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CENTRAL AND SOUTHERN FLORIDA PROJECT

COMPREHENSIVE EVERGLADES RESTORATION PLAN

SECTION 4.0

FUTURE WITHOUT PROJECT CONDITIONS

LAKE OKEECHOBEE WATERSHED PROJECT

U.S. Army Corps of Engineers
Jacksonville District

South Florida
Water Management District

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This document was prepared by the Lake Okeechobee Watershed Project Delivery Team, with assistance from HDR Engineering, Inc. and EA Engineering, Science, and Technology, Inc. The final document will be one component of the Lake Okeechobee Watershed Project Implementation Report, which is scheduled for completion in 2005. Sections of this document are numbered according to the proposed outline for the Project Implementation Report.

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4.0 FUTURE WITHOUT PLAN CONDITIONS

This section describes the future without plan conditions likely to prevail in the LOW Project study area (***Figure 4-1***) over the next fifty years based on the following two major assumptions:

1. None of the CERP recommended projects and activities are implemented, and
2. All currently ongoing, planned and proposed federal, state, and local government initiatives are fully implemented.

The primary objective of this exercise is to be able to identify "net" environmental and economic needs that the proposed CERP projects could potentially address. Consistent with USACE planning guidelines all projections have been made for a fifty-year period.

This section begins with a brief summary of applicable USACE guidance on developing future without plan conditions and defining the project life and planning horizon. This is followed by a description of fifty-year forecasts for hydrologic, climatic, water quality, water supply demand, ecological, demographic, economic, and social conditions.

4.1 With and Without Plan Comparisons

The U.S. Water Resources Council's (USWRC) Principles and Guidelines provide the instructions and rules for Federal water resources planning (USWRC, 1983). A key requirement of these guidelines is that plan formulation is to be based on the comparison of the most likely future conditions with and without alternative plans. Evaluation of these alternatives are based upon the existing and the future conditions with and without alternative plans and the growth patterns that are expected in accordance with ER-1105-2-100. In order to make this kind of comparison, descriptions – often called forecasts – must be developed for two different future conditions:

- the future without–plan condition, and
- the future with–plan condition.

The future without–plan condition describes what is assumed to be in place if none of the study's alternative plans are implemented. It is generally considered to be the same as the "no action" alternative required by the Federal regulations implementing the National Environmental Policy Act of

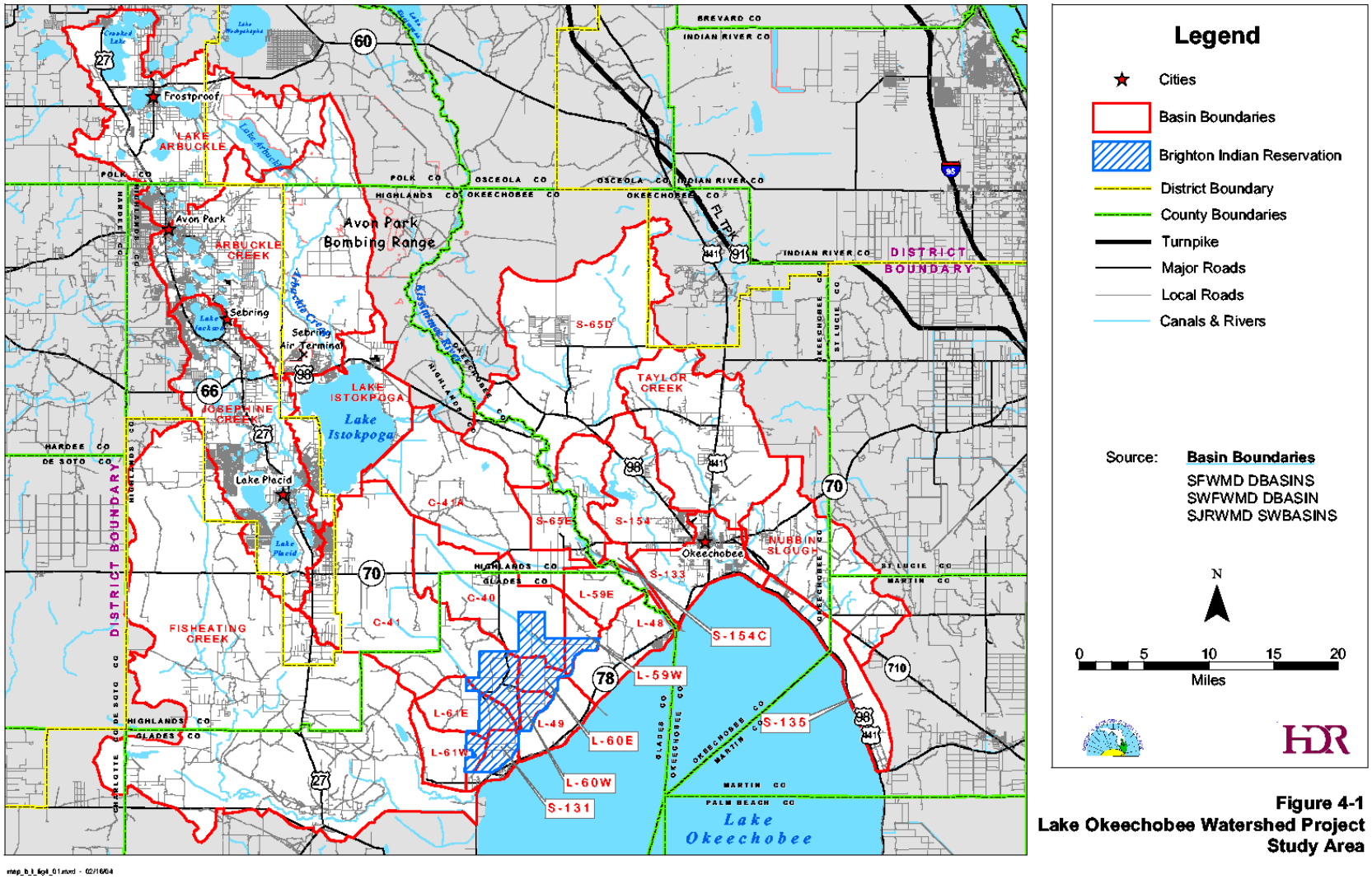


Figure 4-1
Lake Okeechobee Watershed Project Study Area

1969 (NEPA). The future without–plan condition forecasts, thus, provide a description of anticipated actions external to the project and the anticipated consequences of these actions.

The forecasts of future without–plan conditions for this project considered all other actions, plans, and programs that would be implemented in the future to address the problems and opportunities in the study area in absence of the LOW project. Proper definition and forecast of the future without–plan conditions are critical to the success of the planning process as they constitute the benchmarks against which alternative plans will be evaluated.

The future with–plan conditions describe the anticipated effects attributable to the implementation of each alternative plan that is being considered in the study. With–plan conditions are generally developed for each alternative plan; therefore, there are as many with–plan conditions, as there are alternative plans. The differences between the without–plan and the with–plan conditions are defined as the effects or impacts of the plan.

It is important to make a distinction between with– and without–plan conditions versus "before and after" plan conditions. For example, if a proposed levee were to cover four acres of an existing 10-acre wildlife habitat, then, using a before-and-after comparison, the levee could be said to result in a loss of four acres of that habitat. During the "with and without plan" process a need exists to maintain both a system-wide perspective as well as a sub-regional perspective. The benefit and impact analyses conducted for this study was accomplished at both the local and system-wide scale.

For example, the proposed 4-acre levee could have adverse impacts to the wetlands within the footprint of the project while the storage function of the 4 acre levee reservoir (in combination with other features) could have significant ecological benefits by restoring the downstream estuary. The impacted wetlands would be considered a "local" effect, while the ecological benefits to the downstream estuary would be considered "system-wide" effect. Regional models are used to assess impacts to the overall system, while sub-regional models were used to assess impacts to the project area.

4.2 Project Life and Planning Horizon

The planning horizon encompasses the study period, the construction period, the economic analysis period, and the effective life of the project. The time period for forecasting future without-plan and with-plan conditions,

and considering the impacts of alternative plans is called the period of economic analysis or the period of analysis. It is the period of time over which we think it is important to extend our analysis of plan impacts. This time period is frequently confused with the planning horizon, which is a longer and more encompassing concept.

One of the most common measures of impacts has to do with the time value of money. Future dollar values, whether benefits or costs, are worth less than current dollar values. Discounting is the process that is generally used to place dollar values incurred at different times on an equivalent time basis. After 50 years, the discount factor alone reduces monetary values to a mere fraction of their former value. Unless the future dollar values being discounted are large, there is no apparent point to continue to include these values among project impacts. Current guidance from HQUSACE states that environmental non-monetary benefits are not to be discouraged but averaged.

The period of analysis for water resources projects is usually 50 years and never over 100 years. Forecasting conditions and impacts beyond 100 years is pure guessing, even if some structural projects may last more than 100 years. Therefore, the period of economic analysis for the purposes of this study will be 50 years.

4.3 Forecasted Hydrologic Conditions

Changes in the hydrology of the LOW project study area over the planning horizon will be driven primarily by changes in climatic conditions (Section 4.4), water quality improvements (Section 4.5), changes in water supply and demand (Section 4.6), and land use changes (Section 4.7). Overall it is projected that increased urbanization probably will result in increased flows to Lake Okeechobee.

4.4 Forecasted Climatic Conditions

The climate of an area is dictated by the long-term interaction between atmospheric temperature and pressure, wind velocity, humidity, and precipitation. Of these, precipitation (rainfall) has the most significant impacts on hydrologic conditions.

Historical rainfall data presented in Section 3 for the LOW Project study area are based on a 36-year period of record (1965–2000) and it indicates that rainfall in the South Florida region averages about 53 inches annually.

This 36-year period of record is representative of climatic conditions typical for South Florida since it includes years that were characterized by higher than normal rainfall (wet years), lower than normal rainfall (dry years), and years with average rainfall. For example, the periods between 1969-1970, 1982-1983, and 1994-1995 received greater than average rainfall and are representative of wet years. Drought years are represented by 1971, 1975, 1981, 1985, and 1989. 1984 can be considered to be an average year.

Climatic conditions for the project study area over the planning horizon are forecasted to be similar to those represented by the 36-year period between 1965 and 2000.

4.5 Forecasted Water Quality Conditions

Water quality conditions likely to exist in the project study area over the next fifty years will, in large part, be dictated by the degree of success achieved from the implementation of the various watershed projects and programs proposed in the Lake Okeechobee Protection Act (LOPA, Chapter 00-130; Section 373.4595; Laws of Florida). The primary intent of LOPA, which was passed by the State's legislature in 2000, was to establish a restoration and protection program for Lake Okeechobee. LOPA's jurisdiction covers the entire 3.5 million acres of the LOW and thus completely encompasses the LOW Project study area (***Figure 4-2***).

Under LOPA, restoration and protection of Lake Okeechobee will be accomplished by achieving and maintaining compliance with the State's water quality-based standards in the lake and its tributaries through the implementation of a watershed-based phased, comprehensive, and innovative restoration and protection program. The primary objective of this restoration and protection program will be to identify and implement long-term solutions aimed at achieving the phosphorus total maximum daily load (TMDL) for Lake Okeechobee. In addition, the TMDLs being established by FDEP for the tributaries of the lake will be considered in this program.

A TMDL of 140 metric tons of phosphorus was established by FDEP for Lake Okeechobee in 2001 (FDEP, 2001) in an effort to improve the health of the lake. Data for the 10-year period 1991-2000 indicates that the measured load to the lake ranged from 169 to 683 metric tons; the five-year moving average for the same period ranged from 375 to 554 metric tons. It should be noted that the TMDL of 140 metric tons includes 35 metric tons of estimated atmospheric deposition; therefore the load from the watershed has to be reduced to 105 metric tons (140-35) to reach the TMDL.

