appropriate load factors or allowable stresses, in accordance with the governing code(s). In the absence of specific direction by the code, the most severe distribution, concentration and combination of design loads and forces shall be used.

Design shall be performed for structures that contain liquids, extend below grade, or both, for the following load combinations:

- Liquid-containing compartments full; no backfill for liquid containing compartments. No reduction will be made for any counteracting soil pressure on the face remote from a contained liquid unless approved.
- Backfill and groundwater with liquid containing compartments empty and full.
- Liquid containing compartments empty or full in any combination.

3.3.2 Foundation Design

Permanent structure foundation elements shall be designed to distribute loads to the supporting rock or piling in accordance with their allowable loads, and to accommodate predicted deformations of the structure caused by settlement or movement of the supporting elements. Structure foundation elements shall be designed to resist effects of groundwater, including buoyancy.

Design of shallow foundation elements (footings and mats), including excavation and backfill limits and details, shall be performed in accordance with the recommendations of the geotechnical report. To the extent possible, buried piping and duct banks shall be maintained outside the influence zone of the foundation elements. Limits of this zone shall be established based on bearing materials' characteristics as documented in the geotechnical report. At a minimum, this zone shall be defined by a line extended outward and downward from the bottom corners of a foundation element at a 1 vertical to 1 horizontal slope. A reinforced concrete encasement or other appropriate protection shall be provided for any utilities extending into this zone.

The stability of structures to unbalanced lateral loads shall be confirmed for appropriate lateral soil and groundwater pressures, surcharges and other applicable loads. The coefficient of friction between the concrete and the underlying structural fill or crushed stone shall be 0.35. Passive pressures from the soil in front of the wall or footing keys shall not be used to reduce loads, stresses, or overturning and sliding effects, unless measures are taken to ensure against erosion or removal of the soil. The resistance of the upper 2-feet of soil shall be neglected when considering passive pressure resistance to unbalanced lateral loads. Design shall be performed with factors of safety of 2.0 for overturning and 1.5 for sliding.

Buoyancy design shall be performed in accordance with the following. For groundwater at the design level, structures shall be designed to resist buoyancy considering only the structure dead load, soil directly above the structure and footing extensions. The effects of live loads, liquid

contents, vertical soil friction, and soil cohesion shall be neglected. When anchorage systems are used, they shall be designed to resist the net uplift force transmitted to the components of the anchorage. Structures shall be designed to provide minimum factors of safety, calculated as the ratio of total resisting force to total buoyant force. The minimum factor of safety against buoyancy considering only the structure dead load shall be 1.10. The minimum factor of safety against buoyancy considering the combination of structure dead load, soil directly above the structure and footing extensions shall be 1.25. Since the contractor shall be required to maintain a dewatered excavation, it may be assumed that groundwater shall be maintained, at any given time, at or below the surface of the backfill currently in place. If the completed portion of the structure has insufficient resistance against pressures generated in this condition, the groundwater elevations at which the structure is stable shall be provided in the contract documents. Passive and active groundwater relief systems shall not be used for reducing the effects of groundwater pressure on the structure. Relief valves, underdrain systems, and active groundwater lowering systems are not-permitted. Where appropriate geotechnical conditions exist, rock anchors may be used to resist buoyancy. Design of these elements shall be performed considering recommendations from the geotechnical engineer

3.3.3 Concrete Design

Design of all cast-in-place, site-cast, and precast concrete structures shall be performed, except as indicated below in accordance with the governing code(s). Design of site concrete work, such as paving, curbing, and sidewalks shall be performed by the civil discipline. Design of the precast site structures, including manholes, vaults, pipe shall be performed by the fabricator or erector.

Concrete structures shall be designed in accordance with ACI 318 for general structures, ACI 350 for environmental engineering structures, and AWS D1.4 for reinforcing steel and welding.

Structures that convey, store or treat liquid are subjected to severe exposures, or that have restrictive leakage requirements shall be designed as environmental engineering structures.

Design shall be performed for concrete with the following minimum 28-day compressive strengths (f'_c).

