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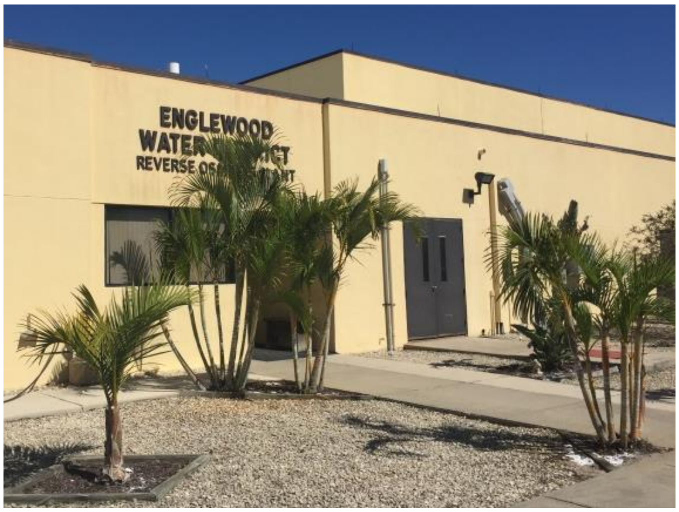
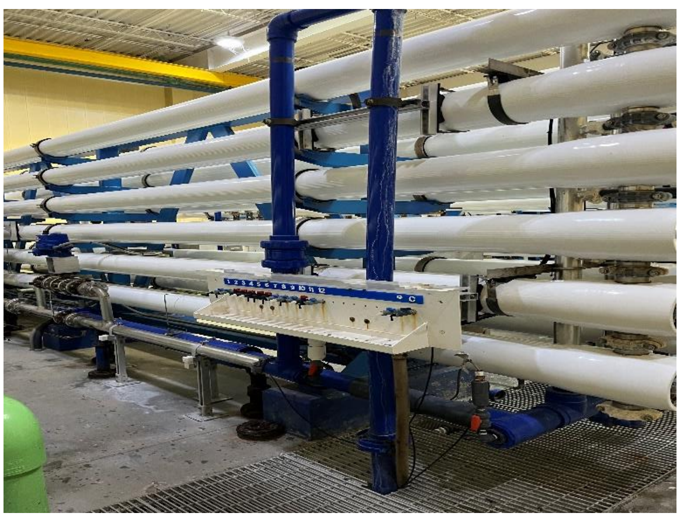
Appendix A – Condition Assessment Technical Memorandum





Potable Water Master Plan - Condition Assessment Technical Memorandum

Englewood Water District

District Agreement No. 2022-129

Englewood, FL

October 19, 2023

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1 Introduction

The Englewood Water District (District) has retained HDR Engineering, Inc. (HDR) to provide professional services to develop a Potable Water Master Plan Update. This Master Plan will assess the District's water service and facility needs for the next 20-year planning period from 2023 through 2043 and the next 50-year period from 2023 to 2073. The purpose of this Technical Memorandum is to present the findings from HDR's condition assessment of the lime softening and reverse osmosis drinking water treatment plants, performed on March 31, 2022, and the resulting recommendations.

2 Background

The District was created in 1959 and is classified as a political sub-division of the State of Florida under Chapter 2004-439. The District owns and operates a public utility that provides water services within the unincorporated areas of Sarasota and Charlotte Counties, generally known as Englewood, Grove City, and Manasota Key. The District's current service area boundary encompasses approximately 44.5 square miles. In addition, the District has interlocal agreements for the delivery of potable water to Bocilla Utilities for the residents of Don Pedro and Knight/Palm Island in Charlotte County.

2.1 Existing Facilities

The District's current Water Use Permit (WUP) issued by the Southwest Florida Water Management District (SWFWMD) (WUP No. 20 004866.012) authorizes groundwater withdrawals of 5,360,000 gallons per day (annual average) and 6,860,000 gallons per day (peak month). These quantities were allocated to meet the District's potable water demand through 2050. The District's WUP expires on December 9, 2050. The District's water supply, treatment and distribution facilities include:

- Five (5) groundwater wellfields
  - Four (4) freshwater well systems with aggregated permitted withdrawal capacities of up to 3.54 MGD (annual average) and up to 4.35 MGD (peak month) within Wellfields 1, 2, 3, and 5 provided the current total WUP allocation is not exceeded.
  - Two (2) brackish water well systems with aggregated permitted withdrawal capacities of up to 4.25 MGD (annual average) and up to 5.44 MGD (peak month) within Wellfields 2 and 4 provided the current total WUP allocation is not exceeded.
- Two (2) water treatment plants
  - One (1) lime softening plant built in 1961 at 3.0 MGD design capacity for treatment of the freshwater wellfield supply; however, the District can only reliably treat 2 MGD of this capacity.
  - One (1) reverse osmosis (RO) Plant built in 1981 at 3.0 MGD design capacity for treatment of the brackish water wellfield supply
- Four (4) finished water storage tanks with a combined capacity of 7.5 million gallons, and one (1) elevated storage tank with 100,000-gallon capacity used to dampen the amplitude of distribution system pressures
- Two (2) deep injection wells

