

Hydrologic Alterations

Quantifiable objectives

HA-1: By 2015, identify, establish and maintain a more natural seasonal variation (annual hydrograph) in freshwater flows for:

- Caloosahatchee River.
- Peace River and its tributaries.
- Myakka River, with special attention to Flatford Swamp and Tatum Sawgrass.
- Estero Bay and its tributaries.

HA-2: By 2020, restore, enhance and improve where practical historic watershed boundaries and natural hydrology for watersheds within the CHNEP study area, with special attention to Outstanding Florida Waters and Class I water bodies.

HA-3: By 2020, enhance and improve to more natural hydrologic conditions water bodies affected by artificially created structures throughout the CHNEP study area, including:

- Sanibel Causeway in Lee County.
- Franklin Lock (S-79) in Lee County.
- Dams on the Myakka River that flows through Manatee, Sarasota and Charlotte counties.
- Causeway between Lovers Key State Recreation Area and Bonita Beach in Lee County.
- Water-control structure on the south end of Lake Hancock in Polk County.
- Structure on Coral Creek in Charlotte County.
- Gator Slough canal collector system in Lee and Charlotte counties.
- Peace Creek canal system in Polk County.
- Cow Pen Slough in Sarasota County.

Reduce negative hydrologic effects of artificially created structures such as weirs, causeways, dams, clay settling areas and new reservoirs.

HA-4: By 2010, for each watershed, identify the linkages between local, water management district, state and federal government development permitting and capital programs affecting water storage, flood control and water quality. By 2012, identify and recommend reforms through tools such as comprehensive watershed management plans. By 2015, implement the reforms.

Priority actions

HA-A: Develop a historic and current estuarine mixing model, focusing on salinity and indicator species that are sensitive to salinity changes, and better evaluate proposed capital and operations projects.

HA-B: Develop integrated ground and surface water models. Address data gaps based on ecosystem needs and projected needs for water withdrawals due to population growth, development, agriculture and mining.

HA-C: Protect headwater tributaries from elimination and restore these tributary courses and their floodplains where opportunities exist.

HA-D: Set and achieve minimum aquifer levels. Reduce the rate of saltwater intrusion in the Floridan aquifer.

HA-E: Establish minimum flows and levels (MFLs).

HA-F: Participate in Everglades restoration and the Southwest Florida Feasibility Study.

HA-G: Reestablish hydrologic watersheds to contribute flows to their historic receiving water bodies.

HA-H: Identify natural, existing and target water budgets for each watershed.

HA-I: Evaluate the impacts of man-made barriers to historic flows.

HA-J: Build and restore water conveyances to have shallow, broad, vegetated and serpentine components that also restore floodplains.

HA-K: Identify the hydrologic and environmental impacts of surface water reservoirs on estuaries within the watershed.

HA-L: Encourage the use of low-impact techniques in new and old developments.

HA-M: Limit big-pulsed release events.

HA-N: Implement watershed (basin) initiative projects to address hydrologic alterations, loss of water storage and changed hydroperiod, and improve water quality.

HA-O: Encourage, expand and develop incentives for the reuse of waters that are protective of water quality and natural hydrology.

HA-P: Support public involvement programs addressing watershed management issues of hydrology, water resource issues, water conservation and water use.



HA-A

Develop a historic and current estuarine mixing model, focusing on salinity and indicator species that are sensitive to salinity changes, and better evaluate proposed capital and operations projects.

Background

The need for a peer-reviewed estuarine mixing model was identified as a need related to the Sanibel Causeway modifications at the time the CCMP was adopted in 2000. Because of various restoration activities and other modifications to flows, an area-wide estuarine mixing model was identified as a need. Necessary data has been collected, such as an update to bathymetry, continuous salinity measurements and U.S. Geological Survey mapping of thousands of measurements taken in a day. These data help to obtain better calibration. Work by the University of South Florida to base estuarine models on Gulf of Mexico processes has made significant progress on the development of estuarine models. The Environmental Fluid Dynamics Code (EFDC Hydro) is emerging as a standard. It is a state-of-the-art hydrodynamic model that can be used to simulate aquatic systems in one, two and three dimensions. EFDC Hydro is available at www.epa.gov/athens/wwqts/html/efdc.html.

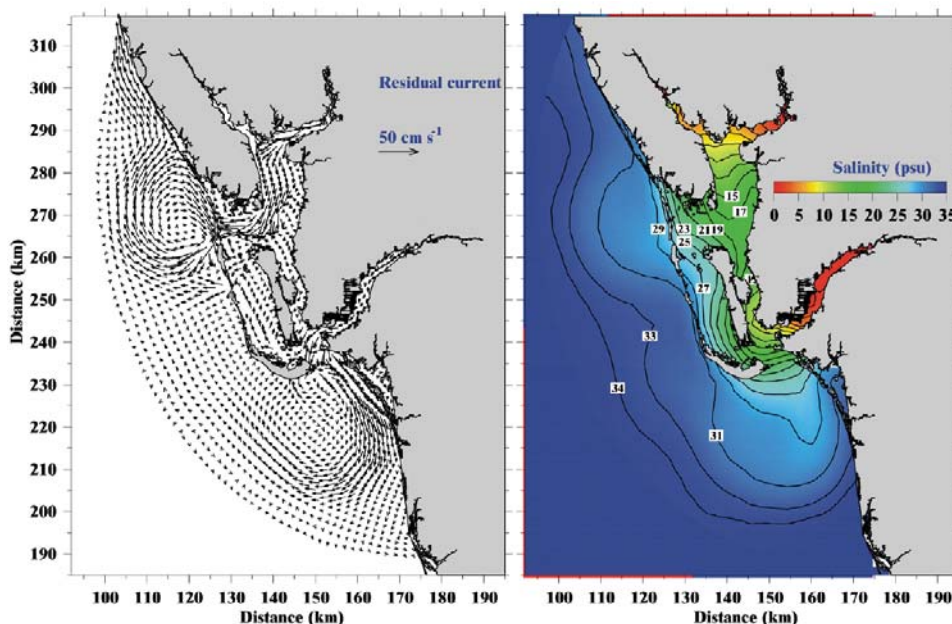
This priority action helps fulfill HA-1.