Table 3-2 Equivalent Fluid Pressures Used in Preliminary Design

Concrete Type	Pounds per Square Inch (psi)[3]
Structural Concrete	4,500
Precast Concrete	5,000
Concrete Fill	2,500[1]
Flowable Fill - non-excavatable	300
Flowable Fill - excavatable	100[2]

1 With Synthetic Fiber Reinforcement
2 Minimum
3 SCDOT Mix

Design shall be performed for the strengths and properties of: deformed reinforcing bars to ASTM A615, Grade 60; deformed reinforcing bars, welded or field bent to ASTM A706; welded wire fabric, plain to ASTM A185; and welded wire fabric deformed to ASTM A497.

An epoxy coating system shall be installed on the interior concrete walls and elevated slabs of the pump station wet well and any exposed piping. The bottom slab is not required to be coated. The epoxy coating system shall be Raven 405 applied at a minimum thickness of 125 mils DFT.

Leakage testing shall occur prior to the installation of the coating system. Any cracks exhibiting leakage shall be repaired with hydrophilic polyurethane injection.

3.4 Electrical Recommendations

This project requires a new service, electrical distribution equipment, emergency generator with automatic transfer switch, and control equipment. Existing PS No. 120 must remain in service until the new station has been commissioned and accepted by the City of Columbia (City) Engineer.

The electrical system must be designed and constructed meeting the minimum requirements of latest edition, unless otherwise noted, of all applicable codes and consensus standards.

Electrical equipment include service disconnect, natural gas generator, automatic transfer switch (ATS), duplex pump control panel, service light, and SCADA panel. The electrical equipment shall be mounted on an aluminum equipment rack. An aluminum canopy shall be constructed over the equipment rack as detailed in the City of Columbia Standards. The canopy shall be equipped with 120V convenience outlet(s) and lighting. An aluminum equipment rack shall be constructed at the wet well. A separate stainless-steel junction box shall be provided for each submersible pump, float, and level probe. Installation at the wet well shall conform with **NFPA 820** and **NEC Article 500**.

The pump station primary power source shall be rated 480/277V, 3-phase, 4-wire electrical service. This requires coordinating with the local electrical utility provider, securing and paying all application and permit fees and cost associated with and incurred for the pump station before final acceptance.

A natural gas standby generator unit shall be provided as the secondary standby source. Size the generator to supply 99.76KW/124.7KVA at a minimum with a 0.8 lagging power factor. An ATS shall be provided to perform automatic switching during unexpected loss of the primary power source. The generator and ATS shall be rated for use with 480/277V, 3-phase, 4-wire power. When there is a loss of utility power the ATS shall automatically start the generator and transfer the PS to generator power. The generator shall be select to meet the minimum requirements provided in City of Columbia Standards.

3.4.1 Electrical Equipment Design

Equipment, and associated components installed in the PS are required to meet the minimum requirements of City's Standards specified in City of Columbia Standards. All materials and equipment shall be new. Similar material and equipment shall be the product of one manufacturer and shall be UL listed.

A natural gas generator shall serve as a secondary power source for the PS and must be capable of running all equipment. If there is a loss of utility power, the ATS must automatically transfer the PS to generator power and return the PS back to the primary utility source after it has been restored. The generator shall be skid mounted and provided, as a minimum, with: factory manufactured weather protective, sound attenuating, enclosure; main circuit breaker; unit mounted radiator with jacket water heater and circulating pump; exhaust system meeting USEPA emissions requirements including an exhaust silencer, with flexible connections, pipes, hangers, and supports mounted inside the enclosure; all parts and pieces required for the fuel system piping installed inside the generator enclosure; engine mounted electric starter with battery, battery cables, and battery charger; and combination engine/alternator instrument and control panel wired, tested and shock mounted at the alternator end of the unit with the control capable of communicating, as a minimum, generator run status, generator common alarm, generator in auto mode, generator emergency stop, and generator suppling load. Refer to the City of Columbia Standards.

Furnish, install, test and place into operation a solidly grounded, automatic transfer switch rated 480/277V, 3 phase, 4 wire. The automatic transfer switch shall be furnished with a NEMA 4X, 316 stainless steel enclosure. The internal contacts shall be break before make.

