

# Tampa Bay Water's Surface Water System Expansion

Amanda Rice and Nicole Thomas

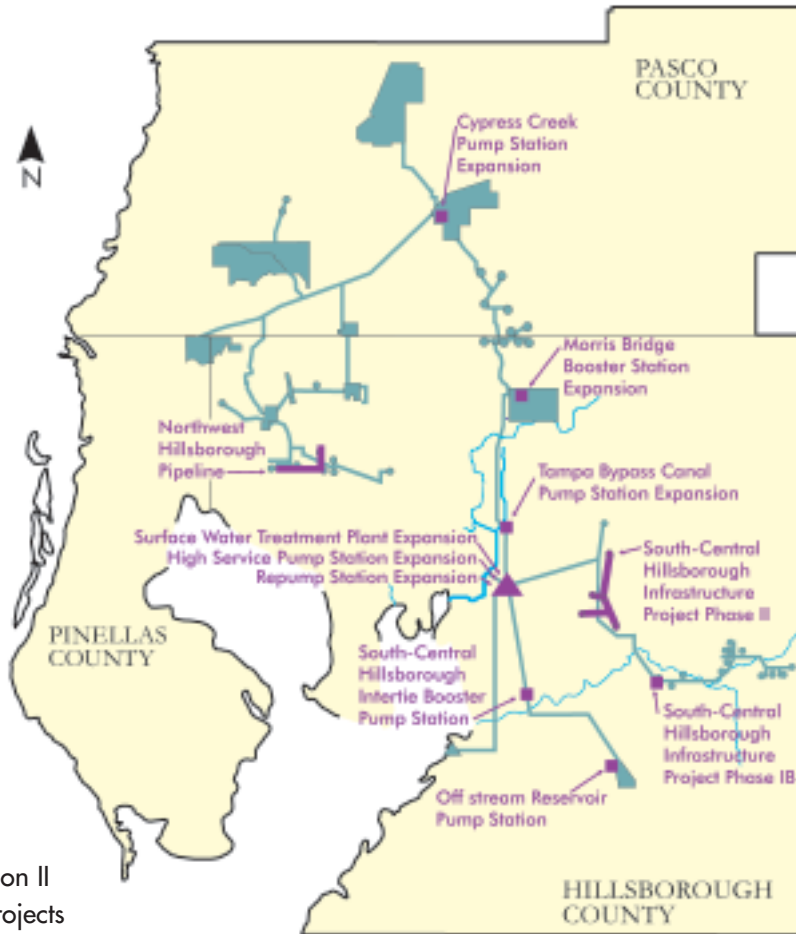


Figure 1:  
Configuration II  
Program Projects

Amanda Rice, P.E., is a senior manager for construction with Tampa Bay Water, a regional agency created by interlocal agreement to provide wholesale water to several counties and cities in the Tampa Bay area. Nicole Thomas, P.E., is a facilities manager with Tampa Bay Water. Both work in the agency's Clearwater office. This article was presented as a technical paper at the Florida Section AWWA Fall Conference in December 2008.

A co-funding agreement between the Southwest Florida Water Management District and Tampa Bay Water was executed in May 2007 to define a program for meeting the future water supply needs of the Tampa Bay area. This agreement established the Configuration II program and a co-funding commitment of \$116 million by the water management district.

By implementing the Configuration II program, which includes expansion of existing water supply facilities and construction of new facilities, Tampa Bay Water will be able to integrate, manage, and enhance the surface water supply source, ensuring that the agency will be able to meet increased demands through 2019. The expanded system will continue to be drought resistant with use of the existing 15-billion-gallon Regional Reservoir. Neither the original configuration nor the expansion can be made drought proof, however, due to the naturally occurring climatic cycles of rainfall and deficit in west-central Florida.

There are 10 projects included in this program (Figure 1), divided among two categories: the four System Interconnects and the six Surface Water System Expansion projects. This article will focus on the six Surface Water System Expansion projects.

Existing facilities to be expanded are the Tampa Bypass Canal Pump Station, the Regional Surface Water Treatment Plant, the Facility Site Repump Station, and the High Service Pump Station. New facilities include the Off-stream Reservoir Pump Station and

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Figure 2: Tampa Bypass Canal Pump Station

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the South-Central Hillsborough Intertie Booster Pump Station. In addition, a pipeline surge protection program has been included to support the increased capacities and pressures associated with the program. Over 100 air valve assemblies will be added or modified.

The benefit of the expansion is that the average production from the treatment plant is expected to increase from 55 million gallons

per day (mgd) to 84 mgd during average rain-fall years.

All the Surface Water System Expansion projects are underway, and as of August 2009, all are in the bidding phase or under construction. For each project, with the exception of the treatment plant expansion, Tampa Bay Water is using the traditional design-bid-build procurement process. The treatment plant expansion is using a design-build/open book process with the ex-

isting operating company as the design-build contractor. The Surface Water System Expansion projects are expected to cost nearly \$200 million, and per the co-funding agreement, all the projects must be completed by December 2011.