    - One (1) 1.58-MGD deep injection well (DIW-1) onsite for RO concentrate disposal
    - One (1) 2.94-MGD deep injection well (DIW-2) offsite at the Holiday Ventures Lift Station for reclaimed water disposal and backup RO concentrate disposal. Backup capacity is limited due to existing use by the South Water Reclamation Facility (WRF) and future use by the North WRF that is being currently planned.
- Over 3,571 miles of water transmission and distribution pipelines and appurtenances, with emergency interconnections with Sarasota and Charlotte Counties.

3 Condition Assessment Framework & Criteria

The Englewood Water District condition assessment framework was based on a three-tier asset hierarchy consisting of the following:

- Level 1: Facility (General Site, Lime Softening, Reverse Osmosis)
- Level 2: System (Site Security, General Plant Facilities, Packed Tower Aerator, Lime Feed System, Lime Treaters, Dual-Media Filters, RO Trains, Disinfection, Clearwells, New/Old High Service Pump Stations, Finished Water Storage Tanks)
- Level 3: Discipline (Structural, Mechanical, Electrical, Instrumentation)

Scores for each Level 3 asset were provided from 1 – 5, with 1 being the best condition and 5 being the worst. Scores were based on a combination of observed conditions and comments on functionality and performance from accompanying Englewood Water District staff.

The following Table 3-1 shows the criteria used for assigning a condition assessment score to each asset.

Table 3-1: Detailed Condition Assessment Criteria Reference

Score	Meaning	Explanation
1	Very Good	Fully operable, well maintained, and consistent with current standards. Little wear shown. No defects noted.
2	Good	Sound and well maintained but may be showing slight signs of early wear. Delivering full efficiency with little or no performance deterioration. Only minor renewal or rehabilitation may be needed in the near term.
3	Average	Functionally sound and acceptable showing normal signs of wear. May have minor failures or diminished efficiency with some performance deterioration or increase in maintenance cost. Moderate renewal or rehabilitation needed in near term.
4	Poor	Functions but requires a high level of maintenance to remain operational. Shows abnormal wear and is likely to cause significant performance deterioration in the near term. Replacement or major rehabilitation needed in the near term.
5	Very Poor	Effective life exceeded and/or excessive maintenance cost incurred. A high risk of breakdown or imminent failure with serious impact on performance. No additional life expectancy with immediate replacement needed.

4 Condition Assessment Summary

The HDR team performed a walkthrough of the lime softening and reverse osmosis plants with Keith Ledford, Technical Support Manager, and Dewey Futch, Water Operations Manager, from the District on Friday, March 31, 2023. The District provided a short overview presentation explaining the layout and flow routing through the plants. The HDR team provided a high-level assessment of the structural, mechanical, electrical, and instrumentation aspects of major plant processes, based on physical observations and input on performance and age from the District.

The HDR team used the findings from the condition assessment to assign scores to each major process. Table 4-1 shows the scoring for each process area sorted by discipline. Color-coding is explained below:

Table 4-1: Condition Assessment Results Summary

Facility	System	Condition Score				
		Structural	Mechanical	Electrical	Instrumentation	Average
General Site	Site Security	1	1	1	2	1
Lime Softening	General Facility	2	4	1	1	3
Lime Softening	Packed Tower Aerator	1	2	1	2	2
Lime Softening	Lime Feed System	3	2	2	2	2
Lime Softening	Treater 1	3	3	2	1	2
Lime Softening	Treater 2	4	3	2	1	2
Lime Softening	Treater 3	4	3	2	1	2
Lime Softening	Filters	4	4	2	4	4
Lime Softening	Old High Service Pump Station	1	2	1	1	1
Lime Softening	New High Service Pump Station	1	2	1	1	1
Lime Softening	Chemical Storage and Dosing	2	2	1	1	2
Reverse Osmosis	General Facility	3	3	1	1	2
Reverse Osmosis	Electrical & Control Rooms	4	1	4	4	3
Reverse Osmosis	RO Train A	5	4	2	3	4
Reverse Osmosis	RO Train B	5	2	2	2	3
Reverse Osmosis	RO Train C	5	1	2	3	3
Reverse Osmosis	RO Train D	5	4	2	2	3
Reverse Osmosis	RO Train E	2	2	2	3	2
Reverse Osmosis	RO Train F	1	3	2	2	2
Reverse Osmosis	Clearwell 1	4	3	2	3	3
Reverse Osmosis	Clearwell 2	1	1	2	2	2
Reverse Osmosis	Chemical Storage and Dosing	2	1	1	1	1

Color Coding Reference:

- **Green** – Very Good
- **Yellow** – Good
- **Gray** – Average
- **Orange** – Poor
- **Red** – Very Poor

5 Condition Assessment Findings

5.1 General Site – Site Security

General site refers to the site as a whole, including both the lime softening and reverse osmosis plants. Site security is adequate but could be improved. The site has one main point of entry at the administrative building with a motor-operated slide gate. There are several security cameras which feed footage to control rooms at each of the two plants. Security camera footage is only kept for 24 hours. The District has at least two operators on site at all times.

