6.E.1 WATER QUALITY

6.E.1.1 Introduction

Water quality problems arise primarily from the discharge of residues from human and natural activities, which may result in the impairment of the desirable use of a waterbody. This impairment is often a natural consequence of physical, chemical, and/or biological processes, such as physical sedimentation, chemical hydrolysis, and bacterial biodegradation.

The desirable use of a waterbody in a particular region is established through legislation, public hearings, and evaluation of public health and ecological standards. Pollutant criteria are developed for waterbodies based on their designated use. If discharges elevate the pollutant concentration above the referenced standard for the designated waterbody, it may be necessary to use environmental engineering controls to maintain the pollutant concentration below the standard.[1]

The canal system surrounding the Fort Lauderdale–Hollywood International Airport (FLL), including primary, secondary, and tertiary canals, is considered a water of the State of Florida, and is classified as "Class III waters." Class III waters are used for "recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife."[2] The waterbodies surrounding FLL are "Predominantly Marine Waters."[3] **Table 6.E.1-1, *FAC 62-302.530, Criteria for Surface Water Quality Classifications,*** presents the surface water quality criteria applicable to the Study Area as described in the Florida Administrative Code (FAC), Chapter 62-302.530.

1 *Principles of Surface Water Quality Modeling and Control*, Thomann-Mueller, 1987.
2 *Florida Administration Code Chapter 62-302 Surface Water Quality Standards*, Florida Department of State, Last Revision: 2006/11/13
3 Personal Communication, Kevin S. Carter, Broward County, Department of Planning & Environmental Protection, Environmental Monitoring Division, December 2004.

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Table 6.E.1-1
FAC 62-302.530, CRITERIA FOR SURFACE WATER QUALITY CLASSIFICATIONS

Parameter	Units	Class I: Potable Water Supply	Class II: Shellfish Propagation or Harvesting	Class III: Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife		Class IV: Agricultural Water Supplies	Class V: Navigation, Utility, and Industrial Use
				Predominantly Fresh Waters	Predominantly Marine Waters		
BOD (Biochemical Oxygen Demand)		Shall not be increased to exceed values which would cause dissolved oxygen to be depressed below the limit established for each class and, in no case, shall it be great enough to produce nuisance conditions.					
Ammonia (un-ionized)	Milligrams/L as NH_3	$\leq$ 0.02	- -(2)	$\leq$ 0.02	- -(2)	- -(2)	- -(2)
Oils and Greases	Milligrams/L	Dissolved or emulsified oils and greases shall not exceed 5.0	Dissolved or emulsified oils and greases shall not exceed 5.0	Dissolved or emulsified oils and greases shall not exceed 5.0	Dissolved or emulsified oils and greases shall not exceed 5.0	Dissolved or emulsified oils and greases shall not exceed 5.0	Dissolved or emulsified oils and greases shall not exceed 10.0
Phosphorus (Elemental)	Micrograms/L	- -(2)	$\leq$ 0.1	- -(2)	$\leq$ 0.1	- -(2)	- -(2)
Cadmium (Cd)	Micrograms/L *See* Notes (1) and (3).	$Cd \leq e^{(0.7852[lnH]-3.49)}$	$\leq$ 9.3	$Cd \leq 0.497^{(4)(5)}$	$\leq$ 9.3	- -(2)	- -(2)
Copper (Cu)	Micrograms/L *See* Notes (1) and (3).	$Cu \leq e^{(0.8545[lnH]-1.702)}$	$\leq$ 3.7	$Cu \leq 3.804^{(4)(6)}$	$\leq$ 3.7	$\leq$ 500	$\leq$ 500
Zinc (Zn)	Micrograms/L *See* Notes (1) and (3).	$Zn \leq e^{(0.8473[lnH]+0.884)}$	$\leq$ 86	$Zn \leq 49.227^{(4)(7)}$	$\leq$ 86	$\leq$ 1,000	$\leq$ 1,000

Notes: (1) "ln H" means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L.

(2) Indicates no criteria / not applicable

(3) For application of dissolved metals criteria see 62-302.500(2)(d), F.A.C.

(4) Hardness used correspond to an average proportioned by the "Technical Report for the Florida Statewide Airports Stormwater Study", Florida Department of Transportation, June 2005. (H = 35 mg/L as $CaCO_3$)

(5) Value derived using a Harness "H" = 35 mg/L as $CaCO_3$, and the following formula $\mathbf{e}^{(0.7852*[lnH] - 3.49)}$

(6) Value derived using a Harness "H" = 35 mg/L as $CaCO_3$,and the following formula $\mathbf{e}^{(0.8545*[lnH] - 1.702)}$

(7) Value derived using a Harness "H" = 35 mg/L as $CaCO_3$,and the following formula $\mathbf{e}^{(0.8473*[lnH] + 0.884)}$

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6.E.1.2 Water Quality General Approach and Methodology

The acreage and location of land required for development of each runway development alternative are very specific to each alternative. A single hydrology and water quality Study Area was established as the baseline for comparison of the runway development alternatives. The water quality analysis estimated annual surface water pollutant loads for each alternative. To quantify the pollutant loads that could be transferred to receiving waters from each alternative, a hydrologic assessment of each alternative was conducted to determine the relevant event mean concentration (EMC) data for each of the water quality parameters of concern.

