TAMPA BAY WATER
Supplying Water To The Region

AGENDA ITEM I1

DATE: February 3, 2020

TO: Matt Jordan, General Manager

FROM: Charles H. Carden, Chief Operating Officer

SUBJECT: Comprehensive Management Plan for the Hillsborough River, the Tampa Bypass Canal, Sulphur Springs and Morris Bridge Wellfield – *Approve*

SUMMARY

Tampa Bay Water, the City of Tampa and the Southwest Florida Water Management District have worked to complete a Comprehensive Management Plan for the Hillsborough River and Tampa Bypass Canal and will present its highlights.

RECOMMENDATION

Approve Plan and receive Presentation.

COST/FUNDING SOURCE

No cost item

DISCUSSION

Tampa Bay Water, the City of Tampa and the Southwest Florida Water Management District have recently completed the Comprehensive Management Plan for the Hillsborough River, the Tampa Bypass Canal, Sulphur Springs and Morris Bridge Wellfield (attached) and staff will present its highlights.

The plan provides comprehensive information operating the multiple uses of the Hillsborough River (River), the Tampa Bypass Canal (TBC), Sulphur Springs, and the Morris Bridge wellfield. The plan will continue to facilitate the management of water-related activities for the River and the TBC. It recognizes the need for flexibility in the management of the systems as conditions demand and will be reviewed every five years and updated as needed.

Attachment

BACKGROUND

The Amended and Restated Inter-Local Agreement states in Section 3.08 (G) of the Agreement:

> "The Authority and Tampa will work in cooperation with SWFWMD to develop an unanimously agreed upon comprehensive management plan for the Hillsborough River, the Tampa Bypass Canal, Sulphur Springs and the Morris Bridge Wellfield."

Attachment

COMPREHENSIVE MANAGEMENT PLAN

for the Hillsborough River, the Tampa Bypass Canal, Sulphur Springs, and the Morris Bridge Wellfield

Hillsborough River Dam

Tampa Bay Regional Surface Water Treatment Plant

Tampa Bypass Canal

City of Tampa Florida

TAMPA BAY WATER
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Southwest Florida Water Management District

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1.0 INTRODUCTION

1.1 Purpose

This Comprehensive Management Plan (Plan) provides comprehensive information that acknowledges the success of the parties since 1998 operating the multiple uses of the Hillsborough River (River), the Tampa Bypass Canal (TBC), Sulphur Springs, and the Morris Bridge wellfield. The Plan will help continue to facilitate the management of water-related activities for the River and the TBC. It is intended to recognize the need for flexibility in the management of the systems as conditions demand. The operations parameters contained in this Plan are current as of the date of this Plan; however, the parties acknowledge that dynamic conditions critically affect the actual operation, making communication and coordination critical when implementing the Plan.

The Amended and Restated Inter-Local Agreement (Agreement) states in Section 3.08 (G) of the Agreement:

> "The Authority and Tampa will work in cooperation with SWFWMD to develop an unanimously agreed upon comprehensive management plan for the Hillsborough River, the Tampa Bypass Canal, Sulphur Springs and the Morris Bridge Wellfield."
>
> The parties shall continue to coordinate the review of the Plan every five years and update as needed.

The Plan shall be presented to and accepted by the following entities:

- Tampa Bay Water Board of Directors
- City of Tampa Mayor or designee
- Southwest Florida Water Management District

1.2 Background

The Hillsborough River basin encompasses approximately 650 square miles and includes several major tributaries, including Cypress Creek, Trout Creek, Cow House Creek, Blackwater Creek, and Crystal Springs. The basin consists primarily of large, flat areas, with many wetlands that drain to the Hillsborough River during wet periods. The River is separated by the Hillsborough River Dam into the Upper Hillsborough River and Lower Hillsborough River. The dam forms a large reservoir (Figure 1) that has been used as the primary source of water for the City of Tampa since 1925.

The TBC was constructed between 1966 and 1981 by the U.S. Army Corps of Engineers (USACE) as a flood control project to divert floodwaters around the City of Tampa, Temple Terrace, and adjacent communities. The Southwest Florida Water Management District (District) operates the TBC for flood control purposes. During periods of exceptional flooding, water can be retained upstream of Structure S-155 in the Lower Hillsborough River Flood Detention Area including the TBC. This water can be released slowly back into the Hillsborough River or diverted into the TBC. Floodwater can also be relieved from the Hillsborough River into the TBC using Structure S-161 on the Harney Canal. Floodwaters in the TBC are discharged into the Palm River via Structure S-160. Structure S-160, like the Hillsborough River Dam, provides a barrier to upstream movement of saltwater.

The TBC is divided into three pools; the Upper Pool located upstream of Structure S-159, the Middle Pool located upstream of Structure S-162 to Structure S-159, which includes the Harney Canal, and the Lower Pool located upstream of Structure S-160 to Structure S-162. An additional structure, Structure S-161, separates the Harney Canal from the reservoir.

Figure 1. Hillsborough River and Tampa Bypass Canal Overview

The City of Tampa and Tampa Bay Water (formerly known as the West Coast Regional Water Supply Authority) started using the TBC as an augmentation source to the Hillsborough River Reservoir in the 1980s. Several Water Use Permits (WUPs) have been issued by the District to set forth operating rules and parameters that provide the guidance and basis for this management plan. A brief summary of each WUP is provided in the following section.

1.3 Governing Water Use Permits and Agreements

The following subsections provide a brief summary of the governing WUPs and agreements that affect the implementation of the Plan. The major sections of this Plan delineate the overall mission of that section, such as flood control or water supply or environmental protection and recovery. The subsections reference the roles and responsibilities of the District, the City, and Tampa Bay Water, and how the three entities coordinate the defined activities.

1.3.1 City of Tampa WUP

Water Use Permit (WUP) No. 20002062.006, authorizes the City of Tampa's water use from the Hillsborough River.

1.3.2 Harney Canal Augmentation WUP

WUP No. 20006675.006 authorizes the withdrawal of water from TBC middle pool as an augmentation source for the Hillsborough River Reservoir for the City of Tampa. Under this permit, water from the Harney Canal may be pumped over Structure S-161 into the Hillsborough River Reservoir during low flow conditions, with an annual average limit of 20 mgd and a peak month limit of 40 mgd. Tampa Bay Water owns and operates the augmentation pump station. The permit defines the water level and flow conditions under which Tampa Bay Water may use the TBC as a source of water and provides primacy of the water source to the City of Tampa.

1.3.3 TBC Raw Water Supply to Tampa Bay Water WUP

WUP No. 20011796 sets forth the conditions that allow Tampa Bay Water to withdraw water diverted from the Hillsborough River into the middle pool of the TBC and to withdraw water from the TBC for use as raw water supplies for drinking water treatment. Tampa Bay Water's allowable withdrawal and diversion quantities are based on the water elevation in the TBC pool and in the River, as well as average flow over the Hillsborough River dam on the previous day. Tampa Bay Water's use of the Hillsborough River and TBC depends not only on hydrologic conditions but also on operational and management decisions made by the City of Tampa and the District.

1.3.4 Sulfur Springs and ASR Augmentation WUP

Water Use Permit No. 20002062.006 authorizes the City of Tampa to withdraw water from Sulphur Springs either to augment the reservoir during low flow periods or to maintain a target minimum flow at the base of the Hillsborough River dam.

1.3.5 1998 Amended & Restated Interlocal Agreement

Six member governments in the Tampa Bay area signed the Amended and Restated Interlocal Agreement in 1998, which created a special district entity known as Tampa Bay Water. Section 3.08 of the Agreement acknowledges that the City of Tampa's historic use of surface water sources constitutes a special circumstance, justifying an exception to the exclusivity requirements of Section 3.02 of the Agreement. Section 3.08 of the Agreement reserves and provides primacy to the City of Tampa to permit withdrawal quantities from the Hillsborough River, the use of Sulphur Springs as well as the existing TBC augmentation.

2.0 Flood Protection

2.1 Water Management District

The Lower Hillsborough Flood Detention Area (LHFDA) is to be utilized to prevent Hillsborough River flows from contributing to water levels that negatively affect property adjacent to the Lower Hillsborough River (between City of Tampa and Structure S-155). TBC canals (C-135, C-136) and water management structures (Structure S-161, Structure S-159s, Structure S-162, Structure S-160) are designed to convey Lower and Upper Hillsborough River Basin water to McKay Bay. When the LHFDA is anticipated to be utilized, Trout Creek Park staff are notified, initiating required closure of recreational areas upstream of Structure S-155.

Major centers of population within the Hillsborough River Basin include portions of Tampa and the City of Temple Terrace where residential development is adjacent to the River. Within the upper half of the Hillsborough River Basin, Hillsborough River State Park and undeveloped, agricultural areas are also adjacent to the River. The LHFDA and TBC are intended to receive inflow resulting from high-water events originating in the Hillsborough River Basin. Much of the inflow to the LHFDA and TBC occurs upstream of River mile 25.7, upstream of Temple Terrace.

