Executive Summary

November 15, 2011

Sarasota County

Southwest Florida Water Management District

BACKGROUND

WATERSHED PLANNING

Sarasota County has six major watersheds in the County: Sarasota Bay, Roberts Bay North, Little Sarasota Bay, Dona and Roberts Bay, Lemon Bay, and the Myakka River (Figure 1). Sarasota County has implemented the Comprehensive Watershed Management Program to address water quality, water quantity, flooding, and natural resources in a holistic manner within each of these watersheds. This program employs an approach consistent with the Southwest Florida Water Management District's (SWFWMD) areas of responsibilities related to water resource management: Natural Systems, Water Quality, Water Supply, and Flood Protection; however, this Plan's main focus is on water quality preservation and enhancement.

Through a cooperative funding partnership, the County and SWFWMD developed the Watershed Management Plan (WMP) for Roberts Bay North, which is an estuary of national significance and a SWFWMD Surface Water Improvement and Management (SWIM) Priority waterbody.

Figure 1: Sarasota County Watersheds

PURPOSE AND OBJECTIVE

The Roberts Bay North WMP is a regional initiative that promotes and furthers the implementation of the *Sarasota County Comprehensive Plan*, the Sarasota Bay Estuary Program's (SBEP) *Comprehensive Conservation and Management Plan (CCMP)*, and the SWFWMD's *Southern Coastal Comprehensive Watershed Management Plan*. The purpose of this initiative is to develop and implement a watershed management plan for Roberts Bay North and its watershed to achieve the following objectives:

1. Improve and protect existing water quality.
2. Help develop Basin Management Action Plans (BMAPs) prepared by the Florida Department of Environmental Protection (FDEP) to address adopted Total Maximum Daily Load (TMDL) issues within the Roberts Bay North watershed.
3. Provide a more natural hydrologic regime for Roberts Bay North and the watershed.
4. Protect existing and future property owners from flood damage.
5. Develop ecosystem goals and targets based on the needs of environmental and biological indicators.
6. Investigate potential sustainable surface water supply options that are consistent with and support objectives from the Sarasota County Comprehensive Plan, SWFWMD's Regional Water Supply Plan, and the Southern Water Use Caution Area Plan.

Sarasota County has embarked on a proactive approach to develop the proper science and community-based vision as a foundation for formulating, evaluating, prioritizing, and implementing watershed management actions. The following sections summarize physical and societal characteristics of the Roberts Bay North watershed.

This WMP discusses the goals and objectives for Sarasota County and the measures the County is taking to meet these goals. Although not participating in this plan, Manatee County is also undertaking measures to meet similar goals for Robert Bay.

Sarasota County, the Southwest Florida Water Management District, the Sarasota Bay Estuary Program, Mote Marine Laboratory, and the South West Florida Regional Planning Council have developed management plans and technical reports through studies, workshops, and other efforts. The previous plans were summarized and incorporated into the WMP where applicable, based on the four watershed areas of responsibility: natural systems, water quality, water supply, and flood protection.

WATERSHED CHARACTERISTICS

The Roberts Bay North watershed is comprised of three basins shown in Figure 2: Phillippi Creek, Matheny Creek and Coastal. The Phillippi Creek basin is about 56 square miles and is by far the largest basin in the watershed. It is also among the most densely developed basins in the County. The Matheny Creek basin is small, about 2.7 square miles, and occupies the southwest tip of the watershed. The Coastal basin includes 6.3 square miles of land that drains directly to Roberts Bay North from the east and west. The vast majority of the Coastal basin is built out for residential use. There are, however, some natural areas along the coast such as the mangroves at the mouth of Phillippi Creek and the bird colony islands. The extensive canals on Siesta Key, including Grand Canal, were excavated beginning in the 1920s. Before that, runoff reached the bays through overland flow. Likewise, on the mainland stormwater is now carried directly to the bays by residential canals instead of traveling overland as it did before development.

Presently, the Roberts Bay North watershed is mostly comprised of medium-density residential development (two to five dwelling units per acre) and has been significantly impacted by anthropogenic activities (Figure 3). Impacts include degradation of water quality from stormwater runoff, wastewater plant discharges, and septic systems; alterations to surface water hydrology from channelization of natural streams and reduction of surface water storage, and conversion of natural habitat to agriculture and urban land uses.

Hydrologic alterations within the Roberts Bay North watershed include:

- Reducing on-site rainfall storage by filling and ditching natural depressions and wetlands.
- Increasing stormwater runoff rates by channelizing natural streams and creating networks of interconnected ditches that flow to the bay.
- Reducing infiltration by introducing pavement and other impervious surfaces.
- Altering flow patterns by constructing water control weirs and increasing sedimentation in the channel from upland erosion.