Table 5-1: Condition Assessment Results - Site Security

Discipline	Condition Assessment Score	Comments
Structural	1	• No defects noted
Mechanical	1	• No defects noted
Electrical	1	• No defects noted
Instrumentation	2	• Few security cameras • Security camera footage only kept for 24 hours

5.2 Lime Softening Plant

The existing lime softening plant consists of an influent packed tower aerator with a DeLoach degasification unit, a lime slaker, three (3) 32-foot-diameter lime softening treaters, three (3) dual-media gravity filters, chlorine gas and anhydrous ammonia stored in covered areas, the 3.25-MGD Old High Service Pump Station, the 8.64-MGD New High Service Pump Station, a backwash storage pond, a 0.5-MG finished water storage tank, a 1.0-MG finished water storage tank, and a 100,000-gallon elevated finished water storage tank. The 0.5- and 1.0-MG finished water storage tanks were not visually assessed during this site visit; however, the District's prior inspections have determined the 0.5-MG finished water storage tank, which is steel, is in bad condition internally and in need of repair.

5.2.1 General Lime Softening Facility

The elevated storage tank was structurally rehabilitated in September 2023. The District is planning to sandblast and repaint the tank in the near future.

The plant achieves clarification, softening, and pH adjustment through the use of three (3) hydrotreaters. District personnel stated that all three treaters are operated to achieve a pH around 10 to provide water stability and meet finished water pH goals of 9.2 to 9.4 when filter effluent combines with RO permeate. In general, the use of lime has resulted in plantwide operational issues such as clogging of lime feed lines, lime buildup and media calcification in filters, and lime settling, dredging, drying, and hauling from the backwash pond. In an effort to minimize lime use, it is suggested that a lime dosing optimization study be conducted and evaluate if caustic instead be added to either Clearwell 1 or filter effluent to raise the pH of the combined filter effluent and RO permeate. This would raise the pH without the operational issues and costs associated with using high quantities of lime.

A pond is located just east of the lime softening plant which is used for filter backwash wastewater and treater wastewater storage. Water is decanted from the pond and sent back to the lime treaters to reduce system water losses. The backwash pond fills quickly with lime sludge and requires regular dredging, which was last performed in 2019. The spent lime is then dried out in adjacent ponds and eventually landfilled; however, the drying process takes a long time, and the site is running out of space to dry the lime sludge. The District has also stated that it is difficult to find reliable and steady services to accept and dispose of the spent lime.

Table 5-2: Condition Assessment Results - General Lime Softening Facility

Discipline	Condition Assessment Score	Comments
Structural	2	• No plantwide defects noted • Per District, 0.5-MG storage tank liner has leaked and is in need of repair. It is offline but its use has not been critical.
Mechanical	4	• High lime use has resulted in process inefficiencies such as clogging of lime feed lines, frequent filter media replacement, and high sludge dredging/drying demands.
Electrical	1	• No plantwide defects noted
Instrumentation	1	• No plantwide defects noted

5.2.2 Packed Tower Aerator

The packed tower aerator was upgraded in 2020 with a new tank and degasification unit. Given the recent upgrade, few defects were noted other than some performance issues reported by District personnel and minor mechanical issues. One of the pumps was being replaced at the time of this site visit.

District personnel noted that they do experience occasional binding of the media within the degasification unit to form what is known as "degas balls". This binding is caused by the attachment of elemental sulfur and sulfur-eating bacteria to the polypropylene media. This issue can be remedied through media replacement or the application of a weak acid to remove some sulfur buildup in between replacements. The District noted this as a minor maintenance issue and not requiring immediate or drastic improvement.

Table 5-3: Condition Assessment Results – Packed Tower Aerator

Discipline	Condition Assessment Score	Comments
Structural	1	• No defects noted
Mechanical	2	• Pump station post-tank aged but performing well • Degas blower aging but in fair condition (no pitting) • Some issues with degas balls
Electrical	1	• No defects noted
Instrumentation	2	• Level transmitter showing normal instrument wear • Instrument piping insulation should be replaced

5.2.3 Lime Feed System

The lime feed system consists of the lime slaker unit and the surrounding building. District personnel noted some recent upgrades to the system including the replacement of the lime slaker motor, replacement of structure beams, and rewelding of the supports. Some missing panels from the structure and rusting were noted as remaining damage from the recent hurricane. The containment skirt for the slaker is replaced by the District staff as needed.

