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TECHNICAL MEMORANDUM

To: Troy L. Lyn, P.E., Vice President – Globaltech, Inc.

From: Jim Andersen, P.G., Connect Consulting, Inc.
Elizabeth S. Owosina, P.G., Connect Consulting, Inc.

Re: Hydrogeologic Consulting Services, Floridan Aquifer Well Evaluation
Town of Highland Beach, Florida

Date: March 13, 2018

INTRODUCTION

Connect Consulting, Inc. (CCI) was contracted by Globaltech, Inc. (GTI), to provide hydrogeologic consulting services to the Town of Highland Beach (Town). The Town uses three wells (Wells 6, 7, and 8) to withdraw brackish groundwater from the Floridan aquifer to supply water to their low-pressure, Reverse Osmosis (RO) Water Treatment Plant (WTP) located at 3612 South Ocean Boulevard, Highland Beach, Florida.

The purpose of this study was to evaluate the operation of the three production wells and to provide recommendations to improve the wellfield's performance and dependability. CCI reviewed well completion reports, RO WTP operating reports and design drawings, available water quality data, South Florida Water Management District (SFWMD) permit information, and performed field testing of Wells 6, 7, and 8 to evaluate water quality and well performance. Wellfield testing was completed on February 5 and February 6, 2018.

CONCLUSIONS

CCI completed a water quality and well performance evaluation of the three, Upper Floridan production wells (Wells 6, 7, and 8) at the Highland Beach RO WTP in February 2018. The conclusions of the study are as follows:

- Specific capacity – The specific capacities of the production wells range from approximately 41 gpm/ft to 51 gpm/ft. Capacity declines in Wells 6 and 7 are approximately 9% and 58%, respectively. Well 8 does not appear to have lost capacity. The percent changes in capacity are estimations as the pumping rates during the February 2018 pump tests were lower than those performed after well construction.

- Water quality – Average chloride concentrations in Wells 6 and 8 increased 12% and 34%, respectively, while they decreased 28% in Well 7. Similarly, specific conductance values increased in Wells 6 and 8 by 15% and 31%, respectively, and decreased 24% in Well 7. Sulfides have remained relatively stable in Well 6 but have decreased by 47% in Well 7 and doubled from 1 to 2 ppm in Well 8. Total iron is now below detection limits in all three wells. The ph of the water is 3 - 5% higher at 7.63 - 7.70. Based on trend lines observed in historic water quality data collected from the Town, the chlorides and conductivity in Wells 6 and 8 are expected to continue to rise.

- Sand and silt production – Sand content was less than 1 ppm during pump testing of the three production wells. Recommended SDI values for RO values facilities are less than 3.0 with ideal values less than 1.0. SDI testing indicated Wells 6 and 7 produced silt at or below 1.0. Well 8 had an SDI of 2.5 after startup when the pumping rate was increased from 900 to 1690 gpm, and slightly above 1 at a pumping rate of approximately 900 gpm.

- Well interference – Additional drawdowns due to well interference were observed during pump testing. The largest drawdown observed was approximately 18 feet in Well 8 when Wells 6 and 7 were pumping approximately 1050 and 900 gpm, respectively. Fifteen feet of drawdown was seen in Well 6 when Well 7 (930 gpm) and Well 8 (900 gpm) were being pumped. Drawdowns of approximately 5 and 6 feet, respectively, were observed in Wells 7 and 8, when Well 6 was pumped at 1050 gpm.

- General observations – The wellhead assemblies and aboveground piping are in fairly good condition. Maintenance of these structures could improve their dependability.

RECOMMENDATIONS

Based on a review of historical data and an analysis of the results of the wellfield evaluation, the following recommendations are made:

- Due to the elevated dissolved chlorides and conductivity in Well 8, we recommend running Well 8 with Well 6 or Well 7 so that the water is blended for more favorable raw water quality entering the RO system.

- The chloride/TDS increases observed in Wells 6 and 8 are irreversible. We suggest evaluating the water quality thresholds for the membrane treatment system and project when they will be reached.