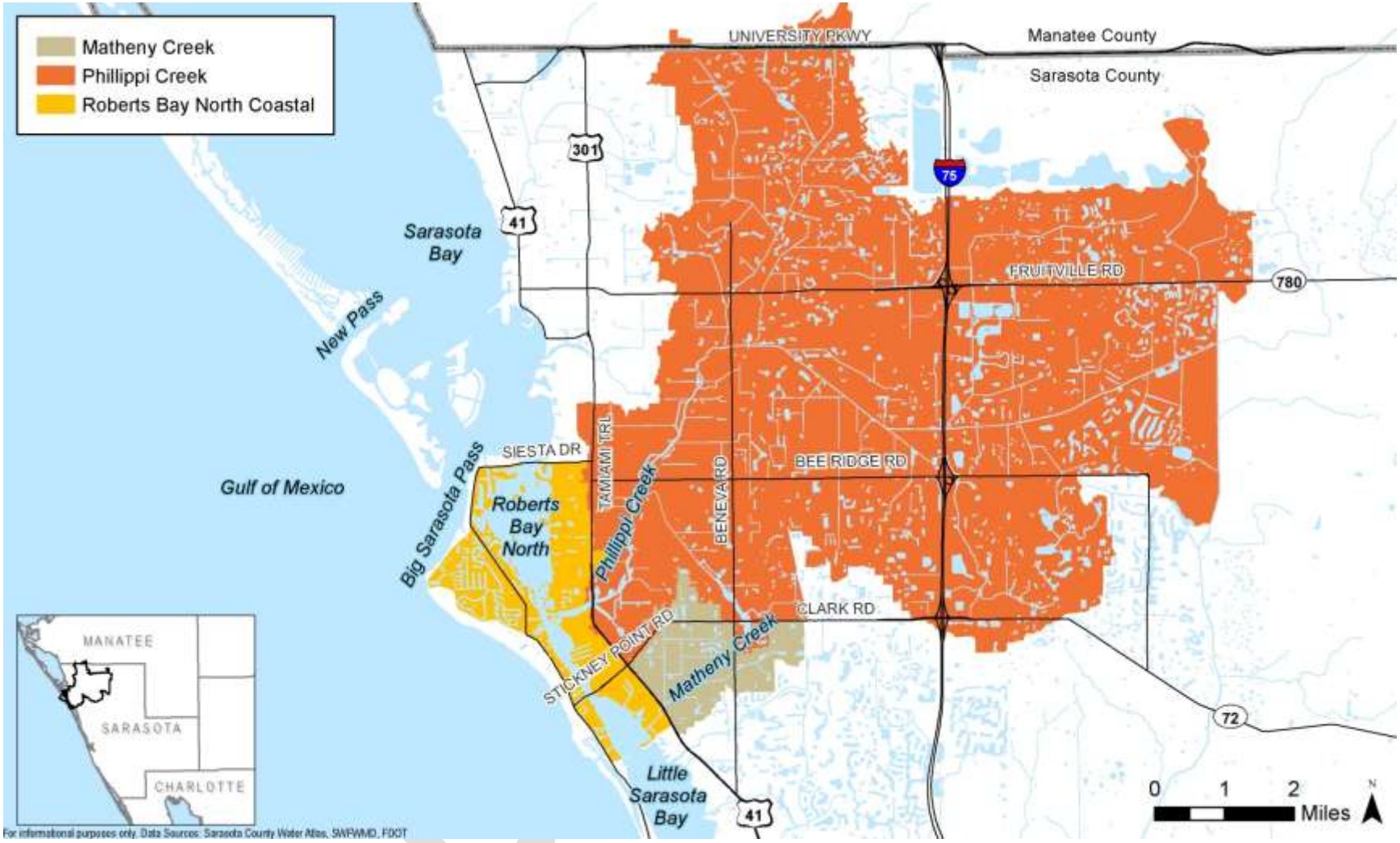

Figure 2: Roberts Bay North Watershed and Basin Boundaries

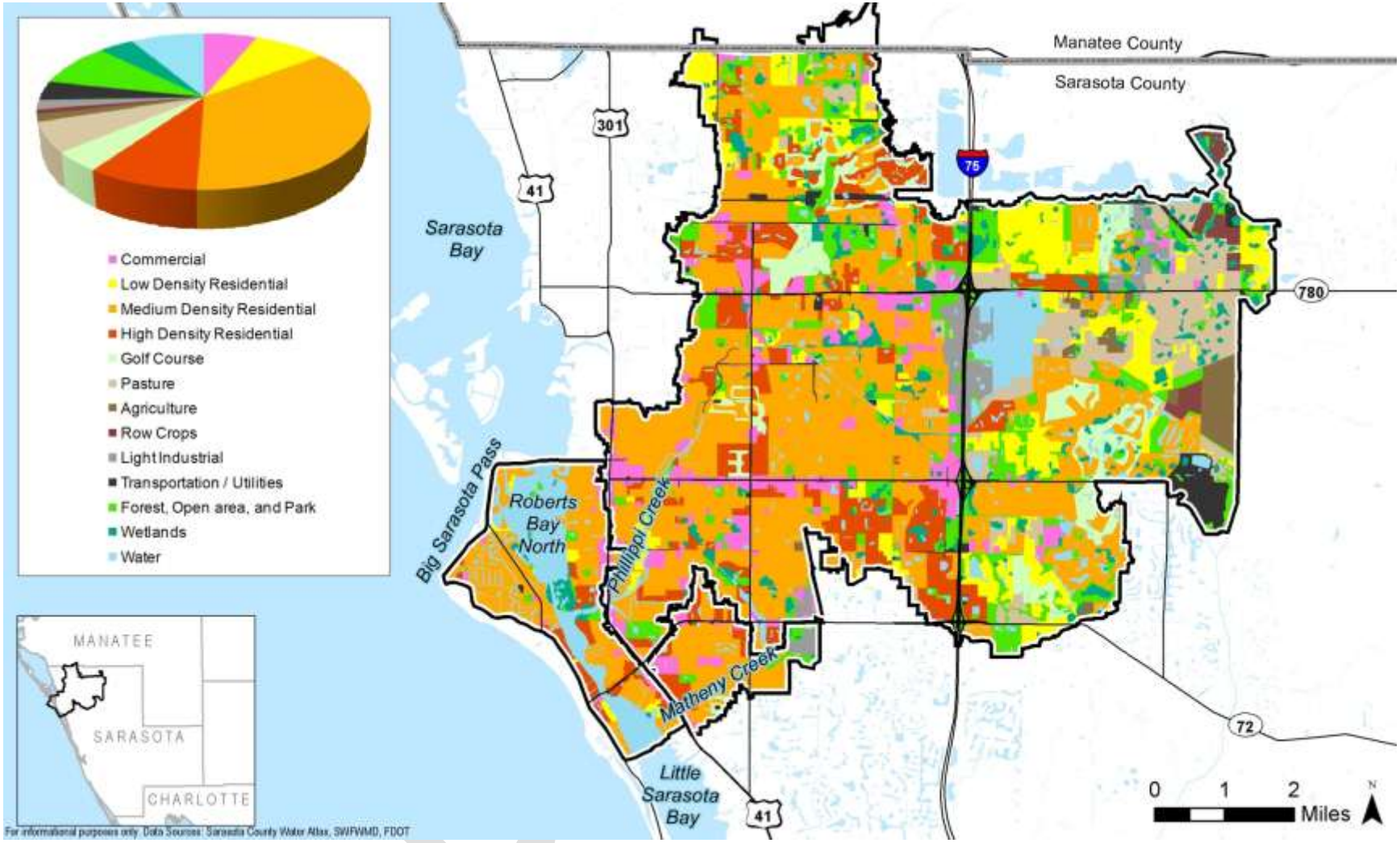

Figure 3: Roberts Bay North Watershed Current Land Use Classification (SWFWMD, 2004)

METHODS

The main focus of this watershed planning effort is maintaining or improving water quality in Phillippi Creek, Matheny Creek, Grand Canal and Roberts Bay North, with a priority on meeting state and federal water quality standards. Less focus was placed on flood protection due to the county's success in meeting our established Level of Service through previous planning efforts such as Basin Master Plans and ICPR models, although not impacting the existing flood levels in a negative manner continues to be a priority. Water supply efforts in the WMP were aimed at looking for opportunities for surface water harvesting to provide for irrigation needs.

Historic, current and future scenarios were evaluated using the County Spatially Integrated Model for Pollutant Loading Estimates (SIMPLE) for pollutant loading and water budget analysis. Seagrass was identified as the resource of concern to protect because it is a keystone species, serving as an important indicator for overall ecosystem health. Seagrass provides nursery and foraging habitat for a variety of marine and estuarine species. It provides an opportunity for nutrient uptake, sedimentation to occur and helps stabilize the benthic sediments and helps prevent erosion. Water quality from the watershed has a substantial effect on the state of seagrass beds.