Four River Basin Project inlet culverts were provided adjacent to project canals and through levees at ditches and low swales where flow entered the C-135 and C-136 (Harney Canal). The inlet culverts were designed to provide for runoff of the 30-year flood in urban areas and the 10-year flood in agricultural and undeveloped areas. Except for the culvert at the west branch of Trout Creek (Trout Creek Structure), the inlet culverts were provided with flap gates, where necessary, to prevent reverse flow through the inlet culverts and to eliminate the need for operating the inlet culverts during periods of high-water in C-135 and C-136. The Trout Creek Structure is equipped with a slide gate that is to be closed when Structure S-155 is closed or reduced in flow and not reopened until the high-water has passed and Structure S-155 is reopened.

2.1.1 Communications Interoperability

It is vital that all parties keep in constant communication. Operation of the LHFDA and the TBC has become complex. Changes to stage or flow, maintenance of a gate(s) could have a direct effect on the operation of pumps, flood control, or water quality. All three entities can have an affect on how the others will have to operate.

2.1.2 Flood Control Actions and Triggers

The District operates the LHFDA and TBC for flood control and water level maintenance purposes. The TBC can be operated independently of the LHFDA. All elevations referenced in this document are referenced to NGVD29.

LHFDA activation trigger:

The activation of the LHFDA is dependent on the operation of Structure S-155, through the full or partial closing of the structure's gates.

The amount of flow reduction at Structure S-155 will vary with each flood event and will depend on the hydrologic conditions that exist downstream. Whenever Structure S-155 is closed or reduced in flow, Structure S-163 and Trout Creek structures shall be closed. All gates should be operated at the same gate opening and should be opened gradually to allow tailwater stages to rise before large releases are made.

TBC activation triggers:

The adjustment of water levels in the middle and lower pools during heavy rainfall events.

- A stage increase of the Hillsborough River to 24.0 feet at Fowler Ave. triggering the closing of Structure S-163 and diverting flow from Cow House Creek into the TBC.
- The operation of Structure S-161 (at the request of City of Tampa) to move River water into the TBC through Structure S-161 (Harney Canal), providing relief for the Hillsborough Dam when it surpasses its maximum capacity.
- When the LHFDA has been activated through the closing or throttling down of Structure S-155.

2.1.3 Hillsborough River

The Hillsborough River flows through the cities of Temple Terrace and Tampa. Prior to the construction of the LHFDA and TBC, the River periodically created extensive flooding in these cities. With the extensive urban development currently in Temple Terrace and Tampa, the Hillsborough River continues to have the potential to create extensive flood damages. The National Weather Service (NWS) utilizes several water level gauges along the Hillsborough River including at Fowler Avenue to provide hydrologic forecasts and warnings for the protection of life and property. The NWS considers the Fowler Avenue location to have a flood stage elevation of 29.0 feet.

The Hillsborough River originates in the Green Swamp north of Lakeland in the Central Highlands and has a drainage area of approximately 685 square miles, encompassing parts of Hillsborough, Pasco, and Polk counties. From the Green Swamp, which is a region of uplands and wetlands, the Hillsborough River flows southwesterly approximately 54 miles to the Coastal Lowlands and Hillsborough Bay. There are numerous ponds, lakes, sinkholes, swamps, and tributary creeks in the basin. Major tributaries are Blackwater and Flint creeks on the south bank of the Hillsborough River and New River, Trout Creek, and Cypress Creek on the north bank.

2.1.4 Lower Hillsborough Flood Detention Area

An area of approximately 26 square miles upstream of Levee 112 (L-112) and Structure S-155 is designated as the LHFDA. The LHFDA is meant to be utilized for temporary storage during Hillsborough River high-water events diverting Hillsborough River flow to the TBC. The LHFDA water level is measured at the Structure S-155 headwater (Hillsborough River). When the LHFDA does not contain water that is being stored temporarily, water levels within the LHFDA typically will be at naturally occurring levels that occur because of the Hillsborough River when Structure S-155 is open.

The LHFDA water level is measured at the Structure S-155 headwater (Hillsborough River). When the LHFDA does not contain water that is being stored temporarily, water levels within the LHFDA typically will be at naturally occurring levels that occur because of the Hillsborough River when Structure S-155 is open.

The Lower Hillsborough Flood Detention Area (LHFDA) and Structure S-155 are designed to eliminate flooding on the lower Hillsborough River by diverting flow to the TBC. During flood events, the structure's gates are lowered to impound the River thereby forcing excess water into the LHFDA and eventually down the TBC to McKay Bay. Reduced water stages in the lower River prevent overflow onto adjacent property and improves drainage from laterals along the River.

Levee 112 (L-112)

L-112 is a compacted earth fill levee that straddles the Hillsborough River, approximately 700 feet upstream of the I-75 Bridge at River mile 25.7 (as measured from the River mouth located at Hillsborough Bay). L-112 has a north and south designation relative to Structure S-155, L-112 South (L-112S) is approximately 2.8 miles long, spanning from Structure S-155 to approximately 0.3 mile south of the Fowler Avenue (State Road 582) Bridge. The 0.3-mile segment south of Fowler Avenue, also known as L-112S, is located west of C-135 and ties into natural high ground that extends to the U.S. Highway 301 bridge. L-112 North (L-112N) is approximately 3.5 miles long spanning from Structure S-155 to approximately one mile northeast of the I-75 and Bruce B. Downs Boulevard intersection. L-112S is also adjacent to and west of the TBC Floodway and Canal 135 (C-135), which spans from Cow House Creek to approximately 1,000 feet south of Fowler Avenue. The levees have one on 3 side slope on the west side (downstream side) and 1 on 6 on the east side (upstream side). The crown has a width of 15 feet except in the reach between Morris Bridge Road and Structure S-155 where the crown was widened to 30 feet to provide access to Structure S-155.

Features that are within the alignment of L-112 are the Trout Creek Structure, Structure S-155, and Structure S-163. When Structure S-155 is closed, L-112 allows impoundment of Hillsborough River flows within the LHFDA as well as the diversion of Hillsborough River flows to the TBC via the TBC Floodway. When Structure S-163 is closed, L-112 allows impoundment of Cow House Creek flows within the LHFDA, diversion of Cow House Creek flows to C-135 and prevents the Hillsborough River downstream of Structure S-163 from flowing through Structure S-163 to the LHFDA and/or C-135.

Structure S-155

Structure S-155 is located in the Hillsborough River and in the L-112 alignment, approximately 700 feet upstream of the I-75 Bridge at River mile 25.7. Structure S-155 is the divide between the Upper and Lower Hillsborough River. Structure S-155 is a two-bay spillway with two 30-feet wide, remotely operated, vertical lift gates that can also be manually operated on-site and seat on the crest of an ogee weir. The crest of the weir is at elevation 15.2 feet, which is meant to provide a 6-foot navigation depth during low flow (Structure S-155 headwater of 21.2 feet). The overhead clearance at Structure S-155 is limited to an elevation of 36.6 feet by the Structure S-155 breast wall.

Typically, Hillsborough River flows up to approximately 4,000 cubic feet per second (cfs) will be conveyed down the Hillsborough River through Structure S-155. However, during high-water events, the discharge at

Structure S-155 will be reduced to regulate stages of the Hillsborough River downstream of Structure S-155. The amount of flow reduction at Structure S-155 will vary with each high-water event and will depend on the hydrologic conditions that exist downstream. The amount of flow reduction at Structure S-155 also influences the amount of water stored in the LHFDA and diverted to the TBC. At a water level of 26.0 feet at Structure S-155, the Hillsborough River has a hydraulic connection to the TBC Floodway.

Structure S-163

Structure S-163 is in the L-112S alignment at Cow House Creek, approximately 1.3 miles south of Structure S-155 at the headwater of C-135. Structure S-163 is a single barrel, 84-inch diameter corrugated metal pipe (CMP) with a standard slide gate at its headwater (LHFDA side) that is manually operated from a platform on the upstream side of L-112S. The invert of Structure S-163 is at elevation of 17.0 feet and has a design discharge of 200 cfs when the differential head across the structure is 1.2 feet. Structure S-163 may function as a two-way structure depending on conditions occurring in the Hillsborough River and Cow House Creek. During moderate Hillsborough River flows, the River backs up into Cow House Creek and the Structure S-163 tailwater becomes more a function of the confluence of Cow House Creek and the River near Fowler Avenue.

Cow House Creek originates from the Hillsborough River, separating from the Hillsborough River south of Morris Bridge Road at River mile 30.5 (20.5 miles upstream of the City of Tampa). After passing through Structure S-163, Cow House Creek rejoins the Hillsborough River downstream of Structure S-155, near Fowler Avenue. Structure S-163 is normally opened to allow for the natural flow of water in Cow House Creek through L-112S to the Hillsborough River. When high-water events occur, Structure S-163 is closed in conjunction with the operation of Structure S-155 preventing Cow House Creek flows from exiting the LHFDA.