TVSS devices shall be provided for the electrical distribution system equipment to reduce the destructive effects of electrical transients and temporary excess voltage and/or current in the electrical circuits. The TVSS devices shall be incorporated to limit short duration events, typically lasting from a few thousandths of a second (milliseconds) to billionths of a second (nanoseconds). The electrical system equipment shall be protected by TVSS on the 480-volt line entering the submersible pump control panel. Latest UL1449 standards shall be specified.

All new wire and cables for this project shall be installed in rigid aluminum conduit. Conduit for equipment used in the hazardous corrosive areas shall be rigid aluminum. Wires and cables shall be of annealed, 98%conductivity, soft drawn copper. All conductors shall be stranded, except lighting and receptacle wiring may be solid. Except for control, signal and instrumentation circuits, wire smaller than No. 12 AWG shall not be used. The minimum conduit size shall be ¾-inches. New conduits shall be concealed in the slab, in walls or the ceiling to the greatest extent possible.

Site grounding shall meet the minimum requirements of **NEC Article 250**. Grounding rods shall be ¾-inch X 10-feet copper clad steel. D. The ground wire shall be bare copper wire sized per NEC. Connections shall be made using exothermic welding. Provide a minimum of one ground rod test well.

The suppliers for major electrical equipment such as circuit breakers, starters, overload relays, etc. for this project and shall be Eaton, Schneider Electric or GE.

Unless otherwise noted or specified electrical enclosures, junction boxes, pull boxes, etc. shall be rated NEMA 4X for outdoor locations.

The sites main disconnecting means shall be an enclosed circuit breaker listed as suitable for service entrance. Additional requirements to be coordinated with the electrical service provider.

Circuit breakers shall be NEMA rated thermal magnetic type. Motor circuit protectors are required for the motor starters. Pilot lights shall be heavy duty 30mm, push-to-test type with LED lamps. Selector switches shall be 30mm, heavy duty with finger safe contact block. Motor controllers shall be Square D Altistart reduced voltage solid state starters (RVSS) only. No substitutes permitted. Provide shorting contactor to bypass the SCRs when the motor is at full speed. Current sensing for motor overloads shall be electronic type set for 115% of motor full load amps. It shall allow motor current up to 350% for no more than 40 seconds. Overload beyond limits specified herein shall trip the motor control circuit in less than 1 Hz. The electronic current sensing device shall also provide phase imbalance protection to remove the motor from the line should voltage levels be unbalanced more than 7-1/2%. The control system shall also remove the motor from the line within 45 seconds should the motor become stalled for any reason. All electrical equipment shall be identified with engraved plastic nameplates or engraved device plates, including pull boxes and junction boxes. Intrinsically safe relay and panel barriers shall be provided in the control panel for all floats. 24V control voltage shall be provided for wet well sensor circuits.

3.4.2 Electrical Testing and Final Acceptance

During construction all electrical equipment installed under this project shall be field tested and commissioned in accordance with the latest revisions of NETA Standard ATS "Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems". A typed test report, in compliance with NETA standards, shall be submitted after final acceptance for each component tested.

Prior to final acceptance, all systems must be inspected and tested for proper operation as directed by the City Engineer. Contractor shall provide all equipment, including electrician, required for this test including specifications and drawings for reference. Equipment that fails the inspection and/or testing must be corrected and/or replaced to the Engineer's satisfaction prior to final acceptance.