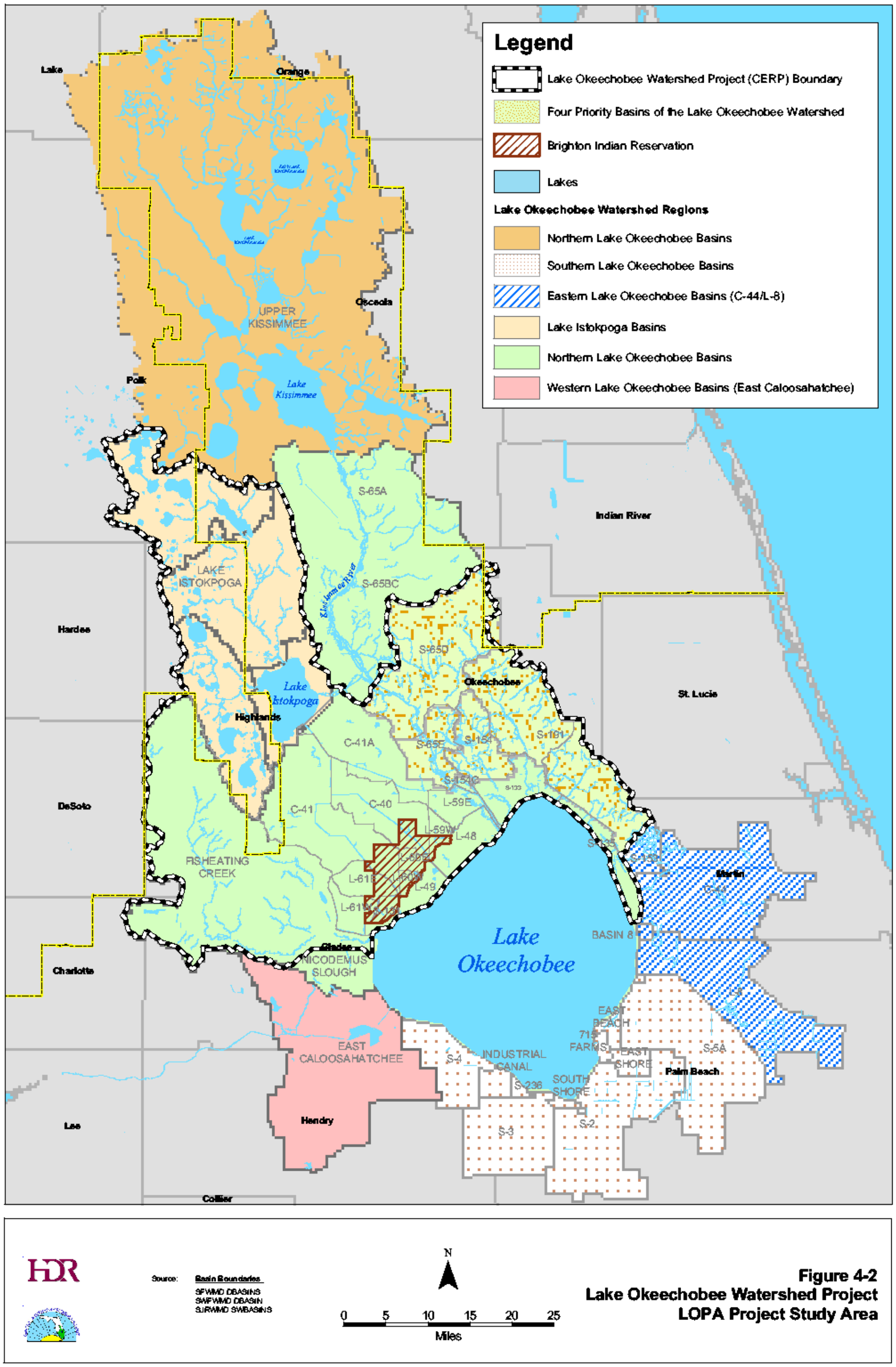


Figure 4-2
Lake Okeechobee Watershed Project
LOPA Project Study Area

The LOPA identified the South Florida Water Management District (SFWMD), the Florida Department of Environmental Protection (FDEP), and the Florida Department of Agriculture and Consumer Services (FDACS) as the coordinating agencies responsible for implementing the various provisions of the Act. Each agency has been assigned responsibility for developing and implementing programs to address phosphorus loading from a specific source.

For example, FDEP is responsible for developing programs for urban areas, whereas FDACS programs are more targeted towards agricultural land uses. The SFWMD has the overall responsibility of developing the LOPP, preparing Annual Progress Reports and implementing selected program elements.

The following eight (8) program elements are specifically required by LOPA and each one of these in turn is supported by one or more projects:

1. Lake Okeechobee Protection Plan (LOPP)
2. Lake Okeechobee Construction Project (LOCP)
3. Lake Okeechobee Watershed Phosphorus Control Program (LOWPCP)
4. Research and Water Quality Monitoring Program
5. Exotic Species Control Program
6. Internal (In-Lake) Phosphorus Control Program
7. Annual Progress Reports
8. Lake Okeechobee Protection Permit Program

Of the eight, the first three program elements are most likely to directly impact water quality conditions in the project study area within the planning horizon. Major components of these three LOPA program elements are described below.

4.5.1 Lake Okeechobee Protection Plan

The primary objective of the LOPP, which was finalized in January 2004, was to identify and evaluate alternative plans, schedules, and costs to meet the total phosphorus TMDL of 140 metric tons by the year 2015. The plan outlined an integrated management strategy to achieve the restoration of Lake Okeechobee. This strategy is based on the implementation of P source control programs including best management practices (BMPs) at the parcel level, sub-regional P control and flow attenuation projects, and in-lake remediation activities. In addition, the LOPP also includes strategies for research and water quality program monitoring and exotic species control both of which are required program elements under the Act.

The problem identification phase of the LOPP included two steps: identification of baseline data and current activities. The baseline data consisted of the watershed data (land use, flow, and basin/sub-basin load contribution) from a ten-year period of record (1991-2000) that was representative of typical hydrologic conditions and encompassed dry and wet periods

Current activities included ongoing phosphorus load reduction initiatives that have been implemented or are under implementation by the coordinating agencies and/or the private sector. Such initiatives can be grouped into four broad categories:

- **Owner implemented BMPs** – which include affordable, cost-effective practices recommended by FDACS and implemented by landowners on their properties.

- **Funded cost-share BMPs** – which have been implemented at various locations in the watershed under existing state and/or federal cost sharing programs.

- **Other phosphorus load reduction projects** – which include ongoing multi-year efforts funded primarily by the state through Public-Private Partnerships, the Phosphorus Source Control Grant Program, Dairy Best Available Technologies, and the Isolated Wetlands Restoration Program.

- **Regional Public Works** – which include regional phosphorus load reduction projects located within the Okeechobee watershed (e.g. Lake Okeechobee Water Retention Phosphorus Removal Critical Project) and within adjoining watershed such as the EAA (Storage Reservoir) basins and C-44 (RASTA).

The plan has determined that excluding phosphorus loads associated with precipitation (35 Mtons), the total load reduction from the watershed necessary to meet the TMDL is 328 Mtons (10-year average load of 433 metric tons minus 105). It has been estimated that currently implemented phosphorus load reduction initiatives identified above will cumulatively reduce 158.5 Mtons, which is 40% of the total load reduction necessary to meet the TMDL.

The LOPP has recommended three principal phosphorus load reduction strategies in order to reduce the remaining load required to achieve the TMDL by 2015:

- Typical Cost-share BMPs that Require Future Funding
- Regional Non-CERP Projects
- Regional CERP Projects (LOWP)

4.4.1.1 Typical Cost Share BMPs

BMPs for each agricultural landowner (non-tribal lands) will be identified through an assessment described in the BMP manuals prepared by FDACS, nutrient management plans, or conservation plans through USDA-NRCS. Examples of BMPs likely to be considered for agricultural areas include internal fencing to keep cattle out of wetlands and streams, on-site retention facilities, storm water management systems, etc. Because implementation of these BMPs will be beyond the financial capabilities of the average landowner, additional funding through a cost-sharing mechanism will be required for implementation.

The use of on-site stormwater BMPs to reduce phosphorus loading from urban areas was not considered cost-effective in achieving the Lake Okeechobee TMDL and therefore it was concluded that urban phosphorus load reductions should be obtained from regional solutions. Urban BMPs are being planned at the sub-regional level to provide load reductions. It is estimated that approximately 0.3 metric tons of phosphorus load would be reduced by these projects.

4.4.1.2 Other Regional (Non-CERP) Projects

Load reductions from regional solutions identified in the LOPP are associated primarily with the expansion of the Nubbin Slough pilot STA (described below in Section 4.4.2), which includes a reservoir and a larger STA area. The District currently owns the land that would be required for this expansion. The expanded STA area can be used to treat additional water from the S-191 basin, which is expected to result in a potential phosphorus load reduction of 4.56 metric tons per year.

4.4.1.3 Regional CERP Projects

Since the study area of the LOW Project is a subset of the area covered by LOPA, phosphorus load reductions achieved by the LOW Project will be credited towards meeting the TMDL target. In fact, the LOPP estimated that approximately 38% of the load reductions needed to achieve the TMDL would be met through solutions contained in the LOW Project. This approach is intended to maximize the opportunities developed under the CERP process, as well as leverage state funds with federal cost-sharing opportunities.

In addition to the load reduction strategies presented above, the LOPP also includes provisions for the following:

4.4.1.4 Additional Regulatory Approaches

Goals, objectives, and implementation strategies of many of the on-going, regulatory-driven, phosphorus-load reduction initiatives in the watershed such as the Works of the District Program and the Dairy Rule were developed prior to LOPA and are therefore not necessarily concurrent with meeting the TMDL by 2015. The LOPP therefore calls for refinement of all relevant existing regulations to ensure that all efforts are suitably coordinated and directed towards meeting the LOPA target.

For example, key roles of the District's WOD program will be amended to:

1. Conduct monitoring to verify the effectiveness of agricultural and non-agricultural BMPs.
2. Update and inventory agricultural and non-agricultural permitted land uses with information obtained from the FDACS and FDEP BMP programs.
3. Monitor water quality, in support of all programs in the LOW, to identify and prioritize high phosphorus source areas and direct resources to assist in the implementation of BMPs inside and outside the high priority basins.
4. Require independent WOD permits where landowners do not participate in the FDACS and FDEP BMP programs.

Also, as a result of United States Environmental Protection Agency's (USEPA) new interpretation of their federal regulations for Concentrated Animal Feeding Operations (CAFO), all dairies within the Okeechobee watershed will have to secure an NPDES (surface water discharge) permit in the near future. New construction specifications for waste treatment systems will require such systems to retain the 24-hour/25- year storm event plus a 3-inch chronic event (i.e. a single rainfall event that lasts 24 hours or longer and dumps 3-inches or more of rain), which should significantly reduce phosphorus-laden runoff going to the Lake. There also is a permitting requirement for updating the nutrient management plan and implementation schedule, which will be addressed through the Agricultural Nutrient Management Plans.

Similarly, the FDEP administered Dairy Rule (Chapter 62-670.500 FAC), the current purpose of which is to control pollution to surface and ground water bodies from discharge of wastewater and runoff from dairies and other

confined animal operations, will be evaluated and modified as necessary to ensure that its implementation meets CAFO requirements.

The state is required to implement the federal CAFO rules by April 2004. As current permits expire, FDEP plans to issue new generic permits that will meet the permitting requirements of both the state and NPDES programs.

Other proposed regulatory initiatives that will coordinate with and support the meeting of the LOPA target include:

1. NPDES MS-4 (urban Stormwater)

2. Future modifications of regulations dealing with the application of wastewater residuals. Changes have already occurred in 2000/2001 – Land application of residuals is now based on phosphorus agronomic needs of the crop, instead of nitrogen.

3. Phosphorus TMDL's were proposed for Lake Okeechobee tributaries (Chandler Hammock Slough, Nubbin Slough, Mosquito Creek, Lettuce Creek, Henry Creek, Myrtle Slough, Taylor Creek, Otter Creek, and S-135) in late 2003. The initial implementation of these TMDLs, once approved, will follow the plan outlined in LOPA, which includes BMPs and regional treatment works.

4. FDACS is developing a rule to address land application of animal manure.

Other proposed non-regulatory initiatives that will coordinate with and support the meeting of the LOPA target include:

1. Update of stormwater master plan for Okeechobee County (Okeechobee City and surrounding urban areas, and urban areas along Lake Okeechobee).

2. Development of stormwater master plan for Glades County (urban areas along Lake Okeechobee) and the City of Moore Haven.

3. Development of wastewater plans for urban areas of Okeechobee and Glades County (to include elimination of malfunctioning septic tanks and small wastewater treatment plants discussed above).

Finally, LOPP also includes provisions for implementation of two discrete LOPA elements namely, establishment of a Research and Water Quality

Monitoring Program and implementation of an Exotic Species Control Program.

4.4.1.5 Research and Water Quality Monitoring Program

A comprehensive program will be required to monitor LOPA's success in meeting the goals of reducing nutrient loads, reducing in-lake nutrient concentrations, and improving Lake Okeechobee's ecological health. Such a monitoring program will not only provide data needed to judge the success of the Act but also provide critical information needed to modify LOPP should changes in water quality or lake ecosystem health not occur as expected as projects are implemented.

In addition to monitoring water quality data, LOPA also requires that BMP performance be verified through monitoring. This will be accomplished through a combination of water quality monitoring at the parcel and subbasin level and ongoing research on BMP performance.

4.4.1.6 Exotic Species Control Program

The objective of this LOPA program element is to identify the exotic species that threaten native flora and fauna within Lake Okeechobee and develop and implement measures to protect native species. Control of exotics will require management of existing invasion and in case of animal species monitoring of possible future invasions.

4.5.2 Lake Okeechobee Construction Project (LOCP)

This LOPA program element includes construction of a series of regional water management facilities to improve the hydrology and water quality of Lake Okeechobee and downstream receiving waters. The LOCP is being implemented in two phases. In Phase I, a series of projects will be constructed in the four priority basins (S-65D, S-65E, S-154, and S-191) consistent with the recommendations of the Lake Okeechobee Issues Team Action Plan (Harvey and Havens, 1999). These projects are to include:

1. **Construction of two pilot stormwater treatment areas and restoration of isolated wetlands**.

   These pilot stormwater treatment areas, when fully operational, will achieve immediate reduction in phosphorus loads. Building retention areas on properties in the project study area will allow storm water to be retained on-site thus improving water quality of the run-off prior to discharge from the property. The stormwater treatment areas and the runoff retention are therefore expected to improve water quality by

reducing phosphorus loads Lake Okeechobee. Improvements in water quality attained through both these efforts should be cumulative to enhancements resulting from other ongoing and planned projects in the watershed.

Design and construction of the two pilot stormwater treatment areas and stormwater retention has already been initiated under **Lake Okeechobee Water Retention/Phosphorus Removal Critical Restoration Project**. The first pilot project will be located on Taylor Creek and is known as the Grassy Island STA since it is located on lands purchased from the Grassy Island Ranch. Covering approximately 190 acres in size, this water treatment facility will receive phosphorus-rich water from Taylor Creek. After treatment, the effluent will be released back into the creek.

Currently Taylor Creek, contributes about 29% (78 metric tons) of the phosphorus inflows to the lake, and accounts for only 4.5 percent of the total water flow (SWIM, 2002). Phosphorus concentrations in the creek near the site average about 500 μg/l. Treatment of a portion of Taylor Creek flows through the proposed STA is expected to remove 10% of the phosphorus in the creek.

Besides phosphorus reduction, this project also offers potential for wetland rehydration and enhanced food chain productivity that will support a broad variety of wetland-dependent wildlife species. Additional benefits will include groundwater recharge and drought protection.

Construction of the Grassy Island STA is expected to be completed by June 2005 according to the latest design information. The construction end date is based on the current schedule for contracting and the proposed construction schedule in the final design.