Trout Creek Structure

Trout Creek is located 0.8 miles north of Structure S-155 on Levee 112. The structure is in the Hillsborough River Basin (13), northeast Hillsborough County in Section 25, Township 27 S, Range 19 E. Trout Creek structure consists of a culvert yoked to a slide gate on the front slope of the levee. The 54-inch diameter corrugated metal culvert penetrates levee from east to west. The gate hoist assembly has a special collar and plate assembly that is attached to wood pilings. The system is manually operated via a gear head and hand crank, which rest on a wood platform attached to the top of the pilings. The upstream and downstream channel slopes are lined with riprap to protect against eroding velocities.

Unlike most of the District's water control structures, Trout Creek does not control any water levels. The structure was not part of the USACOE's original levee concept but was added to convey low flows from the west fork of Trout Creek (west of I-75) to Trout Creek. The structure has two purposes: during non-flood periods, it passes normal stormwater runoff from the west side of the interstate into Trout Creek; its second purpose is to impound floodwaters stored in the LHFDA. However, since the construction of this facility, various regulatory programs have come into effect that possibly negate the original reasons for its construction.

2.1.5 Tampa Bypass Canal Structures and Harney Canal

The TBC is an interrelated system that includes a floodway, two canal segments, water control structures, and inlet culverts. The TBC may function in combination with the LHFDA or independently, depending upon conditions at the Hillsborough River at Fowler Avenue near Temple Terrace water level gage. The TBC is divided into three pools: the Upper Pool located upstream of Structure S-159, the Middle Pool located upstream of Structure S-162, and the Lower Pool.

Canal 135 (C-135)

C-135 is approximately 12.5 miles long and extends from McKay Bay at the Palm River community of Tampa, approximately one mile southwest of the intersection of U.S. Highway 41 and the Crosstown Expressway, to approximately 325 feet north of Cow House Creek. C-135 has bottom widths varying from 400 to 200 feet and bottom elevations from -21.0 to 16.0 feet at McKay Bay and Cow House Creek, respectively. C-135 includes Structure S-159 (Upper/Middle/Lower), Structure S-160, and Structure S-162. These structures result in a reduction of cross sectional area in C-135. C-135 is designed to convey combined flows, which include:

- 12,000 cfs from the LHFDA
- 4,000 cfs from the Hillsborough River downstream of Structure S-155
- The Standard Project Flood (SPF) runoff from the 33 square-mile area adjacent to C-135 and C-136 through various inlet culverts including 4,900 cfs from the Thonotosassa Canal (never constructed)
- Hillsborough River inflow through Structure S-161 via C-136 (Harney Canal)

TBC Floodway

The TBC Floodway is located near the upstream side of L-112S, at the northern end of C-135. The TBC Floodway is approximately one-half mile long, approximately 200 feet wide, and has a bottom elevation of 26.0 feet. The northern end of the TBC Floodway is approximately three quarters of a mile from Structure S-155 and approximately one-half mile from the closest point of the Hillsborough River. The TBC Floodway provides connection of the Hillsborough River, upstream of Structure S-155, to C-135 when Structure S-155 is closed and/or when the water level in the LHFDA is above elevation 26.0 feet. The TBC Floodway provides conveyance for approximately 50 percent of the total flow diverted to C-135.

Structure 159 Upper/Middle/Lower S-159s

Structure S-159 Upper, Structure S-159 Middle, and Structure S-159 Lower are located in C-135, downstream of the southern end of L-112S and upstream of the confluence of C-135 and C-136 (Harney Canal). Structure S-159 Upper is located 1,800 feet upstream of the Harney Road Bridge over C-135. Structure S-159 Middle is approximately 1,150 feet upstream of the Harney Road Bridge. Structure S-159 Lower is located 600 feet downstream of the Harney Road Bridge. Structure S-159 Upper, Structure S-159 Middle and Structure S-159 Lower are designed to spread the differential head over the three structures to avoid the foundation problems that would have occurred with a larger single structure. Structure S-159 Upper is a three-bay spillway with 29-feet wide, remotely operated, vertical lift gates that can also be manually operated on-site and seat on an ogee weir crest at elevation 24.3 feet. There are also tieback levees adjacent to C-135 that extend from natural

high ground south of the U.S. Highway 301 Bridge to Structure S-159 Upper. The tieback levees are intended to prevent C-135 flows from bypassing Structure S-159 Upper during high-water events. Structure S-159 Middle is an ungated, ogee spillway with a crest elevation of 20.4 feet. Structure S-159 Lower is similar to Structure S-159 Middle, with the weir crest at elevation 13.6 feet. The Structure S-159s provide water control and prevent over drainage in the area adjacent to C-135. Periodic releases for water quality may occur during low-flow times.

Structure S-162

Structure S-162 is located in C-135, approximately 1,000 feet upstream of the East Martin Luther King Jr. Boulevard Bridge over C-135 and downstream of both Structure S-161 and Structure S-159 Lower. Structure S-162 is a seven-bay spillway with 28 feet-wide, remotely operated, vertical lift gates that can also be manually operated on-site and seat on an ogee weir crest at an elevation of 4.2 feet. In addition, the vertical lift gates have a sluice gate integrated into the upper portion of the gate. Five of the sluice gates are manually operated and two are remotely operated. Structure S-162 is designed to pass 23,500 cfs at a headwater elevation of 14.5 feet and a tailwater elevation of 11.9 feet. Structure S-162 provides water control and prevention of detrimental groundwater effects to areas adjacent to Structure S-162.

Structure S-160

Structure S-160 is a coastal structure located in C-135, approximately 3.7 miles upstream of McKay Bay. Structure S-160 is approximately 1,700 feet upstream of the State Road 60 (East Adamo Drive) Bridge over C-135, and downstream of Structure S-162. Structure S-160 is a six-bay spillway with 28 feet wide, remotely operated, vertical lift gates that can also be manually operated on-site and seat on an ogee weir crest at elevation -0.7 feet. In addition, five of the vertical lift gates have a sluice gate integrated into the upper portion of the gate. Three of the sluice gates are manually operated and two are remotely operated. Structure S-160 is designed to pass 26,700 cfs at a headwater elevation of 11.2 feet and a tailwater elevation of 3.1 feet. Structure S-160 provides water control and prevention of saltwater intrusion into C-135.

Canal 136 (C-136)

C-136 (Harney Canal) is approximately 1.5 miles long and extends from the Lower Hillsborough River (City of Tampa reservoir) to C-135. The west end of C-136, located at the Lower Hillsborough River, is approximately 8.8 miles downstream of Structure S-155. The east end of C-136, located at C-135, is approximately 1.7 miles downstream of Structure S-159 Lower. Structure S-161 controls flows from the Hillsborough River to C-136 and is designed to convey up to 4,000 cfs from the Hillsborough River to C-135. C-136 has a bottom width of 70 feet downstream of Structure S-161 and a bottom elevation that varies from 10.2 to 0.7 feet. C-136 upstream of Structure S-161 has a bottom width of 45 feet and a bottom elevation of 4.5 feet.

Structure S-161

Structure S-161 is located in C-136 (Harney Canal), approximately 1,300 feet east of the intersection of C-136 and the Lower Hillsborough River (City of Tampa reservoir). Structure S-161 is a two-bay spillway with 18 feet wide, remotely operated, vertical lift gates that can also be manually operated on-site and seat on an ogee weir

crest at elevation 11.3 feet. There are also tieback levees adjacent to C-136 that extend from natural high ground east of the Harney Road Bridge to Structure S-161. The tieback levees are intended to prevent Lower Hillsborough River (City of Tampa reservoir) flows during high-water events from bypassing Structure S-161 and inundating low ground in the area. In addition, the vertical lift gates have a sluice gate integrated into the upper portion of the gate. One of the sluice gates is manually operated and one is remotely operated. The purpose of Structure S-161 is to regulate the diversion of flows from the Hillsborough River to C-135 that are in excess of the capacity of the River channel downstream of the City of Tampa. The maximum capacity of Structure S-161 is 4,000 cfs.

Inlet Culverts

The District is responsible for regulating non-Federal secondary drainage and water supply related infrastructure that is upstream of and within the LHFDA and TBC. Numerous inlet culverts are located adjacent to project canals and through levees, at ditches and low swales. The inlet culverts provide a means of controlling inflow and preventing erosion of the ditches and consequent silting of the canal. In general, inlet culverts were designed to provide for runoff of the 30-year flood in urban areas and the 10-year flood in agricultural and undeveloped areas. With the exception of the culvert at the west branch of Trout Creek (Trout Creek Structure), the inlet culverts were provided with flap gates, where necessary to eliminate the need for operating during periods of high-water. The Trout Creek Structure is equipped with a manual slide gate that is to be closed when Structure S-155 is closed or reduced in flow and not reopened until the high-water event has passed and Structure S-155 is opened for normal operation.

2.2 Tampa Bay Water

Tampa Bay Water's use of the TBC for raw water supplies is authorized by WUP No. 20011796.002. Tampa Bay Water's allowable withdrawal and diversion quantities are based on the water elevation in the TBC pool and in the Hillsborough River, as well as average flow over the Hillsborough River dam on the previous day. Tampa Bay Water's use of the Hillsborough River and TBC depends not only on hydrologic conditions, but also on operational and management decisions made by the City of Tampa and the District.