Appendix A

Pump Test Report

FLYGT a xylem brand

Pump Startup Report
Xylem Water Solutions USA Inc.
14125 South Bridge Circle Charlotte, NC 28273
Voice 704-504-8804 - - - Fax 704-504-8773

FLYGT a xylem brand

Report Date:	June 22, 2017	Purchase Order No.:	1622001	Delivery Note	E16507
Pump Serial Numbers:	1640057, 58	Model No.:	np 3102/464		
Start-Up Date:	6/21/2017	Control Panel Mfgr:	RSI		
Project Name:	Three Rivers PS	Project Location:	Columbia SC		
Start-Up Technician:	MP	FUS#	A70017		
Engineer's Contact:		Phone:		Engineer:	Weston & Sampson
Contractor's Contact:	Dean Fairweather	Phone:	803 227 1205	Contractor:	MB Khan
End User's Contact:		Phone:		End User:	City of Columbia

VOLTAGE & CURRENT CHECKS

FLA:	14	HP:	5.0	GPM:	230	TDH:	31.6	VOLTAGE:	230	PHASE:	3

VOLTAGE UNITS OFF:

L1-L2:	247	L1-GND:	123
L2-L3:	247	L2-GND:	217
L1-L3:	247	L3-GND:	123

VOLTAGE UNITS ON:

UNIT NO. 1:				UNIT NO. 2:				UNIT NO. 3:			
L1-L2:	245	L1-GND:	123	L1-L2:	246	L1-GND:	123	L1-L2:		L1-GND:	
L2-L3:	246	L2-GND:	216	L2-L3:	247	L2-GND:	216	L2-L3:		L2-GND:	
L1-L3:	246	L3-GND:	122	L1-L3:	246	L3-GND:	124	L1-L3:		L3-GND:	

CURRENT:

UNIT NO. 1:		UNIT NO. 2:		UNIT NO. 3:	
L1:	12.0	L1:	12.0	L1:	
L2:	12.0	L2:	12.0	L2:	
L3:	12.0	L3:	12.0	L3:	

UNBALANCE CALCULATIONS VOLTAGE

UNIT NO. 1:		UNIT NO. 2:		UNIT NO. 3:	
AVERAGE	245.7	AVERAGE	246.3	AVERAGE	
MAX. DEV.	0.7	MAX. DEV.	0.3	MAX. DEV.	
UNBALANCE	0.27%	UNBALANCE	0.14%	UNBALANCE	

UNBALANCE CALCULATIONS CURRENT

UNIT NO. 1:		UNIT NO. 2:		UNIT NO. 3:	
AVERAGE	12.0	AVERAGE	12.0	AVERAGE	
MAX. DEV.	0.0	MAX. DEV.	0.0	MAX. DEV.	
UNBALANCE	0.00%	UNBALANCE	0.00%	UNBALANCE	

DRAW DOWN TEST

MANHOLE DIAMETER =	8	FT =	375.99	GAL/FT DEPTH			PRESSURE GAUGE READING
60	SEC. DRAWDOWN =	8.00	IN. = PUMP RATE OF	250.66	GPM FOR UNIT 1	9	psi
60	SEC. DRAWDOWN =	8.50	IN. = PUMP RATE OF	266.32	GPM FOR UNIT 2	9	psi
	SEC. DRAWDOWN =		IN. = PUMP RATE OF	0.00	GPM FOR UNIT 3		psi
AVG PRESSURE READING	20.79	FT	STATIC HEAD MEASUREMENT		10 FT	TDH	30.79 FT

STATION CONTROLS

TYPE OF CONTROLLER	NONE		APP 500		APP 700		OTHER PLC		
TYPE OF LEVEL SENSOR	FLOATS	x	PROBE		U.SONIC		PRESSURE	x	OTHER
SENSOR(S) ACTUATE?									

CONDITION OF STATION

CONTROL PANEL:	RSI					
GUIDE RAILS PLUMB?:	x	PUMPS RIDE RAILS:	x	PUMPS CLEAR HATCH:	x	
GENERAL NOTES:						

1 Startup Report 7/10/2017

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Appendix B

Pump Calculations

CLIENT	Columbia Water	JOB NO.	121860-231550	DATE	2/18/20
PROJECT	Colonial Life Pump Station	DATE CHECKED	2/18/2020	COMPUTED BY	KED
DETAIL	Wetwell Elevation	CHECKED BY	CSF		

For Constant Speed Operation

Pump Cycle Volume

Maximum Starts Per Hour	10
Minium Cycle Time	6 min
Pump Station Max Flow at Min Speec	400 gpm
Requried Storage Volume	600 gal
Wetwell Diameter	8 ft
Wet Well Area	50 ft^2
Storage Volume Per Foot	376 gal/ft
Wet Well Stage Need	1.60 ft