The second pilot project is located on the New Palm/Newcomer Dairy property acquired by the District through the Save Our Rivers Program and is also known as the Nubbin Slough STA. Water quality in the slough is very degraded primarily due to high nutrient loadings from agricultural runoff. Current phosphorus concentrations in the slough average approximately 500 μg/l. Spread over approximately 760 acres, the Nubbin Slough STA is expected to produce an effluent with a phosphorus concentration of 40 μg/l. Treated water will be discharged back to the slough. Phosphorus load reductions achieved through this STA will greatly contribute to the reduction of total phosphorus loading from the Taylor Creek /Nubbin Slough sub-basin to Lake Okeechobee.

Similar to the Grassy Island STA, the Nubbin Slough STA will also have the potential for wetland restoration, re-isolation of ditched depressed wetlands, construction of water quality treatment areas to retain runoff, and nutrient removal. Additional benefits include groundwater recharge, drought protection, and an increase in habitat for waterfowl and other wildlife. It is anticipated that this STA could potentially be dry for part of the year.

Construction of the Nubbin Slough STA is expected to be completed by March 2006. Construction end date is based on the current schedule for contracting and the proposed construction schedule in the final design.

2. **Design and construction of a large Reservoir Assisted Stormwater Treatment Area (RASTA)**.

   This dual-purpose water storage and treatment facility will be located at a yet undecided location in Taylor Creek/Nubbin Slough subbasin. The reservoir component of the RASTA will be used to capture and store runoff from the subbasin to attenuate peak inflows to Lake Okeechobee. Water stored in the reservoir will be released to the STA component for treatment prior to release to Lake Okeechobee. Treatment of the runoff prior to release will add to the water quality improvements achieved by other projects in the subbasin and thereby contribute to the overall load reduction to the lake. This project is currently in the planning phase and is expected to be completed by 2009.

3. **Lake Okeechobee Tributary Sediment Removal Demonstration Project**.

   The objective of this demonstration project, which was initiated in 2000, is to evaluate the technical feasibility and economic viability of two sediment removal technologies in reducing phosphorus loads from the LOW to the lake. It is intended to provide critical information regarding the potential benefits of controlling phosphorus loads in the watershed through tributary sediment removal.

   The project involves direct comparison of the results from operation of a continuous deflective separation unit and a tributary sediment trap at the discharge point of Lettuce Creek to the SFWMD conveyance system. Lettuce Creek was selected for this demonstration project because it was considered to have high particulate phosphorus load discharging into the lake.

Total cost including maintenance fees and cost per unit of phosphorus removed will be analyzed for each technology to determine if they are feasible and economically effective methods of reducing phosphorus exports to the lake. This multiphase project is expected to be completed by June 2004.

The twelve-month monitoring was completed in November 2003. The contractor is now working the data up to evaluate the nutrient removal efficiencies of the devices. The final project report will be completed by May 2004. This project officially ends in June 2004.

If found effective, the technologies would be used to expand sediment removal from other tributaries in the watershed. It is well known that the sediment bed in Lake Okeechobee serves as a sink for pollutants, notably phosphorus. Unless they are permanently removed, contaminants stored in the sediment bed can potentially get resuspended into the water column through turbulence thereby adversely impacting water quality. Removal of sediments from the tributaries would improve water quality in the tributaries and reduce phosphorus loadings to the lake.

Phase II of the LOCP calls for the development and implementation of such additional projects that are determined to be necessary to achieve the phosphorus TMDL for Lake Okeechobee. The Phase II plan will also include an evaluation of any further phosphorus load reductions necessary to achieve compliance with the Lake Okeechobee TMDL.

4.5.3 The Lake Okeechobee Watershed Phosphorus Control Program

The objective of this LOPA program element is to develop a multifaceted approach to reducing phosphorus loads by improving the management of phosphorus sources in the watershed. This is intended to be accomplished through continued implementation of existing regulations and BMPs; development and implementation of improved BMPs; improvement and restoration of the hydrologic function of naturally-managed systems; and utilization of alternative technologies for nutrient management. The long-term target is to help meet the Lake Okeechobee TMDL and appropriate LOW tributary TMDLs, as applicable.

Two broad categories of projects are either on-going or have been planned for implementation in the watershed under this program element.

1. **The Agricultural Non-point Source Control Program.**

   This voluntary program is spearheaded by FDACS and is focused on development, implementation, and verification of BMP effectiveness in reducing phosphorus loadings from agricultural non-point sources. BMPs will be identified, implemented, and monitored at selected locations. If water quality problems persist on farms where BMPs have been implemented, FDACS will reevaluate the BMPs and make appropriate modifications.

   Progress made to date under this program includes the completion of Agricultural Nutrient Management Assessments (AgNMAs) for all active dairies in the four priority basins representing over 31,000 acres. An additional 16,600 acres, covering buyout dairies, have also had AgNMAs completed. Four large cow/calf operations, representing 15,331 acres are currently in the advanced stages of the planning process.

2. **The Non-agricultural Non-point Source Control Program.**

   The primary objective of this FDEP-led effort is to reduce phosphorus loadings to Lake Okeechobee from non-agricultural, non-point sources in the LOW. This program focuses on the development of appropriate nutrient application rates for nonagricultural soil amendments, development and implementation of interim measures, improvement of domestic wastewater systems, development of agricultural use plans for land application of wastewater residuals, and the implementation of monitoring to verify effectiveness of BMPs.

3. Implementation of Alternative Nutrient Reduction Technologies

   In addition to the two categories of programs described above, other relevant water quality improvement programs that are currently being implemented in the watershed under the LOWPCP include the Dairy Best Available Technologies Project. The objective of this project is to identify, select, and implement best available technologies (BATs) that will significantly reduce the export of phosphorus from dairy operations into tributaries and Lake Okeechobee. Various alternatives are being evaluated to determine the comprehensive system of technologies that will address multiple dairy farm components [high intensity areas (HIAs), waste management systems, pastures, etc.]. Selection of technologies for implementation is accomplished by an objective methodology that allows for review and input by a multi-agency team that includes stakeholders. The alternatives chosen are focused on stormwater management on the outer pastures of the dairies.

Issues considered by this project include engineering feasibility of proposed alternatives; short– and long-term costs; feasibility of each alternative relative to obtaining the water quality goal of 40 ppb; process start-up time and a timeline to achieve desired treatment goals; socioeconomic implications; legal and permitting issues; coordination with other agencies to avoid duplication of effort; and opportunities for partnerships with the private sector.

The project has completed construction of three different edge-of-farm chemical treatment systems, which was the selected alternative during the evaluation process. A fourth system is in the preliminary design phase. Stormwater runoff will be captured and reused if possible prior to chemical treatment and offsite discharge. These systems will be monitored and evaluated for performance over a two-year period.

4.5.4 Projected Cumulative P Load Reductions from LOPP

As stated earlier, measured data for the 10-year period from 1991 to 2000 shows that, excluding precipitation which contributes an estimated 35 Mtons of TP to the lake, an average of 433 Mtons of phosphorus were discharged into Lake Okeechobee. The total load reduction necessary to meet the TMDL is 328 Mtons (433 minus 105). ***Table 4-1*** presents the phosphorus load reductions projected in the LOPP for various initiatives.

TABLE 4-1 LOPP PHOSPHORUS LOAD REDUCTION SUMMARY

Phosphorus Load Reduction Strategies (10-year average load = 433 Mtons) (Load to be removed = 328 Mtons)	**Load Reduction Potential (Mtons)**	**Load Reduction Potential (%)**
Ongoing P load reduction initiatives	158.64	48
Typical cost-share BMPs that require future funding	34.87	11
Other non-CERP regional projects	4.56	1
CERP regional projects (LOWP)	130.02	40

The above table indicates that LOPP is projecting that water quality improvement strategies being considered by the LOW Project will have to cumulatively remove approximately 40% total p-load reduction required to meet the TMDL. In other words, p-load reductions to be achieved by the LOW Project will play a significant role in meeting the total phosphorus TMDL for Lake Okeechobee.

Finally, it should be noted that The LOPP is to be re-evaluated every 3 years to incorporate any new or updated information. This review will include analyses of BMP performance. If actual BMP performance does not meet initial expectations, the LOPA requires that BMPs be appropriately modified

to improve their effectiveness. Should there be a significant deviation from the assumptions and performance expectations of this Plan, the plan will be modified accordingly. Also, the TMDL itself is expected to be reevaluated within five years (2006), and should the target of 105 metric tons, this could increase or decrease the scale of LOPP.

4.5.5 Surface Water Quality Parameters other than Phosphorus

With a few exceptions, the majority of the water quality improvement initiatives proposed to be implemented under LOPA are focused on reducing phosphorus loadings to Lake Okeechobee and thereby contribute towards achieving the phosphorus TMDL. A review of historical LOW water quality data (summarized in Section 3) indicates that besides phosphorus, concentrations of a few other water quality parameters have occasionally been of concern at several sites in the LOW, particularly the priority basins. For example,

- Taylor Creek/Nubbin Slough basin had consistently higher bimonthly averages (1997-2001) of ammonia, inorganic nitrogen, nitrate, and nitrite than all other sites (DBHYDRO, 2002).

- Monthly pesticide monitoring conducted in Taylor Creek/ Nubbin Slough from February 2000 through May 2001 showed measurable concentrations of three pesticides, namely atrazine, simazine, and bromacil, on sustained basis. Average concentration of atrazine was reported to be 0.03 μg/l with values ranging from 0.02 μg/l to 0.04 μg/l. During the same monitoring period, simazine was detected in two samples for an average concentration of 0.04 μg/l. The average concentration of bromacil was reported as 0.05 μg/l.

- Monthly pesticide monitoring conducted in priority basin S-65E showed the consistent presence of atrazine, bromacil, and simazine. Atrazine concentrations ranged from 0.01 μg/l to 0.09 μg/l for samples collected from February 2000 to May 2001. Simazine and bromacil were measured in four of the six monitoring events and averaged 0.03 μg/l and 0.08 μg/l, respectively. Hexazinone was detected only once (November 2000) at a concentration of 0.02 μg/l.

- Measured concentrations of metals in surface water have been evaluated and heavy metals, especially mercury in fish tissue, are of highest concern in the Kissimmee River and Taylor Creek/Nubbin Slough basins. High concentrations of mercury have been identified as a primary concern for the entire Everglades ecosystem and atmospheric deposition

has been identified as one of the significant sources of mercury contamination (SFWMD, 1999; Fink and Rawlik, 2000).

- Low concentrations of dissolved oxygen and elevated coliforms levels were reported for several locations in the LOW.

While most of the on-going and planned water quality improvement projects in the LOW are focused primarily on removal of phosphorus, it is likely that removal of other contaminants such as nitrogen, metals, and sediments may also accompany phosphorus removal. Emergent macrophyte-dominated stormwater treatment areas, for example, are likely to be used as the primary technology for achieving large-scale phosphorus load reductions in the LOW. These constructed wetlands provide overall water quality enhancement through natural wetland process such as trapping and sedimentation of solids, biological uptake, and resulting settling and soil accretion, and chemical and biological transformation of pollutants. It is very likely that the effluent from these constructed wetlands will show reduced concentrations of not only phosphorus but also metals, nitrogen, and total suspended solids as compared to the influent.

Similarly, above ground storage reservoirs that are being considered for capturing and storing runoff in the LOW may also provide not only some reduction in phosphorus loads, but also overall water quality enhancement through the same physical, chemical, and biological processes.

Likewise, agricultural and non-agricultural non-point source BMPs designed primarily for phosphorus load reductions have also been shown to trap nutrient-laden sediments from entering the surface water bodies. Mikkelsen and Gilliam (1995) reported that vegetated filter strips consisting of trees, grass, and other vegetation around agricultural fields were able to reduce sediment and phosphorus loads by as much as 70%. Vegetative filters, a recommended BMP for livestock holding areas, have been shown to be effective in trapping not only sediments and particulate matter but may also remove some total nitrogen besides total phosphorus (Dillaha, et. al. 1988).

Finally, removal of accumulated sediments from the tributaries to the lake can be reasonably expected to lead to a reduction in concentration and loads of all other contaminants (nitrogen, pesticides, metals, etc.), which may have accumulated in the sediments along with phosphorus.

Thus, it is possible that the multitude of phosphorus control measures currently implemented in the watershed or planned for the future

implementation under LOPA will also result in reduction of loading rates of other contaminants to Lake Okeechobee.

4.5.6 Projection of "Net" Water Quality Needs

As shown above in ***Table 4-1***, the LOW Project has to accomplish the removal of approximately 30% of the total phosphorus loading from the watershed. It is possible that that not all strategies implemented under LOPP will be one hundred percent successful. Allowing for this contingency, it forecasted that the LOW Project would have to remove approximately one-third of the phosphorus load in the watershed. Note that this estimate is based on existing land use practices.

Future changes in agricultural land uses within the watershed are not expected to have a significant effect on water quality or quantity, particularly phosphorus loadings, since landowners contemplating major changes in the use of agricultural lands will be required to obtain permits from the SFWMD and implement BMPs and/or best available technologies (BATs) that will ensure no net increase in phosphorus loadings. Section 373.4595(3)(c) 7, Florida Statutes, requires that responsible parties demonstrate that proposed changes in land uses will not result in increased phosphorus loading over that of existing land uses.

Assuming that the TMDL will be met in the prescribed time frame, it is anticipated that overall water quality in the project study area over the planning horizon will be significantly improved compared to the baseline.

4.6 Water Supply Demand Projections

Given that the principal land use in the project study area is predominantly agricultural, majority of the demand for water supply is for agricultural needs (SFWMD, 2000a). Historically, the principal water supply source for urban and agricultural needs within the project study area has been groundwater from the Upper Floridan aquifer (SFWMD, 2000b).

