FINAL REPORT
AN INVESTIGATION OF COMPLAINTS OF WATER QUALITY PROBLEMS IN THE NORTH, WEST, AND EAST CORAL LAKES, OAKLAND PARK, FLORIDA

BROWARD COUNTY DEPARTMENT OF PLANNING
AND ENVIRONMENTAL PROTECTION

WATER RESOURCES DIVISION

February 2002

FINAL REPORT -- AN INVESTIGATION OF COMPLAINTS OF WATER QUALITY PROBLEMS IN THE NORTH, WEST, AND EAST CORAL LAKES, OAKLAND PARK, FLORIDA

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1.0 EXECUTIVE SUMMARY

An investigation of water quality problems in the Coral Heights subdivision of Oakland Park was initiated based on citizen complaints. Coral Heights is located southwest of the intersection of Commercial Boulevard and U.S. 1 in the northeastern portion of the City. Drainage maps and a stormwater master plan developed for the City were reviewed along with information concerning inlet and storm drain locations from a citizen. The stormwater master plan also included potential drainage improvement projects being considered by the City. Aquatic plant management records for the lakes and waterway within Coral Heights were reviewed.

Drainage improvement and aquatic plant management activities were examined for compliance with federal, Broward County, and City regulations and code. A water quality monitoring program was established for the lakes and waterway. Samples obtained during the monitoring program were tested for a variety of parameters.

Sample test results indicated elevated levels of copper and total phosphorus at four sites during both the dry and wet seasons. The location of the existing drainage system elements was verified with a field inspection.

The draft of this report was reviewed by the City. The City conducted an additional study, and the results of the study as well as comments of the City's consulting firm were incorporated into this final report. The conclusions and recommendations of this investigation included the following:

- There were significant differences between the drainage system shown on the City maps compared to what was found in the field. The City indicated that the differences are explained by mapping errors. No other evidence was found that the City constructed some drainage facilities without the proper licenses or permits.

- The feasibility of restoring grassy swales along the roadways and removing bulkheads along the water should continue to be pursued by the City.

- The City and County should periodically inspect the Commercial Boulevard Industrial Park area for illicit discharges which could affect lake water quality.

- The City should confer with the County to determine if the potential drainage improvements require a County surface water management license.

- The aquatic plant management activities appear to have been conducted within EPA, State, and County regulations and Code. These maintenance records should include the depth of water treated to assure continued compliance with label directions.

- The elevated copper levels may be controlled by more frequent algae treatment over smaller affected areas.

- The elevated total phosphorus levels may be controlled by educating homeowners on the proper use of fertilizers.

- The City has been and should continue to meet its requirements under the EPA NPDES MS4 Permit for Broward County.

- The City should strive to balance the competing goals of improved drainage and improved water quality by assuring that drainage improvements contain provisions to address water quality.

- The dredging of the shallow areas near the bridge crossings should be considered further because the benefits may outweigh the negative impacts.

2.0 BACKGROUND

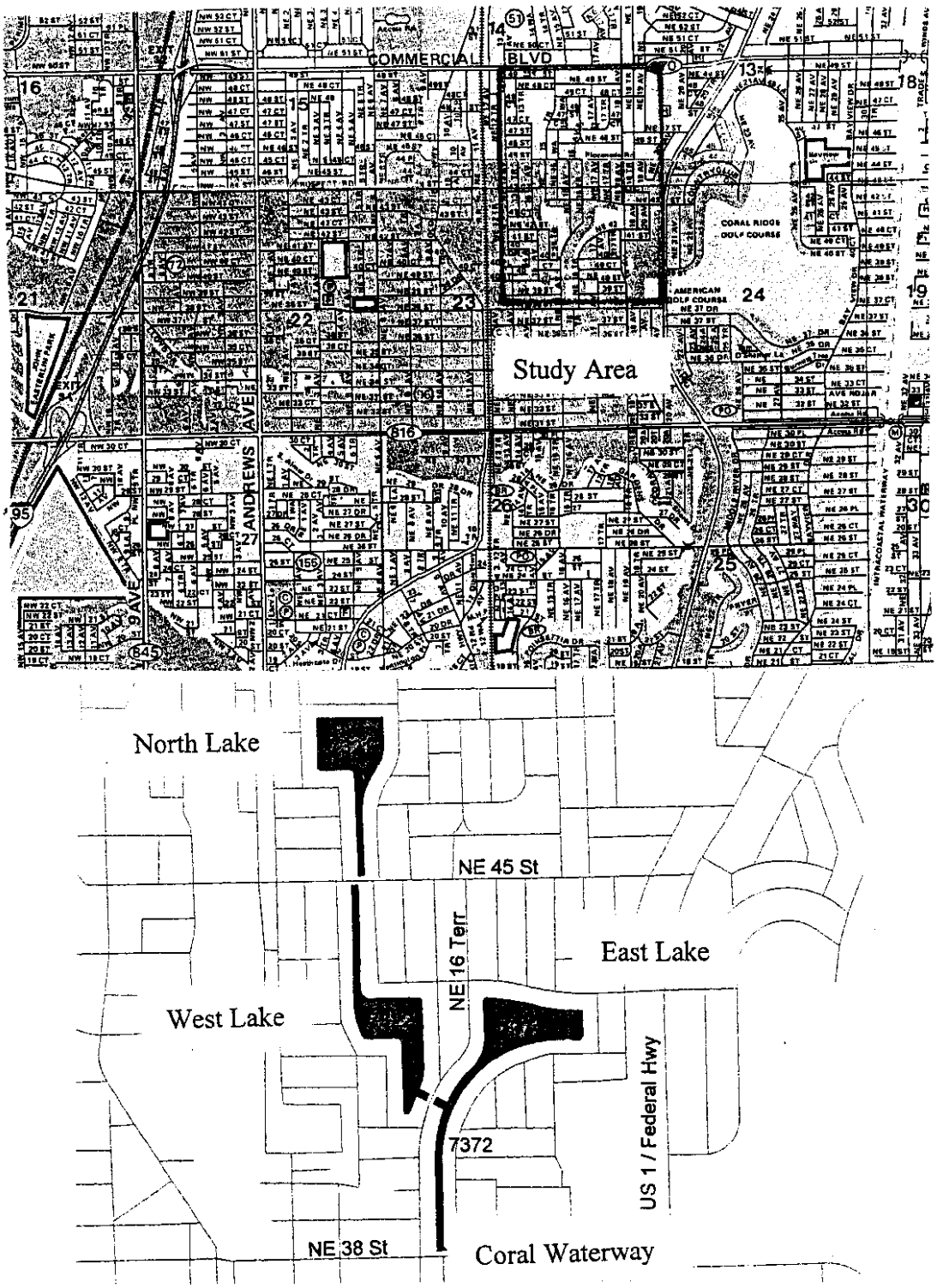
The Broward County Department of Planning and Environmental Protection (DPEP), Water Resources Division, received complaints beginning around November 1998 of poor water quality in the North, West, and East Coral Lakes of the Coral Heights Subdivision in Oakland Park. The complaints included the clogging of inlets and storm sewers with trash, grass, and debris; the presence of oily sheens; the discoloration of the lakes; the presence of algae blooms; the presence of excessive vegetative growth; and the addition of inlets and storm drains which provide drainage for areas which had not had a positive drainage outfall.

DPEP initiated an investigation which included field inspections; the review of existing and proposed plans, lake maintenance activities, and regulations; and a water quality monitoring program. The period of concern is October 1996 through January 1999. The purpose of this report is to document the investigation and to provide conclusions and recommendations pertaining to actions that the City may pursue as well as potential regulatory actions by DPEP.

3.0 DESCRIPTION OF THE STUDY AREA

The Coral Heights Subdivision of the City of Oakland Park is located near the eastern boundary of the City. Figure 1 shows the Coral Heights Subdivision and its associated

Figure 1. Coral Heights Subdivision and Waterways.



waterways. Coral Heights is bounded approximately by NE 49th Street on the north, NE 40th Court on the south, NE 18th Avenue and NE 20th Avenue on the east, and NE 13th Avenue on the west. The North, West, and East Coral Lakes were apparently constructed in the same time frame as the Coral Heights Subdivision. The lakes are zoned OS, open space/recreation, while the remainder of the subdivision is R-1, single family residential.

Storm water runoff from Coral Heights is conveyed through the North, West, and East Lakes to the Coral Waterway, and then to the south to the North Fork of the Middle River. The entire drainage system is tidally influenced, as there is no control structure to separate fresh water from tidal flows from the Intracoastal Waterway and the North Fork of the Middle River.

4.0 INITIAL FIELD INSPECTION

A representative of the DPEP Water Resources Division performed a field inspection shortly after the water quality complaints were received. The purpose of the field inspection was to look for evidence of on-going construction of inlets and storm drains which would discharge to the lakes. No evidence any current construction activities was observed during the inspection.

5.0 REVIEW OF PLANS AND STORMWATER MASTER PLAN

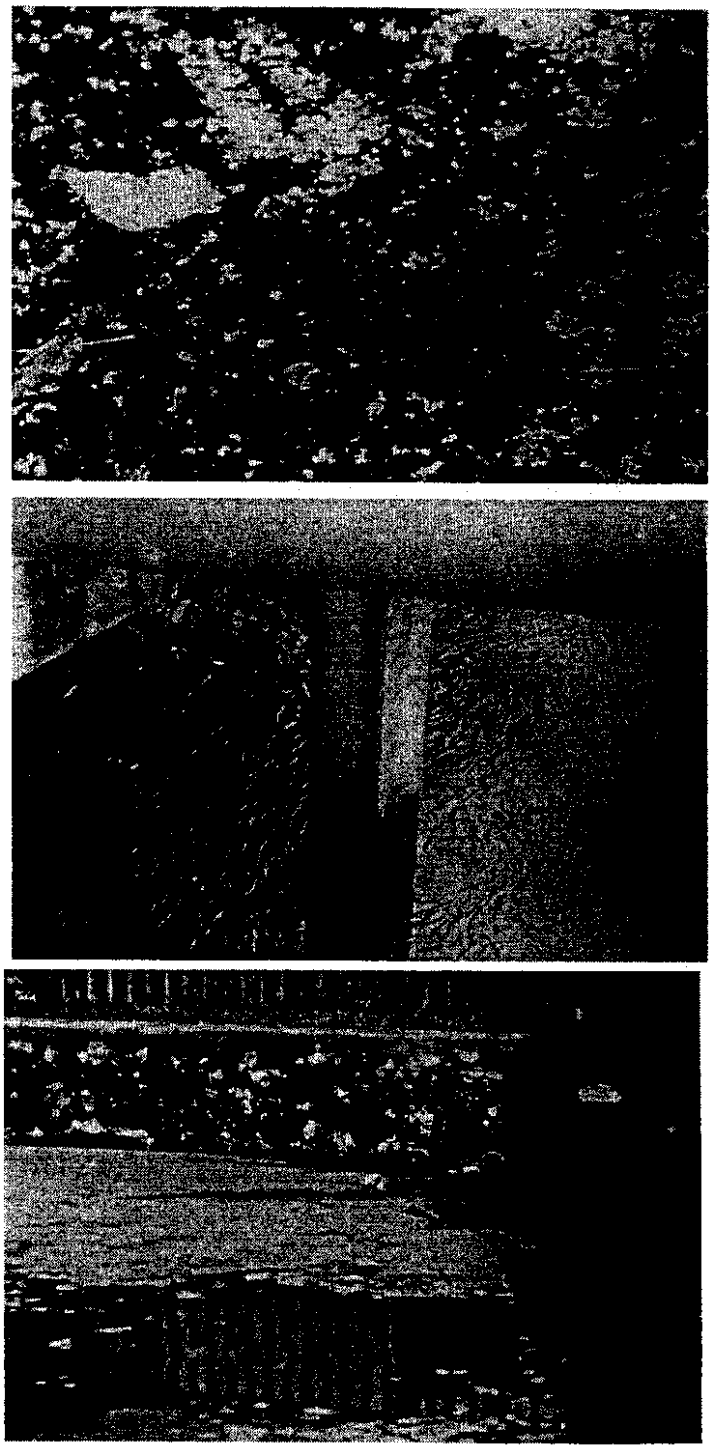
Drainage maps were provided by both City representatives and a concerned citizen in the area. A key City representative became familiar with the area in October 1998 after he began employment with the City. The City provided a set of plans entitled, "City of Oakland Park, Broward County, Florida, Storm Drainage Facilities, Existing and Proposed," September 1975, by the City of Oakland Park Engineering Department. The City also provided a copy of "City of Oakland Park, Stormwater Master Plan, Volumes I and II," February 1998, by Craig A. Smith & Associates. The maps in both of the above references indicate existing and proposed storm drainage facilities for their respective dates.