The EMCs for the pollutants of concern are developed from long-term studies and estimates of the average annual concentrations of pollutants by collecting and analyzing samples directly from stormwater runoff. Because pollutant concentrations vary, based on short and long-term seasonal factors,[4] the estimation of representative EMCs takes years to develop to a statistically representative point. The EMCs used in the analysis described in this EIS were developed by Miami-Dade County (Department of Planning and Environmental Protection (DERM), Environmental Monitoring Division) and Miami International Airport (MIA), using the method described above.

The potential pollutant loads, resulting from each runway development alternative that would be discharged to receiving waters surrounding FLL, were calculated by multiplying each EMC by the volume of annual average runoff. Annual average runoff volumes were calculated using annual average precipitation, drainage area, runoff coefficients, and impervious fractions.[5]

This water quality analysis compares the estimated pollutant loads delivered to surface waters with implementation of the No Action Alternative and runway development alternatives compared to the estimated existing (baseline condition). The baseline analysis estimated the existing on-airport pollutant load, as well as that associated with other areas within the FLL property.

Additional details regarding these sources and methodology are provided in Appendix L*, Water Resources*.

6.E.1.2.1 WATER QUALITY PARAMETERS OF CONCERN

Limited information is available regarding the identification of water quality parameters of concern at airports. Two sources were considered to assist in selecting the parameters of concern: (a) the parameters required by the pertinent Multi-Sector General Permit as mandated by the National Pollutant Discharge

[4] Seasonal factors can include: storm intensity, frequency, and total rainfall and storm duration.
[5] An impervious fraction is a proportion between the surface not impervious to water and the rest of the area.

Elimination System (NPDES)[6] and (b) the *Technical Report for the Florida Statewide Airport Stormwater Study,* recently published by the Florida Department of Transportation (Florida DOT).[7]

Five water quality parameters of concern have been identified for the detailed impact analysis described in this EIS. These parameters were selected based on the requirements of the Multi-Sector General Permit (under the provisions of Section 403.0885, Florida Statutes), the Storm Water Monitoring Program (SWPPP) described in the FLL Storm Water Pollution Prevention Plan,[8] and limited data collected by Broward County thorough monitoring of the stormwater outfalls located at FLL.[9]

- Biochemical Oxygen Demand, five-day (BOD_5)
- Chemical Oxygen Demand (COD)
- Ammonia Nitrogen;
- Total Suspended Solids (TSS)
- Oil and Grease

Biochemical Oxygen Demand (BOD) is the amount of oxygen required by microbes, mainly bacteria, in the stabilization of organic materials under aerobic conditions. Because the amount of oxygen varies with the length of time and the temperature, the standard test is for five days at 20 degrees centigrade. The value the test yields is referred as the five-day biochemical oxygen demand (BOD_5). Elevated BOD_5 levels can indicate circumstances under which total dissolved oxygen levels within a waterbody could be reduced. In extreme cases, reductions in dissolved oxygen concentrations can lead to odors and even fish kills.

Chemical Oxygen Demand (COD) provides a similar measurement, but accounts for organic compounds that are not biodegradable. COD is a measure of the organic materials in a waterbody in terms of the oxygen required to chemically oxidize the organic materials.

Ammonia Nitrogen occurs in two forms in natural waters: ammonium ion (NH_4^+) and ammonia gas (NH_3). Where ammonium is innocuous at the levels encountered in most natural waters (e.g. less than 3 milligrams per liter (mg/L)), ammonia gas, the un-ionized form, is toxic to plants and animals. Moreover, the nitrification process, which forms nitrate from ammonia and requires oxygen, can deplete dissolved oxygen, and stimulate excessive plant growth.[10]

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6 Federal Register, Vol. 60, No 189, National Pollutant Discharge Elimination System (NPDES) permit, Sector S "Air Transportation Facilities Fact Sheet", September, 1995.

7 Internet web site: http://www.dot.state.fl.us/aviation/stormwater.htm, *Technical Report for the Florida Statewide Airport Stormwater Study*, Florida Department of Transportation, June 2005.

8 *Fort Lauderdale-Hollywood International Airport Storm Water Pollution Prevention Plan*, MACTEC Engineering and Consulting of Georgia, Inc., December 2002.

9 *2003 Analytical Stormwater Monitoring Report, Fort Lauderdale-Hollywood International Airport (FLL) Ft. Lauderdale, Broward County, Florida*, MACTEC Engineering and Consulting, Inc., April 9, 2004.

10 *Surface Water Quality*, Steven Chapra, 1997.

Total Suspended Solids (TSS) is a measure of the particulate matter that is suspended in water. These suspended materials consist of soils or other surface materials transported or deposited by wind, water, or gravity due to erosion. Suspended solids can block the penetration of light through the water column. By limiting the amount of light penetrating the water, aquatic plant growth can be restricted. Suspended solids can settle out of the water column and can cover fish spawning habitats.

Oil and Grease are characterized as high-molecular weight organic compounds. Primary sources of oil and grease are petroleum hydrocarbon products, motor products, esters, oils, fats, waxes, and high molecular-weight fatty acids. Elevated oil and grease concentrations can decrease the aesthetic value of a waterbody, as well as its water quality.

Based on a review of the ambient water quality parameters monitored by Broward County Department of Planning and Environmental Protection (BCDPEP) and water quality parameters of concern identified in the Florida DOT Technical Report, five additional water quality parameters were incorporated into the impact analysis.