Strategy

- 1) Identify indicator species, variables to be modeled and spatiotemporal data needs.
- 2) Collect data for flow, stage, salinity, indicator species and others for model calibration.
- 3) Identify a host agency to run, maintain and update models.
- 4) Develop an overarching three-dimensional model for the entire tidal Charlotte Harbor system and more detailed watershed models for each estuary watershed.
- 5) Update land-use change analysis with 2005 aerial photography and conduct similar analyses every five years, as identified through the *Peace River Resource Management Plan*.

Potential coordinating organizations

County and municipal governments: City of Sanibel and Lee County
Florida Department of Environmental Protection
NOAA National Marine Fisheries Service
U.S. Army Corps of Engineers
U.S. Coast Guard
U.S. Environmental Protection Agency
Water management districts



Robert Weisberg with the College of Marine Science, University of South Florida, has been developing three-dimensional estuarine models in the Charlotte Harbor area. Here is a sample.



HA-B

Develop integrated ground and surface water models. Address data gaps based on ecosystem needs and projected needs for water withdrawals due to population growth, development, agriculture and mining.

Background

To document changes in surface water flows and patterns due to hydrologic alterations, it is important that accurate, long-term databases be developed for all watersheds within the CHNEP study area. While many areas within the CHNEP have extensive historical flow records, other areas lack this historic record. Accurate data will also be needed to assess the effectiveness of the action plans. Action will provide accurate, long-term information on amounts and variability of surface water resources and provide a basis for planning. Identifying gaps in flow data will provide a scientific basis for the establishment of minimum flows and levels and assess future changes related to projected development and consumptive uses.

South Florida Water Management District uses a validated Mike-She model to provide existing and target flows for use in other models like STELLA. STELLA is a model used to assess relative contributions of hydrologic projects to overall flows.

This priority action helps fulfill HA-1.

Strategy

- 1) Identify watersheds where there is insufficient watershed flow data to accurately assess seasonal and long-term changes in water resources, such as the tidal creeks along the east wall of Charlotte Harbor and Cape Haze peninsula.
- 2) Determine the minimum number and appropriate locations of needed gauges. Install appropriate monitoring gauges.
- 3) Integrate flow and stage monitoring into stormwater utility programs.
- 4) Collect information and analyze effects that stormwater runoff has on flow characteristics of tributaries. (This is already planned for Estero Bay tributaries.)
- 5) Monitor surface water stages and groundwater levels in the Caloosahatchee, Peace and Myakka rivers watersheds.

- 6) Fill in data gaps on flow and salinity patterns to support the development and implementation of hydrodynamic models as planned in Lee County, portions of Charlotte County and as needed in Sarasota and Charlotte counties.
- 7) Expand the “Continuous Surface Water Level Monitoring” to monitor surface water levels in the CHNEP study area within South Florida Water Management District’s jurisdiction.
- 8) Encourage the development and implementation of local government “Stormwater Management Plans” to improve the timing of water flows reaching natural water bodies.
- 9) The CHNEP and its partners should participate in the feasibility study and implementation activities for the Comprehensive Everglades Restoration Plan, Southwest Florida Feasibility Study, the Caloosahatchee Water Management Plan, the Lower West Coast Water Supply Plan and any efforts that will be measuring and managing flows in the Caloosahatchee River.
- 10) Develop a Peace River integrated ground and surface water model, as identified through the *Peace River Resource Management Plan*.

Potential coordinating organizations

Charlotte Harbor National Estuary Program
County and municipal governments
U.S. Army Corps of Engineers
U.S. Geological Survey
Water management districts
Water supply authorities

TIP: Acre-feet per day can be converted to cubic feet per second. Divide acre-feet per day by 2 (or more precisely 1.98) to get cubic feet per second. Double cubic feet per second to get acre-feet per day.



HA-C

Protect headwater tributaries from elimination and restore these tributary courses and their floodplains where opportunities exist.

Background

Headwater tributaries are like the capillary system of a blood supply network. Just as the health of the whole organism depends upon a functioning capillary system, the health of larger streams and rivers depend upon an intact primary headwater stream network. The hydrology of headwater streams can be altered directly (e.g., phosphate mining, channelization, transportation) and indirectly (e.g., groundwater withdrawals). Headwater streams benefit entire river systems through sediment deposition reduction, nutrient input reduction, flood control, wildlife habitat corridor protection and water and food supply for fish and wildlife. An intact network of functioning primary headwater streams can reduce dredging costs, reduce water treatment costs, reduce the siltation of larger stream habitats, improve recreational opportunities, reduce water treatment costs, reduce human health risks, reduce degradation of downstream waters, reduce local and downstream flooding, prevent excess erosion, increase property values, increase or maintain biological diversity, improve opportunities for hunting and fishing and maintain base flow in larger streams in times of drought. They are a key determinant in the overall condition of the river system.

This priority action helps fulfill HA-1.

Strategy

- 1) Work with phosphate and fertilizer facilities to protect and restore the hydrology of headwater tributaries, such as Wingate Creek in Manatee County, Bowlegs Creek in Polk County, Horse Creek in Hardee and DeSoto counties, Upper Saddle Creek in Polk County, McCullough Creek in Polk County, Six-Mile Creek in Polk County,

- Bear Creek Branch in DeSoto County, Brushy Creek in Hardee County and Payne Creek/Little Payne Creek in Polk and Hardee counties.
- 2) Work with the agriculture industry to protect and restore hydrology on private lands, such as Owen Branch in Manatee County, Peace Creek Canal in Polk County, Joshua Creek in DeSoto County, Prairie Creek in Charlotte and DeSoto counties, Myrtle Slough in Charlotte County and upper Myakka River (e.g., Ogleby, Long, Coker creeks) in Manatee County.
- 3) Encourage local governments to protect headwater tributaries, such as the Orange River and Telegraph Creek in Lee County, and assist in the development and implementation of restoration plans.