5.1 EXISTING CONDITIONS

The concerned citizen provided mark ups of a reduced copy of the pertinent portions of the Stormwater Master Plan as well as some other untitled maps of the area and fifteen photographs which depict some of the water quality conditions observed. Along with the marked up maps is a list of storm sewer locations. Selected photographs are shown on Figure 2.

The existing drainage systems depicted on the 1975 City maps, the 1998 City maps, and the 1999 marked up maps were reviewed. Appendix 1 indicates the differences found among these three references. The numbers shown in the 1975 City Maps column refer to outfall numbers on the City maps and the numbers shown on the 1999 Mark Ups column refer to storm

Figure 2. Selected Lake Photographs.



drain numbers on the marked up maps. A review of the inlet number and storm drain location data indicates that the 1999 Mark Ups differ from the 1998 City maps in about fifty percent of the cases.

5.2 POTENTIAL IMPROVEMENTS

The 1998 Stormwater Master Plan also indicates drainage deficient areas and presents potential stormwater improvements. Some of the potential stormwater improvements would be connected to the Coral Lakes drainage system. Appendix 2 shows the potential improvements pertinent to the study area. The Stormwater Master Plan indicates that these improvements would typically consist of catch basins and exfiltration trenches utilizing perforated high density polyethylene (HDPE) pipe with a drainfield with an overflow structure to the existing drainage system. Please see Section 7.2 for information concerning some proposed improvements for the Downtown District.

6.0 LAKE MAINTENANCE ACTIVITIES

Data concerning lake and waterway maintenance activities were obtained from City staff and from the Broward County Office of Environmental Services, Water Management Division (WMD). Lake maintenance activities throughout the period of concern (October 1996 - January 1999) were contracted with the WMD. The last report of lake maintenance activities by the WMD is in January 1999. Starting approximately in May of 1999, the City contracted lake maintenance activities with Aquagenix, Inc. Appendix 3 shows aquatic plant management activities for the period of concern. Eight species of aquatic plants were treated utilizing thirteen different herbicides and other chemicals. A description of the chemicals (herbicides and adjuvants) utilized by WMD for the Coral Lakes and Coral Waterway is presented in Appendix 4 along with the vegetation they are designed to treat.

7.0 EPA REGULATIONS, THE BROWARD COUNTY CODE, AND THE CITY OF OAKLAND PARK CODE

7.1 EPA REGULATIONS

Lake maintenance chemicals, such as herbicides, are regulated by the federal government. Labeling for herbicides registered by the U.S. Environmental Protection Agency (EPA) for aquatic plant growth control indicates that the use and application of the herbicides must follow label instructions. The State of Florida Department of Agriculture and Consumer Services regulates the sale and application of pesticides. Licensed applicators may purchase and apply pesticides in accordance with Florida Statutes and Florida Administrative Code.

The City of Oakland Park (City), twenty-three other municipal governments in Broward County, unincorporated Broward County, and the Florida Department of Transportation were issued EPA National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit Number FLS000016 effective December 1, 1996. Municipalities and counties with populations greater than or equal to 100,000 were required to obtain a MS4 Permit under EPA MS4 Phase I regulations. The City and the other co-permittees were made a part of the Broward County MS4 Permit by EPA.

Annual reports for the first four periods (12/96-11/97, 12/97-11/98, 12/98-11/99, and 12/99-11/00) which summarize the permit requirements accomplished during each year by all co-permittees were prepared by DPEP and filed with EPA. The report for the fifth year from December 2000 to November 2001 is in the initial stages of preparation.

Among other responsibilities and obligations under the permit, the City has reported the maintenance activities shown below during the fourth permit year. The City also produced a newsletter containing waterway maintenance guidelines to inform their citizens of waterway activities and a copy of the City's Adopt-A-Street program. The City developed and installed inlet markers with a stormwater pollution prevention message. Some concerned citizens delivered a door hanger announcing the stormwater pollution prevention program to residences around the lakes. The City has supplied copies of Florida Department of Agriculture and Consumer Services restricted pesticide identification cards for those persons responsible for aquatic plant growth control. The City has indicated that it has spent $700,000 in capital improvement drainage projects for FY 2000 and has budgeted $900,000 for FY 2001. Total stormwater funds budgeted for FY 2000 and FY 2001 were $2,426,498 and $2,118,280, respectively. City records and reports are available for inspection on request.

- 4.5 miles of canal were inspected once per month,
- 4.5 miles of canal were maintained once per month,
- 750 inlets and catch basins were inspected twice per year,
- 400 inlets and catch basins were maintained once per year,
- 5 lakes (193 acres total) were cleaned of debris/inspected once per month,
- 15 miles of exfiltration trenches were inspected twice per year,
- 3 stormwater structures were inspected/cleaned per month,
- 1 stormwater weir unit was inspected/cleaned per month,
- 87.4 miles of streets were swept once per month, and
- 10 miles of street swales were cleaned and maintained every other month.

7.2 BROWARD COUNTY CODE

Section 27-195 of the Broward County Code provides water quality standards for

Section 27-198(d)(1) of the Broward County Code states that any person constructing water management works other than those exempted in section 27-194(c) shall obtain a county license. Water management works as defined in section 27-192 includes works which are designed to alter, regulate, control, or in any way affect or modify the natural flow or level of water. The exemptions presented in section 27-194(c) include the construction or modification or relocation of facilities on sites of two acres or less which results in unchanged or lessened impacts to water quality, quantity, and discharge provided there is no net increase in impervious area and no impact to wetlands. Another exemption is for drainage structure and pipe replacement up to eight hundred feet with like structure or pipe at the same location and elevations.

The DPEP Surface Water Management Program licensing database and general permit file were checked for licenses obtained by the City. Appendix 5 presents the seven projects and licenses found pertaining to the City. None of the licenses found are for projects located in the study area.

Section 27-354(m) of the Broward County Code provides an exemption for activities and operations involving pesticides used pursuant to labeling and registration requirements contained in the Florida Statutes and provided that the application is not done negligently.

Section 27-380(d) of the Broward County Code provides an exemption for the use of regulated substances such as herbicides for aquatic plant control in wellfield protection zones under certain conditions. However, the Coral Heights Subdivision is located outside of County wellfield protection areas.

7.3 CITY OF OAKLAND PARK CODE

A draft of the City of Oakland Park Stormwater Ordinance appears in the City's Stormwater Master Plan. The draft ordinance indicates that the purposes of the ordinance are, among others:

- to reduce pollutant loads entering water bodies,
- to protect, restore, and maintain the chemical, physical, and biological quality of ground and surface waters,
- to implement best management practices identified in the Stormwater Master Plan,
- to encourage the construction of adequate stormwater systems,
- to reduce damage from flooding while recognizing that natural fluctuations in water levels are beneficial,
- and to increase stormwater infiltration, settling of suspended solids and removal of pollutants from runoff prior to discharge into surface waters.

8.0 WATER QUALITY MONITORING PROGRAM

In response to the complaints of poor water quality in the Coral Lakes and Waterway, DPEP developed a monitoring plan to sample and test water in the back yards with the permission of the owner at four locations:

- 1360 NE 48th Court (North Lake),
- 4251 NE 16th Avenue (West Lake),
- 1801 NE 42nd Street (East Lake),
- and 39th Street & 16th Terrace (Coral Waterway).

The plan included obtaining one set of samples during a dry period and one set of samples during a wet period. The samples were tested for the following parameters, which typically are of concern for stormwater runoff:

- turbidity,
- cadmium,
- chromium,
- copper,
- lead,
- nickel,
- zinc,
- ammonia,
- total Kjeldahl nitrogen (TKN),
- total phosphorous,
- nitrite + nitrate,
- total organic carbon,
- total coliform, and
- fecal coliform.

The dry period samples were obtained on March 3, 1999, and the wet period samples were obtained on June 3, 1999. Complete sample results, including the testing method, are contained on the laboratory reports in Appendix 6.

Sample values exceeded the Broward County Code standards for two parameters, copper and total phosphorus, although the Code provides for an exemption for aquatic plant control under certain circumstances. The test values for copper were about two and one-half and two and one-quarter above the standard for March 3 and June 3, respectively. The test values for total phosphorus were about one and one-quarter and one and one-half above the standard for March 3 and June 3, respectively. The sample values and the standard values are presented in Appendix 7.

9.0 FOLLOW UP FIELD INSPECTIONS

A follow up field inspection was conducted on May 2, 2000. The inlets and drainage system depicted on the 1999 Mark Ups were targeted for inspection. Field observations were

were obtained on June 3, 1999. Complete sample results, including the testing method, are contained on the laboratory reports in Appendix 6.

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9.0 FOLLOW UP FIELD INSPECTIONS

A follow up field inspection was conducted on May 2, 2000. The inlets and drainage system depicted on the 1999 Mark Ups were targeted for inspection. Field observations were compared to the 1975 City Maps, the 1998 City Maps, and the 1999 Mark Ups. Inlets and storm drains not shown on the 1998 maps were found. Saw cuts in the pavement were observed. The sumps of some inlets had been filled in with concrete to the approximate elevation of the pipe invert. The newer type of plastic drainage pipe was observed at some of the inlets. Very few road drainage swales were found. Remnants of grassy swales along some roadways were found, as evidenced by depressions in adjoining paved driveways. The benefits of swales are presented in the brochure, "Save the Swales," by the Florida Department of Environmental Protection. A copy of this brochure may be found in Appendix 8.

Residential lawns throughout the area appeared to be very well kept. Most lawns were green in color, mowed, and relatively weed free. Bulkheads or hard edges were observed in many areas around the lakes and waterway.

Signs posted in several lawns announced a meeting of the Corals of Oakland Park Homeowners Association (COPHA) on May 2, 2000. COPHA has formed a lakes committee to address the lake water quality concerns. One of the citizens on the Lakes Committee reported that an oily sheen had been observed recently on the surface of the northeast corner of West Lake. The sheen had disbursed before this inspection was conducted.

A drive through the Commercial Boulevard Industrial Park area was conducted on May 12, 2000, to look for any illicit discharges to the storm drainage system. Several auto repair facilities, screen printing & graphics, and other industrial use businesses are located in the area. No illicit discharges were observed at the time.

