

6.1 Air Quality

6.1.1 State of the Air Quality

Measurement: This benchmark indicates the percentage of monitored days when the air quality is rated "good" based on the highest pollutant concentration of that day. *Effective in 1999, the measurement of the ozone concentration has changed. As a result, the Air Quality Index reported for 1999 is not comparable to the AQI reported for the previous years.*

Explanation: Poor air quality affects public health, especially children and the elderly. The EPA has established National Ambient Air Quality Standards for ozone, particulate matter, nitrogen dioxide, sulfur dioxide, carbon monoxide and lead to ensure adequate public health and environmental protection. A national Air Quality Index was also developed to reflect air quality on any given day. Broward County provides the Air Quality Index information to the public daily.

Data source: Broward County Department of Planning and Environmental Protection (DPEP), Air Quality Division (available on an annual basis), Daniel Banu.

6.1.2 Fleet of Alternative Fuel Vehicles

Measurement: The number of vehicles used by federal, municipal and local government that operate on alternative fuels including compressed and liquefied natural gas, liquefied petroleum gas (LPG), electricity and others.

Explanation: Vehicular traffic is a major source of air pollution in general. The incomplete combustion of gasoline in motor vehicles results in the emissions of hydrocarbons and nitrogen oxides, which react in the presence of sunlight to produce ozone, the pollutant of main concern in the area. Ozone can cause respiratory distress to individuals with impaired

respiratory functions. The Energy Policy Act of 1992, established goals to reduce dependence on imported oil by requiring federal and state fleets to increase the percentage of their vehicles operating on alternative fuels. Energy diversification protects our energy security, enhances environmental protection, and promotes economic development.

Data sources: Broward County Public Works, Energy Management Section, Don Steigerwald; South Florida Regional Planning Council, Larry Merritt.

6.2 Groundwater Quality

6.2.1 Quality of groundwater

Measurement: The cumulative percentage of petroleum-contaminated sites that had been cleaned up to state standards.

Explanation: One of the greatest threats to our drinking water supply is contamination from leaking underground petroleum storage tanks, especially where these sources are located within drinking water well field zones. The Biscayne Aquifer, Broward County's sole source of drinking water supplies, lies very close to the surface, making it extremely vulnerable to contamination from surface and near-surface pollution sources. Underground petroleum storage tanks are the most numerous of these sources.

Data source: Broward County DPEP, Pollution Prevention and Remediation Division, Lorenzo Fernandez.

6.3 Surface Water Quality

6.3.1 Surface Water Quality, Fresh Water Streams

Measurement: This benchmark is calculated based on the data obtained from DPEP's surface water quality monitoring network along the fresh water portion of the C-13 canal (Middle River Canal, from 31st Avenue to Hiatus Road). This segment is presently represented by DPEP stations #12, 13 and 14. Improvements are measured against the 1995 baseline water quality index. The index is calculated using the Florida Department of Environmental Protection's Florida Stream Water Quality Index (WQI) to rate the quality of fresh water systems. The WQI is based on the measurement of six water quality categories: water clarity, dissolved oxygen, oxygen demanding substances, bacteria, nutrients and biological diversity with each category potentially having more than one parameter. Raw data for the six categories are converted to index values from 0-99 and a percentile value is assigned based on Florida stream water quality data as reported in the *SE and South Florida District Water Quality Assessment 1996 305(b) Report*. The WQI is based on the five water chemistry parameters as biological diversity measurements are not available for Broward County surface waters.

Explanation: County and federal regulations and programs that are intended to positively impact surface water quality have been developed and improved since 1995. These regulations and programs include the redevelopment of areas constructed before the implementation of surface water management regulations, the 5-year renewal of surface water management licenses issued prior to 1989, and the Broward County National Pollution Discharge Elimination System Municipal



Separate Storm Sewer System Permit. The C-13 Canal basin is selected because the majority of the basin is located outside of independent drainage districts and is subject to DPEP regulations.

Data source: Broward County DPEP, Environmental Monitoring Division, George Riley.