- Total Nitrogen (TN)
- Total Phosphorus (TP)
- Cadmium (Cd)
- Copper (Cu)
- Zinc (Zn)

Total Nitrogen (TN) is the total concentration of ammonia, organic nitrogen, nitrate, and nitrite. Although phosphorus and nitrogen, as nutrients, are required for the growth of plants and animals, excessive amounts can be detrimental to a waterbody. Overgrowth of aquatic algae and plants can lead to a state of eutrophication in the waterbody. Eutrophication occurs when overgrowth leads to excessive decay of organic matter in the waterbody, loss of oxygen in the water, and the eventual death of organisms. Sources of nitrogen and phosphorus include fertilizers, animal and human wastes, automobile exhausts, and refrigeration.

Heavy metal contaminants of concern at airports typically include Cadmium (Cd), Copper (Cu), and Zinc (Zn). Sources for heavy metal contaminants can include weathered soils, atmospheric deposition, vehicle emissions and residuals, and applied chemicals. These metals are also commercially available and are found in formed or manufactured metals and metal products. Metals are also used as raw material components in non-metal products such as fuels, adhesives, paints, and other coatings. A primary source of heavy metal pollution in stormwater is commercially available metals and metal products. Under certain conditions, these products can react or degrade such that their metal components are released to the environment and transported via leaching or erosion to local bodies of water. At high concentrations in their soluble form, heavy metal compounds can be toxic to plants and animals.

6.E.1.2.2 WATER QUALITY POLLUTANT LOADING ANALYSIS

Water quality pollutant loads for each runway development alternative were calculated by multiplying constituent stormwater EMCs (considered a function of land use) by average annual stormwater runoff volumes, yielding an annual mass of discharged water pollutants.

The *Final Report on the National Urban Runoff Program* presents the results of an extensive stormwater runoff sampling and analysis program, which consisted of the collection of water quality samples from more than 2,300 separate storm events.[11] This report concluded that concentrations of pollutants in urban runoff are a function of land use and that pollutant loads from these land uses can be assessed for planning purposes using EMCs. Similarly, stormwater investigations conducted by the Federal Highway Administration (FHWA) and the American Association of Airport Executives (AAAE), in conjunction with the Airport Research and Development Foundation, have concluded that pollutant concentrations in stormwater runoff are a function of land use.[12]

Land Use Classification: The analysis in this EIS assumes a homogeneous land use across airport property in order to estimate pollutant loadings. (*See* Appendix L, *Water Resources*.)

Land use categories developed for use in this analysis were based on the Broward County Land Use Plan,[13] which classifies the entire airport property under "Transportation Land Use."

Stormwater Event Mean Concentrations: Water quality analysis requires representative data from the general area where the study takes place. Broward County has been conducting a monitoring program to support the County's stormwater quality management program, in connection with the County's NPDES municipal permit. A similar set of data was collected from Broward County for the same general purpose, however, the resulting database is very limited and this second set of data is not considered representative of the region.

The closest airport with similar conditions to FLL is MIA, located south of FLL in Miami-Dade County. MIA and Miami-Dade County have a large quantity of available data suitable for more weather-local representative EMCs. The Miami-Dade County Department of Environmental Resource Management, Division of Water Management, under their NPDES and Floodplain Management Program, sampled stormwater runoff from various land uses over a ten-year period from 1993 through 2003.[14] [15] [16] The EMCs developed for MIA and based on the data

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[11] *Final Report on the National Urban Runoff Program*, United States Environmental Protection Agency, Water Planning Division, December 1983.

[12] *Predicting Pollutants Loads in Airport Stormwater Runoff – Advanced Spatial Statistics*, Brenda Ostrom, May 12, 1994.

[13] *1989 Broward County Land Use Plan*, Broward County – Planning Council, March 1, 1989.

[14] *Personal Communication*, Marcia Steelman, Miami-Dade Department of Environmental Resources Management, Water Management Division, June 2006.

[15] *Stormwater Management Plan*, Miami-Dade County Department of Environmental Resource Management, January 1996.

[16] Miami-Dade County DERM File No. 15077/ARP68

collected there, were used in this water quality analysis. A summary of the resultant EMCs applied for the land use categories at FLL impacted by the runway development alternatives, with the exception of Oil and Grease, is in Appendix L, *Water Resources*. The EMC for Oil and Grease at FLL was based on data taken from Los Angeles County.[17]

Stormwater Runoff Analysis: Annual average stormwater runoff is based on annual rainfall data, drainage area, and the percentage of impervious surfaces within the drainage area. Annual average precipitation at FLL was obtained from *Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000* for Station No. 030, Fort Lauderdale, Florida.[18] For the 30-year period of record, the annual average precipitation was 64.19 inches (5.35 feet), with the majority of precipitation occurring between June and October.

Drainage areas for the analysis were based on the delineation of drainage sub-basins within the footprint of the area impacted by the runway development alternatives. The distribution of land uses, the fraction of the area lying outside of the airport boundary, and the outfall were identified and quantified for each sub-basin.

Stormwater runoff generated from an area is largely a function of the percentage of impervious surfaces within the drainage area. The runoff coefficient in the annual average runoff equation is related to the percent of impervious surface in a given area and accounts for the correlation between runoff volumes and impervious surface area. The runoff coefficient, the annual average precipitation, and size/area of each sub-basin are used for calculating the annual average runoff quantities per unit area.