- To accommodate a 1-2 train per well operation, it is recommended that the well pump in Well 8 be replaced with a smaller pump designed for that purpose. Flow would be controlled using a VFD (variable frequency drive) as the well is currently operated.

- Reduce the individual well pumping rate to a one well per skid operation. A reduction in pumping rate may reduce performance losses and slow the degradation of water quality. When more water is needed, we recommend increasing the flow rate using the VFD, assuming no adverse impacts to the pumps' life expectancy. Develop an operating plan for the wellfield.

- Although the dissolved chloride concentration in Well 7 has decreased, there has been a significant loss of capacity in Well 7 since its installation. This well is recommended for rehabilitation to improve performance. We suggest procuring a water well contractor to complete this item. It's likely that it will require 5,000-10,000 gallons of high strength hydrochloric acid to achieve the desired well performance again at an estimated cost of $125,000 to $175,000.

- We recommend testing the backflow prevention devices on the production wells. The conductivity of water in Well 8 prior to pumping was 13,164 uS/cm. After pumping commenced the conductivity increased quickly to 17,412 uS/cm and then gradually decreased over the next 2 hours of the test to 16,787 uS/cm. Similarly, the conductivity of water in Well 7 was 9,210 uS/cm prior to pumping. After the start of pumping, the conductivity dropped over the next 45 minutes to 8,647 uS/cm. A leaky backflow preventer may be the cause of the different conductivity of the well water prior to the start of pumping. We suggest testing the backflow prevention devices on all three wells to ensure they are operating properly.

- The above ground well piping for all three wells is in fairly good physical condition. Rust and chipping paint were noted on all three wellhead assemblies. We recommend painting, as needed, and fixing and/or replacing broken valves.

BACKGROUND

Wells 6 and 7 were drilled on the Highland Beach RO WTP site in 2001 and 2002, respectively, approximately 410 feet apart. In 2007, Well 8 was drilled approximately 185 feet northeast of Well 6 and 250 feet west of Well 7 on the WTP site. The three wells are fitted with 2,080 gpm submersible well pumps. Wells 6 and 7 are typically pumped at approximately 1,570 gpm, while Well 8 is pumped at 1,805 gpm. Well details are provided in Table 1.

Table 1. Town of Highland Beach Public Water Supply Well Details.

Well	Year Drilled	Well Diameter (in)	Total Well Depth (feet bls)	Cased Depth (feet bls)	Screen Interval (feet bls)	Pump Intake Elevation (feet bls)	Pump Type
6	2001	17	1,200	1,027	open	N/A	sub
7	2002	17	1,200	1,010	open	N/A	sub
8	2007	12	1,200	1,010	open	N/A	sub

Notes: Data from CH2M Hill and ARCADIS well completion reports and SFWMD WUP 50-000346-W.
bls = below land surface

The RO WTP was originally designed to produce 2.25 MGD from three trains, requiring 3.0 MGD of raw water (2,080 gpm). This capacity enabled one well to be operated to feed three trains with one well on standby. The plant capacity was later increased to 3.0 MGD, which required the use of two, in-service wells producing a total of approximately 4 MGD of raw water. At that time, a third well (Well 8) was installed to provide the required backup capacity needed with two wells in service and one well out of service. After the completion of Well 8 in 2007, a drawdown test was performed with Well 8 pumping at a rate of 2,800 gpm. Observed drawdowns in Wells 6 and 7 were 25 and 23 feet, respectively.

METHODOLOGY

Wellfield testing was performed to evaluate changes in well performance and water quality since the time of construction, to make observations on the physical condition of the well sites/facilities, and provide recommendations for future well improvements. Historical data were reviewed and summarized to provide a baseline for well performance and individual well water quality.