	Calculated	Use
Station Invert	170.48 ft	170.00 ft
Min Submergence EL	171.40 ft	170.92 ft
Low level alarm	171.98 ft	171.50 ft
Pump Off	172.48 ft	172.00 ft
Lead Pump On	174.08 ft	174.00 ft
Lag Pump On	174.58 ft	174.50 ft
High Level Alarm	175.08 ft	175.00 ft
Gravity Invert	175.58 ft	175.58 ft

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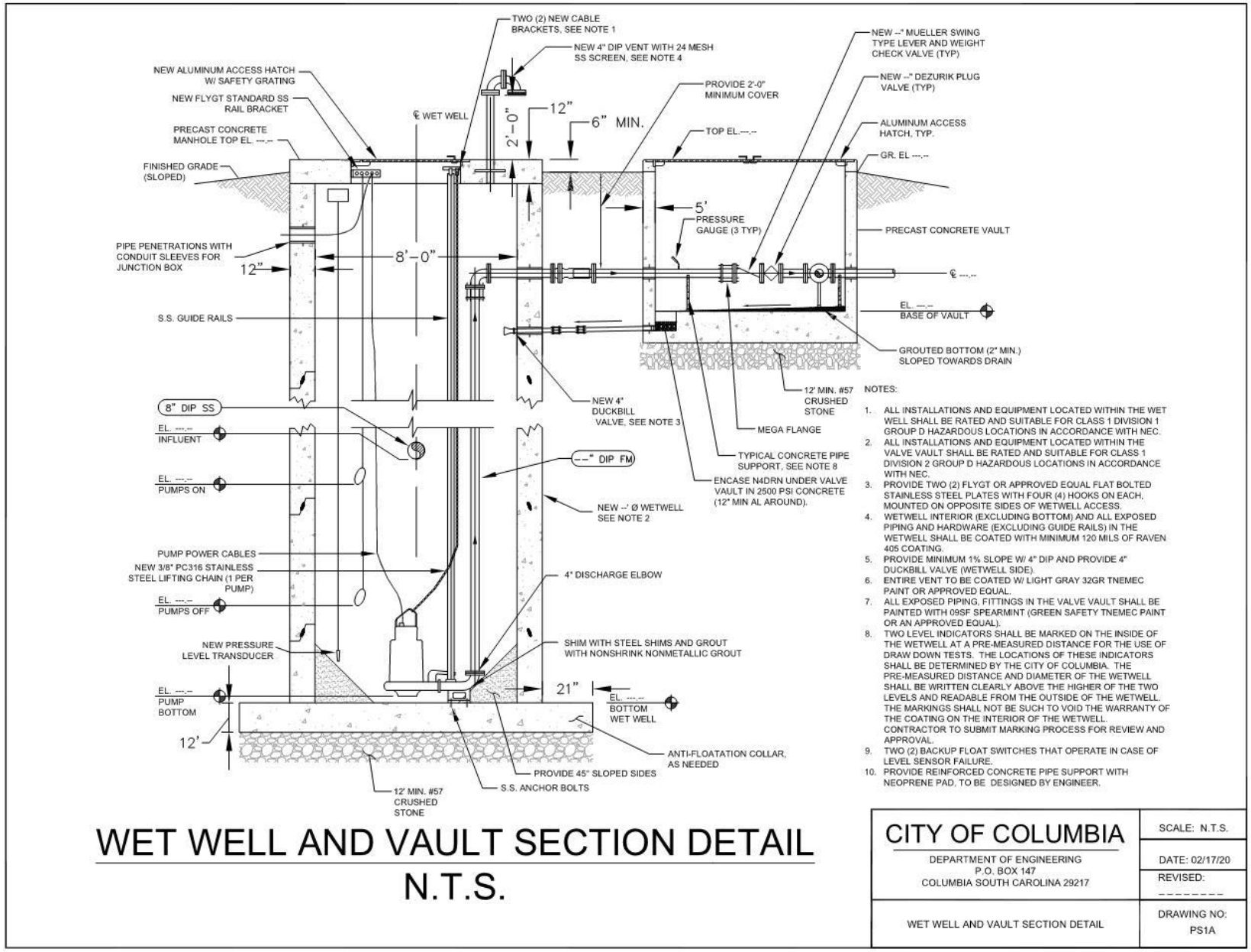
Appendix C