6.3.2 Surface Water Quality, Marine Waters

Measurement: This benchmark is calculated based on the data obtained from DPEP's surface water quality monitoring network within the tidal portion of the C-13 and C-14 Canals (Pompano and Middle River Canals, east of Dixie Highway). This segment is currently represented by DPEP sites #5 and #10. Improvements are measured against the 1995 baseline water quality index. The index is calculated using the Florida Department of Environmental Protection's Trophic State Index, to rate the quality of estuarine systems and based upon regression parameters in effect for the SE and South Florida District Water Quality Assessment 1996 305(b) Report. The Trophic State Index is based on measurements of chlorophyll and nutrients. Calculating an overall index value requires both nitrogen and phosphorus measurements.

Explanation: County and federal regulations and programs that are intended to positively impact surface water quality have been developed and improved since 1995. These regulations and programs include the redevelopment of areas constructed before the implementation of surface water management regulations, the 5-year renewal of surface water management and licenses issued prior to 1989, and the Broward County NPDES Municipal Separate Storm Sewer System Permit. The C-13 and C-14 Canal Basins were selected because the majority of the basin areas is located outside

of independent drainage districts and is subject to DPEP regulations.

Data source: Broward County DPEP, Environmental Monitoring Division, George Riley.

6.3.3 Quality of marine bathing water, from a bacteriological standpoint

Measurement: This benchmark tracks the percentage of beach water quality measurements rated as good, based upon weekly enterococci testing at 8 public beaches in Broward County.

Explanation: The Broward County Health Department, in conjunction with the Department of Community Affairs (Coastal Management Program) and the National Oceanic and Atmospheric Administration has initiated (1998) a program to provide scientific information on the quality of coastal beach water to the public. Based on a statistically-sufficient number of samples, the geometric mean of the enterococci densities should not exceed 35 colonies/100ml. Monitoring of enterococci species bacteria is performed at eight locations along Broward's Atlantic coast. The density of enterococci species bacteria as an indicator group in seawater shows the best relationship to swimming-associated gastroenteritis.

Data sources: Broward County Health Department and Florida Department of Health, Howard Rosen.

6.4 Water Use

6.4.1 Water consumption

Measurement: The conservation and efficient use of water resources by the citizens of Broward County.

Explanation: Per capita usage, the average amount of potable water each person in Broward County uses on a given day, is calculated based on the amount of water provided by the utilities and owner-operated potable water wells divided by the population of the County. Uses of that water include public water supply, irrigation, domestic and commercial self-supply, recreational use, and agriculture. The per capita use value in 1990 is relatively high compared to the 1995 value because a greater amount of Broward County land was used for agriculture with greater irrigation needs.

Data sources: ¹South Florida Water Management District-wide Water Supply Assessment, July 1998; ²South Florida Water Management District-wide Water Management Plan, Volume II, April 1995.

6.4.2 Water use restrictions

Measurement: Water-use restrictions are imposed by the South Florida Water Management District (SFWMD) during drought conditions when water levels in the regional system or groundwater levels monitored locally fall below a target level. The measure is calculated by dividing the number of months when water restrictions were imposed (even for a single day) by 60 months (5 year period). SFWMD predicts that without enhancements in our current water management system, Service Area 1 (North Broward and Lower Palm Beach County) and Service Area 2 (Central and Southern Broward County) will experience increasing shortages from 15% and 16% of the



time in 1990 to 37% and 29% in 2010 respectively¹. Three major water resources planning efforts are currently underway to reduce water use restrictions by increasing storage capabilities and improving the efficiency of water management. The three plans are: Everglades Restoration (Restudy) - a state and federal partnership; the Lower East Coast Regional Water Supply Plan (LEC); and the SFWMD and Broward Countywide Integrated Water Resources Plan (IWRP). As these planning efforts move forward, the number of days in water shortage should be maintained or reduced despite increasing demands on water resources with increasing population. The Restudy and LEC components alone are expected to reduce these shortages to 9% and 14%. The IWRP should further enhance these improvements. The number is based on the number of months over a 26-year model simulation resulting in water shortages of any type.