District personnel stated that the lime lines clog frequently, sometimes daily. The operators run the system at about 130 – 140ºF; typical systems run closer to 160-180ºF.

Table 5-4: Condition Assessment Results - Lime Feed System

Discipline	Condition Assessment Score	Comments
Structural	3	• Damage due to hurricane
Mechanical	2	• Lime lines clog up frequently
Electrical	2	• Electrical equipment inside of slaker enclosure showing normal wear
Instrumentation	2	• Pressure gauges and float switch showing normal instrument wear

5.2.4 Treater 1

Each of the District's three treaters were evaluated separately due to differences in tank and internal materials. District personnel noted that covers have been removed from the treaters due to the "greenhouse" conditions which lead to unwanted plant growth. It was also mentioned that the District no longer runs lime recirculators because of the resulting turbidity of water in the treaters.

Treater 1 is made of a painted steel tank with painted steel internals. Treater 1 is typically sandblasted and coated in the summer when flows are lower. Treater 1 was out of service for repairs at the time of observation. No operational issues were noted by District personnel for Treater 1 during this site visit.

Table 5-5: Condition Assessment Results – Treater 1

Discipline	Condition Assessment Score	Comments
Structural	3	• Moderate rust on all endpoints • Internal coating pulling off • Some paint/concrete issues
Mechanical	3	• Normal wear, could use new paint • Drive not in good shape
Electrical	2	• Disconnect switches and conduits aging but operational
Instrumentation	1	• No defects noted

5.2.5 Treater 2

Treater 2 is made of a CROM prestressed concrete tank with stainless steel internals. Treater 2 was recently rehabilitated in 2021. This treater was filled at the time of this site visit but appeared to be in overall good operational condition. Though not impacting operation, the CROM tanks were showing external moisture under the paint coat, which provides evidence of possible waterstop failure. The rust color of moisture spots seen on the external of the tank walls may indicate waterstop or rebar corrosion.

Table 5-6: Condition Assessment Results - Treater 2

Discipline	Condition Assessment Score	Comments
Structural	4	• Tank showing signs of waterstop failure
Mechanical	3	• No air source or mixers
Electrical	2	• Disconnect switches and conduits aging but operational
Instrumentation	1	• No defects noted

5.2.6 Treater 3

Treater 3 is made of a CROM prestressed concrete tank with painted steel internals. Treater 3 was rehabilitated in 2020. This treater was filled at the time of this site visit but appeared to be in overall good operational condition. Though not impacting operation, the CROM tanks were showing external moisture under the paint coat, which provides evidence of possible waterstop failure. The rust color of moisture spots seen on the external of the tank walls may indicate waterstop or rebar corrosion.

Table 5-7: Condition Assessment Results – Treater 3

Discipline	Condition Assessment Score	Comments
Structural	4	• Tank showing signs of waterstop failure
Mechanical	3	• No air source or mixers
Electrical	2	• Disconnect switches and conduits aging but operational
Instrumentation	1	• No defects noted

5.2.7 Filters

The District operates three (3) dual-media gravity filters downstream of the lime treaters. The filters consist of layers of anthracite, sand, and gravel above a Wheeler underdrain system. District personnel stated that filter media is replaced every 3 to 5 years; typical recommended service life of filter media is about 10 to 20 years. The lime treaters use a high quantity of lime to raise the pH to around 10 so that finished water pH goals are met when filter effluent combines with RO permeate. This lime builds up in the filters and causes calcification and blowouts in the filter media. It is suspected that the lack of mechanical sweeps and halting the use of backwash air scour in the filters provides inadequate backwashing, resulting in faster calcification and blowouts. The District also reported that there is a lot of media carry over into the backwash troughs. This is likely because troughs are low and close to the media surface.

The backwash pump has not been replaced in many years but is operating well. The District does have another backwash pump in storage in case the existing one needs replacement in the future. No defects were noted with the backwash pump.

Table 5-8: Condition Assessment Results - Filters

Discipline	Condition Assessment Score	Comments
Structural	4	• Rusting • Coating peeling off the walls • Troughs lower than the media
Mechanical	4	• Media calcification and blowout • No air scour • No mechanical mixers
Electrical	2	• Conduits in aging but in fair condition
Instrumentation	4	• Local control panels for filters in poor condition and not up to industry standards • LCP for Filter #3 missing front door and conduit is detached from panel exposing wire

5.2.8 Old High Service Pump (HSP) Station

The Old High Service Pump (HSP) Station contains the backwash pump along with one (1) 30-HP pump and three (3) 50-HP pumps (Pumps 1, 2, 3, and 4) and all related electrical and controls equipment. All four pumps and valves have been replaced since 2018 and are in good condition. It was noted that check valves installed in vaults in the floor are not able to be easily replaced due to the small and deep configuration of the vaults.