Pump Station Details

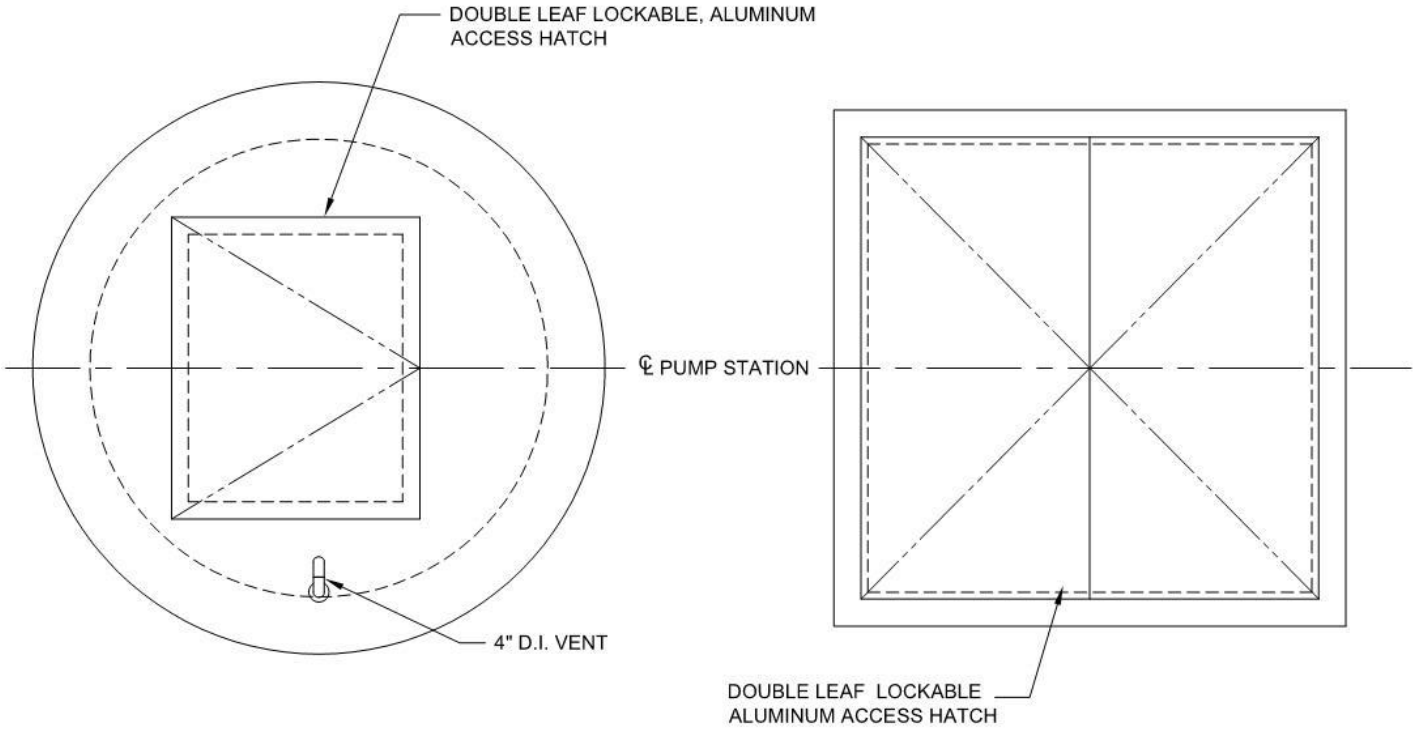


WET WELL AND VAULT SECTION DETAIL
N.T.S.