Explanation: This benchmark measures the ability of water managers in Broward County and South Florida's ability to effectively deal with drought conditions.

Data source: South Florida Water Management District; ¹South Florida Water Management District Lower East Coast Regional Water Supply Plan (Draft), March 1997.

6.5 Wildlife Habitat

6.5.1 Natural resource land in managed areas east of conservation area levees

Measurement: The number of acres of land in public ownership/protection where some degree of protection and management is offered to native plants and animals pursuant to an

approved and funded management plan for their natural resource values.

Explanation: Natural resource lands are important to the community as examples of Broward's ecological history and provide important habitat for local and migratory wildlife and indigenous plants. To maintain or regain their function and values these lands must be protected from development and the effects of invasive plants, over drainage and other deleterious effects.

Data source: Broward County DPEP, collection of data from management agencies, Heather Carman.

6.5.2 Total tree canopy coverage in Broward County, east of Conservation Areas

Measurement: To be defined.

Explanation: As part of the Broward County Commission's New Vision goal to protect the environment, the DPEP has embarked on a project to map the tree canopy in Broward into their Geographical Information Management System. This is being done to give local jurisdictions a tool for managing their urban forest. Trees reduce our energy bills, clean our air, keep pollution out of our waterways, save tax dollars for storm water drainage, recharge our drinking water supply, reduce noise pollution, support our multi-billion dollar tourist industry, support birds and wildlife and make our community more attractive, cohesive and livable.

Data source: Broward County DPEP, Sean McSweeney.

6.5.3 Conservation and recreation areas

Measurement: These measures track the conservation and recreational lands system in Broward County. Land tracked includes:

Existing Protected Lands

Conservation and Passive Recreation Lands this category includes environmentally sensitive lands and predominantly passive recreational parks.

Active Recreational Lands includes predominantly active recreational facilities and parks.

Other Protected Lands include mitigation sites and other public or private lands predominantly managed for conservation.

East Coast Buffer lands acquired by the South Florida Water Management District (SFWMD) within the East Coast Buffer program.

Unprotected (developable) Lands

Proposed Fee-Simple conservation lands and green space proposed for acquisition within the DPEP Land Acquisition Program.

Potential Open Space this category includes lands without any ecological value identified, with the sole purpose of providing open space in those areas of the County that lack an adequate amount of conservation lands and green space, with a potential for acquisition.

Potential Property Development Rights Agreement lands that appear to be characterized by a predominant agricultural use on aerial photographs, which could be considered for less than fee-simple acquisition. Potential Management Agreements include lands that already are owned by Broward County or by a city, are characterized by high ecological value and currently are not managed for conservation.

Listed East Coast Buffer lands listed in the SFWMD East Coast Buffer Acquisition Program.

Explanation: Natural resource lands are important to the community as examples of Broward's ecological history and provide important habitat for local and migratory wildlife and indigenous plants. To maintain or regain their function and values, these lands



must be protected from development and the effects of invasive plants, over-drainage and other deleterious effects.

Data source: Broward County DPEP, Biological Resources Division, Valaria Volin.

6.6 Threatened and Endangered Species

6.6.1 Manatee population

Measurement: Manatees are counted statewide in a synchronized or synoptic manner to get the most accurate population count possible. This is done following a major cold front, which concentrates the animals in warm water refuges.

¹Through July 1999

²Highest Total from synoptic survey

Explanation: Manatees are an endangered species whose existence is threatened by a number of anthropomorphic activities including injuries or death from boat and ship impacts, water control structures, water pollution and habitat reduction as well as toxic algal blooms and other problems. Some of these problems are addressed through various means with the goal of increasing the manatee population to a point where it can be reclassified as threatened and eventually delisted in the U. S. Fish and Wildlife Service "Multi-Species Recovery Plan for South Florida." The annual statewide count is important in identifying population trends. Likewise, County mortality data may be indicative of the population's health or the effectiveness of local manatee protection measures.

