

## **5.E.1 WATER QUALITY**

The following subsections summarize the existing surface water resources, drainage systems, groundwater resources, and stormwater management systems, as well as the laws and regulations governing these resources at FLL. Additional information is provided in Appendix L, *Water Resources*.

### **5.E.1.1 Regulatory Context**

#### **5.E.1.1.1 FEDERAL**

The Federal Water Pollution Control Act, commonly known as the Clean Water Act (CWA), governs the control of water pollution in the nation. The objective of the act is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Federal agencies are required to comply with all Federal, state, interstate, and local water pollution control requirements both substantively and procedurally. The CWA provides the statutory basis for state water quality standards programs.

Section 401 of the CWA includes Water Quality Certification, and Section 402 of the CWA describes the National Pollution Discharge Elimination System (NPDES). Section 401 requires that states certify compliance of Federal permits or licenses through the state Water Quality Certification program and ensure that actions are consistent with the water quality regulations of the State of Florida. The USEPA regulates these programs in accordance with Title 40, Chapter I, Part 131, Code of Federal Regulations (40 CFR 131).

The Oil Pollution Act of 1990, as amended, requires the prevention of oil pollution into navigable waters by tank vessels. This includes the preparation of a response plan and inspection of spill response equipment. This act applies to the storage of flammable/combustible liquids. Prior to 1990, the Water Quality Improvement Act of 1974 was the primary Federal law governing the discharge of oil into navigable waters. This regulation prohibits the discharge of harmful quantities of oil into navigable waters.

The Safe Drinking Water Act (SDWA) regulates the safety of drinking water in the country and requires entities of the Federal Government to comply with all requirements of state programs designed to prevent contamination of underground sources of drinking water. The Sole Source Aquifer Program (SSA), authorized by Section 1424(e) of the SDWA, requires the USEPA to review any Federally financially-assisted projects that have the potential to contaminate an aquifer which has been designated a sole source.

### **5.E.1.1.2 STATE AND LOCAL**

**State of Florida:** In the State of Florida, the 1972 Water Resources Act, the Florida Air and Water Pollution Control Act, and the State Comprehensive Plan address water resources and natural systems protection.<sup>1</sup>

The Florida Department of Environmental Protection (DEP) administers Water Quality Certification in the State of Florida. Permitting and enforcement authority under Section 402 of the CWA has been delegated by the USEPA to Florida DEP under the Wastewater Program.<sup>2</sup> The Florida DEP was authorized by the USEPA in October 2000 to implement the NPDES stormwater permitting program in the State of Florida, in all areas except those controlled by Tribal entities.

The Florida surface water quality standards system is published in Chapter 62-302, Florida Administrative Code (FAC). The components of this system include classifications, criteria, an anti-degradation policy, and special protection of certain waters, e.g. Outstanding Florida Waters. The Florida DEP Ground Water Regulatory Program is responsible for implementation and support of regulatory programs affecting groundwater quality under Chapter 62-520, FAC.

The NPDES stormwater program regulates point source discharges of stormwater into surface waters of the State of Florida from certain municipal, industrial, and construction activities. As the NPDES stormwater permitting authority, Florida DEP is responsible for promulgating rules and issuing permits, managing and reviewing permit applications, and performing compliance and enforcement activities. The Florida NPDES stormwater permitting program is separate from the state stormwater/environmental resource permitting programs and local stormwater / water quality programs, which have their own regulations and permitting requirements.<sup>3</sup>

The Florida DEP manages both the quantity and quality of water through its relationship with the State of Florida's five water management districts. The 1972 Water Resources Act gives Florida DEP "general supervisory authority" over the districts and directs Florida DEP to delegate water resources programs to them, where possible. The Project Study Area is located within the jurisdiction of the South Florida Water Management District (SFWMD). Regulatory authority under programs delegated to the SFWMD include management of the consumptive use of water, aquifer recharge, well construction, and surface water management, and the administration of the DEP's stormwater management program. The canal system surrounding FLL including primary, secondary, and tertiary canals, is considered a water of the State of Florida, and is classified as Class III waters.

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<sup>1</sup> Internet web site: <http://www.dep.state.fl.us/legal/Rules/shared/62-40.pdf>, Florida Department of Environmental Protection (Florida DEP), Last updated: December, 4 2006.

<sup>2</sup> Internet web site: <http://www.dep.state.fl.us/water/wastewater/index.htm>, Florida Department of Environmental Protection (Florida DEP), Last updated: April 23, 2004.

<sup>3</sup> Internet web site: <http://www.dep.state.fl.us/water/stormwater/npdes/index.htm>, Florida Department of Environmental Protection (Florida DEP), Last Updated: November 05, 2004.

Class III waters are designated as being used for "recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife."<sup>4</sup> The waterbodies surrounding FLL are considered predominantly marine.<sup>5</sup>

The Florida DEP is also responsible for regulating public water systems in the State of Florida. This authority derives from Chapter 403, Part IV, Florida Statutes (FS), and by delegation of the Federal program from the USEPA.

**Broward County:** Chapter 27 of the Broward County Code of Ordinances addresses pollution control. Most of the water resources regulations are contained in Article V Water Resource Management. The Broward County Department of Planning and Environmental Protection (BCDPEP) Water Resources Division's primary function is water resources planning and licensing countywide.