Water Quality Pollutant Loads: The annual average stormwater runoff from annual rainfall data, drainage area, and the percentage of impervious surfaces within the given drainage area were used to calculate the water quality pollutant loads. Annual water quality pollutant loads were calculated for each sub-basin and totaled for each outfall. A detailed description of the previously mentioned processes can be found in Appendix L, *Water Resources*.

USEPA has designated the Biscayne Aquifer as a sole source drinking water aquifer.[19] Water in the Biscayne Aquifer water table is under unconfined conditions. The groundwater encompassed by the Biscayne Aquifer has been reported at FLL to

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[17] Internet web site: http://ladpw.org/wmd/NPDES/9400_wq_tbl/Table_4-9.pdf, *Summary Water Quality Data-Stormwater Data Tables for Transportation Land Use*, Los Angeles County Department of Public Works, Last updated: January 6, 2005.

[18] Internet web site: http://hurricane.ncdc.noaa.gov/climatenormals/clim81/FLnorm.pdf, *Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1971-2000*, National Oceanic and Atmospheric Administration, Issue Date: February 2004, Latest update: May 27, 2005.

[19] 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.

be between four and five feet below land surface. This fact, and its high permeability, makes the Biscayne Aquifer readily susceptible to groundwater contamination. Major sources of contamination are salt water encroachment and infiltration of contaminants carried in canal water.

The effects on the pervious areas of FLL by the runway development alternatives were evaluated by comparing the percentage of pervious areas under the alternatives. All the alternatives reported a decrease of pervious area, commensurate with the increase of impervious area. The conveyance of the increment of runoff will reduce the potential risk of pollutants reaching the groundwater. Reduction in the pervious area percentages varies from 4.95 percent for Alternative C1 to 0.51 percent for Alternative B1c.

To avoid disturbing the Biscayne Aquifer, Best Management Practices (BMPs) should be implemented during construction and operational phases of the selected alternative. It is estimated that the BMPs would address the possible impacts related to stormwater infiltration. The BMPS could include dry detention basins, infiltration trenches, porous pavement, and grassed swales, the use of which can account for reductions in metal loads from 63 percent to 88 percent on average and Total Recoverable Petroleum Hydrocarbons (TRPH) by 52 percent on average.[20]

Other BMPs detailed in the FLL SWPPP for other point sources (spills, washing operations, etc.) are also in place at FLL. The combination of these BMPs and other measures are considered to be sufficient to ensure that concentrations of pollutants would not exceed the regulatory criteria depicted in FAC Chapter 62-302.530 criteria for Surface Water Quality for Class III Waters. Consequently, there is no likelihood of violation of the requirement of *State of Florida Multi Sector Generic Permit for the Stormwater Discharge Associated with industrial Activity* (MSGP) number FLR05A457.

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 salt water intruded area, as defined by a 250 gm/L 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.[21]

6.E.1.3 Water Quality Impacts

The Watershed Restoration Act and the rules that the Florida Department of Environmental Protection (DEP) has subsequently adopted are intended to identify Florida surface waters impaired by pollutants, establish scientifically-based pollutant

[20] Internet web site: http://www.dot.state.fl.us/aviation/stormwater.htm, *Technical Report for the Florida Statewide Airport Stormwater Study*, Florida Department of Transportation, June 2005.

[21] Internet Web site: http://www.sflorida.er.usgs.gov/ddn_data/graphics/graphs/descgraph_14530.html, Description of chloride measurements form the past 25 years at G-2900 United States Geological Survey, last updated: August 09, 2006.

reduction objectives, including Total Maximum Daily Load (TMDLs)[22], develop locally-based plans to reduce pollutants as determined necessary by the corresponding TMDL, and promote the physical and financial mechanisms necessary to implement those plans.[23] To date, Florida DEP has developed TMDLs for a limited number of waterbodies, in accordance with an established priority list.[24] The South New River Canal is the only waterbody near FLL considered impaired, that is directly impacted by the FLL Stormwater Management System. TMDLs for South New River Canal are not scheduled to be established until 2011.[25]

FAC Chapter 62-302.530 establishes criteria for Surface Water Quality for Class III Waters, which are presented in **Table 6.E.1-2**. The relevant criteria for Predominantly Marine Waters were used to determine the potential impacts on water quality due to each runway development alternative. The pollutant level concentrations for all alternatives compared to applicable FAC Chapter 62-302 Criteria for Class III Predominantly Marine Waters are presented in Table 6.E.1-2.

Quantitative descriptions of the impacts of each runway development alternative on water quality, including the No Action Alternative, are presented in the following sections. The comparison analysis was performed prior to mixing between onsite runoff and the receiving waterbodies. Consequently, the analysis does not take into account any dilution of the produced runoff into the surrounding waterbodies and each pollutant concentration was analyzed under the criteria for Predominantly Marine Waters.

The drainage areas, percent of impervious surfaces, and the land use category used to determine the pollutant loadings expected from each outfall are detailed in Appendix L*, Water Resources*.

The total amount of airport property classified as Transportation Land Use remains constant for the 2012 and 2020 planning horizons. Pollutant loadings would remain basically constant from the end of construction to the end of the planning horizon in 2020 for each alternative analyzed.

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[22] A TMDL or Total Maximum Daily Load is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources.