Field testing included the measurement of field water quality parameters and well performance data under normal steady-state operating conditions, and involved the following observations and measurements:

- Physical Measurements and Observations
  - Pumping Rate
  - Pumping Water Level
  - Observations of Wellhead and Equipment
  - Wellhead Pressure
  - Static Water Level
- Field Water Quality Measurements
  - SDI
  - Sand Content Testing
  - Temperature
  - Specific Conductance
  - Chloride
  - Dissolved Oxygen

- pH
- Total Dissolved Solids
- Turbidity
- Soluble Iron
- Total Iron
- Hydrogen Sulfide

The production of suspended solids in each well was evaluated with the use of an SDI kit. SDI testing was performed per ASTM Standard Method D4189-07 after steady-state pumping was achieved. For membrane treatment, the recommended SDI value of raw water produced from a well is less than 3.0, with an ideal value less than 1.0.

A Rossum sand tester was used to measure the sand content of the pumped water from each well. The Rossum assembly was attached to the wellhead piping for sampling of the produced water from the well. The American Water Works Association (AWWA) standard for sand content in wells is a maximum of 5 parts per million (ppm), however recommended sand values for membrane treatment are less than 1 ppm, and ideally less than 0.1 ppm, if possible.

A calibrated, multi-parameter, field testing unit was used to measure temperature, specific conductance, total dissolved solids, and dissolved oxygen (DO). DO concentrations were measured to recognize the stability of water quality parameters as well as the presence of air intrusion into the raw water system. Turbidity was measured using a calibrated field portable turbidimeter: pH was measured using a pH meter. Sulfide and soluble and total iron were tested visually using colorimetric test kits in accordance with standard methods. Two water samples were collected from each well and analyzed for dissolved chloride concentration using the argentometric titration method in our office laboratory.

Static water levels and pumping water levels were measured using an electronic well data logger and supported with manual readings. The static and pumping water level data were used, along with the pumping rates, to calculate specific capacity values for each well. The specific capacity is the ratio of the pumping rate to the drawdown at a given time and is used to determine the productivity of the well. The higher the specific capacity, the more efficient the well, all other factors being equal.

DATA REVIEW

CCI reviewed well completion reports for the three Floridan aquifer wells, the Town's SFWMD water use permit, and water treatment plant water quality and operational data. Water quality data collected at the completion of well construction were available in the well completion reports. Available water quality information collected by Town staff since that time were also reviewed. This data consisted primarily of monthly raw water analyses conducted on well samples from 2010 through 2017, although there were some significant gaps in the available data.

Initial chloride and conductivity data collected during well construction and data collected by the Town since 2010 were graphed (Figures 1 and 2). The data indicate an increase in chloride concentration and conductivity with time in Wells 6 and 8. In Well 7, a decrease in chloride concentration is noted but a very slight increase is observed in conductivity. Note that our conductivity measurements in February 2018 were significantly lower than those recorded by Town staff as part of their monitoring program (2013-2015 and 2017), even as recently as December 2017, when a conductivity of 12,210 uS/cm was recorded.

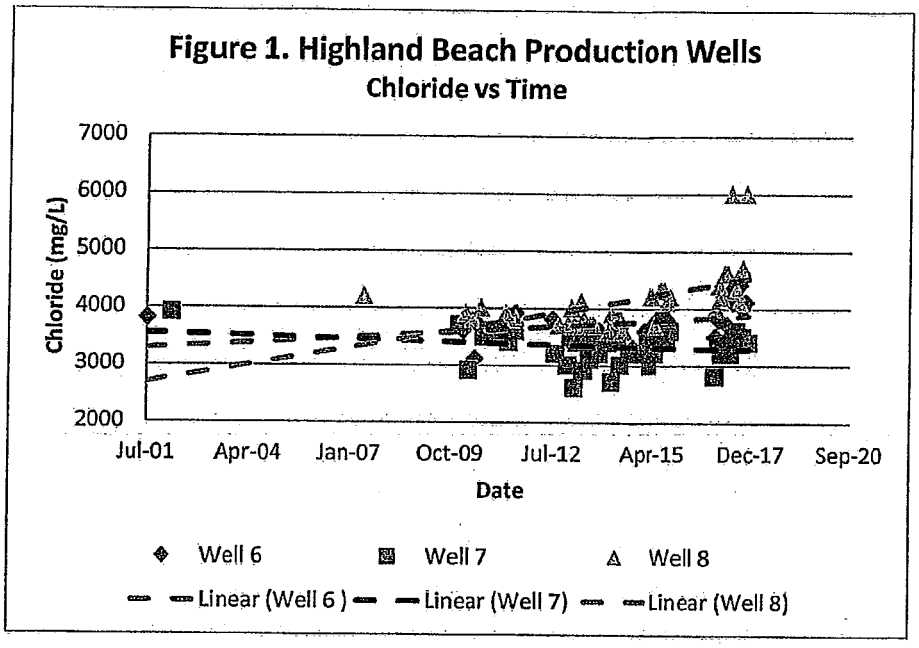
Figure 1. Highland Beach Production Wells
Chloride vs Time
Chloride (mg/L)
7000
6000
5000
4000
3000
2000
Jul-01
Apr-04
Jan-07
Oct-09
Jul-12
Apr-15
Dec-17
Sep-20
Date
Well 6
Well 7
Well 8
Linear (Well 6)
Linear (Well 7)
Linear (Well 8)