### **5.E.1.2 Stormwater Management at FLL**

Elevations at FLL range from sea level to ten feet above the 1988 North American Vertical Datum. Slopes are generally mild to flat, ranging from 0.01 to 0.98 percent and soils are moderately drained. The airport is approximately 77 percent impervious. For existing conditions (survey conducted in 2004) drainage problems include shallow ponding in airside and landside areas during high intensity rainfall events with a recurrence interval greater than five years.<sup>6</sup>

#### **5.E.1.2.1 FLL DRAINAGE BASINS**

Surface water runoff at FLL is collected in a series of catch basins, storm sewers, ditches, swales, and canals through each of four major drainage basins. These basins include the Northern Basin, the Eastern/Terminal Basin, the Western Basin, and the Ravenswood Watershed, which discharge via the seven outfalls graphically depicted on **Exhibit 5.E.1-1, Major Basins and Outfall Locations of the Existing Baseline Stormwater Management System at FLL.**

The primary stormwater management system at FLL includes stormwater pollution control structures, such as oil/water separators, weir boxes, and exfiltration trenches. Dry detention swales and wet detention swales are located around the airport.

**Northern Basin:** The Northern Basin consists of approximately 250 acres. It includes a portion of Runway 9L/27R, the adjacent taxiways, and a number of fixed-base operators (FBOs) located within the North airfield. Stormwater runoff from this basin is collected in a drainage swale located between Taxiway A and the adjacent Service Road. This swale drains towards the west, turning toward the northwest along the south side of the Service Road at the northwest end of Runway 13/31, turning northward, under the North Facilities Service Road, to

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<sup>4</sup> Florida Administration Code Chapter 62-302 Surface Water Quality Standards, Florida Department of State, Last Revision: 2006/11/13.

<sup>5</sup> Personal Communication, Kevin S. Carter, Broward County, Department of Planning & Environmental Protection, Environmental Monitoring Division, December 2004.

<sup>6</sup> Fort Lauderdale Hollywood International Airport Stormwater Master Plan, Camp Dresser and McKee Inc., July 2001, pg. 1-7.

Outfall 4. Runoff from the basin is discharged northward under Interstate-595, State Road 84, and Interstate-95, via Osceola Creek to the South Fork New River, as graphically depicted on **Exhibit 5.E.1-2 (a), Northern Basin Existing Baseline Stormwater Management System at FLL, Including Outfall and Minor Sub-basins, and Drainage Infrastructure.**<sup>7</sup>

**Eastern/Terminal Basin:** The Eastern/Terminal Basin consists of approximately 650 acres. It includes the passenger terminal area, ramps, taxiways, parking facilities, the consolidated rental car facility under construction for existing conditions (survey conducted in 2004), rental car agencies, and a portion of Runways 9L/27R, 9R/27L, and 13/31. Runoff from the easternmost portion of this basin discharges from Outfalls 2 and 3, via the Florida Department of Transportation (DOT) drainage system for U.S. Highway 1 and the Interstate-595 interchange, which discharge to the Dania Cut-Off Canal. Runoff from the western three-fourths of this basin discharges from Outfall 1 directly into the Dania Cut-Off Canal, as graphically depicted on **Exhibit 5.E.1-2 (b), Eastern/Terminal Basin Existing Baseline Stormwater Management System at FLL, Including Outfall and Minor Sub-basins, and Drainage Infrastructure.**<sup>8</sup>

**Western Basin:** The Western Basin consists of approximately 420 acres. It includes a portion of Runways 9L/27R, 9R/27L, and 13/31; the adjacent taxiways, ramps, and parking facilities; Broward County Aviation Department maintenance facilities and rental car facilities; and a number of FBOs located within the West airfield. Stormwater runoff from this basin is collected in a series of catch basins, swales, ditches, culverts, and canals. Stormwater runoff is then discharged from two separate structures (Outfalls 6 and 7) directly into the Dania Cut-Off Canal, as graphically depicted on **Exhibit 5.E.1-2 (c), Western Basin Existing Baseline Stormwater Management System at FLL, Including Outfall and Minor Sub-basins, and Drainage Infrastructure.**

**Ravenswood Watershed:** The Ravenswood Watershed is located to the west of Interstate-95. It includes the offsite employee and remote parking facilities. Stormwater runoff from this watershed discharges from Outfall 5 into a finger canal tributary to the Dania Cut-Off Canal, as graphically depicted on **Exhibit 5.E.1-2 (d), Ravenswood Watershed Existing Baseline Stormwater Management System at FLL, Including Outfall and Minor Sub-basins, and Drainage Infrastructure.**

#### **5.E.1.2.2 PERMITTING**

**Surface Water Management and Environmental Resource Permitting:** As discussed above in Regulatory Context, the SFWMD has been delegated surface water management authority and the administration of the Florida DEP stormwater management program at FLL. The first permit issued to Broward County for the management of stormwater at FLL was issued by the Central and Southern Florida

<sup>7</sup> Fort Lauderdale-Hollywood International Airport Stormwater Pollution Prevention Plan, MACTEC Engineering and Consulting of Georgia, Inc., December 2002.

<sup>8</sup> Fort Lauderdale-Hollywood International Airport Stormwater Pollution Prevention Plan, MACTEC Engineering and Consulting of Georgia, Inc., December 2002.

Flood Control District (FCD) in 1967 (FCD Permit No. 3274) and authorized a double barrel culvert connection to the Dania Cut-Off Canal, which drained approximately 400 acres of airport property. The first Surface Water Management Permit issued to FLL on March 12, 1981 (No. 06-00339-S) authorized the construction and operation of a water management system serving slightly more than 300 acres of taxiways and aprons with discharges to the Dania Cut-Off Canal. This permit was modified numerous times to account for significant project changes and to include additional areas not covered by the original permit.<sup>9</sup> Several additional permits have been issued for areas on the west side of the airport, the Ravenswood Watershed, in addition to a series of water use permits. An inventory of the permits issued by the SFWMD and its predecessor, the Central and Southern Florida FCD, to the Broward County Aviation Department since 1967 is included in Appendix L, *Water Resources*.