## Tampa Bypass Canal Pump Station Expansion

The Tampa Bypass Canal Pump Station



Figure 3: Aerial View, Tampa Bypass Canal Pump Station Expansion Site

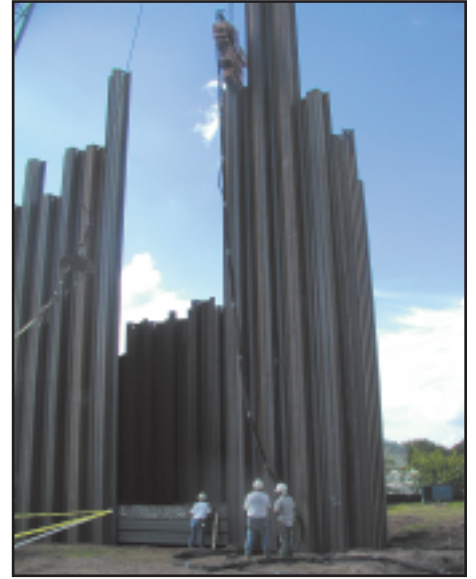


Figure 4: Cofferd Cell Sheet Piling Installation for the Tampa Bypass Canal Pump Station Expansion

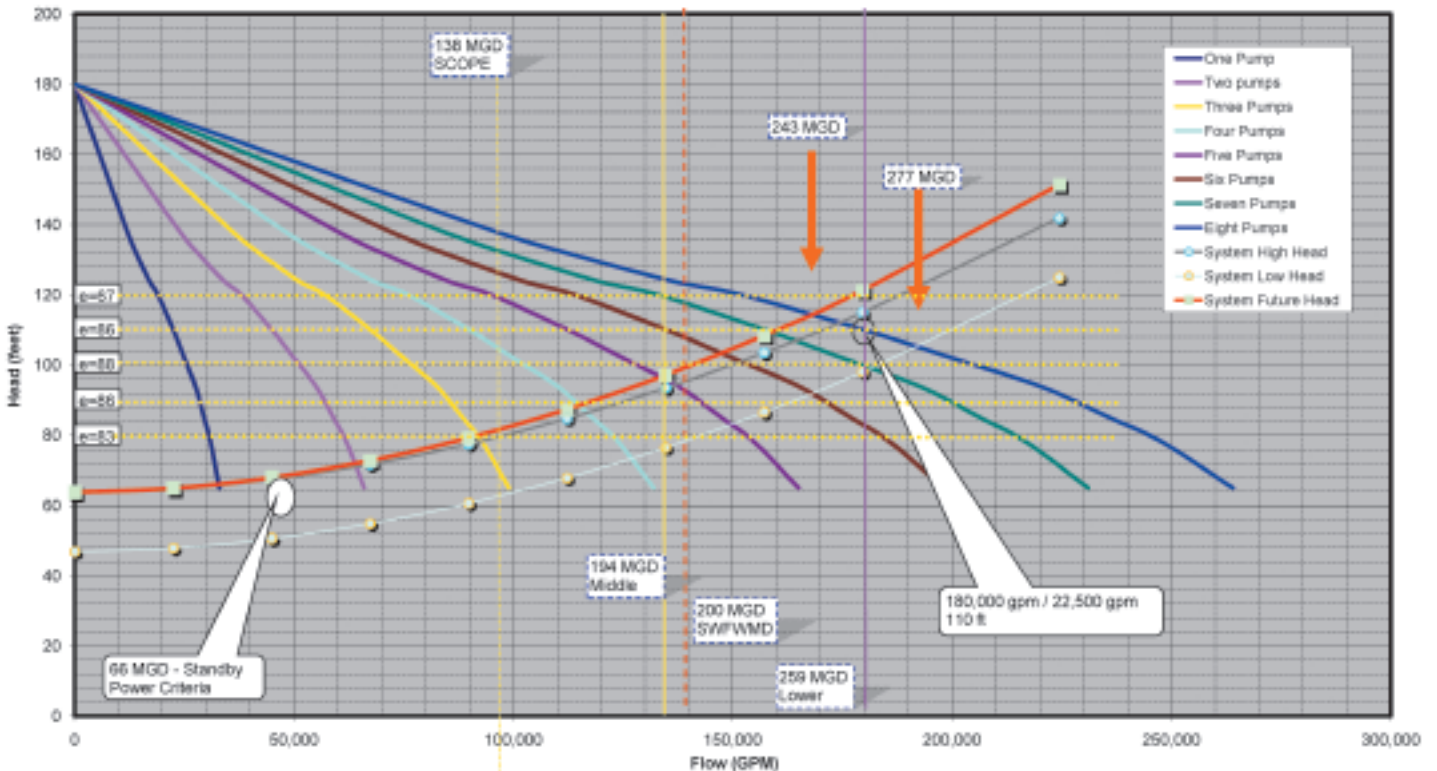


Figure 5: System Operating Curves for the Expanded Tampa Bypass Canal Pump Station





Figure 6: High Service Pump Station

(Figure 2) is used to withdraw raw surface water from the Tampa Bypass Canal and is located in Hillsborough County. The existing facility became operational in 2002.

The original water-use permit issued by the water management district allowed variable withdrawals based on the flow rate in the canal and the Hillsborough River on the previous day, with a maximum withdrawal rate of 259 mgd. The existing facility was installed with a maximum withdrawal capacity of 138 mgd, currently accomplished with four single-stage 30.4-inch impeller vertical can pumps driven by 600-horsepower (hp) motors. All four motors are constant speed.