Tampa Bay Water does not have responsibility for flood control. Tampa Bay Water provides normal daily control of the automated skimming gates on Structure S-160, Structure S-161, and Structure S-162 for the purpose of permit compliance and raw water supply to the surface water treatment system. Gate positions are adjusted using automated controls in compliance with the requirements of the WUP. When conditions dictate the need for flood control measures, the District controls water movement and levels in the TBC.

Timely communication of any changes to gate positions relative to flood control by the District or the City of Tampa is critical to optimize the operation of Tampa Bay Water's Surface Water Treatment Plant (SWTP). With advance notice, Tampa Bay Water may make changes to the treatment processes in anticipation of changes to received water quality, or Tampa Bay Water may find it prudent to temporarily cease withdrawals from the TBC until sufficient flushing and/or reduced turbulence has occurred and water quality in the TBC improves.

Whereas the WUP provides constraints to TBC based on Hillsborough River flows over the Tampa dam, and the City of Tampa controls the flows and levels at the dam, close coordination between the City of Tampa and Tampa Bay Water regarding dam management is also important.

2.3 City of Tampa

The Hillsborough Dam is owned and operated by the City of Tampa. The primary function of the dam in dry conditions is for impoundment, and not flood control. However, during rain events, operations reacts to rising levels upstream and in the watershed by increasing the discharge. The East Fowler Avenue datum gauge is a critically observed level. Rising levels at Fowler triggers increased release at the dam. Coordination with the District structure control team is essential during these events. When conditions warrant, or upon request from the City, the District may open Structure S-161 at the Harney Canal to provide additional relief.

2.4 Coordination

The full or partial closure of Structure S-155 will cause the diversion of River water into the LHFDA, causing the TBC to transition into flood control mode. The LHFDA and TBC are intended to receive inflow resulting from high-water events originating in the Hillsborough River Basin. Much of the inflow to the LHFDA and TBC occurs upstream of River mile 25.7, upstream of Temple Terrace. The amount of flow reduction at Structure S-155 also influences the amount of water stored in the LHFDA and diverted to the TBC. When the water level reaches 26.0 feet at Structure S-155, the Hillsborough River has a hydraulic connection to the TBC Floodway.

Historically, both Tampa Bay Water and Tampa have experienced treatment challenges when receiving water discharged from the LHFDA. These challenges include rapid plugging of carbon filters and increased oxidant demand in the treatment processes, as well as increased water treatment residuals (solids) production. Coordination between the parties is critical during the LHFDA discharges. Prior to activating Structure S-155, the District will notify Trout Creek Park staff, initiating required closure of recreational areas upstream of Structure S-155. Tampa Bay Water and the City of Tampa will also be notified.

Maintenance activities on Structure S-159, Structure S-160, Structure S-161, or Structure S-162 may require the operation of the gates by the District. The District will communicate and coordinate with Tampa Bay Water, allowing time to plan for alternate supply sources during the maintenance activities. With advance notice, Tampa Bay Water may make changes to the treatment processes in anticipation of changes to received water quality, or Tampa Bay Water may find it prudent to temporarily cease withdrawals from the TBC until sufficient flushing and/or reduced turbulence has occurred and water quality in the TBC improves.

3.0 Water Supply

3.1 Water Management District

The TBC is an interrelated system that includes a floodway, two canal segments, water control structures, and inlet culverts. The TBC may function in combination with the LHFDA or independently, depending upon conditions at the Hillsborough River at Fowler Avenue near Temple Terrace water level gage. The TBC is divided into three pools: the Upper Pool located upstream of Structure S-159, the Middle Pool located upstream of Structure S-162, and the Lower Pool.

Water Use Permit No. 20011796 for the TBC Water Supply Project was issued by the District in March 1999 and has been renewed several times. The latest version authorizes withdrawal of raw water up to 258 mgd (400

cfs) in total from the TBC Lower Pool and/or Middle Pool through the pumping station located at Dr. M.L. King, Jr. Boulevard, near District Structure S-162, subject to withdrawal conditions detailed in other sections of this document.

Although the Tampa Bypass Canal's primary function is flood control, the District cooperatively works in conjunction with the City of Tampa and Tampa Bay Water to ensure the TBC continues to meet its responsibilities as a raw water supply.

3.2 Tampa Bay Water

Tampa Bay Water utilizes the TBC as a raw water supply to the surface water treatment facility and for replenishing storage in the off-stream reservoir. These activities are governed by WUP No. 2011796.002, which specifies the minimum flows and levels and the maximum withdrawal amounts, as well as coordination parameters with water supply activities of the City of Tampa.

The intake facilities include four submerged, pile-mounted, 84-inch diameter, wedge-wire screens in the MP and LP of the TBC. The screens are located adjacent to Structure S-162 and inside boat barriers located in each pool. The screens are cleaned via an air backwash system. The intake header will facilitate withdrawal of the total maximum day permitted 400 cubic feet per second (cfs) (equivalent to 258 mgd) at this site.

The facility at the TBC pumping station includes four constant speed, and four VFD-driven 800-horsepower vertical turbine pumps. Valves installed on the pumping station suction header prevent water siphoning through the pumping station from the Middle to the Lower Pool of the TBC. These valves also enable each pump to pump from only one pool of the canal at any given time. Combined with flow meters on the discharge pipe from each pump, the valve system enables separate metering of withdrawals from the two TBC pools. As required in Water Use Permit No. 20011796.002, flow from each pool is totaled daily and reported monthly to the District's Water Use Permit Bureau.

3.2.1 Agreements/Permits

License Agreement with the District for use of Property

On March 27, 2000, the District executed a license agreement with Tampa Bay Water authorizing use of District-owned lands along the TBC near Structure S-162 for installation of water intake structures and piping for the TBC pumping station. In addition to intake structures and pipes associated with the TBC pumping station, the license agreement also authorized Tampa Bay Water to use District property along the TBC for installation of the North-Central Intertie Pipeline.

Tampa Bypass Canal Flood Control Structure Operating Agreement

On November 7, 2001, the District executed an agreement with Tampa Bay Water authorizing the installation, operation and maintenance of automated controls and monitoring equipment on certain slide gates on the TBC structures. The purpose of the automated equipment was to: a) facilitate daily operation of the TBC for the permitted regional water supply purpose (see WUP No. 2011796.002); b) facilitate more accurate calculations

of flow/discharge from the TBC; and c) enable stage adjustments in the TBC Middle and Lower pools without investing significant District staff resources.

Permitting - Water Use Permit - Tampa Bypass Canal Water Supply Project (including Hillsborough River Water Source)

Water Use Permit No. 20011796 for the TBC Water Supply Project was issued by District in March 1999 and has been renewed several times. The latest version authorizes withdrawal of raw water up to 258 mg (400 cfs) in total from the TBC Lower Pool and/or Middle Pool through the TBC pumping station located at Dr. M.L. King, Jr. Boulevard, near District Structure S-162, subject to withdrawal conditions detailed in other sections of this document.

Coordination Plan

Special condition 13 of WUP. No. 20011796 required Tampa Bay Water to develop and submit a Coordination Plan for the TBC. The Coordination Plan was submitted to the District in March 2002 and the District notified Tampa Bay Water that the TBC Coordination Plan met the requirements of Special Condition 13.

The Coordination Plan enables Tampa Bay Water to operate slide gates at Structure S-160, Structure S-161, and Structure S-162 for water supply management purposes while maintaining water level conditions in the TBC within historical ranges, and not compromising the integrity of the TBC as a flood control system.

Optimized Regional Operations Plan (OROP)

Special condition 3 of the CWUP provides the general requirements for an Operations Plan, including, "The Operations Plan shall be optimized to avoid or minimize environmental stress. Throughout the term of this permit, any changes to the Operations Plan that could result in a change to the distribution of wellfield withdrawals will require District approval." Currently, Tampa Bay Water is required to submit biennial reports on the operation of the Central System Wellfields (i.e., Consolidated Water Use Permit wellfields).

3.2.2 Water Sources

Tampa Bypass Canal Middle and Lower Pools

WUP No. 20011796 for the TBC and Hillsborough River High-water Supply authorizes withdrawal of raw water up to 258 mgd (400 cfs) total from the TBC Lower Pool and/or Middle Pool through the TBC pumping station located at Dr. M.L. King Jr. Boulevard, near District Structure S-162. The following sections describe the conditions for authorized withdrawals.

Middle Pool: When water is being diverted through Structure S-161 to the TBC Middle Pool, allowed withdrawal from the Middle Pool is up to diversion quantities, or greater than diversion quantities when flow at Structure 160 is 100 cfs (65 mgd) or greater. No Middle Pool withdrawals are allowed when water levels in the Middle Pool and Harney Canal are below an elevation of 12.5 feet as measured on gages at Structure S-161 and Structure S-162, or the difference between the Harney Canal and Hillsborough River Reservoir as measured on east/west gages at Structure S-161 is 9.5 feet or greater.