The BCDPEP issues two types of licenses, including a Surface Water Management License, for projects greater than an acre, and a General License for smaller projects. The Broward County Department of Natural Resource Protection (BCDNRP) has not issued a general permit or license to Broward County for FLL, which includes the entire airport. An inventory of the permits or licenses issued since 1982 to Broward County for FLL is located in Appendix L, *Water Resources*.

**Florida Pollutant Discharge Elimination System Permitting:** As discussed above in Regulatory Context, Florida DEP issues permits for industrial and municipal discharges to the state's waters. Broward County and the FLL tenants that conduct air transportation operations are regulated under the NPDES Industrial Activity Phase I; Standard Industrial Classification Code 4512-4581 Air Transportation Facilities, Sector S-Air Transportation Facilities. This regulation requires Broward County and those airport tenants whose operations fall within this Standard Industrial Classification Code to obtain a State of Florida Multi-Sector Generic Permit for Stormwater Discharge Associated with Industrial Activity (MSGP). The MSGP number for both Broward County and FLL tenants is FLR05A457.<sup>10</sup> An inventory of the Notices of Intent (NOIs) submitted to Florida DEP to request use of the MSGP for Stormwater Discharge Associated with Industrial Activity at FLL is located in Appendix L, *Water Resources*.

**Stormwater Pollution Prevention Plan (SWPPP):** A Stormwater Pollution Prevention Plan (SWPPP) has been prepared for FLL in accordance with the requirements set forth in the Federal Register Notice entitled *Final Re-issuance of National Pollutant Discharge Elimination System (NPDES) Stormwater Multi-Sector General Permit (MSGP) for Industrial Activity* Volume 65, Number 210, dated October 30, 2000. It documents procedures for FLL to eliminate or reduce pollution of stormwater runoff. Broward County has developed, and continues to implement, a comprehensive approach to address the environmental management of stormwater discharges associated with industrial activities and air transportation

<sup>9</sup> *Update Existing Water, Sewer and Drainage Permits Fort Lauderdale-Hollywood International Airport*, Williams, Hatfield & Stoner, Inc., Revised October 1996.

<sup>10</sup> *Fort Lauderdale-Hollywood International Airport Stormwater Pollution Prevention Plan*, MACTEC Engineering and Consulting of Georgia, Inc., December 2002.

facility operations at FLL. This approach currently applies to approximately 46 tenants performing fueling, maintenance, cleaning, and/or other activities that may result in the discharge of pollutants to the stormwater management system.<sup>11</sup>

### **5.E.1.3 Surface Water Resources**

The surface features of the State of Florida are the result of a complex interaction of deposition and erosion. Marine waters have repeatedly inundated the Florida Platform during the later Cenozoic Era, resulting in marine depositional processes dominating the development of Florida's geomorphology.<sup>12</sup> The Study Area is located in an area of generally flat terrain, where land surface elevations do not exceed 15 feet above sea level.<sup>13</sup>

Broward County's system of drainage consists of approximately 266 miles of waterways. The primary drainage system maintained by the SFWMD includes nine major canals and associated drainage basins. Primarily, the canals are used for flood control, with secondary uses including discharge of excess water from the Water Conservation Areas (WCAs), prevention of saltwater intrusion, recharge of wellfields, and drainage of land for development.<sup>14</sup>

Water management by the SFWMD, the Broward County Water and Wastewater Services Water Management Division, and/or Independent Drainage Districts is often determined by rainfall, water elevations, and/or the threat of tropical weather systems. Annual rainfall is highly variable, averaging approximately 53 inches, with two-thirds (35 inches) falling during the June through October wet season.<sup>15</sup> These rainfall amounts, combined with the large area of impervious urban land, make stormwater runoff in eastern Broward County a major transport mechanism for land-based pollutants. Water levels and discharges can be quite variable within the canal system, as well as between adjacent canals. The complicated stormwater conveyance through this system, including primary, secondary, and tertiary canals, adds to the complexity of identifying the source(s) and tracking the fate of stormwater pollutants.<sup>16</sup> The canal system, including primary, secondary, and

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<sup>11</sup> *Fort Lauderdale-Hollywood International Airport Stormwater Pollution Prevention Plan*, MACTEC Engineering and Consulting of Georgia, Inc., December 2002.

<sup>12</sup> *Florida's Groundwater Quality Monitoring Program, Hydrogeologic Framework – Florida Geological Survey – Special Publication No. 32*, Maddox, G. and J. M. Lloyd, October 1992.

<sup>13</sup> *Assessment of Saltwater Intrusion in Southern Coastal Broward County, Florida - Water-Resources Investigations Report 99-4221*, Merritt, M. L., 1996.

<sup>14</sup> *Broward County, Florida Historical Water Quality Atlas: 1972-1997 - Technical Report Series, TR: 01-03*, Broward County Department of Planning and Environmental Protection (BCDPEP), February 28, 2001.

<sup>15</sup> *The South Florida Environment - U.S. Geological Survey Circular 1134*, McPherson, B. F. and R. Halley, 1996.