The current expansion project will increase the maximum withdrawal capacity to the water-use permit limit of 259 mgd from the Lower Pool, the Middle Pool, or a combination of the two. In 2007, the Southwest Water Management District issued a renewed water use permit for the facility that retained the maximum withdrawal limit, but altered the criteria for withdrawal quantities to be based on minimum water level elevations in the Lower and Middle Pools. The full scope of the Tampa Bypass Canal Pump Station expansion project includes the following elements:

- ◆ New pump building
- ◆ New electrical building
- ◆ One 1750 kW/4160 V standby

- generator (pre-purchased)
- ◆ One above-ground fuel storage tank (pre-purchased)
- ◆ Four new vertical turbine pumps with 800-hp motors
- ◆ Four new variable frequency drives
- ◆ Modification of four existing pumps and motors, including new 800-hp motors
- ◆ Suction and discharge header modifications
- ◆ Four additional intake screens

Figure 3 shows an aerial view of the construction site. The new pump and electrical buildings are being constructed next to the existing buildings in a mirror-image configuration. The auxiliary power facilities will be located between the two pump buildings and are sized to provide 66 mgd of capacity. Figure 4 shows 65-foot sections of sheet piling being installed to form the coffer cell that will surround the four new pump cans.

Several alternatives for the expansion

were examined. The selected alternative involves modifying the four existing pumps to increase the impeller size from 30.4 to 32.74 inches and adding four matching pumps, for a total of eight pumps with 800-hp drive motors.

Figure 5 shows the pump and system curves for the expanded facility. It can be seen that the 259-mgd goal is met at 110 feet of head. Actual production will depend on system conditions, including water elevation in the raw water storage tanks at the treatment plant site. The production range, depending on hydraulic conditions, is 243 to 277 mgd.

The design engineer for the Tampa Bypass Canal Pump Station Expansion project is MWH. Advertisement of the construction contract for the project occurred in June 2008. Bids were supplied by six contractors and were opened publicly in July 2008.

The Tampa Bay Water Board of Directors awarded the construction contract to Encore Construction on August 18, 2008, in the amount of \$16,960,000. Notice-to-proceed was issued on September 2, 2008. Substantial and final completion are scheduled for January 2011 and May 2011, respectively.

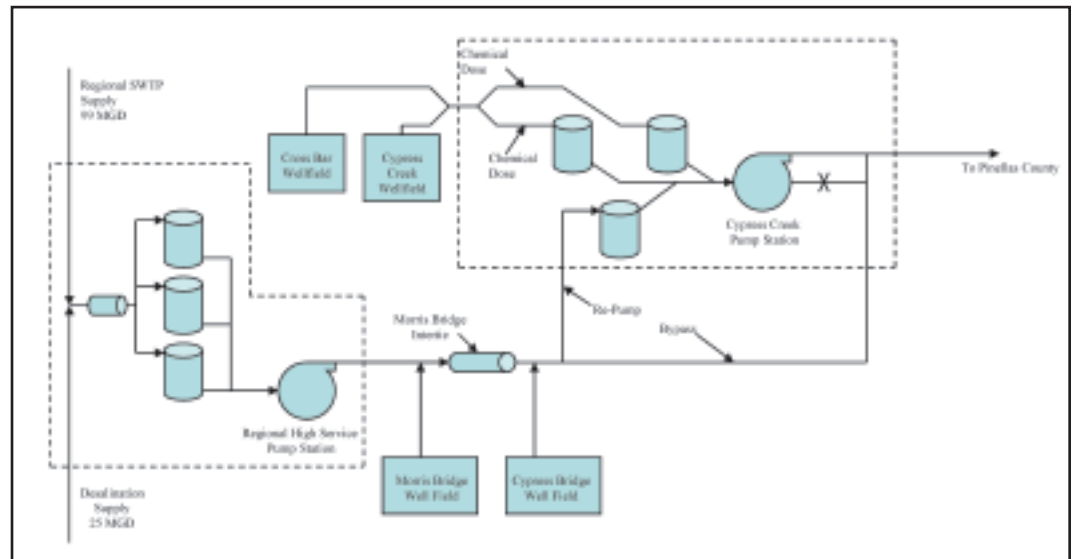
## High Service Pump Station Expansion

The High Service Pump Station (Figure 6) is located at Tampa Bay Water's Regional Facilities Site in Hillsborough County. The facility includes three 7.5-million-gallon storage tanks where treated surface water and desalinated water are blended before being pumped into Tampa Bay Water's Regional System for delivery to the member governments. The capacity of the existing facility is 120 mgd.

The pump station currently consists of five horizontal split-case centrifugal pumps

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Figure 7: High Service Pump Station Operational Modes