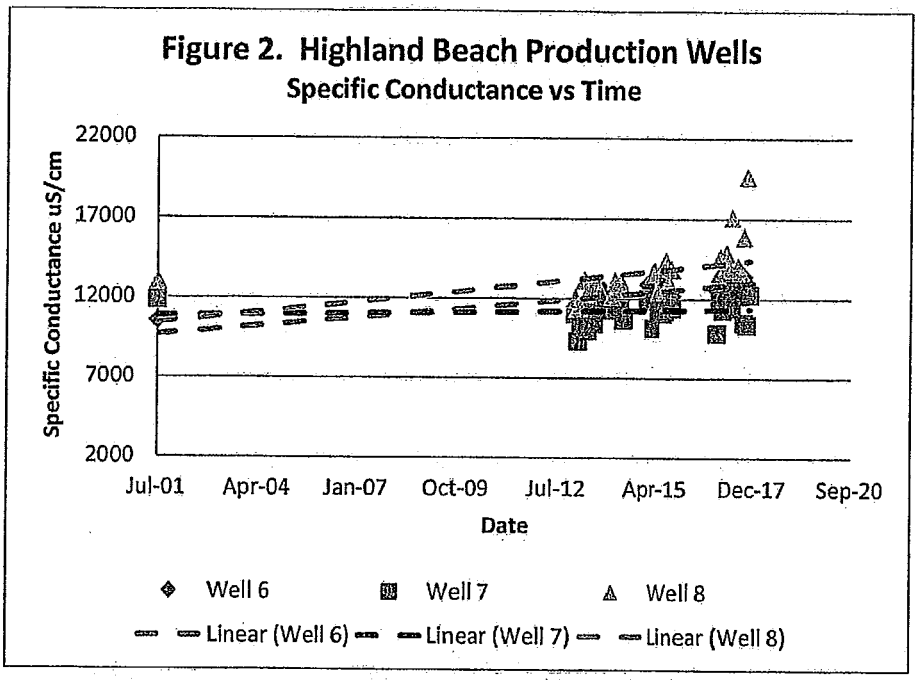
Figure 2. Highland Beach Production Wells
Specific Conductance vs Time
Specific Conductance uS/cm
22000
17000
12000
7000
2000
Jul-01
Apr-04
Jan-07
Oct-09
Jul-12
Apr-15
Dec-17
Sep-20
Date
Well 6
Well 7
Well 8
Linear (Well 6)
Linear (Well 7)
Linear (Well 8)

WATER QUALITY AND PERFORMANCE TESTING RESULTS

The three, Highland Beach wells are completed at the top of the upper Floridan aquifer. Current dissolved chloride concentrations based on our testing range from approximately 2,800 to 5,650 mg/L. A review of available historic water quality data indicate that the chloride concentration and conductivity of water in Wells 6 and 8 have increased since the wells were originally completed, while they have decreased in Well 7. Water produced by Well 7 currently has the lowest chloride concentration (2,823 mg/L) of the three wells. The chloride concentration was 3,900 mg/L when the well was completed in 2002. In Wells 6 and 8, the chloride concentrations are approximately 4,200 mg/L and 5,650 mg/L, respectively.

