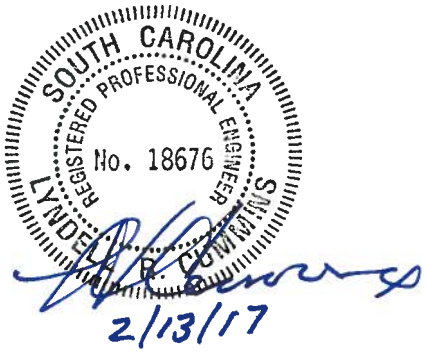
PRELIMINARY ENGINEERING REPORT
FOR:

TOWN OF EDISTO BEACH, SC
WATER SYSTEM IMPROVEMENTS

PREPARED FOR:
TOWN OF EDISTO BEACH, SC

J – 25683.0000



FEBRUARY, 2017

Prepared by:

THOMAS & HUTTON

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1. INTRODUCTION

The existing water system is in full compliance with primary regulations but is non-compliant with current Fluoride secondary standards. Also, because the water system has other significant issues with taste and corrosiveness, the Town of Edisto Beach has voted to proceed with major improvements to the water system which will correct any deficiencies and quality concerns currently identified. This Preliminary Engineering Report (PER) will describe specific water system improvements proposed to meet these goals set by Town Council:

A. Improve water quality.

B. Increase ability of the system to meet peak daily demand (PDD).

C. Design for projected demand of 20% above current average daily demand (ADD).

D. Utilize existing system components to the fullest extent possible.

2. GENERAL INFORMATION

A. DHEC System ID Number: 15WS002

B. DHEC Operating Permit Number: SC1510006

C. Responsible Official, Town of Edisto Beach, SC
Name & Title: Jane Darby, Mayor

Address: 2414 Murray Street
Edisto Beach, SC 29438

Phone: (843) 869-2505

D. Director of Public Works, Town of Edisto Beach, SC
Name & Title: Bob Doub, Class "C" Treatment License, Class "A" Distribution

Address: 2414 Murray Street
Edisto Beach, SC 29438

Phone: (843) 869-2505

E. Engineer
Name: Thomas & Hutton Engineering Co.

Address: 682 Johnnie Dodds Blvd., Suite 100
Mt. Pleasant, SC 29464

Phone: (843) 849-0200

Engineer: Mark F. Yodice, P.E., No. SC 13293

3. SERVICE AREA & EXISTING WATER SYSTEM

The Town of Edisto Beach is located at the end of Hwy. 174 approximately 20 miles south of Hwy. 17 as shown on **Figure 3.1**. Edisto Beach consists of the island bounded by the Atlantic Ocean, Edisto River and Big Bay Creek as shown on **Figure 3.2**. The Edisto Beach water system service area includes the area within the Town limits and it also serves the Edisto State Park and businesses along Hwy. 174 up to Palmetto Rd. including the True Value Hardware Store shopping complex located near this intersection. All areas north of Palmetto Rd. are located in Charleston County and are therefore not served. A large portion of the economy is based upon tourism. The terrain is flat and soils are sandy with a high groundwater table, especially at high tide.

There are currently 641 permanent residents but there are 2,360 water customers due to the resort nature of this community. Most customers are single family residential with a mixture of condominiums and commercial. A large portion of the residential units are rentals for visitors especially during the summer months. There are 2185 residential customers (92.6%) and 175 commercial customers (7.4%). Meters are read on a 6-month basis to coincide with the billing cycle.

Figure 3.2 indicates the location of components that comprise the existing public water supply including; six active wells, 100,000-gallon elevated storage tank (ET), 200,000-gallon ground storage tank (GST) with booster pumps and a water distribution system. Four of the six active wells pump directly into the distribution system after being treated with only chlorination (sodium hypochlorite). The two remaining wells are located off-island in Edisto State Park and they pump directly into the 200,000-gallon GST after receiving chlorination and they are controlled by water level in the GST. The two boosters deliver water from the GST to the distribution system at an average pumping rate of 500 gpm, and they are driven with VFD motors. The boosters are controlled by water level in the elevated tank. A summary of the existing well characteristics is presented in Table 3.1.

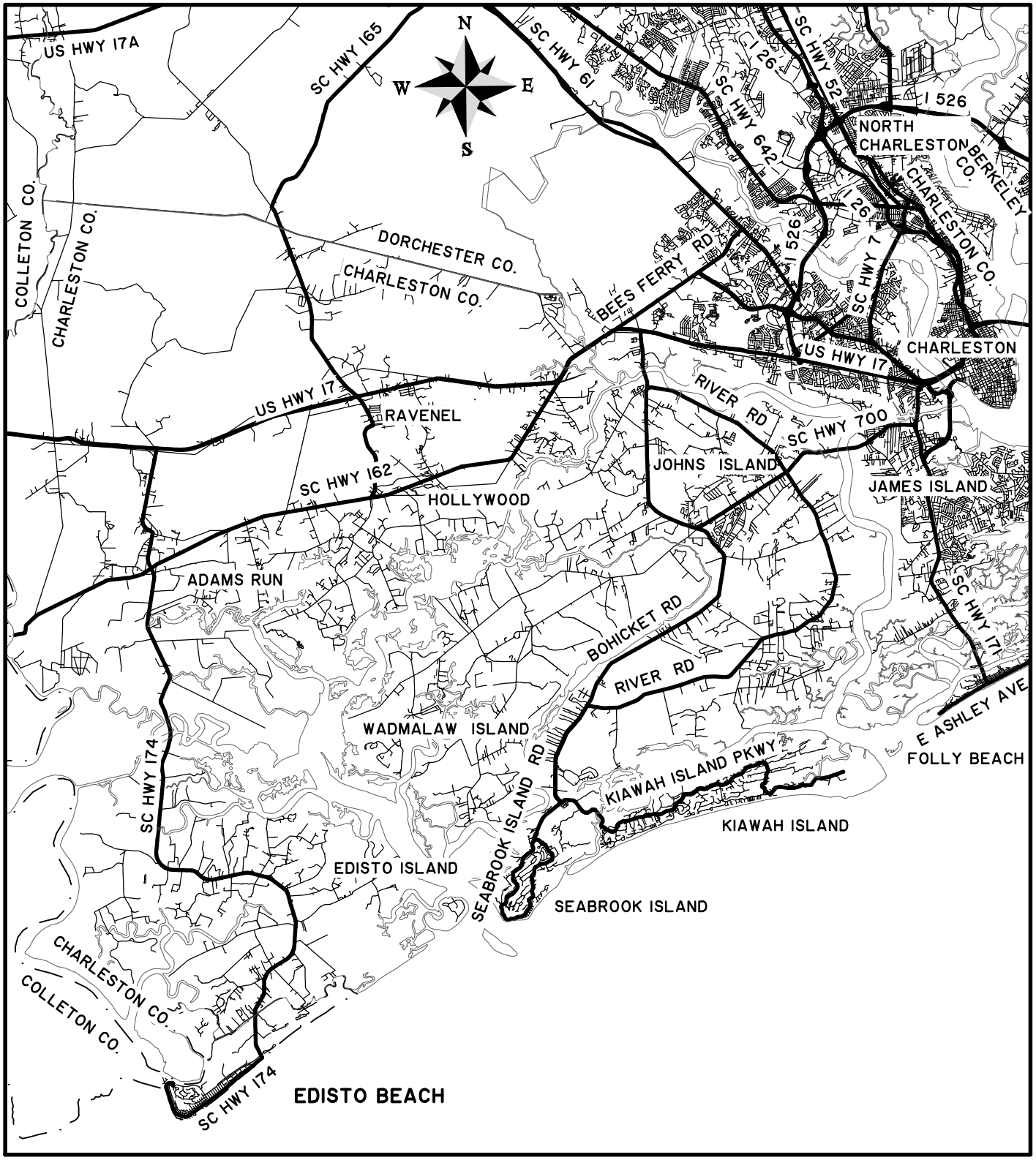
TABLE 3.1
Town of Edisto Beach
Summary of Existing Potable Supply Wells

Well No.	Location	Depth (feet)		Casing Size	Year	Capacity
		Bore Hole	Casing	(inches)	Completed	(gpm)
#1	Dockside	555	539	8	1979	250
#2	Bay Point	552	346	6	1962	135
#3	Lions Club	565	540	4	1975	90
#4	Edisto Park	562	534	6	1973	186
#5	Edisto Park	593	532	8	1993	276
#6	McConkey	580	540	8	2000	495

URS RO/ASR Feasibility Study 2012

Figure 3.1

Location Map



EDISTO BEACH RO WTP

LOCATION MAP

CLIENT:

TOWN OF EDISTO BEACH

LOCATION: COLLETON COUNTY, SOUTH CAROLINA

DATE: 12-1-16 DRAWN BY: DNF SHEET: FIG. 3.1

JOB NUMBER: J-25683.0001 REVIEWED BY: LRC SCALE: NO SCALE

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Figure 3.2

Water System Map

Z:\25683\25683.0001\Engineering\Drawings\Exhibits\FIG 3.2.dwg - Feb 7, 2017 - 10:40:32 AM

LEGEND

EXISTING 6" WATER LINE
EXISTING 8" WATER LINE
EXISTING 10" WATER LINE
EXISTING WELL
EXISTING TANK

NOTE:
EXISTING WATER LINES BELOW 6" ARE NOT SHOWN FOR CLARITY.

BAY POINT WELL #2 (135 GPM)
COUNTY LINE
YACHT CLUB ROAD
WELL #6 (495 GPM)
DOCKSITE WELL #1 (250 GPM)
EDISTO RIVER
PALMETTO BLVD
MYRTLE ST
CHARLESTON COUNTY
COLLETON COUNTY
DOCK SITE RD
BIG BAY CREEK
100,000 GALLON ELEVATED TANK
LEE ST
MYRTLE ST
PALMETTO BLVD
POINT ST
LIONS CLUB WELL 3 (90 GPM)
ATLANTIC OCEAN
JUNGLE RD
JUNGLE SHORES DR
YACHT BASIN
ISLAND COVE
SCOTT CREEK
EDISTO BEACH STATE PARK
STATE PARK RV PARK
JUNGLE ROAD
SC HWY 174
FISHING CREEK
EDISTO BEACH STATE PARK WELL #4 (186 GPM)
CHARLESTON COUNTY
PALMETTO ROAD
COLLETON COUNTY
OYSTER ROW LN
200,000 GALLON GROUND STORAGE TANK AND BOOSTER PUMP STATION (2-500 GPM PUMPS)
WELL #5 (276 GPM)
N
W
E
S

TOWN OF EDISTO BEACH

Figure 3.2 - Water System Map

CLIENT:
TOWN OF EDISTO BEACH

LOCATION: COLLETON COUNTY, SC
DATE: 10/04/16
DRAWN BY: DNF
SHEET: FIGURE 3.2
JOB NUMBER: 25683.0001
REVIEWED BY: LRC
SCALE: 1" = 1200'

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4. PROPOSED PROJECT

The Town developed an intensive program for the selection of a Progressive Design/Build team to complete the water system's improvements. The team selected for this project includes:

- Wharton-Smith, Inc., Sanford, FL, General Contractor
- Harn RO Systems, Inc., Venice, FL, RO Equipment Manufacturer
- Thomas & Hutton, Mt. Pleasant, SC, Design/Permitting Engineer

The team developed eight various options with associated costs and presented this to the Town in a matrix format during Phase 1 of the project. The options consisted of combinations including; Middendorf or Santee well supply, aquifer storage and recovery (ASR) or clearwell storage, various sizes of reverse osmosis (RO) treatment plants, two different locations for the RO plant and concentrate discharge lines, use of existing GST during peak demand season. The team provided budget pricing and prepared a hydraulic model for each option to compare their ability to meet PDD with fire flow. The Town selected Option 4C consisting of the improvements as shown on **Figure 4.1** and more fully described in the following sections.

Phase 1 of this Progressive Design/Build also includes completion of this PER and sufficient design detail to allow the team to present a Guaranteed Maximum Price (GMP) for the complete project to the Town. Phase 2 will not begin until the Town accepts the GMP and authorizes the team to proceed and it will consist of completion of construction drawings, procurement of required permits, construction, and commissioning of the project.