<sup>16</sup> *Broward County, Florida Historical Water Quality Atlas: 1972-1997 - Technical Report Series, TR: 01-03*, Broward County Department of Planning and Environmental Protection (BCDPEP), February 28, 2001.

tertiary canals, is considered a water of the State of Florida, and is classified as a Class III water. Class III waters are designated as being used for "recreation, propagation, and maintenance of a healthy, well balanced population of fish and wildlife."<sup>17</sup>

### **5.E.1.3.1 BROWARD COUNTY DRAINAGE BASINS**

FLL is located within the New River Basin of the East Coast Urban Area. The New River Basin is divided into a number of sub-basins, including the South Fork New River, North Fork New River, and Intracoastal Waterway. FLL is located within the estuarine portion of the South Fork New River Sub-basin, immediately to the north of the Dania Cut-Off Canal, as graphically depicted on **Exhibit 5.E.1-3, Water Management Basins, Primary Canals, Control Structures, and BCDPEP Surface Water Sampling Locations within the Project Study Area.**

**South Fork New River (C-11) Sub-basin:** The South Fork New River is composed of two freshwater tributaries, including the South New River (C-11) Canal and the North New River Canal. These converge and then join with the North Fork New River to form the New River. The C-11 Canal drains a total area of about 104 square miles, including approximately 81 square miles in the western part of the drainage basin and 23 square miles in the eastern part of the drainage basin.<sup>18</sup> Land use along the C-11 Canal is partially residential with a significant number of commercial marine industry properties. Flow in the C-11 Canal is maintained chiefly by groundwater inflow, which may occur directly or into the many drainage canals that discharge into the C-11 Canal. Surface runoff from low areas occurs during periods of heavy rainfall. Flow may be either to the east or to the west. Structure S-13 regulates water level at the east end of the C-11 Canal by controlling discharges to tidewaters.<sup>19</sup> Tidewaters east of Structure S-13 split into the South Fork New River and the Dania Cut-Off Canal.

The North New River Canal drains a total area of about 30 square miles. There are approximately 23 square miles in the western part of the drainage basin and seven square miles in the eastern part of the drainage basin.<sup>20</sup> Flow in the North New River Canal is maintained by releases and seepage from Water Conservation Area (WCA) 2 and WCA 3, and by groundwater inflow that enters either directly or from the secondary canals that discharge into the Canal. Control Structure G-54, located

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<sup>17</sup> *Florida Administration Code Chapter 62-302 Surface Water Quality Standards*, Florida Department of State.

<sup>18</sup> *Broward County, Florida Historical Water Quality Atlas: 1972-1997 - Technical Report Series, TR: 01-03*, Broward County Department of Planning and Environmental Protection (BCDPEP), February 28, 2001.

<sup>19</sup> *New River Restoration Plan Update: Activities and Accomplishments from 1991 to 2002 - Technical Report Series, TR: 01-01*, Broward County Department of Planning and Environmental Protection (BCDPEP), January 2001.

<sup>20</sup> *Hydrological Conditions in Broward County, Florida, 1976 - Open-File Report 79-1258*, Beaven, T.R., 1979.

approximately 1.7 miles west of U.S. Highway 441, controls water levels in the eastern part of the canal. The canal is tidal east of G-54 and joins the South Fork New River just east of U.S. Highway 441.<sup>21</sup>

**North Fork New River Sub-basin:** The North Fork New River is a shallow, meandering tributary of the New River extending through the northwest section of the city of Fort Lauderdale and unincorporated Broward County. The river lies in the same drainage basin as the freshwater Plantation (C-12) Canal upstream of Structure S-33. Land use is mixed along this fork of the river and includes industrial, commercial, multi-family residential, single-family residential, and parks. The majority of the properties south of Broward Boulevard to the confluence with the South Fork New River are on septic systems.<sup>22</sup>

Minimal tidal flow within this section of the river limits circulatory exchanges of tidal waters. Flow has been restricted by large amounts of sediment and debris, especially south of Broward Boulevard. Natural freshwater flow characteristics are further restricted in the upstream section of the North Fork New River by Structure S-33. Opening of this salinity control structure is typically limited to significant storm events, effectively eliminating freshwater inflows from the western C-12 drainage basin. Other sources of water include continuous groundwater inflow from the surrounding basin, point source, and non-point source inflows of stormwater runoff.<sup>23</sup>

**Intracoastal Waterway Sub-basin:** The New River is located in east-central Broward County. The main New River meanders through the center of downtown, urban Fort Lauderdale, characterized by many office centers, buildings, shops, and restaurants.<sup>24</sup> The Las Olas Isles are a series of artificial islands located along Las Olas Boulevard in east-central Fort Lauderdale. The Isles are a transition area between the New River and the Middle River on the Intracoastal Waterway.<sup>25</sup>

All the basins described above flow into the Intracoastal Waterway where the outflow is mixed with tidal waters and discharges through Port Everglades Inlet to the Atlantic Ocean.<sup>26</sup>

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<sup>21</sup> *New River Restoration Plan Update: Activities and Accomplishments from 1991 to 2002 - Technical Report Series, TR: 01-01*, Broward County Department of Planning and Environmental Protection (BCDPEP), January 2001.

<sup>22</sup> *North Fork New River Operational Flow (OPFLOW) 2002 Study - Technical Report Series, TR: 03-07*, Broward County Department of Planning and Environmental Protection (BCDPEP), October 2003.

<sup>23</sup> *New River Restoration Plan Update: Activities and Accomplishments from 1991 to 2002 - Technical Report Series, TR: 01-01*, Broward County Department of Planning and Environmental Protection (BCDPEP), January 2001.

<sup>24</sup> *Broward County, Florida Historical Water Quality Atlas: 1972-1997 - Technical Report Series, TR: 01-03*, Broward County Department of Planning and Environmental Protection (BCDPEP), February 28, 2001.

<sup>25</sup> *New River Restoration Plan Update: Activities and Accomplishments from 1991 to 2002 - Technical Report Series, TR: 01-01*, Broward County Department of Planning and Environmental Protection (BCDPEP), January 2001.

<sup>26</sup> *New River Restoration Plan Update: Activities and Accomplishments from 1991 to 2002 - Technical Report Series, TR: 01-01*, Broward County Department of Planning and Environmental Protection (BCDPEP), January 2001.