Lower Pool: When the water level in the TBC Lower Pool is at an elevation of 9.0 feet or greater as measured on the Lower Pool gage at Structure S-162, withdrawals of up to 258 mgd from the Lower Pool are authorized. No Lower Pool withdrawals are allowed when the difference in water levels between Lower and Middle pools is 6.5 feet or greater as measured at gages at Structure S-162.

Hillsborough River Diversions to TBC

The quantity of water to be diverted from the Hillsborough River to the TBC through Structure S-161 is to be determined based on the previous day's average calculated flow at the Hillsborough River Dam. The permitted diversion schedule is presented below and shown in Figure 2:

Hillsborough River Dam Discharge (cfs)	Structure S-161 Diversion (cfs)
0 – 100	0 (no diversion)
100 – 166	0% - 40% of total flow (sliding scale)
166 – 746	40% of total flow
>746	300

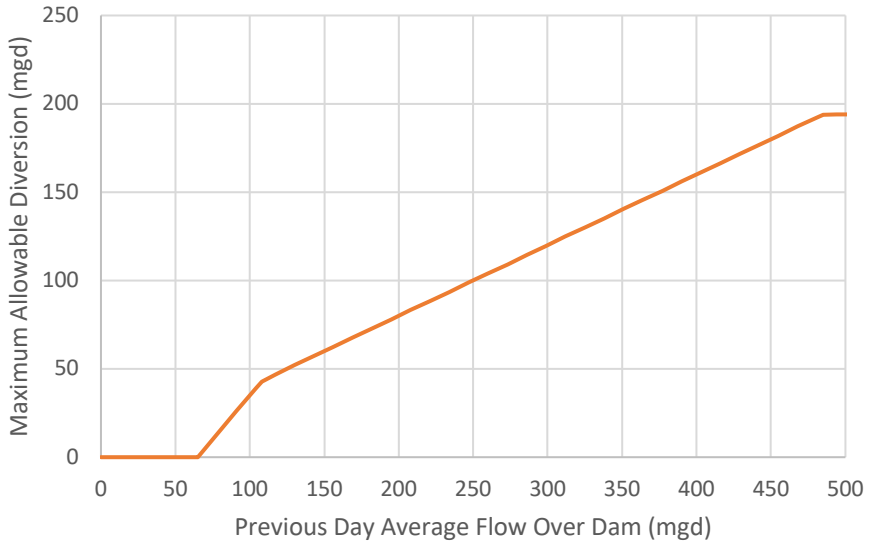

Figure 2. Maximum allowable diversions from the Hillsborough River Reservoir to the Tampa Bypass Canal versus the previous day's average flow over the Hillsborough River Dam

If the previous day's average flow over the dam is less than 65 mgd (100 cfs), no diversion is allowed.

If the previous day's average flow over the dam is greater than 65 mgd (100 cfs) and less than 108 mgd (166 cfs), then the allowable diversion is the amount over 65 mgd (100 cfs) as long as it is no more than 40% of the previous day's total average flow over the dam. The sliding scale of 0% to 40% refers to the percentage allowable based on taking all of the flow above the previous day average dam discharge of 100 cfs (65 mgd). At 100 cfs, the allowable diversion is 0% and at the other end of the flow range (166 cfs), the allowable diversion is 40% of the previous day's dam discharge while still leaving 100 cfs flow over the dam. For example: if the previous days average flow over the dam was 85.09 mgd, subtracting 65 mgd equals 20.09 mgd. Since 20.09 mgd is 23.6% of the previous day's average flow over the dam (20.09/85.09 = 23.6%), 20.09 mgd is the allowed diversion as it is less than 40%.

If the previous day's average flow over the dam is greater than or equal to 108 mgd (166 cfs), then the allowable diversion is 40% of that value up to 194 mgd (300 cfs). The maximum allowable diversion is 194 mgd (300 cfs). Figure 2 depicts these restrictions for the range of allowable withdrawals.

To preserve storage in the Hillsborough Reservoir and ensure that the minimum flows at the Hillsborough River Dam (20 cfs freshwater equivalents between July 1 and March 31 or 24 cfs freshwater equivalents between April 1 and June 30) are not affected by regional withdrawals, an additional operating constraint has been developed as a part of the Plan for regional water supply diversions through Structure S-161. This constraint would be implemented only as flows into the Hillsborough River Reservoir are receding to 100 cfs. Under such conditions, there exists a possibility that actual flow at the Hillsborough River Dam on a particular day could drop to 20 cfs or less while diversions (which are based on the previous day's discharge) through Structure S-161 are occurring. To address this situation, water diversion through Structure S-161 will cease for the remainder of the calendar day if discharge at the Hillsborough River Dam declines to a four-hour running average rate of 20 cfs (or 24 cfs) or less.

Tampa Bay Water's regional water supply system is comprised of interconnected transmission mains, wellfields, an off-stream reservoir, a surface water treatment plant (SWTP), a desalination plant, pump stations and booster pumps to supply wholesale drinking water to citizens throughout Hillsborough, Pasco, and Pinellas counties. Water withdrawn from TBC may be directed to the SWTP, or the regional reservoir, or both at the same time. In addition, water withdrawn from the Alafia River may go to either the regional reservoir or the SWTP. When the reservoir is being filled with water from TBC, the SWTP can only receive TBC water for treatment and any water withdrawn from the Alafia River will travel to the reservoir. If the reservoir is not being filled, any combination of flows from TBC, the Alafia River, and the regional reservoir may be blended in the raw water tanks and treated at the SWTP. If none of the surface water sources is available, Tampa Bay Water can meet drinking water demands through the wellfields and the desalination facility.

C.W. Bill Young Regional Reservoir

The C.W. Bill Young Regional Reservoir is a 15.5-billion gallon off-stream storage facility located in southeastern Hillsborough County. It stores surface waters from the Hillsborough and Alafia Rivers and the TBC. During dry times, when River and canal water is unavailable, water stored in the reservoir may be withdrawn, treated and blended with other supplies to serve the region. The facility is operated under Environmental Resource Permit (ERP) No. 29-0178328-008 issued by the Florida Department of Environmental Protection (FDEP).

Water in the reservoir is contained by an earthen embankment with a circumference at the crest of approximately five miles, and with height varying from 45 feet to more than 75 feet above the surrounding ground surface. The facility has a surface area of more than 1,000 acres and water depths when full varying from 40 to 80 feet. The maximum water elevation is 136.5 feet NGVD, and the minimum withdrawal elevation is 70.5 feet NGVD. The stored water is aerated and circulated to prevent low oxygen conditions and to prevent algal blooms. This is accomplished with either compressed air that is directed to seven aeration towers or air diffuser lines that run along the bottom.

Operational requirements of the reservoir are detailed in the Operations, Monitoring, and Maintenance (OM&M). The OM&M Plan is a comprehensive Plan for the safe and efficient operation of the reservoir and may be modified from time to time, but modifications must be reviewed and approved by the FDEP.

The reservoir is used as part of the larger Raw Water System that includes the facilities shown in Figure 3. Water entering and leaving the reservoir is controlled by the Tampa Bay Water operations control center, which is manned around the clock. When filling the reservoir, water is pumped into the control tower through an 84-inch pipeline and enters the reservoir through a gated check valve. Water is withdrawn from the reservoir through intake screens at varying elevations into the control tower and then into the same 84-inch pipeline. Tampa Bay Water staff determine the amount of water that can be withdrawn from the surface water sources daily, based on the permitted withdrawal schedules. On days when the quantity of surface water withdrawn from these sources exceeds the Surface Water Treatment Plant's desired production rate, the surplus water can be pumped to the reservoir for storage. On days when withdrawals from the surface water sources are less than the Surface Water Treatment Plant's desired production rate, the deficit may be made up by withdrawing stored water from the reservoir.