Additional water quality data was collected during pump testing and several trends were noted. In Well 6, the specific conductance steadily increased from 10,772 uS/cm to 12, 018 uS/cm over the course of 77 minutes, although the chloride concentration decreased during that time from 4,475 to 4,000 mg/L. At Well 7, the conductivity dropped for the first 45 minutes from 9,210 uS/cm to 8,647 us/cm and then rose steadily to 9,142 uS/cm after 167 minutes of pumping. At Well 8, the pre-pumping conductivity (13,164 uS/cm) of the water was significantly lower than that measured during pumping. Also, after the initiation of pumping the conductivity declined from 17,412 to 16,787 uS/cm. Dissolved chloride concentration declined as well from 5,875 to 5,400 mg/L. Sulfide concentrations generally increased in all 3 wells during pumping. Sulfide is present in higher concentrations in Wells 6 and 7 (3.3 and 3.4 ppm, respectively) than in Well 8 (2.0 ppm).

The wells produced a small amount of sand (<1.0 ppm) during the Rossum sand tests, primarily during startup or when pumping rates were increased. Wells 6 and 7 had SDI values equal to or less than 1.0. Well 8 had SDI values between 0.8 and 2.5. Iron was not detected in any of the wells. Little dissolved oxygen was present in the water samples collected. Turbidity was 0 NTU in Wells 6 and 7 and ranged from 0 NTU to 0.33 NTU in Well 8. The average pH measurement in Wells 6, 7, and 8 was 7.7, 7.7, and 7.6, respectively. The data is provided in Tables 2 through 5.

Table 2. Well 6 Water Quality and Well Performance Data.

Pumping Rate (gpm)	Average	970	970	970	970	1,720	1,720	1,920	1,920
Time on 2/5/18	--	15:37	15:54	16:01	16:14	16:26	16:34	16:40	16:54
Elapsed Time (min)	--	0	17	24	37	49	57	63	77
Temp (deg C)	23.4	23.5	23.4	23.4	23.4	23.4	23.4	23.4	23.4
Specific Conductance (uS/cm)	11,630	10,772	11,428	11,543	11,643	11,825	11,886	11,926	12,018
TDS (mg/L)	7,562	7,019	7,430	7,503	7,569	7,684	7,727	7,751	7,809
DO (mg/L)	0.02	0.04	0.03	--	0.03	0.01	0.01	0.01	0.01
DO (%)	0.2	0.5	0.4	--	0.4	0.1	0.1	0.1	0.1
Turbidity (NTU)	0	0	0	0	0	0	0	0	0
Sulfide (ppm)	3.3	3	3	3	3.5	3.5	3.5	3.5	3.5
Soluble Iron (ppm)	ND	ND	ND	--	--	ND	ND	--	--
Total Iron (ppm)	ND	ND	ND	--	--	ND	ND	--	--
pH	7.65	7.68	7.66	7.66	7.66	7.64	7.64	7.64	7.64
Chloride (mg/L)	4,238	--	--	--	4,475	--	--	--	4,000

Rehabilitation Recommended?	no
Pumping Rate (gpm)	1,920
Static Water Level (ft bpl)	21.93
Pumping Water Level (ft bpl)	24.42
Drawdown (ft)	46.35
Specific Capacity (gpm/ft)	41.4
Sand Content (ppm)	0.11-0.14
SDI (1)	0.3
SDI (2)	0.2
SDI (3)	0.3

Field Comments:
SDI #1: light gray, clean
SDI #2: light gray, clean
SDI #3: clean, no color change or particles
Rossum #1: 80% rust, 10-12 grains quartz (95%) and carbonate (5%) sand
Rossum #2 :< 0.1 mL, approx 10 grains, light dusting
Cracked fiberglass near PSI valve, algae on wellhead pad, and main slab connection ARV needs correct screen on end.