The Broward County DPEP has developed three brochures which may assist the City and

its citizens in developing better water quality in the Coral Lakes system:

- "South Florida Yards Conserve and Beautify,"
- "Where Should the Water Go?," and
- "Common Causes of Fish Kills."

These brochures provide information concerning the proper irrigation and fertilization of lawns; the proper disposal of washwater; and how weather patterns, water depth, water quality, and other factors can affect fish life. The brochures are presented in Appendix 8.

10.0 RESPONSE BY THE CITY

A draft report containing the findings of this study was distributed to the City and to concerned citizens in May 2000. The information in the report as well as the conclusions and recommendations were discussed with representatives of the City and with some concerned citizens.

Regarding the appearance of inlets on recent maps which hadn't been shown on older mapping, City representatives indicated that no new inlets had been constructed where none had been before. The failure to show the inlets on the newer maps was believed to be a mapping omission. The saw cuts in the pavement and the newer pavement was the result of the replacement of failed inlets and pipes under the roadways and into the lakes.

The City contracted with Craig A. Smith and Associates, Inc. (CAS), and J.J. Goldasich and Associates, Inc. (Goldasich), to perform additional studies. The purpose of the Goldasich study was to conduct two field surveys and obtain and test water samples at seven points throughout the lake and waterway system and at varying sample depths. The field surveys were scheduled to reflect both wet and dry weather conditions. In addition, the sediment at the bottom of each lake was sampled and tested.

The Goldasich study concluded that the lake and waterway system had high water quality based on the analysis of the samples obtained. The lake system was found to be fairly well flushed by normal tidal action. Excerpts of the Goldasich study recommends are as follows:

- Dredging the shallow areas adjacent to the bridge crossings would increase tidal interchange among the water bodies but probably would not account for measurable improvements in the water quality of the system.
- Parties responsible for grassed swales and slopes adjacent to road rights-of-way should maintain these areas.
- All areas adjacent to seawalls along the shoreline should be graded such that runoff from

the adjoining lots does not drain directly into the water bodies.

- Grassed areas should be installed and maintained around catch basins.
- Native aquatic and marine emergent vegetation should be installed on the water side of the seawalls and in areas of shallow water depth.
- Where possible, vertical seawalls should be removed and riprap with planted emergent aquatic and marine vegetation should be planted.
- Scuppers which convey water from lots adjoining the waterways into the water bodies should be removed or modified to provide some water quality treatment before discharge.
- Conduct a complete tidal survey.
- Conduct a synoptic survey of the lake and waterway sediment.

CAS prepared a point by point response to the recommendations made in the draft of this report. Highlights of their response are as follows:

- CAS has conducted a full survey of the stormwater system and believes that the representation of the drainage elements is accurate. The Goldasich study was conducted to identify potential pollution sources and to suggest improvements.
- The City seeks opportunities to reconstruct grassy swales along the roadways.
- The City did not find any illicit discharges from the Commercial Boulevard Industrial Park area.
- Drainage improvements designed by CAS have been properly permitted.
- The City ended its long standing arrangement with the County for aquatic plant control and has retained a private contractor to perform these services.
- The new private contractor is not applying copper in heavy concentrations.
- The City is distributing information via newsletters and through the City website.
- The City continues to satisfy the NPDES MS$ Permit requirements.
- The City may not need a stormwater ordinance because the County Code addressed pollution concerns. The City has been working with Team Lake to develop and distribute educational materials.

11.0 CONCLUSIONS

1. There are significant differences between what is shown on the City's 1998 Stormwater Master Plan and what was found during the field investigation. Additional inlets were found near 1801 NE 42nd Street, 4250 NE 16th Terrace, 4300 NE 15th Terrace, 4450 NE 15th Avenue, 4841 NE 15th Terrace, 1511 NE 48th Court, and 1360 NE 47th Court. The City has indicated that the differences are explained by mapping errors. Inlet sumps were found to be partially filled with concrete to the pipe invert elevation at 1511 NE 48th Court, 4830 NE 13th Terrace, and 1360 NE 47th Court. It is not sure why some inlet sumps were partially filled with concrete. One possibility is that standing water in the

inlets may be believed to promote mosquito population. Saw cuts which indicate maintenance work in the vicinity of storm drain lines and inlets were found in numerous places. The saw cuts indicate activity since the roadway was last resurfaced, which could have been several years prior to the field inspection. The presence of plastic drainage pipe at some of the inlets indicates that older, corrugated metal pipe has been replaced with newer, HDPE pipe.

There are at least two explanations for these differences. The first explanation is that the inlets and storm drains in question could have been missed during the survey work accomplished for the 1998 Stormwater Master Plan. The second explanation is that these facilities were constructed or replaced after the plan survey work was accomplished. DPEP records do not indicate that these drainage improvements were licensed. If the facilities were constructed or replaced since the County requirements regarding surface water management were established, the City may be in violation of Chapter 27 of the Broward County Code.

If the inlet and storm drain system has been extended from the original drainage design for the Coral Heights subdivision, then the volume of fresh water entering the lakes and waterway will have increased. A change in the relative amount of fresh water versus salt water or the presence of a fresh water lens on top of the salt water could significantly impact aquatic/marine populations.

2. The restoration of grassy drainage swales along the roadways could enhance the water quality of the lakes and waterway. The removal of bulkheads or other hard edges around the lakes and waterway and the establishment of swales and berms along the edge of the water could also enhance water quality.

3. The Commercial Boulevard Industrial Park area should be monitored periodically for illicit discharges.

4. The potential storm drainage improvements should be licensed by the County where applicable. In particular, water quality provisions such as the suggested exfiltration trenches should be made for the potential drainage improvements.

5. There aquatic plant management activities appear to have been conducted within herbicide label instructions and accepted application practices. The application of 20 gallons of Aquathol K over an area of one acre on June 2, 1997, was at a rate significantly greater than the other applications. This may not be a concern if the depth of the hydrilla treated at the time was several feet or more rather than a foot or two.

6. The elevated copper levels found in the lake water and in the waterway on March 3 and June 3, 1999, are most likely due to the application of herbicides containing copper. The herbicide Clearigate contains copper. Portions of the North Lake had been treated with Clearigate on December 28, 1998, December 29, 1998, and January 8, 1999. Cutrine Plus also contains copper, but the last application of Cutrine Plus was reported to be May 4, 1998.

7. The elevated phosphorus levels found in the lake water and in the waterway on March 3 and June 3, 1999, are most likely due to the application of fertilizers in residential lawns and subsequent storm runoff containing dissolved phosphorus into the lakes and waterway. The green color of most lawns suggests that the lawns are watered and fertilized to achieve their appearance.

8. The City is meeting the requirements of and obligations under the EPA NPDES Municipal Separate Storm Sewer System Permit issued to Broward County and other co-permittees.

9. The purposes of the draft stormwater ordinance have competing goals. Improved drainage through the extension of storm drains, the addition of inlets, and the replacement of failed metal pipes may negatively impact water quality unless practices such as grassy swales or inlet filter devices are incorporated into the drainage system.

   An aggressive aquatic plant control program may negatively impact lake water quality, creating elevated levels of certain chemicals above water quality standards. Therefore, many residents have a stake in the ramifications of the stormwater ordinance, including those who live near a lake, those who live in areas of poor drainage, and those who will be asked to pay for the drainage improvements.

10. The dredging of the shallow areas has both positive and negative impacts. The Goldasich field evaluation indicated that the areas adjacent to the bridges may contribute to poor water quality during storm events because of bare, steep slopes of erodible earth. The conclusions and recommendations section indicated that the dredging of these areas would not account for measurable improvements in the water quality of the system because of an enhanced flushing effect. In addition, important benthic macro invertebrate associations would be impacted by the dredging of these areas.

12.0 RECOMMENDATIONS

1. The City of Oakland Park and their consultant believes that the current map of the drainage system is accurate. The City currently utilizes tighter controls concerning the

production of storm drainage system maps. The maps showing different storm inlets and drains alone do not provide sufficient evidence that the City constructed drainage systems without obtaining the proper licenses and permits. The City should still look for opportunities to enhance water quality treatment prior to the discharge of storm drainage to the water bodies.

2. The City should investigate the feasibility of and implement where practical the restoration of grassy drainage swales along the roadways and bulkheads along the water.

3. The City should inspect the Commercial Boulevard Industrial Park area for potential City Code violations affecting storm runoff, and DPEP should investigate potential illicit discharges from the Commercial Boulevard Industrial Park.

4. The City should confer with DPEP concerning which potential drainage improvement projects require a surface water management license.

5. The City's aquatic plant control program records should include the depth of the water treated to help assure a proper application rate is achieved. The City should continue to use licensed herbicide applicators who properly apply the herbicides.

6. More frequent herbicide treatment for algae using copper products over smaller affected areas may result in lowered copper concentrations.

7. The City and DPEP should continue to develop and distribute information to property owners concerning the proper use of fertilizers to reduce phosphorus inputs using media such as newsletters and the Internet.

8. The City should continue to meet its requirements and obligations under the EPA NPDES MS4 Permit.

9. The City should strive to balance the competing goals of improved drainage and improved water quality by assuring that drainage improvement projects contain provisions to address water quality. The City should continue enlist the assistance of the COPHA, Team Lake, and/or other citizen groups in developing drainage and water quality improvements and in educating residents on the use of fertilizers, controlling car wash water discharges, and other means to promote good water quality.

10. The dredging of the shallow areas near the bridge crossings and the regrading and vegetative stabilization of the steep, bare slopes should be considered further because the benefits may outweigh the negative impacts. The benthic macro invertebrate associations

could be relocated to the existing shallow areas adjacent to portions of the seawall. In addition, new shallow areas along the existing seawalls as suggested in the Goldasich recommended actions could be created for benthic macro invertebrate associations.

REFERENCES

The following documents were consulted during the investigation and preparation of the report.

"City of Oakland Park, Broward County, Florida, Storm Drainage Facilities, Existing and Proposed," September 1975, plan sheets by the City of Oakland Park Engineering Department.

City of Oakland Park, Stormwater Master Plan, Volumes I and II, February 1998, by Craig A. Smith & Associates.

Mark Ups of a Reduced Copy of the Pertinent Portions of the Stormwater Master Plan by a concerned citizen.

Herbicide Handbook of the Weed Science Society of America, Fifth Edition, 1983.

Training Manual for Aquatic Herbicide Applicators in the Southeastern United States, K.A. Langeland, Editor, University of Florida Institute for Food and Agricultural Sciences, 1998.

The Merck Index, Ninth Edition, 1976.

Manufacturer's Product Information Brochures, Product Labels, and Material Safety Data Sheets for several aquatic plant control chemicals by their manufacturers.

"Chemical Control of Aquatic Weeds," Ohio State University Extension Fact Sheet.

How to Identify and Control Water Weeds and Algae, 5th Edition, Applied Biochemists.

"The Aquatic Pesticide Application Assistant," Version 1.1, 1999, CD-ROM by Applied Biochemists.

"Aquatic Plant Information System," Version 1.0, CD-ROM by the US Army Corps of Engineers.

"Authorization to Discharge under the National Pollutant Discharge Elimination System, Permit No. FLS000016," US Environmental Protection Agency, Region 4, issued October 31, 1996, and effective December 1, 1996.

"Annual Report, City of Oakland Park, NPDES Permit No. FLS00016," City of Oakland Park, Florida.

Broward County Code, Chapter 27, Pollution Control, Municipal Code Corporation.

Code of Ordinances, City of Oakland Park, FL, Municipal Code Corporation.