Working with the Sarasota Bay Estuary Program (SBEP), seagrass targets were established for Roberts Bay North based on the years with the highest acreage of seagrass in the bay. The water quality data around the same years was analyzed and water quality targets and criteria were established by the SBEP Technical Advisory Committee for chlorophyll *a*, nitrogen concentration, and phosphorus concentration. A distinction is made between a **target**, i.e., a desired concentration and criteria, i.e., a concentration above which undesirable concentrations exist and should not be exceeded.

WATER BUDGET

Changes in the natural freshwater inflow to estuaries can have significant impacts on the health and distribution of plants and wildlife. There is natural variability in the total volume, direct runoff, and the overall range of inflow to Roberts Bay North, which fluctuates annually, seasonally, and monthly due to fluctuation in rainfall. The natural hydrologic regimes or water budget of the watershed have evolved over the last several decades. With increased urbanization have come significant changes in the components of the water budget of the Roberts Bay North watershed.

The current water budget for the Roberts Bay North watershed includes all of the freshwater inputs less the outputs for the entire watershed and bay area based on current conditions. The primary sources of freshwater inflows to Roberts Bay North, based on annual average inflows, are direct runoff and baseflow as shown in Figure 4. Direct runoff enters the bay from the surrounding land or via its tributaries, Matheny Creek and Phillippi Creek and baseflow is made up of groundwater inflow

contributed to streams. To a lesser extent, direct rainfall onto the bay, point sources, irrigation, and septic tanks contribute.

The Phillippi Creek basin is the primary contributor of freshwater to Roberts Bay North, currently contributing over 85% of the direct runoff, baseflow, irrigation, and septic volume.