### **5.E.1.3.2 SURFACE WATER QUALITY**

Primary water bodies within the Project Study Area include the C-11 Canal, South Fork New River, and Dania Cut-Off Canal, all of which are located within the South Fork New River Sub-basin, described above. Surface water runoff from FLL drains to the Atlantic Ocean via several local rivers and canals, including the Dania Cut-Off Canal and the New River, via Osceola Creek and the South Fork New River.

Since 1972, the BCDPEP, then named the Broward County Pollution Control Board, has monitored the water quality of waterways within the County. Nine sampling sites are located within the Project Study Area, including:

- Site 27, South New River (C-11) Canal;
- Site 26, Dania Cut-Off Canal;
- Site 24, Dania Cut-off Canal;
- Site 47, Dania Cut-Off Canal;
- Site 25, Hollywood (C-10) Canal;
- Site 90, South Fork New River;
- Site 20, South Fork New River;
- Site 21, North New River Canal; and
- Site 39, Intracoastal Waterway.

Site 19, located at the South Fork New River, has been included in this assessment because it is the closest sampling location downstream of the confluence with Osceola Creek. Outfall 4 within Site 19 of the FLL stormwater management system discharges into Osceola Creek, as graphically depicted on Exhibit 5.E.1-3, *Water Management Basins, Primary Canals, Control Structures, and BCDPEP Surface Water Sampling Locations within the Project Study Area*.

In 2004, the sites listed above were sampled four times for each of sixteen water quality parameters. These water quality parameters include: pH; specific conductance; water temperature; turbidity; dissolved oxygen; total organic carbon; nitrogen forms including ammonia and ammonium nitrogen, nitrite and nitrate nitrogen, and total Kjeldahl nitrogen; phosphorus, including orthophosphate and total phosphorus; chlorophyll a; pheophytin-a (a degradation product of chlorophyll a); and bacteriological parameters, including total coliform bacteria and fecal coliforms. Sampling was conducted twice during both the dry season (November through May) and the wet season (June through October).

Appendix L, *Water Resources*, includes summaries of the sampling results for 2004 existing conditions, descriptive statistics for the (1989 through 2003) sampling results from 1998 through 2003 (since the cessation of wastewater treatment discharges), and the complete sampling dataset for the period 1989 through 2003 for each sampling site within the Study Area, including Site 19.

**South New River (C-11) Canal:** *The South New River (C-11) Canal is a primary canal, which begins at the Miami Canal in WCA 3A in western Broward County. The canal extends east from Structure S-9 for 18 miles, where it divides into the Dania Cut-Off Canal and the South Fork New River.<sup>27</sup> Structure S-9 is a pump station, which removes floodwater from the South New River Canal east of Structure S-9 and discharges it into WCA 3A. Structures S-13A and S-13 regulate flow in the east part of the canal.<sup>28</sup> Structure S-13 is a coastal control structure, which consists of three pumping units with a gated spillway. The pumping units maintain optimum water-control stages upstream in the C-11 Canal and prevent saltwater intrusion during periods of high tides.<sup>29</sup>*

Only Site 27, one of the three surface water quality stations maintained by BCDPEP on the C-11 Canal, is located within the Study Area. This sampling location is located immediately to the west of Structure S-13. Site 27 has been monitored continuously since 1973.

**Dania Cut-Off Canal:** The Dania Cut-Off Canal is a primary canal and heads at the meeting of the C-11 Canal, South Fork New River, and Dania Cut-Off Canal, approximately 0.35 miles east of U.S. Highway 441. The Dania Cut-Off Canal flows east to join the Intracoastal Waterway just south of Port Everglades.<sup>30</sup> The majority of the runoff from the airport discharges directly, or indirectly, into this canal.

BCDPEP maintains three surface water quality stations on the Dania Cut-off Canal and one station on the Hollywood (C-10) Canal. All of these sites are located in tidally influenced waters, downstream of Structure S-13.

Site 26 is located on the Dania Cut-off Canal between Outfalls 5 and 6, to the west of FLL. The site has been continuously sampled by BCDPEP since 1973. Site 24 is located on the Dania Cut-off Canal, approximately 0.28 miles south of FLL. This sampling location is located approximately 0.17 miles east of Outfall 1. Sampling at Site 24 also began in 1973, with a hiatus between October 1974 and October 1978, after which sampling continued in unison with Site 26. Site 47 is located on the Dania Cut-Off Canal, 200 feet west of the confluence with the Intracoastal Waterway. This sampling location is located approximately 1.8 miles east of Outfall 1. The site has been monitored continuously since 1973.

**South Fork New River:** The South Fork New River is a primary canal and heads at the junction of the C-11 Canal, South Fork New River, and Dania Cut-Off Canal, east of U.S. Highway 441. The South Fork New River is a natural stream, which has been canalized in part. The North New River Canal enters from the west. Osceola Creek, a canalized tributary enters from the south, approximately three

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<sup>27</sup> *Assessment of Saltwater Intrusion in Southern Coastal Broward County, Florida - Water-Resources Investigations Report 99-4221, Merritt, M. L., 1996.*

<sup>28</sup> *Hydrological Conditions in Broward County, Florida, 1976 - Open-File Report 79-1258, Beaven, T.R., 1979.*

<sup>29</sup> *Determining Discharge-Coefficient Ratings For Selected Coastal Control Structures in Broward and Palm Beach Counties, Florida - Water Resources Investigations Report 98-4007, Tillis, G. M. and E. D. Swain, 1998, pg. 30.*

<sup>30</sup> *Assessment of Saltwater Intrusion in Southern Coastal Broward County, Florida - Water-Resources Investigations Report 99-4221, Merritt, M. L., 1996, pg. 19.*

miles from the head via a dredged boat basin. Two miles further to the northeast, the meandering South Fork New River meets the North Fork New River and the two branches form the New River.<sup>31</sup>

BCDPEP maintains three surface water quality stations on the South Fork New River. Site 90, located just north of State Road (SR) 84, and Site 20, located at the confluence with North New River Canal, are both located within the Study Area and upstream of Osceola Creek to which Outfall 4 discharges. Site 19, on the South Fork New River, falls outside the Study Area. However, as mentioned above, it is the closest sampling location downstream of Osceola Creek.