[23] Internet web site: http://www.dep.state.fl.us/water/tmdl/docs/2005TMDL_Report_final_2-25-05.pdf, *Florida's Total Maximum Daily Load Program: the First 5 Years, A Report to the Legislature and Governor*, Florida Department of Environmental Protection, Division of Water Resources Management, February 2005.

[24] Internet web site: http://www.dep.state.fl.us/water/tmdl/docs/303d_lists/group4/adopted/SCBB_Verified_051206.pdf, Adopted Verified Lists of Impaired Waters for the Group 4 Basins, last update: 05/12/2006.

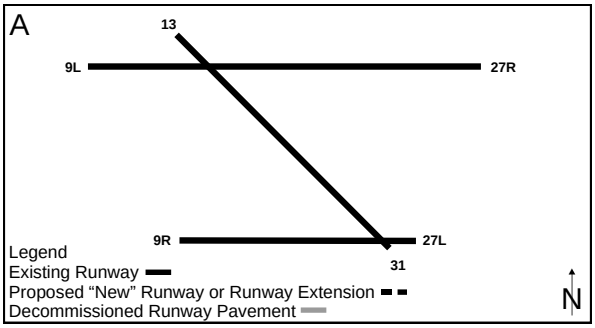
[25] Internet web site: http://www.dep.state.fl.us/water/tmdl/docs/303d_lists/group4/adopted/SCBB_Verified_051206.pdf, Adopted Verified Lists of Impaired Waters for the Group 4 Basins, last update: 05/12/2006.

Table 6.E.1-2
POLLUTANT LEVEL CONCENTRATION FOR ALL ALTERNATIVES VERSUS APPLICABLE FAC CHAPTER 62-302 CRITERIA FOR CLASS III – PREDOMINANTLY MARINE WATER

Parameter	Units	Ch. 62-302 Applicable Criteria for Class III – Predominantly Marine Water	Alternative								
			A	B1	B1b	B1c	B4	B5	C1	D1	D2
BOD (Biochemical Oxygen Demand)		Shall not be increased to exceed values which would cause dissolved oxygen to be depressed below the limit established for each class and, in no case, shall it be great enough to produce nuisance conditions.									
Ammonia (un-ionized)	Milligrams/L as NH_3	(2)	0.081	0.089	0.089	0.089	0.09	0.09	0.089	0.089	0.089
Oils and Greases	Milligrams/L	Dissolved or emulsified oils and greases shall not exceed 5.0	2.3	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Phosphorus (Elemental)	Milligrams/L	$\leq$ 0.1	0.088	0.098	0.098	0.098	0.098	0.098	0.097	0.098	0.098
Cadmium (Cd)	Milligrams/L *See* Notes (1) and (3).	Cd $\leq$ 0.0093	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Copper (Cu)	Milligrams/L *See* Notes (1) and (3).	Cu $\leq$ 0.0037	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Zinc (Zn)	Milligrams/L *See* Notes (1) and (3).	Zn $\leq$ 0.086	0.017	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019

Notes: (1) For application of dissolved metals criteria see 62-302.500(2)(d), F.A.C.
(2) Indicates no criteria / not applicable.
(3) Hardness used correspond to an average proportioned by the "Technical Report for the Florida Statewide Airports Stormwater Study", Florida Department of Transportation, June 2005. (H = 35 mg/L as $CaCO_3$)
(4) Value derived using a Harness "H" = 35 mg/L as $CaCO_3$, and the following formula $\mathbf{e}^{(0.7852*[\ln H] - 3.49)}$
(5) Value derived using a Harness "H" = 35 mg/L as $CaCO_3$,and the following formula $\mathbf{e}^{(0.8545*[\ln H] - 1.702)}$
(6) Value derived using a Harness "H" = 35 mg/L as $CaCO_3$,and the following formula $\mathbf{e}^{(0.8473*[\ln H] + 0.884}$

6.E.1.3.1 ALTERNATIVE A: NO ACTION



The predicted water quality pollutant loads discharged to receiving waterbodies under the No Action Alternative have been estimated using the methods previously described for the pollutants of concern. A comparison of these results with the relevant criteria for Predominantly Marine Waters, described in Table 6.E.1-2, results in the following:

- The average concentration for Total Copper of 0.004 mg/L exceeds the corresponding criteria, stated in Table 6.E.1-1, of 0.0037 mg/L by 0.0003 mg/L, considered negligible for the purpose of this analysis.

- All other water quality parameters of concern identified in Table 6.E.1-2 were below the applicable regulatory criteria.

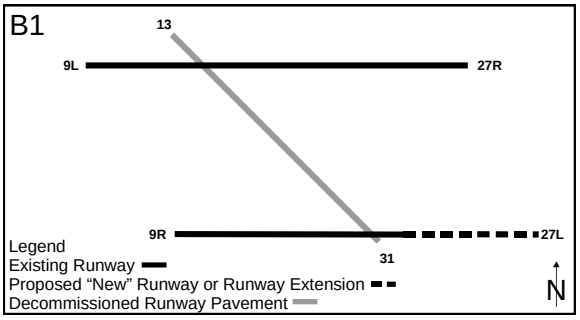
Detailed stormwater runoff and pollutant load calculations for the No Action Alternative are presented in Appendix L, *Water Resources*.