Potential coordinating organizations

County and municipal governments
Florida Dept. of Agriculture and Consumer Affairs
Florida Department of Environmental Protection
Industry: Agriculture and mining
Regional planning councils
Water management districts



Healthy headwater tributary in the upper Horse Creek watershed.

Photo by Catherine Corbett, 6/25/03



HA-D

Set and achieve minimum aquifer levels. Reduce the rate of saltwater intrusion in the Floridan aquifer.

Background

The Southwest Florida Water Management District (SWFWMD) established minimum flows and levels in the Southern Water Use Caution Area (SWUCA), including the Floridan aquifer in coastal Manatee and Sarasota counties, the upper Peace River and eight lakes in the Ridge Area in Polk and Highlands counties. Recovery efforts will slow the inland movement of saltwater intrusion such that the withdrawal infrastructure will be at minimal risk of water quality deterioration over the next century. In March 2006, the SWFWMD Governing Board adopted the minimum flows and levels, including a saltwater intrusion minimum aquifer level of 13.1 feet above sea level. Based on the existing distribution of withdrawals, it is estimated that long-term average annual withdrawals from the Floridan aquifer need to be reduced by 50 mgd to ensure saltwater intrusion minimum aquifer levels are met. Currently 650 mgd are withdrawn annually.

The South Florida Water Management District (SFWMD) established minimum aquifer levels for the lower Tamiami aquifer, the Sandstone aquifer and the mid-Hawthorn aquifer to equal the structural top of the aquifer. The draft recovery strategy (i.e., Lower West Coast Plan) for this rule states: (a) establish “no harm” maximum permissible levels for each aquifer for a 1-in-10 -year level of certainty, (b) implement rule criteria to prevent harm through the consumptive use permitting process, (c) construct and operate water resource and supply development projects and (d) implement the water shortage plan. The draft document *Proposed Minimum Water Levels for the Lower West Coast Aquifer System Within the SFWMD*, dated September 5, 2000, proposed further research into what constitutes “significant harm” to the water table aquifer before proposing a minimum aquifer level (MAL) for this aquifer. According to this document, water levels in the mid-Hawthorne aquifer have dropped approximately 60 to 80 feet, and more than 15 to 30 feet, depending on season, locally in the lower Tamiami, Sandstone and Floridan aquifers from estimated predevelopment levels in Lee County.

This priority action helps fulfill HA-1.

Strategy

- 1) Develop a priority for the establishment of minimum aquifer levels (MALs) in the South Florida Water Management District portion of the CHNEP study area.
- 2) Collect the data and conduct the necessary research to establish MALs on a watershed approach.
 - a. Develop better surface water/groundwater model parameters (discharge, seepage and water level data) through analysis and processing of field data and statistical techniques.
 - b. Expand the groundwater and surface water monitoring networks to monitor groundwater levels and surface water stages at select wells.
- 3) Establish an MFL rule for the water table aquifer in Lee and southern Charlotte counties protective of aquatic resources and water supply.
- 4) Encourage conservation and development of alternative supplies through projects such as reuse water projects, low-volume plumbing rebate programs, potable water aquifer storage and recovery systems, BMP implementation and water resource development projects.
- 5) Identify and plug abandoned artesian wells that allow uncontrolled surface discharge.
- 6) Reduce interaquifer contamination through reestablishment of the confinement between aquifers by back-plugging sections of well bores.
- 7) Retire water use permits associated with acquired preservation lands.
- 8) Streamline collection and analysis of water use permitting data.
- 9) Increase efficiency of irrigation water use (i.e., FARMS projects).

Potential coordinating organizations

County and municipal governments
Florida Dept. of Agriculture and Consumer Affairs
Industry: Agriculture
Water management districts
Water supply authorities



Background

The water management districts are directed by Chapter 373.042, Florida Statutes, to set minimum flows and levels. The minimum flow for a given watercourse is the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area.

The minimum level is the level of ground water in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area. Each water management district is required to annually submit to the Florida Department of Environmental Protection for review and approval a priority list and schedule for establishment of minimum flows and levels for surface watercourses, aquifers and surface waters within the district. The list shall be based on the importance of the waters to the state or region and shall include those waters that are experiencing or may reasonably be expected to experience adverse impacts.

This priority action helps fulfill HA-1.

Strategy

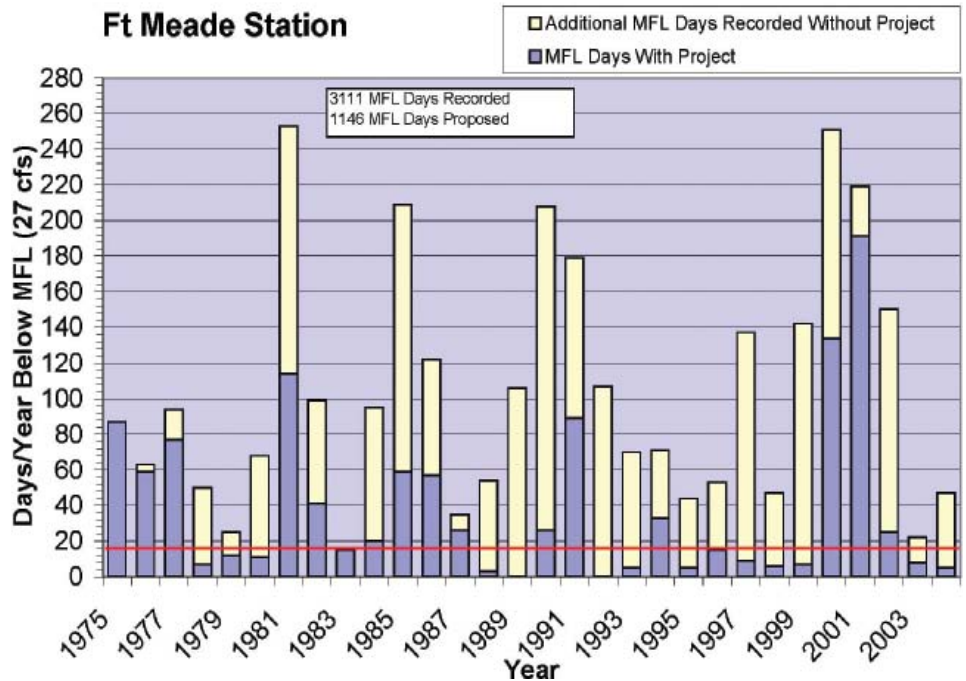
- 1) Develop a priority for the establishment of minimum flows and levels (MFLs) based on:
 - a. The importance of the waters to the state or region.
 - b. The likelihood that the waters are experiencing or may be expected to experience adverse impacts.
- 2) Collect the data and conduct the necessary research to establish MFLs on a watershed approach.
 - a. Develop better surface water/groundwater model parameters (discharge, seepage and water level

data) through analysis and processing of field data and statistical techniques.