Figure 4.1

Water System Improvements Map

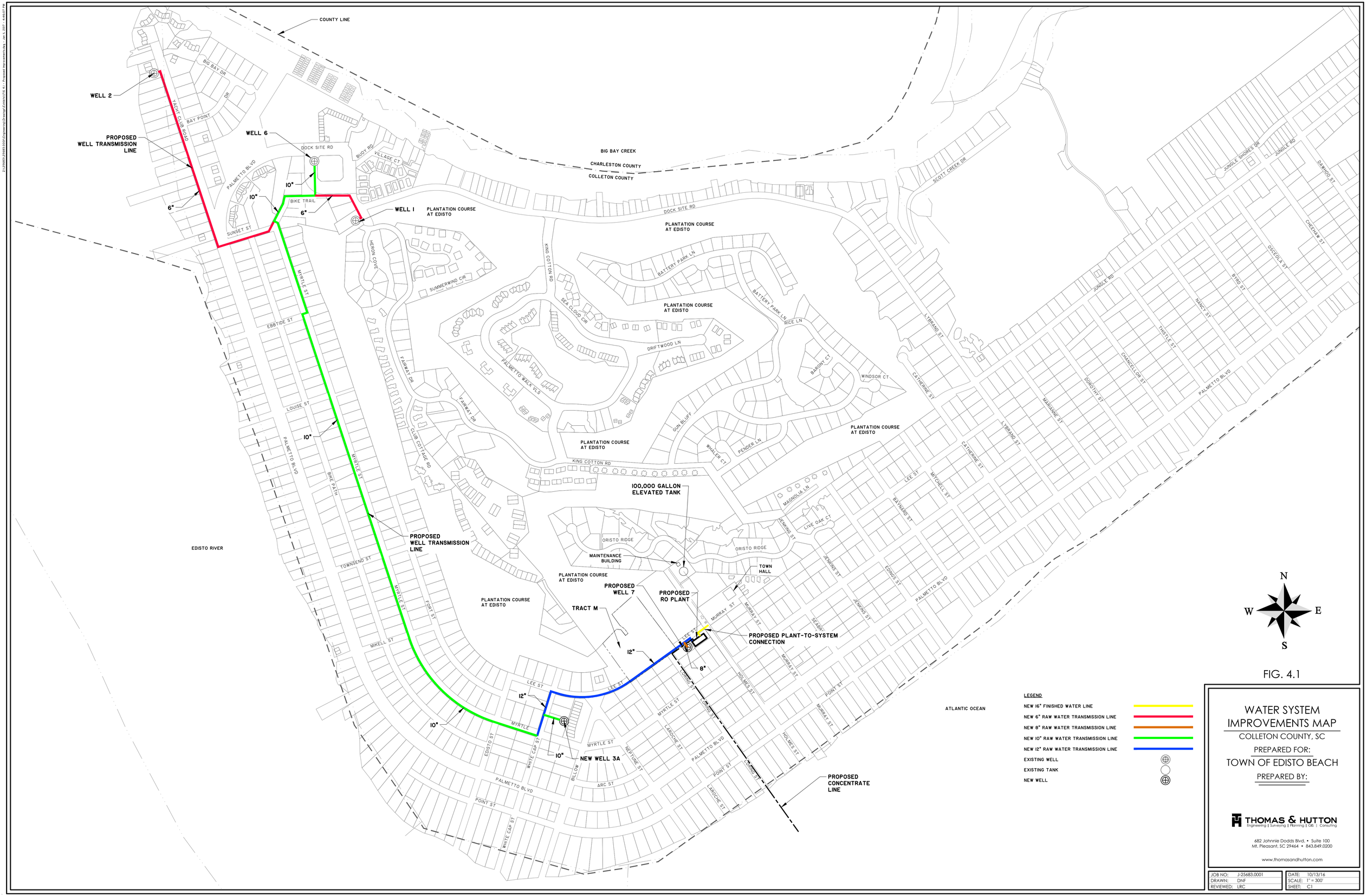

FIG. 4.1

LEGEND

- NEW 16" FINISHED WATER LINE
- NEW 6" RAW WATER TRANSMISSION LINE
- NEW 8" RAW WATER TRANSMISSION LINE
- NEW 10" RAW WATER TRANSMISSION LINE
- NEW 12" RAW WATER TRANSMISSION LINE
- EXISTING WELL
- EXISTING TANK
- NEW WELL

WATER SYSTEM IMPROVEMENTS MAP

COLLETON COUNTY, SC

PREPARED FOR:

TOWN OF EDISTO BEACH

PREPARED BY:

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DATE:	10/13/16
SCALE:	1" = 300'
SHEET:	C1

5. WATER DEMAND

With direction from the Town, the team utilized previous engineering studies and historical water use records to develop the projected water demand for design purposes. Previous studies concluded that the average daily water demand per customer was 250 gallons per day (gpd). Current customer base is 2,350; therefore, current average daily demand (ADD) is 587,500 gpd. Table 5.1 is a table of well-pumping records over a 6-year period as reported to SCDHEC which indicates an average usage of 530,720 gpd over that period of time.

The current ADD of 587,500 gpd should be conservative since water usage has been declining over recent years and the service area is approximately 87% built out. The Town requested that projections for future demand should be limited to 20% more than current usage; therefore, the design ADD will be 705,000 gpd (587,500 gpd X 1.2).

TABLE 5.1
Town of Edisto Beach
Total Average Well Production (gpd)

Well #	2010	2011	2012	2013	2014	2015
1	53,351	46,800	49,660	60,236	56,041	51,142
2	40,112	45,263	46,164	43,504	39,748	51,214
3	31,712	32,479	24,615	26,819	31,901	21,096
4	85,200	89,068	50,951	70,205	53,082	40,504
5	150,819	166,329	189,900	163,151	156,025	125,526
6	229,855	208,055	228,890	147,559	147,890	129,444
ADD (gpd)	**591,049**	**587,995**	**590,180**	**511,474**	**484,688**	**418,926**
Peak Day		1,410,300	1,263,800	1,095,600	1,244,300	
Peak Factor		**2.40**	**2.14**	**2.14**	**2.57**	

Well records also indicate that the peak daily demand (PDD) factor has ranged between 2.14 to 2.57. A peaking factor of 2.30 was chosen for design purposes which yields a PDD of 1,621,500 gpd (1.622 mgd) or 1,126 gpm.

6. SUPPLY & TRANSMISSION LINE

The goal of this project is to supply only water treated by the RO plant at all times so the supply wells will be piped directly to the RO plant. Total well capacity to the plant will be 1,521 gpm consisting of three existing wells and two new wells drilled into the Santee aquifer. Although it is not possible to predict the exact capacity of the proposed wells, each will be 10-inch diameter designed to accommodate a submersible pump and motor with a capacity of at least 507 gpm each.

The system must be carefully monitored to ensure that current groundwater withdrawal limits are not exceeded. Annual withdrawal permit currently allows 256 MG/year to be withdrawn from the aquifer or an average of 701,370 gpd. The proposed RO system will produce 553,713 gpd based upon this withdrawal limit. Assuming a 2% increase in water

use annually and the 2015 system usage average of 418,926 gpd, this withdrawal limit will be reached in the year 2029. A January 9, 2017 letter from DHEC recommends: "if increased usage indicates that the permitted withdrawal amount needs to be increased, the Department will gladly review a request for an increase at that time".

This first new well (Well #7) will be located on the site of the proposed RO plant as indicated on **Figure 7.3**. The location of the second new well is yet to be determined but it will most likely be located near the plant yet at a distance to minimize interference with the first well. The Town is currently negotiating for ownership of "Tract M" as shown on **Figure 4.1** and may select this site as the location of the second new well (Well #8). However, for purposes of this report it will be assumed that the second new well will be located at the site of existing Well #3 and will be labeled "New Well #3A" as indicated on **Figure 4.1**.

Existing wells #1, 2, and 6 will be connected to the RO plant with a dedicated transmission line as indicated on **Figure 4.1**. Chlorination of these wells will be discontinued since the RO plant will be designed to treat raw well water with post chemical addition including chlorination. All wells will have variable frequency drive (VFD) motors controlled by a new SCADA system. The remainder of the existing wells will be removed from the distribution system upon completion of the improvements, but will remain on standby status for emergency use only. Table 6.1 lists the existing and proposed wells that will provide the supply to the proposed RO Plant. Well #6 will be upgraded to 510 gpm.

All wells connected to the RO plant must be flushed to reduce the silt density index (SDI) for a period of time prior to discharging into the transmission line to the plant. An automatic valve will be installed on the discharge piping of each well. The valves will be controlled by SCADA based upon the flushing time required for each well. The flush water will be discharged into nearby drainage systems.

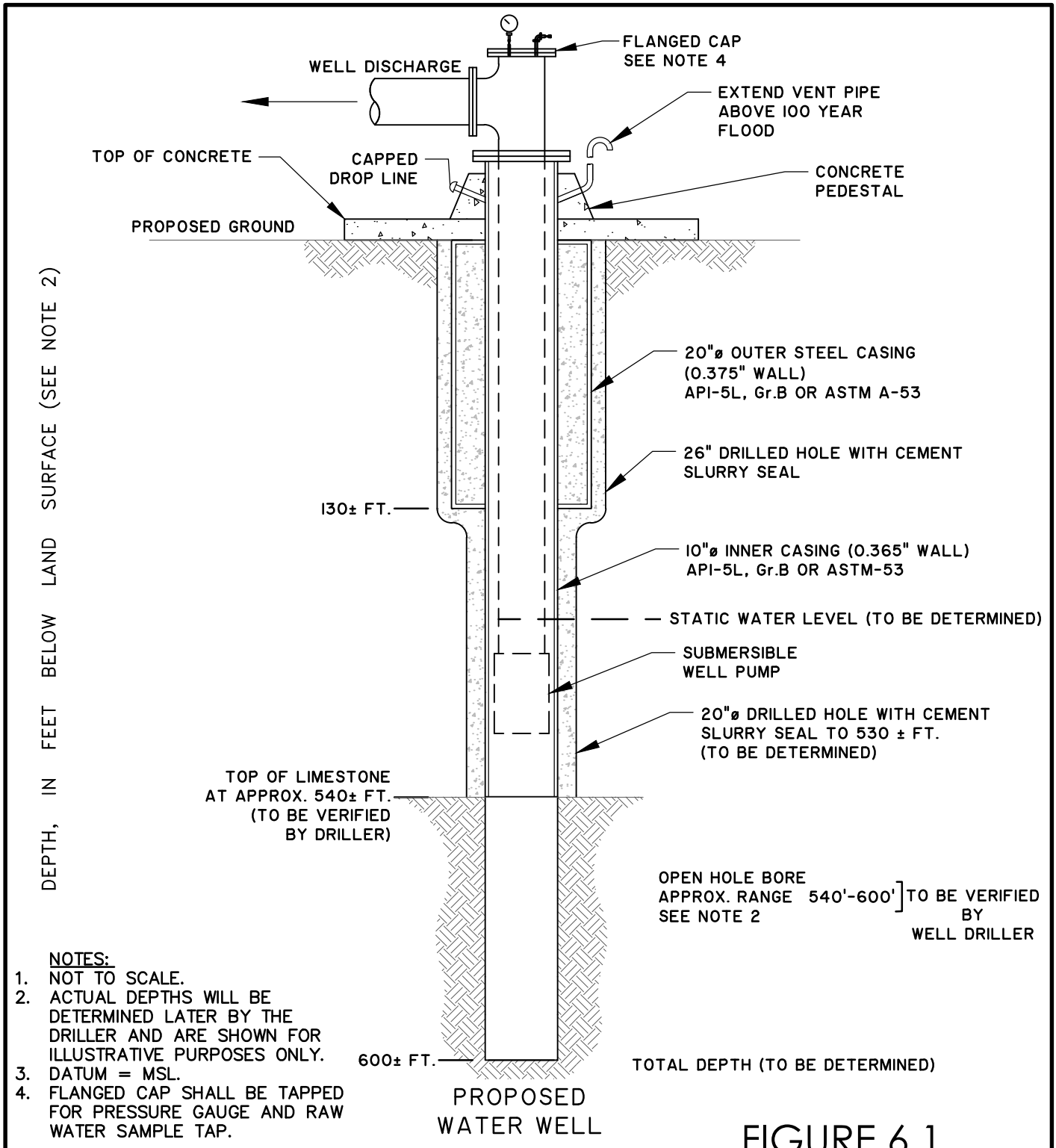
The new wells will be constructed as shown on the typical well diagram **Figure 6.1**. The wells will be completed with submersible pumps and motors with the well casing fitted with a blind flange to protect against the 100-year flood. VFD motors will allow the pumps to deliver 510-750 gpm. All piping extending through the well casing will be installed with welded fittings including the discharge piping, power cord conduit, airline conduit, and vent pipe. The vent pipe will be extended to an elevation of 1 foot above the 100-year flood elevation. All electrical switch gear and controls will be housed in pedestal-mounted NEMA 6X stainless steel panels. Each of the new wells will be designed and constructed in accordance with SCDHEC regulations unless waivers are granted.

TABLE 6.1
Town of Edisto Beach
Proposed Potable Supply Wells

Well No.	Location	Depth (feet)		Casing Size (inches)	Year Completed	Capacity (gpm)
		Bore Hole	Casing			
#1	Dockside	555	539	8	1979	250
#2	Bay Point	552	346	6	1962	135
#6	McConkey	580	540	8	2000	495
#7	RO Plant	600	540	10	2017	510
#8	TBD	600	540	10	2017	510

Figure 6.1

Proposed Well Diagram



NOTES:
1. NOT TO SCALE.
2. ACTUAL DEPTHS WILL BE DETERMINED LATER BY THE DRILLER AND ARE SHOWN FOR ILLUSTRATIVE PURPOSES ONLY.
3. DATUM = MSL.
4. FLANGED CAP SHALL BE TAPPED FOR PRESSURE GAUGE AND RAW WATER SAMPLE TAP.