Table 5-9: Condition Assessment Results – Old High Service Pump (HSP) Station

Discipline	Condition Assessment Score	Comments
Structural	1	• No defects noted
Mechanical	2	• Check valves in vaults are unreplaceable • Moderate corrosion on small pump distribution
Electrical	1	• No defects noted
Instrumentation	1	• No defects noted

5.2.9 New High Service Pump (HSP) Building

The New High Service Pump Station consists of three (3) large pumps (Pump 7, 8, and 9) with space for two (2) more pumps to be installed in the future. Check valves installed on Pumps 7 and 9 within the New High Service Pump Building cause the whole building to shake. District personnel mentioned that Pump 8 has a “Slaminator” check valve which is effective for reducing the shaking and vibrating. The District would like to install similar check valves on pumps 7 and 9, as well.

Table 5-10: Condition Assessment Results - New High Service Pump (HSP) Building

Discipline	Condition Assessment Score	Comments
Structural	1	• No defects noted
Mechanical	2	• Severe vibrations from Pumps 7 and 9
Electrical	1	• No defects noted
Instrumentation	1	• No defects noted

5.2.10 Chemical Storage and Dosing

Both the lime softening and reverse osmosis plants blends chlorine gas and anhydrous ammonia to produce chloramines for disinfection. The District has expressed interest in switching from using chlorine gas to liquid chlorine. Liquid chlorine would be safer for handling and storage, and it would potentially allow the District to consolidate their chlorine storage into one location for the site. The District has had difficulty finding suppliers for liquid chlorine. If possible, the District also expressed a desire to use free chlorine instead of chloramines.

Chlorine gas for the lime softening plant is stored in a covered building with a chain link fence to prevent unwanted entry. Safety signage and security appear to be adequate. A gantry crane is used to moved chlorine tanks in and out of the building for refill and replacement. The gantry crane mechanism had moderate rusting, but the District did not state any operational issues.

The District blends chlorine gas with anhydrous ammonia to form chloramines. Anhydrous ammonia for the lime softening plant is stored in a pressure vessel covered by an awning adjacent to the chlorine storage room. The awning appeared to be in good structural condition; however, in order to maximize safety and shelf life, it is recommended that the anhydrous ammonia be stored in a covered room (similar to the chlorine storage) so that it remains cool and away from direct sunlight.

Chemical dosing, monitoring instrumentation is mounted on the north interior wall of the Old High Service Pump Station building. This instrumentation appeared to be in good condition and no performance issues were noted by District personnel.

Table 5-11: Condition Assessment Results – Chemical Storage and Dosing

Discipline	Condition Assessment Score	Comments
Structural	2	• Anhydrous ammonia stored outdoors with only an awning for cover
Mechanical	2	• Some rusting/corrosion of gantry crane mechanism in chlorine storage room
Electrical	1	• No defects noted
Instrumentation	1	• No defects noted

5.3 Reverse Osmosis (RO) Plant

The existing RO plant consists of an electrical supply room, six (6) RO trains, chlorine gas and ammonia for disinfection, chemical feed rooms, a generator room, two (2) clearwells operating in series which accept treated water from both the lime softening and RO plants, a 0.5-MG finished water storage tank, a 1-MG finished water storage tank, a 2-MG finished water storage tank, and a 4-MG finished water storage tank. The finished water storage tanks were not assessed during this site visit. The following subsections describe specific condition-related observations made for each of these processes within the RO plant.

5.3.1 General RO Facility

The RO system and electrical supply are housed in a large building (approximately 4,000 ft^2) along the north side of Selma Avenue. This facility includes a 3,500 ft^2 addition which was constructed to expand the RO process to treat 2 MGD of additional flow with four new trains. The District noted that the electrical room, which was designed to provide power to the new RO trains, was too small and did not meet current electrical codes and standards. The District would like to find an alternative site for the electrical room if the RO system is expanded in the future.

The RO Facility includes a large generator room which contains two (2) 500 KW (480V/3P/60Hz) Caterpillar generators and includes space for a third. These generators were replaced in 2019 and appear to be in good condition. The District did not note any operational concerns with the generators.

The RO Facility also includes a large laboratory where the District analyzes samples daily from its lime softening, RO, and wastewater plants for regulatory compliance. The District performs its own bacteriological testing. The HDR team noted some leak staining on ceiling panels due to Hurricane Ian. The lab appeared to be in good condition otherwise.