Note: Well on at 15:26 at 1390 gpm.
ND = Not detected

Table 3. Well 7 Water Quality and Well Performance Data.

Pumping Rate (gpm)	Average	0	880	900-940	900-940	1830	1830	1830	1830	1840
Time on 2/6/18	--	10:45	10:58	11:28	11:47	12:28	12:34	12:50	13:08	13:32
Elapsed Time (min)	--	0	13	43	62	103	109	125	143	167
Temp (deg C)	24.0	24.5	23.7	25.7	23.7	23.7	23.7	23.7	23.7	23.7
Specific Conductance (uS/cm)	8,932	9,210	9,063	8,647	8,648	8,751	8,902	8,975	9,050	9,142
TDS (mg/L)	5,805	5,986	5,882	5,618	5,622	5,697	5,786	5,833	5,883	5,940
DO (mg/L)	0.03	--	0.09	0.03	0.03	0.02	0.02	0.02	0.02	0.01
DO (%)	0.3	--	1.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2
Turbidity (NTU)	0	--	0	0	0	0	0	0	--	--
Sulfide (ppm)	3.4	--	2.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Soluble Iron (ppm)	ND	--	ND	ND	--	ND	--	--	--	--
Total Iron (ppm)	ND	--	ND	ND	--	ND	--	--	--	--
pH	7.70	--	7.73	7.72	7.71	7.69	7.69	7.69	7.68	7.68
Chloride (mg/L)	2,823	--	--	--	2,570	--	--	--	--	3,075

Rehabilitation Recommended?	yes
Pumping Rate (gpm)	1,840
Static Water Level (ft bpl)	23.32
Pumping Water Level (ft bpl)	-15.41
Drawdown (ft)	38.73
Specific Capacity (gpm/ft)	47.5
Sand Content (ppm)	0.54-0.85
SDI (1)	0.4
SDI (2)	0.4
SDI (3)	1.0
SDI (4)	0.4
SDI (5)	0.3

Field Comments:
SDI #1: light brown, very fine to fine grain quartz (90%) and carbonate (10%) sand
SDI #2: clean, no visible particles
SDI #3: light brown to light gray, abundant, very fine, quartz/carbonate sand
SDI #4: light gray to light brown, very fine to fine grain, quartz and carbonate sand (trace to countable)
SDI #5: light gray, trace, quartz grains (about 4 grains)
Rossum #1: at 21 min sand 0.08 mL, very fine to fine quartz sand (90%) and carbonate sand (10%), traces of brown particles; 1 cm length piece of fiberglass (?) total sand 0.09 mL = 0.54 ppm
Rossum #2: at 16 min sand = 0.1 mL, very fine to fine quartz (80%) and carbonate (20%) sand, total sand accum = 0.11 mL = 0.85 ppm
A pipe support is on a concrete block and rusty, the flange at the raw water main valve has dry rot, biofoul on wellhead, and FRP needs to be replaced near the valves.

Note: Well on at 10:46 at 880 gpm
ND = Not detected

Table 4. Well 8 Water Quality and Well Performance Data.

Pumping Rate (gpm)	Average w/o pre-pumping data	0	860-990	890-900	890-900	890-900	1690	1690	900
Time on 2/5/18	--	12:11	12:49	13:14	13:29	13:34	14:10	14:12	14:27
Elapsed Time (min)	--	0	38	63	78	83	119	121	136
Temp (deg C)	23.2	25	23.2	23.2	23.2	23.2	23.1	23.2	23.1
Specific Conductance (uS/cm)	16,988	13,164	17,412	17,107	17,054	17,036	16,776	16,747	16,787
TDS (mg/L)	11,040	8,562	11,306	11,120	11,085	11,077	10,898	10,887	10,908
DO (mg/L)	0.05	0.29	0.18	0.06	0.02	0.02	0.01	0.01	0.02
DO (%)	0.5	3.5	1.7	0.7	0.3	0.2	0.1	0.1	0.3
Turbidity (NTU)	0.10	--	0.26	0	0	0	--	0.01	0.33
Sulfide (ppm)	2.0	--	1.5	2	--	2	--	2	2.5
Soluble Iron (ppm)	ND	--	ND	ND	--	ND	--	--	--
Total Iron (ppm)	ND	--	ND	ND	--	ND	--	--	--
pH	7.63	7.16	7.63	7.63	7.63	7.63	--	7.64	--
Chloride (mg/L)	5,638	--	--	--	5,875	--	--	--	5,400