- b. Expand the groundwater and surface water monitoring networks to monitor groundwater levels and surface water stages at select wells.
- 3) Participate in peer review for select methodologies.
- 4) Set MFLs for water bodies within the CHNEP study area.
- 5) Encourage conservation and development of alternative supplies through projects such as reuse water projects, stormwater reuse systems, potable water aquifer storage and recovery systems, BMP implementation and water resource development projects.
- 6) Develop MFLs and recovery strategies where needed, as identified through the *Peace River Resource Management Plan*.

Potential coordinating organizations

Florida Department of Environmental Protection
 U.S. Geological Survey
 Water management districts



The Southwest Florida Water Management District Lake Hancock Lake Level Modification Project is expected to provide approximately 50 percent of minimum flow requirements for a 20-mile portion of river, protect thousands of acres of floodplain and reduce nitrogen levels by 27 percent.



Background

The Comprehensive Everglades Restoration Plan (CERP) provides a framework and guide to restore, protect and preserve the water resources of central and southern Florida, including the Everglades. It covers 16 counties over an 18,000-square-mile area and centers on an update of the Central and Southern Florida (C and SF) Project, also known as the Restudy. The Plan was approved in the Water Resources Development Act (WRDA) of 2000. It includes more than 60 elements, will take more than 30 years to construct and will cost an estimated \$7.8 billion. WRDA 2000 also included a component known as the Southwest Florida Feasibility Study (SWFFS).

This priority action helps fulfill HA-1, HA-2 and HA-3.

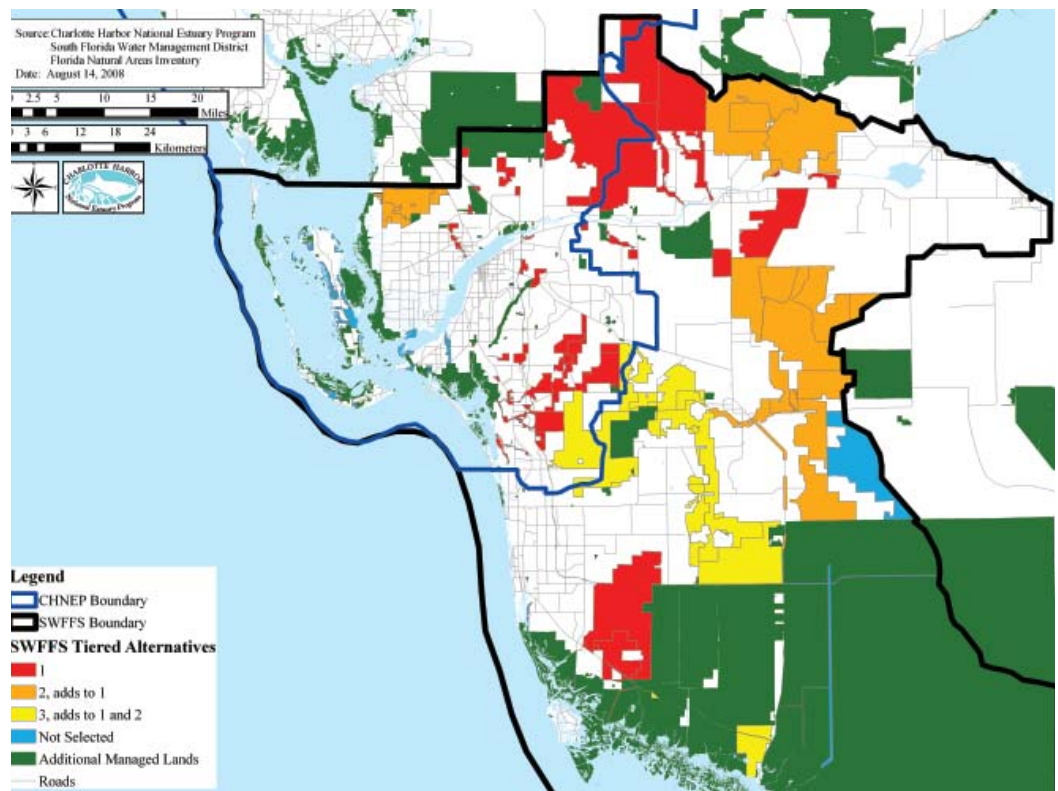
Strategy

- 1) Provide that members of the review committees for the U.S. Army Corps of Engineers’s C and SF are aware of the concerns in the *Comprehensive Conservation and Management Plan*.
- 2) Include CHNEP partners on the CERP and SWFFS committees to develop, review and evaluate results.
- 3) Restore seasonal extent of the isohaline (natural seasonality of salinity) in the Caloosahatchee to stabilize valued ecosystem components including wild celery (*Vallisneria*), blue crab, oysters, clams and juvenile fish.

Potential coordinating organizations

- Charlotte Harbor National Estuary Program
- County and municipal governments: Lee and Charlotte counties
- Florida Department of Environmental Protection
- Florida Fish and Wildlife Conservation Commission
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency
- Water management district: South Florida WMD

Data Source: 2007



The Southwest Florida Feasibility Study (SWFFS) includes Lee County and portions of Charlotte, Glades, Hendry, Collier and Monroe counties. The CHNEP helped develop the methodology to obtain initial alternatives..