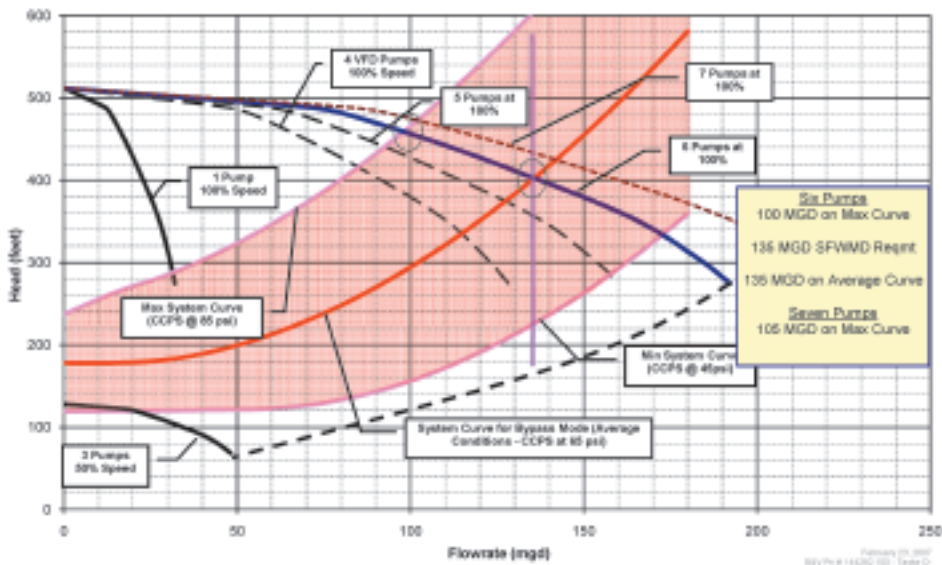


Figure 8: Expanded High Service Pump Station System Operating Curves for Bypass Mode

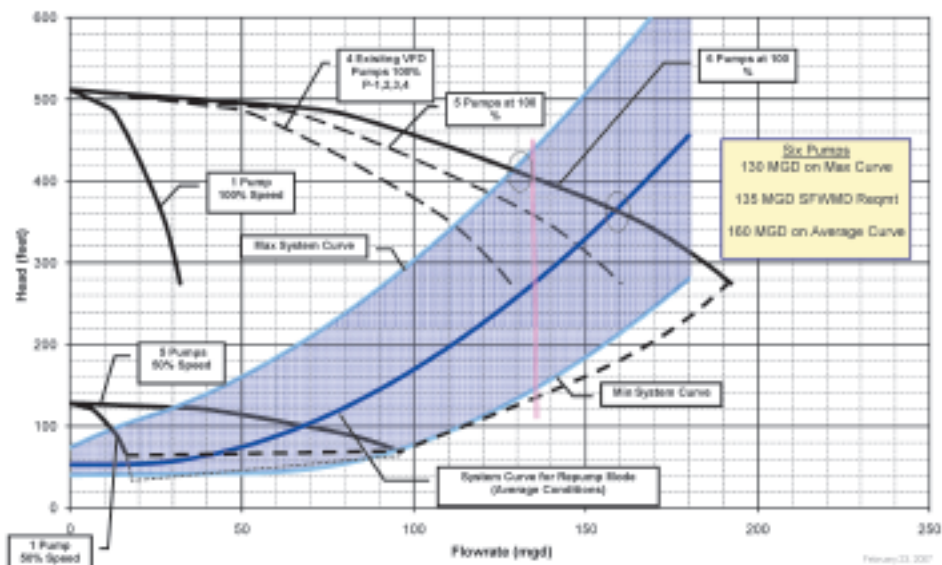


Figure 9: Expanded High Service Pump Station System Operating Curves for Repump Mode



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with 2,000-hp motors. Four of the five pumps have variable frequency drives. The expanded facility will have a capacity of 135 mgd. The scope of the High Service Pump Station expansion project includes the following elements:

- ◆ New horizontal split-case pump in position six with 2,000-hp motor and variable frequency drive
- ◆ New variable frequency drive to operate existing pump in position five
- ◆ One 2500 kW/13.2 kV standby generator and one 300 kW/480 V standby generator (pre-purchased), in addition to existing 2250 kW unit
- ◆ Two above-ground fuel storage tanks (pre-purchased)
- ◆ Large diameter yard piping to bring free chlorine effluent from Surface Water Treatment Plant and Desalination Plant to common point for new ammonia dosing station
- ◆ New chlorine storage, feed and dosing facilities
- ◆ Modified ammonia storage, feed and dosing facilities

There are two possible modes of operation for the High Service Pump Station that can be seen in Figure 7. The current mode of operation is the “bypass” mode in which water from the High Service Pump Station bypasses the Cypress Creek Pump Station in Pasco County. In this mode, both pump stations operate in a pressure-controlled scenario.

When the system expansions are complete, Tampa Bay Water plans to operate in the “re-pump” mode in which water from the High Service Pump Station will be delivered to a ground storage tank, and then will feed the suction side of the Cypress Creek Pump Station. In this mode, the High Service Pump Station will be operated in a flow-controlled scenario and the Cypress Creek Pump Station will be operated in a pressure-controlled scenario.

Advantages of the re-pump scenario include power costs savings and increased operational reliability because of the hydraulic disconnection between the two large pump stations. Set-point conflicts are a concern, especially given the higher flows associated with the expansions and the large member government deliveries that can occur from the transmission main between the two pump stations.

Tampa Bay Water must retain the ability to operate in either bypass or re-pump mode to best manage planned and unplanned facil-

Figure 10: Repump Station



ity outages. As such, alternatives were analyzed that included both operational scenarios.

The selected alternative involves retrofitting existing Unit 5 with a variable frequency drive and adding a sixth pump with a variable frequency drive. Adding the variable drives allows better service on the lower system curves.

Figure 8 indicates a production of 135 mgd at 400 feet of head can be expected under average system conditions while operating in bypass mode. Figure 9 indicates a production of 160 mgd at 360 feet of head can be expected under average system conditions while operating in re-pump mode.

The design engineer for the High Service Pump Station Expansion project is MWH. Construction was combined under a common construction contract with the Repump Station Expansion project, which is described in the following section of this article. The resulting contract is called the Regional Facilities Site Expansions.

Advertisement of the construction contract occurred in June 2008. Bids were supplied by three contractors and opened publicly in July 2008.