A small portion of the study area – the Lake Okeechobee Service Area (LOSA) – depends directly upon lake supply for agricultural, irrigation, and urban use. The LOSA includes parts of Glades, Okeechobee, and Martin counties (***Figure 4-3***). In addition to being the primary water supply source for the LOSA, the lake also provides water storage for urban and agricultural water supply for much of the lower east coast (SFWMD, 2000c). During water shortages, canal discharges from the lake provide recharge water for the Biscayne aquifer, indirectly supplying water to 90% of the five

million residents of the Lower East Coast (LEC) planning region of the District (SFWMD, 2000c). The lake also supplies irrigation water for sugarcane, vegetables, sod, and rice crops grown in the EAA.

4.6.1 Water Supply Demand Projections

A very large portion of the project study area lies falls within the jurisdiction of the SFWMD. For this portion, water supply demands for the project study area through 2020 were presented in the District-wide Water Supply Assessment (DWSA) (SFWMD, 1998b). Using 1995 as the base year, the DWSA projected combined demand for urban and agricultural needs for various counties within the planning area. Public water supply utility demand was projected only for utilities with projected pumping rate of 0.5 MGD or greater in 2020.

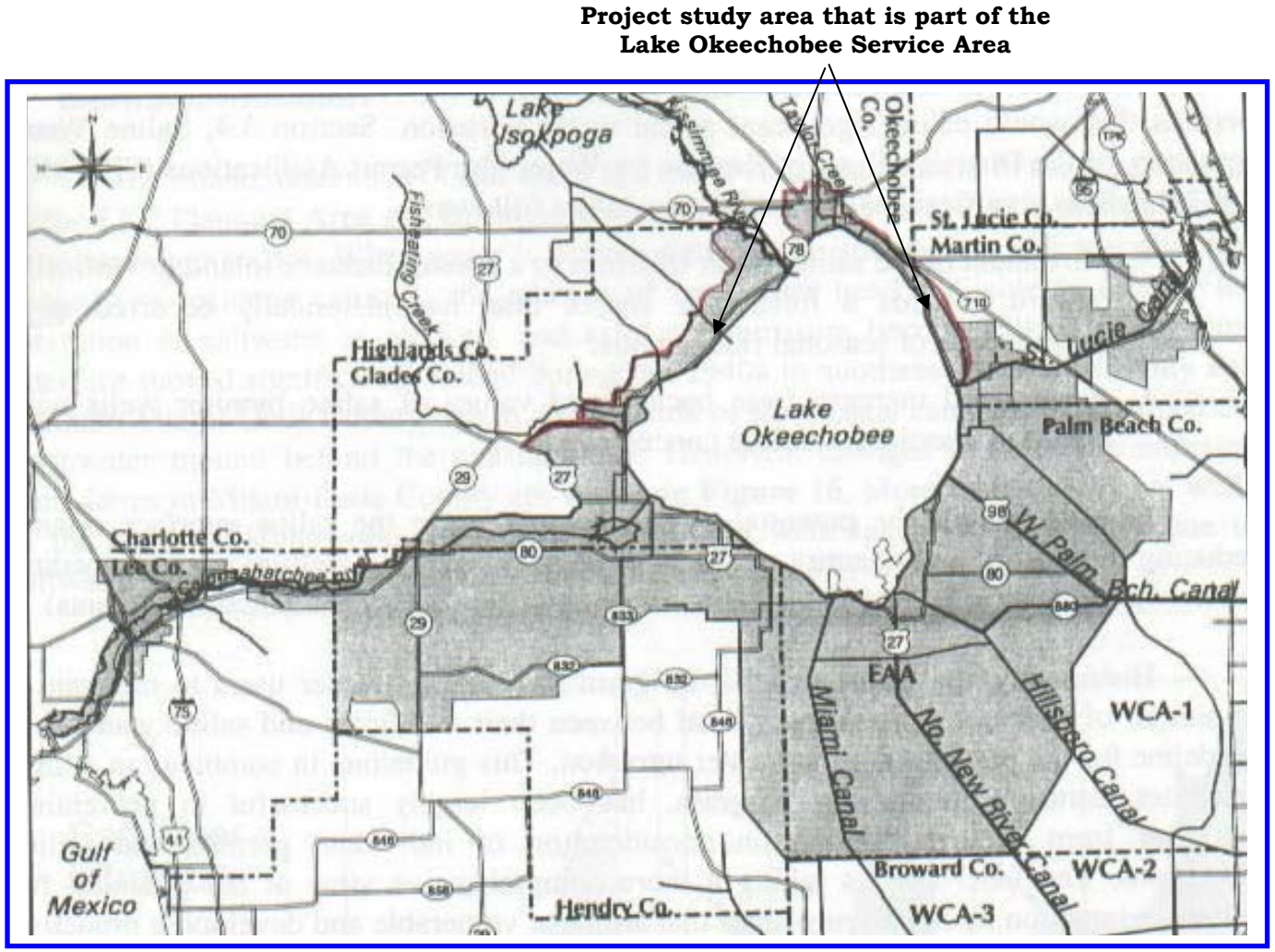
Water supply demand projections for the area within the SFWMD jurisdiction are presented below and these are based on the demand projection methodology developed by the SFWMD for the "District-wide Water Supply Assessment." Forecasts over the planning horizon were developed by applying revised population projections to the District's methodology.

Note that these forecasts represent water supply demand under conditions that do not include implementation of any CERP projects. Implementation of such projects is likely to result in significant localized changes in land use, which in turn may influence localized water supply demands. It must also be noted that environmental demands were not quantified in the DWSA, as they are addressed in the District's water supply planning process through the incorporation of restoration goals and targets, minimum flows and levels, performance measures, reservation of water, and resource protection criteria.

4.5.1.2 Okeechobee County

Most of the population in Okeechobee County resides in the western part of the county. Coincidentally, a majority of the irrigated agriculture is also concentrated in the western portion.

FIGURE 4-3
LAKE OKEECHOBEE SERVICE AREA



As discussed later in Section 4.9 (Forecasted Demographic Data), the population in the county is projected to grow from 38,910 in 2000 to 58,800 in 2050, a 51% increase. Total average demand for water is projected to increase from 3.55 million gallons per day (MGD) [4,000 acre-feet/year (ac-ft/yr)] in 2000 to 5.36 MGD (6,000 ac-ft/yr) in 2050.

Public Water Supply (PWS) – This demand category includes entities such as private homes, industries, etc. that rely upon a public water utility system for their potable water supply. There is one public water utility in Okeechobee County, namely the Okeechobee Utility Authority. In 1995, the population of western Okeechobee county was 28,737 of which 21,200 (73.5%) was served by the utility, the rest of the population was rural self-supplied. Population served by the utility in 2000 was estimated at 29,394 and has been projected to increase to 43,218 by 2050.

PWS water supply demand in 2000 was 2.68 MGD (3,000 ac-ft/yr) and is projected to increase to 3.94 MGD (4,400 ac-ft/yr) by 2050. The 1-in-10 demand (i.e. the demand for a 1 in 10 year drought condition – defined as a below normal rainfall with a 90% probability of being exceeded over a 12-month period) for 2050 is forecasted at 4.18 MGD (4,682 ac-ft/yr). Overall, urban demands in western Okeechobee County are projected to remain at between 9 and 10% of the total demand.

Domestic Self-Supply (DSS) – The DSS category includes small public systems with a projected demand of less than 0.5 million gallon per day (MGD) as well as residents that supply their own water needs. Self-supplied residents may be within a public utility boundary or located outside of the utility boundary (rural self-supplied).

In 2000, the self-supplied population in western Okeechobee County was determined to be 9,561 residents (***Table 4-2)***. This number is projected to increase to 15,582 residents by 2050. Associated residential self-supplied water demand is forecasted to increase from 0.87 MGD (975 ac-ft/yr) in 2000 to an average demand of 1.42 MGD (1,600 ac-ft/yr) in 2050. The 1-in-10 demand for 2050 is projected at 1.51 MGD (1,700 ac-ft/yr).

Recreation Self-Supply – This demand category includes self-supplied irrigation demands for large landscaped and recreational areas such as parks and sporting arenas (as opposed to private homes) and for golf courses.

TABLE 4-2
PWS AND DSS DEMAND PROJECTIONS FOR OKEECHOBEE (EASTERN AND WESTERN) COUNTY

2000

	Total	**PWS**	**PWS**		**Percent**	**Average**	**PWS**		**PWS**	**DSS**	**DSS**	**DSS**	**DSS**
Utility	Population	Population	Base MGD	GPCD*	Outdoor	Factor	Average MGD	1-in-10	1-in-10 MGD	Population	Base MGD	Average MGD	1-in-10 MGD
Okeechobee UA	29,394	29,394	2.70	92	35%	0.973	2.68	1.172	2.84	0	0	0	0
Rural Self Supplied	9,516	0	0	92	35%	0.973	0	1.172	0	9,516	0.88	0.87	0.92
Total	38,910	29,394	2.70				2.68		2.84	9,516	0.88	0.87	0.92

Projected: 2010

	Total	PWS	PWS		Percent	Average	PWS		PWS	DSS	DSS	DSS	DSS
Utility	Population	Population	Base MGD	GPCD*	Outdoor	Factor	Average MGD	1-in-10	1-in-10 MGD	Population	Base MGD	Average MGD	1-in-10 MGD
Okeechobee UA	29,253	29,253	2.69	92	35%	0.973	2.67	1.172	2.83	0	0	0	0
Rural Self Supplied	10,547	0	0	92	35%	0.973	0	1.172	0	10,547	0.97	0.96	1.02
Total	39,800	29,253	2.69				2.67		2.83	10,547	0.97	0.96	1.02

Projected: 2020

	Total	PWS	PWS		Percent	Average	PWS		PWS	DSS	DSS	DSS	DSS
Utility	Population	Population	Base MGD	GPCD*	Outdoor	Factor	Average MGD	1-in-10	1-in-10 MGD	Population	Base MGD	Average MGD	1-in-10 MGD
Okeechobee UA	32,487	32,487	2.99	92	35%	0.973	2.96	1.172	3.14	0	0	0	0
Rural Self Supplied	11,713	0	0	92	35%	0.973	0	1.172	0	11,713	1.08	1.07	1.13
Total	44,200	32,487	2.99				2.96		3.14	11,713	1.08	1.07	1.13

TABLE 4-2
(Continued)

Projected: 2030													
	Total	PWS	PWS		Percent	Average	PWS		PWS	DSS	DSS	**DSS**	**DSS**
Utility	Population	Population	Base MGD	GPCD*	Outdoor	Factor	Average MGD	1-in-10	1-in-10 MGD	Population	Base MGD	Average MGD	1-in-10 MGD
Okeechobee UA	35,500	35,500	3.27	92	35%	0.973	3.24	1.172	3.43	0	0	0	0
Rural Self Supplied	12,800	0	0	92	35%	0.973	0	1.172	0	12,800	1.18	1.17	1.24
Total	48,300	35,500	3.27				3.24		3.43	12,800	1.18	1.17	1.24
Projected: 2040													
	Total	PWS	PWS		Percent	Average	PWS		PWS	DSS	DSS	DSS	DSS
Utility	Population	Population	Base MGD	GPCD*	Outdoor	Factor	Average MGD	1-in-10	1-in-10 MGD	Population	Base MGD	Average MGD	1-in-10 MGD
Okeechobee UA	39,175	39,175	3.60	92	35%	0.973	3.57	1.172	3.78	0	0	0	0
Rural Self Supplied	14,125	0	0	92	35%	0.973	0	1.172	0	14,125	1.30	1.29	1.36
Total	53,300	39,175	3.60				3.57		3.78	14,125	1.30	1.29	1.36
Projected: 2050													
	Total	PWS	PWS		Percent	Average	PWS		PWS	DSS	DSS	DSS	DSS
Utility	Population	Population	Base MGD	GPCD*	Outdoor	Factor	Average MGD	1-in-10	1-in-10 MGD	Population	Base MGD	Average MGD	1-in-10 MGD
Okeechobee UA	43,218	43,218	3.98	92	35%	0.973	3.94	1.172	4.18	0	0	0	0
Rural Self Supplied	15,582	0	0	92	35%	0.973	0	1.172	0	15,582	1.43	1.42	1.51
Total	58,800	43,218	3.98				3.94		4.18	15,582	1.43	1.42	1.51

Source: Modified based on data and methodology provided by the SFWMD (1998).
*GPCD = Gallons Per Capita Day

The DWSA forecasted that self-supplied large landscaped areas in western Okeechobee County would increase from 30 acres in 1995 to 47 acres in 2020, a 56% increase in 25 years. Assuming the same percent increase over the next 30 years, self-supplied land areas in western Okeechobee County are projected to increase to 73 acres by 2050.

Landscaping self-supplied demand in western Okeechobee County (not including golf courses) was projected to increase from 35 million gallons per year (MGY) (107 ac-ft/yr) in 1995 to 55 MGY (170 ac-ft/yr) by 2020, a 57% increase. If this increase kept up from 2020 to 2050, landscaping self-supplied demand in western Okeechobee County is projected to be 86 MGY (265 ac-ft/yr) by 2050.

Agricultural Self-Supply – Irrigated commercially grown crops in Okeechobee County are citrus, vegetables, sod, and ornamental nursery; most of the irrigated land is in the western part of the county. Improved pasture is very seldom irrigated, but cattle watering entails significant demands. No net increase in irrigated agriculture is projected for Okeechobee County for the foreseeable future.

Miscellaneous – Other water usage demands in western Okeechobee County include demand for cattle watering and aquaculture. In 1995, 83% of non-dairy cattle in Okeechobee County were in the western half of the county. This trend is expected to continue in the foreseeable future. The 1995 demand for cattle watering was assessed at 2,407 MGY (7,400 ac-ft/yr) and was projected to decline to 2,389 MGY (7,350 ac-ft/yr) by 2020 as some of the former pastureland is converted to irrigated crops. If the decline continues at the same level, demand for cattle watering is projected to be at 2,372 MGY (7,280 ac-ft/yr) by 2050.