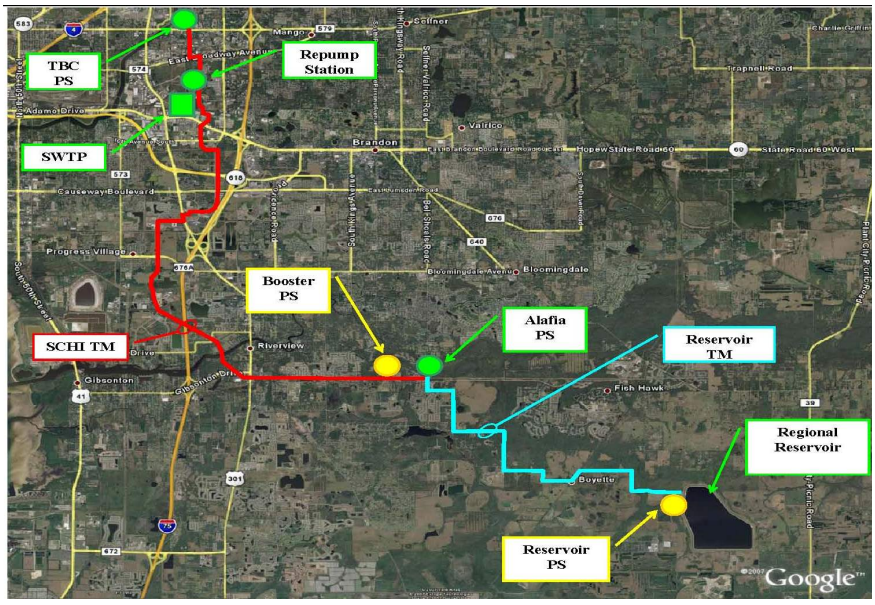

Figure 3. Tampa Bay Water's Raw Water System facilities including the C.W. Bill Young Regional Reservoir (TBC = Tampa Bypass Canal; PS = pump station; SWTP = Surface Water Treatment Plant; SCHI TM = South-Central Hillsborough Intertie Booster Station)

The maximum permitted operational drawdown rate for the reservoir is 100 mgd per the facility's operational ERP. Gravity flow from the reservoir to the Surface Water Treatment Plant varies depending on water elevation in the reservoir, the rate at which the Alafia River Pump Station is pumping, and the valve configuration at the water raw tanks that feed the Surface Water Treatment Plant. The maximum gravity flow rate is approximately 77 mgd and decreases with lower reservoir water elevations and increased Alafia River Pump Station pumping rates. In 2011, Tampa Bay Water completed construction of the Off-Stream Reservoir Pump Station to allow increased drawdown capacity from the reservoir to the Surface Water Treatment Plant. This pump station has a design capacity of 120 mgd.

The maximum permitted fill rate for the reservoir is 212 mgd. If streamflow in the surface water supply sources support large withdrawals, up to 180 mgd of surplus water from the TBC Pump Station can be pumped to the reservoir by the Repump Station when boosted by the South-Central Hillsborough Intertie Booster Station. This flow may then be further supplemented by up to 60 mgd from the Alafia River Pump Station. The permitted withdrawal schedules for the TBC and Alafia River pump stations are described in previous sections.

The maximum controlled emergency drawdown rate for the reservoir is 160 mgd. The procedure for lowering the reservoir in the event of an emergency is included as Appendix D-1 to the OM&M Plan. This procedure involves using the Off-Stream Reservoir Pump Station pumps together with blow-off assemblies located at Long Flat Creek and at the Alafia River Pump Station to withdraw water from the reservoir at a rate up to 160 mgd.

Harney Canal Augmentation of Hillsborough Reservoir

The Harney Pump Station is used when necessary to augment the City of Tampa's raw water supply by pumping water from the TBC Middle Pool to the Hillsborough River Reservoir.

Section 3.08(D) of the Amended and Restated Interlocal Agreement (Interlocal) states that the City of Tampa is granted priority for delivery of water from the TBC to augment the Hillsborough River Reservoir up to 20 mgd on an average annual basis and up to 40 mgd on a maximum daily basis (only as available based on hydrologic conditions). In addition, specific condition No. 3 of Tampa Bay Water's water use permit for the TBC Pump Station (No. 20011796.002) states that operation of the TBC Pump Station shall not interfere with the Hillsborough River Reservoir augmentation requirements as specified in the Amended and Restated Interlocal Agreement. The City of Tampa's water use permit for withdrawals from the Hillsborough River Reservoir (No. 20002062.006) states that the TBC will be the City of Tampa's first and primary augmentation source for the reservoir and will be used to meet augmentation demands before City of Tampa initiates withdrawals from Sulphur Springs.

Tampa Bay Water's current water use permit for the Harney Pump Station sets forth the criteria for when augmentation is allowed. It includes an annual average withdrawal limitation of 20 mgd, and a peak month limitation of 40 mgd. It also states that augmentation may commence from the TBC (see Section 3.3.1 Harney Canal (TBC Middle Pool)). The permit also states that augmentation withdrawals at the Harney pump station must stop when any of the following conditions exist:

1. The surface water elevation in the Harney Canal, as read on the gage at Structure S-161, is at or below twelve feet NGVD 29.
2. The difference in surface water elevations between the Harney Canal, as read at Structure S-161, and the Hillsborough River as read at Structure S-161, is ten feet or greater.
3. The stage at the Hillsborough River Dam is at or above 22.5 feet NGVD 29.

Emergency Pumping Authorizations may be considered under stipulated conditions.

3.2.3 Operations

To facilitate water supply management of the TBC system and afford general management of water levels in the middle and lower pools in accordance with the TBC Flood Control Structure Operating Agreement between the District and Tampa Bay Water, a number of slide gates at Structure S-160, Structure S-161, and Structure S-162 were equipped with motor operators, which can be activated locally or remotely based on a predetermined set of conditions as detailed in the TBC Coordination Plan.

The WUP requires that operation of the structures for water supply purposes shall not interfere with District operations. The first and foremost priority of these structures shall continue to be for the purposes of flood management. Augmentation of the Hillsborough River Reservoir by the Harney Canal pumping station shall also remain a priority. These functions supersede the operation of the TBC for regional water supply purposes.

In August 2007, the District established a minimum flow for the TBC and revised minimum flows for the lower Hillsborough River (see rules 40D-8.041(4) and (1), Florida Administrative Code, i.e., FAC, respectively). The minimum flow at Structure S-160 on the TBC is set at 0.0 cfs. Seasonally dependent minimum flows of 20 cfs or 24 cfs freshwater equivalents, with adjustments for reduced inflows to the Hillsborough River Reservoir, are required for the lower River. The District also adopted a Recovery Strategy in 2007 to achieve minimum flows in the Hillsborough River. A component of this Recovery Strategy is the designated use of water in the Middle and Lower pools of TBC. The flow conditions under which the District or the COT, as indicated in the Recovery Strategy, will use water from the TBC to aid in meeting the Hillsborough River minimum flows are fully described in Rule 40D-80.073(8), FAC. Use of water from the TBC to meet the Hillsborough River minimum flows supersedes the operation of the TBC for regional water supply purposes.

3.3 City of Tampa

The City of Tampa Water Department (TWD) and one of the City of Tampa's Public Works and Utility Services' departments treats and delivers drinking water to a service population of approximately 600,000 people within the city limits as well as parts of the City of Temple Terrace and unincorporated Hillsborough County.

Tampa is typical of most Florida communities. Water use varies throughout the year, with the lowest use occurring during the wet season. During the dry season, which occurs in late spring and late fall, water demands increase due to greater irrigation demands. The TWD relies on surface water resources as its primary water supply. The following section provides a detailed discussion on available water supply resources for the TWD and Tampa's operation and management of these resources.

3.3.1 Water Sources

City of Tampa holds a consumptive water use permit (No. 20002062.006) that authorizes annual average withdrawals of 82 million gallons per day (mgd) from the Hillsborough River Reservoir. The current water use permit was issued by the District on December 14, 2004, and will expire on December 14, 2024. The David L. Tippin Water Treatment Facility (DLTWTF), located adjacent to the reservoir, has a maximum daily treatment capacity of 120 million gallons a day. Almost all of Tampa's drinking water is treated surface water from the impounded portion of the Hillsborough River.

The Hillsborough River Reservoir (Reservoir), which is the stretch of River between the dam owned by the City of Tampa and the 40th Street Bridge, impounds more than 1 billion gallons of water. Additional sources include the Harney Canal (part of the TBC Middle Pool) and recovered water from the City's Aquifer Storage and Recovery System. A treated water point of connection (POC) with Tampa Bay Water's Regional Water main exists at the Morris Bridge Pump Station. The POC can provide treated water into the City's distribution system. The following sections of this Plan provide additional background information for these various water supply sources for the City of Tampa and how the City operates and manages of these resources.

Hillsborough River Reservoir

The Hillsborough River flows approximately 54 miles from its headwaters in the Green Swamp, located in central Florida, to upper Hillsborough Bay, where it discharges at a point located at the southern extremity of the Central Business District of the City. The Hillsborough River watershed encompasses portions of three counties: Hillsborough, Pasco and Polk. Typical land uses within the watershed are agricultural, industrial and urban.

As previously discussed, TWD owns, maintains and operates a dam (Figure 4) on the Hillsborough River about ten miles upstream of the point where the River discharges into Hillsborough Bay, forming the Hillsborough River Reservoir. With a storage capacity of more than 1 billion gallons of water, the Hillsborough River Reservoir is the primary source of drinking water supply for TWD's service area. The operation of the Hillsborough River Dam is the responsibility of TWD. Operational protocols are based on an agreement between TWD and the District, which is responsible for operating the Lower Hillsborough River Flood Protection System as guided by the "Four River Basins (FRB), Florida Project, Master Water Control Manual for Lower Hillsborough Flood Detention Area, and TBC."

Figure 4. The City of Tampa's dam on the Hillsborough River

The Hillsborough River Reservoir (Reservoir) receives water from the Hillsborough River, Trout Creek and Cypress Creek, as well as ungauged surface runoff. The gauged sources have highly variable seasonal flows and it is not uncommon for flows in Trout Creek, Cow House Creek and Cypress Creek to be zero.

