

Little St. James

SWRO Plant Engineering Report

Prepared for:

Little St. James

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December 4, 2014

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Introduction

On November 19, 2014, TSG conducted an assessment of the present condition of the 90,000 gallon per day (gpd) SWRO plant on Little St. James. This plant was designed and installed by TSG in February 2011 and has been operated by Owner's staff since that time. Previously, a 25,000 gpd plant was installed by TSG in 2007. The intake screen structure and piping were installed as a part of that original project to accommodate the needs of the larger future plant.

Plant Observations and Recommendations

Intake Structure

Observations

The 8-inch diameter intake screen and check valve are located at the seaward end of the property's dock in about 10 feet of water. During our visit, we visually inspected the screen on which we observed an abundance of marine growth. The excessive marine growth causes an increase in the suction pressure of the intake pumps, which in turn can create maintenance issues with the pump seals and makes it more difficult for the pumps to hold prime during shutdown. The stainless steel support structures for the intake and pipeline to shore were inspected and found to be in good order.

Recommendations

- A new intake screen should be procured and installed.
- The old screen should be removed and cleaned with acid to remove imbedded marine growth. The old screen can then be stored and rotated into service as the new screen becomes fouled. This will allow a clean screen to be rotated into service quickly, with minimal disruptions to water production.
- The existing 8-inch check valve also needs to be cleaned with acid and reinstalled.

Intake Pumps and Priming System



Figure 1: Corrosion on Intake Pump



Figure 2: Dismantled Intake Pump and Piping

Observations

As noted previously, this system was originally installed in 2007 and expanded in 2011 for the larger plant. The expansion consisted of installing new intake pumps, additional basket strainers, a new control panel, and repairs to the priming system. The priming system is vital to insuring that the intake pumps start without cavitation, which causes damage to the impellers.

During our visit, it was noted that the entire pumping and priming system has fallen into disrepair. The plant currently operates on Pumps A and D. Pump D has a leaking seal. Pump B is not operational at all and seems to have been disassembled. The suction piping for Pump B has also been removed. It is not clear if Pump C operates. Corrosion is apparent on all of the pumps and all of the motor grease fittings. The priming system was started in hand and worked, although the priming pump has corrosion issues as well. The intake control panel appears to be in good condition, but it was not communicating with the RO plant's PLC (programmable logic controller) located in the main control panel on the RO skid during this visit. Since that time, the Profibus repeater and adapter card have been installed by TSG and have fixed the communication problem.

Recommendations

- Replace Pumps B and C and reinstall suction piping for Pump B.
- Replace seal on Pump D.
- Provide shelf spare of priming pump and at least one intake pump.

Media Filters



Figure 3: Media Filters

Observations

The plant's pre-filtration system consists of three 48-inch diameter mixed media filter vessels that provide removal of fine particulates from the raw seawater. These filters must be monitored and backwashed manually on a regular basis – at least weekly, if the plant sees regular use. At the time of our visit, this system appeared to be well maintained and clean. However, there were no logs of the use of this system. Regular backwashing logs need to be kept with pressure data recorded before and after every backwashing event.

The cartridge filtration consists of one vertical vessel with twelve 40-inch long cartridge elements that further filter the raw seawater to 5 micron purity. This system appeared to be clean and well maintained, but regular logs of cartridge filter changes need to be kept. The cartridge filters should be changed approximately every two weeks.

Recommendations

- From a previous visit in February, we reported that the media filter sight glass had debris left in it after a backwashing event. The debris appeared to be media from the filter. Media was also found in the cartridge filters. If the top layers of media have indeed been removed, then they need to be replaced. The media filters need to be drained and checked for proper media levels.

Energy Recovery Pressure Exchangers and Boost Pump

Observations

The energy recovery system allows the pressure energy from the reject brine to be transferred directly to a portion of the incoming raw seawater. This allows the unit to utilize a smaller high pressure pump and therefore use less energy. This system's high and low pressure flows need to be carefully balanced for correct operation of the pressure exchangers. The pressure exchangers depend on a continuous supply of water for lubrication. The high and low pressure flow rates were found to be out of balance.

Severe motor bearing noise was observed in the boost pump. Failure of this system will result in the plant not operating.

Recommendations

- Replace boost pump and motor and rebalance system.

High Pressure Pump and Motor



Figure 4: HP Pump Gallery



Figure 5: HP Pump Motor

Observations

The high pressure pump is the “heart” of any RO plant as it raises the seawater feed pressure to approximately 850 psi to allow membrane separation to occur and convert seawater to fresh water. The system consists of a Wheatley 110Q-3L oil-filled positive displacement pump, driven by a 75 hp high efficiency motor. The drive belt was examined and found to be in acceptable condition. Front bearing noise was observed from the motor. The pulsation dampener connection has an apparent leak. Minor leaks and salt buildup were observed in the pump gallery indicating that seals were worn and may need to be replaced. Oil change records were not available. The oil/water separator was full and needed to be cleaned. There is a warranty issue with the HP Pump soft start and that is already in process.

Recommendations

- Perform annual service on Wheatley pump.
- Check and replace bad valves or seals.
- Clean out salt buildup in pump gallery.
- Change oil and clean out oil/water separator.

Membranes and Vessels**Observations**

The membranes in the plant have recently been replaced. The current water quality coming off the RO unit is good. The analytical instruments have not been calibrated in some time.

Recommendations

- Conduct regular membrane profiling and probing to detect future problems.
- Clean membranes as needed using in place cleaning system.
- Calibrate analytical instruments.

Post Treatment System**Observations**

The RO permeate without post treatment is highly aggressive to plumbing systems and hot water heaters. TSG installed a post treatment system that consists of a single 48-inch diameter calcium carbonate reactor and chemical injection pumps that provide hardness and alkalinity to the permeate to reduce corrosivity. Chlorine is also injected to provide a disinfectant. These systems were found to be acceptable but daily testing using handheld instruments and test kits are needed to establish that correct dosages are applied and that the finished water is acceptable. The analytical instruments have not been calibrated in some time.

Recommendations

- Calibrate analytical instruments.

Overall Plant

The overall plant is clean and free from clutter. A few additional items that were noted:

- There is not an adequate internet connection to the RO control panel. This is needed so that the plant can be monitored by offsite personnel.
- Corrosion was noted on some of the connections in the control panel, but nothing too serious.

Summary

The Little St. James SWRO Plant is now approaching four years old and is in need of maintenance and some capital investment to retain its value and functionality for the long term. In addition to the recommendations made above, we highly recommend that the plant be operated and maintained on a regular basis by RO water treatment professionals.

As you know, TSG would be happy to assist Little St. James in implementing the recommendations presented in this report. We have included the estimated costs associated with those recommendations below.

Item	Price
<i>New intake screen, cleaning, and installation</i>	\$3,252
<i>Two new intake pumps; including installation</i>	\$12,194
<i>Spare Intake Pump</i>	\$5,821
<i>Spare Priming Pump</i>	\$2,100
<i>Intake Pump Seal; including installation</i>	\$567
<i>Media Filter Inspection; NOT including any needed media</i>	\$1,433
<i>New Boost Pump; including installation</i>	\$13,145
<i>HP Pump Service; using Owner's onsite spare parts</i>	\$5,388
<i>HP Pump Oil; 55 gallon drum</i>	\$1,475
Total	\$45,376