The Tampa Bay Water Board of Directors awarded the construction contract to Encore Construction on August 18, 2008, in the amount of \$15,100,000. The portion of that amount associated with the High Service Pump Station Expansion is \$8,155,600. Notice-to-proceed was issued on September 2, 2008. Substantial and final completion are scheduled for May 2010 and August 2010, respectively.

## Repump Station Expansion

The Repump Station (Figure 10) is also located in Hillsborough County at Tampa Bay Water's Regional Facilities Site. Quantities withdrawn from the Tampa Bypass Canal Pump Station that are in excess of the influent required for the Surface Water Treatment Plant are sent to Storage Tank No. 2 next to the Repump Station.

Water from Storage Tank No. 2 is drawn into the suction side of the Repump Station and transferred to the 15-billion gallon Regional Reservoir located in southeastern Hillsborough County. Raw surface water from the Regional Reservoir is then available during dry conditions to feed the Surface Water Treatment Plant.

The current maximum capacity of the Repump Station is between 119 and 140 mgd, depending on the water elevation in the Regional Reservoir and whether or not the Alafia River Pump Station is operating. Currently, the Repump Station consists of four 1,750-hp vertical turbine pumps with variable fre-

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Figure 11: Repump Facility Operational Schematic

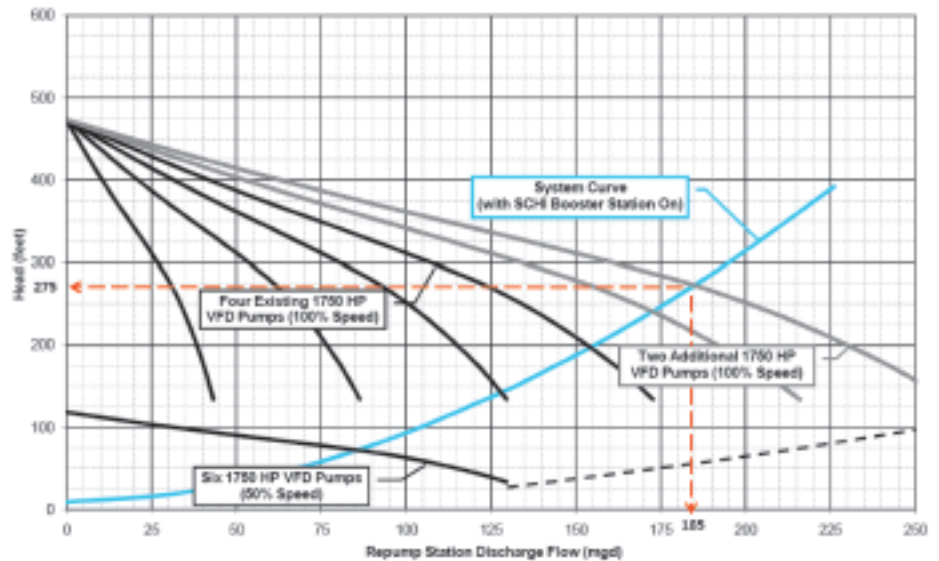
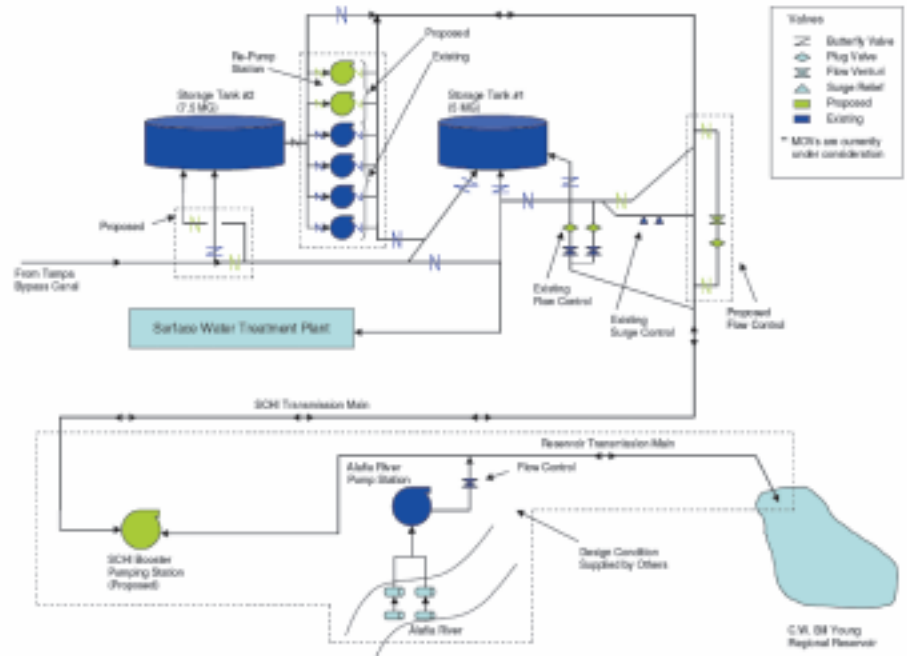