"Ecological Evaluation - North, West and East Lake Coral Lakes, Oakland Park, Florida; Sections 14 & 23, Township 49E, Range 42S," by J.J. Goldasich and Associates, Incorporated, January 2001.

"City of Oakland Park, Downtown District Conceptual Stormwater Master Plan," by Craig A. Smith & Associates, Inc., Status Report, May 29, 2001.

"Save the Swales," brochure by the Florida Department of Environmental Protection.

"South Florida Yards Conserve and Beautify," brochure by the Broward County Department of Planning and Environmental Protection and the University of Florida Extension.

"Where Should the Water Go?," brochure by the Broward County Department of Planning and Environmental Protection.

"Common Causes of Fish Kills," Broward County Department of Planning and Environmental Protection.

APPENDIX

Appendix 1. Comparison of Map Data for Existing Drainage System.

Appendix 2. Stormwater Master Plan Potential Improvements.

Appendix 3. Aquatic Plant Management Activities.

Appendix 4. Chemicals Utilized and Vegetation Treated.

Appendix 5. Broward County Surface Water Management Licenses Issued to the City.

Appendix 6. Broward County DPEP Laboratory Reports.

Appendix 7. Sample Parameters Exceeding Marine Water Quality Standards.

Appendix 8. Informational Brochures Concerning Lake Water Quality.

Appendix 1. Comparison of Map Data for Existing Drainage System.

Location	*1975 City Maps*	*1998 City Maps*	*1999 Mark Ups*	*2000 Field Inspection*
4510 NE 15th Terrace	three inlets shown - flows to #NE 6 and #NE 8	one inlet shown	#1 - three inlets shown	three inlets found - saw cuts on pavement
1831 NE 43rd Street	three inlets shown - flows south to #NE 14	three inlets shown as in 1975	#2 - three inlets shown flowing to SW	three inlets found as in 1998 maps
1801 NE 42nd Street	absent	one inlet shown	#3 - two inlets shown	two inlets found as shown on mark ups - saw cut in pavement
3951 NE 16th Terrace	absent	two inlets shown	#4 - two inlets shown	two inlets found as in 1998 maps
3780 NE 16th Terrace	absent	absent	#5 - one inlet shown	no inlets found
3821 NE 16th Avenue	three inlets shown - flows to #NE 16	three inlets shown	#6 - three inlets shown	three inlets found as in 1998 maps - outlet ½ silted in
3830 NE 16th Avenue	one inlet shown - drains south to #NE 16	one inlet shown	#7 - one inlet shown - drains to east	one inlet found as in 1998 maps
4250 NE 16th Terrace	absent	one inlet shown at 43rd St./16th Terr. intersection	two inlets shown two lots to south of 1998 maps	two inlets found as shown on mark ups

Location	*1975 City Maps*	*1998 City Maps*	*1999 Mark Ups*	*2000 Field Inspection*
4300 NE 15th Terrace	one inlet shown - drains to SW to #NE 10	one inlet shown as in 1975	two inlets shown - drains to west	two inlets found as shown on mark ups - pavement overlaid recently
4510 NE 15th Terrace	one inlet shown - flows to #NE 8	one inlet shown	#8 - one inlet shown	one inlet found - saw cut on pavement
4450 NE 15th Avenue	four inlets shown - flows to #NE 7 and #NE 9	four inlets shown	#9 - four inlets shown	five inlets found - saw cuts on pavement
4651 NE 15th Terrace	four inlets shown - flows to #NE 5	three inlets shown	#10 - three inlets shown	four inlets found as shown on 1975 maps
4841 NE 15th Terrace	four inlets shown - flows to #NE 3 and #NE 4	three inlets shown	#11 - three inlets shown	four inlets shown with two outlets to lake - saw cuts on pavement - black plastic pipe found
1511 NE 48th Court	absent	absent	#12 - two inlets shown	two inlets found - inlet sumps filled with concrete to pipe invert

Location	*1975 City Maps*	*1998 City Maps*	*1999 Mark Ups*	*2000 Field Inspection*
4830 NE 13th Terrace	three inlets shown - flows to #NE 2; abandoned sewer outfall flows to #NE 1	three inlets shown; abandoned sewer outfall shown	#13 - three inlets shown	three inlets found - saw cuts in pavement - inlet sumps filled with concrete to pipe invert
1360 NE 47th Court	absent	absent	#14 - two inlets shown	two inlets found - saw cuts in pavement - inlet sumps filled with concrete to pipe invert
1750 NE 43rd Street	three inlets shown - flows to #NE 13	three inlets shown	#15 - three inlets shown	three inlets found as in 1998 maps - saw cuts in pavement
Commercial Boulevard Industrial Park	not connected to Coral Lake system	connected to Coral Lake system	N/A	N/A

Appendix 2. Stormwater Master Plan Potential Improvements.

Stormwater Master Plan Drainage Deficient Map No.	*Affected Roadways*	*Outfall Location*
23	NE 12th Terrace at the Commercial Boulevard Industrial Park	#NE 9 - near Floranada Road crossing of canal between North and West Lakes
24	NE 46th Street between NE 15th Way and NE 18th Avenue	#NE 5 - near NE 15th Terrace and NE 47th Street
27	NE 38th Street between NE 13th Avenue and NE 18th Avenue	#NE 16 and unnamed outfall - near NE 38th Street crossing of Coral Waterway

Appendix 3. Aquatic Plant Management Activities.

Date	*Location*	*Vegetation Treated*	*Area Treated (acres)*	*Chemical Applied*	*Amount Applied (gal)*	*Application Rate (gal/ac)*
10/11/96	North and West Lakes	hydrilla	1	Reward	2.5	2.5
10/22/96	North and West Lakes	duckweed	2.5	Reward	5	2
10/23/96	North and West Lakes	torpedo grass	1.5	Rodeo	1.5	1
10/23/96	North and West Lakes	algae	3	Cutrine Plus	10	3.33
10/23/96	North and West Lakes	hydrilla	5	Reward	10	2
6/2/97	North and West Lakes	hydrilla	1	Aquathol K	20	20
6/16/97	East Lake and Coral Waterway	hydrilla	7.5	Reward	15	2
6/16/97	East Lake and Coral Waterway	torpedo grass	2.5	Rodeo	5	2
6/16/97	East Lake and Coral Waterway	N/A - adjuvant	Not Known	Poly-control	1	Not Known
6/16/97	East Lake and Coral Waterway	N/A - adjuvant	Not Known	Nalco-Trol II	1	Not Known
11/6/97	North and West Lakes	duckweed	4	Reward	4	1
11/6/97	North and West Lakes	N/A - adjuvant	Not Known	Corsair	1	Not Known
11/12/97	North and West Lakes	duckweed	5	Reward	5	1
11/18/97	North and West Lakes	duckweed	7	Reward	7	1

Date	*Location*	*Vegetation Treated*	*Area Treated (acres)*	*Chemical Applied*	*Amount Applied (gal)*	*Application Rate (gal/ac)*
11/19/97	North and West Lakes	hygrophila	4	Reward	8	2
12/1/97	North and West Lakes	cabomba	1.5	Reward	2.5	1.67
3/3/98	North and West Lakes	hydrilla	2.5	Reward	5	2
5/1/98	North and West Lakes	torpedo grass	1	Rodeo	0.5	0.5
5/1/98	North and West Lakes	N/A - adjuvant	Not Known	Nalco-Trol	0.2	Not Known
5/4/98	North and West Lakes	algae	1	Cutrine Plus	5	5
5/4/98	North and West Lakes	hydrilla	1	Reward	1	1
9/4/98	Coral Waterway	N/A - inspection	--	--	--	--
10/9/98	Coral Waterway	torpedo grass	1	Rodeo	1	1
10/9/98	Coral Waterway	N/A - adjuvant	Not Known	X77	0.5	Not Known
10/29/98	North Lake	naiad	1.2	Diluent Blue	2.5	2
10/29/98	North Lake	N/A - adjuvant	Not Known	Subcide	1	Not Known
11/10/98	Coral Waterway	N/A - inspection	--	--	--	--
12/8/98	North Lake	N/A - inspection	--	--	--	--
12/23/98	Coral Waterway	N/A - inspection	--	--	--	--
12/28/98	North Lake	naiad	5	Reward	10	2
12/28/98	North Lake	algae	5	Clearigate	15	3

Date	*Location*	*Vegetation Treated*	*Area Treated (acres)*	*Chemical Applied*	*Amount Applied (gal)*	*Application Rate (gal/ac)*
12/28/98	North Lake	N/A - adjuvant	Not Known	Subcide	3	Not Known
12/29/98	North Lake	naiad	5	Reward	10	2
12/29/98	North Lake	algae	5	Clearigate	15	3
12/29/98	North Lake	duckweed	2.5	Reward	2.5	1
12/29/98	North Lake	N/A - adjuvant	Not Known	Subcide	8	Not Known
12/29/98	North Lake	N/A - adjuvant	Not Known	Silnet	0.5	Not Known
1/4/99	North Lake	N/A - inspection	--	--	--	--
1/8/99	North Lake	pondweed	5	Reward	10	2
1/8/99	North Lake	algae	5	Clearigate	15	3
1/8/99	North Lake	N/A - adjuvant	Not Known	Subcide	8	Not Known

Appendix 4. Chemicals Utilized and Vegetation Treated.

Herbicides			
Chemical	*Common Name*	*Typical Application Rate*	*Vegetation Treated*
Aquathol K	endothal	0.5 to 5.0 ppm	bur weed, coontail, hydrilla, hygrophila, milfoil, naiad, pondweed, sago pondweed, and water scar grass
Cutrine Plus	copper ethanolamine	0.6 to 4.8 gal./acre	algae, chara, and nitella
Rodeo	glyphosate	3 to 20 gal./acre	arrowhead, bullrush, cattails, pickerelweed, purple loosestrife, smartweeds, spike-rush, willows, American lotus, spatterdock, and water-shield
Reward	diquat dibromide	2 gal./acre	bulrush, cattails, pickerelweed, spike-bush, algae, duckweed, pondweed, bladderwort, coontail, watermilfoil, elodea, hydrilla, and naiad
Clearigate	emulsified copper ethanolamine	0.9 to 9.7 gal./acre	algae, nitella, chara, elodea, hydrilla, water milfoil, naiad, pondweeds, duckweed, water hyacinth
Adjuvants (additives to enhance herbicide performance)			
Chemical	*Common Name*	*Typical Application Rate*	*Purpose*
Polycontrol	polyacrylamide copolymer	½ to 8 ounces/100 gal.	drift control, sinking agent, sticking and spreading agent
Nalco-Trol	acrylamide acrylate polymer	4-32 oz./100 gal.	mist and drift retardant
Nalco-Trol II	acrylamide acrylate polymer	4 oz-32 oz/100 gal.	mist and drift retardant
Diluent Blue	hydrotreated hydrocarbon mixture	5%-50% herbicide in diluent	information not available

Date	*Location*	*Vegetation Treated*	*Area Treated (acres)*
X77	alkylarypoly-xyethylele, alkypoly-xyethliene	½-4 pints/100 gals.	information not available
Silnet	silicone copolymer	12-24 oz./100 gal.	information not available
Subcide	polyacrylamide	1-2 gal./100 gal.	sinking agent
Corsair	polyamide copolymer	4 to 32 oz.	information not available

Appendix 5. Broward County Surface Water Management Licenses Issued to the City.