**Other Local Area Waterbodies:** Other major local area waterbodies within the Study Area include Hollywood (C-10) Canal, C-10 Spur Canal, Intracoastal Waterway, and the North New River Canal.

The C-10 Canal and C-10 Spur Canal are primary tributaries to the Dania Cut-Off Canal. The confluence of the C-10 Canal with the Dania Cut-Off Canal is located between Outfalls 1 and 7. Site 25 is located on the C-10 Canal at the Stirling Road bridge, approximately one mile north of the confluence with the C-10 Spur Canal and approximately 0.8 miles south of the confluence with the Dania Cut-Off Canal. Site 25 has been monitored since 1980.

The Intracoastal Waterway parallels the coast in Broward County and is separated from the ocean by a narrow offshore bar.<sup>32</sup> Of the nine surface water quality stations maintained by BCDPEP on the Intracoastal Waterway, only Site 39 is located within the Study Area. This sampling location is located 300 feet north of Marker #35, and 50 feet west of the east bank. Site 39 is heavily influenced by both Port Everglades and the Dania Cut-Off Canal and has been monitored since 1980.

The North New River Canal is one of the major canals in the SFWMD network. The canal is approximately 60 miles long, extending south from the southeastern tip of Lake Okeechobee to Structure S-7, a pump station located at the southeast corner of the Everglades Agricultural Area; south through the western boundary of WCA 2A; to Structure S-34, where gates control the flow. South of Structure S-34 the canal turns east to Structure G-54, a coastal control structure, and then to the ocean.<sup>33</sup> Of the three surface water quality stations maintained by BCDPEP on the North New River Canal, only Site 21 is located within the Study Area. This sampling location is located on the west side of Structure G-54. Site 21 has been monitored continuously since 1973.

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<sup>31</sup> *Water Resources of Southeastern Florida, With Special Reference to the Geology and Groundwater of the Miami Area - Geological Survey Water-Supply Paper 1255*, Parker, G. G. et. al., 1955, pg. 399.

<sup>32</sup> *Hydrological Conditions in Broward County, Florida, 1976 - Open-File Report 79-1258*, Beaven, T.R., 1979.

<sup>33</sup> *Hydrological Conditions in Broward County, Florida, 1976 - Open-File Report 79-1258*, Beaven, T.R., 1979.

**See Table 5.E.1-1, Annual 2004 Base Baseline and Summary of Pollutants Average Concentrations for Calendar Year 2004 for All BCDPEP Surface Water Quality Stations in Study Area.**

**Stormwater Quality Data at FLL:** Broward County is not currently subject to regulations requiring visual, analytical, or compliance monitoring of the stormwater outfalls located at FLL with respect to the Florida DEP NPDES Stormwater Program and the County's MSGP. Nevertheless, the County conducted limited monitoring of the stormwater outfalls located at FLL in 2004.

All seven outfalls were sampled during three monitoring events in 2004. Of the five parameters monitored, only chemical oxygen demand (COD) exceeded its MSGP benchmark at Outfall Nos. 6 and 7. The MSGP states, "exceedences of a benchmark value does not automatically indicate that a violation of a water quality standard has occurred. It does signal that modifications to the SWPPP may be necessary."<sup>34</sup>

A summary of the sampling results for the existing conditions (survey conducted in 2004) is contained in Appendix L, *Water Resources*.

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<sup>34</sup> 2004 Analytical Stormwater Monitoring Report, Fort Lauderdale-Hollywood International Airport (FLL) Ft. Lauderdale, Broward County, Florida, MACTEC Engineering and Consulting, Inc., December, 2004.

**Table 5.E.1-1  
ANNUAL 2004 BASELINE AND SUMMARY OF POLLUTANTS AVERAGE CONCENTRATIONS FOR CALENDAR  
YEAR 2004 FOR ALL BCDPEP SURFACE WATER QUALITY STATIONS IN STUDY AREA  
Fort Lauderdale-Hollywood International Airport**