FIGURE 6.1

PROPOSED WELL DIAGRAM

PROPOSED ACTIVITY:

750 GPM DEEP WELL - OPEN HOLE CONSTRUCTION

CLIENT:

TOWN OF EDISTO BEACH

LOCATION: EDISTO BEACH, SC

DATE: 12/06/16 DRAWN BY: DNF SHEET: 1 OF 1

JOB NUMBER: J-25683.0001 REVIEWED BY: KEN SCALE: N.T.S.

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7. TREATMENT

The proposed RO plant will be located on Town-owned property located on the south side of Murray St. (Lee St.) between Holmes and Loring Streets as shown on **Figure 4.1** with dimensions of 75 feet X 308 feet. The property is zoned PB which allows water treatment facilities. This site will not be adequate for future plant expansion; however, the Town feels plant capacity will be sufficient through buildout. The 100-year flood elevation at this location is 15 feet above MSL in a VE zone according to FEMA; however, the latest draft of the FEMA map indicates this location is in an AE zone with the 100-year flood elevation of 9 feet above MSL. Ground elevation at this location averages from 6 to 7 feet above MSL.

The operating floor of the treatment plant will be elevated to at least 2 feet above the 100-year flood elevation, as it will be supported by a reinforced concrete clearwell with an 11-foot water depth.

Treatment units will consist of three RO trains rated at 320 gpm permeate per train for a total permeate production 960 gpm. The system will be designed for 75% recovery and 20% raw water blend. Scale inhibitor will be added prior to the cartridge filters. The blended product water; therefore, will be 1,200 gpm total for all trains or a 24-hour production rate of 1.728 million gallons per day (mgd). The blended water will be further treated after the RO and blending processes by addition of calcium chloride for stabilization and sodium hypochlorite for disinfection before discharging into the clearwell. These chemicals will be housed in a separate room located within the treatment plant building. Three high service pumps (HSP) will deliver the finished water from the clearwell into the distribution system. The pumps will be located at the opposite end of the clearwell from the discharge point of the treated water. These pumps will be vertical turbine pumps with VFDs; one will be rated at 1,200 gpm while the other two will be rated at 600 gpm each. Concentrate from the RO process will be piped from the plant to the Atlantic Ocean along Loring Street as shown on **Figure 4.1**. Concentrate flow rate from each train will be 106.64 gpm for a total flow rate of 320 gpm when the plant is operating at full capacity. The concentrate line will be installed by horizontal directional drilling (HDD) under the dunes and ocean floor to the discharge point where a diffuser will be installed to properly mix the concentrate with ocean water. An NPDES Permit will be required for this discharge. **Table 7.1** is a summary of plant flow rates.

TABLE 7.1
Town of Edisto Beach
Summary of RO Plant Flow Rates (gpm)

	Raw	Feed	Blend	Permeate	Finished	Concentrate
Skid #1	506.67	426.67	80.00	320.03	400.03	106.64
Skid #2	506.67	426.67	80.00	320.03	400.03	106.64
Skid #3	506.67	426.67	80.00	320.03	400.03	106.64
Total	**1520**	**1280**	**240**	**960**	**1200**	**320**

A 24-hour pump test was conducted on existing Well #6 during November 2016 and samples were collected for lab analysis. Lab analysis of the existing groundwater supply is included as **Appendix A**. High levels of chloride, sodium, bicarbonate alkalinity, and total dissolved solids were reported in this raw groundwater sample. All of these parameters are, of course, secondary standards, but to achieve the Town's goal of improved water quality, the RO plant will be designed to reduce these to acceptable levels.

Harn R/O Systems, Inc. prepared a computer analysis to predict finished water quality based upon their specific design of an RO treatment system. The design includes a 20% blend of raw water with permeate from the RO units as requested by the Town. Town officials conducted a "taste test" of water from their existing RO dispensing station at Town Hall that was blended with well water from the distribution system in ratios of 10% and 20%. The 20% blend was selected by the Town which will provide more treatment capacity with the same treatment units and it will still meet Town water quality goals and will comply with primary and secondary water standards. The computer analysis of the selected RO system is included as **Appendix B** and a summary of the water quality is shown in Table 7.2 below:

TABLE 7.2
Town of Edisto Beach
Water Quality Projections

Parameter	Raw (mg/l)	Permeate (mg/l)	Blended (mg/l)
Bicarbon. Alkalinity	519	25.75	126.06
Sodium	512	18.14	123.52
Chloride	490	12.8	108.24
Fluoride	2.56	0.12	0.61
pH	8.9	8.3	8.92
TDS	1680	64.64	396.71

Raw water quality based upon testing from well #6 sample collected November 2015

An emergency generator will be located on the same level as the treatment plant operations floor but outside the building. The generator will be sized to provide sufficient power for a minimum plant operating capacity of ½ PDD (480 gpm) during power outages. The generator fuel tank will be double-walled and self-contained located under the generator. The motor control center will be located in a separate room within the building. The plant building will also include a control room where the SCADA control system will be located and a separate room will contain the HSP system.

Figure 7.1 is a conceptual layout of the operating floor while **Figure 7.2** shows an elevation view of the proposed treatment facility including the clearwell. **Figure 7.3** is a site plan of the proposed plant and proposed new well #7. The facility construction will comply with state and local codes and regulations.

Figure 7.1

RO Treatment Plant

Floor Plan

LEE STREET
EXISTING ROAD R/W
21'-6" SETBACK
118'-3"
BOLLARD
12" PVC FROM WELL
BUILDING OVERHANG ABOVE
6"-90° BEND
HANDRAILS
TS 8.50
5'-4" DBL WINDOW
10'-0" ROLL UP DOOR
10'-0" ROLL UP DOOR
10'-0" ROLL UP DOOR
5'-0" DOUBLE DOOR
LANDING
TC 12.92
TC 12.92
CLEARWELL VENT
CLEARWELL VENT
CLEARWELL VENT
MAIN BREAKER
SCALE INHIBITOR SYSTEM
PROCESS ROOM (61'-3" X 40'-0")
4'-0" (TYP)
MOTOR CONTROL CENTER/ ELECTRICAL ROOM (10'-3" X 25'9")
3'-0" DOOR
2'-0" X 2'-0" ELECTRICAL CHASE
6" PVC CONCENTRATE LINE
5'-0"
ACCESS HATCH TO CLEARWELL
UP STAIRS
UP STAIRS
CARTRIDGE FILTERS
EMERGENCY GENERATOR WITH ENCLOSURE
TS 8.75
HANDRAILS
TOP TC 17.0
GENERATOR BREAKER
BOT TC 8.89
BOLLARD
PUMP ROOM (18'-0" X 25'-9")
6' WIDE X 10' LONG DOCK LIFT
MCC LINEUP
PORCH
REMOVABLE HANDRAILS
5'-0" DOUBLE DOOR
ATS
EMERGENCY EYEWASH & SHOWER STATION
200 GALLON CALCIUM CHLORIDE STORAGE TANKS
6"-90° BEND
6" X 3" TEE
6" X 3" TEE
6"-90° BEND
SCADA
5'-0" DOUBLE DOOR
3'-6" DOOR
42'-0"
HOLMES STREET
ACCESS HATCH TO CLEARWELL
3'-0" DOOR
4'-0" WIDE X 4" THICK CONCRETE SIDEWALK TO HOLMES STREET
SODIUM HYPOCHLORITE SYSTEM (17'-0" X 19'-0")
DESK/RO/SCADA/COMPUTER
HALL WAY (4'-9" WIDE)
3'-6" DOOR
TS 8.85
HANDRAILS
4'-6" VIEWING WINDOW
CONTROL ROOM (11'-6" X 13'-6")
TOP TC 17.0
BOT TC 8.85
12" PVC BLENDED PRODUCT WATER TO CLEARWELL
WATER FOUNTAIN
3'-0" DOOR
3'-0" DOOR
3'-6" DOOR
COMMUNICATIONS CLOSET (2'-6" X 4'-0")
UNDER COUNTER REFRIGERATOR
BATH ROOM (12'-0" X 8'-0")
UP STAIRS
UP STAIRS
CLEANING SYSTEM
R/O TRAIN NO. 3
R/O TRAIN NO. 2
R/O TRAIN NO. 1
CLEARWELL VENT
SINK
ELEVATOR
CLEARWELL VENT
5'-0" (TYP)
COUNTER
TC 12.92
LANDING
CLEARWELL VENT
5'-4" DBL WINDOW
5'-4" DBL WINDOW
5'-4" DBL WINDOW
5'-4" DBL WINDOW
5'-4" DBL WINDOW
EXHAUST FAN
CLEARWELL WALL BELOW (TYP)
3'-0" DOOR FOR LOWER MECHANICAL ROOM
MECHANICAL ROOM (4'-0"X 6'-0") SEE NOTE 1
BUILDING OVERHANG ABOVE
4'-0"⌀ TANK OF SODIUM HYPOCHLORITE SOLUTION (TYP OF 4)
11'-6" SETBACK
EXISTING PROPERTY LINE

A — RO PLANT – UPPER LEVEL LAYOUT
FIG. 7.1 — 1/4"=1'-0"

NOTE:
1. LOWER LEVEL TO BE MECHANICAL ROOM FOR ELEVATOR. UPPER LEVEL TO BE MECHANICAL SPACE FOR BLDG., HVAC, ETC.

FIG. 7.1

UPPER LEVEL LAYOUT

EDISTO BEACH RO WTP

COLLETON COUNTY, SOUTH CAROLINA

PREPARED FOR:

TOWN OF EDISTO BEACH

PREPARED BY:

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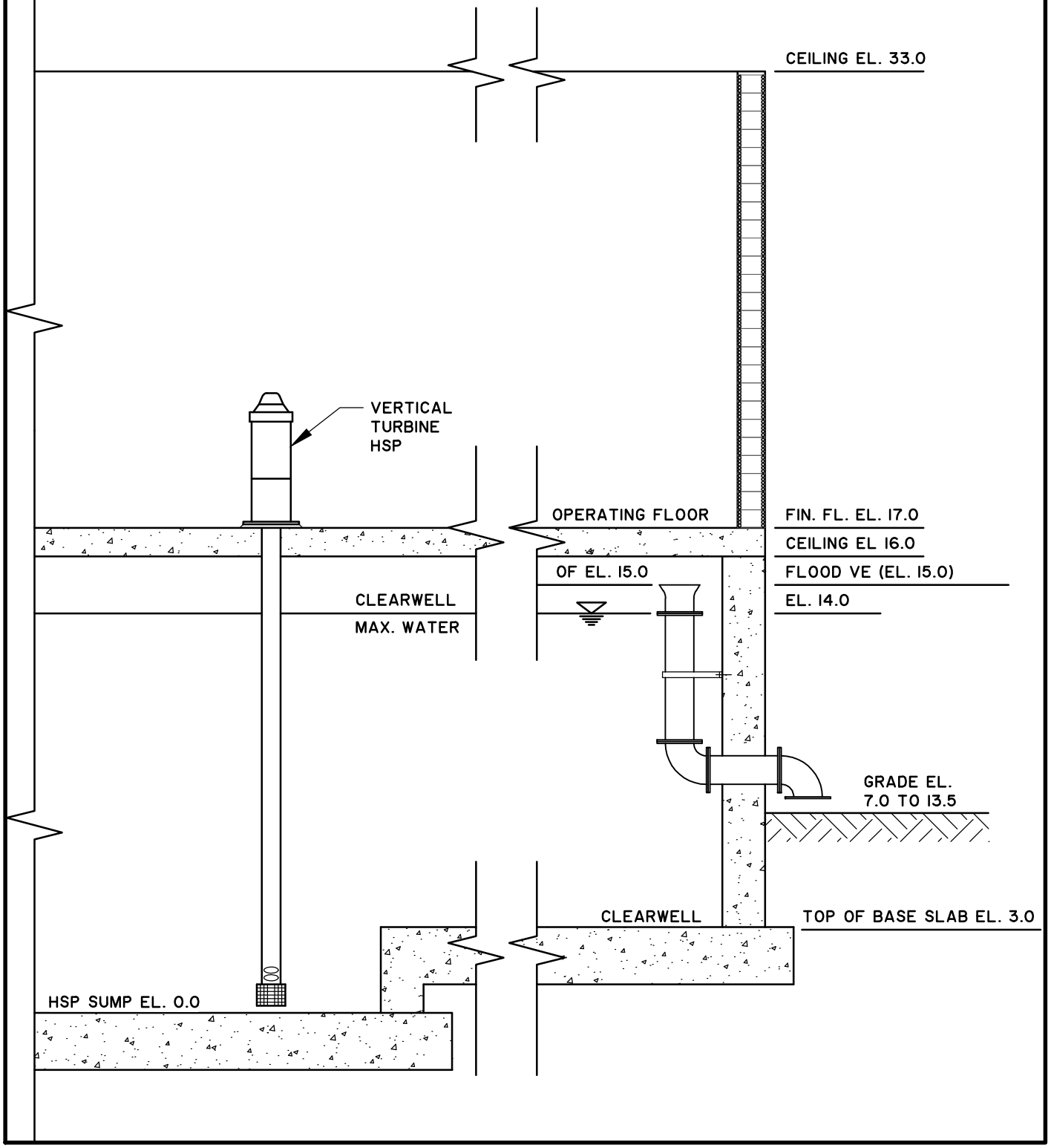
JOB NO:	J-25683.0002	DATE:	01-10-17
DRAWN:	DNF	SCALE:	AS SHOWN
REVIEWED:	LRC	SHEET:	FIG. 7.1