Project Name	*License Number*
Downtown District	SWM2001-171-0
NW 42 Street, NW 43 Street, & NW 43 Court Drainage Imp.	SWM2001-124-0
NE 19 Terrace / NE 20 Avenue	SWM2000-200-0
NE 34 Street East of NE 6 Avenue	SWM1998-159-0
NE 33, 34, & 35 Street & NE 34 Court between 5 & 6 Avenue	SWM1998-158-0
NE 32 Street & NE 33 Street, East of NE 6 Avenue	SWM1998-157-0
NE 42 Street Drainage Improvements	SWM1998-156-0
NE 7 Terrace Storm Sewer Improvements	SWM1998-066-0
NE 6 Avenue (between NE 38 Street & Oakland Park Boulevard)	SWM2000-050-0
NE 48 Street & 11 Avenue Corridor Drainage Improvements	SWM1996-069-0
NW 17 Terrace	GL01-090
NE 15 Avenue & NE 38 Street	GL01-084
NE 19 Terrace / NE 20 Avenue	GL01-014
NW 10 Terrace	GL99-181

Appendix 6. Broward County DPEP Laboratory Reports.

Broward County Board of County Commissioners
Department of Natural Resource Protection
Environmental Monitoring Division
218 S.W. 1st Ave
Fort Lauderdale, FL 33301
(954) 519-1240
FHRS Laboratory Certification #E46053/#46027
Comprehensive Quality Assurance Plan #870191G

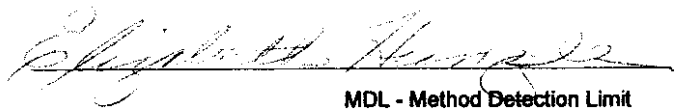
Laboratory Report

Sample Id: 99N67160 **Project:** WRD **Matrix:** MARINE **Sample Type:** SALINE SURFACE WATER
Source: CORAL HEIGHTS LAKES **Sample Point:** 4251 NE 16 AVE.
Sample Date: 3/3/99 **Sample Time:** 12:05 **Sampled By:** Robert Jensen
Guidance Limits Applied: **Standard Limits Applied:** CHAPTER 27 - BROWARD COUNTY CODE

Parameter	Result	Units	Method	MDL	PQL	UGC	LGC	GV	USL	LSL	SV	DQC	Date	Time	Analyst
Bacteria Prep	DONE	N/A	PREP										3/3/99	16:35	VATHAUER
Microwave Acid Dig	DONE	N/A	SW 846 3015										3/10/99	09:49	WBARTO
TURBIDITY	1.00	ntu	EPA 180.1	0.5	2				10			M	3/4/99	16:05	ALOUIS
CADMIUM BY ICP	<0.999	ug/l	EPA 200.7 GRP10	0.999	4				5			U	3/10/99	09:49	WBARTO
CHROMIUM BY ICP	5.14	ug/l	EPA 200.7 GRP10	1.37	5.48				50			M	3/10/99	09:49	WBARTO
COPPER BY ICP	7.01	ug/l	EPA 200.7 GRP10	3.9	15.6				3		Y	M	3/10/99	09:49	WBARTO
LEAD BY ICP	<9.13	ug/l	EPA 200.7 GRP10	9.13	36.5				5.6			U	3/10/99	09:49	WBARTO
NICKEL BY ICP	<13.5	ug/l	EPA 200.7 GRP10	13.5	54				8.3			T	3/10/99	09:49	WBARTO
ZINC BY ICP	9.19	ug/l	EPA 200.7 GRP10	3.65	14.6				86			M	3/10/99	09:49	WBARTO
AMMONIA	<0.0150	mg/l	EPA 350.1	0.015	0.06							U	3/8/99	14:00	BJOHNSON
TOTAL KJELDAHL NITROGEN	1.13	mg/l	EPA 351.2/365.4	0.131	0.524								3/19/99	11:00	BJOHNSON
TOTAL PHOSPHOROUS	0.0650	mg/l	EPA 351.2/365.4	0.012	0.048				0.05		Y		3/18/99	14:00	BJOHNSON
NITRITE + NITRATE	<0.0250	mg/l	EPA 353.2	0.025	0.1							U	3/22/99	14:42	BJOHNSON
TOTAL ORGANIC CARBON	13.2	mg/l	EPA 415.1	0.181	0.724								3/5/99	12:50	RJENSEN
TOTAL COLIFORM	73	c/100	SM 9222B	24	96				2400			B	3/4/99	15:31	ALOUIS
FECAL COLIFORM	15	c/100	SM 9222D	7	28	800			800			B	3/4/99	15:31	ALOUIS

Lab Comments:

Field Comments:

Approval:  3/26/99

DQC Code Descriptions

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- M Presence verified but not quantified - Estimated Value
- T Value reported is greater than 0 but less than the MDL
- U Indicates material was analyzed for but not detected

MDL - Method Detection Limit	USL - Upper Standard Limit	UGC - Upper Guidance Concentration
PQL - Practical Quantitation Limit	LSL - Lower Standard Limit	LGC - Lower Guidance Concentration
DQC - Data Qualifier Code	SV - Standard Violation	GV - Guidance Violation

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Fort Lauderdale, FL 33301
(954) 519-1240

FHRS Laboratory Certification #E46053/#46027
Comprehensive Quality Assurance Plan #870191G

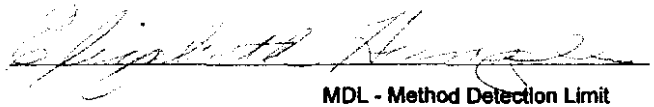
Laboratory Report

Sample Id: 99N67161 **Project:** WRD **Matrix:** MARINE **Sample Type:** SALINE SURFACE WATER
Source: CORAL HEIGHTS LAKES **Sample Point:** 1801 NE 42 ST.
Sample Date: 3/3/99 **Sample Time:** 12:30 **Sampled By:** Robert Jensen
Guidance Limits Applied: **Standard Limits Applied:** CHAPTER 27 - BROWARD COUNTY CODE

Parameter	Result	Units	Method	MDL	PQL	UGC	LGC	GV	USL	LSL	SV	DQC	Date	Time	Analyst
Bacteria Prep	DONE	N/A	PREP										3/3/99	16:35	VATHAUER
Microwave Acid Dig	DONE	N/A	SW 846 3015										3/10/99	09:52	WBARTO
TURBIDITY	0.600	ntu	EPA 180.1	0.5	2				10			M	3/4/99	16:05	ALOUIS
CADMIUM BY ICP	<0.999	ug/l	EPA 200.7 GRP10	0.999	4				5			U	3/10/99	09:52	WBARTO
CHROMIUM BY ICP	<1.37	ug/l	EPA 200.7 GRP10	1.37	5.48				50			T	3/10/99	09:52	WBARTO
COPPER BY ICP	7.99	ug/l	EPA 200.7 GRP10	3.9	15.6				3		Y	M	3/10/99	09:52	WBARTO
LEAD BY ICP	<9.13	ug/l	EPA 200.7 GRP10	9.13	36.5				5.6			U	3/10/99	09:52	WBARTO
NICKEL BY ICP	<13.5	ug/l	EPA 200.7 GRP10	13.5	54				8.3			U	3/10/99	09:52	WBARTO
ZINC BY ICP	7.92	ug/l	EPA 200.7 GRP10	3.65	14.6				86			M	3/10/99	09:52	WBARTO
AMMONIA	<0.0150	mg/l	EPA 350.1	0.015	0.06							U	3/8/99	14:00	BJOHNSON
TOTAL KJELDAHL NITROGEN	1.26	mg/l	EPA 351.2/365.4	0.131	0.524								3/19/99	11:00	BJOHNSON
TOTAL PHOSPHOROUS	0.0580	mg/l	EPA 351.2/365.4	0.012	0.048				0.05		Y		3/18/99	14:00	BJOHNSON
NITRITE + NITRATE	0.0270	mg/l	EPA 353.2	0.025	0.1							M	3/22/99	10:51	BJOHNSON
TOTAL ORGANIC CARBON	13.0	mg/l	EPA 415.1	0.181	0.724								3/5/99	12:50	RJENSEN
TOTAL COLIFORM	73	c/100	SM 9222B	24	96				2400			B	3/4/99	15:31	ALOUIS
FECAL COLIFORM	7	c/100	SM 9222D	7	28	800			800			B	3/4/99	15:31	ALOUIS

Lab Comments:

Field Comments:

Approval:  3/26/99

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FHRS Laboratory Certification #E46053/#46027
Comprehensive Quality Assurance Plan #870191G

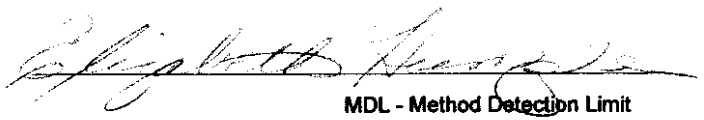
Laboratory Report

Sample Id: 99N67162 **Project:** WRD **Matrix:** MARINE **Sample Type:** SALINE SURFACE WATER
Source: CORAL HEIGHTS LAKES **Sample Point:** 1360 NE 48 CT.
Sample Date: 3/3/99 **Sample Time:** 12:05 **Sampled By:** Robert Jensen
Guidance Limits Applied: **Standard Limits Applied:** CHAPTER 27 - BROWARD COUNTY CODE

Parameter	Result	Units	Method	MDL	PQL	UGC	LGC	GV	USL	LSL	SV	DQC	Date	Time	Analyst
Bacteria Prep	DONE	N/A	PREP										3/3/99	16:35	VATHAUER
Microwave Acid Dig	DONE	N/A	SW 846 3015										3/10/99	09:54	WBARTO
TURBIDITY	0.800	ntu	EPA 180.1	0.5	2				10			M	3/4/99	16:05	ALOUIS
CADMIUM BY ICP	<0.999	ug/l	EPA 200.7 GRP10	0.999	4				5			U	3/10/99	09:54	WBARTO
CHROMIUM BY ICP	<1.37	ug/l	EPA 200.7 GRP10	1.37	5.48				50			T	3/10/99	09:54	WBARTO
COPPER BY ICP	5.11	ug/l	EPA 200.7 GRP10	3.9	15.6				3		Y	M	3/10/99	09:54	WBARTO
LEAD BY ICP	<9.13	ug/l	EPA 200.7 GRP10	9.13	36.5				5.6			U	3/10/99	09:54	WBARTO
NICKEL BY ICP	<13.5	ug/l	EPA 200.7 GRP10	13.5	54				8.3			U	3/10/99	09:54	WBARTO
ZINC BY ICP	8.16	ug/l	EPA 200.7 GRP10	3.65	14.6				86			M	3/10/99	09:54	WBARTO
AMMONIA	<0.0150	mg/l	EPA 350.1	0.015	0.06							U	3/8/99	14:00	BJOHNSON
TOTAL KJELDAHL NITROGEN	1.07	mg/l	EPA 351.2/365.4	0.131	0.524								3/19/99	11:00	BJOHNSON
TOTAL PHOSPHOROUS	0.0710	mg/l	EPA 351.2/365.4	0.012	0.048				0.05		Y		3/18/99	14:00	BJOHNSON
NITRITE + NITRATE	0.0250	mg/l	EPA 353.2	0.025	0.1							M	3/22/99	14:45	BJOHNSON
TOTAL ORGANIC CARBON	12.4	mg/l	EPA 415.1	0.181	0.724								3/5/99	12:50	RJENSEN
TOTAL COLIFORM	150	c/100	SM 9222B	24	96				2400			B	3/4/99	15:31	ALOUIS
FECAL COLIFORM	22	c/100	SM 9222D	7	28	800			800			B	3/4/99	15:31	ALOUIS