4.5.1.2 Northern Glades County

Northern Glades is predominantly agricultural and there has been a steady increase in acreage of irrigated crops; most irrigated crops are on lands that were formerly used for non-irrigated pasture. There are no major public water utilities in this part of Glades County. Total average demand for water was expected to grow by 52% from 9,557 MGY (29,350 ac-ft/yr) in 1995 to 14,625 MGY (44,900 ac-ft/yr) in 2020 and agricultural demand is anticipated to make up almost 98% of the total demand over the projected period. This trend is expected to continue beyond 2020.

Domestic Self-Supply (including small PWS) - The entire population of Northern Glades County is self-supplied and projected to grow from 8,131 in 2000 to 14,000 by 2050. Domestic self-supplied demand in 2000 was determined to be 1.03 MGD (1,200 ac-ft/yr) and based on the projected increase in self-supplied population, average demands are forecasted to rise to 1.89 MGD (2,120 ac-ft/yr) by 2050 (***Table 4-3)***. The 1-in-10 demand for 2050 is forecasted at 2.0 MGD (2,240 ac-ft/yr). Overall, urban demand is projected to remain low for this part of Glades County.

Agricultural Self-Supply – Irrigated commercially grown crops in northern Glades County include citrus, sugarcane, vegetables, and sod. Improved pasture is generally not irrigated but there is demand for cattle watering. Agricultural irrigation demand in 1995 was assessed at 9,423 MGY (28,900 ac-ft/yr) and was forecasted to increase to 14,285 MGY (43,900 ac-ft/yr) by 2020, a 52% increase. If this rate of increase continues beyond 2020, agricultural irrigation demand for 2050 is forecasted to 21,713 MGY (66,600 ac-ft/yr).

Miscellaneous – SFWMD land use maps from 1995 indicate that two thirds of the cattle in Glades County were in the northern portion. The 1995 demand for cattle watering were 222 MGY (680 ac-ft/yr) and is projected to decline to 214 MGY (660 ac-ft/yr) by 2020 (4% decline) as non-dairy ranches are converted to other agricultural uses. If this rate of decline continues beyond 2020, demand for cattle watering is projected to be 205 MGY (630 ac-ft/yr) by 2050.

4.5.1.3 Eastern Highlands County

There are no major public water supply utilities in eastern Highlands County and all residents are self-supplied. Population is expected to increase from 10,748 in 2000 to 18,500 in 2050. According to District estimates total demand in 1995 was 34,157 MGY (105,000 ac-ft/yr) and was projected to grow by 71% to 58,522 MGY (180,000 ac-ft/yr) in 2020. This trend is expected to continue through 2050. Demand for agricultural irrigation makes up 96% of the total projected demand. Urban demand, although increasing by 55%, still only makes up a minor portion of total demand through 2025.

Domestic Self-Supply - All residents in eastern Highlands County are either self-supplied or receive water from very small utilities. Domestic self-supplied demand is projected to grow from 1.13 MGD (1,270 ac-ft/yr) in 2000 to 2.04 MGD (2,290 ac-ft/yr) in 2050 (***Table 4-4)***. One-in-10 demand for 2050 is projected at 2.15 MGD (2,410 ac-ft/yr).

Recreational Self-Supply – This category includes self-supplied irrigation demands for large landscaped areas such as parks and sporting arenas (as opposed to private homes) and for golf courses. Self-supplied large landscaped area was projected to increase from 989 acres in 1995 to 1,524 acres in 2020, a 54% increase. If this trend continues, the self-supplied large landscaped areas are projected at 2,347 acres in 2050.

Landscaping self-supplied average demand for this portion of the county (not including golf courses) was projected to increase from 1,203 MGY (3,700 ac-ft/yr) in 1995 to 1,853 MGY (5,690 ac-ft/yr) by 2020, a 54% increase. Assuming a similar increase over the next 30 years, the landscaping self-supplied average demand is likely to be at 2,854 MGY (8,760 ac-ft/yr) in 2050. There are no golf courses in this part of the county.

Agricultural Self-Supply – Irrigated commercially grown crops in eastern Highlands County are citrus, vegetables, blueberries, sod, and greenhouse/nursery operations. Improved pastures are usually not irrigated but there is demand for cattle watering.

Miscellaneous – In 1995, demand for cattle watering was assessed at 827 MGY (2,540 ac-ft/yr) and is projected to decline to 766 MGY (2,350 ac-ft/yr) by 2020 as some land formerly used for pasture is used for irrigated crops. This demand is projected to continue to decline through 2050. Demand for aquaculture was assessed at 97 MGY (300 ac-ft/yr) in 1995 and is projected to remain unchanged through 2050.

4.5.1.4 Western Highlands County

The western half of Highlands County falls within the jurisdiction of the Southwest Florida Water Management District (SWFWMD). For this region, the SWFWMD has estimated that the total population in 1995 was 76,575, and is projected to grow to 118,734 by the year 2020. The District has also forecasted water supply demands for this region through 2020. However, the methodology used by the District for forecasting water supply demands is not conducive to extrapolating the projections to 2050; therefore projections through 2020 only are discussed below.

Overall demand for agricultural supply accounts for 75 percent of the total existing and projected demand. Urban demand, although increasing by 73 percent, still only makes up a minor portion of total demand through 2020 (***Table 4-5)***.

Domestic Self-Supply – In 1995, there were 14,645 residents in western Highlands County that are self-supplied, and 18,008 residents were supplied by small utilities. Domestic self-supply population is projected to grow from 14,645 in 1995 to 22,708 in 2020. Water supply for domestic self-supply is projected to grow from 1.2 MGD to 2.0 MGD in year 2020.

Public Water Supply – In 1995, there were 43,922 1995 in western Highlands County that were publicly supplied, and by the year 2020 this number is projected to increase to 68,104. Water supply for PWS is expected to grow from 10.6 MGD in 1995 to 17.8 MGD in the year 2020.

Recreational Self-Supply – This category includes self-supplied irrigation demands for large landscape areas including golf courses. In 1995 recreational self-supply water use was estimated at 3.58 MGD and projected to increase by 61 percent to 5.78 MGD.

Agricultural Self-Supply – Irrigated commercially grown crops in western Highlands County include citrus, vegetables, strawberries, sod, and greenhouse/nursery operations. Improved pasture areas are usually not irrigated but there is some demand for cattle watering.

Miscellaneous – In 1995, demand for commercial and industrial water usage was assessed at 0.11 MGD and by the year 2020 the demand is projected to grow to 0.13 MGD. There is some water demand for cattle watering and peat mining.

TABLE 4-3
PWS AND DSS DEMAND PROJECTIONS FOR NORTHERN GLADES COUNTY

2000													
	Total	PWS	PWS		Percent	Average	PWS		PWS	DSS	DSS	DSS	DSS
Utility	Population	Population	Base MGD	GPCD*	Outdoor	Factor	Average MGD	1-in-10	1-in-10 MGD	Population	Base MGD	Average MGD	1-in-10 MGD
Rural Self Supplied	8,131	0	0	127	35%	1.182	0	1.163	0	8,131	1.03	1.10	1.16
Total	8,131	0	0				0		0	8,131	1.03	1.10	1.16
Projected: 2010													
	Total	PWS	PWS		Percent	Average	PWS		PWS	DSS	DSS	DSS	DSS
Utility	Population	Population	Base MGD	GPCD*	Outdoor	Factor	Average MGD	1-in-10	1-in-10 MGD	Population	Base MGD	Average MGD	1-in-10 MGD
Rural Self Supplied	9,100	0	0	127	35%	1.182	0	1.163	0	9,100	1.16	1.23	1.30
Total	9,100	0	0				0		0	9,100	1.16	1.23	1.30
Projected: 2020													
	Total	PWS	PWS		Percent	Average	PWS		PWS	DSS	DSS	DSS	DSS
Utility	Population	Population	Base MGD	GPCD*	Outdoor	Factor	Average MGD	1-in-10	1-in-10 MGD	Population	Base MGD	Average MGD	1-in-10 MGD
Rural Self Supplied	10,200	0	0	127	35%	1.182	0	1.163	0	10,200	1.30	1.38	1.46
Total	10,200	0	0				0		0	10,200	1.30	1.38	1.46

TABLE 4-3
(Continued)

Projected: 2030

Utility	Total Population	PWS Population	PWS Base MGD	GPCD*	Percent Outdoor	Average Factor	PWS Average MGD	1-in-10	PWS 1-in-10 MGD	DSS Population	DSS Base MGD	DSS Average MGD	DSS 1-in-10 MGD
Rural Self Supplied	11,200	0	0	127	35%	1.182	0	1.163	0	11,200	1.42	1.51	1.60
Total	11,200	0	0				0		0	11,200	1.42	1.51	1.60

Projected: 2040

Utility	Total Population	PWS Population	PWS Base MGD	GPCD*	Percent Outdoor	Average Factor	PWS Average MGD	1-in-10	PWS 1-in-10 MGD	DSS Population	DSS Base MGD	DSS Average MGD	DSS 1-in-10 MGD
Rural Self Supplied	12,500	0	0	127	35%	1.182	0	1.163	0	12,500	1.59	1.69	1.78
Total	12,500	0	0				0		0	12,500	1.59	1.69	1.78

Projected: 2050

Utility	Total Population	PWS Population	PWS Base MGD	GPCD*	Percent Outdoor	Average Factor	PWS Average MGD	1-in-10	PWS 1-in-10 MGD	DSS Population	DSS Base MGD	DSS Average MGD	DSS 1-in-10 MGD
Rural Self Supplied	14,000	0	0	127	35%	1.182	0	1.163	0	14,000	1.78	1.89	2.00
Total	14,000	0	0				0		0	14,000	1.78	1.89	2.00

Source: Modified based on data and methodology provided by the SFWMD (1998).
*GPCD = Gallons Per Capita Day

TABLE 4-4
PWS AND DSS DEMAND PROJECTIONS FOR EASTERN HIGHLANDS COUNTY

2000													
	Total	PWS	PWS		Percent	Average	PWS		PWS	DSS	DSS	DSS	DSS
Utility	Population	Population	Base MGD	GPCD*	Outdoor	Factor	Average MGD	1-in-10	1-in-10 MGD	Population	Base MGD	Average MGD	1-in-10 MGD
Rural Self Supplied	10,748	0	0	105	35%	1.138	0	1.165	0	10,748	1.13	1.18	1.25
Total	10,748	0	0				0		0	10,748	1.13	1.18	1.25
Projected: 2010													
	Total	PWS	PWS		Percent	Average	PWS		PWS	DSS	DSS	DSS	DSS
Utility	Population	Population	Base MGD	GPCD*	Outdoor	Factor	Average MGD	1-in-10	1-in-10 MGD	Population	Base MGD	Average MGD	1-in-10 MGD
Rural Self Supplied	12,000	0	0	105	35%	1.138	0	1.165	0	12,000	1.26	1.32	1.40
Total	12,000	0	0				0		0	12,000	1.26	1.32	1.40
Projected: 2020													
	Total	PWS	PWS		Percent	Average	PWS		PWS	DSS	DSS	DSS	DSS
Utility	Population	Population	Base MGD	GPCD*	Outdoor	Factor	Average MGD	1-in-10	1-in-10 MGD	Population	Base MGD	Average MGD	1-in-10 MGD
Rural Self Supplied	13,500	0	0	105	35%	1.138	0	1.165	0	13,500	1.42	1.49	1.57
Total	13,500	0	0				0		0	13,500	1.42	1.49	1.57

TABLE 4-4
(Continued)

Projected: 2030

Utility	Total Population	PWS Population	PWS Base MGD	GPCD*	Percent Outdoor	Average Factor	PWS Average MGD	1-in-10	PWS 1-in-10 MGD	DSS Population	DSS Base MGD	DSS Average MGD	DSS 1-in-10 MGD
Rural Self Supplied	14,900	0	0	105	35%	1.138	0	1.165	0	14,900	1.56	1.64	1.73
Total	14,900	0	0				0		0	14,900	1.56	1.64	1.73

Projected: 2040

Utility	Total Population	PWS Population	PWS Base MGD	GPCD*	Percent Outdoor	Average Factor	PWS Average MGD	1-in-10	PWS 1-in-10 MGD	DSS Population	DSS Base MGD	DSS Average MGD	DSS 1-in-10 MGD
Rural Self Supplied	16,600	0	0	105	35%	1.138	0	1.165	0	16,600	1.74	1.83	1.93
Total	16,600	0	0				0		0	16,600	1.74	1.83	1.93

Projected: 2050

Utility	Total Population	PWS Population	PWS Base MGD	GPCD*	Percent Outdoor	Average Factor	PWS Average MGD	1-in-10	PWS 1-in-10 MGD	DSS Population	DSS Base MGD	DSS Average MGD	DSS 1-in-10 MGD
Rural Self Supplied	18,500	0	0	105	35%	1.138	0	1.165	0	18,500	1.94	2.04	2.15
Total	18,500	0	0				0		0	18,500	1.94	2.04	2.15

Source: Modified based on data and methodology provided by the SFWMD (1998).
*GPCD = Gallons Per Capita Day

TABLE 4-5
AGRICULTURAL AND URBAN DEMAND PROJECTIONS FOR WESTERN HIGHLANDS COUNTY

Urban and Agricultural Demands	Assessed 1995 (MGD)	Average 2020 (MGD)	Percent Change	1-in-10 Demand 2020 (MGD)
Urban				
Public Water Supply	10.6	17.8	68	18.9
Domestic Self-Supply	1.2	2	67	2
Commercial/ Industrial Self-Supply	0.11	0.13	18	0.13
Recreational Self-Supply	3.58	5.78	61	7
Total Urban	15.5	25.7	73.0	28.5
Agricultural				
Irrigated	65	76	17	108
Non-Irrigated	0.2	0.2	0	0.2
Total Agricultural	65.2	76.2	17.0	108.2
Total Urban And Agricultural	80.7	101.9	26.3	136.7

Source: SWFWMD Regional Water Supply Plan 1998.