Characteristic	Units <sup>1</sup>	2004 Baseline									
		Site 27	Site 26	Site 24	Site 47	Site 25	Site 90	Site 20	Site 19	Site 21	Site 39
<b>Physical Parameters</b>											
PH	std units	7.53	7.58	7.66	7.73	7.53	7.74	7.74	7.71	7.75	7.84
Salinity	ppt	0.4	11.5	20.2	30.0	11.5	4.3	2.0	4.2	0.4	31.8
Specific conductivity	µmho/cm	682	18920	32125	46150	18918	7763	4158	7620	774	48650
Temperature, water	deg C	25.5	26.4	26.2	26.9	26.4	29.7	26.8	26.8	25.2	26.9
Turbidity	NTU	2.4	2.5	2.4	1.6	2.0	1.3	1.5	2.1	1.2	1.6
<b>Nutrients</b>											
Dissolved oxygen (DO)	mg/l	4.57	6.64	5.86	8.19	5.78	6.09	5.06	5.53	4.94	7.86
Nitrogen, ammonia (NH3) + ammonium (NH4+)	mg/l	0.193	0.118	0.063	0.026	0.143	0.071	0.084	0.076	0.128	0.024
Nitrogen, Kjeldahl	mg/l	1.43	1.25	0.91	0.87	1.23	1.44	1.49	1.44	1.45	0.81
Nitrogen, Nitrite (NO2-) + Nitrate (NO3-) as N	mg/l	0.289	0.234	0.186	0.086	0.431	0.294	0.223	0.281	0.164	0.063
Phosphorus as P	mg/l	0.029	0.039	0.046	0.040	0.071	0.024	0.030	0.035	0.016	0.035
Phosphorus, orthophosphate as P	mg/l	0.008	0.016	0.018	0.014	0.041	0.011	0.009	0.015	0.005	0.013
Total Organic Carbon (TOC)	mg/l	16.8	10.4	6.5	3.2	7.3	15.4	18.1	16.1	20.2	2.7
<b>Biological Indicators</b>											
Chlorophyll a, corrected for pheophytin	mg/m <sup>3</sup>	6.12	6.88	3.55	0.92	3.79	4.50	4.67	5.57	8.03	1.90
Pheophytin-a	mg/m <sup>3</sup>	2.07	5.31	3.20	2.08	3.46	5.26	4.91	6.33	4.60	1.52
<b>Bacteriology</b>											
Fecal Coliform	#/100ml	187	356	92	50	195	56	197	205	167	16
Total Coliform	#/100ml	600	1007	576	189	579	182	1331	1097	770	102

Notes:

- <sup>1</sup> "Std units" indicates Standard Units
- "ppt" indicates parts per thousand
- "µmho/cm" indicates micro mho (multiplicative inverse of ohm) per centimeter
- "deg C" indicates degrees Centigrade
- "NTU" indicates Nephelometric Turbidity Units
- "mg/l" indicates milligrams per liter
- "mg/m<sup>3</sup>" indicates milligrams per cubic meter
- "#/100ml" indicates number per 100 milliliters

Source: Broward County Department of Planning and Environmental Protection (BCDPEP), 2005

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## **5.E.1.4 Groundwater Resources**

### **5.E.1.4.1 AQUIFERS**

The principal aquifers within the Study Area include the Biscayne aquifer, the intermediate aquifer systems, and the Floridian aquifer system. Waters in all the aquifer systems are a calcium bicarbonate type, due to the dominance of shell, limestone, or dolomite. The presence of these substrates contributes to the hard to very hard classification of the water.<sup>35</sup>

**Biscayne Aquifer:** The Biscayne Aquifer is a surficial aquifer that underlies Broward, Dade, and parts of Palm Beach counties. The Biscayne Aquifer consists of very permeable, interbedded limestone and sandstone of marine origin. The aquifer is greater than 200 feet thick along the Broward County coastline and thins to approximately 70 feet thick near U.S. Highway 27 in Broward County. The thickness and permeability of the aquifer generally decreases towards the north.<sup>36</sup>

USEPA has designated the Biscayne Aquifer as a sole source drinking water aquifer.<sup>37</sup> Water in the Biscayne Aquifer water table is under unconfined conditions. At FLL the groundwater encompassed by the Biscayne Aquifer has been reported to be between four and five feet below the surface. The close proximity of the water table to the surface and its high permeability makes the Biscayne Aquifer readily susceptible to groundwater contamination. Major sources of contamination are saltwater encroachment and infiltration of contaminants carried in canal water.

The water table within the Biscayne Aquifer has a high recharge rate of approximately 98 centimeters per year (cm/yr).<sup>38</sup> Principal means of recharge include infiltration of rainfall through surface materials and seepage from canals and WCAs. Recharge by rainfall is greatest during the wet season, June through November. Recharge from canals is greatest during the dry season, from December through May, when water levels in the canals are generally higher than the adjacent levels in the aquifer. The regional flow direction is generally toward the southeast, although this flow pattern may be distorted in some locations due to the influence of concentrated pumping in wellfields and the proximity of surface waters.<sup>39</sup>

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<sup>35</sup> *Water-Quality Assessment of Southern Florida: An Overview of Available Information on Surface- and Ground-Water Quality and Ecology - Water-Resources Investigations Report 96-4177*, Haag, K. H. et. al., 1996, pg 18.

<sup>36</sup> *Water-Quality Assessment of Southern Florida: An Overview of Available Information on Surface- and Ground-Water Quality and Ecology - Water-Resources Investigations Report 96-4177*, Haag, K. H. et. al., 1996, pg 18.

<sup>37</sup> Internet Web site: <http://www2.dep.state.fl.us/water/>. Integrated Water Quality Assessment for Florida: 2004 305(b) Report and 303 (d) List Update, FDEP, July 29, 2004.

<sup>38</sup> *Water-Quality Assessment of Southern Florida: An Overview of Available Information on Surface- and Ground-Water Quality and Ecology - Water-Resources Investigations Report 96-4177*, Haag, K. H. et. al., 1996, pg 19.

<sup>39</sup> *Spill Prevention Control and Countermeasure Plan, Fort Lauderdale/Hollywood International Airport*, Cherokee Enterprises, Inc., Revised April 2003.