Figure 7.2

RO Treatment Plant

Elevation Section



EDISTO BEACH RO WTP

FIGURE 7.2

BUILDING SECTION

CLIENT:

TOWN OF EDISTO BEACH

LOCATION: COLLETON COUNTY, SOUTH CAROLINA

DATE: 10-31-16 DRAWN BY: DNF SHEET: C1

JOB NUMBER: J-25683.0002 REVIEWED BY: LRC SCALE: 1" = 5'

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Figure 7.3

RO Treatment Plant & Well #7

Site Plan

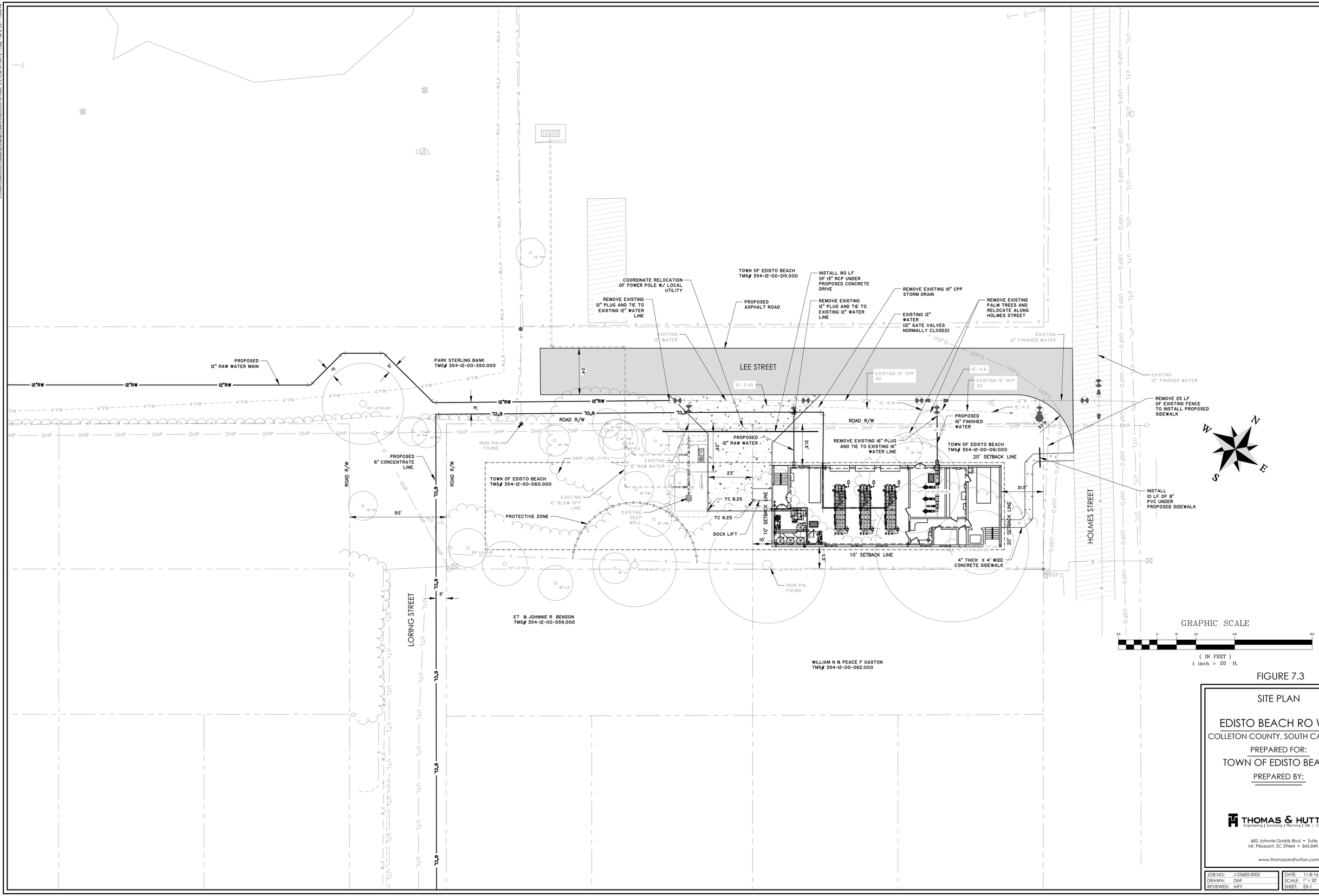

FIGURE 7.3

SITE PLAN

EDISTO BEACH RO WTP

COLLETON COUNTY, SOUTH CAROLINA

PREPARED FOR:

TOWN OF EDISTO BEACH

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DRAWN:	DNF
REVIEWED:	MFY
DATE:	11-8-16
SCALE:	1" = 20'
SHEET:	EX-1

8. STORAGE

The clearwell, located under the treatment facility, discussed above, will cover an area of approximately 3,518 square feet (SF) and will contain 290,000 gallons at an 11-foot water depth. The clearwell is designed to provide in excess of the required 30-minute chlorine detention time and to allow for more continuous operation of the RO plant. The clearwell will be vented through the operations room floor (clearwell ceiling) and through the plant building wall to the exterior of the building. The top of the clearwell will be 2 feet above the 100-year flood elevation. Finished water in the clearwell will be discharged into the distribution system with the HSPs as previously described. A water level transducer within the clearwell will control the operation of the RO plant and supply wells.

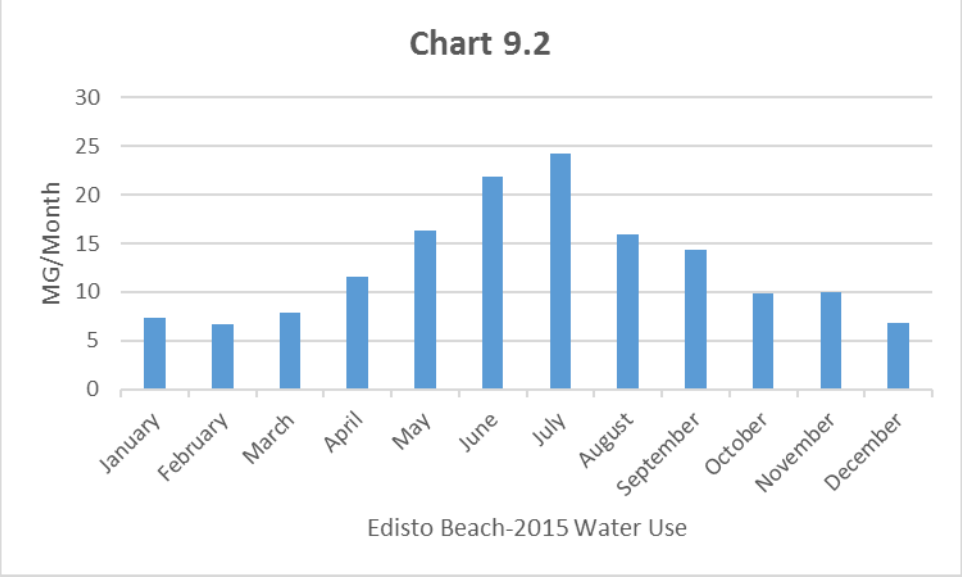
The existing 200,000-gallon GST at Edisto State Park will be available for use during peak demand periods. As described previously, the GST will be used to store treated water only and the existing wells that now fill this tank will be taken offline. An automatic control valve (ACV) will be installed on a new line to be constructed between the GST and the existing 10-inch discharge line from the booster pumps that delivers water to the distribution system. The valve will open to fill the tank with treated water from the distribution system only during periods of lower demand during peak demand days (approximately 11:00 pm – 4:00 am). The ACV will be closed at all other times allowing the booster pumps to deliver stored water from the GST to the system upon demand.

The existing 100,000-gallon elevated storage tank will remain in service and the level in the tank will continue to provide the signal for the operation of water supply to the distribution system. Tank level now controls the operation of the wells but will control the operation of the HSP's after these improvements are completed. An ACV will be installed on the line feeding this tank. This ACV will close when the ACV at the GST is open and will reopen when the GST ACV closes.

9. CONTROL SYSTEM

A new supervisory control and data acquisition (SCADA) system will be installed to automatically control the operation of the water system. The existing system is now controlled by an antiquated proprietary SCADA system that requires replacement. The new SCADA system will receive data transmission from the remote locations through RF signals. The control center will be located in the control room at the water treatment facility. The Process & Instrumentation Diagram (P&ID) is included as **Figure 9.1**. This diagram graphically illustrates the control system for the improved water system. The P&ID specifically for the proposed RO system is also included as **Figure 9.1**. **Figure 9.2**, Process Flow Diagram, is a representation of the proposed improvements and existing infrastructure that will be included in the completed project and it depicts the flow of water through the various processes.

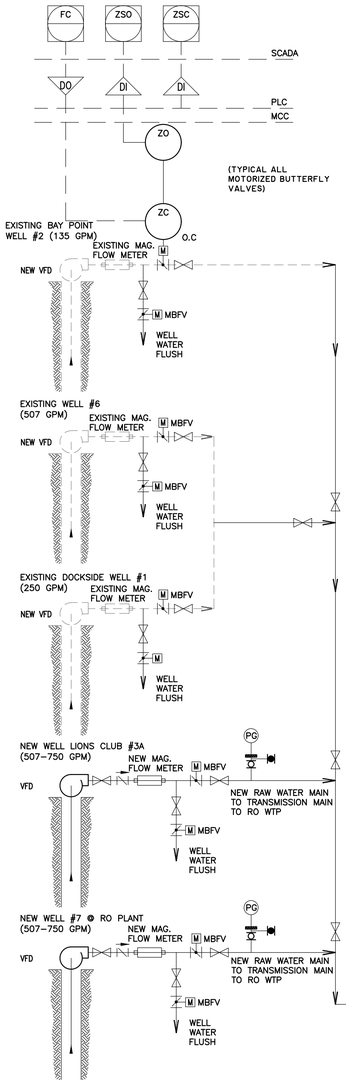
Basically, the level in the existing elevated tank will control the operation of the HSPs and the water level in the clearwell will control the operation of the water supply wells and, in turn, the operation of the RO plant. It is anticipated that there may be at least 3 different modes of operation depending upon seasonal demands. Since the improved water system is designed to meet PDD during the tourist season, treated water may become aged during the winter months unless operational changes are made. The SCADA system will allow those changes to be easily made on the touch-screen monitor. The 3-skid RO plant provides the flexibility to run only one skid during the winter months of low demand, 2 skids during average demand, or all 3 skids during peak demand months. The RO units should be run as continuously as possible and this arrangement will allow for the rotation of the skids on a daily basis during periods of lower demand increasing efficiency and allowing for maintenance of the idle skids. **Chart 9.2** shows actual system water use during 2015. The significant increase in water use during the summer months demonstrates the need for flexibility of the facility control system.



The GST may only be needed during periods of peak demand. The control system can be adjusted to allow the tank to fill during early morning hours of peak demand days and pump into the system during peak demand hours that same day as described previously.

Figure 9.1

Process & Instrumentation Diagram



NOTE:

1. CONNECT EXISTING MAGNETIC FLOW METERS ON EXISTING WELLS AND AT EXISTING GROUND STORAGE TANKS AND BOOSTER PUMPS INTO SCADA.