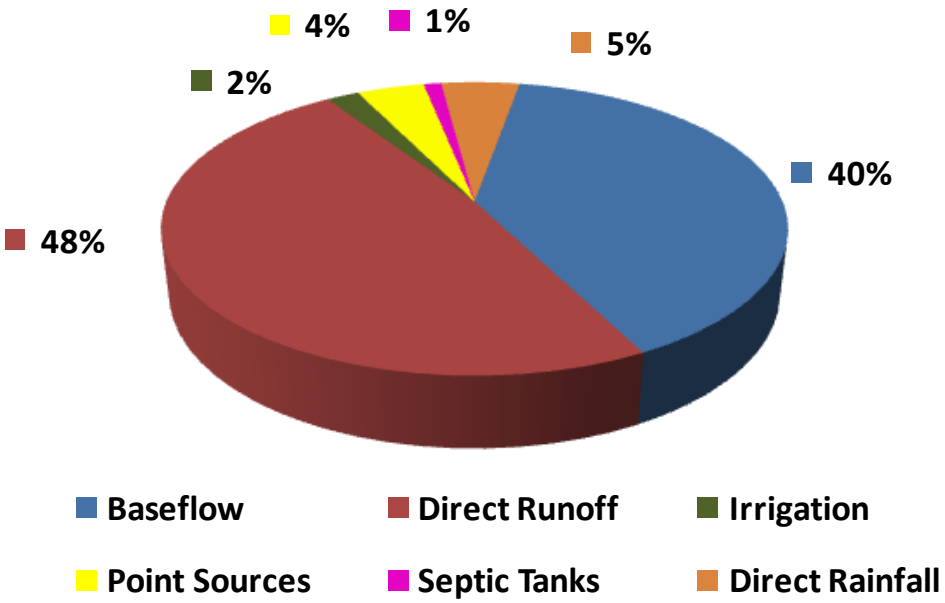

Figure 4: Current Water Budget Components in the Roberts Bay North Watershed

There are notable increases in both the overall volume and direct runoff volume entering Roberts Bay North from historical to current conditions, with an annual average increase of 17% for direct runoff.

Analysis of the future water budget considered a completely built-out scenario and the potential anthropogenic influences that could affect the overall water budget and direct runoff of the watershed in the future. The projected future volume and direct runoff are estimated to increase significantly, with an estimated 6% increase of direct runoff. Figure 5 compares the historic, current and future estimates for direct runoff in the Roberts Bay North watershed.

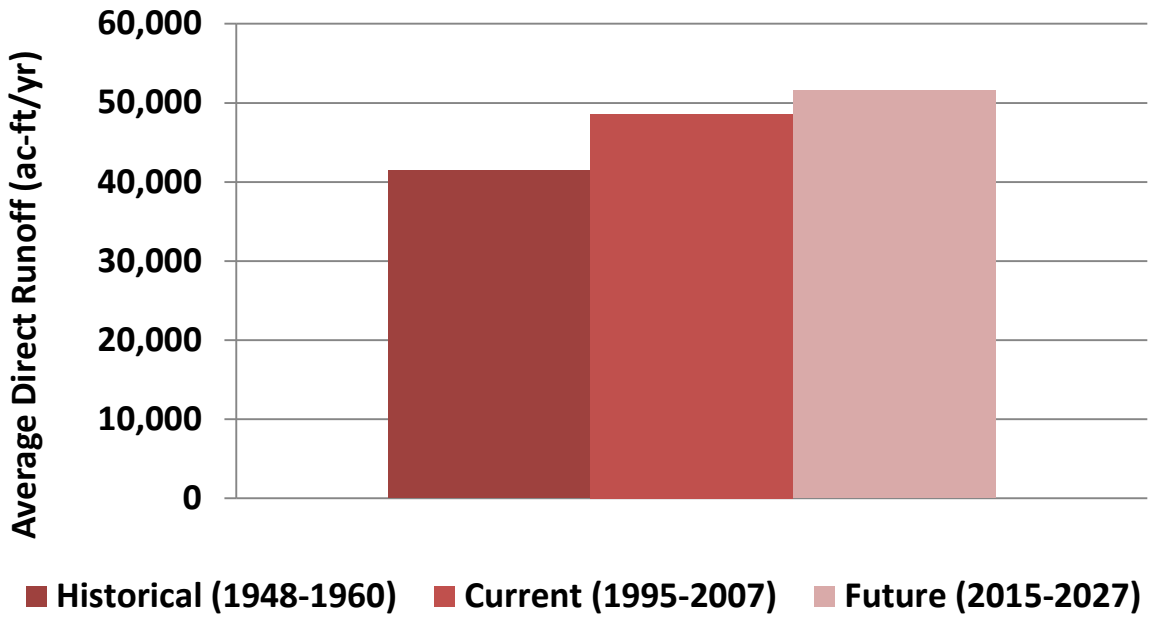

Figure 5: Historical, Current, and Future - Average Annual Direct Runoff in the Roberts Bay North Watershed

Results of the simulations (historical, current, future) indicate that fluctuations in the total volume and direct runoff volume within each simulation are driven by the rainfall. The changes in total volume and direct runoff between simulations, however, are a result of changes in land use. For the historic to current simulation, the greatest water budget changes occur in areas of the watershed that were developed before Land Development Regulations (LDRs) implementation in 1981. The greatest water budget changes from the current to future simulation were from areas assumed to be developed in the future.