Brackish raw water flows through several bottlenecks in the piping system before reaching the plant. Raw water from Wellfield 2 flows through a 16-inch pipe before combining with raw water from Wellfield 4 into a 12-inch pipe. This is the first bottleneck in the influent brackish water feed to the RO plant. District personnel mentioned another bottleneck directly in front of the reverse osmosis facility. Specifics of this second bottleneck are not yet known but will be further investigated using as-builts to be provided by the District.

Table 5-12: Condition Assessment Results - General RO Facility

Discipline	Condition Assessment Score	Comments
Structural	3	• Addition for RO expansion does not have space for compliant electrical room. • Minor staining of ceiling panels in laboratory.
Mechanical	3	• Bottlenecks in influent piping.
Electrical	1	• No plantwide defects noted
Instrumentation	1	• No plantwide defects noted

5.3.1.1 Background on RO Filtration System

The RO plant operates six (6) trains, known as Trains A through F, which utilize Protec pressure vessels and Hydranautics CPA5-LD membranes. Each RO skid consists of two (2) trains of pressure vessels with six (6) rows of pressure vessels on each side, resulting in twelve (12) total rows of pressure vessels. Skids are mounted on reinforced concrete pedestals. Each train has its own pump to provide pretreated feedwater to the membranes. These pumps are not the same but generally supply between 100 and 150 HP to the RO trains. The District also keeps a universal standby pump (Pump "S") which can connect to any RO train in case a duty pump is temporarily out of service. During the site visit, Pump S was out of service. Pumps are not connected to VFDs.

The RO skids were designed to provide 0.5 MGD of permeate and typically operate at 70% recovery, although this fluctuates and was noted to be as low as 60% recently. Low recovery is often due to fouling or scaling of the membranes, which results in a higher differential pressure that feed pumps cannot overcome. Performing an analysis using operating and water quality data could provide recommendations for more optimized operation of the RO system.

Membrane permeate is routed out of the south end of the RO building to Clearwell 1, where it is mixed with filter effluent and disinfected. Concentrate flows out along the north end of the building and is disposed of through the deep injection well on the property. In the event that the deep injection well capacity is met, the District sends concentrate to their Deep Injection Well 2 (DIW2) located at the Holiday Ventures site..

Vertically-oriented cartridge filters are located upstream of each RO skid for pretreatment. Cartridge filters are 5-micron in size. Cartridge filters are replaced based on a differential pressure drop of around 10 psi.

District personnel stated that the membranes are typically replaced in-house every 5 to 7 years. The District also stated that they have a regular practice of attempting to extend the service life of membranes by moving used membranes into Train A, which has the highest rated pump. Used membranes are left in the open air before being placed into Train A, which introduces risk of drying and biofouling.

The District also stated that they do not clean membranes. Periodically performing clean-in-place (CIP) events could help to extend their useful life. Operating performance and autopsy results would be required to recommend a specific cleaning schedule and procedure.

The team noted structural and mechanical issues including severe deterioration of the concrete pedestals, leakage, and corrosion of mechanical joints installed vertically between membranes.

5.3.2 Electrical & Control Rooms

Structural, mechanical, and electrical issues were observed within the electrical and control rooms which provide power and controls for the RO trains. The electrical room is generally undersized and does not meet code requirements for motor control center (MCC) and variable frequency drive (VFD) spacing. Prior to Hurricane Ian, a leak in the roof caused a fire in the control room. The leak has been repaired but damages from the fire have not been fully repaired. The team noted that there is a roof drain which runs along the ceiling within the electrical room. This is a cause for concern as leaks or damage to this pipe could result in further equipment damage. The team also noted that new MCC equipment was installed within the existing MCC enclosures. This new equipment is too large for the enclosures and prevents them from closing.

Table 5-13: Condition Assessment Results - Electrical & Control Rooms

Discipline	Condition Assessment Score	Comments
Structural	4	• Room is undersized; does not meet code • Roof drain runs along ceiling
Mechanical	1	• No defects noted
Electrical	4	• MCC enclosures in poor condition • MCC enclosure doors cannot be closed because equipment does not fit inside enclosures
Instrumentation	4	• Control system enclosure in poor condition and not up to industry standards • Fire damage visible on existing control system enclosure • Some equipment indicating lights not functioning • New Siemens PLC

5.3.3 RO Train A

RO Train A is located on the easternmost end of the RO system and is operated by a 150-HP pump. Train A was installed in 1980. Used membranes from other RO trains are often placed into Train A to extend their service lives since Train A has the highest power pump. The S-pump is also located next to Train A was out of service. Additional observations are listed in the table below.