LEGEND

- PROPOSED
- NEW GATE VALVE
- NEW CHECK VALVE
- MOTORORIZED BUTTERFLY VALVE
- NEW LEVEL SENSOR
- NEW VERTICAL TURBINE PUMP
- SUBMERSIBLE PUMP
- NEW FLOW METER (MAGNETIC)

ABBREVIATIONS

BP	BACKFLOW PREVENTER
CACL2	CALCIUM CHLORIDE
CL	CHLORINE
DIP	DUCTILE IRON PIPE
DW	DEEP WELL
FT	FLOW TRANSMITTER
HSP	HIGH SERVICE PUMP
L	LEVEL
M	MOTOR
MBFV	MOTORIZED BUTTERFLY VALVE
NAOCL	SODIUM HYPOCHLORITE
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
O.C.	OPEN/CLOSE
RO	REVERSE OSMOSIS
VFD	VARIABLE FREQUENCY DRIVE (VARIABLE SPEED)

EQUIPMENT PREFIXES

FAL	FLOW ALARM
FC	FLOW CONTROLLER
FCV	FLOW CONTROL VALVE (MODULATING)
FE	FLOW SENSOR
FI	FLOW INDICATOR
FIR	FLOW INDICATOR RECORDER
FIT	FLOW INDICATOR TRANSMITTER
FIQ	FLOW INDICATOR TOTAL
FT	FLOW TRANSMITTER
LAH	LEVEL ALARM HIGH
LAL	LEVEL ALARM LOW
LE	LEVEL SENSOR
LIR	LEVEL INDICATOR RECORDER
LIT	LEVEL INDICATOR TRANSMITTER
LS	LEVEL SWITCH
LSL	LEVEL SWITCH LOW
LSH	LEVEL SWITCH HIGH
LT	LEVEL TRANSMITTER
PG	PRESSURE GAUGE
PI	PRESSURE INDICATOR
PSH	PRESSURE SENSOR HIGH
ZC	VALVE MOTOR CLOSED
ZIC	INDICATING CONTROLLER CLOSED
ZO	VALVE MOTOR OPEN
ZSC	VALVE MOTOR OPERATOR CLOSED SWITCH
ZSO	VALVE MOTOR OPERATOR OPEN SWITCH

GENERAL INSTRUMENT OR FUNCTION SYMBOLS

	FIELD MOUNTED	PRIMARY LOCATION ACCESSIBLE TO OPERATOR	PRIMARY LOCATION INACCESSIBLE TO OPERATOR
DISCRETE INSTRUMENTS	○	⊖	⊖
SHARED DISPLAY SHARED CONTROL	○	⊖	⊖
COMPUTER FUNCTION	⬡	⬡	⬡
PROGRAMMABLE LOGIC CONTROL	◇ TAG	◇ TAG	◇ TAG

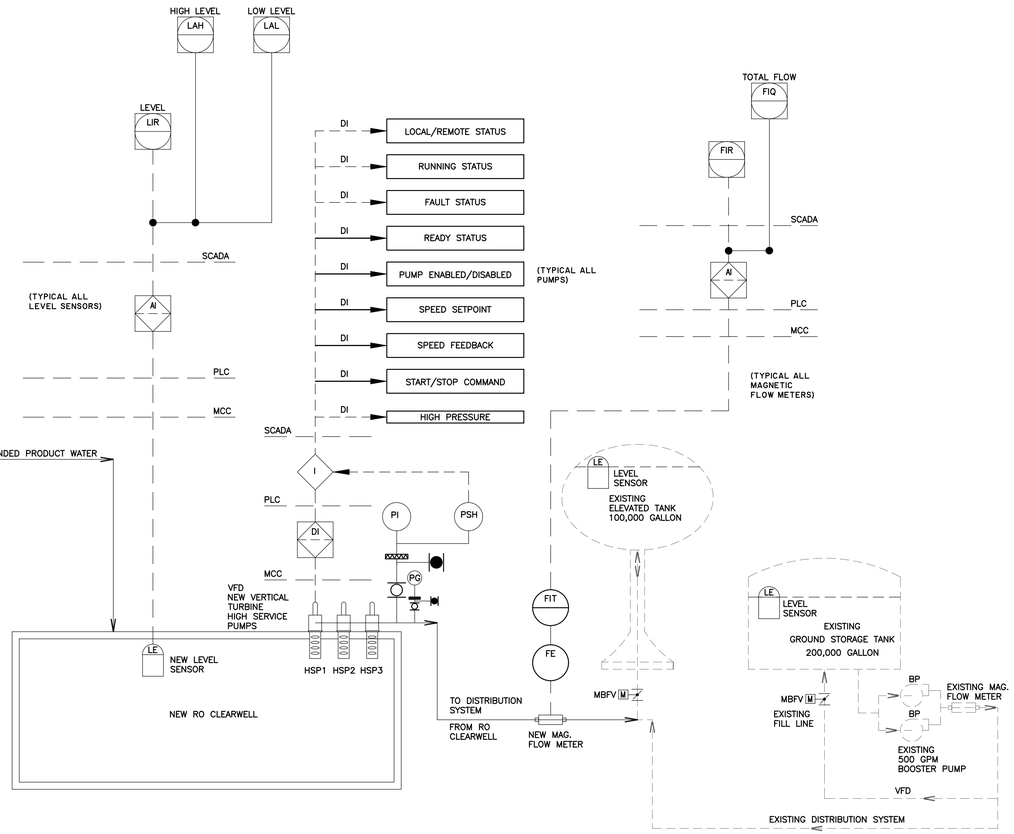


FIG. 9.1

P& ID

EDISTO BEACH RO WTP

COLLETON COUNTY, SOUTH CAROLINA

PREPARED FOR:

TOWN OF EDISTO BEACH

PREPARED BY:

THOMAS & HUTTON
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SCALE:	NOT TO SCALE
SHEET:	FIG. 9.1

Process and Instrumentation Diagram Legend

NOTE: ALL FITTINGS TO BE STANDARD DIMENSIONS UNLESS OTHERWISE NOTED.

PROCESS DEVICE SYMBOLS

- "Y" STRAINER
- VALVE: GATE, OR OTHER
- VALVE: GLOBE
- VALVE: THREE WAY
- VALVE: BUTTERFLY, DAMPER OR LOUVER
- VALVE: ROTARY BALL TYPE
- VALVE: DIAPHRAGM
- VALVE: GENERIC CHECK
- VALVE: CHECK
- VALVE: BALL CHECK
- VALVE: DOUBLE DOOR CHECK
- VALVE: PLUG TYPE
- VALVE: FLOAT
- VENT TO ATMOSPHERE
- AIR/VACUUM VALVE RELEASE
- ANTI-SIPHON VALVE
- AIR RELEASE VALVE
- 5 WAY VALVE
- HIGH PRESSURE PUMP
- CENTRIFUGAL PUMP
- STATIC MIXER
- MIXER
- PRESSURE RELIEF VALVE
- ORIFICE PLATE
- PIPE
- DIAPHRAGM SEAL
- DRAIN
- PROPORTIONING OR METERING PUMP
- VARIABLE AREA FLOW METER
- TURBINE FLOW METER
- MAGNETIC FLOW METER
- VENTURI FLOW METER
- WEIR FLOW METER
- FLUME FLOW METER
- PITOT TUBE FLOW METER
- ULTRASONIC FLOW METER
- CHEMICAL INJECTOR
- ERT (ENERGY RECOVERY TURBINE)
- EXPANSION JOINT
- VACUUM BREAKER
- RUPTURE DISK
- OBSERVATION POINT- ACRYLIC PIPE
- BACK FLOW PREVENTER
- PLATE HEAT EXCHANGER

VALVE AND ACTUATOR SYMBOLS

- DIAPHRAGM ACTUATOR (AIR TO CLOSE)
- DIAPHRAGM ACTUATOR (AIR TO OPEN)
- DIAPHRAGM ACTUATOR (AIR TO AIR OR DOUBLE ACTING)
- PRESSURE-REDUCING VALVE, SELF-CONTAINED
- BACK PRESSURE VALVE, SELF-CONTAINED
- DIAPHRAGM VALVE
- THREE - WAY SOLENOID VALVE
- FOUR - WAY SOLENOID VALVE
- SOLENOID
- ELECTRO-HYDRAULIC OPERATOR
- ELECTRIC MOTOR
- HYDRAULIC CYLINDER
- AIR ACTUATOR (DOUBLE ACTING)
- AIR ACTUATOR (SPRING TO CLOSE)
- AIR ACTUATOR (SPRING TO OPEN)

INSTRUMENT LINE SYMBOLS

- MAJOR PROCESS PIPING OR FLOW CHANNEL
- OTHER PIPING
- FUTURE/PIPING BY OTHERS
- ELECTRIC SIGNAL
- PNEUMATIC SIGNAL
- ELECTRICAL DIRECTION ARROW
- ELECTRICAL CONNECTION POINT
- FLOW DIRECTION ARROW FOR PIPING
- PANEL
- PROCESS LINES CROSSING (NOT CONNECTED)
- INTERNAL SYSTEM SIGNAL LINK (SOFTWARE OR DATA LINK)
- TP — FILLED TRIANGLE INDICATES EQUIPMENT SUPPLIED UNDER THIS CONTRACT.

GENERAL INSTRUMENT SYMBOLS

- FIELD MOUNTED INSTRUMENT
- PANEL MOUNTED INSTRUMENT
- PANEL MOUNTED PILOT LIGHT
- SHARED FIELD MOUNTED INSTRUMENT
- SHARED PANEL MOUNTED INSTRUMENT
- FIELD MOUNTED INSTRUMENT (COMPUTER FUNCTION)
- PANEL MOUNTED INSTRUMENT (COMPUTER FUNCTION
- SHARED FIELD MOUNTED INSTRUMENT (PLC CONTROL)
- SHARED PANEL MOUNTED INSTRUMENT (PLC CONTROL)
- INSTRUMENTS SHARING COMMON HOUSING
- UNDEFINED INTERLOCK LOGIC

IDENTIFICATION LETTERS

LETTER	FIRST LETTER: MEASURED OR INITIATING VARIABLE	FIRST LETTER: MODIFIER	SUCCEEDING LETTERS: READOUT OR PASSIVE FUNCTION	SUCCEEDING LETTERS: OUTPUT FUNCTION	SUCCEEDING LETTERS: MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	CONDUCTIVITY (ELECTRICAL)			CONTROL	
D	USER'D CHOICE	DIFFERENTIAL			
E	VOLTAGE (EMF)		PRIMARY ELEMENT		
F	FLOW RATE	RATIO (FRACTION)			
G	USER'S CHOICE		GLASS		
H	HAND (MANUALLY INITIATED)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME OR TIME-SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOISTURE OR HUMIDITY	MOMENTARY			MIDDLE OR INTER-MEDIATE
N	USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	USER'S CHOICE		ORIFICE (RESTRICTION)		
P	PRESSURE OR VACUUM		POINT (TEST CONNECTION)		
Q	QUANTITY	INTEGRATE OR TOTALIZE	INTEGRATE OR TOTALIZE		
R	RADIATION		RECORD OR PRINT		
S	SPEED OR FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION			VALVE, DAMPER, OR LOUVER	
W	WEIGHT OR FORCE		WELL		
X	UNCLASSIFIED		UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE, OR PRESENCE			RELAY OR COMPUTE	
Z	POSITION, DIMENSION			DRIVE, ACTUATOR OR UNCLASSIFIED FINAL CONTROL ELEMENT	

FUNCTION DESIGNATIONS

INSTRUMENT MODIFIERS

- Σ ADD OR SUM (ADD AND SUBTRACT)
- Δ SUBTRACT (DIFFERENCE)
- √‾ EXTRACT SQUARE ROOT
- — DIVIDE
- / INTEGRATE (TIME INTEGRAL)
- Cl_2 CHLORINE
- CO_2 CARBON DIOXIDE
- COND CONDUCTIVITY
- DO DISSOLVED OXYGEN
- pH pH
- TURB TURBIDITY
- MCC MOTOR CONTROL CENTER

NOTE:
1. THE P & ID SYMBOLS etc. ARE BASED ON THE INSTRUMENT SOCIETY OF AMERICA (ISA), STANDARD ANSI/ISA-S5.1 (1984).

HAND SWITCH MODIFIERS

- HOA HAND OFF AUTO
- OAC OPEN AUTO CLOSE
- LR LOCAL REMOTE
- OC OPEN-CLOSE
- OO ON-OFF
- OOR ON-OFF-REMOTE
- OSC OPEN-STOP-CLOSE
- TBR TOP-BOTTOM-REMOTE

TRANSDUCER & CONVERTER DESIGNATION

- E VOLTAGE
- FSK FREQUENCY SHIFT KEYING
- H HYDRAULIC
- I CURRENT
- P PNEUMATIC
- PD PULSE DURATION
- PF PULSE FREQUENCY
- R RESISTANCE (ELECTRICAL)

COMPUTER SYSTEMS INTERFACE SYMBOLS

NOTE: REFER TO DETAILED SYSTEM SPECIFICATIONS FOR FUNCTIONAL DESCRIPTION. ALSO SEE I/O SCHEDULES FOR COMPLETE INPUT AND OUTPUT LISTINGS.

- COMPUTER OR DISTRIBUTED CONTROL SYSTEM FUNCTION BLOCK
- CB X — PROGRAMMABLE LOGIC CONTROLLER SYSTEM FUNCTION BLOCK
  - CONTROL ALGORITHM IN SPECIFICATIONS
- DIGITAL SYSTEM I/O INTERFACE DIRECTION OF ARROW DENOTES WHETHER INPUT OR OUTPUT. FILLED ARROW INDICATES DIGITAL SIGNAL.
- LETTER, TAG NUMBER, ABBREVIATIONS AND OTHER ANNOTATIONS ARE SIMILAR TO THE GENERAL INSTRUMENT LEGEND. SOLID LINE REPRESENTS SHARED DISPLAY OR OPERATOR ACCESSIBLE FUNCTION.
- (n) — DENOTES MULTIPLE I/O POINTS W/ (n) AS THE NUMBER OF POINTS
- A / A — TRIANGLE DENOTES ANALOG SIGNAL USUALLY (4 - 20 mA) WITH DIRECTION

PRELIMINARY

VERIFY SCALES, 0 — 1"

PRELIMINARY	BY:	DATE:
PROCESS DESIGN MANAGER		
PROJECT ENGINEER		
SHOP SUPERVISOR		
CADD SUPERVISOR		

REVISIONS

#	DESCRIPTIONS	DATE	DRN	REL
01	PRELIMINARY	09/30/16	DFS	

Harn R/O SYSTEMS INC.
310 CENTER COURT
VENICE, FL 34285
(941)488-9671

JOB NO:	15-2100C
DATE:	09/30/16
DESIGN BY:	DFS
DRAWN BY:	DFS
SCALE:	NTS
CHECKED BY:	
APPROVED BY:	

JOB: TOWN OF EDISTO BEACH
WATER SYSTEM IMPROVEMENT PROJECT

DRAWING TITLE: Process and Instrumentation Diagram Legend

DRAWING NO. 15-2100C-PID-00
SUB ASSEMBLY PAGE NO.
DRAWING SET PAGE NO. 1 of 3

R/O Process and Instrumentation Diagram

NOTE: ALL FITTINGS TO BE STANDARD DIMENSIONS UNLESS OTHERWISE NOTED.