NOTES:

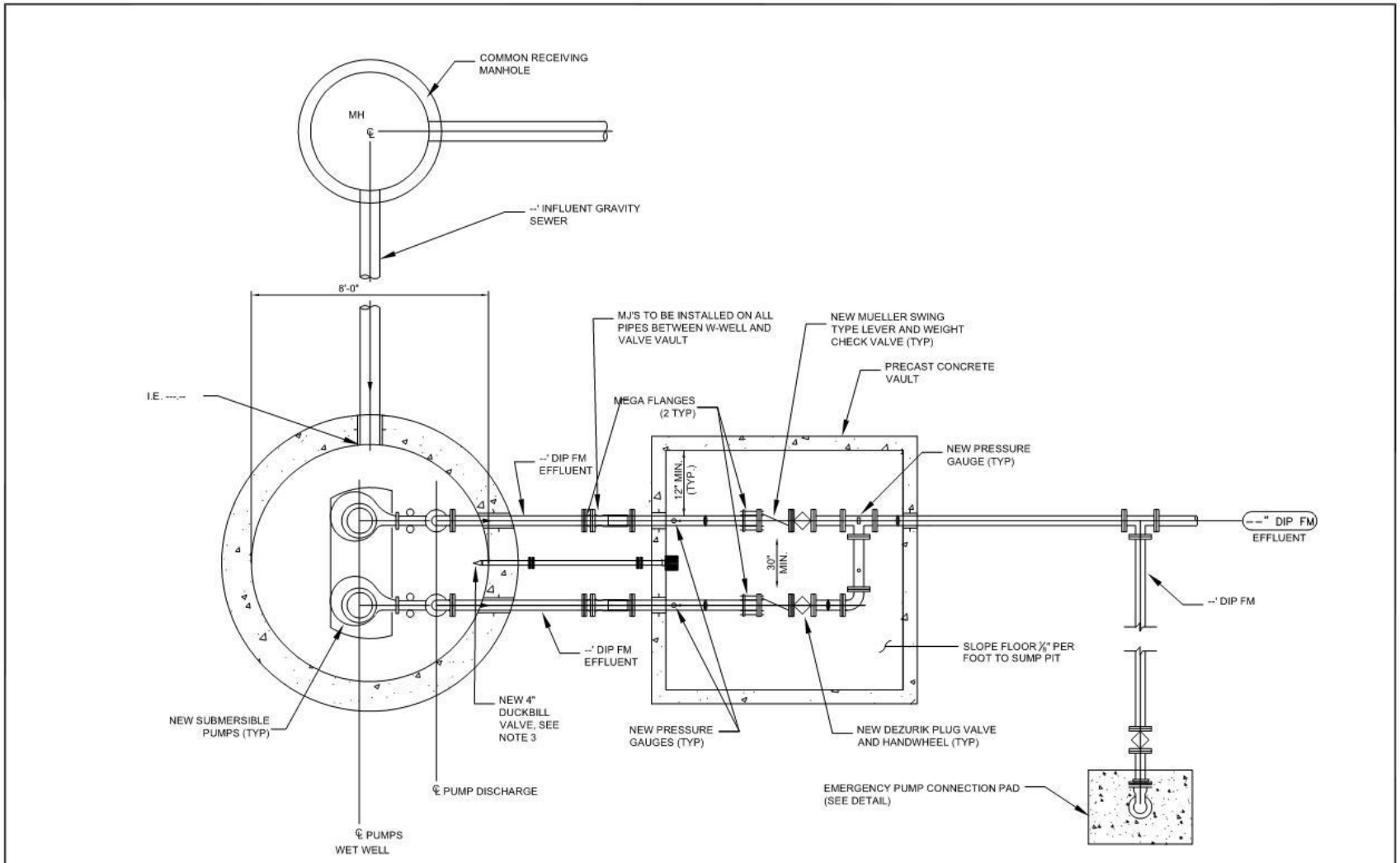
1. ALL INSTALLATIONS AND EQUIPMENT LOCATED WITHIN THE WET WELL SHALL BE RATED AND SUITABLE FOR CLASS 1 DIVISION 1 GROUP D HAZARDOUS LOCATIONS IN ACCORDANCE WITH NEC.
2. ALL INSTALLATIONS AND EQUIPMENT LOCATED WITHIN THE VALVE VAULT SHALL BE RATED AND SUITABLE FOR CLASS 1 DIVISION 2 GROUP D HAZARDOUS LOCATIONS IN ACCORDANCE WITH NEC.
3. PROVIDE TWO (2) FLYGT OR APPROVED EQUAL FLAT BOLTED STAINLESS STEEL PLATES WITH FOUR (4) HOOKS ON EACH, MOUNTED ON OPPOSITE SIDES OF WETWELL ACCESS.
4. WETWELL INTERIOR (EXCLUDING BOTTOM) AND ALL EXPOSED PIPING AND HARDWARE (EXCLUDING GUIDE RAILS) IN THE WETWELL SHALL BE COATED WITH MINIMUM 120 MILS OF RAVEN 405 COATING.
5. PROVIDE MINIMUM 1% SLOPE W/ 4" DIP AND PROVIDE 4" DUCKBILL VALVE (WETWELL SIDE).
6. ENTIRE VENT TO BE COATED W/ LIGHT GRAY 32GR TNEMEC PAINT OR APPROVED EQUAL.
7. ALL EXPOSED PIPING, FITTINGS IN THE VALVE VAULT SHALL BE PAINTED WITH 09SF SPEARMINT (GREEN SAFETY TNEMEC PAINT OR AN APPROVED EQUAL).
8. TWO LEVEL INDICATORS SHALL BE MARKED ON THE INSIDE OF THE WETWELL AT A PRE-MEASURED DISTANCE FOR THE USE OF DRAW DOWN TESTS. THE LOCATIONS OF THESE INDICATORS SHALL BE DETERMINED BY THE CITY OF COLUMBIA. THE PRE-MEASURED DISTANCE AND DIAMETER OF THE WETWELL SHALL BE WRITTEN CLEARLY ABOVE THE HIGHER OF THE TWO LEVELS AND READABLE FROM THE OUTSIDE OF THE WETWELL. THE MARKINGS SHALL NOT BE SUCH TO VOID THE WARRANTY OF THE COATING ON THE INTERIOR OF THE WETWELL. CONTRACTOR TO SUBMIT MARKING PROCESS FOR REVIEW AND APPROVAL.
9. TWO (2) BACKUP FLOAT SWITCHES THAT OPERATE IN CASE OF LEVEL SENSOR FAILURE.
10. PROVIDE REINFORCED CONCRETE PIPE SUPPORT WITH NEOPRENE PAD, TO BE DESIGNED BY ENGINEER.