Lab Comments:

Field Comments:

Approval:  3/26/99

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(954) 519-1240

FHRS Laboratory Certification #E46053/#46027
Comprehensive Quality Assurance Plan #870191G

Laboratory Report

Sample Id: 99N67163 **Project:** WRD **Matrix:** MARINE **Sample Type:** SALINE SURFACE WATER
Source: CORAL HEIGHTS LAKES **Sample Point:** 39 ST. & NE 16 TERR.
Sample Date: 3/3/99 **Sample Time:** 12:55 **Sampled By:** Robert Jensen
Guidance Limits Applied: **Standard Limits Applied:** CHAPTER 27 - BROWARD COUNTY CODE

Parameter	Result	Units	Method	MDL	PQL	UGC	LGC	GV	USL	LSL	SV	DQC	Date	Time	Analyst
Bacteria Prep	DONE	N/A	PREP										3/4/99	15:31	ALOUIS
Microwave Acid Dig	DONE	N/A	SW 846 3015										3/10/99	09:57	WBARTO
TURBIDITY	0.800	ntu	EPA 180.1	0.5	2				10			M	3/4/99	16:05	ALOUIS
CADMIUM BY ICP	<0.999	ug/l	EPA 200.7 GRP10	0.999	4				5			U	3/10/99	09:57	WBARTO
CHROMIUM BY ICP	<1.37	ug/l	EPA 200.7 GRP10	1.37	5.48				50			T	3/10/99	09:57	WBARTO
COPPER BY ICP	8.01	ug/l	EPA 200.7 GRP10	3.9	15.6				3		Y	M	3/10/99	09:57	WBARTO
LEAD BY ICP	<9.13	ug/l	EPA 200.7 GRP10	9.13	36.5				5.6			U	3/10/99	09:57	WBARTO
NICKEL BY ICP	<13.5	ug/l	EPA 200.7 GRP10	13.5	54				8.3			U	3/10/99	09:57	WBARTO
ZINC BY ICP	8.43	ug/l	EPA 200.7 GRP10	3.65	14.6				86			M	3/10/99	09:57	WBARTO
AMMONIA	<0.0150	mg/l	EPA 350.1	0.015	0.06							U	3/8/99	14:00	BJOHNSON
TOTAL KJELDAHL NITROGEN	1.06	mg/l	EPA 351.2/365.4	0.131	0.524								3/19/99	11:00	BJOHNSON
TOTAL PHOSPHOROUS	0.0610	mg/l	EPA 351.2/365.4	0.012	0.048				0.05		Y		3/18/99	14:00	BJOHNSON
NITRITE + NITRATE	<0.0250	mg/l	EPA 353.2	0.025	0.1							T	3/22/99	14:46	BJOHNSON
TOTAL ORGANIC CARBON	12.5	mg/l	EPA 415.1	0.181	0.724								3/5/99	12:50	RJENSEN
TOTAL COLIFORM	73	c/100	SM 9222B	24	96				2400			B	3/4/99	15:31	ALOUIS
FECAL COLIFORM	30	c/100	SM 9222D	7	28	800			800			B	3/4/99	15:31	ALOUIS

Lab Comments:

Field Comments:

DQC Code Descriptions

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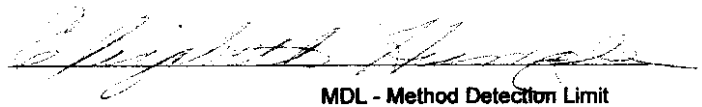
Approval:  3/26/99

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Environmental Monitoring Division
218 S.W. 1st Ave
Fort Lauderdale, FL 33301
(954) 519-1240

FHRS Laboratory Certification #E46053
Comprehensive Quality Assurance Plan #870191G

Laboratory Report

Sample Id: 99N67890 **Project:** WRD **Matrix:** FRESH **Sample Type:** FRESH SURFACE WATER
Source: CORAL HEIGHTS LAKES **Sample Point:** 4251 NE 16 AVE.
Sample Date: 6/3/99 **Sample Time:** 14:45 **Sampled By:** Russ Rand
Guidance Limits Applied: **Standard Limits Applied:** CHAPTER 27 - BROWARD COUNTY CODE

Parameter	Result	Units	Method	MDL	PQL	UGC	LGC	GV	USL	LSL	SV	DQC	Date	Time	Analyst
Bacteria Prep	DONE	N/A	PREP										6/3/99	16:30	VATHAUER
Microwave Acid Dig	DONE	N/A	SW 846 3015										6/7/99	13:14	WBARTO
TURBIDITY	1.15	ntu	EPA 180.1	0.5	2				10			M	6/4/99	11:07	ALOUIS
CADMIUM BY ICP	<0.999	ug/l	EPA 200.7 GRP6	0.999	4				1			U	6/7/99	11:21	WBARTO
CHROMIUM BY ICP	<1.37	ug/l	EPA 200.7 GRP6	1.37	5.48				50			U	6/7/99	11:21	WBARTO
COPPER BY ICP	8.89	ug/l	EPA 200.7 GRP6	3.9	15.6				3		Y	M	6/7/99	11:21	WBARTO
LEAD BY ICP	<9.13	ug/l	EPA 200.7 GRP6	9.13	36.5				30			T	6/7/99	11:21	WBARTO
NICKEL BY ICP	<13.5	ug/l	EPA 200.7 GRP6	13.5	54				100			T	6/7/99	11:21	WBARTO
ZINC BY ICP	<3.65	ug/l	EPA 200.7 GRP6	3.65	14.6				86			U	6/7/99	11:21	WBARTO
AMMONIA	0.108	mg/l	EPA 350.1	0.024	0.096				20				6/17/99	16:17	BJOHNSON
TOTAL KJELDAHL NITROGEN	1.17	mg/l	EPA 351.2/365.4	0.131	0.524				1.5				6/15/99	14:00	BJOHNSON
TOTAL PHOSPHOROUS	0.0825	mg/l	EPA 351.2/365.4	0.012	0.048				0.02		Y		6/16/99	14:00	BJOHNSON
NITRITE + NITRATE	0.0760	mg/l	EPA 353.2	0.005	0.02								6/17/99	16:17	BJOHNSON
TOTAL COLIFORM	180	c/100	SM 9222B	24	96				2400			B	6/4/99	16:10	RRAND
FECAL COLIFORM	41	c/100	SM 9222D	7	28	800			800			B	6/4/99	16:10	RRAND

Lab Comments:

Field Comments: SAMPLE WAS TEA COLORED.

Approval: Kenneth Vatheuer Jr 7/16/99

DQC Code Descriptions

- B Results based on colony counts outside the acceptable range
- M Presence verified but not quantified - Estimated Value
- T Value reported is greater than 0 but less than the MDL
- U Indicates material was analyzed for but not detected

MDL - Method Detection Limit
PQL - Practical Quantitation Limit
DQC - Data Qualifier Code

USL - Upper Standard Limit
LSL - Lower Standard Limit
SV - Standard Violation

UGC - Upper Guidance Concentration
LGC - Lower Guidance Concentration
GV - Guidance Violation

Broward County Board of County Commissioners
Department of Planning and Environmental Protection
Environmental Monitoring Division
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Fort Lauderdale, FL 33301
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FHRS Laboratory Certification #E46053
Comprehensive Quality Assurance Plan #870191G

Laboratory Report

Sample Id: 99N67891 **Project:** WRD **Matrix:** FRESH **Sample Type:** FRESH SURFACE WATER
Source: CORAL HEIGHTS LAKES **Sample Point:** 1801 NE 42 ST.
Sample Date: 6/3/99 **Sample Time:** 15:30 **Sampled By:** Russ Rand
Guidance Limits Applied: **Standard Limits Applied:** CHAPTER 27 - BROWARD COUNTY CODE

Parameter	Result	Units	Method	MDL	PQL	UGC	LGC	GV	USL	LSL	SV	DQC	Date	Time	Analyst
Bacteria Prep	DONE	N/A	PREP										6/3/99	16:30	ALOUIS
Microwave Acid Dig	DONE	N/A	SW 846 3015										6/7/99	11:25	WBARTO
TURBIDITY	1.30	ntu	EPA 180.1	0.5	2				10			M	6/4/99	11:07	ALOUIS
CADMIUM BY ICP	<0.999	ug/l	EPA 200.7 GRP6	0.999	4				1			U	6/7/99	11:25	WBARTO
CHROMIUM BY ICP	<1.37	ug/l	EPA 200.7 GRP6	1.37	5.48				50			U	6/7/99	11:25	WBARTO
COPPER BY ICP	5.94	ug/l	EPA 200.7 GRP6	3.9	15.6				3		Y	M	6/7/99	11:25	WBARTO
LEAD BY ICP	<9.13	ug/l	EPA 200.7 GRP6	9.13	36.5				30			U	6/7/99	11:25	WBARTO
NICKEL BY ICP	<13.5	ug/l	EPA 200.7 GRP6	13.5	54				100			U	6/7/99	11:25	WBARTO
ZINC BY ICP	<3.65	ug/l	EPA 200.7 GRP6	3.65	14.6				86			U	6/7/99	11:25	WBARTO
AMMONIA	0.114	mg/l	EPA 350.1	0.024	0.096				20				6/9/99	10:00	BJOHNSON
TOTAL KJELDAHL NITROGEN	1.08	mg/l	EPA 351.2/365.4	0.131	0.524				1.5				6/15/99	14:00	BJOHNSON
TOTAL PHOSPHOROUS	0.0800	mg/l	EPA 351.2/365.4	0.012	0.048				0.02		Y		6/16/99	14:00	BJOHNSON
NITRITE + NITRATE	0.0810	mg/l	EPA 353.2	0.005	0.02								6/17/99	14:00	BJOHNSON
TOTAL COLIFORM	220	c/100	SM 9222B	24	96				2400			B	6/4/99	16:10	RRAND
FECAL COLIFORM	52	c/100	SM 9222D	7	28	800			800			B	6/4/99	16:10	RRAND

Lab Comments:

Field Comments: SAMPLE WAS TEA COLORED.