Rehabilitation Recommended?	no
Pumping Rate (gpm)	820
Static Water Level (ft bpl)	10.7
Pumping Water Level (ft bpl)	-5.4
Drawdown (ft)	16.1
Specific Capacity (gpm/ft)	50.9
Sand Content (ppm)	0.35
SDI (1)	1.1
SDI (2)	0.8
SDI (3)	2.5

Field Comments:
SDI#1: light gray, clean
SDI#2: light gray, clean, trace amount of very fine, black deposits
SDI #3: light brown to yellowish brown, dirty, traces of very fine to fine grained quarz and carbonate sand
Rossum: very fine to fine quartz sand (90%) and carbonate sand (10%), traces of black/brown fragments, total sand accum < 0.1 mL, 0.35 ppm
The wellhead flange is leaking, pipe supports are crooked, air release valve is leaking and needs a new screen on the end.

Note: Well on at 12:20 at 900 gpm
ND = Not detected

Table 5. Water Quality Data for Production Wells 6, 7, and 8 at Time of Construction and February 2018.

Water Quality Data	Units	Well 6		Well 7		Well 8	
		Completion (2001)[1]	February 2018	Completion (2002)[1]	February 2018	Completion (2007)[1]	February 2018[2]
Temperature	deg C	N/A	23.4	N/A	24.0	26.0	23.2
Specific Conductance	uS/cm	10,500	11,630	11,800	8,932	12,975	16,988
TDS	mg/L	6,600	7,562	7,280	5,805	7,000	11,040
DO	mg/L	N/A	0.02	0.30	0.03	N/A	0.05
DO	%	N/A	0.24	N/A	0.34	N/A	0.49
Turbidity	NTU	ND	0	N/A	0	2.1	0.1
Sulfide	ppm	3.2	3.3	6.4	3.4	1.0	2.0
Soluble Iron	ppm	N/A	ND	N/A	ND	N/A	ND
Total Iron	ppm	ND	ND	0.1	ND	0.14	ND
pH	pH	7.4	7.65	7.40	7.70	7.30	7.63
Chloride	mg/L	3,800	4,238	3,900	2,823	4,200	5,638
SDI	--	N/A	0.21-0.28	N/A	0.25-0.98	1.4-2.3	0.79-2.5
Sand production	ppm	N/A	0.11-0.14[3]	N/A	0.54-0.85	7	0.35

[1]Water quality data from CH2M Hill and ARCADIS well completion reports.
[2]This data is an average of the data collected after the start of pumping.
[3]Trace sand accumulation of 10-12 grains in tests measuring 38 and 49 minutes.
ND = not detected; N/A = not available

Pump Testing

During pump testing, each of the three production wells was run alone and with a second well. The pumping rates for each well ranged from 500 gpm to 1920 gpm. Lower pumping rates in one well, such as the 500 gpm rate, were temporarily observed when a second well was turned on. Electronic data loggers were installed in all three, upper Floridan aquifer, production wells to monitor water levels and interference under different pumping scenarios. A description of the well testing program is provided in Table 6.

Specific Capacity

The specific capacity of a well is defined as its yield per unit of drawdown and is often expressed as gallons of water per minute per foot of drawdown. The current specific capacities of the Highland Beach production wells range from approximately 41 to 51 gpm/ft (Table 7). Historic specific capacity data were compared to data calculated during wellfield testing to determine the degree of fouling (plugging) of the well. The capacity of Well 6 has declined slightly, Well 7 has declined by nearly 60%, and Well 8 appears to have improved. Because the pump rates are lower than those used in the original pump tests, the specific capacity data is likely overestimated, as capacity tends to decrease with an increase in pumping rate.

