## TAMPA BAY SEAWATER DESALINATION PLANT



June 24<sup>th</sup>,2020







2. History, Time Line and Location





#### 2. History and Time Line

- **Owner:** Tampa Bay Water (TBW).
  - Tampa Bay Water (TBW) was created in 1998 to supply wholesale drinking water to Hillsborough County, Pasco County, Pinellas County, New Port Richey, St. Petersburg and Tampa.







## 1. Location



 The Tampa Bay Seawater Desalination Facility (TBSDF) is located next to Tampa Electric's (TECO) Big Bend Power Station at Hillsborough County.













New coagulation/flocculaton and sedimentation system







Improve Dyna Sand Sand Filters inner design of washers + novel vacuum-fed system





New Chemical System





New Diatomaceous Earth Precoat Filters System





Upgrade Posttreatment System. 2 x Lime Saturators





West Scavenger Tank



New Waste Treatment System.



4. Process Stages





### 4. Process Stages – Seawater Station

- Four (4) 350hp Vertical Sea Water Pumps:
  - TECO Tunnel #3: Sea Water Pumps #1 (VFD) and #3 (Soft start)
  - TECO Tunnel #4: Sea Water Pumps #2 (VFD) and #4 (Soft start)





- Influent Water Quality:
  - Temperature: 65 120 F
  - TOC & DOC: high content: 9-12 mg/L
  - TDS Concentration: 24,000-35,000 mg/L



- East and West Pretreatment Basins
  - Traveling screens
  - Rapid Mix (chemical dosage)
    - Chlorine Dioxide
    - Sodium Hypochlorite
    - Ferric Chloride
    - Sulfuric Acid



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### <u>4. Process Stages – Pretreatment</u>

- East and West Pretreatment Basins
  - Coagulation/Flocculation
  - Sedimentation
    - Contact time
    - Scraper
    - Sludge removal
    - Sludge to waste treatment







### 4. Process Stages – Sand Filters

#### 32 Sand Filters (Dynasand)

- 8 air lifts per Sand Filter (Airlift new design by Acciona)
- Up flow Sand Filters washers (new design by Acciona)
- Sand-bed support & shape modified (new design by Acciona)
- Water distribution modified (new design by Acciona)
- Continuous backwash
- Backwash Pumps added









## 4. Process Stages – Sand Filters

- NEW Backwash System
  - Backwash Pit
  - 3 Submergible pumps
  - Backwash Water to Waste Treatment







## <u>4. Process Stages – NEW Diatomaceous Earth (DE) Precoat Filters</u>

#### 18 DE Pressure Vessels

- East and West side
- 377 candles per vessel
- 4 VFD Supply Pumps

#### DE Preparation System

- East and West side
- 2 DE hoppers + 2 tanks + 2 pumps

#### Compensation System

- Compensation tank
- 2 Compensation pumps

#### Waste System

- Waste tank
- 2 Waste pumps





#### 4. Process Stages – DE Precoat Filters

- DE Preparation System
  - Build a new DE precoat filter
  - Time: 1 hour
  - Remove old DE to Waste System
  - Create new layer of DE
  - Add new DE through Compensation System)
  - Recirculation and Pressurization

#### Compensation system

- Tank + 2 pumps
- New layer of DE

#### Waste system

- Tank + 2 pumps
- Sludge to waste treatment







#### RO Racks

- 7 Feed Transfer Pumps
- 7 High Pressure Pumps
- RO Rack (168 pressure vessels)
- Energy Recovery Turbines
- 9 Second Pass RO Racks
  - Chlorides (<100 mg/l)</li>

#### Flush System

- 1 Flush Tank (100,000 gal)
- 2 pumps

#### Cleaning in place System (CIP)

- 1 CIP tank (10,000 gal)
- 2 CIP pumps
- 1 Mix tank (1,000 gal)
- 2 Mix pumps





- High Pressure Feed Pump (HPFP)
  - Pumps the CF effluent to the RO Rack
  - HPFP increases the pressure to 800-950 psi
  - 2,000hp motor with VFD.
  - Pump + Motor + Energy Recovery Turbine connected to the same shaft





- Reverse Osmosis membranes
- Hydranautics and Dow hybrid configurations in all 7 RO units
- Despite CIO2 + NaCIO pretreatment, no oxidation observed in 13 years
- Biofouling dP increase controlled under OEM parameters
- Regular membrane replacement as per contract.