Approval: Kenneth L. Whitmore, Jr. 7/16/99

DQC Code Descriptions

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- M Presence verified but not quantified - Estimated Value
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FHRS Laboratory Certification #E46053
Comprehensive Quality Assurance Plan #870191G

Laboratory Report

Sample Id: 99N67892 **Project:** WRD **Matrix:** FRESH **Sample Type:** FRESH SURFACE WATER
Source: CORAL HEIGHTS LAKES **Sample Point:** 1360 NE 48 CT.
Sample Date: 6/3/99 **Sample Time:** 15:15 **Sampled By:** Russ Rand
Guidance Limits Applied: **Standard Limits Applied:** CHAPTER 27 - BROWARD COUNTY CODE

Parameter	Result	Units	Method	MDL	PQL	UGC	LGC	GV	USL	LSL	SV	DQC	Date	Time	Analyst
Bacteria Prep	DONE	N/A	PREP										6/3/99	16:30	ALOUIS
Microwave Acid Dig	DONE	N/A	SW 846 3015										6/7/99	11:29	WBARTO
TURBIDITY	1.30	ntu	EPA 180.1	0.5	2				10			M	6/4/99	11:07	ALOUIS
CADMIUM BY ICP	<0.999	ug/l	EPA 200.7 GRP6	0.999	4				1			U	6/7/99	11:29	WBARTO
CHROMIUM BY ICP	<1.37	ug/l	EPA 200.7 GRP6	1.37	5.48				50			U	6/7/99	11:29	WBARTO
COPPER BY ICP	6.82	ug/l	EPA 200.7 GRP6	3.9	15.6				3		Y	M	6/7/99	11:29	WBARTO
LEAD BY ICP	<9.13	ug/l	EPA 200.7 GRP6	9.13	36.5				30			U	6/7/99	11:29	WBARTO
NICKEL BY ICP	<13.5	ug/l	EPA 200.7 GRP6	13.5	54				100			U	6/7/99	11:29	WBARTO
ZINC BY ICP	<3.65	ug/l	EPA 200.7 GRP6	3.65	14.6				86			U	6/7/99	11:29	WBARTO
AMMONIA	0.0900	mg/l	EPA 350.1	0.024	0.096				20			M	6/9/99	10:00	BJOHNSON
TOTAL KJELDAHL NITROGEN	0.933	mg/l	EPA 351.2/365.4	0.131	0.524				1.5				6/15/99	14:00	BJOHNSON
TOTAL PHOSPHOROUS	0.0720	mg/l	EPA 351.2/365.4	0.012	0.048				0.02		Y		6/16/99	14:00	BJOHNSON
NITRITE + NITRATE	0.0260	mg/l	EPA 353.2	0.005	0.02								6/17/99	16:13	BJOHNSON
TOTAL COLIFORM	220	c/100	SM 9222B	24	96				2400			B	6/4/99	16:10	RRAND
FECAL COLIFORM	7	c/100	SM 9222D	7	28	800			800			B	6/4/99	16:10	RRAND

Lab Comments:

Field Comments: SAMPLE WAS TEA COLORED.

DQC Code Descriptions

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Approval: 7/16/99

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Comprehensive Quality Assurance Plan #870191G

Laboratory Report

Sample Id: 99N67893 **Project:** WRD **Matrix:** FRESH **Sample Type:** FRESH SURFACE WATER
Source: CORAL HEIGHTS LAKES **Sample Point:** 39 ST. & NE 16 TERR.
Sample Date: 6/3/99 **Sample Time:** 15:45 **Sampled By:** Russ Rand
Guidance Limits Applied: **Standard Limits Applied:** CHAPTER 27 - BROWARD COUNTY CODE

Parameter	Result	Units	Method	MDL	PQL	UGC	LGC	GV	USL	LSL	SV	DQC	Date	Time	Analyst
Bacteria Prep	DONE	N/A	PREP										6/3/99	16:30	ALOUIS
Microwave Acid Dig	DONE	N/A	SW 846 3015										6/7/99	11:31	WBARTO
TURBIDITY	1.30	ntu	EPA 180.1	0.5	2				10			M	6/4/99	11:07	ALOUIS
CADMIUM BY ICP	<0.999	ug/l	EPA 200.7 GRP6	0.999	4				1			U	6/7/99	11:31	WBARTO
CHROMIUM BY ICP	<1.37	ug/l	EPA 200.7 GRP6	1.37	5.48				50			U	6/7/99	11:31	WBARTO
COPPER BY ICP	5.73	ug/l	EPA 200.7 GRP6	3.9	15.6				3		Y	M	6/7/99	11:31	WBARTO
LEAD BY ICP	<9.13	ug/l	EPA 200.7 GRP6	9.13	36.5				30			U	6/7/99	11:31	WBARTO
NICKEL BY ICP	<13.5	ug/l	EPA 200.7 GRP6	13.5	54				100			U	6/7/99	11:31	WBARTO
ZINC BY ICP	<3.65	ug/l	EPA 200.7 GRP6	3.65	14.6				86			U	6/7/99	11:31	WBARTO
AMMONIA	0.0640	mg/l	EPA 350.1	0.024	0.096				20			M	6/9/99	10:00	BJOHNSON
TOTAL KJELDAHL NITROGEN	1.04	mg/l	EPA 351.2/365.4	0.131	0.524				1.5				6/15/99	14:00	BJOHNSON
TOTAL PHOSPHOROUS	0.0660	mg/l	EPA 351.2/365.4	0.012	0.048				0.02		Y		6/16/99	14:00	BJOHNSON
NITRITE + NITRATE	0.0440	mg/l	EPA 353.2	0.005	0.02								6/17/99	14:00	BJOHNSON
TOTAL COLIFORM	540	c/100	SM 9222B	24	96				2400			B	6/4/99	16:10	RRAND
FECAL COLIFORM	140	c/100	SM 9222D	7	28	800			800			B	6/4/99	16:10	RRAND

Lab Comments:

Field Comments: SAMPLE WAS TEA COLORED.

DQC Code Descriptions

- B Results based on colony counts outside the acceptable range
- M Presence verified but not quantified - Estimated Value
- U Indicates material was analyzed for but not detected

Approval: Kenneth L Latham, Jr. 7/16/99

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Appendix 7. Sample Parameters Exceeding Marine Water Quality Standards.

Parameter	*Location*	*Marine Water Quality Standard & Units*	*Test Value on March 3, 1999*	*Test Value on June 3, 1999*
copper	North Lake	3 ug/l	5.11 ug/l	6.82 ug/l
copper	West Lake	3 ug/l	7.01 ug/l	8.89 ug/l
copper	East Lake	3 ug/l	7.99 ug/l	5.94 ug/l
copper	Coral Waterway	3 ug/l	8.01 ug/l	5.73 ug/l
total phosphorus	North Lake	0.05 mg/l	0.0710 mg/l	0.0720 mg/l
total phosphorus	West Lake	0.05 mg/l	0.0650 mg/l	0.0825 mg/l
total phosphorus	East Lake	0.05 mg/l	0.0580 mg/l	0.0800 mg/l
total phosphorus	Coral Waterway	0.05 mg/l	0.0610 mg/l	0.0660 mg/l

Appendix 8. Informational Brochures Concerning Lake Water Quality

HOW CAN YOU REDUCE POLLUTED RUNOFF?

- MAINTAIN YOUR SWALE
  - Mow the swale but be careful to not damage swale blocks.
  - Remove and then compost leaves and grass clippings.
  - Keep good grass growth.
  - Minimize use of fertilizers, pesticides, and herbicides.
  - Aerate soils to restore percolation rate
- DO NOT MISUSE YOUR SWALE
  - Do not pile garbage, trash, leaves, limbs or garden debris in swales - this adds pollutants which can wash into downstream waters.
  - Do not pave the swale - this reduces percolation of runoff.
  - Do not park vehicles in the swale - this compacts the soil so less runoff soaks in.
- LET THE WATER POND
  - Runoff should temporarily pond in the swale for 24 to 36 hours.
  - Don't damage or remove swale blocks or check dams.
  - Don't increase driveway culvert sizes.
  - Don't lower driveway culverts.
- ADD SWALES TO YOUR YARD
  - Waterfront property owners should build a swale and berm system to intercept runoff and pollutants from their yard.
  - Swales can be used between lots and at the rear of lots to intercept and retain runoff.
  - Swales can be used on residential and commercial land uses to collect roof runoff.
- TALK TO ELECTED OFFICIALS
  - Help "Save the Swales". Local regulations often require the use of curbs and storm sewers and prohibit the use of swales. Why should they?
  - Don't complain when water ponds in the swale for 24 to 36 hours - mosquitos won't breed until water ponds for 72 hours or longer.
  - Let local officials know if water ponds so long that swale vegetation begins to die.

IF YOU WANT MORE INFORMATION ABOUT SWALES AND STORMWATER TREATMENT, CONTACT:

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
Stormwater/Nonpoint Source Management Section
2600 Blairstone Road, Tallahassee, FL 32399
Phone: 904/488-0782

SAVE THE

SWALES

WHY MANAGE RUNOFF?

When land is converted from its natural state to other uses, especially urban land uses such as roads, homes, and shopping centers, many impervious or paved surfaces are created. Rainfall can no longer soak into the ground. Instead it becomes stormwater or runoff.

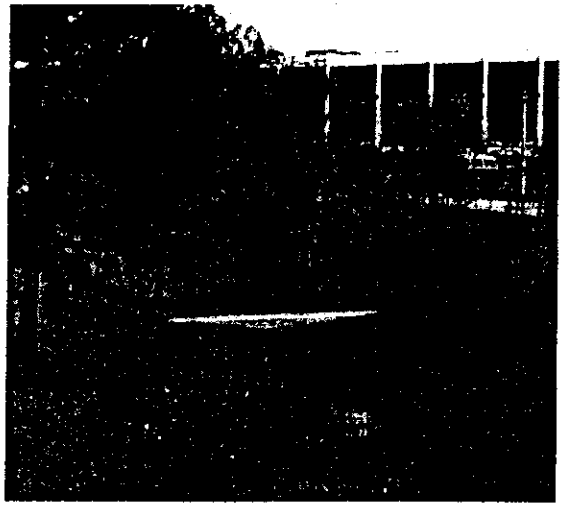
As land is developed the volume, speed of flow, and pollutant loading of runoff increases. To minimize downstream flooding and protect lives and property, and to reduce pollution of water bodies, stormwater management practices are used to retain, detain, and/or filter the runoff.

WHAT IS A SWALE?

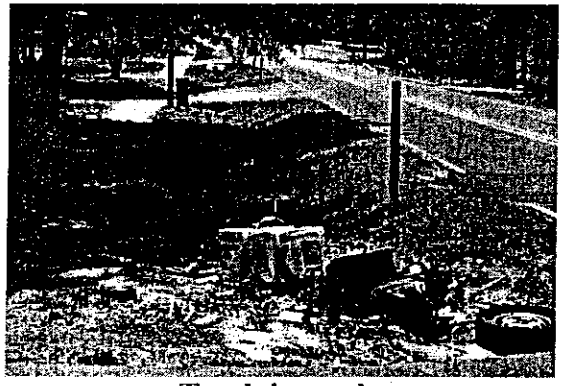
Swales are one of the most commonly used stormwater practices. For many years they have been used along rural highways and residential streets to convey runoff. Today, swales not only convey stormwater but also help to treat runoff to reduce pollutants.

Like ditches, swales collect stormwater from roads, driveways, parking lots and other hard surfaces.

Unlike ditches, swales are not deep with straight sides. They have gently sloping sides and are wider than they are deep.



Swale with a swale block



Trash in swale

Swale and berm system

They are vegetated to prevent the slopes from eroding and to help filter pollutants during and after rainstorms.

WHY ARE SWALES IMPORTANT?

Because swales are wider than they are deep (usually a 6:1 ratio), the rainwater is spread over a broader area. This slows the water and allows the runoff to temporarily pond.

Reducing the water's speed allows the vegetation to filter the rainwater and remove sediments, heavy metals and hydrocarbons such as oil and grease.

Ponding of runoff in the swale allows the water to soak into the soil, helping to reduce the volume and amount of pollutants.

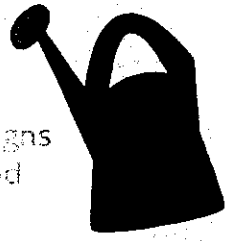
The gradual sloping sides of the swale make them easier to maintain and vegetate. This decreases erosion that causes sedimentation of streams, lakes and wetlands.

Swale blocks or raised driveway culverts sometimes are used to promote ponding of runoff in the swale, especially when the swale has a steep slope. Swale blocks or check dams can be made of soil, wood, or concrete.