Table 5-14: Condition Assessment Results – RO Train A

Discipline	Condition Assessment Score	Comments
Structural	5	• Severe erosion of concrete pedestals
Mechanical	4	• Significant leaking but operational
Electrical	2	• Conduits showing normal signs of wear
Instrumentation	3	• Instruments and enclosures showing rust/corrosion

5.3.4 RO Train B

RO Train B is the second easternmost train of the RO system and is operated by a 100-HP pump. Train B was installed in 1982. Additional observations are listed in the table below.

Table 5-15: Condition Assessment Results - RO Train B

Discipline	Condition Assessment Score	Comments
Structural	5	• Severe erosion of concrete pedestals • Exposed rebar
Mechanical	2	• Minor corrosion on spacers • No leaking apparent
Electrical	2	• Conduits showing normal signs of wear
Instrumentation	2	• Instruments and enclosures showing rust/corrosion

5.3.5 RO Train C

RO Train C is the third easternmost train of the RO system and is operated by a 100-HP pump. Train C was installed in 1982. This train was offline during inspection, and the District determined that this was due to a bad pump/motor assembly as the motor was overheating within 2 hours of running. District personnel stated that two membranes from Train C were recently sent out for autopsy, but these results have not come in yet. Additional observations are listed in the table below.

Table 5-16: Condition Assessment Results - RO Train C

Discipline	Condition Assessment Score	Comments
Structural	5	• Severe erosion of concrete pedestals
Mechanical	5	• Nonfunctional pump/motor assembly
Electrical	2	• Conduits showing normal signs of wear
Instrumentation	3	• Instruments and enclosures showing rust/corrosion

5.3.6 RO Train D

RO Train D is the third westernmost train of the RO system and is operated by a 125-HP pump. Train D was installed in 1989. Additional observations are listed in the table below.

Table 5-17: Condition Assessment Results - RO Train D

Discipline	Condition Assessment Score	Comments
Structural	5	• Severe erosion of concrete pedestals
Mechanical	4	• Severe corrosion on pump valving
Electrical	2	• Conduits showing normal signs of wear
Instrumentation	2	• Instruments and enclosures showing rust/corrosion

5.3.7 RO Train E

RO Train E is the second westernmost train of the RO system and is operated by a 125-HP pump. Train E was installed in 1992. Additional observations are listed in the table below.

Table 5-18: Condition Assessment Results - RO Train E

Discipline	Condition Assessment Score	Comments
Structural	2	• Minor erosion of concrete pedestals
Mechanical	2	• Minor corrosion on pump valving
Electrical	2	• Conduits showing normal signs of wear
Instrumentation	3	• Instruments and enclosures showing rust/corrosion

5.3.8 RO Train F

RO Train F is the westernmost train of the RO system and is operated by a 125-HP pump. Train F was installed in 2006. Additional observations are listed in the table below.

Table 5-19: Condition Assessment Results: RO Train F

Discipline	Condition Assessment Score	Comments
Structural	1	• No defects noted
Mechanical	3	• Minor leaks on multiple tubes • Minor corrosion on spacers • Moderate wear
Electrical	2	• Conduits showing normal signs of wear
Instrumentation	2	• Instruments and enclosures showing rust/corrosion

5.3.9 Clearwell 1

District personnel explained that water from both the lime softening and RO plants flows into Clearwell 1 and then flows by gravity into Clearwell 2, where it is then pumped to the finished water storage tanks via transfer pumps in Clearwell 2. Clearwell 1 contains an attached degasification unit which was recently constructed and is in good structural condition. District personnel noted that water from the degasification unit has eroded a fair amount of concrete within Clearwell 1. The District prefers not to operate the pumps at Clearwell 1 whenever possible.

Table 5-20: Condition Assessment Results - Clearwell 1

Discipline	Condition Assessment Score	Comments
Structural	4	• Turbulent water causing concrete to chip away
Mechanical	3	• Disconnected pump • Hanging wires • No pressure gages present on 2 of the 3 pumps
Electrical	2	• Disconnect switches and conduits in good shape
Instrumentation	3	• Instruments missing on pump discharge piping

5.3.10 Clearwell 2

Clearwell 2 was constructed more recently than Clearwell 1 and is in good condition overall. Clearwell 2 contains new pressure gages and pressure switches. The transfer pumps at Clearwell 2 appear to be performing well.

Table 5-21: Condition Assessment Results - Clearwell 2

Discipline	Condition Assessment Score	Comments
Structural	1	• No defects noted
Mechanical	1	• No defects noted
Electrical	2	• Disconnect switches and conduits aging but performing well
Instrumentation	2	• Some rusting/corrosion on instruments

5.3.11 Chemical Storage and Dosing

Sulfuric acid and an antiscalant are added upstream of membranes for pretreatment. Sulfuric acid (50%) is stored in an elevated 300-gallon tank above a low concrete sump. Some damage to the concrete sump bottom and coating indicates minor leaks have occurred in the past. Sulfuric acid is fed from two ProMinent peristaltic pumps. The antiscalant used is the PWT SpectraGuard™ 350. This product is diluted to 11.5% antiscalant prior to feeding to the RO feedwater. Two small LMI pumps are used to feed the antiscalant.