4.6.2 Urban Water Demand Breakdown

Urban water demand to meet municipal and industrial (M&I) needs in parts of the project study area was published by the Corps of Engineers, Jacksonville District. They used an existing pre-calibrated IWR-MAIN Water Demand Management Suite model to forecast M&I demand through 2050. IWR-MAIN is a computerized water resources planning tool that allows the development of water use forecasts and evaluation of water conservation programs. Input data to this model included:

- Total number of housing units for the base year (2000) and forecast years, number of housing units by type of unit (number of units per structure)
- Total employment in the base year and forecast years
- Base year employment for eight major industries
- Median household income (in 1990 dollar),
- Average persons per household, number of housing units per acre, and marginal and fixed cost of water for each housing type

Population growth estimates provided by the Bureau of Economic and Business Research (BEBR) were used for these analyses. Note that BEBR projections go through 2020 and were extrapolated under the assumption that the growth trends would continue through 2050.

Urban water demands projected by the IWR-MAIN model fast-track analyses for the developed area along the northwestern shore of Lake Okeechobee in Okeechobee and Glades Counties (i.e. LOSA Sub Area 3) are presented in ***Table 4-6***. Three population projection scenarios were developed for the analyses; 1) BEBR low population projection; 2) BEBR medium (most-likely population scenario) population projection; and 3) BEBR high population projection. For the purposes of this analysis the most-likely population scenario was used.

The most-likely projections were made for unrestricted (baseline) demand and restricted demand. Restricted demand assumes that private water conservation measures incorporated into the water conservation plans of most water utilities are adhered to. Such measures include increasing block rate structure, the required use of ultra-low flow (ultra-conserving) water fixtures on new construction or renovation of existing structures, restrictions on lawn watering, requiring rain sensors on automatic sprinklers systems, a leak detection program, and public education concerning water conservation measures.

Annual average baseline daily water demand for 2000 was estimated at 3.14 MGD (3,518 ac-ft/yr). By 2050, baseline water demand for this area is projected to increase 62% to 5.09 MGD (5,702 ac-ft/yr). Average daily baseline water demand during winter months in 2050 is projected at 5.39 MGD (6,039 ac-ft/yr) and average daily demand during summer months is projected at 4.67 MGD (5,232 ac-ft/yr). Unrestricted water demand projections are also shown in ***Table 4-6***.

The annual average restricted water demand in 2050 was projected at 4.35 MGD (4,873 ac-ft/yr), 15% less than the 2050 unrestricted water demand. Average daily-restricted water demand during winter months was projected at 4.64 MGD (5,198 ac-ft/yr) and average daily demand during summer months was forecasted to be at 3.95 MGD (4,425 ac-ft/yr).

4.6.3 Critical Water Supply and Demand Issues

Currently, the regional water supply system meets the urban and agricultural needs under average rainfall conditions. However, large portions of the Everglades and important estuary systems do not receive adequate quantities, quality, timing, or distribution of water. In most areas within the project study area, existing water resources tend to fall short during dry periods.

The major water supply and demand issues that are likely to affect the project study area over the planning horizon are supply availability, continuation and completion of the Kissimmee River Restoration Projects, Lake Okeechobee water quality, changing agricultural demands, and environmental needs.

TABLE 4-6
URBAN WATER SUPPLY DEMAND PROJECTIONS FOR LOSA SUB AREA 3

Year	Category	Baseline Water Use (MGD)			Restricted Water Use (MGD)		
		Dry (Winter)	Wet (Summer)	Annual	Dry (Winter)	Wet (Summer)	Annual
2000	Residential	1.95	1.67	1.83	1.95	1.67	1.83
	Commercial	0.85	0.74	0.80	0.85	0.74	0.80
	Manufacturing	0.01	0.01	0.01	0.01	0.01	0.01
	Government	0.05	0.05	0.05	0.05	0.05	0.05
	Unaccounted	0.47	0.40	0.46	0.47	0.40	0.46
	Total Municipal	**3.33**	**2.87**	**3.14**	**3.33**	**2.87**	**3.14**
2010	Residential	2.17	1.85	2.04	2.04	1.73	1.91
	Commercial	0.96	0.83	0.91	0.94	0.81	0.88
	Manufacturing	0.01	0.01	0.01	0.01	0.01	0.01
	Government	0.05	0.05	0.05	0.05	0.05	0.05
	Unaccounted	0.52	0.45	0.49	0.50	0.42	0.47
	Total Municipal	**3.71**	**3.20**	**3.50**	**3.53**	**3.03**	**3.32**
2020	Residential	2.44	2.09	2.30	2.19	1.85	2.05
	Commercial	1.08	0.94	1.02	1.03	0.90	0.97
	Manufacturing	0.01	0.01	0.01	0.01	0.01	0.01
	Government	0.06	0.06	0.06	0.05	0.05	0.05
	Unaccounted	0.59	0.51	0.55	0.54	0.46	0.50
	Total Municipal	**4.17**	**3.60**	**3.94**	**3.82**	**3.26**	**3.59**
2030	Residential	2.71	2.32	2.55	2.34	1.97	2.19
	Commercial	1.19	1.03	1.12	1.12	0.97	1.06
	Manufacturing	0.01	0.01	0.01	0.01	0.01	0.01
	Government	0.06	0.06	0.06	0.06	0.06	0.06
	Unaccounted	0.65	0.56	0.61	0.58	0.49	0.54
	Total Municipal	**4.62**	**3.99**	**4.35**	**4.11**	**3.51**	**3.86**

TABLE 4-6
(Continued)

Year	Category	Baseline Water Use (MGD)			Restricted Water Use (MGD)		
		Dry (Winter)	Wet (Summer)	Annual	Dry (Winter)	Wet (Summer)	Annual
2040	Residential	2.94	2.53	2.77	2.48	2.09	2.32
	Commercial	1.28	1.11	1.21	1.20	1.04	1.13
	Manufacturing	0.01	0.01	0.01	0.01	0.01	0.01
	Government	0.07	0.07	0.07	0.06	0.06	0.06
	Unaccounted	0.70	0.61	0.66	0.61	0.52	0.58
	Total Municipal	**5.00**	**4.33**	**4.72**	**4.37**	**3.72**	**4.10**
2050	Residential	3.18	2.74	2.99	2.64	2.21	2.46
	Commercial	1.37	1.20	1.30	1.28	1.11	1.21
	Manufacturing	0.02	0.02	0.02	0.01	0.01	0.01
	Government	0.07	0.07	0.07	0.06	0.06	0.06
	Unaccounted	0.76	0.66	0.71	0.65	0.55	0.61
	Total Municipal	**5.39**	**4.67**	**5.09**	**4.64**	**3.95**	**4.35**

Source: August 2003 Final Report – *Municipal and Industrial (M&I) Water Use Forecast, Initial Comprehensive Everglades Restoration Plan (CERP) Update.*

4.7 Forecasted Land Use Changes

Review of various local government comprehensive plan future land use maps has indicated that the portion of the project study located to the south of Lake Istokpoga is expected to remain primarily rural for the foreseeable future. Areas within the project study area that are located to the north of Lake Istokpoga are projected to remain a mix of largely rural and to a lesser extent urban for the predictable future.

Effective years for future land use maps for Glades and Okeechobee Counties range from 2007 to 2010. The Highlands County Future Land Use Map, which was approved in 2003, projects general land use changes through 2020. The Polk County Future Land Use Map, which was approved in 1992, projects land use changes in the county through 2010. In an effort to reflect 2050 without-project conditions for the LOW Project, city and county planners were asked to identify possible major land use changes in the project area to the extent possible based on projections made in the county future land use maps.

It should be noted that for developing future land use projections for areas located to the north and west of Lake Istokpoga, the land use map files were geospatially clipped to the project area and a cross-walking operation was performed to generalize and reduce the number of land use categories contained in the two counties' future land use maps. The land uses included within some categories in one county overlapped considerably with categories in the other county. This was particularly problematic with respect to the Preservation designation (in Highlands County) and the Recreation/Open Space designation (in Polk County), where the latter included preservation lands as well as recreation and open space.

Table 4-7 shows the correlation of land use categories as designated in the two counties' respective future land use maps (32 land use categories) with categories assigned for the LOW Project (11 land use categories).

Figures 4-4 and 4-5 show land use projections for the LOW Project study area. These maps are adapted from the approved comprehensive plan future land maps provided by the counties of Glades, Highlands, Polk, Okeechobee, Martin, St. Lucie, Charlotte, and DeSoto, and the City of Okeechobee. In addition to showing generalized future land use categories as contained in the original maps, both these figures also identify probable future urban transition areas (based on data provided by county planners), and existing and proposed conservation lands (based on available DEP and SFWMD GIS data).

TABLE 4-7
CORRELATION OF FUTURE LAND USE CATEGORIES

County	Future land uses as presented in the County Comprehensive Plan	Future land uses Generalized for the Project As?
Highlands	Agriculture (AU)	Agriculture/Rural Residential
	City (CITY)	Urban
	Conservation Management (CM)	Preservation
	Commercial (COMM)	Commercial/Services
	Commercial Mix (COMMIX)	Commercial/Industrial Mix
	Subdivisions (DRI)	Residential
	Existing Designation (ED)	Replaced with principal existing land use
	High Density Residential (HDR)	Residential
	Industrial (IND)	Industrial
	Low Density Residential (LDR)	Residential
	Medium Density Residential (MDR)	Residential
	Public Lands (PUB)	Institutional
	Public Water Supply (PW)	Utilities
Polk	Agriculture/Rural Residential (A/RR)	Agriculture/Rural Residential
	Convenience Centers (CC)	Commercial/Services
	Commercial Enclave (CE)	Commercial/Services
	Industrial (IND)	Industrial
	Institutional (INST-1)	Institutional
	Institutional (INST-2)	Institutional
	Lakes (LAKES)	Lakes
	Leisure/Recreation (LR)	Recreation/Open Space
	Neighborhood Activity Centers (NAC)	Commercial/Services
	Preservation (PRESV)	Preservation
	Rural Cluster Center (RCC)	Commercial/Services
	Rural Cluster Center- Residential (RCC-R)	Residential
	Residential – High Density (RH)	Residential
	Residential- Low Density (RL-1)	Residential
	Residential - Low Density (Rl-2)	Residential
	Residential – Low Density (RL- 3)	Residential
	Residential - Low Density (RL-4)	Residential
	Residential – Medium Density (RM)	Residential
	Recreation & Open Space (ROS)	Recreation/Open Space

Source: Polk County and Highlands County Comprehensive Plan Future Land Use Maps

4.7.1 Priority Basins

Agriculture is expected to comprise the predominant future land use throughout the four priority basins (***Figure 4-4*** and ***Table 4-8***), ranging between 81.0 and 92.7% of the individual basin areas. Conservation lands account for 5.1% of the basins and include SFWMD Save Our Rivers acquisitions along the Kissimmee River, Chandler Slough, the Kissimmee Prairie State Preserve, and the Ordway Whittell Kissimmee Prairie Sanctuary.

Rural lands transitioning to urban uses (the urban being primarily residential) are expected to account for 2.3%, followed by mixed urban uses (primarily commercial and residential), which account for 1.6%. Other land uses (residential, public/institutional lands, and power generation facilities) are projected to comprise less than one percent of the four priority basins.

The future urban and mixed urban/agricultural land uses extend outward from the City of Okeechobee, primarily along SR 70 and US 98. Basin S-154 is the most urbanized of the priority basins. This basin includes US 98 and SR 70 in unincorporated Okeechobee County west of the City of Okeechobee. The designated future urban land uses, for the most part, are conterminous with existing urbanized areas. Small pockets of primarily residential areas, however, are present in designated future agricultural lands in all four of the priority basins, primarily along the major roadways.

Okeechobee County planners identified one area of designated future agricultural land use in the northern portion of basin S-65D that may transition to urban uses. This area, the Vikings Subdivision (also known as the Coquina Water Control District), is an old platted subdivision encompassing approximately 22 square miles divided into 1.25-acre lots and consisting largely of poorly drained prairies and wetlands. As many as 13,693 acres could augment existing conservation lands if all currently proposed properties are acquired. The majority of this additional acreage consists of proposed SOR acquisitions along the Kissimmee River and Chandler Slough.