HA-G

Reestablish hydrologic watersheds to contribute flows to their historic receiving water bodies.

Background

There are regions where surface flows no longer contribute or contribute too much flow to their historic watersheds. In some areas, hydrologic alterations have accounted for significant changes in both the amount and seasonal characteristics of flows of the major tributaries within these watersheds.

This priority action helps fulfill HA-2.

Strategy

- 1) Assess and document changes in historic watersheds caused by past and current alterations, including mining, ditching, channelizing, damming and other structural changes.
- 2) Inventory stormwater systems and facilities.
- 3) Promote projects that address freshwater runoff problems from canal systems, including the Gator Canal System in Lee County, Blackburn Canal in Sarasota County, Curry Canal in Sarasota County and Peace Creek Canal in Polk County.
- 4) Evaluate plans to establish more natural surface water flows from historic watersheds.

- 5) Encourage coordination among stormwater utilities, natural resource managers and transportation planning and projects.
- 6) Determine and promote mechanisms to fund restoration projects, including property taxes to purchase environmentally sensitive lands to place in public trust in order to preserve natural hydrology.
- 7) Develop a proposal to ensure adequate funding for the Nonmandatory Reclamation Program to fund reclamation targeted at specific water resource benefits, as identified through the *Peace River Resource Management Plan*.

Potential coordinating organizations

County and municipal governments
Florida Department of Environmental Protection
Florida Department of Transportation
Industry
Regional planning councils
U.S. Department of Transportation
Water management districts



Photo from the Dona Bay Watershed Management Plan

The Cow Pen Canal construction shifted historic flows from the Myakka River to Dona and Roberts bays.



HA-H

Identify natural, existing and target water budgets for each watershed.

Background

Water flow has been modified by humans since they first came to the region and continues today. Inadvertent ecological degradation resulted from these modifications. To balance the demands of people for drainage, drinking water, navigation and recreation with preservation of ecological health, one must first understand water flow. Significant benchmarks for studying volume and timing of flow include natural flows from a time before human influence, flow at the present time and a practical estimate of future water budgets that would more wisely balance conflicting needs.

This priority action helps fulfill HA-2.

Strategy

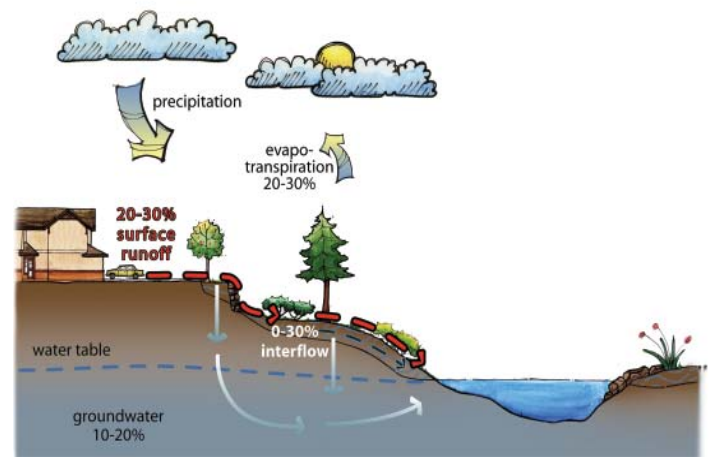
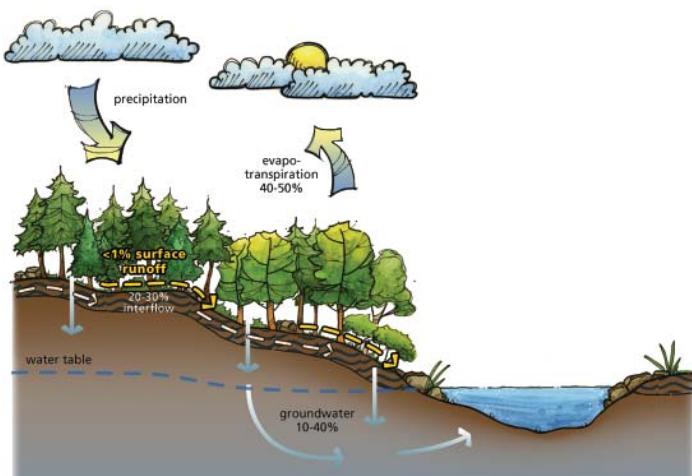
- 1) Determine natural, existing and target watershed boundaries using existing studies of historic drainage watershed boundaries.
- 2) Define natural, existing and projected evapotranspiration, precipitation and other input and outputs of a water budget equation for each watershed. Consider the effects of ground water converted to surface water, wastewater reuse, connections between watersheds, impermeable surfaces and constructed conveyances.

- 3) Determine target water budgets by watershed. Involve stakeholders in the discussion of target water budgets to include planning efforts already expected.
- 4) Determine negative hydrologic modifications that can be improved through restoration. Rank potential projects by geographic areas based on significant modifications and potential for remediation.

Potential coordinating organizations

Charlotte Harbor National Estuary Program
County and municipal governments
Drainage districts
Florida Department of Environmental Protection
Industry: Agriculture
Stormwater utilities
U.S. Environmental Protection Agency
Utilities: Public and private
Water management districts
Water supply authorities

Graphics below are from Low Impact Development Technical Guidance Manual for Puget Sound produced by the Puget Sound Partnership and WSU Extension. Credit for the diagram goes to AHBL, Inc. Planners.



Groundwater resources are dependent on areas inside and outside of the CHNEP study area. Installation of impervious surface has shifted the water budget toward reduced ground water and increased runoff.



HA-I

Evaluate the impacts of man-made barriers to historic flows.



Photo by Bob Howard, EPA, 11/16/05

The Peace Creek Canal changes historic flows.

Background

Historic flow patterns, including timing and volume, are critical needs for the aquatic life in the ecosystem that has evolved and adapted to natural conditions. Large and small opportunities to restore historic flows are possible if decision-makers are provided with comprehensive information about them.