Table 6. Well Testing Program at Highland Beach RO WTP.

Date	Time	Action	Flow Rate (gpm)			# of Trains	Notes
			Well 6	Well 7	Well 8		
2/5/2018	8:00	On site	0	910	0	1	Well 7 already running
	8:42	Started setting up data loggers in well 7, 6, then 8	0	910	0	1	
	12:20	Start Well 8	0	910	900	1	Started collecting water quality data (Well 8)
	12:21	Well 7 flow rate decreased. Well 8 flow rate increased, added 2nd train	0	500	1300	2	
	12:27	Well 7 flow rate increased. Well 8 flow rate decreased	0	930	930	2	
	12:31	Well 8 flow rate variable	0	930	860-990	2	
	13:02	Well 8 flow rate more steady	0	930	890-900	2	
	13:55	Increased flow rate in Well 8	0	0	1690	2	
	14:24	Train failed	0	0	0	0	
	14:25	Well 8 on and 1 train	0	0	900	1	
	15:09	All wells off	0	0	0	0	
	15:26	Well 6 turned on and 1 train	1390	0	0	1	
	15:27	Well 6 pumping rate dropping	1300	0	0	1	Started collecting water quality data (Well 6)
	15:44	Well 6 pumping rate stabilized	970	0	0	1	
	16:18	Well 6 pumping rate increased, added 2nd train	1720	0	0	2	
	16:37	Well 6 pumping rate increased	1920	0	0	2	
	17:15	Well 6 pumping rate lowered, 1 train	1020-1080	0	0	1	
2/6/2018	0:58	Well 6 ran overnight. Well 7 was turned on, then off, during the night	1020-1080	900	0	2	Pumping rates assumed based on previous pumping rates and drawdown data
	5:00	Well 7 off	970	0	0	1	Pumping rates assumed based on previous pumping rates and drawdown data
	7:40	On site	970	0	0	1	
	8:46	Well 6 running	970	0	0	1	
	9:10	Well 8 turned on, added 2nd train	970	0	830	2	
	10:18	Well 8 pumping rate dropped slightly	970	0	820	2	
	10:46	Turned off Wells 6 and 8. Turned on Well 7 with 1 train	0	880	0	1	Started collecting water quality data (Well 7)
	11:16	Well 7 pumping rate fluctuating	0	900-940	0	1	
	12:15	Well 7 pumping rate stabilized	0	910	0	1	
	12:23	Increase Well 7 pumping rate and added 2nd train	0	1830	0	2	
	13:11	Well 7 pumping rate fluctuating	0	1830-1840	0	2	
	13:20	Well 7 pumping rate stabilized	0	1840	0	2	
	14:16	All wells off	0	0	0	0	
	15:39	Wells 6 & 8 on with 3 trains; started removing well loggers	1530	0	1160	3	
	16:20	Returned to normal operations					

Table 7. Specific Capacity Following Well Construction and February 2018 Wellfield Testing.

Well	Year Constructed	Original Construction[1]		February 2018		Percent Change in Specific Capacity	Priority for Rehab
		Pumping Rate (gpm)	Specific Capacity (gpm/ft)	Pumping Rate (gpm)	Specific Capacity (gpm/ft)		
6	2001	3,000	45.5	1,920	41.4	-9%	No
7	2002	3,000	112	1,840	47.5	-58%	Yes
8	2007	2,800	38.6	820	50.9	31.9[2]	No

[1]Data from CH2M Hill and ARCADIS well completion reports.
[2]Significantly different pumping rates between the 2 tests. Well 8 does not appear to have lost capacity.

Physical Condition of the Well Sites

Overall, the Town's wells appear to be in fairly good physical condition. Rust and chipping paint were noted on all three wellhead assemblies. Several leaks were observed, sometimes resulting in the accumulation of biofoul on the wellheads, and there were some misaligned pipe supports. A summary of the physical condition of the wellheads and the results of testing are provided in Tables 2 through 4.