BCDPEP has designated the Biscayne Aquifer as a G-II aquifer, containing potable water with a total dissolved solids concentration of less than 10,000 milligrams per liter (mg/L). The Biscayne Aquifer is aerobic in the upper 30 feet or so, and anaerobic in the deeper parts. Waters from the Biscayne Aquifer are used extensively as a public water supply. Pumping of the aquifer is managed carefully to minimize saltwater intrusion. Concentrations of most water quality constituents in the aquifer do not exceed primary drinking water standards.<sup>40</sup> Water quality constituents, which may be of concern where groundwater is the source of drinking water include: sodium, chloride, and dissolved solids in areas affected by saltwater intrusion; hydrocarbons in urban-industrial areas; and nitrate in localized areas of urban or suburban development.<sup>41</sup>

FLL is located to the east of coastal control Structure S-13 and is surrounded by tidally influenced canals. As a result, FLL generally lies within the saltwater intruded area of the aquifer, as defined by a 250 milligram per liter isochlor. (See Exhibit L-11, *Delineation of Salt Water Intrusion Within the Project Study Area*, presented in Appendix L.) According to data from the closest U.S. Geological Survey (USGS) monitoring well to FLL (G-2900), salinity concentrations in the Biscayne Aquifer exceed 2,000 mg/l, rendering the aquifer non-potable.<sup>42</sup>

**Intermediate and Floridian Aquifer Systems:** The intermediate aquifer system is similar to the sand, silt, and shell surficial aquifer system, but is somewhat deeper. Saltwater intrusion and free-flowing deeper artesian wells have rendered parts of this aquifer system non-potable.<sup>43</sup>

The Floridian aquifer system underlies the entire Study Area and consists of limestone and dolomite beds that are generally highly transmissive. The Floridian aquifer system generally contains older water or a mix of recent and older water. In Broward County the aquifer contains non-potable water due to high salinity.<sup>44</sup>

#### **5.E.1.4.2 GROUNDWATER QUALITY**

The Detailed Study Area is located to the east of coastal control Structure S-13 and is surrounded by tidally influenced canals. As a result, the Detailed Study Area generally is located within the saltwater intruded area, as defined by a 250 mg/L isochlor,<sup>45</sup> as graphically depicted on **Exhibit 5.E.1-4, *Delineation of Salt Water Intrusion Within the Project Study Area***. According to data from the closest

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<sup>40</sup> Anderson and Shaw, 1991.

<sup>41</sup> *Water-Quality Assessment of Southern Florida: An Overview of Available Information on Surface- and Ground-Water Quality and Ecology - Water-Resources Investigations Report 96-4177*, Haag, K. H. et. al., 1996, pg 19.

<sup>42</sup> Internet Website: [http://www.sflorida.er.usgs.gov/ddn\\_data/graphics/graphs/desc/graph\\_14530.html](http://www.sflorida.er.usgs.gov/ddn_data/graphics/graphs/desc/graph_14530.html), Description of chloride measurements from the past 25 years at G-2900 United States Geological Survey, last updated: August 09, 2006

<sup>43</sup> *Water-Quality Assessment of Southern Florida: An Overview of Available Information on Surface- and Ground-Water Quality and Ecology - Water-Resources Investigations Report 96-4177*, Haag, K. H. et. al., 1996, pg 19.

<sup>44</sup> *Water-Quality Assessment of Southern Florida: An Overview of Available Information on Surface- and Ground-Water Quality and Ecology - Water-Resources Investigations Report 96-4177*, Haag, K. H. et. al., 1996, pg 19.

<sup>45</sup> Isochlor = line connecting points of equal chlorine concentration.

geological survey monitoring well to the Detailed Study Area (G-2900), salinity concentrations in the Biscayne Aquifer exceed 2,000 mg/L, rendering the aquifer non-potable.<sup>46 47</sup> The Detailed Study Area is not located within the footprint of any wellfield zones of protection, as graphically depicted on **Exhibit 5.E.1-5, Wellfield Zones of Protection Within the Project Study Area.**<sup>48</sup>

Only limited data is available on groundwater quality at FLL. Most of the recent information has been obtained from a number of site contamination assessments conducted within the Eastern/Terminal and Western Basins to determine petroleum-related impacts on soil and groundwater, due to past fueling operations. An inventory of the groundwater quality data obtained as a result of various site assessments conducted at FLL during the past decade is presented in Attachment L-4, *Groundwater Data from FLL (1998-2004)*, in Appendix L, *Water Resources*.

### **5.E.1.4.3 WATER SUPPLY**

FLL uses most of its potable water routinely for human consumption, fighting fires, washing equipment, cleaning paved areas, and ultimately for aesthetic purposes. As airport operations have increased, the demand for potable water has increased as well. A survey of the monthly water consumption for FLL is presented in Table L-37, *Fort Lauderdale-Hollywood International Airport Monthly Water Consumption (1000 Gallons) for years 2003 and 2004*, in Appendix L, *Water Resources*.

Although Broward County Water & Wastewater Services (BCWWS) does not have a dedicated contract to supply water to FLL, the City of Hollywood has a contract with BCWWS and provides FLL with potable water through the City's water system. The businesses and operations at FLL are provided with potable water through a standard master meter. The City of Hollywood operates an Upper Floridan Aquifer (UFA) well, on which there are no current restrictions on the quantity of water that can be withdrawn.

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<sup>46</sup> Internet web site: [http://www.sflorida.er.usgs.gov/ddn\\_data/graphics/graphs/desc/graph\\_14530.html](http://www.sflorida.er.usgs.gov/ddn_data/graphics/graphs/desc/graph_14530.html), Description of chloride measurements from the past 25 years at G-2900 United States Geological Survey, last updated: August 09, 2006

<sup>47</sup> Internet web site: Information obtained from Mr. Scott Prinos, USGS Broward Office, July 26, 2006.

<sup>48</sup> [http://www.broward.org/pprd/wf\\_map.pdf](http://www.broward.org/pprd/wf_map.pdf), Broward County Wellfield Map, Broward County Department of Planning and Environmental Protection, Pollution Prevention and Remediation Division. Last Updated: February 27, 2001.

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