PROPRIETARY INFORMATION!

This information is provided for the use of the Owner and the Engineer on this specific project – for bid evaluation and execution by Harn R/O Systems, Inc. The Owner and Engineer shall maintain the information in confidence. All proprietary information is the property of Harn R/O Systems, Inc. and shall be returned to Harn R/O Systems, Inc. or destroyed if the project is not executed by Harn R/O Systems, Inc.

LEGEND

TYPICAL OF TRAIN 1

COMPONENT

TAG LEGEND:

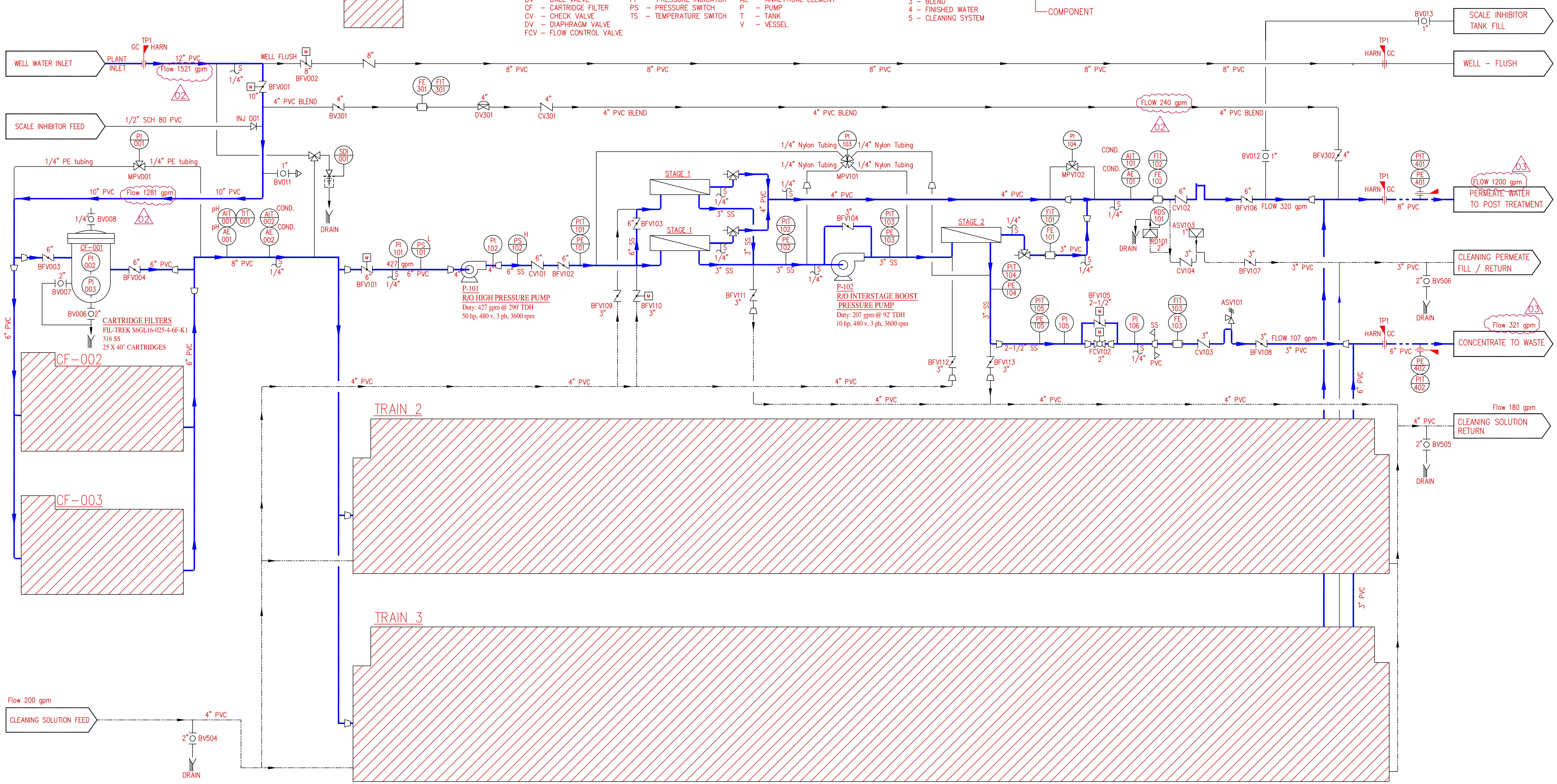
- ASV – ANTI-SIPHON VALVE
- AV – AIR VENT
- BFV – BUTTERFLY VALVE
- BV – BALL VALVE
- CF – CARTRIDGE FILTER
- CV – CHECK VALVE
- DV – DIAPHRAGM VALVE
- FCV – FLOW CONTROL VALVE
- MPV – MULTIPORT VALVE
- RD – RUPTURE DISK
- RDS – RUPTURE DISK SENSOR
- PI – PRESSURE INDICATOR
- PS – PRESSURE SWITCH
- TS – TEMPERATURE SWITCH
- FIT – FLOW INDICATING TRANSMITTER
- FE – FLOW ELEMENT
- AIT – ANALYTICAL INDICATING TRANSMITTER
- AE – ANALYTICAL ELEMENT
- P – PUMP
- T – TANK
- V – VESSEL

PROCESS

- 0 – PRETREATMENT
- 1 – R/O TRAIN 1
- 2 – R/O TRAIN 2
- 3 – BLEND
- 4 – FINISHED WATER
- 5 – CLEANING SYSTEM

XXX – ###

- COMPONENT NUMBER
- PROCESS
- COMPONENT



PRELIMINARY REVISED

VERIFY SCALES 0 1"

PRELIMINARY	BY:	DATE:
PROCESS DESIGN MANAGER		
PROJECT ENGINEER		
SHOP SUPERVISOR		
CADD SUPERVISOR		

REVISIONS

#	DESCRIPTIONS	DATE	DRN	REL
01	PRELIMINARY	09/30/16	DFS	
02	PRELIMINARY–REVISED BLEND FLOW AND LINE SIZE AND WELL INLET FLOW AND PRE–TREAT FLOW	12/08/16	DFS	
03	PRELIMINARY – REVISED PERMEATE AND CONCNETRATE FLOWS PER COMMENTS.	01/10/17	DFS	

Harn R/O SYSTEMS INC.

310 CENTER COURT
VENICE, FL 34285
(941)488-9671

JOB NO:	15-2100C
DATE:	09/30/16
DESIGN BY:	DFS
DRAWN BY:	DFS
SCALE:	NTS
CHECKED BY:	
APPROVED BY:	

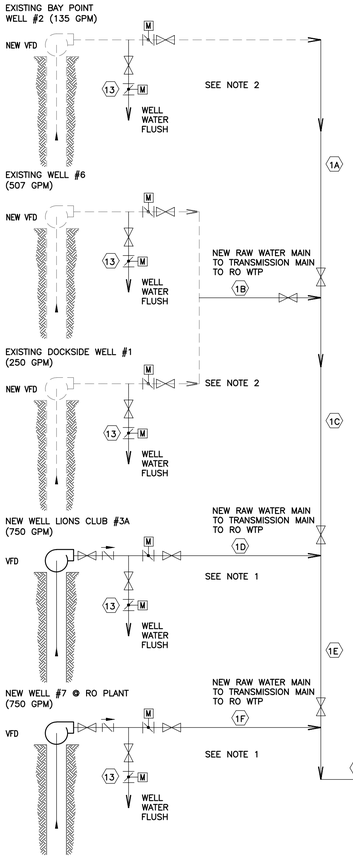
JOB: TOWN OF EDISTO BEACH
WATER SYSTEM IMPROVEMENT PROJECT

DRAWING TITLE: R/O Process and Instrumentation Diagram

DRAWING NO. 15-2100C-PID-00
SUB ASSEMBLY PAGE NO. 2 of 3
DRAWING SET PAGE NO.

Figure 9.2

Process Flow Diagram



OPERATING CONDITIONS

NO. OF TRAINS ON	REQUIRED RAW WATER FLOW (gpm)	RO FEED FLOW (gpm)	BLENDED PRODUCT (gpm)	CONCENTRATE FLOW (gpm)
1	507	427	400	107
2	1014	854	800	214
3	1521	1281	1200	321

NOTES:

1. PROPOSED WELLS #3A AND #7 WILL BE DESIGNED AS VFD WITH VARIABLE FLOW RATES 500–750 GPM. EACH WELL WILL NORMALLY SUPPLY 507 GPM TO FEED ONE RO SKID.
2. EXISTING WELLS #1, #2 & #6 WILL BE RETROFITTED WITH VFD'S. WELL #6 PUMPING RATE WILL BE INCREASED FROM 495 GPM TO 507 GPM.

LEGEND

- NEW PUMP
- EXISTING PUMP
- NEW GATE VALVE
- NEW BUTTERFLY VALVE
- NEW CHECK VALVE
- NEW BALL VALVE
- M — NEW MOTORIZED BUTTERFLY VALVE
- NEW VERTICAL TURBINE PUMP
- NEW MAGNETIC FLOW METER
- 10 — LINE NUMBER
- NEW LEVEL SENSOR
- ISB — INTERSTAGE BOOSTER PUMP
- DW — DEEP WELL
- HSP — HIGH SERVICE PUMP
- EXISTING
- DEEP WELL (DW)

PUMP INFORMATION

PUMP	LOCATION	CAPACITY (gpm)	TDH (ft)	H.P.	VOLTAGE	PHASE	SPEED
WELL #2	BAY POINT	135					VARIABLE
WELL #6	McCONKEY SITE	507					VARIABLE
WELL #1	DOCKSIDE	250					VARIABLE
WELL #3A (NEW)	LIONS CLUB	750	270	75	480	3	VARIABLE
WELL #7 (NEW)	RO WTP	750	270	75	480	3	VARIABLE
HSP1 (NEW)	ONSITE (HSP)	600	162	40	460	3	VARIABLE
HSP2 (NEW)	ONSITE (HSP)	600	162	40	460	3	VARIABLE
HSP3 (NEW)	ONSITE (HSP)	1200	162	75	460	3	VARIABLE
RO FEED 1	RO BUILDING	427	290	50	480	3	VARIABLE
RO FEED 2	RO BUILDING	427	290	50	480	3	VARIABLE
RO FEED 3	RO BUILDING	427	290	50	480	3	VARIABLE
CP #1	CLEANING PUMP	200	N/A	15	480	3	CONSTANT
ISB #1	INTERSTAGE BOOSTER	N/A	92	10	480	3	CONSTANT
ISB #2	INTERSTAGE BOOSTER	N/A	92	10	480	3	CONSTANT
ISB #3	INTERSTAGE BOOSTER	N/A	92	10	480	3	CONSTANT

OFF SITE

ON SITE GENERATOR

NOTES:

1. DESIGN DATA FOR NEW RO 1, 2 AND 3 PROVIDED BY HARN R/O SYSTEMS.

LINE NUMBER (WELL #)	1A (2)	1B (6 & 1)	1C	1D (3A)	1E	1F (7)	1	2	3	4	4A	5	6	7	8	9	10	11	12	13	14	15	20	A	B
PARAMETER / STREAM	RAW WELL WATER	RAW WELL WATER	RAW WELL WATER	RAW WELL WATER	RAW WELL WATER	RAW WELL WATER	COMBINED RAW WELL WTR	RO FEED WATER	CART. FILT. INLET	CART. FILT. OUTLET	RO FEED	RO PUMP SUCTION	RO PUMP DISCHARGE	RO UNIT PERMEATE	RO UNIT CONC.	COMBINED CONC.	COMBINED PERMEATE	NOT USED	COMBINED CONC.	WELL WATER FLUSH	BLENDED PRODUCT	NEW HSP DSCHG COMB.	BYPASS	SCALE INHIBITOR	POST CHEMICAL FEED
FLOW, gpm	135	757	892	750	1642	750	2392	1521											321		1200	2400			
PRESSURE, psig									← SEE HARN R/O SYSTEMS P & ID SHEETS →												N/A	70	SEE HARN R/O SYSTEMS P & ID SHEETS		
PIPE DIAMETER, inch	6	10	10	8	12	8	12	12											6		12	16			
PIPE MATERIAL	PVC C900	PVC C900	PVC C900	PVC C900	PVC C900	PVC C900	PVC C900	PVC S80											PVC C900		PVC C900	DIP			
FLUID VELOCITY, fps	1.5	3.1	3.6	4.8	4.7	4.8	6.8	4.3											3.6		3.6	3.8			
COMMENTS	EXISTING WELL NO. 2 (BAY POINT)	EXISTING WELL NO. 6 + NO. 1	MANIFOLD PIPING FOR WELLS	NEW WELL NO. 3A (LIONS CLUB)	MANIFOLD PIPING FOR WELLS	NEW PRODUCTION WELL NO. 7	COMBINED RAW WATER (RO FEED)	NEW INSIDE BUILDING	NEW INSIDE BUILDING	NEW INSIDE BUILDING	NEW INSIDE BUILDING	NEW INSIDE BUILDING	NEW INSIDE BUILDING	NEW INSIDE BUILDING	NEW INSIDE BUILDING	NEW INSIDE BUILDING	NEW INSIDE BUILDING	NOT USED	NEW OUTSIDE DISCHARGE		NEW LINE	NEW LINE			