Both the lime softening and reverse osmosis plants blends chlorine gas and anhydrous ammonia to produce chloramines for disinfection. The District has expressed interest in switching from using chlorine gas to liquid chlorine. Liquid chlorine would be safer for handling and storage, and it would potentially allow the District to consolidate their chlorine storage into one location for the site. The District has had difficulty finding suppliers for liquid chlorine. If possible, the District also expressed a desire to use free chlorine instead of chloramines.

Chlorine gas for the RO plant is stored in a covered room attached to the RO Facility with a chain link fence to prevent unwanted entry. Safety signage and security appear to be adequate. No structural deficiencies were observed, other than minor rusting of the chain link fence.

The District blends chlorine gas with anhydrous ammonia to form chloramines. Anhydrous ammonia for the RO plant was not observed during this site visit.

Chemical dosing pumps and instrumentation appeared to be in good condition. No deficiencies were observed visually or noted by District personnel.

Table 5-22: Condition Assessment Results – Chemical Storage and Dosing

Discipline	Condition Assessment Score	Comments
Structural	2	• Minor rusting of chain link fence around chlorine storage • Coating damage and minor corrosion of sump beneath sulfuric acid tank
Mechanical	1	• No defects noted
Electrical	1	• No defects noted
Instrumentation	1	• No defects noted

6 Recommendations

The HDR team has compiled the following recommendations to address the defects noted in this report. In future submittals, alternatives for future changes to treatment processes will be modeled and analyzed. Some of the recommendations listed below may be deemed unnecessary based on the results of these analyses. Therefore, the recommendations in Table 6-1 should be considered short-term and subject to change in future submittals.

Table 6-1: Recommendations from Condition Assessment

Plant	System	Recommendation
General	Site Security	Increase security cameras and footage storage.
General	Disinfection (Sitewide)	Consider switching to liquid chlorine and consolidate storage to one location on site.
General	Disinfection (Sitewide)	Consider using free chlorine instead of chloramines.
Lime Softening	Packed Tower Aerator	Replace blower.
Lime Softening	Lime Softening (General)	Conduct lime dosing optimization study to reduce lime use and assess caustic to filter effluent or clearwell for finished water pH balance.
Lime Softening	Treater 1	Replace drive unit.
Lime Softening	Treater 2	Observe for worsening external moisture and consider performing structural testing for tank integrity.
Lime Softening	Treater 3	Observe for worsening external moisture and consider performing structural testing for tank integrity.
Lime Softening	Filters	Consider raising troughs to reduce media carryover.
Lime Softening	Filters	Add air scour and media sweeps to improve backwashing and prevent media hardening.
Lime Softening	Filters	Replace existing local control panels containing backwash controls.
Lime Softening	Filters	Replace missing and deteriorating guardrails.
Lime Softening	New HSP Station	Replace check valves at Pumps 7 and 9 with Slaminator check valves.
Lime Softening	Chemical Storage and Dosing	Store anhydrous ammonia in a cooler location without exposure to direct sunlight.

Reverse Osmosis	RO General Facility	Evaluate alternatives for electrical supply to future RO expansion.
Reverse Osmosis	RO General Facility	Increase raw water pipe sizes to remove bottlenecks.
Reverse Osmosis	RO General Facility	Reroute raw water piping to RO plant.
Reverse Osmosis	Electrical & Control Rooms	Move some equipment to new electrical supply room to meet code.
Reverse Osmosis	Electrical & Control Rooms	Reroute roof drain along outside of building.
Reverse Osmosis	Electrical & Control Rooms	Repair damage from fire and replace failed control system enclosure components
Reverse Osmosis	RO (General)	Perform CIPs as needed to extend membrane service life.
Reverse Osmosis	RO (General)	Review and trend operating data and water quality to optimize operation, including alternative pH adjustment or antiscalant chemicals/doses.
Reverse Osmosis	RO (General)	If reusing membranes from Train B-F is needed, make relocation to Train A as soon as possible to avoid membrane drying.
Reverse Osmosis	RO (General)	Repair/replace concrete pedestals.
Reverse Osmosis	RO (General)	Perform electrical study and check pump performance metrics to troubleshoot Train C supply pump motor issues.
Reverse Osmosis	RO (General)	Repair/replace leaking joints.
Reverse Osmosis	Clearwell 1	Repair eroded concrete and make modifications to clearwell to prevent future damage.
Reverse Osmosis	Chemical Storage and Dosing	Repair damage to sump beneath sulfuric acid storage tank.