Early development altered the hydrology of the watershed, decreasing storage and infiltration and increasing flows into the bay, which in turn resulted in increased pollutant loading to the bay. Although it may not be practical to restore the historical water budget of the Roberts Bay North watershed, improvements can be made in developed areas and precautions can be taken to avoid increased flows in the future water budget. Development typically brings increasing areas of impervious surfaces which usually increase direct runoff. Although recent and future development require the inclusion of stormwater management best management practices such as stormwater ponds which control the rate of runoff, the total volume of runoff typically increases.

Moving forward, LDRs will continue to be enforced and Low Impact Development (LID) projects are recommended for retrofits, redevelopment, and future development to maintain or improve the current Roberts Bay North watershed water budget.

WATER QUALITY

SEAGRASS TARGETS

The importance of seagrasses to Florida estuaries cannot be overstated. Seagrasses serve significant functions within the estuarine ecosystem. They help maintain water clarity by trapping fine sediments and particles with their leaves and stabilizing the estuarine sediments with their roots. Seagrasses are very effective at removing dissolved nutrients from water that can enter from land runoff. The removal of sediment and nutrients improves water clarity, thereby improving overall ecosystem health. Seagrasses provide nursery habitats for fish, crustaceans, and shellfish, providing a nursery ground for many recreationally and commercially valuable species. They are also food for organisms that inhabit them and marine mammals such as manatees.

Human activities can harm seagrasses by degrading estuarine water quality and promoting physical disturbances and algal blooms. Reductions in light availability associated with nutrient inputs and sediments can damage or eliminate seagrass habitat. If seagrass is thriving, then it is likely that the system is general healthy. Seagrass can be mapped through field reconnaissance and aerial mapping to track its extent over time. Also, the spatial extent of seagrass growth depends on water clarity, which depends on other water quality parameters, including chlorophyll *a*, turbidity, and color. Given the importance of seagrasses in the Roberts Bay North estuary, setting water quality targets based on the requirements for their growth and reproduction is preferred.

Seagrass targets for Roberts Bay North were established by the Sarasota Bay Estuary Program (SBEP) based on a reference period approach. The seagrass target for Roberts Bay North is 348 acres, which is the average of the 2004 and 2006 seagrass coverage, shown in Figure 6.

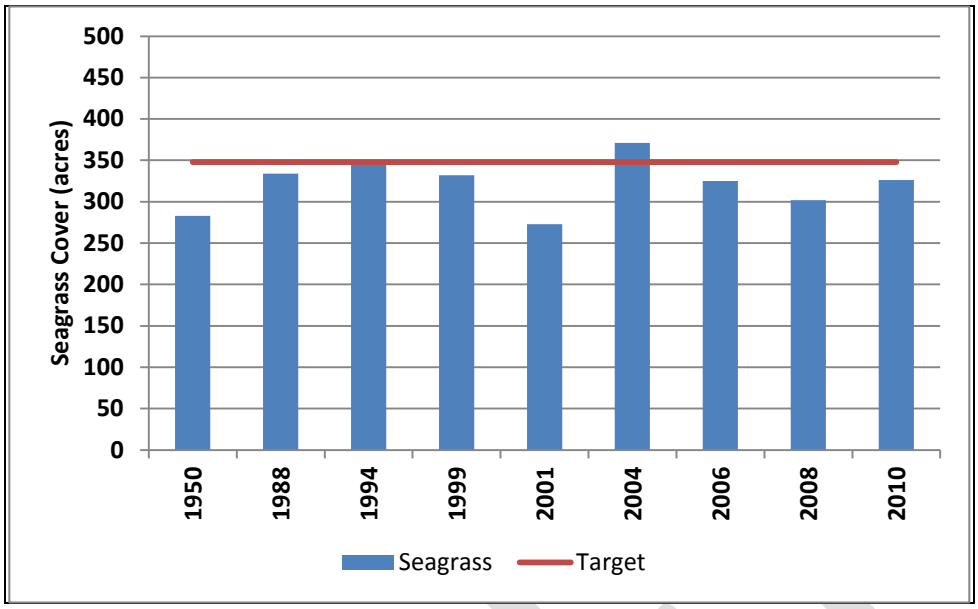

Figure 6: Seagrass Cover (Acres) from the Historical and Recent Surveys in Roberts Bay North with Target of 348 Acres

WATER QUALITY TARGETS

Water clarity, a measure of the amount of sunlight that can penetrate the water, is a significant determinant of seagrass success in a given estuary (Dawes et al., 2004). Clear waters are indicative of a healthy estuary. Nutrients, mainly nitrogen and phosphorus, can fuel the growth of photosynthesizing algae, chlorophyll *a*, which can decrease water clarity. In turn, decreased water clarity can negatively impact seagrass cover, reducing habitat availability to the hundreds of species that depend on them. Overall, the water quality in Roberts Bay North is good as evidenced by the chlorophyll *a* concentrations, water clarity, and resulting seagrass coverage. The recent water clarity conditions and chlorophyll *a* concentrations from 2001 through 2005 in Roberts Bay North are conducive to seagrass growth and reproduction in those waters. Working with SBEP, the reference period approach was used to establish the water quality targets in Table 1. These were established based on the average of 2001-2005 data for chlorophyll *a* and water clarity (Kd). The dissolved oxygen target is the state standard of 4 mg/L.