The alterations with the most dramatic impact have been highway projects, large-scale mining and drainage works. Watershed flows, volumes and timing have been redirected, impeded or accelerated by such projects. Remediation of existing and new construction of roads and drainage works need special attention to ensure that the resources of the CHNEP study area are sustained. Remaining natural flow ways deserve particular attention for remaining unaltered.

This priority action helps fulfill HA-3.

Strategy

1) Develop a map of historic flow ways and watershed boundaries. Poll the CHNEP membership to supplement the restoration plan to create a preliminary list of barriers to historic surface and groundwater flow and suggestions for additional sources of information. Particular attention should be given to drainage works,

mining or roadbeds that change watershed boundaries.

2) Supplement the preliminary list after tracking down additional sources of information.

3) Propose restoration projects for each site using creative but practical ideas. Consider phased projects or small projects as well as comprehensive restorations.

4) Rank the projects using a matrix based on possibility for permitting, relative cost, relative ecological value of the outcomes and other criteria learned from adaptive management during the project effort. Identify the agencies that may be willing to do the project.

- 5) For top-ranked projects, contact the agencies and private entities that may implement them and identify what additional information they need to fund and execute the projects. Based on feedback, rerank the projects and provide needed information to potential project implementers.
- 6) Make mitigation of any potential hydrologic alterations a key criterion for evaluation during any new roadway, drainage, mining and construction projects.

Potential coordinating organizations

Associations: Farmers and growers
Charlotte Harbor National Estuary Program
County and municipal governments
Florida Dept. of Agriculture and Consumer Affairs
Florida Department of Environmental Protection
Florida Department of Transportation
Florida Fish and Wildlife Conservation Commission
Metropolitan planning organizations
Organizations: Conservation
Organizations: Nonprofit research
Regional planning councils
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
Water management districts
West Coast Inland Navigation District



HA-J

Build and restore water conveyances to have shallow, broad, vegetated and serpentine components that also restore floodplains.

Background

The history of Florida is replete with drainage improvements that reduced wetlands and made streams straighter and deeper. Channelized waterways offer fewer habitat opportunities for terrestrial and aquatic wildlife, degrade water quality by quickly forcing fresh water into estuaries and reduce the natural beauty of Florida for its human residents. There are abundant opportunities for improvements to the drainage system that still allow for flood protection in cooperation with wetland restoration, recreational opportunities, improved water quality and perhaps even water supply enhancement.

This priority action helps fulfill HA-3.

Strategy

- 1) Inventory innovative stormwater treatment and conveyance systems from around the CHNEP study area and other areas.
- 2) Provide educational opportunities, including workshops, to engineers and planners of environmentally friendly design techniques.

- 3) Create a large “toolbox” of engineering techniques that improve environmental quality. Make it easy to choose environmentally friendly techniques.
- 4) Create demonstration projects that combine drainage, environmental and neighborhood concerns. Advertise this information to engineers and others outside the environmental community.
- 5) Initiate discussions with significant stakeholders at Blackburn Canal, Gator Slough Canal, Peace Creek Canal and 10-Mile Canal.
- 6) Apply geomorphology to this effort: build and modify systems so they coincide with how nature would have done it.

Potential coordinating organizations

Charlotte Harbor National Estuary Program
County and municipal governments
Drainage districts
Florida Department of Environmental Protection
Florida Department of Transportation
Florida Stormwater Association
Stormwater Academy at UCF
Stormwater utilities
U.S. Environmental Protection Agency
Water management districts



Photo by Lisa Beever, 8/12/03

Bonita Bay Development Group created broad and shallow flow ways to restore flows to water-starved Halfway Creek and provide an amenity.



HA-K

Identify the hydrologic and environmental impacts of surface water reservoirs on estuaries within the watershed.

Background

The hydrologic impacts of reservoirs on downstream estuaries will depend on the management priorities established for the reservoirs. If maintaining a certain water level in the reservoir is given a higher priority than maintaining a relatively natural flow to the estuary, then the estuary water supply will be disrupted. On the other hand, a reservoir can smooth out large flow variations caused by a disturbed upstream water supply, if that smoothing is made a high priority for the reservoir management. Identifying the impacts would require monitoring water flows and salinity variations within the system. Environmental impacts would include chemical and biological changes to water reaching the estuaries.

This priority action helps fulfill HA-3.

Strategy

- 1) Evaluate effects of existing reservoirs on downstream water resources, including above- and below-surface reservoirs for water supply, restoration or mining.
- 2) Examine soil chemistry at proposed reservoir sites, including pesticides and metals.
- 3) Examine groundwater chemistry at proposed reservoir sites.

- 4) Monitor water chemistry and biology (esp. algae/phytoplankton) in and downstream of reservoirs. Possible chemical changes include salts, metals, nutrients and pesticides picked up from the soil or rock that form the reservoir. Ground water mixing with reservoir water could also change its chemical composition. Possible biological effects of reservoirs include changes in the kind and amount of plankton released into the estuaries and the changes in water chemistry that are produced by the biological conditions in the reservoir. These include nutrient uptake, oxygen production (or uptake) and chemicals used for vegetation control in the reservoir.
- 5) Ensuring the protection of the health of estuaries is high on the list of reservoir management priorities.
- 6) Where appropriate, develop education programs to disseminate information that the protection of estuaries is vital to reservoir management priorities.
- 7) Develop professional presentations for legislators and commissioners.
- 8) With input from utilities, water supply authorities, local municipalities, industry, agriculture, water management districts, resource managers and the public, develop educational materials and programs to emphasize the impacts of reservoirs on natural resources. Present these materials/programs at events, trade shows and other venues.

- 9) Encourage federal and state regulations and statute changes related to reservoir siting, construction and operations to protect natural resources.

Potential coordinating organizations

County and municipal governments
Florida Department of Environmental Protection
U.S. Army Corps of Engineers
U.S. Geological Survey
Water management districts
Water supply authorities



C-43 (Caloosahatchee) Reservoir test cells.

From a 10/29/07 presentation by Carol Ann Wehle, SFWMD Executive Director



HA-L

Encourage the use of low-impact techniques in new and old developments.