SOUTH FLORIDA Lawns CONSERVE and Beautify

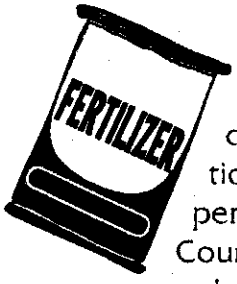
Ongoing water restrictions need not spell the end of healthy lawns in South Florida. The following guidelines are provided to encourage homeowners to follow the current water use restrictions and allow their lawns to gradually adapt to lesser amounts of irrigation.

The guidelines shown here were developed by the C-11 West Canal Basin Working Group, a consortium of South Florida academic, regulatory and commercial interests. The C-11 group has been meeting together for the past [illegible] develop environmentally friendly turfgrass and landscaping practices that will reduce pollution without sacrificing the aesthetics of the South Florida landscape.



- Water only when [illegible] following the appropriate irrigation schedule for [illegible] adaptation to drought conditions, do not water [illegible] lawn begins to show visible signs of moisture depletion (grass blades appear folded and the turf takes on a [illegible] off-color appearance).

- When irrigating, [illegible] to soak the root zone, (3/4 to 1 inch per irrigation should be sufficient). A rain gauge, or marked coffee can or tuna fish container [illegible] as a useful measure.

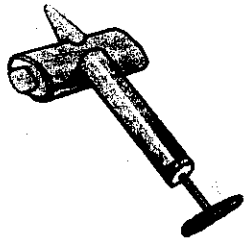


- Fertilize [illegible] needed. Fertilizer products have labels that feature [illegible] numbers indicating the relative amounts of nitrogen (N), [illegible] phosphorus (P), and potassium (K). Under drought conditions, [illegible] products offering more balanced proportions of N and K should be preferred over those having high percentages of P relative to K. Because most soils in Broward County need little additional phosphorous, choose products with a relatively low P content (2-3 percent or less). Slow release fertilizer formulations or products having at least 30-50% of their nutrients in a slow release form [illegible] (e.g. sulfur coated urea) are preferred because they minimize the burn potential and extend the period of effective feeding.

- Adjust mower cutting height to the highest possible setting. Mowing stresses turf and reduces root growth. A higher cutting height will allow the lawn to develop a deeper, more extensive root system, resulting in better tolerance to drought-stress and foot traffic.

- Check sprinkler systems, particularly the heads, to make sure they are functioning properly and providing adequate coverage. Be sure the timer is set to comply with current water conservation restrictions.

- Do not apply weed killers to drought-stressed turf. Under such conditions, they may harm the turf and will not necessarily provide satisfactory control.



- Monitor the lawn for chinchbugs. These small (less than ¼" in length), orange-brown to black insects can become a serious pest under prolonged hot, dry conditions. When warranted, spot treat accordingly with a recommended, labeled insecticide.

- Avoid foot traffic and parking on drought-stressed turf as these additional stresses will only delay the lawn's ability to recover.

- Replenish mulch in landscaping beds, but be careful to keep mulch away from the base of tree trunks, to reduce the risk of trunk rot. Regardless of the bed, mulch should never be more than 3 to 4 inches deep.

- If you use a lawn service or landscape company, ask to make sure they are using management practices that comply with the above guidelines and current water conservation restrictions.

For more information on lawn care, contact the Broward County Extension Education Division in Davie at (954) 370-3725 or visit their website at www.broward.org/extension. Another good source of turfgrass management information is the University of Florida Institute of Food and Agricultural Sciences (IFAS) turfgrass website at http://turf.ufl.edu. Click on the residential landscapes button. For additional information on water conservation, visit www.everydropcounts.org.

BROWARD COUNTY
FLORIDA

This public document was promulgated at a cost of $760.00 or $.076 per copy to provide information to the public on water conservation guidelines.

bewatersmart EVERY DROP COUNTS!

UNIVERSITY OF FLORIDA EXTENSION

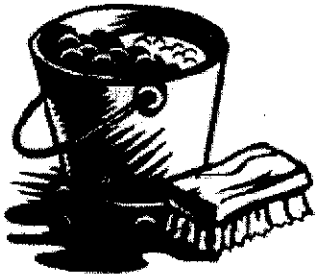
WATER RESOURCES DIVISION

Where should the water go?

Almost everywhere in Broward County, water in gutters and storm drains flows directly to local surface waters with no wastewater treatment. Washwater used in outdoor cleaning projects often carrie dirt and other harmful pollutants that clog storm drains, damage sensitive habitats in local waterways and finally end up polluting canals, river, and coastal waters.

Soaps, degreasers, automotive fluids, litter, and a host of other materials washed off of buildings, sidewalks, plazas, parking areas, vehicles, and equipment all harm wildlife and pollute Broward Count waters. Allowing hazardous materials into a storm drain is illegal.

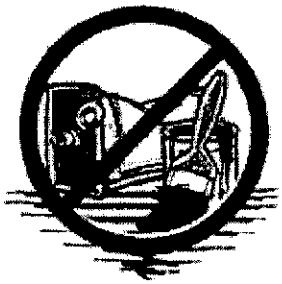
Use these guidelines when cleaning outdoors or disposing of washwater!



Onto landscaping or unpaved surface?

YES! Dispose of small amounts of washwater from cleaning building exterio sidewalks, or plazas as long as it does not contain soap or other cleaning materials onto landscaping or unpaved surface if you have the owner's permission and the discharge will not cause flooding or nuisance problems or flow to a canal.

NO! Be sure large amounts of these types of washwater are not discharged onto landscaping or soil where water may run to a street or storm drain. Wastewater from exterior cleaning may be pumped to a sewer line with specific permission from the local wastewater treatment plant.



Down a sink or toilet — through the sewer to a wastewater treatment plant?

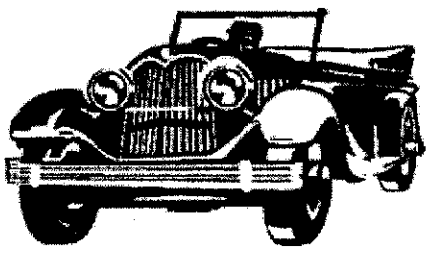
YES! Water from many outdoor cleaning activities may be acceptable to the loc wastewater treatment plant. See the list on the back of this flyer for phone numbers of treatment plants in your area.

NO! Hazardous wastes should never be poured down the sewer and must be disposed of properly. Wh in doubt, call the local wastewater treatment agency! They will be able to tell you what kinds of wastes they *cannot* accept.

To the street or storm drain?

YES! Water (with no soap) used to remove dust from clean vehicles may be discharged to a street or storm drain.

Washwater from sidewalk, plaza, and building surface cleaning may go into a street or storm drain if ALL of these conditions are met:



1. You have used dry cleanup methods (sweeping, and cleaning any oil or chemical spills with rags or other absorbent materia before using water.
2. The surfaces being cleaned were all free of fresh oil stains, debris, and similar pollutants.
3. Cleaning is done with water only — no soap or other cleaning materials.
4. You have not used the water to remove paint from surfaces during cleaning.

NO! Sending water that contains soap or any other type of pollution to a storm drain or water body violates state and local regulations. Because wastewater from cleaning parking areas or roadways normally contains metallic brake pad dust, oil, and other automotive fluids, it should never be discharg to a street, gutter, or storm drain.

Broward County Pollution Prevention Agencies

Stormwater

- Department of Planning & Environmental Protection: (954) 519-1270 — Water Resources Division
- Office of Environmental Services: (954) 960-3060

Wastewater Treatment

- North Regional WWTP: (954) 960-3068
- Cooper City West WWTP: (954) 434-5519
- Coral Springs Improvement District: (954) 753-0380
- Davie Utilities System II WWTP: (954) 433-4000
- Day Star, Inc. (Private Nursing Facility): (954) 473-0167
- Ferncrest Utilities, Inc.: (954) 587-8833
- George T. Lohmeyer WWTP (City of Fort Lauderdale): (954) 523-1002
- Hollywood Regional WWTP: (954) 921-3301/3288
- Margate Utilities: (954) 972-0828
- City of Pembroke Pines WWTP: (954) 435-6721
- Plantation Regional WWTP: (954) 797-2285
- City of Pompano Beach Effluent Irrigation Facility: (954) 786-4106
- South Broward Utilities, Inc.: (954) 434-6900
- Sunrise Regional WWTP Facilities: (954) 846-7400

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(954) 519-1499

WATER RESOURCES DIVISION

A sudden appearance of dead fish in a lake or pond causes considerable concern and alarm for most people. Our first reaction is to suspect poisoning of the waterbody. Most fish kills, however, result from natural events, although people can influence their frequency and severity. Fish kills usually result from too little oxygen in the water. South Florida receives between 150 and 200 fish kill reports each year. While some result from spills or illegal discharges of toxic substances, most kills occur when oxygen dissolved in the water drops to levels insufficient for fish survival.

For a dissolved oxygen or DO-related fish kill to occur, a combination of environmental conditions transpire simultaneously. Weather patterns, water temperature, depth and quality, amount and type of plant growth, fish community structure, along with the presence of viruses and bacteria are all factors that are necessary to trigger a fish kill. Lakes, ponds, and canals located in residential areas are particularly vulnerable to DO related fish kills. Developed areas create runoff that contain high amounts of nutrients from septic tanks.

In addition, street and yard drainage that enters waterbodies can cause water quality problems. High levels of nutrients from fertilizers applied to lawns, golf courses and farms cause aquatic plants to thrive.

Ponds with high nutrient levels produce dense growths of microscopic plants called algae. When sunlight is available, algae use nutrients and product oxygen through the process of photosynthesis. Most oxygen available to fish comes from algae. During nightime and cloudy weather, low sunlight causes algae to switch from photosynthesis to respiration, consuming oxygen needed by fish. During severe events, fish can suffocate from low DO.

Most frequently, however, fish become stressed during a low DO period and become susceptible to viral or bacterial infections.

Most times, fish can tolerate temporary lags in DO levels. Fish kills occur when several contributory factors occur simultaneously such as prolonged cloudy weather, drought conditions, overcrowded fish populations, excessive algae or other plant growths and high water temperatures.

Most DO-related fish kills occur in the warmer months from May through September, although winter cold fronts can also trigger DO lags. A typical scenario occurs when fish are observed at the water surface appearing to gasp for breath. Fish usually continue to die from viral or bacterial infections for 3-4 days. Most of the time, this occurs after a period of rainy or cloudy weather.

During the spring, kills involving only one species can occur and these are caused from stress

brought on by spawning activities. Along coastal areas of Florida, surface and groundwater inflows of saltwater can kill freshwater fishes. Herbicide spraying of problem aquatic plants often results in fish kills. Overspraying can have toxic effects; however, more commonly, the decay of the vegetation uses oxygen at a rapid rate.

Application of pesticides to control lawn and crop insects can enter a pond during heavy rains and cause a fish kill.

Fish kills can only be prevented by maintaining good water quality. Clean-up of fish kills occurring in private residential lakes and canals are generally the responsibility of the property owner or homeowners association, Governmental agencies generally do not have the resources available to undertake the task of removing dead fish, however some city-maintained lakes are often cleaned up by city crews. Concerned individuals can report fish kills to the DPEP, especially if they suspect that a kill is a result of toxic spills. Discussions with pond owners often lead to determinations of cause. DPEP's biologists can provide recommendations to prevent future kills.

On site investigations are done on waterbodies with public access and when environmental laws have been broken. Should anyone suspect that a fish kill be a result of unnatural causes, they should call the DPEP at **(954) 519-1499.**

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