CITY OF COLUMBIA DEPARTMENT OF ENGINEERING P.O. BOX 147 COLUMBIA SOUTH CAROLINA 29217	SCALE: N.T.S. DATE: 02/17/20 REVISED: _ _ _ _ _ _ _ _
WET WELL AND VAULT SECTION DETAIL	DRAWING NO: PS1A



WET WELL AND VAULT
PLAN DETAIL
N.T.S.

CITY OF COLUMBIA DEPARTMENT OF ENGINEERING P.O. BOX 147 COLUMBIA SOUTH CAROLINA 29217	SCALE: N.T.S. DATE: 02/17/20 REVISED: _ _ _ _ _ _ _ _
WET WELL AND VAULT PLAN DETAIL	DRAWING NO: PS1C



WET WELL AND VAULT PLAN DETAIL

N.T.S.

NOTES:

1. WETWELL AND VALVE VAULT MINIMUM DIMENSIONS ARE DEFINED IN THE CITY STANDARDS. ACTUAL DIMENSIONS TO BE DESIGNED BY THE ENGINEER.

CITY OF COLUMBIA DEPARTMENT OF ENGINEERING P.O. BOX 147 COLUMBIA SOUTH CAROLINA 29217	SCALE: N.T.S. DATE: 02/17/20 REVISED:
WET WELL AND VAULT PLAN DETAIL	DRAWING NO: PS1B

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