Data sources: Florida Fish and Wildlife Conservation Commission, Bureau of Protected Species and Florida Marine Research Institute.

6.6.2 Sea Turtle survey

Measurement: Broward County's 24 miles of beaches are surveyed daily during the sea turtle nesting season, March through October. The number of nests deposited and the location of each are recorded. Those nests that are in sites that are not amenable to successful emergence and entry of hatchling sea turtles into the surf are relocated to hatcheries.

Explanation: The Broward County Sea Turtle Conservation Program was originally instituted through specific requirements of dredge and fill permits issued to DPEP for beach renourishment projects. The goal of the program is to minimize the number of sea turtle nests that need to be relocated and maximize the survivability of nests that are left on the beach. The Conservation Program is conducted during non-renourishment years to allow for continuity of data collection and analysis. It is expected that the number of sea turtle nests that will be relocated in the year 2000 will be reduced as per the above table due to the enactment of a sea turtle lighting ordinance in the City of Pompano Beach. The ordinance will require beach lighting to be shaded from the beach or turned off during the nesting and hatching season. Compliance will allow additional nests to be left *in-situ*. The DPEP Biological Resources Division contracts with qualified firms to conduct the Sea Turtle Conservation Program. Part of the contractors scope of work requires that they provide DPEP Biological Resources Division with sea turtle nesting survey results which includes, but is not limited to the data in the above table.

Data source: Broward County DPEP Biological Resources Division, Louis Fisher.

6.7 Coastline

6.7.1 Beach adequacy

Measurement: These criteria provide a measure of the ability of Broward County's beaches to provide storm protection and recreational opportunities. Beach width, from which average width is derived, is measured from the shorefront reference monument (established by the State of Florida) to the zero foot elevation contour (NGVD), except where monuments are located landward of roads. Acreage is based on 24 miles of beachfront in Broward County. Critically-eroded beaches are those the width of which at high tide is deemed inadequate to provide storm wave damage protection and/or recreational opportunities. For the purposes of this survey, the threshold width is assumed to be 75 feet from road, seawall, or toe of critically-eroded beaches. Distances scaled from Countywide Survey profile plots.

Explanation: Broward's beaches serve two critical functions: storm wave protection for upland property, structures, infrastructure, and our recreational economic engine. Vital to the beaches' storm protective function is their width. Adequate beach width allows storm waves to break and dissipate energy harmlessly; however, in so protecting the upland, storm waves cause some net erosion of beach sand. Inasmuch as Broward County's beaches protect almost \$4 billion in upland structures and property, it is of vital importance to maintain a beach width adequate to protect against a moderate frequency storm event. Beach acreage is a useful measure because it indicates the amount of recreational space available to beach users. As a \$600 million annual contributor to Broward County's economy, the beaches are on of the foundations of our tourist economy. Our beaches also provide critical nesting habitat for



several threatened and endangered species of sea turtles and adequate acreage is necessary for this purpose.

Data source: Broward County DPEP, Biological Resources Division, Steve Higgins.

6.8 Coral Reefs

6.8.1 Coral reef health

Measurement: Broward County initiated a coral reef community monitoring program involving the measurement of the relative abundance and diversity of stony corals and the abundance of octocorals and sponges at eighteen reef sites located throughout Broward's coastal waters.

Explanation: Coral reef communities and associated sea life of those communities are an important natural resource for recreation and the fishing and diving industries in Broward. The sound ecological condition of this resource community is a key indicator of the general condition of all the marine resources adjacent to the Broward coast. Stony coral abundance, diversity, and evenness are calculated values commonly used to characterize the relative health of coral reef communities. In general, a diversity index value (H') for stony corals is a way of comparing the relative abundance of each species of coral among different populations of corals or different reef sites. Evenness (J') is the calculated ratio value of H' divided by H' max and it increases value as the number of species increases and reaches its maximum value of one when the number of individuals of each species at a given site are the same. We don't expect to see substantial increases or decreases in index values over time and would hope for maintenance of existing values. Data collection on a yearly basis will continue beyond the year 2000. As yearly data

becomes available, comparison to previous years will allow detailed evaluation of trends in the ecological condition of the reef community