Figure 12: System Operating Curves for the Expanded Repump Station

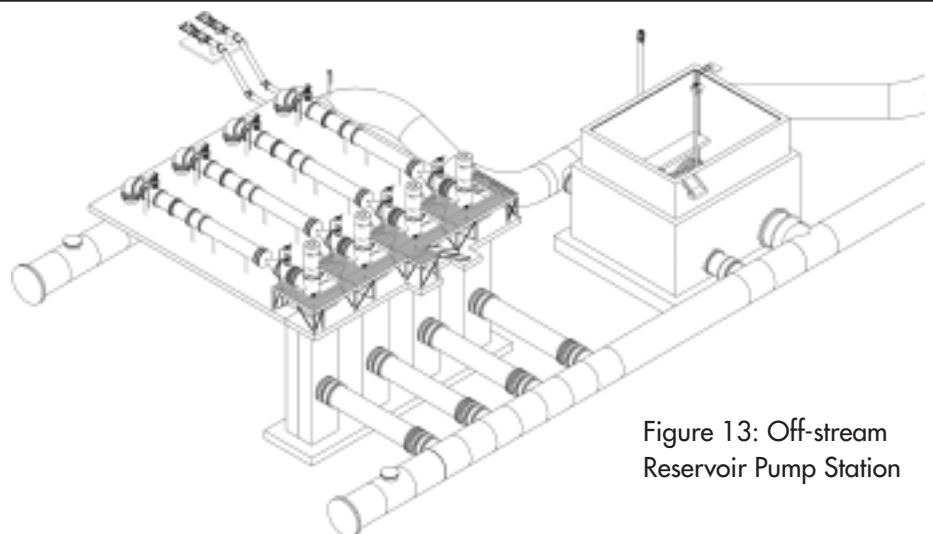


Figure 13: Off-stream Reservoir Pump Station

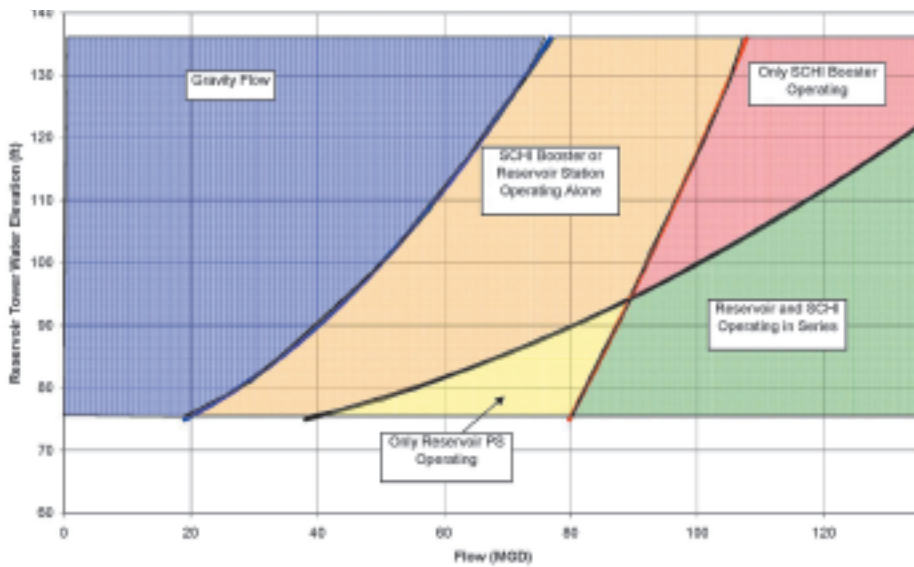


Figure 14: Options for Delivering Water from the Reservoir to the Surface Water Treatment Plant

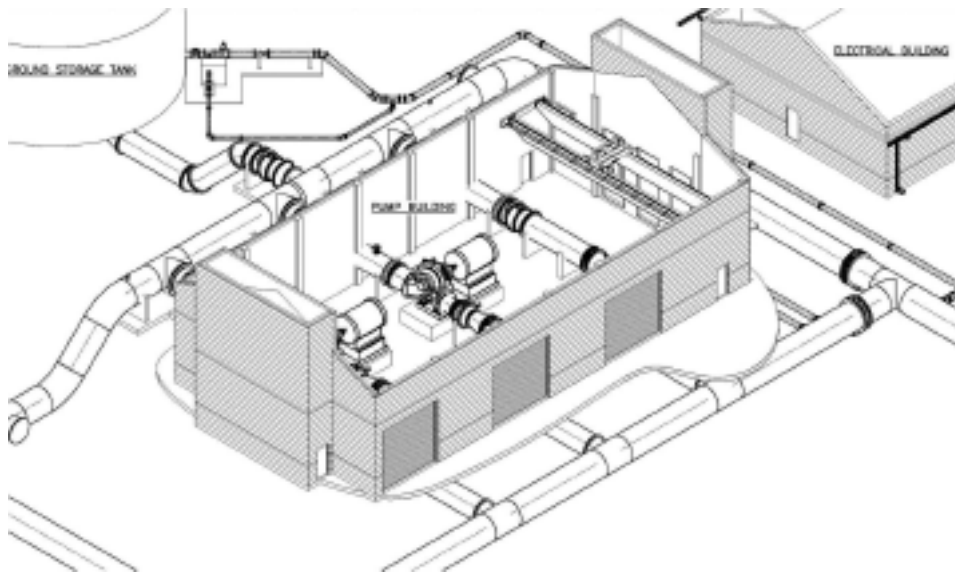


Figure 15: South-Central Hillsborough Intertie Booster Pump Station



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quency drives. Figure 11 shows a schematic of the Repump Station and the system in which it operates.