The BMPs currently followed at FLL are adequate to reduce the concentrations of pollutants of concern below regulatory criteria, and eliminate or minimize stormwater impacts to the receiving waterbodies. The use of BMPs such as dry detention basins, infiltration trenches, porous pavement, and grassed swales can account for reductions in metal loads from 63 to 88 percent on average.[26] Other BMPs described in the FLL SWPPP for other point sources (e.g., spills, washing operations, etc.) are also in place at FLL. The combination of these BMPs and other measures are considered to be sufficient to ensure that concentrations of pollutants of concern would not exceed the regulatory criteria described in FAC Chapter 62-302 Class III. Accordingly, the No Action Alternative would not result in a potential for exceeding current water quality standards.

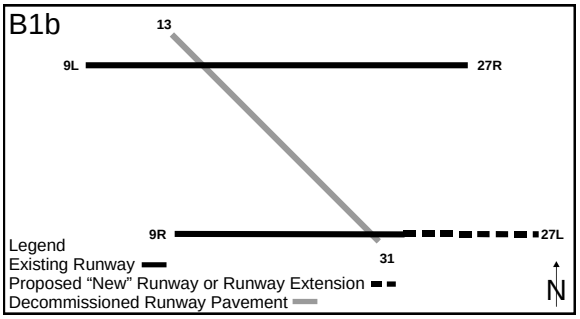
[26] Internet web site: http://www.dot.state.fl.us/aviation/stormwater.htm, *Technical Report for the Florida Statewide Airport Stormwater Study*, Florida Department of Transportation, June 2005.

6.E.1.3.2 ALTERNATIVES B1, B1b, B1c, B4, B5, C1, D1, AND D2

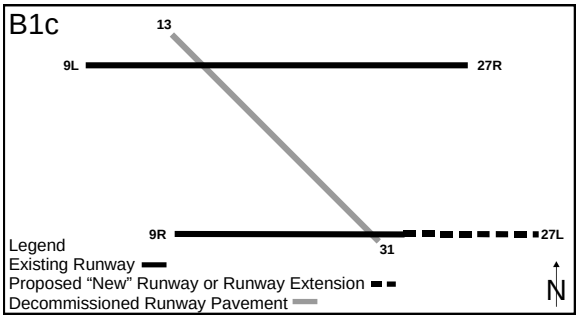
ALTERNATIVE B1: REDEVELOP AND EXTEND EXISTING RUNWAY 9R/27L TO AN 8,600-FOOT BY 150-FOOT ELEVATED RUNWAY



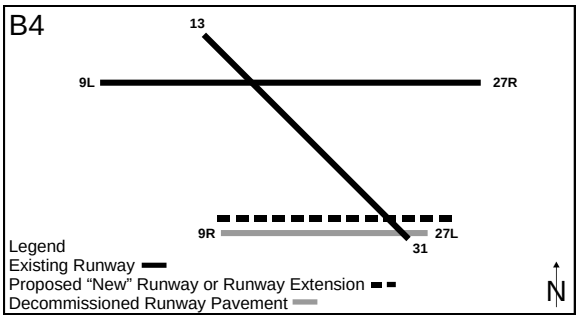
ALTERNATIVE B1b: REDEVELOP AND EXTEND EXISTING RUNWAY 9R/27L TO AN 8,000-FOOT BY 150-FOOT ELEVATED RUNWAY WITH EMAS



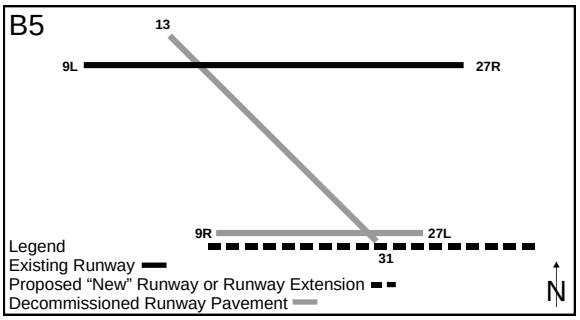
ALTERNATIVE B1c: (AIRPORT SPONSOR'S PROPOSED PROJECT): REDEVELOP AND EXTEND EXISTING RUNWAY 9R/27L TO AN 8,000-FOOT BY 150-FOOT ELEVATED RUNWAY WITH EMAS; RUNWAY USE DETERMINED BY BROWARD COUNTY'S INTERLOCAL AGREEMENTS



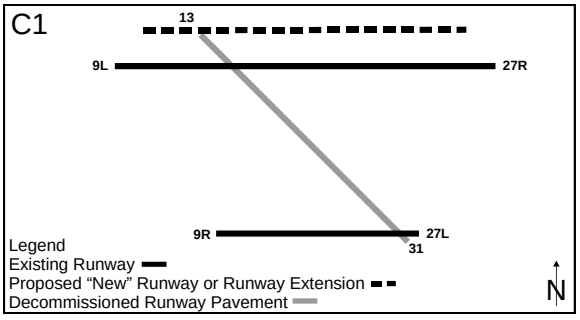
ALTERNATIVE B4: BUILD A NEW 6,001-FOOT AT GRADE RUNWAY WITH EMAS LOCATED 340 FEET NORTH OF EXISTING SOUTH RUNWAY (TO REPLACE EXISTING RUNWAY 9R/27L)