FIG. 9.2

PROCESS FLOW DIAGRAM

EDISTO BEACH RO WTP

COLLETON COUNTY, SOUTH CAROLINA

PREPARED FOR:

TOWN OF EDISTO BEACH

PREPARED BY:

THOMAS & HUTTON
Engineering | Surveying | Planning | GIS | Consulting

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SHEET:	FIG. 9.2

10. HYDRAULIC MODEL

A computerized hydraulic model of the entire water system developed during previous engineering studies was updated for recent infrastructure improvements and current operating data. Data for proposed improvements was entered into the model for each of the 8 options considered during the matrix development process. This data included but was not limited to:

- Supply wells pressure and flow rates.
- RO plant treatment capacity.
- HSPs pressure and flow rates.
- Clearwell volume per foot of depth.
- Elevated storage tank volume per foot of depth and corresponding elevations.
- ASR pressure and flow rate.
- GST volume per foot of depth.
- GST booster pumps pressure and flow rates.
- PDD and fire flow within the water distribution system.

The model was manipulated with various control points for pumps, RO plant, ASR and tank elevations to provide sizing for each proposed improvement option required to meet PDD with a fire flow of 1,000 gpm for 2 hours impressed during PHD. PHD peaking factor of 2.1 X PDD was used to be conservative since AWWA average PHD factor is 1.8 X PDD. Many options failed to meet the required conditions and were eliminated from consideration. The options that did meet the required conditions were compared on an initial cost and a life cycle basis.

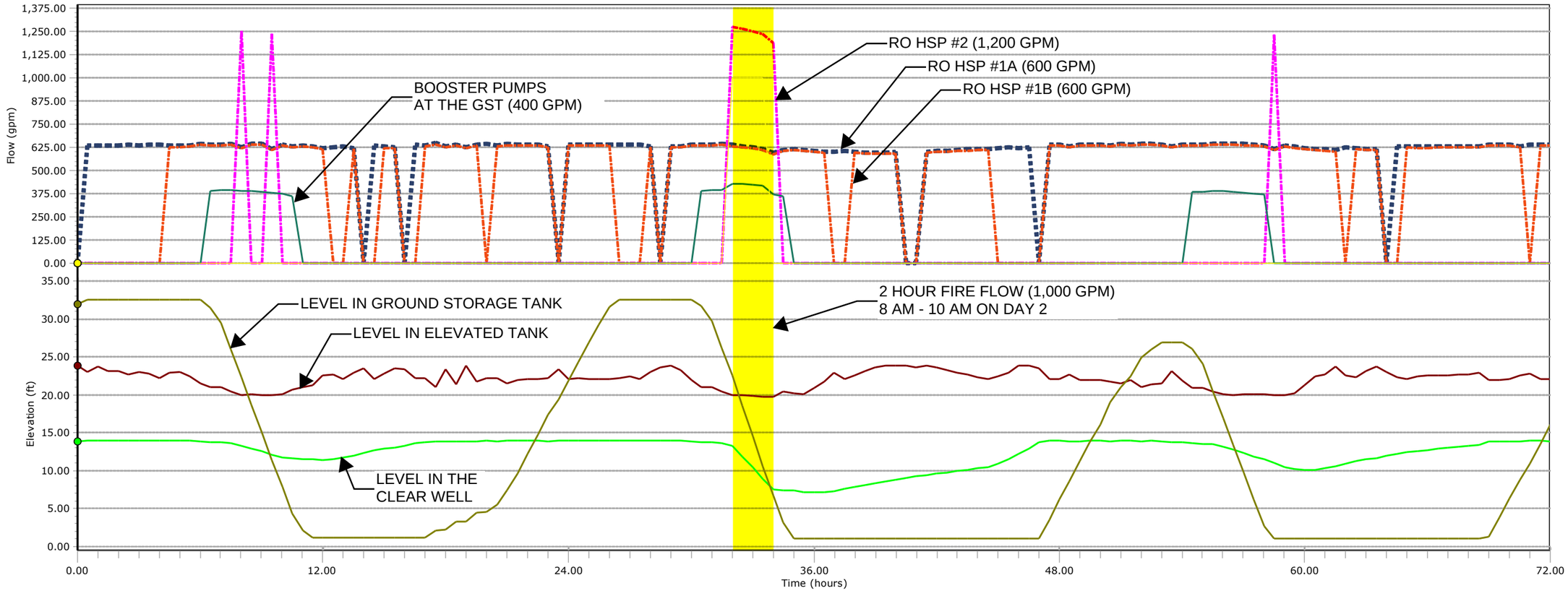
Figure 10.1 is a graph of the model results for selected Option 4C. It shows tank levels and pumping rates for existing infrastructure and the new improvements included with this option during PDD with 1,000 gpm fire flow for 2 hours during the peak hour. Even though it is highly unlikely that this scenario will ever occur, the modeling results indicate that Option 4C will be capable of meeting this demand provided all infrastructure is operating properly.

Figure 10.1

Hydraulic Modeling Graph

Option 4C

EDISTO BEACH PROPOSED RO PLANT
OPTION 4C



PMP-CW-1A - Option 4C (72 Hour) - 1,200 gpm RO, 3518 SF clearwell, 1,000 GPM FF at J-28 from 8-10 AM on Day 2 - Flow (Total)
PMP-CW-1B - Option 4C (72 Hour) - 1,200 gpm RO, 3518 SF clearwell, 1,000 GPM FF at J-28 from 8-10 AM on Day 2 - Flow (Total)
PMP-CW-2 - Option 4C (72 Hour) - 1,200 gpm RO, 3518 SF clearwell, 1,000 GPM FF at J-28 from 8-10 AM on Day 2 - Flow (Total)
GST Booster Pump-2 - Option 4C (72 Hour) - 1,200 gpm RO, 3518 SF clearwell, 1,000 GPM FF at J-28 from 8-10 AM on Day 2 - Flow (Total)
Elevated Tank - Option 4C (72 Hour) - 1,200 gpm RO, 3518 SF clearwell, 1,000 GPM FF at J-28 from 8-10 AM on Day 2 - Level (Calculated)
T-CW-1 - Option 4C (72 Hour) - 1,200 gpm RO, 3518 SF clearwell, 1,000 GPM FF at J-28 from 8-10 AM on Day 2 - Level (Calculated)
Ground Tank 1 - Option 4C (72 Hour) - 1,200 gpm RO, 3518 SF clearwell, 1,000 GPM FF at J-28 from 8-10 AM on Day 2 - Level (Calculated)

FIGURE 10.1

11. SUMMARY

The proposed water system improvements for the Town of Edisto Beach will be constructed under a Progressive Design/Build delivery method. Permitting for this project is scheduled to be completed during 2017 with construction beginning immediately after all permits are issued with completion anticipated within 12-14 months.

Improvements included in this project consist of:

- Two new 10-inch Santee wells approximately 580-feet deep with submersible pumps and VFD motors.
- Approximately 10,000 feet of new transmission water main to connect wells to the treatment plant.
- Water treatment plant consisting of 3 RO treatment skids each with a permeate capacity of 320 gpm for a combined treatment capacity of 1,200 gpm including a 20% blend with raw well water. The plant will also include pre and post treatment equipment and a system to chemically clean the RO membranes.
- Water treatment plant building housing RO treatment system, chemical systems, motor control center, emergency generator, high service pumps, control room/SCADA and rest room.
- Approximately 1,900 feet of concentrate discharge line with length dependent upon required depth of diffuser from ocean surface.
- Reinforced concrete clearwell will be constructed under the treatment plant building. The surface area of the clearwell will be approximately 3,518 SF with an 11-foot water depth and 2 feet of freeboard. Total volume of the clearwell will be 290,000 gallons.
- Three vertical turbine high service pumps with VFD motors. One pump rated at 1,200 gpm and the other two rated at 600 gpm each.
- Automatic control valves will be installed on the fill line of both the existing elevated storage tank and GST. New SCADA controls will allow the GST to fill during off-peak hours on high demand days, and deliver stored water from the GST to the system as needed during peak hours. Control valve on the elevated tank will be closed while the GST is filling.

Summary of completed project capacities:

- Current ADD 587,500 gpd
- Design ADD 705,000 gpd
- Design PDD 1,621,500 gpd (1,126 gpm)

- Total well supply 1,521 gpm + 385 gpm Reserve
- Blended RO 1,728,000 gpd (1,200 gpm)
- High Service Pumps 1,200 gpm, 600 gpm, 600 gpm
- Clearwell Capacity 290,000 gallons
- Existing Storage ET=100,000 gal., GST=200,000 gal,

Appendix A

Lab Analysis-Existing Well #6

TRIDENT LABS SERVICES, INC.
ANALYTICAL LABORATORY
Soil, Water, Wastewater & Industrial Chemical Analysis
9104 Canvas Lane △ Ladson, South Carolina 29456
Telephone (843) 871-4999 △ Fax (843) 875-2266
e-mail: tls@tridentlabs.com

REPORT OF ANALYSIS

Thomas & Hutton Engineering
935 Houston Northcutt Blvd.
Mt. Pleasant, SC 29465
Attn: Mark Yodice

Report Date: 01/05/16

Sampled: 11/20/15 10:29
Collected By: JGL
Sample Matrix: DW
1 of 3

Received: 11/20/15 11:40
Received By: KDL

Sample Id: 0154218
Sample Number(s): 190427 - 190430
Project Name: Edisto Beach
Location: Well 6

ANALYSIS	METHOD	RESULT	UNITS	DATE/TIME	ANALYST
Sample Type: Grab					
Bicarbonate Alkalinity	SM 2320B	519	mg/l	11/23/15 10:00	LJH
Carbonate Alkalinity	SM 2320B	0	mg/l	11/23/15 10:00	LJH
Chloride	EPA 300.0	490	mg/l	11/20/15 15:33	MBL
Fluoride	EPA 300.0	2.56	mg/l	11/20/15 13:38	MBL
Nitrate-Nitrogen	EPA 300.0	< 0.5	mg/l	11/20/15 13:38	MBL
Residue, Filterable (TDS)	SM 2540C	1398	mg/l	11/25/15 12:00	ACE
Specific Conductance	EPA 120.1	2.61	mS/cm	11/20/15 14:00	ACE
Sulfate	EPA 300.0	52.8	mg/l	11/20/15 13:43	MBL
Metals Prep	EPA 200.2	Complete	None	11/24/15 08:00	MBL
Barium	EPA 200.7	< 0.050	mg/l	11/25/15 10:46	MBL
Calcium	EPA 200.7	5.3	mg/l	11/25/15 10:46	MBL
Chromium	EPA 200.7	0.005	mg/l	11/25/15 10:46	MBL
Copper	EPA 200.7	0.105	mg/l	11/25/15 10:46	MBL
Iron	EPA 200.7	< 0.3	mg/l	11/25/15 10:46	MBL
Manganese	EPA 200.7	< 0.010	mg/l	11/25/15 10:46	MBL
Zinc	EPA 200.7	0.089	mg/l	11/25/15 10:46	MBL
Aluminum	EPA 200.7	< 0.050	mg/l	11/25/15 10:46	MBL
Sub Work	Sub Contractor	Attached	None	12/04/15 14:16	JL

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566
REPORT APPROVED BY:

Report Comments :
Ammended Report: Incorrect Result entered.