Expansion of the Repump Station will allow transfer of higher flow rates to the Regional Reservoir, in conjunction with the South-Central Hillsborough Intertie Booster Pump Station (described below). The scope of the Repump Station expansion project includes the following elements:

- ◆ Two new vertical turbine pumps with 2,000-hp motors and variable frequency drives
- ◆ Storage Tank No. 2 influent piping and valve modifications
- ◆ Storage Tank No. 1 flow control and valve modifications
- ◆ Reservoir return line flow control and bypass piping

The modifications will allow the two storage tanks to be operated in series for flows from the Tampa Bypass Canal or the Regional Reservoir. This will provide additional flexibility and a more uniform influent water quality for the treatment plant.

The expanded Repump Station will operate in series with the South-Central Hillsborough Intertie Booster Pump Station. Figure 12 shows the system/operational curves with the expanded flow from the Repump Station being boosted by the South-Central Hillsborough Intertie Booster Pump Station. Operation of the six three-stage vertical turbine pumps at 100-percent speed achieves a capacity of 180 mgd at 275 feet of head.

As described above, construction of the Repump Station Expansion is included in the same contract as the High Service Pump Station Expansion. The design engineer for this project is also MWH. The component of the contract amount associated with the Repump Station Expansion is \$6,944,400. The contractual completion dates are the same as those for the High Service Pump Station.

## Off-Stream Reservoir Pump Station

The Off-stream Reservoir Pump Station (Figure 13) will be a new facility that pumps raw water from the Regional Reservoir to the Surface Water Treatment Plant. This new station will be located approximately 700 feet west of the existing reservoir embankment.

The Off-stream Reservoir Pump Station will have the ability to send raw water to the Surface Water Treatment Plant as a stand-

Figure 16: Regional Surface Water Treatment Plant

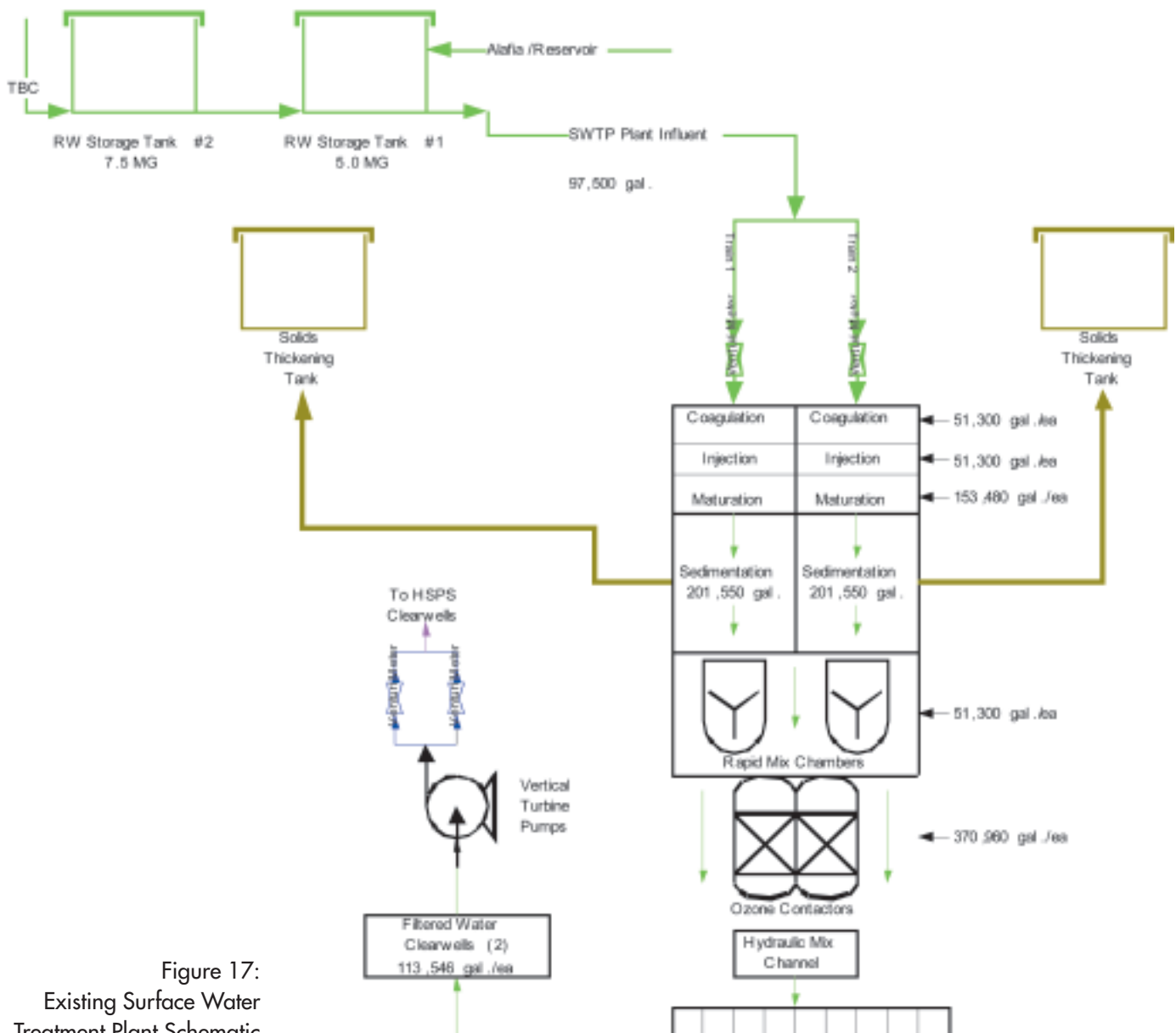


Figure 17:  
Existing Surface Water  
Treatment Plant Schematic

alone facility, or it could be operated in series with the South-Central Hillsborough Intertie Booster Pump Station. Figure 14 shows the options for delivering water from the reservoir to the Surface Water Treatment Plant at various Reservoir depths and required flows.