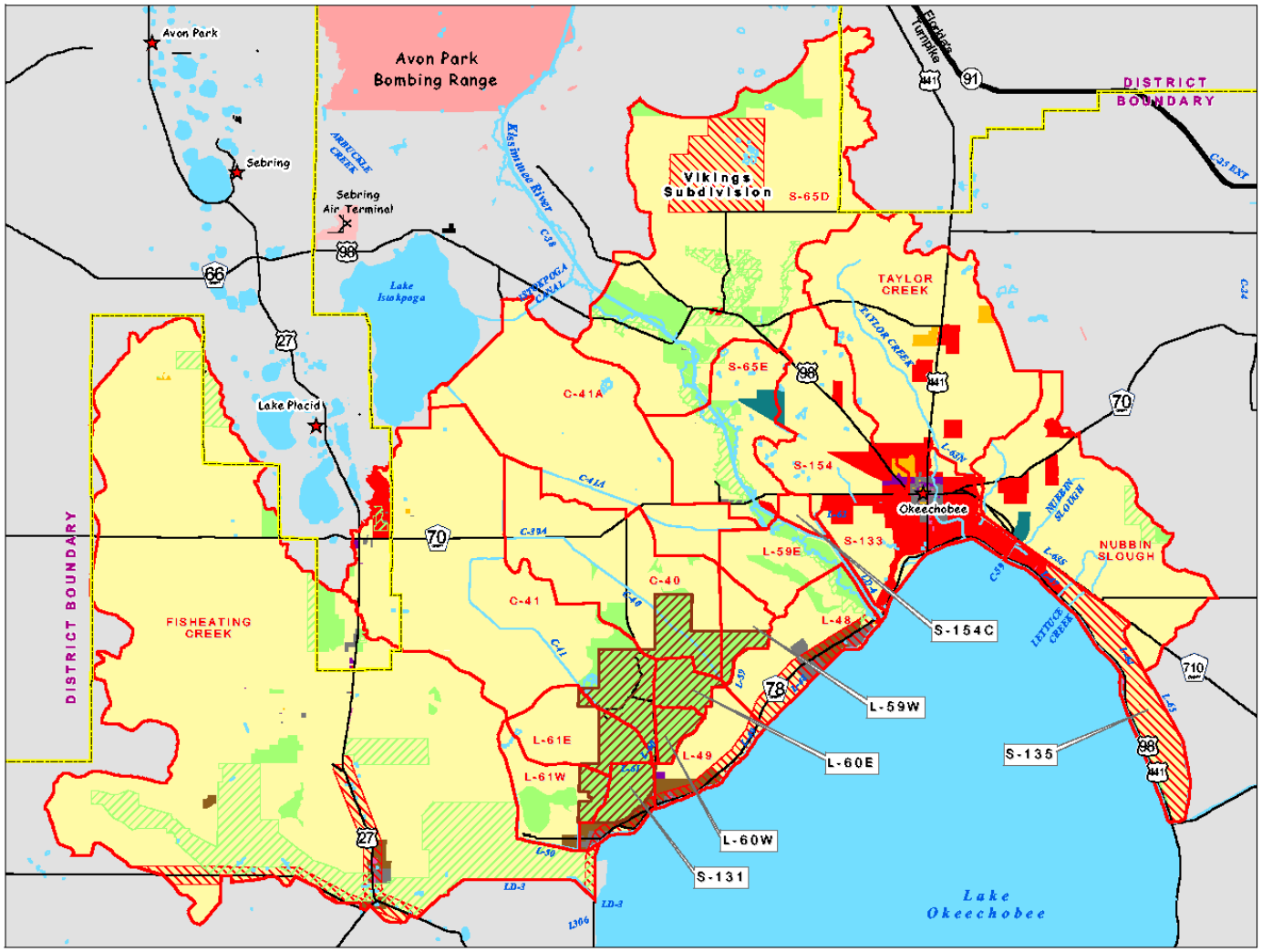


Figure 4-4
Future Land Use Projections For the Lower Portion of the LOW Project Study Area

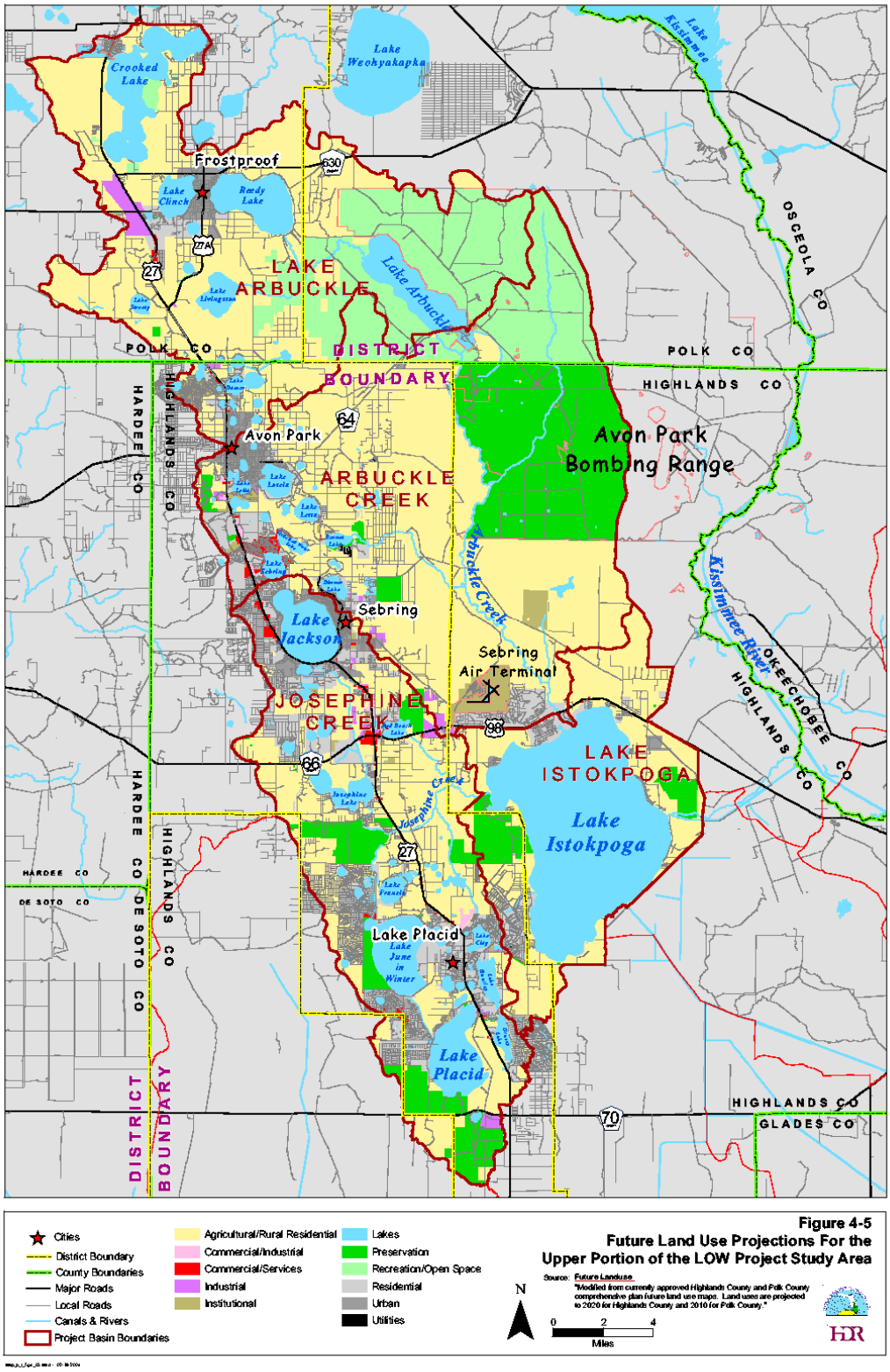


Figure 4-5
Future Land Use Projections For the Upper Portion of the LOW Project Study Area

Source: Future Landuse
"Modified from currently approved Highlands County and Polk County comprehensive plan future land use maps. Land uses are projected to 2020 for Highlands County and 2010 for Polk County."

TABLE 4-8
LAND USE PROJECTIONS – PRIORITY BASINS

Future Land Use Category	S-65D	%	TCNS	%	S-65E	%	S-154	%	Totals	%
Residential	121	0.1			294	1.0		0.0	415	0.1
Commercial										
Industrial							371	1.2	371	0.1
Public/Institutional Lands			1,152	1.0			300	0.9	1,452	0.5
Power Generation			759	0.6	1,362	4.7	526	1.7	2,648	0.9
Mixed Urban Uses			1,478	1.2	1	0.0	3,716	11.7	4,679	1.6
Rural Land in Transition	192	0.2	5,069	4.2	310	1.1	1,109	3.5	6,680	2.3
Agriculture	100,031	88.5	111,514	92.7	25,273	86.7	25,597	81.0	262,931	89.4
Native American Reservation										
Conservation	12,621	11.2	381	0.3	1,918	6.5			14,920	5.1
	112,965	100.0	120,353	100.0	29,158	100.0	31,619	100.0	294,096	100.0

Source: Local County Government Comprehensive Plan Future Land Use Maps

4.7.2 Other Basins South of Lake Istokpoga

Agriculture is expected to comprise the predominant future land use throughout the non-priority basins located south of Lake Istokpoga (***Figure 4-4*** *and* ***Table 4-9***). Agricultural land uses are expected to cover over 80% of these basins. Brighton Indian Reservation, located in Glades County near the northwest shore of Lake Okeechobee, encompasses 58.5 square miles and includes portions of eight basins. Conservation lands (including portions of the Archbold Biological Station, CARL's Lake Wales Ridge Ecosystem acquisitions, and SFWMD's Save Our Rivers existing and proposed acquisitions along Fisheating Creek and the Kissimmee River) account for 7.2% of these basins.

Future land uses of minor extent, in decreasing order of coverage, include mixed urban uses (2.8%), rural land in transition (1.5%), residential (0.9%), commercial (0.2%), industrial (0.1%), and public/institutional lands (0.1%). Although the designated future urban land uses, for the most part, are conterminous with existing urbanized areas, scattered urban uses (primarily residential) are present in designated future agricultural lands in all four of the priority basins [S-65D, S-65E, S-154, and S-191 (Taylor Creek/Nubbin Slough)], particularly along the Lake Wales Ridge area and along SR 721 within the Brighton Indian Reservation.

Glades County is proposing a large-scale comprehensive amendment to its future land use map. The proposed amendment greatly enlarges the existing "Transitional" category, a mixed-use designation allowing residential, commercial, and industrial land uses. If approved by Florida Department of Community Affairs, approximately 15 square miles of the project watershed would be affected, in particular those sections paralleling US 27 and SR 75 in the Fisheating Creek basin, and SR 78 along the northwestern shore of the lake (these area are included within the Urban Transition Areas on ***Figure 4-4***).

Okeechobee County planners identified the S-135 basin area as potential future urban transition. Highlands County has an estimated 91,000 platted lots available for development. With the exception of golf course developments, the County anticipates that future urban expansion over the next several decades will occur in these areas. As much as 54,000 acres could augment existing conservation lands if all currently proposed properties are acquired. The bulk of this additional acreage consists of proposed SOR acquisitions along Fisheating Creek.

TABLE 4-9
LAND USES PROJECTIONS – NON-PRIORITY BASINS SOUTH OF LAKE ISTOKPOGA

Future Land Use Category	Acreage	%
Residential	5,884	0.9
Commercial	1,115	0.2
Industrial	765	0.1
Public/Institutional Lands	798	0.1
Power Generation	0	0.0
Mixed Urban Uses	17,220	2.8
Rural Land in Transition	8,470	1.4
Agriculture	503,788	81.3
Native American Reservation	37,475	6.0
Conservation	44,817	7.2
Totals	620,332	100.0

Source: Local County Government Comprehensive Plan Future Land Use Maps

4.7.3 Basins North of Lake Istokpoga

Arbuckle Creek Basin – This basin occupies portions of northern Highlands and southern Polk county line. Agricultural/rural residential land uses are expected to continue to be the predominant land use in the Arbuckle Creek basin, accounting for over 50 percent of the basin area (***Figure 4-5 and Table 4-10)***. Lands designated as preservation (by Highlands County) and much that has been designated Recreation/Open Space (Polk County) will account for nearly 34 percent of the basin, with most of that being the western portion of the Avon Park Air Force Range. Approximately 6,683 acres of land are currently proposed for acquisition in this basin.

Urban and urban-related land uses (e.g., residential, commercial and services, industrial, institutional, and utilities) collectively account for approximately 12 percent of the basin area. New urban land uses are planned to expand outward from the existing urban centers of Avon Park and Sebring and along US 27 and US 98.

Josephine Creek Basin – This basin is located entirely in Highlands County. Agricultural/rural residential land uses will remain the primary land use in the basin, accounting for roughly 44 percent of the area (***Figure 4-5*** *and* ***Table 4-10)***. Preservation lands will cover nearly 11 percent of the basin, and could increase to as much as 16 percent depending on the amount of proposed conservation lands (6,674 acres) that are acquired.

Urban and urban-related land uses collectively account for 25 percent of the basin. New urban areas are planned to expand outward from the existing urban centers of Sebring and Lake Placid and along US 27 and SR 66.

Lake Arbuckle Basin – This basin is located primarily in southern Polk County, with a small southerly portion extending into northern Highlands County. Agricultural/rural residential land uses will continue as the primary land use in the basin, accounting for approximately 48 percent of the area (***Figure 4-5 and Table 4-10)***. Nearly one-quarter of the basin is designated as Recreation/Open Space (Polk County) and Preservation lands (Highlands County), with most of that being the northwestern portion of the Avon Park Air Force Range.

If all of the proposed 10,172 acres of proposed conservation lands within the basin are acquired, preservation lands would grow another 9.6 percent. Urban and urban-related land uses collectively account for approximately 11 percent of the basin area. New urban areas are planned to expand in the areas of south of Frostproof and north of Avon Park, and along US 27 and adjoining arterial roadways.

Lake Istokpoga Basin – This basin is located entirely in Highlands County. Agricultural/rural residential land uses are anticipated to remain the principal land use in the basin accounting for 38.3% of the area (***Figure 4-5 and Table 4-10)***. Approximately seven percent of the basin is designated Preservation. As much as 1,871 acres of land are currently proposed for acquisition, which would increase that percentage to slightly over 10 percent of the basin.

Nearly half of the basin is taken up by lakes, most notably Lake Istokpoga. Urban and urban-related land uses collectively account for seven percent of the basin area. New urban areas are planned to expand near the northern and southwestern shore of Lake Istokpoga, in the vicinity of the Spring Lake community and Highland Park Estates, respectively.

TABLE 4-10
LAND USE PROJECTIONS – BASINS NORTH OF LAKE ISTOKPOGA

Future Land Use Category	Arbuckle Creek		Josephine Creek		Lake Arbuckle		Lake Istokpoga	
	Acres	%	Acres	%	Acres	%	Acres	%
Agriculture/Rural Residential	69,680	51.3	40,196	44.1	51,178	48.1	21,688	38.3
Commercial/Industrial	244	0.2	420	0.5	43	0.0	0	0.0
Commercial/Services	1,206	0.9	1,268	1.4	257	0.2	77	0.1
Industrial	602	0.4	861	0.9	1,280	1.2	0	0.0
Institutional	4,192	3.1	567	0.6	1,492	1.4	83	0.1
Lakes	3,603	2.7	15,688	17.2	17,009	16.0	26,988	47.7
Preservation	28,934	21.3	9,865	10.8	78	0.1	4,001	7.1
Recreation/Open Space	16,956	12.5	0	0.0	26,235	24.7	0	0.0
Residential	7,789	5.7	19,724	21.6	6,049	5.7	3,243	5.7
Urban	2,666	2.0	2,603	2.9	2,734	2.6	545	1.0
Utilities	0	0.0	6	0.0	0	0.0	0	0.0
TOTALS	135,873	100.0	91,198	100.0	106,356	100.0	56,624	100.0

Source: Polk County and Highlands County Comprehensive Plan Future Land Use Maps

4.8 Forecasted Ecological Conditions

The ecological health of the LOW Project study area is likely to show substantial improvements over the planning horizon. In large part, these improvements will result from numerous ongoing and planned non-CERP habitat restoration and enhancement projects that are expected to be completed over the foreseeable future. Planned and ongoing habitat restoration and enhancement initiatives within the LOW include:

- Wetland and upland restoration/enhancement projects,
- Construction of surface water storage facilities,
- Public and private conservation land acquisition programs,
- Water quality improvement programs,
- Listed species recovery and habitat protection plans, and
- Regulation schedule modifications.