Background

Low-impact development is a comprehensive land planning and engineering design approach with a goal of maintaining and restoring the predevelopment hydrologic regime of urban and developing watersheds. It is best applied in redevelopment areas to restore hydrologic regimes rather than simply reduce the impacts of new development. In the CHNEP study area, the water resource is stressed in two ways: (1) altering storage to drainage by extensive stormwater works stresses vegetation such that artificial irrigation is needed that further impacts the water resource and (2) “downstream” impact of flooding and drought extreme variations cause estuarine salinity “yo-yo” in short cycles. Implementation of low-impact techniques reduces drainage and impacts stresses through greater storage standards, including retrofitting older developments where feasible.

This priority action helps fulfill HA-4.

Strategy

- 1) Promote alternatives to the local and state criteria used by engineers who design stormwater systems and determine relationships with natural systems.
- 2) Promote changing stormwater design criteria from the rate of flow to the volume of storage, pre equals post storage, not pre equals post drainage.
- 3) Establish land alteration monitoring programs that evaluate the current condition of “impervious surface” by watershed for prioritization for more storage efforts and attenuation BMPs.
- 4) Support retrofitting in older developments to low-impact development (LID). Promote utilization and expansion of existing efforts such as Adopt-A-Pond and Florida Yards & Neighborhoods to reduce impervious surface, increase small-scale water storage, integrate stormwater systems,



Low impact development (LID) practices, many of which are shown above, reduce stormwater runoff and reduce the need for large regional stormwater treatment systems.

Graphic from Low Impact Development Technical Guidance Manual for Puget Sound produced by the Puget Sound Partnership and WSU Extension. Credit for the diagram goes to AHBL, Inc. Planners.

reduce dependence on septic systems and enhance existing stormwater systems.

- 5) Advocate LID in new developments through programs such as the SFWMD Southwest Florida Basin Rule, Sarasota County Sustainability program, Lee County Smart Growth LDRs, Charlotte County stem-wall construction rule, transfer of development rights (TDR) ordinance and Puget Sound’s low-impact development technical manual.

Potential coordinating organizations

County and municipal governments
Federal, state, community and municipal government agencies
Organizations: Conservation
Organizations: Nonprofit research
Water management districts



Background

Decades of development, including agriculture, in southwest Florida have altered landscape drainage patterns. In order to drain the landscape quickly and efficiently, excessive ditching has often circumvented the traditional water retention and water quality treatment function of wetland systems. These alterations have caused increased and excessive wet season discharge to our coastal environment. The excessive discharge volumes contain higher pollutant loads and freshwater pulses that alter and impact estuarine and marine habitat. Additionally, these alterations have resulted in a lower surface groundwater table than existed historically. The lower surface groundwater table alters freshwater wetland hydroperiods and increases the annual need for irrigation. Development pressure, construction techniques and agricultural practices have also resulted in areas where dry season retention and water supply needs for irrigation require holding more fresh water back on the landscape.

Balancing water budget needs around the four areas of responsibility (natural systems, flood protection, water supply and water quality) established by the water management districts reduces development impacts on our natural systems. Drafting comprehensive watershed management plans around these areas of responsibility will identify the water resource requirements for major watersheds and establish goals and objectives that meet the needs of those major watersheds.

The SFWMD has taken an additional step for certain water bodies in establishing “maximum” water flows, beyond which for any sustained period or intense special event damage can be expected to either the quality of receiving water bodies, or through flooding economic activities, or endangering human health. This approach may be examined for additional water bodies in the future.

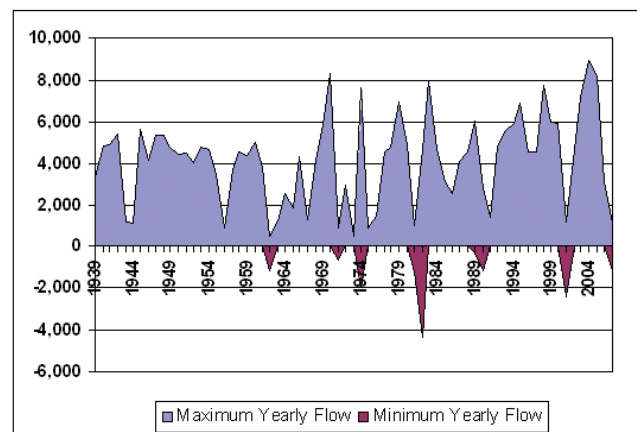
This priority action helps fulfill HA-4.

Strategy

- 1) Encourage and support the drafting of comprehensive watershed management plans for major contributing watersheds.
- 2) Advocate stormwater ordinance revisions so that off-site discharges mimic natural system flow rates and timing.
- 3) Encourage and support stormwater retrofit projects to restore natural system flow rates and timing.
- 4) Reevaluate water and consumptive use permits to bring permits in line with actual needs and usage, accounting for on-site storage. On-site storage would allow for adequate residence time, increased recharge and reduction of discharging off-site, which would better mimic natural wetland hydrology.
- 5) Rehydrate surficial aquifer to historic levels by protecting existing wetlands, limiting impervious surfaces and reducing drainage canal depths.

Potential coordinating organizations

- County and municipal governments
- Florida Department of Environmental Protection
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency
- Water management districts



After S-77 (Moore Haven Lock) was modified in the 1960s, maximum flows to the Caloosahatchee increased from 4,500 to 8,000 cubic feet per second.



HA-N

Implement watershed (basin) initiative projects to address hydrologic alterations, loss of water storage and changed hydroperiod, and improve water quality.

Background

Both the Southwest Florida Water Management District and the South Florida Water Management District have developed watershed (basin) initiative strategies. By focusing energy and resources on an overall watershed strategy, projects can yield greater cost benefit toward restoration. Watershed initiatives are a way to build partnerships, leverage funding and address complex problems. Watershed initiatives in the CHNEP study area include the Upper Peace Initiative (SWFWMD), the Myakka River Initiative (SWFWMD), the Charlotte Harbor Initiative (SWFWMD), the Caloosahatchee Initiative (SWFWMD) and the Estero Bay Initiative (SWFWMD).