Operation of the Reservoir is based on streamflow's, rainfall, potable water demands, and minimum flows established by the District for the Lower Hillsborough River. United States Geological Survey streamflow gauging stations in the Hillsborough River Basin are used to monitor flows. These stations include Hillsborough River State Park, Crystal Springs, Morris Bridge, Fowler, and the Hillsborough River Dam. During periods of high-water flow conditions, water is released over the dam and into the Harney Canal, in coordination with the District, to mitigate flooding. During normal rainfall conditions, the City coordinates with the District and Tampa Bay Water to allow flow from the River into the Harney Canal to supply water to Tampa Bay Water's regional water system. During low water flow conditions when the flow drops below 100 cfs over the dam, water can no longer be discharged into the Harney Canal. If the discharge over the dam drops to 11 cfs, pumps may be turned on at the Harney Canal and the dam, pumping water from the TBC middle pool into the River and over the dam to help maintain minimum flows in the lower River.

The TWD operates the Reservoir to maximize water supply availability to meet the City's water demands. The normal operating reservoir levels range between a maximum of 22.5 feet and a minimum of 14.5 feet NGVD29. Within that, range is about one billion gallons of storage. During the summer rainy season when daily flows in the River are typically well above supply needed to meet water demands and are above quantities that TBC can divert, management of the Reservoir focuses on flood control. However, during much of the water year, flows

in Hillsborough River can drop well below daily withdrawal rates required by the City to continue meeting daily demands. The primary source of augmentation to the Reservoir is the Harney Canal.

Downstream of the reservoir, the Lower Hillsborough River is tidally influenced by Hillsborough Bay and the amount of water flowing over the dam can affect the salinity level in the Lower Hillsborough River. For this reason, TWD must meet minimum flow requirements established for the Lower Hillsborough River. Additional discussion on the Minimum Flows requirement for the Lower Hillsborough River and sources for meeting the recovery strategy are provided in Section 4.0.

Harney Canal (TBC Middle Pool)

The TBC Middle Pool and Hillsborough River Reservoir (Reservoir) are interconnected by the Harney Canal, which is essentially a tributary canal of the Middle Pool. Structure S-161 can be used to control movement of water between the Harney Canal and the Reservoir. Tampa Bay Water holds a consumptive water use permit (No. 20006675.006), which authorizes annual average withdrawal from the Harney Canal of 20 mgd average annual and 40 mgd maximum day to augment the City's Hillsborough River Reservoir in support of the City's WUP No. 20002062.006. The canal withdrawal point is a combined set of three, high capacity, low-head pumps installed in the Harney Pump Station adjacent to Structure S-161. In normal operations, two of the pumps run simultaneously or individually depending on demand and in accordance with the permit conditions. One pump is available as an emergency backup. The City is granted priority for delivery of water from the TBC as outlined in the Amended and Restated Interlocal Agreement.

Morris Bridge Point of Connection

The Morris Bridge POC is designed to provide Tampa Bay Water regional water supply to the City of Tampa. Design pressure at the point of connection is a minimum of 30 psi. As outlined in the Master Water Supply Contract, it is an "Exhibit C" point of connection and can deliver approximately 45 mgd. The treated water from Tampa Bay Water is delivered to the Morris Bridge Pump Station's east storage tank and then pumped to the City's transmission and distribution system.

US Highway 301 Emergency Interconnect

Tampa Bay Water and the City of Tampa entered into the U.S. Highway 301 Point of Connection (POC) Joint Project Agreement on June 25, 2007. The U.S. Highway 301 POC is an emergency delivery point of connection with a capacity of 30 million gallons per day. The design pressure for this point of connection is 30 psi, unless the parties agree to a different pressure. It is not an "Exhibit C" connection at this time.

3.4 Coordination

The LHFDA is to be utilized to prevent Hillsborough River flows from contributing to water levels that negatively affect property adjacent to the Lower Hillsborough River (between City of Tampa and Structure S-155). TBC canals (C-135, C-136) and water management structures (Structure S-161, Structure S-159s, Structure S-162, Structure S-160) are designed to convey Lower and Upper Hillsborough River Basin water to McKay Bay. The full or partial closure of Structure S-155 will cause the diversion of River water into the LHFDA. The activation of Structure S-155 places the TBC in flood control mode. Prior to activating Structure

S-155 the District will notify Trout Creek Park staff, initiating required closure of recreational areas upstream of Structure S-155. Tampa Bay Water and the City of Tampa will also be notified.

Structure S-161 is located in C-136 (Harney Canal), approximately 1,300 feet east of the intersection of C-136 and the Lower Hillsborough River (City of Tampa reservoir). Structure S-161 is a two-bay spillway with 18 feet wide, remotely operated, vertical lift gates that can also be manually operated on-site and seat on an ogee weir crest at elevation 11.3 feet. In addition, the vertical lift gates have a sluice gate integrated into the upper portion of the gate. One of the sluice gates is manually operated and one is remotely operated (by Tampa Bay Water). The purpose of S-161 is to regulate the diversion of flows from the Hillsborough River to C-135 that are in excess of the capacity of the River channel downstream of the City of Tampa. The maximum capacity of Structure S-161 is 4,000 cfs. The District agrees to ensure that all requests to discharge water through Structure S-161, made by the City of Tampa, will be met and completed in a timely fashion. Any issues that may cause the District not to be able to fulfill the request will be communicated to City of Tampa immediately. All operations of Structure S-161 gates will be communicated to Tampa Bay Water and the City of Tampa.

The District will communicate all operations, maintenance issues in a timely fashion, providing data and information as requested.

4.0 Minimum Flows and Levels

4.1 Lower Hillsborough River Minimum Flows and Hillsborough River Recovery Strategy

In 1999, the District Governing Board approved a minimum flow of 10 cfs, equivalent to 6.4 mgd, at the base of the City of Tampa Dam to improve salinity conditions in the Lower Hillsborough River. The minimum flow was challenged and a settlement agreement was reached that established the 10 cfs minimum flow requirement into District rules (Rule 40D-8.041(1), Florida Administrative Code or FAC) in 2000, and inclusion of a 10 cfs minimum flow requirement as a special condition of Water Use Permit (WUP) 20002062.006 issued to the City of Tampa for withdrawals from the Hillsborough River, Sulphur Springs and an Aquifer Storage and Recovery system. The settlement agreement also required a scientific reevaluation of the established minimum flow. The draft reevaluation was completed in 2006 by District staff, reviewed by an independent scientific peer-review panel, and ultimately led to the adoption of revised minimum flows for the Lower Hillsborough River in 2007.

The revised, adopted minimum flows for the Lower Hillsborough River are based on extending a salinity range of less than 5 parts per thousand (ppt) from the base of the Hillsborough River Reservoir Dam toward Sulphur Springs. The minimum flows are: 20 cfs freshwater equivalent from July 1 through March 31, and 24 cfs freshwater equivalent from April 1 through June 30 at the base of the dam, as adjusted based on a proportionate amount that flow at the US Geological Survey (USGS) station No. 02303000, Hillsborough River near Zephyrhills, Florida is below 58 cfs. For every 1 cfs below 58 cfs at station No. 02303000, the minimum flow requirement is reduced by 0.35 cfs between July 1 and March 31, and by 0.40 cfs between April 1 and June 30. Freshwater equivalent means water that has a salinity concentration of 0.0 ppt for modeling purposes.

Because the revised minimum flows were not being achieved in the lower River, the Hillsborough River Recovery Strategy included in Rule 40D-80.073, FAC, was revised in 2007 to include several recovery projects

and a timeline for their implementation by the District and the City of Tampa. The strategy requires the established minimum flows for the Lower Hillsborough River to have been met by October 1, 2017. To achieve this goal, a joint funding agreement and several additional agreements were executed between the District and City of Tampa to implement recovery projects. The projects include pumping and diverting flows to the base of the dam from Sulphur Springs, the TBC, Morris Bridge Sink and Blue Sink. Projects associated with diverting flow from Sulphur Springs and Blue Sink have been completed and are being implemented by the City of Tampa. Projects for moving flow from the TBC to the Lower Hillsborough River have been completed and implemented by the District and City of Tampa. In addition, the District adopted a reservation and was issued a water use permit authorizing the withdrawal of water from the Morris Bridge Sink, in priority order, to assist in meeting the MFL. This source is available if needed, but permanent pumping facilities have not been constructed. If needed, temporary pumps may be installed to assist in meeting the MFL.

The adopted recovery strategy for the Lower Hillsborough River specifies the priority for use of the water sources identified for minimum flow recovery in the lower River. The specific sources, Sulphur Springs, Blue Sink, Morris Bridge Sink, and the TBC, are shown in Figure 5 and numbered according to their identified priority of use.