Table 1: Water Quality Targets

	Target
Chlorophyll *a* (µg/L)	8.2
Water Clarity (Kd) (m1)	1.0
Dissolved Oxygen (mg/L)	4

SBEP established additional water quality criteria for Roberts Bay North for Total Nitrogen (TN) and Total Phosphorus (TP) concentrations as part of the Numeric Nutrient Criteria (NNC) effort. During the development of the NNC, it was observed that there may be years in which targets are exceeded without causing significant reductions in seagrass cover. This means that there is some allowable, or acceptable, amount of variation that should not elicit a significant degradation in water quality and therefore seagrass coverage. This level of variation is defined as "the standard deviation around the mean annual concentrations in each segment for the entire period of record". Therefore, a distinction is made between a **target**, i.e., a desired concentration and **criteria**, i.e., a concentration above which undesirable concentrations exist and should not be exceeded. The criterion is "the sum of the target and the standard deviation around the mean annual concentrations for that segment". The NNC were presented to the Environmental Protection Agency and the Florida Department of Environmental Protection in 2011 and are listed in Table 2.

Table 2: Numeric Nutrient Criteria

	Criteria
Total Nitrogen Concentration (mg/L)	0.54
Total Phosphorus Concentration (mg/L)	0.23

Figure 7 compares the Total Nitrogen Concentrations in Roberts Bay North from 1998 through 2010 to the Total Nitrogen Criteria.

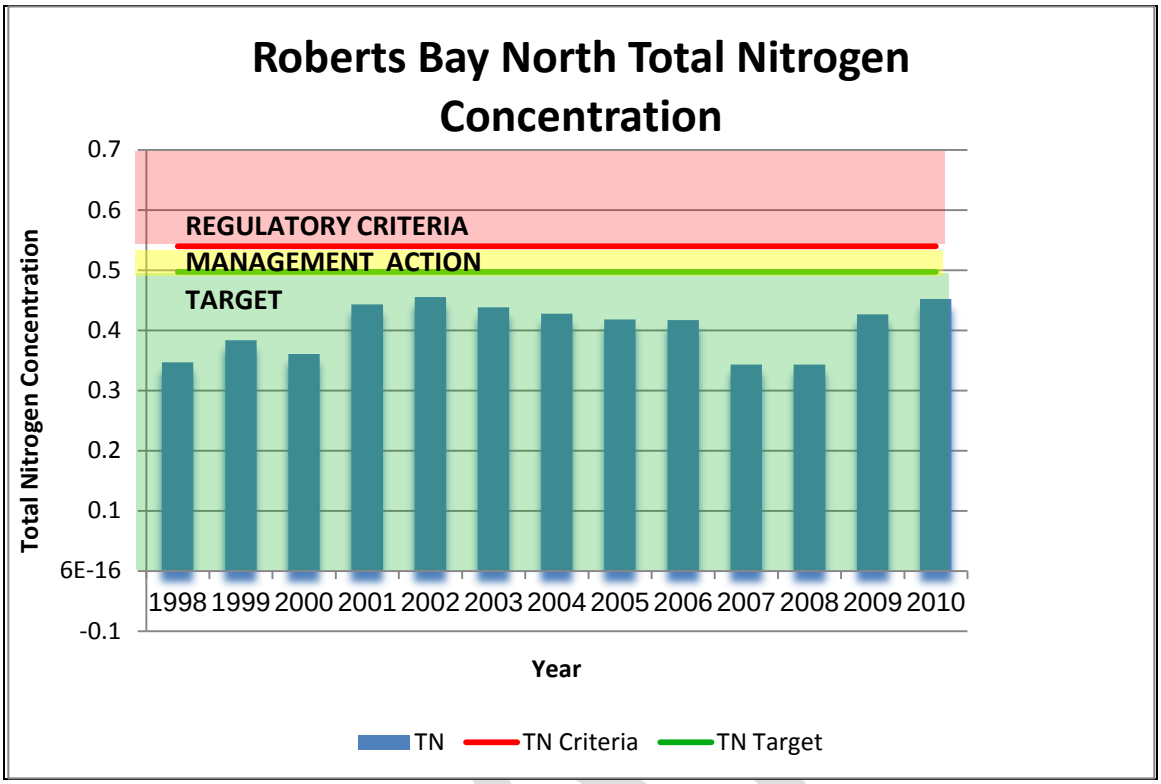

Figure 7: Total Nitrogen Concentration Compared to Criteria

POLLUTANT LOADING

To better understand the influence of loadings to Roberts Bay North, a pollutant-loading model, the SIMPLE, was created. It generates hydrologic yield and loading estimates for a wide array of pollutants, including nutrients, metals, coliforms, and—specific to the present analysis—Total Nitrogen (TN) loads throughout the watershed. TN loading is especially important because excess nitrogen in estuarine ecosystems can lead to increased rates of chlorophyll *a* which decreases the amount of light reaching seagrasses.