This priority action helps fulfill HA-4.

Strategy

- 1) Implement projects in the upper Peace River to address alterations and loss of storage to restore minimum flows and levels, and to protect and improve water quality in the Peace River and Charlotte Harbor.
 - a. Reconnect mined lands and reestablish historic surface water connections.
 - b. Complete watershed management programs for priority watersheds.
 - c. Continue to develop and implement resource recovery projects in the upper Peace River watershed that are consistent with the SWFWMD *Southern Water Use Caution Area (SWUCA) Recovery Strategy*.
 - d. Implement alternatives identified in the SWFWMD *SWUCA Recovery Strategy* and in completed watershed management plans.
 - e. Implement projects to reduce nonpoint-source loadings of nutrients and other pollutants.
- 2) Collect the necessary data, develop and implement water resource projects to restore hydroperiods in the Myakka River watershed.
 - a. Develop the technical analysis and modeling tools necessary for assessing management options.
 - b. Identify and evaluate best management practices.

- c. Implement alternatives identified in the SWFWMD *SWUCA Recovery Strategy* and in completed watershed management plans.
 - d. Monitor response to implement projects and adapt management as necessary.
- 3) Support new watershed initiatives by advocating a watershed approach to addressing problems and pursuing funding.
- 4) Promote greater participation in the Facilitating Agricultural Resource Management Systems program, as identified through the *Peace River Resource Management Plan*.
- 5) Promote greater use of the mobile irrigation laboratory program, as identified through the *Peace River Resource Management Plan*.
- 6) Implement SWUCA recovery strategies, as identified through the *Peace River Resource Management Plan*.
- 7) Accelerate and secure funding for Upper Peace River/Saddle Creek restoration project, as identified through the *Peace River Resource Management Plan*.
- 8) Implement projects in Charlotte Harbor, Caloosahatchee and Estero Bay that are defined annually for lower Charlotte Harbor.

Potential coordinating organizations

County and municipal governments
Florida Dept. of Agriculture and Consumer Affairs
Florida Department of Environmental Protection
Florida Fish and Wildlife Conservation Commission
Water management districts



HA-O

Encourage, expand and develop incentives for the reuse of waters that are protective of water quality and natural hydrology.

Background

Water supplies in southwest Florida are being stressed by the area's rapid growth. The efficient use and reuse of water should be made a key planning element at the local, regional and state levels. Water reuse programs can be an effective method of reducing pressures on surface and groundwater resources. However, irrigation with reuse water may elevate nutrient loads to adjacent wetlands and water bodies and contributes to water body impairments.

This priority action helps fulfill HA-4, WQ-1 and SG-1.

Strategy

- 1) Develop a regional reuse water policy that considers the conventional benefit of the resource and the potential for nutrient impacts on adjacent wetlands and water bodies.
- 2) Identify areas where reuse water service has the greatest potential for benefit, evaluate options for providing such service and study the feasibility of setting up service to areas without reuse water service.
- 3) Encourage utilities to quantify reuse for large reuse water users. Encourage nutrient management plans for large reuse water users.
- 4) Encourage utilities to adopt progressive rate structures for all water services (potable and reuse) to encourage efficient use of the resource.
- 5) Enhance existing education programs designed to inform and promote public awareness of the importance of efficient water use.
- 6) Evaluate public perceptions concerning the use of reuse water. Determine the barriers and benefits surrounding the acceptance of reuse water service in residential settings.
- 7) Use rebates or other incentives to encourage the retrofitting of pre-1992 irrigation systems with a sensor to interrupt irrigation when rain or moisture is present.
- 8) Study the effectiveness, benefits and impacts of existing reuse water services. Determine if the



Photo by Lisa Beever, 5/19/03

Inside the reclaimed water facility at the Cape Coral Wastewater Treatment Plant.

- runoff of reuse water is contributing to impairments of adjacent wetlands and water bodies.
- 9) Discourage the disposal of a potential reuse water resource, such as highly treated wastewater, through industrial outfalls or deep well injection.
- 10) Encourage the use of storm water as a water resource that protects or restores natural hydrology.
- 11) Determine if wet-weather temporary reservoir availability is a significant barrier to reuse water system development and, if so, develop feasible alternatives.
- 12) Investigate the use of water from reclaimed mine lakes to recharge aquifer systems.

Potential coordinating organizations

County and municipal governments
Education: Colleges and universities
Florida Dept. of Agriculture and Consumer Affairs
Florida Department of Environmental Protection
Industry
Regional planning councils
U.S. Environmental Protection Agency
U.S.D.A. Natural Resources Conservation Service
Utilities: Public and private
Water management districts



HA-P

Support public involvement programs addressing watershed management issues of hydrology, water resource issues, water conservation and water use.

Background

Hydrology — the study of water flow — is a little-understood environmental value. The land in the CHNEP study area has little variation in elevation and is characterized by water flowing over land as opposed to being dominated by major streams and rivers. In order to conduct agricultural and land development, drainage has been altered. This has resulted in the loss of water storage and an increase in stormwater runoff. Homeowners have the opportunity to reduce these impacts through choices made at home such as water conservation, landscaping and incorporating water storage features into landscape design.

This priority action helps fulfill HA-1, HA-2, HA-3, HA-4 and SG-1.

Strategy

- 1) Promote and support programs and opportunities for citizens to be involved with water conservation and hydrology issues.
- 2) Promote and support demonstration areas that instruct people on water conservation and hydrology issues.
- 3) Provide water conservation and hydrology information through local media and other outlets.

Potential coordinating organizations

Charlotte Harbor National Estuary Program
County and municipal governments
Education: Colleges and universities
Education: School districts
Florida Department of Environmental Protection
Florida Fish and Wildlife Conservation Commission
Industry
Regional planning councils
U.S. Fish and Wildlife Service
Water management districts
Water supply authorities



Photo by Maran Hilgendorf, 5/1/06

Children learning about the hydrologic cycle through play at the Explorations V Science Museum in Lakeland.