C = stony coral live polyp coverage (%)

N = numbers of individuals

H' = diversity index

J' = evenness (H'/H' max)

H' max = $1N/(\# \text{ of species})$

- 1) $H'C$ = diversity of live coral polyp coverage
- 2) $H'N$ = Diversity of numbers of individuals per species
- 3) $J'C$ = Evenness in distribution of live coral polyp coverage
- 4) $J'N$ = Evenness in distribution of numbers of individuals per species

Data source: Broward County DPEP, Biological Resources Division, Louis Fisher.

6.9 Energy Use

6.9.1 Energy consumption

a) Kilowatt-hours of total electricity consumption

Measurement: The total electric power consumed in Broward County annually, including residential and non-residential (kilowatt-hours)

Explanation: The production and consumption of electric energy is a significant source of air pollution. Generating electricity by burning oil and natural gas generates emissions of volatile organic compounds (VOCs), nitrogen oxides (NO_x) carbon monoxide (CO), sulfur dioxide (SO_2) and carbon dioxide (CO_2). VOC and NO_x are precursors for ozone, while CO_2 is a greenhouse gas that increases the risk of climate change. NO_x and SO_2 are also precursors for acid rain, which in turn contribute to poor air and water quality. Poor air quality affects

public health, especially children and the elderly.

Data source: Florida Power and Light Company, Lynn Shatas.

b) Kilowatt-hours of per capita power consumption

Measurement: The average annual energy usage per residential customer in kilowatt-hours per year.

Explanation: The production and consumption of electric energy is a significant source of air pollution. Generating electricity by burning oil and natural gas generates emissions of volatile organic compounds (VOCs), nitrogen oxides (NO_x) carbon monoxide (CO), sulfur dioxide (SO_2) and carbon dioxide (CO_2). VOC and NO_x are precursors for ozone, while CO_2 is a greenhouse gas that increases the risk of climate change. NO_x and SO_2 are also precursors for acid rain, which in turn contribute to poor air and water quality. Poor air quality affects public health, especially children and the elderly.

Data source: Florida Power and Light Company, Lynn Shatas.

6.10 Waste Management

6.10.1 Waste production

Measurement: Data provided to FDEP by Broward County Office of Integrated Waste Management (OIWM) and published by FDEP, Bureau of Solid and Hazardous Waste, Division of Waste Management, Table 5A of the Solid Waste Management in Florida Annual Report. The total tons per year reported in the table above is the gross tons per year including recycling tonnage, but less the tons per year of



combuster ash and recovered metal from the waste-to-energy plants.

Explanation: Largely because of Broward County's continued rapid population growth and the solid economy, the total amount of municipal solid waste (MSW) produced has increased, offsetting the gains made by recycling and limiting waste reduction efforts. The amount of MSW generated in calendar year 1998 was 8% more than that generated in 1995.

Data sources: Florida Department of Environmental Protection, Bureau of Solid and Hazardous Waste, Division of Waste Management; Table 5A of the *Solid Waste Management in Florida Annual Report*; Broward County Office of Integrated Waste Management, Peter Foye.

6.10.2 Waste disposal

Measurement: The Broward County Office of Integrated Waste Management tracks the production and disposal of solid waste in Broward County and provides annual reports to the Florida Department of Environmental Protection.

Explanation: Tracking of the handling, management and disposal of solid waste helps measure waste reduction/pollution prevention programs and highlights efforts to maintain sufficient disposal options for future generations.

Data sources: Florida Department of Environmental Protection, Bureau of Solid and Hazardous Waste, Division of Waste Management; Table 5A of the *Solid Waste Management in Florida Annual Report*; Broward County Office of Integrated Waste Management, Peter Foye.