Figure 8 illustrates that the majority of the TN loading to Roberts Bay North from 1995 through 2007 was from direct runoff (62%), base flow (23%), and point sources (7%). More than 80% of the total TN load to the bay was generated in the Phillippi Creek basin as outlined in Figure 9.

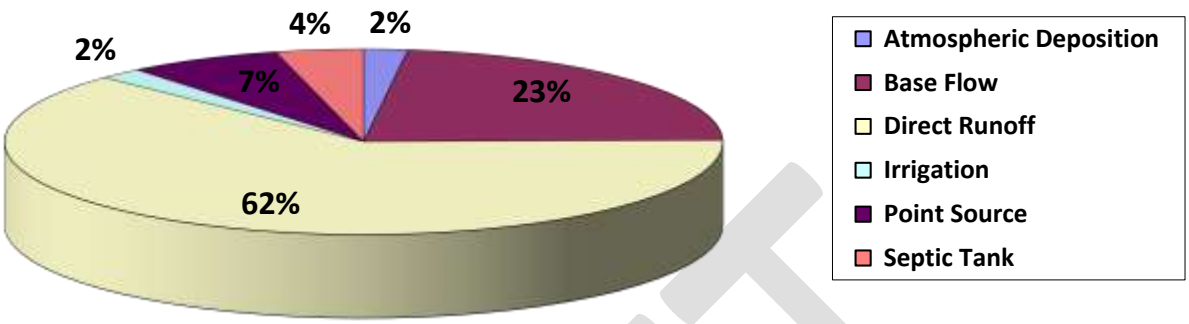

Figure 8: Relative Contributions from Each Source of TN Loads to Roberts Bay North (1995–2007)

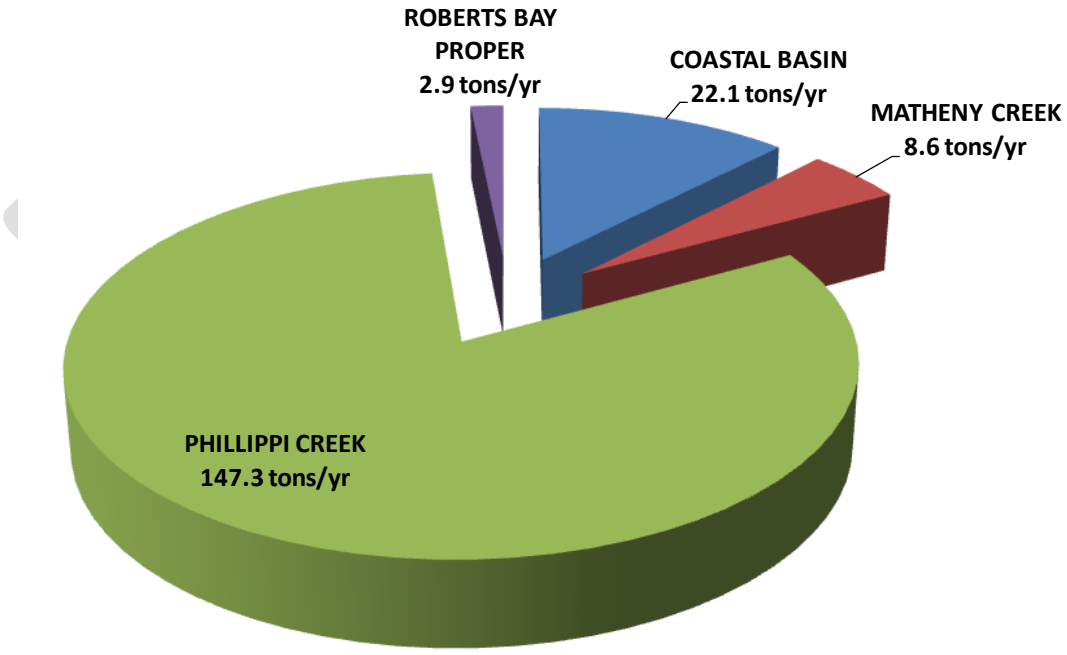

Figure 9: Relative Contributions from Each Source of TN Loads to Roberts Bay North (1995–2007)

Meeting the chlorophyll *a* target for Roberts Bay North will depend on managing nitrogen loading to the bay. It logically follows that if the current water quality conditions have been adequate to maintain seagrass coverage at desired levels, the nitrogen loading is also at levels adequate to maintain the chlorophyll *a* concentrations at or near their desired levels. Therefore, the proposed nitrogen loading target is 213 tons/year, which is the average TN load for the period 2001–2005, as shown in Figure 10. There is a clear relationship between chlorophyll *a* concentrations and TN loadings in Roberts Bay North. The nitrogen loads to Roberts Bay North do not exceed the target load and inter-annual variation is due to rainfall. The focus of nitrogen load management will be on precluding significant load increases with any future land-use changes.