The Off-stream Reservoir Pump Station will have four 400-hp vertical turbine pumps with variable frequency drives. The pumps will be mounted in pump suction cans because the ground elevation at its location is approximately 15 feet higher than the minimum hydraulic grade in the raw water transmission pipeline. The pump suction cans will extend as much as 30 to 35 feet below existing grade. The full scope of the Offstream Reservoir Pump Station includes the following elements:

- ◆ Electrical building
- ◆ Four vertical turbine pumps with 400-hp motors
- ◆ Four variable frequency drives
- ◆ Piping and valve connections to existing 84-inch transmission main

The design engineer for the Off-stream Reservoir Pump Station project is CDM. Advertisement for the construction contract for the project occurred in August 2009. Bids were scheduled to be opened in September 2009, and award of the construction contract by the Tampa Bay Water Board of Directors is scheduled for October 19.

The engineer's cost estimate for construction is \$10.5 million. The construction completion date for this project is scheduled for mid-2011.

### South-Central Hillsborough Intertie Booster Pump Station

The South-Central Hillsborough Intertie Booster Pump Station (Figure 15) will be a new facility that is intended to operate in series with the Facility Site Repump Station to transmit raw water to the reservoir. In addition, the station will operate in series with the Off-Stream Reservoir Pump Station to increase flows from the reservoir to the Surface Water Treatment Plant (See Figure 14).

The project will include two 3,000-hp horizontal split case pumps with variable frequency drives. The station also includes a ground storage tank that functions as a "feed tank" to supply water to the suction side of the

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Figure 18: Surface Water Treatment Plant Expansion Construction

*Continued from page 47*

pumps in the event of a sudden drop in suction pressure. The full scope of the South-Central Hillsborough Intertie Booster Pump Station includes the following elements:

- ◆ Pump building
- ◆ Electrical building
- ◆ 330,000 gallon ground storage tank
- ◆ Two horizontal split-case pumps with 3,000-hp motors
- ◆ Two variable frequency drives
- ◆ Piping and valve connections to existing 72-inch transmission main

The design engineer is CDM, and the bidding and construction schedule is the same as for the Off-stream Reservoir Pump Station. The engineer's estimate for construction is \$12.6 million.

## Regional Surface Water Treatment Plant

The Surface Water Treatment Plant (Fig-

ures 16 and 17) treats raw water from the Tampa Bypass Canal and Alafia River, as well as raw water stored in the Regional Reservoir. The plant is being expanded through a "design-build construction manager at-risk" contract with Veolia Water North America - South LLC.

Veolia, formerly US Filter, was the original constructor and has been the operator of the treatment plant since the project's inception. An amendment to Veolia's existing contract was executed in April 2007 to cover the expansion. Under the amendment, Veolia is designing, permitting, and constructing the expansion and will continue to operate the plant.

The current plant has a rated capacity of 72 mgd. The expanded plant will be able to produce 99 mgd on a daily basis and will have a rated capacity of 120 mgd.

The Regional Surface Water Treatment Plant expansion project includes two new complete treatment trains with capacities similar to the existing two trains. The following

facilities are being added:

- ◆ Two sets of high-rate flocculation/sedimentation/settling basins
- ◆ Two ozone contactors
- ◆ Six dual media filters with sand and granular activated carbon
- ◆ Gravity thickener
- ◆ Two backwash water clarifier units
- ◆ Segregated clearwell to augment the existing smaller clearwell
- ◆ Chlorine contact chamber and increased transfer pumping capacity
- ◆ Two belt filter presses and belt filter press building for solids handling
- ◆ Replacement of existing effluent line with a larger diameter line
- ◆ Auxiliary power for half of the treatment trains (capacity of 66 mgd)
- ◆ Expansion of existing chemical feed systems

The guaranteed maximum price provided by Veolia for the expansion is \$126,764,728. An owners allowance of \$7 million was also approved, bringing the project budget to \$133,764,728.

Construction costs are being paid based on competitive procurement and an open book approach. The major construction and equipment packages were required to be bid to ensure market competitive pricing for the majority of the overall project costs. The primary installation contractor is Brasfield & Gorrie. This project is currently under construction (Figure 18) with anticipated startup by July 2010, and acceptance testing completion by the end of December 2010.

## Supply Increase

Because use of the surface water supply system is so dependent on stream flows and climatic conditions, the Regional Surface Water Treatment Plant is not expected to operate at capacity at all times. As an example, the plant has a current rated capacity of 72 mgd, but it produced an average of 42 mgd in water year 2008 and is on track to produce an average of 33 mgd in water year 2009.

The lower production in 2009 is caused by extreme drought conditions and reservoir operational constraints that caused the plant to be completely down from mid-March through the end of May. Up to 45 mgd of plant production is budgeted for water year 2010. Once the Surface Water System Expansion is complete, and all components are operational, average production from the treatment plant is expected to be 84 mgd during average rainfall years. ◊