- Energy Recovery Turbine (ERT)
  - 7 ERTs, one for each RO rack
  - Fed by RO Concentrate Water
  - TDS around 55,000 mg/l
  - Controls flow and pressure







- Second Pass
- 1st Stage +2nd Stage
- Original design by Covanta (year 2001)
- Redesigned and revamped by Acciona Agua (2012)
- Target: < 100 mg/l Chlorides</p>
- Replacement rate under contractual values





#### <u>4. Process Stages – Posttreatment</u>

- Carbon Dioxide (CO2)
  - North and South CO2 silos
    - One at a time
- Calcium Hydroxide (Ca(OH)<sub>2</sub>)
  - North and South Lime silos
    - 2 tanks + 4 pumps
    - 1 tank + 1 pump at a time
  - North and South Saturators
    - Dilutes permeate water with slurry water
    - Create retention time
- Lime Contactor
  - Create contact time
  - Sodium Hypochlorite dosage





## 4. Process Stages – Posttreatment





# <u>4. Process Stages – Posttreatment</u>





#### 4. Process Stages – Product Water

- 3 Product Water Pumps (PWP)
  - 2 motor with VFD
  - 1 motor with Soft start
- 5 MG Product Water Tank
- Water Quality Avgs
  - pH 7.9
  - Turbidity 0.4 NTU
  - Conductivity 450 us
  - Chlorides < 100 mg/l</li>







### 4. Process Stages – Waste Treatment

- Lamella Treatment
  - Rapid mix
    - Polymer dose
  - Coagulation/Flocculation
    - Create contact time

#### Lamella Clarifier

- Clarify water flows over the weirs to Supernatant basin
- Sludge is pumped to the belt press
- Supernatant basin
  - Clarifier water to pretreatment
- Lamella basement
  - 3 Pumps to pretreatment
  - 2 Pumps to Belt Press



Rapid mix basin Coagulation and Flocculation basin

Lamella clarifier



## 4. Process Stages – Waste Treatment









- Sludge from Waste Treatment
- Polymer
- Water





INLET - TECO units/tunnels in service or out of service

TECO Unit 1A In Service	TECO Unit 1B In Service
TECO Unit 2A In Service	TECO Unit 2B In Service
TECO Unit 3A In Service	TECO Unit 3B In Service
TECO Unit 4A In Service	TECO Unit 4B In Service





OUTLET - TECO Dilution ratio. Minimum 28:1 by NPDES permit

	DILUTION RATIO DATA	
DILUTION RATIO = 570.56 : 1		
ουτ	FALL FLOW	0.054 MGH
TEC	0 FLOW	58.094 MG H







- ELECTRICAL STORMS: frequent power blips
  - > 20 Events in a year
  - 7 Complete Shutdowns



# **DISTRIBUTION OF EVENTS**



#### Water Temperature variations

- Seawater temperature varies depending on power plant activities. Seawater temperatures can vary up to 20oF in 24 hours
- Seawater temperatures vary depending on the season and TECO operations.





Variation of 30ºF can occur within 1 hour



### **MAXIMUM MONTHLY TEMPERATURES (2007-2020)**



- TDS Concentration variations
  - In the Tampa Bay area, the salinity changes with the amount of rain. Severe dry seasons make the TDS concentration increase requiring a higher power consumption rate
  - Variation of 10,000 mg/l of TDS can occur in a single month.



### 2007 - 2020 SEAWATER TDS (mg/l)

- Optimization projects
  - Power Consumption
    - Improve efficiency and performance of ERTs
    - Improve RO Start up
    - Decreasing Feed pressure from 50 psi (Approx 2.0 % energy savings)







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- Optimization projects
  - Chemical consumptions (Sulfuric Acid)
    - High PH better turbidity removal at pretreatment basins



5. Production Summary





## 5. Production Summary

## TAMPA AREA DEMAND (2007-2020)



6. Did You Know?





#### 6. Did You Know TBSWDP....

#### **Tamps Bay Secwater Devaluation**

Did you know....

- · Tanga Bay Services Devaluation's 25-million-gallon per day angle used production reparity makes it the second largest sensates desalization plant in North America
- The distornanceous earth (DE) used in the parcost microfiltunion process has other constitues uses in today's products and prosesses, from toolkpaste to signal, plastics to papella, filter media in varianning pools to home fish tasks.
- · There are 18 distorns reveals an tite plant; each one is apprecianticly 14 feet tell sont & feet in ensenates
- The total stafface area of the 9,408 network company (BO) membranes in the plant's 14 pass alone or 82 some or 62 football fields. The faulty sets on land about one texth that size.
- · If the plant's BO membranes were supplied and connected, they woold startely. the 223 miles from Tamps to Tallahatere.
- . The age of each RO menhance pose is about 0.001 minutes or 1/100,0008 the character of a barrier bain
- 6.000 eshie yanh (12,150 tent) of concerts were powerd for the remediation that's enough coansets to build a 4-foot wide aslevalk more than 23 miles long.
- 610 terms of an-bar wave placed and tied into the nemediation, if placed end to stud. it would extend store than 131 miles (100% of the seion placed came from recycled materials).
- The electric motors at the plant encoded 27,000 homepower in total.
- · The 1.4 billion galous of warm water that typically flow through the Big Bend power plant's cooling statem daily could provide every New York City resident. with three hot showers.
- · The plant's high presence RO feed pumps proh source water through RO membranes at up to 1,000 periods per separa and (po). That's the same passings that high-quility passings trachen use to dean concests dependent.
- · All the plant's high pressure BO feed pumps have energy assovery units which help ent the plant's energy costs and boost pranp horse power by as much as 40 percent.
- · The temperatures must connecting the desidention fields; with Tanga Bay Wates's facility site occuses the Alafa River. This consists spass more than onehalf mile and is the longest busicental directional shill involving a Writch. Eberghos pipe in the country.





WWW ACCIONA US



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