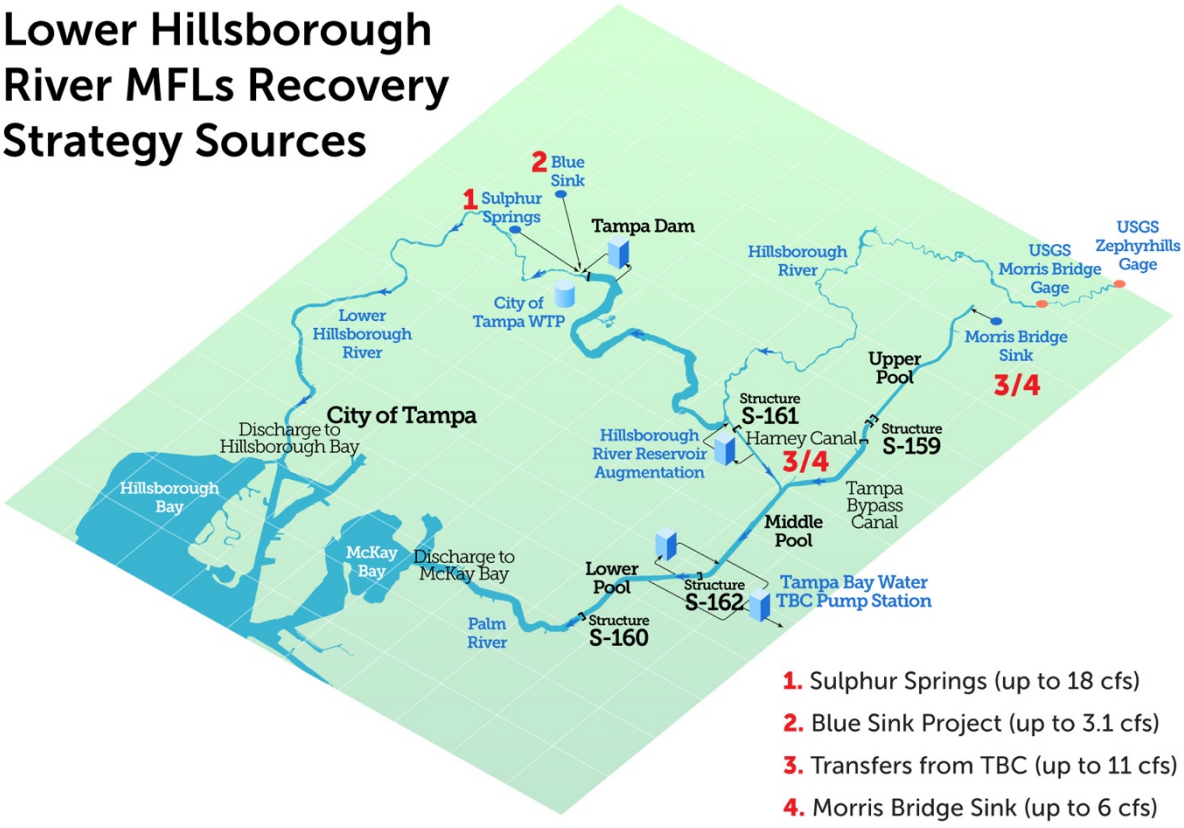

Figure 5. Four of the sources (numbered) identified for use in the minimum flows recovery strategy for the Lower Hillsborough River. Sources are numbered based on their identified order of use.

4.2 Data Coordination

4.2.1 USGS

Data from several USGS sites can be utilized to understand current and past conditions in the system. These data are provided in near real time as provisional on the USGS website. Following subsequent USGS review, these data are made available as approved records.

Relevant USGS sites include:

- Hillsborough River at State Park near Zephyrhills, Florida (No. 02303000)
  - Parameters collected: discharge, gage height, stream level (NAVD)
  - Relevance: if flows are less than 58 cfs at this gage, the required minimum flow is adjusted for the Lower Hillsborough River for the time flows remain less than 58 cfs.

- Hillsborough River near Tampa, Florida (No. 02304500)
  - Parameters collected: precipitation, discharge, and gage height
  - Relevance: reports total flow through the Hillsborough River Dam (weir plus large gates). Can be used to calculate flow for the base of the dam and support assessment of minimum flow recovery needs for the lower River.

- Sulphur Springs at Sulphur Springs, Florida (No. 02306000)
  - Parameters collected: bottom water temperature, precipitation, discharge, gage height, bottom specific conductance, stream level (NAVD)
  - Relevance: gage is within Sulphur Spring pool. Data can be used to monitor salinity and temperature as compared to the spring run for minimum flow needs and status for Sulphur Springs. Also used to identify availability of source water from Sulphur Springs for Lower Hillsborough River minimum flows recovery.

- Sulphur Springs Run at Sulphur Springs, Florida (No. 023060003)
  - Parameters collected: Temperature, discharge, gage height, specific conductance, stream level (NAVD)
  - Relevance: gage is within Sulphur Spring run. Data can be used to monitor salinity and temperature as compared to the spring pool for determining minimum flow needs and status for Sulphur Springs. These data are also used to identify availability of source water from Sulphur Springs for Lower Hillsborough River minimum flows recovery.

- Hillsborough River at I-275 Bridge at Sulphur Springs, Florida (No. 023060013)
  - Parameters collected: top and bottom water temperature, gage height, top and bottom specific conductance, stream level (NAVD)
  - Relevance: the gage is within the Hillsborough River near the mouth of the Sulphur Springs Run. Data from the site can be used to monitor salinity and especially temperature in the River. River water temperature information is used for determining minimum flow needs and status for Sulphur Springs.

4.2.2 City of Tampa

The City of Tampa provides data to the District for sites in the system on an hourly and daily average submitted to the District via email in pdf format approximately twice a week reporting flow used to augment the Lower Hillsborough River flow and achieve the MFL. Daily average data is reported on a monthly basis to the District that is associated with a water use permit condition. This data is uploaded via spreadsheet directly to the ePIC system. The hourly data contained in the emailed pdf reports includes:

- Flow diverted from the Hillsborough River Reservoir to base of dam over the weir (WUP 20002062, DID 300)
- Flow diverted from Sulphur Springs to the base of dam (WUP 2002062, DID 903)
- Flow diverted from Blue Sink to base of dam (WUP 20020382, DID 1)
- Flow diverted from Middle Pool of the TBC to the Hillsborough River Reservoir (WUP 20020802, DID 1)
- Flow diverted from Reservoir to the base of the dam via a sluice gate (WUP 2002062, DID 905)
- Sulphur Springs Run flow (WUP 2002062, DID 301); and
- Calculated total Lower Hillsborough flow

If pumping is initiated by City of Tampa at Structure S-161, the City of Tampa notifies District operations staff in the most expeditious manner available. District staff can then determine if pumping needs to be initiated at Structure S-162 based on the rule criteria.

4.2.3 Tampa Bay Water

Tampa Bay Water automated a nightly email that informs District Operations staff of the daily average total flow over the Structure S-162 structure. District staff can utilize to determine if pumping may occur at the Lower Pool to assist in achieving the MFL. If the daily average total flow reported for Structure S-162 is greater than 11 cfs, the Lower Pool should not be used for augmentation. If the daily average total flow reported for Structure S-162 is less than 11 cfs, the Lower Pool may be utilized for augmentation.

Tampa Bay Water also submits a daily operations report to City of Tampa and the District. Figure 6 provides an example of the data provided by Tampa Bay Water in the daily email.

ENHANCED SURFACE WATER SYSTEM (MG unless noted)

	QUANTITY DELIVERED	QUANTITY ALLOWED	WATER LEVELS (FT MSL) NGVD 29		STREAM FLOWS		
MIDDLE POOL TO TBC PS	0.00	194.00	HILLSBOROUGH RIVER	22.80	HILLSBOROUGH RIVER DAM	662.19	
LOWER POOL TO TBC PS	19.18		MIDDLE POOL	14.05	S-161 (HR to MP)	0.00	
ALAFIA RIVER PS	5.74	49.65	LOWER POOL	9.90	S-162 (MP to LP)	96.90	
RESERVOIR INFLUENT	0.00		ALAFIA RIVER	9.42	S-160 (LP to Bay)	100.41	cfps
PLUG VALVE	35.08		RESERVOIR (max=136.5)	128.88	ALAFIA RIVER	564.74	874.21
RESERVOIR EFFLUENT	29.34		RESERVOIR STORAGE (BG)	12.96	HILLS RIVER AT MB RD	597.75	925.31
HARNEY CANAL PS	0.00	40.00			LITHIA MAJOR + BUCKHORN	15.11	23.39

Figure 6. Example Tampa Bay Water Daily Operations Report

4.2.4 Water Management District

The District monitors water levels upstream and downstream of the Structure S-161 and Structure S-162 structures. These data are viewable in near real time on the Structures Web Application that is located on the District's website and the District's Supervisory Control and Data Acquisition (SCADA) system. The most recent 15-minute data are presented in the web application and monitored in the SCADA. These data may assist in determining which priority sources may be used within the TBC if the pump at Structure S-161 is utilized the City of Tampa to divert water from the Middle Pool to the Reservoir. The District will take corresponding operation in the SCADA.