TRIDENT LABS SERVICES, INC.
ANALYTICAL LABORATORY
Soil, Water, Wastewater & Industrial Chemical Analysis
9104 Canvas Lane △ Ladson, South Carolina 29456
Telephone (843) 871-4999 △ Fax (843) 875-2266
e-mail: tls@tridentlabs.com

QC SUMMARY

Thomas & Hutton Engineering
935 Houston Northcutt Blvd.
Mt. Pleasant, SC 29465
Attn: Mark Yodice

Report Date: 1/5/16

Sample ID: 0154218

Batch	30113	Method : EPA 300.0					
Parameter		**Expected**	**Actual Result**	**% Rec**	**Range**	**Analyst**	**Date/Time**
	LCS-CL Chloride	2	1.99	99.35	90 - 110	MBL	11/20/2015 1:42:34 PM
	LCS-F Fluoride	2	2.16	108.15	90 - 110	MBL	11/20/2015 1:42:34 PM
	LCS-NO3 Nitrate-Nitrogen	2	2.01	100.30	90 - 110	MBL	11/20/2015 1:42:34 PM
	LCS-SO4 Sulfate	2	2.12	106.05	90 - 110	MBL	11/20/2015 1:42:34 PM
	MSPK-F Fluoride	5	5.34	106.88	80 - 120	MBL	11/20/2015 1:42:34 PM
	MSPK-NO3 Nitrate-Nitrogen	5	4.84	96.72	80 - 120	MBL	11/20/2015 1:42:34 PM
	MSPK-CL Chloride	9.998	9.90	99.00	80 - 120	MBL	11/20/2015 1:42:34 PM
	MSPK-SO4 Sulfate	20.2	20.50	101.49	80 - 120	MBL	11/20/2015 1:42:34 PM
Batch	**30115**	**Method : EPA 120.1**					
Parameter		**Expected**	**Actual Result**	**% Rec**	**Range**	**Analyst**	**Date/Time**
	Duplicate	2.61	2.62	0.38	-10 - 10	MBL	11/20/2015 2:28:24 PM
	LCS Specific Conductance	1410	1416.00	100.43	90 - 110	MBL	11/20/2015 2:28:24 PM
Batch	**30125**	**Method : SM 2320B**					
Parameter		**Expected**	**Actual Result**	**% Rec**	**Range**	**Analyst**	**Date/Time**
	Duplicate Bicarbonate Alkalinity	0	0.00	0.00	-10 - 10	LJH	11/23/2015 11:40:19 AM
Batch	**30126**	**Method : SM 2320B**					
Parameter		**Expected**	**Actual Result**	**% Rec**	**Range**	**Analyst**	**Date/Time**
	Duplicate Carbonate Alkalinity	0	0.00	0.00	-10 - 10	LJH	11/23/2015 11:43:42 AM
Batch	**30150**	**Method : EPA 200.7**					
Parameter		**Expected**	**Actual Result**	**% Rec**	**Range**	**Analyst**	**Date/Time**
	LCS-AL Aluminum	1	1.09	109.00	85 - 115	MBL	11/25/2015 8:04:34 AM
	LCS-BA Barium	1	1.09	109.00	85 - 115	MBL	11/25/2015 8:04:34 AM
	LCS-CA Calcium	1	1.11	111.00	85 - 115	MBL	11/25/2015 8:04:34 AM
	LCS-CR Chromium	1	1.06	106.00	85 - 115	MBL	11/25/2015 8:04:34 AM
	LCS-CU Copper	1	1.02	102.00	85 - 115	MBL	11/25/2015 8:04:34 AM
	LCS-FE Iron	1	1.24	124.00	85 - 115	MBL	11/25/2015 8:04:34 AM

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY:

Report Comments :
Ammended Report: Incorrect Result entered.

TRIDENT LABS SERVICES, INC.
ANALYTICAL LABORATORY
Soil, Water, Wastewater & Industrial Chemical Analysis
9104 Canvas Lane ∠ Ladson, South Carolina 29456
Telephone (843) 871-4999 ∆ Fax (843) 875-2266
e-mail: tls@tridentlabs.com

QC SUMMARY

Thomas & Hutton Engineering
935 Houston Northcutt Blvd.
Mt. Pleasant, SC 29465
Attn: Mark Yodice

Report Date: 1/5/16

Sample ID: 0154218

LCS-MN Manganese	1	1.07	107.00	85 - 115	MBL	11/25/2015 8:04:34 AM
LCS-ZN Zinc	1	1.07	107.00	85 - 115	MBL	11/25/2015 8:04:34 AM
MSPK-CR Chromium	1	1.10	110.00	75 - 125	MBL	11/25/2015 8:04:34 AM
MSPK-CU Copper	1	1.08	108.00	75 - 125	MBL	11/25/2015 8:04:34 AM
MSPK-MN Manganese	1	1.09	109.00	75 - 125	MBL	11/25/2015 8:04:34 AM
MSPK-ZN Zinc	1	1.23	123.00	75 - 125	MBL	11/25/2015 8:04:34 AM

Batch **30178** **Method : SM 2540C**

Parameter	Expected	Actual Result	% Rec	Range	Analyst	Date/Time
Duplicate Residue, Filterable (TDS)	1398	1490.00	6.58	-10 - 10	ACE	11/25/2015 12:00:00 PM

LABORATORY I.D. NO. 10122, FIELD SERVICES I.D. NO 08566

REPORT APPROVED BY: Melinda Tillman

Report Comments :
Ammended Report: Incorrect Result entered.

Davis & Brown

PO Box 15038
Quinby, SC 29506
(843) 665-6746 FAX: (843) 629-1444

Certificate of Analysis

Client: ACCESS ANALYTICAL
7478 CARLISLE ST
IRMO, SC 29063
Contact: ASHLEY AMICK
Client #: 941

South Carolina Certification Number: 21117

Receipt Date: 02-Dec-15
Report Date: 07-Jan-16

Sample Date: 20-Nov-15
SDG #: SDG-109601
Lab Sample ID: LSID-242559
Sample ID: 190430

Approved By: Van Ward
Van Ward
Lab Director

Parameter	Result	Reporting Limit	Unit	Method	Flag	Date	Time	Analyst
Beryllium, Total	<0.001	0.001	mg/L	EPA 200.7		12/16/2015	11:40	JR
Boron, Total	2.01	0.02	mg/L	EPA 200.7		12/17/2015	14:53	JR
Magnesium, Total	8.07	0.02	mg/L	EPA 200.7		12/4/2015	19:50	JR
Nickel, Total	<0.005	0.005	mg/L	EPA 200.7		12/14/2015	13:28	JR
Potassium, Total	<25	25	mg/L	EPA 200.7		12/16/2015	9:07	JR
Sodium, Total	512	25	mg/L	EPA 200.7		12/16/2015	9:07	JR
Silver, Total	<0.005	0.005	mg/L	EPA 200.7 / 200.		12/15/2015	15:31	JR/AE
Mercury, Total	<0.20	0.2	ug/L	EPA 245.1		12/3/2015	9:00	CG
Thallium, Total	<0.5	0.5	ug/L	EPA 279.2/ 200.		12/16/2015	13:19	JR
Lead, Total	0.001	0.001	mg/L	SM 3113B-2010		1/5/2016	12:00	JR
Arsenic, Total	<0.005	0.005	mg/L	SM 3113B-99		1/5/2016	16:27	JR
Cadmium, Total-PQL	0.0001	0.0001	mg/L	SM 3113B-99		1/6/2016	10:21	JR
Selenium, Total	<0.005	0.005	mg/L	SM 3113B-99		1/6/2016	10:04	JR

Revision 2

Appendix B

Reverse Osmosis System Analysis

Reverse Osmosis System Analysis for FILMTEC™ Membranes
Project: Santee Well 6 WQ Town Hall Cases
JEN, Harn R/O Systems, Inc.

ROSA 9.1 ConfigDB u399339_356
Case: 5
9/25/2016

Project Information: Edisto Beach

Case-specific: three 320 gpm perrm. skids

System Details

Feed Flow to Stage 1	426.67 gpm	Pass 1 Permeate Flow	320.01 gpm	Osmotic Pressure:			
Raw Water Flow to System	506.67 gpm	Pass 1 Recovery	75.00 %	Feed	16.50 psig		
Feed Pressure	110.32 psig	Feed Temperature	25.0 C	Concentrate	62.46 psig		
Flow Factor	0.85	Feed TDS	1724.21 mg/l	Average	39.48 psig		
Chem. Dose (100% H2SO4)	0.00	Number of Elements	84	Average NDP	71.13 psig		
Total Active Area	33600.00 ft²	Average Pass 1 Flux	13.71 gfd	Power	28.89 kW		
Water Classification: Well Water SDI < 3		Bypass Blending Flow	80.00 gpm	Specific Energy	1.20 kWh/kgal		
System Recovery	78.95 %	Total Blended Product	400.01 gpm				

Stage	Element	#PV	#Ele	Feed Flow (gpm)	Feed Press (psig)	Recirc Flow (gpm)	Conc Flow (gpm)	Conc Press (psig)	Perm Flow (gpm)	Avg Flux (gfd)	Perm Press (psig)	Boost Press (psig)	Perm TDS (mg/l)
1	BW30XFRLE-400/34	8	7	426.67	105.32	0.00	201.51	92.95	225.15	14.47	0.00	0.00	38.20
2	BW30XFRLE-400/34	4	7	201.51	117.95	0.00	106.65	106.18	94.86	12.20	0.00	30.00	107.06

Pass Streams (mg/l as Ion)								
Name	Feed	Adjusted Feed	Concentrate		Permeate			
			Stage 1	Stage 2	Stage 1	Stage 2	Total	Blended Total
NH4+ + NH3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K	18.08	18.08	37.69	69.92	0.52	1.46	0.80	4.25
Na	534.86	538.90	1128.03	2102.27	11.61	32.68	17.85	122.06
Mg	6.16	6.16	13.00	24.48	0.04	0.10	0.05	1.28
Ca	4.62	4.62	9.75	18.36	0.03	0.07	0.04	0.96
Sr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ba	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO3	10.01	10.01	27.59	62.76	0.00	0.02	0.01	0.41
HCO3	586.49	586.49	1209.68	2221.57	17.19	47.75	26.25	141.52
NO3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cl	474.00	474.00	994.54	1858.57	8.11	23.08	12.55	104.84
F	3.30	3.30	6.87	12.72	0.10	0.29	0.16	0.79
SO4	55.15	55.15	116.35	218.89	0.38	1.07	0.58	11.50
SiO2	27.48	27.48	57.93	108.99	0.23	0.53	0.32	5.75
Boron	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	4.28	4.28	8.02	14.79	5.06	9.11	6.26	4.71
TDS	1720.18	1724.21	3601.47	6698.55	38.20	107.06	58.61	393.35
pH	8.20	8.20	8.19	8.14	6.73	6.89	6.81	7.61

Reverse Osmosis System Analysis for FILMTEC™ Membranes
Project: Santee Well 6 WQ Town Hall Cases
JEN, Harn R/O Systems, Inc.

ROSA 9.1 ConfigDB u399339_356
Case: 5
9/25/2016

Design Warnings

-None-

Solubility Warnings

Langelier Saturation Index > 0
Stiff & Davis Stability Index > 0
CaF2 (% Saturation) > 100%
Antiscalants may be required. Consult your antiscalant manufacturer for dosing and maximum allowable system recovery.

Stage Details

Stage 1 Element	Recovery	Perm Flow (gpm)	Perm TDS (mg/l)	Feed Flow (gpm)	Feed TDS (mg/l)	Feed Press (psig)
1	0.09	4.73	21.84	53.33	1724.21	105.32
2	0.09	4.48	25.75	48.61	1889.39	102.76
3	0.10	4.24	30.55	44.13	2077.99	100.51
4	0.10	4.01	36.52	39.89	2294.93	98.53
5	0.11	3.79	44.07	35.88	2546.61	96.81
6	0.11	3.57	53.77	32.10	2841.03	95.32
7	0.12	3.34	66.51	28.53	3188.47	94.04
Stage 2 Element	Recovery	Perm Flow (gpm)	Perm TDS (mg/l)	Feed Flow (gpm)	Feed TDS (mg/l)	Feed Press (psig)
1	0.09	4.53	57.00	50.38	3601.47	117.95
2	0.09	4.17	69.29	45.85	3951.00	115.58
3	0.09	3.79	85.11	41.68	4338.14	113.49
4	0.09	3.40	105.64	37.89	4762.32	111.65
5	0.09	3.00	132.48	34.49	5219.96	110.03
6	0.08	2.60	167.77	31.49	5703.56	108.59
7	0.08	2.22	214.23	28.88	6201.44	107.32

Scaling Calculations

	Raw Water	Adjusted Feed	Concentrate
pH	8.20	8.20	8.14
Langelier Saturation Index	0.00	0.00	1.08
Stiff & Davis Stability Index	0.29	0.29	0.85
Ionic Strength (Molal)	0.03	0.03	0.10
TDS (mg/l)	1720.18	1724.21	6698.55
HCO3	586.49	586.49	2221.57
CO2	4.28	4.28	14.79
CO3	10.01	10.01	62.76
CaSO4 (% Saturation)	0.05	0.05	0.35
BaSO4 (% Saturation)	0.00	0.00	0.00
SrSO4 (% Saturation)	0.00	0.00	0.00
CaF2 (% Saturation)	6.69	6.69	395.23
SiO2 (% Saturation)	17.82	17.82	73.45
Mg(OH)2 (% Saturation)	0.01	0.01	0.02

To balance: 4.03 mg/l Na added to feed.