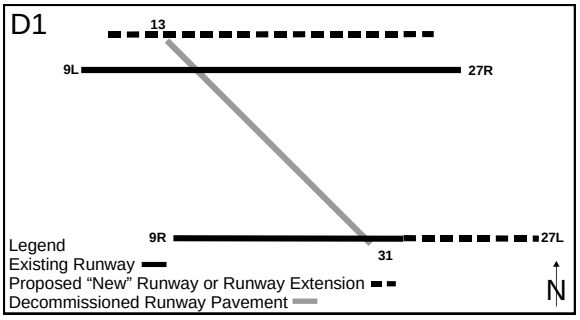
ALTERNATIVE B5: BUILD A 7,800-FOOT ELEVATED RUNWAY WITH EMAS LOCATED 320 FEET SOUTH OF EXISTING SOUTH RUNWAY (TO REPLACE EXISTING RUNWAY 9R/27L)



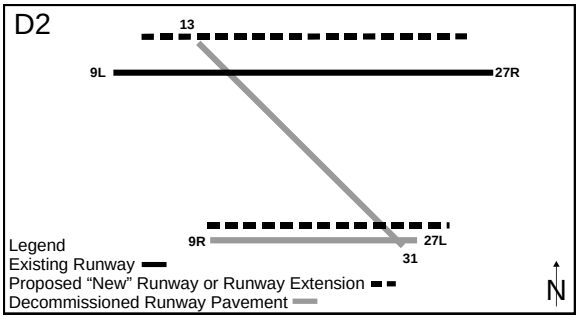
ALTERNATIVE C1: BUILD A 7,721-FOOT AT GRADE RUNWAY LOCATED 850 FEET NORTH OF EXISTING RUNWAY 9L/27R (A DEPENDENT PARALLEL RUNWAY TO EXISTING RUNWAY 9L/27R)



ALTERNATIVE D1: REDEVELOP AND EXTEND EXISTING RUNWAY 9R/27L TO 8,000 FEET AND BUILD A NEW 7,721-FOOT RUNWAY NORTH OF EXISTING RUNWAY 9L/27R (COMBINATION OF ALTERNATIVES B1b AND C1)



ALTERNATIVE D2: BUILD A NEW 6,001-FOOT AT GRADE RUNWAY WITH EMAS LOCATED 340 FEET NORTH OF EXISTING SOUTH RUNWAY AND BUILD A 7,721-FOOT AT GRADE RUNWAY LOCATED 850 FEET NORTH OF EXISTING RUNWAY 9L/27R (COMBINATION OF ALTERNATIVES B4 AND C1)



An analysis of all the runway development alternatives, Alternatives B1, B1b, B1c, B4, B5, C1, D1, and D2, yielded the same conclusions regarding water quality as reached under Alternative A. The water quality pollutant loads to be discharged to receiving waterbodies were estimated using the methods previously described for the pollutants of concern. A comparison of these results with the relevant criteria for Predominantly Marine Waters, described in Table 6.E.1-1, results in the following:

- The average concentration for Total Copper of 0.004 mg/L exceeds the corresponding criteria, stated in Table 6.E.1-1, of 0.0037 mg/L by 0.0003 mg/L, considered negligible for the purpose of this analysis.

- All other water quality parameters of concern identified in Table 6.E.1-2 were below the applicable regulatory criteria.

Detailed stormwater runoff and pollutant load calculations for each of the runway development alternative conditions are presented in Appendix L, *Water Resources*.

As described under the No Action Alternative, the BMPs currently followed at FLL are adequate to reduce the concentrations of pollutants of concern below regulatory criteria, and eliminate or minimize stormwater impacts to the receiving waterbodies. The combination of BMPs and other measures are considered to be sufficient to ensure that concentrations of pollutants of concern would not exceed the regulatory criteria described in FAC Chapter 62-302 Class III with implementation of any of the runway development alternatives. Accordingly, none of the runway development alternatives would result in a potential for exceeding water quality standards.

6.E.1.4 Summary of Water Quality Impacts

6.E.1.4.1 SURFACE WATER QUALITY

No significant direct impacts to surface waters are expected with the No Action Alternative. However, the forecast increase in aircraft operations could increase the pollutant loading to surrounding receiving waterbodies if current BMPs or other measures are not implemented to reduce pollutant concentrations in stormwater runoff from FLL. As stated by the recent Florida DOT Technical Report, the airport airside pavement is estimated to produce a minimal difference in concentrations of elements considered in this analysis. The most significant of these elements is Copper, which has been predicted to have an annual average concentration which would exceed, by a negligible amount, the criteria defined by FAC Chapter 62.302 (Table 6.E.1-2) for Predominantly Marine Waters.

For each of the runway development alternatives, BMPs currently in use at FLL in combination with other measures are considered to be sufficient to ensure that concentrations of pollutants would not exceed the regulatory criteria depicted in FAC Chapter 62-302 Class III. Accordingly, none of the runway development alternatives would result in the potential for exceeding water quality standards.

The South New River Canal is the only waterbody surrounding FLL that is considered to be impaired. This canal is directly impacted by stormwater runoff from FLL. Appendix L, *Water Resources,* Attachments L-3-1 to L-3-10, indicate that the waterbodies that surround FLL currently contain high levels of various pollutants. Appendix L, Tables L-16 to L-25, presents the pollutant loading levels predicted to occur at each outfall as using the previously described analysis method. Tables L-26 to L-36, detail the calculated percent increase in pollutants of concern loadings among the runway development alternatives.

The background concentration levels of the pollutants of concern and the relatively small volume of runoff from FLL would make any water quality impacts on the surrounding waterbodies unlikely.