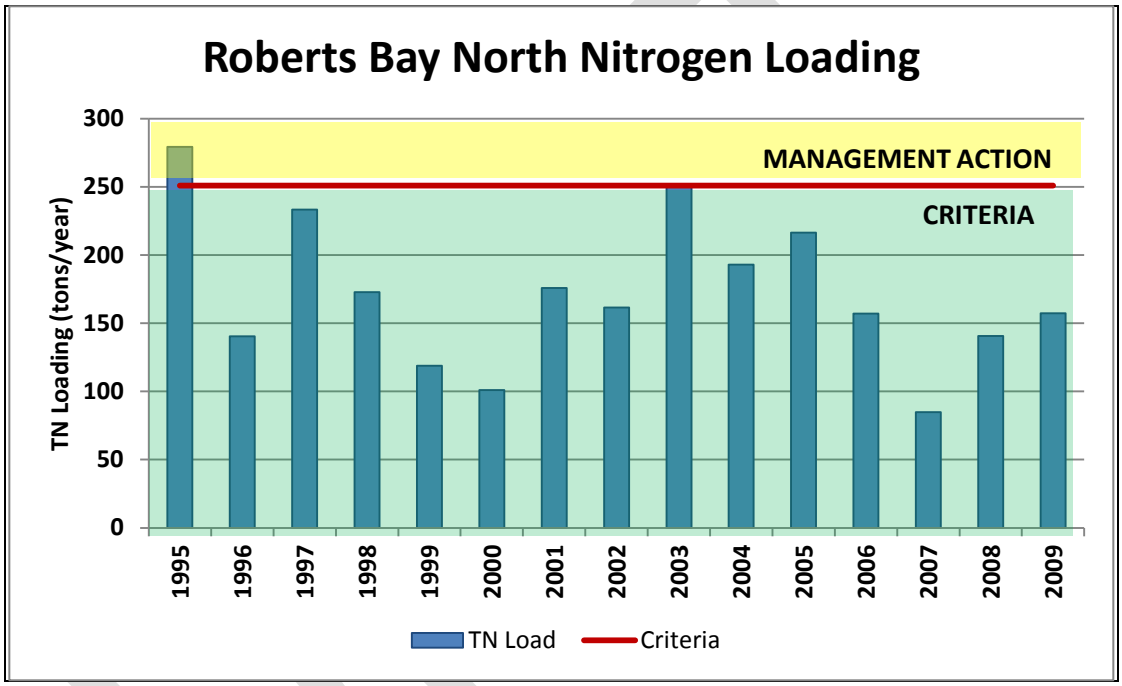

Figure 10: Roberts Bay North Nitrogen Loading Target and Criteria

RECOMMENDATIONS

Current conditions indicate that wet season flows are greater than in historic period; therefore, projects or programs that can contribute to a reduction of wet season flows are recommended. Recommendations are targeted towards addressing the primary water quality goal to protect, maintain, and improve water quality conditions in estuarine and freshwater environments; however, they are categorized to cover four categories: flood control, water quality, natural systems, and water supply. Chapter 8 contains a detailed analysis of programs and projects.

PROGRAMS

Stormwater System Maintenance – opportunities to improve water quality while performing flood conveyance maintenance include: removing cut vegetation; harvesting vegetation; incorporating Low Impact Design (LID) into projects; leaving buffer zone along watercourses; and keeping cut vegetation out of submerged areas.
Environmental Monitoring – continuation of the current program in order to evaluate meeting water quality targets and criteria.
Continue to Enforce Fertilizer Ordinance – the WMP assumed 5% reduction of nitrogen loading in commercial, residential, and golf course land uses in the watershed.
Septic System Replacement Program – continuation of the current Phillippi Creek Septic System Replacement Program.
Low Impact Design - Low impact design techniques such as *stormwater harvesting for irrigation, pervious pavement, Florida friendly landscaping, and residential cistern programs* offer opportunities to conserve potable water by not using it for irrigation as well as reducing stormwater runoff that may carry pollutants to the creeks and bay.
Implement buffer zones on County-owned uplands – establish and restore 50 to 100 foot vegetated buffer zones along waterways.
Public Outreach and Education – increase efforts in watershed to promote Neighborhood Environmental Stewardship Team (NEST) Program concepts.

PROJECTS

In order to meet the goals outlined in the Roberts Bay North WMP, opportunities were identified to improve water quality, restore natural systems habitat, and reduce freshwater inputs. Capital projects were analyzed for financial cost-benefit based on nitrogen reduction capability. Projects recommended to address the WMP goals were prioritized to be consistent with and support the County's established levels of service and were ranked based on cost, nitrogen reduction, sediment removal, permitability, and other factors.

CONCLUSION

In summary, Roberts Bay North is in fair condition. The Watershed Management Plan contains recommendations to maintain and improve watershed and bay water quality as the community moves into the future. Targets, monitoring and reporting strategies are in place to track management actions and the effects on water quality.