The concentration level of pollutants of concern, other than Copper and Cadmium, increase for the runway development alternatives compared to the No Action Alternative. This is due to the larger amount of impervious area. The concentration levels for these parameters remain below the criteria for Predominantly Marine Waters for those pollutants for which criteria have been established.

6.E.1.4.2 GROUNDWATER QUALITY

Because of the forecast increase in aircraft operations that would occur under the No Action as well as the proposed runway development alternatives, impacts on groundwater resources could occur. Along with the increase in aircraft operations there would be an increase in fueling operations. These actions could increase the potential for fuel spills during aircraft fueling and maintenance activities. Groundwater impacts also could result from leaking storage tanks or infiltration of polluted runoff.

Within the EIS Detailed Study Area, the Broward County Environmental Protection Department (BCEPD) database identified the Broward County Aviation Department facility at 2360 SW 36th Street as having chlorinated solvent contamination onsite. Therefore, while the most documented contamination is petroleum-based, other site-specific sources of contamination may be encountered. (*See* Chapter Five, *Affected Environment*, Section 5.G.1, *Hazardous Waste*, Subsection 5.G.1.2.3, *Fueling Facility and Storage.*)

As environmental site assessments are prepared for the airport and surrounding areas, previously unidentified areas of contamination may be discovered. These would have to be addressed prior to initiating any construction activities. As necessary, environmental site assessments should be conducted in accordance with the specifications of Chapter 62-780, FAC.

Site-specific management plans would be prepared prior to construction. These management plans would be used to address site-specific conditions such as personnel safety, groundwater conditions, and drainage requirements.

The continuation of current BMPs as part of the National Pollutant Discharge Elimination System (NPDES) permit in combination with environmental engineering controls could be used to minimize or eliminate the potential for groundwater contamination. These measures are considered to be sufficient to ensure that concentrations of pollutants would not exceed the applicable regulatory criteria depicted in FAC Chapter 62-777. Therefore, none of the alternatives would result in the potential for exceeding water quality standards for groundwater.

The Environmental Data Resources (EDR) report[27] shows a Public Water Supply well located north of FLL within a one-mile radius of the center of the property and outside of the proposed construction area. One other water well is located at the southern border of the Detailed Study Area outside of the proposed construction area, along Griffin Road. If construction activities are initiated near these water wells precautions would need to be taken to prevent the transfer of potential contaminants through the groundwater.

Broward County may need to apply for a separate NPDES generic permit for the construction activities at FLL. This would be a State of Florida Generic Permit for Stormwater Discharge from Construction Activities that Disturb Five or More Acres of Land (CGP), as indicated by Rule 62-621.300(5)(a) FAC. The permittee

[27] *Ft. Lauderdale International Airport, Environmental Data Resources (EDR) Report*, Environmental Data Resources Inc. October 2004.

(Broward County) is required to develop a site-specific SWPPP to address potential pollutants derived from construction activities and prevent them from reaching the waters of the United States. In the event that other groundwater wells are discovered prior to the construction phase, those wells would be replaced or abandoned in accordance with the specifications detailed in Chapter 62-532, FAC.[28]

6.E.1.4.3 WATER SUPPLY

Broward County's future water supply requirements have been addressed by the Florida State legislature through the development of the *10-Year Water Supply Facilities Work Plan* (Plan), as mandated by Chapter 163, Florida Statutes. This Plan was developed to address coordination issues pertaining to future land use and water supply planning in Florida.[29]

The BCEPD and the Broward County Water and Wastewater Services (BCWWS) conducted an analysis of the water needs for its retail and wholesale customers, and generated this Plan, tailored to the BCWWS service areas.[30]

BCWWS Retail District 3A covers approximately 7.8 square miles and includes FLL as one of its biggest customers.[31] BCWWS purchases potable water from the City of Hollywood, per an interlocal agreement, for resale to Retail District 3A. "The term of this agreement is endless and will continue in perpetuity unless there is a mutual agreement for termination."[32]

BCWWS has evaluated the water demand for Retail District 3A and concluded that water supply needs for the BCWWS District 3A Service Area will be met in both the short-term and long-term[33]. Because the forecast increase in operations is the same regardless of whether or not the airfield is expanded, and because the FLL water supply needs will be met in both the short-term and long-term, it can be concluded that the water demand needs at FLL will be met.

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[28] NOTE: The Biscayne Aquifer under FLL property is considered non-potable due to salt water intrusions. This aquifer is described in Chapter Five, Section 5.E.1, *Water Quality,* and in Appendix L, Exhibit L-11, *Delineation of Salt Water Intrusion within the Project Study Area.*

[29] http://www.broward.org/waterresources/factbookoct2007.pdf, *Broward County Water Resources Fact Book*, Environmental Protection Department, Water Resources Division, 2007.

[30] http://www.broward.org/waterresources/factbookoct2007.pdf, Broward County Water Resources Book, Environmental Protection Department, Water Resources Div., 2007.

[31] 10-Year Water Supply Facilities Workplan, Broward County Water and Wastewater Services, Board of County Commissioners, December 2007.

[32] 10-Year Water Supply Facilities Workplan, Broward County Water and Wastewater Services, Board of County Commissioners, December 2007.

[33] 10-Year Water Supply Facilities Workplan, Broward County Water and Wastewater Services, Board of County Commissioners, December 2007.

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