4.8.1 Wetland and upland restoration/enhancement projects

Many different ongoing and planned projects are seeking to restore and/or enhance degraded wetlands and native uplands within or adjacent to the LOW. Some of the more significant efforts are described below.

The Kissimmee River Restoration Project (KRRP) – which lies upstream and partially within the project study area, is expected to result in substantial hydrological and ecological benefits to the LOW. The KRRP was authorized by Congress in the 1992 Water Resources Development Act (WRDA) and is being implemented as a joint partnership between the SFWMD and the USACE (Jacksonville District).

The project is divided into two components: the Upper Basin (Headwaters Revitalization) and the Lower Basin (Kissimmee River Restoration). The Upper Basin involves modification to the operation of the lakes, canal improvements, and land acquisition for Lakes Kissimmee and Hatchineha, and Cypress Lake north of State Road 60. Structural modifications include enlargements of canals 36 and 37.

The Lower Basin efforts extend southwards from the outlet of Lake Kissimmee and include land acquisition, restoration of natural flooding in the historic floodplain to reestablish wetland conditions, and structural modifications such as backfilling about 22 miles of C-38 canal, excavation of about 9 miles of new river channel to provide hydrologic connection, and removal of two water control structures and locks.

When completed the project is expected to restore over 40 square miles of river/flood plain ecosystem including 43 miles of meandering river channel

and 27,000 acres of wetlands. Reestablishment of the flood plain and the associated nutrient filtration function is expected to result in decreased nutrient load to Lake Okeechobee. Also, the restored floodplain wetlands will provide habitat for more than 320 fish and wildlife species including key avian species, such as wading birds and waterfowl, by providing increased feeding and breeding habitat and refuge during adverse conditions.

Phase I of the KRRP has been completed and Phase II is currently underway. To date the KRRP has restored an estimated 47,300 acres in the S-65C and S-65B basins, including 25,000 acres within the Kissimmee Prairie Preserve State Park. The project is expected to be completed by early 2012.

Lake Okeechobee Water Retention/Phosphorus Removal Program – Funded jointly by the USACE and the SFWMD, this critical restoration project has two primary objectives. The first is to improve water quality north of Lake Okeechobee through the construction of two stormwater treatment areas in Taylor Creek/ Nubbin Slough basin. Creation of constructed wetlands is likely to provide habitat for fish and wildlife, albeit of somewhat lesser functional value (due to low dissolved oxygen, habitat homogeneity, and low diversity and abundance of benthic macroinvertebrate populations).

The second objective of this project is to increase local water storage, improve water quality and provide enhanced habitat through restoration of approximately 375 acres of isolated degraded wetlands in the S-154 subbasin. Restored wetlands are likely to provide enhanced habitat for a variety of fauna and flora.

Both the STA and the restored wetlands components are anticipated to improve water quality, which in turn has significant positive impact on the ecological health of the ecosystem.

Lake Okeechobee Isolated Wetlands Restoration and Creation Program – This SFWMD-sponsored voluntary landowner cost-sharing program encourages and assists landowners to restore isolated wetlands that have been converted to other uses. The primary goal of the program is to reduce phosphorus loadings to Lake Okeechobee by restoring isolated wetlands. Secondary goals include helping land owners meet regulatory requirements, while restoring wildlife habitat and retaining storm water flows to the lake. The program is administered by the SFWMD in cooperation with a multi-agency team that includes the Florida Department of Agriculture and Consumer Services (FDACS), Florida Department of Environmental Protection (FDEP), USDA Natural Resources

Conservation Service (NRCS), U.S. Fish & Wildlife Service (USFWS), and University of Florida, Institute of Food and Agricultural Science (IFAS).

Approximately 410 acres of wetlands located within the boundaries of the Kirton Ranch were restored under this project. This ranch is located approximately six miles north east of Lake Okeechobee off State Highway 70. About 170 acres of the restoration area still exists as native wetlands, of which two-thirds is comprised of herbaceous freshwater marsh. The other one-third is made up of forested swamp.

Construction elements completed by March 2004 included earthen ditch plugs, low berms, a pair of culvert risers for a weir which backs up water to restore the historical wetland foot print, and 2 shallow spreader swales to divert water from ditches into the wetlands. Water quality stations are currently being installed to measure P concentrations and water flow to give us the P load reduction being accomplished by the restoration project. Additional work completed at this site includes removal of exotic vegetation, constructing fencing around the easement area, and vegetation monitoring for mapping out the wetland ecotones.

Future plans for this project include yearly spraying of exotics by the landowner, one year of water quality monitoring, and yearly vegetation monitoring to track the growth of the wetland. By restoring historical hydrology to the Lake Okeechobee watershed wetlands in a natural way, water will be treated and retained while preserving wildlife habitat.

The Lake Istokpoga Environmental Enhancement Project – This multiagency (FFWCC, SFWMD, FDEP, USACE, and Highlands County) cooperative effort was completed in 2001. It included a drawdown of Lake Istokpoga followed by removal and consolidation of exotic vegetation and organic matter into islands within the littoral zone of the lake. It is expected that the estimated 1,300 acres of shoreline restored through this effort will provide improved habitat for fish and wildlife. Exotic species management was implemented after the completion of this project and will continue as needed (Furse and Davis, 2002).

The Wetland Reserve Program – This NRCS-funded Wetland Reserve Program has acquired a 30-year easement on 543 acres of land in the uppermost part of the watershed, west–northwest of Lake Arbuckle (Steve Schubert, USFWS; personal communication; January 2004). Additional wetland restoration efforts are also on going at the Buck Ranch Site.

Royce Property Restoration Project – Hydrological restoration is proposed to be performed on this 2,600 acre property by the FFWCC, in conjunction with the SFWMD, to convert currently existing pastureland into Cutthroat grass wetlands. The property is located four miles west of

Lake Istokpoga (Kevin Main, FFWCC; personal communication; January 2004).

Jack Creek Hydrologic Restoration Project – Sponsored by the SFWMD, this project includes performing hydrologic restoration in the Jack Creek area to restore high water flow into neighboring wetlands. A 5,268 acres study area within the watershed, which is located on the west side of Crooked Lake and the Eastern Side of Lake Baffum has been proposed for restoration activities (K. Kolasa, SWFWMD; personal communication; January 2004).

The Lake Wales Ridge Conservation Lands Hydrologic and Water Quality Restoration – This SWFWMD-funded study will assess conservation lands along the Lake Wales Ridge for the purpose of hydrologic restoration, water quality improvement, and habitat re-establishment. The lands to be evaluated include lands held in public ownership or in ownership by private conservation organizations.

4.8.2 Construction of surface water storage facilities

Nubbin Slough RASTA Project – The Reservoir component of this project is one of the larger surface water storage facilities that will be constructed in the project study area through a non-CERP funding mechanism. The reservoir and expanded STA should provide water storage, additional water quality improvements and increased habitat for wading aquatic fauna and flora including wading birds, fish, etc.

4.8.3 Conservation land acquisition programs

Major conservation land acquisition efforts have been underway in the project study area for the past several years and are expected to continue into the foreseeable future. Nearly 60,000 acres have already been acquired under the Save Our Rivers (SOR) and Conservation and Recreation Lands (CARL) programs, and an additional 68,000 acres of land is proposed for acquisition. Most of this land is located along Fisheating Creek and the Kissimmee River, or is part of the Brighton Indian Reservation. Significant acreage has also been, or may be, acquired along Chandler Slough and Paradise Run, within the Kissimmee prairie and Southern Lake Wales Ridge ecosystems.

By the next decade, if most the proposed acquisitions are realized, almost 130,000 acres (almost 15% of the project study area located south of Lake Istokpoga) will be public conservation lands. In addition to public holdings, thousands of acres of privately-owned land have been designated as Wildlife and Environmental Areas (WEA) and are open to the public for

hunting and other recreational uses. WEAs in the project study area include:

- Fisheating Creek WEA – 18,272 ac; owned by the State of Florida
- Kissimmee River Public Use Area – 21,502 ac
- Fisheating Creek Conservation Easement – 41,525 ac; privately owned; no public access
- Platt Branch Mitigation Park Wildlife and Environmental Area – 1,973 ac; managed by the FWC
- Lake Wales Ridge Wildlife and Environmental Area - 12,910 ac; owned by the State of Florida
- Arbuckle Wildlife Management Area – 13,531 ac; owned by the Florida Division of Forestry.

North of Lake Istokpoga, approximately 102,422 acres have been protected or acquired by Federal (Air Force, USFWS), State (FFWCC, CARL, SOR), County (Polk and Highlands), and private (Nature Conservancy) organizations. An additional 35,898 acres of land have been recently acquired or proposed for acquisition.

Significant acreage has also been acquired and proposed through the Florida Forever Program (CARL) in the Lake Wales Ridge Ecosystem (***Table 4-10***). This project consists of separate sites along the Lake Wales Ridge, which are intended to be part of a system of managed areas that conserve the character, biodiversity, and biological function of the ancient scrubs of the Ridge as well as lakefront, swamps, blackwater streams, pine flatwoods, seepage slopes, hammocks, and sandhills. Seventy-five rare elements of occurrence (FNAI) have been documented in this diverse ecosystem.

The Lake Wales Ridge Ecosystem is included within the USFWS Lake Wales Ridge National Wildlife Refuge, which is a top priority endangered species project of the Service. The Multi-Species Recovery Plan (USFWS, 1999) identifies management plans for the many threatened and endangered species within the Lake Wales Ridge Ecosystem, and should help the preservation and recovery of those species.

Other acquisitions within the Lake Istokpoga Watershed (***Table 4-10***) include Royce property (FFWCC), which comprises 2,600 acres and 4 miles of shoreline on the west side of Lake Istokpoga near Josephine Creek. The Nature Conservancy, under the Florida Lands and Outstanding Waters (FLOW) program has recently acquired 3,362 acres along the western shore of Arbuckle Creek which is located approximately one-third of the way down the creek toward Lake Arbuckle. Highlands County and the Nature Conservancy have proposed the acquisition of 2,315 acres of the

Carter Creek property on the east side of the Lake Wales Ridge (C. Ford, HSWCD, pers. comm., January 2004).

4.8.4 Water quality improvement programs

Numerous water quality improvement programs have already been initiated or proposed for the Okeechobee watershed. Significant ones include:

- Legislative efforts such as the PLRGs and TMDLs,
- Regional and watershed planning (e.g., Lake Okeechobee SWIM, USFWS's Multi-species Recovery Plan),
- Regulatory programs (e.g., WOD, Dairy Rule, and Lake Okeechobee Protection Permits, and
- Non-regulatory programs (e.g., Dairy BATs, Phosphorus Source Control Grant Program, Private-Public Partnership, Former Dairy Remediation)

While the primary benefit from these programs is likely to be improvements in surface water quality, this should directly translate into enhanced habitat fauna and flora and result in overall improvements to the ecological conditions in the project study area. Listed species recovery and habitat protection plans

Taken together, the Lake Okeechobee SWIM program, the Multi-Species Recovery Plan (USFWS, 1999), the Lake Okeechobee Protection Plan, and other current and planned programs should help restore degraded fish and wildlife habitat not only in the watershed but also within the lake's littoral zone.

4.8.5 Regulation schedule modifications

The Water Supply and Environment (WSE) lake regulation schedule, implemented in July 2000, and the adaptive management protocols were developed with the intention of reducing the undesirable effects of extreme high and low lake stages with the lake's littoral zone. Also, one of the goals of the SFWMD's Lake Okeechobee SWIM Plan is to protect and enhance the biological diversity, ecological functions and the distribution and abundance of native plants and animals.
The continued implementation of the SWIM Plan could effect marked improvements in the ecological conditions of areas in the immediate vicinity of the lake. Specifically, the SWIM plan seeks to identify the range of lake levels that are conducive to healthy submerged and emergent native plants and dependent fish and wildlife communities,

For areas located north of Lake Istokpoga, the Upper Chain of Lakes Integrated Feasibility Study has evaluated the regulation schedules for the Kissimmee Chain of Lakes and may improve fish and wildlife habitat of the area. The Lake Istokpoga Environmental Enhancement Project, a FFWCC project in partnership with the SFWMD, FDEP, USACE, and Highlands County, was completed in 2001. Drawdown of the lake and subsequent removal of exotic vegetation has helped restore an estimated 1,300 acres of shoreline habitat for fish and wildlife.

4.9 Forecasted Demographic Data

The projections presented in this assessment are based on the existing demographic data for the project watershed developed from the 2000 Census block level data for Glades, Highlands, Okeechobee, and Polk Counties. The projections from the year 2000 to 2030 are based on extrapolations of projections identified by the Florida Bureau of Economic and Business Research (BEBR) presented in the *Florida Statistical Abstract 2001* and *Population Projections by Age, Gender and Race for Florida and Its Counties, 2001-2020*. Projections from the year 2030 to 2050, where presented, are based on trends identified in the BEBR data.

Demographic data forecasts are presented in two discrete sections. Section 4.8.1 presents data for the area shown in ***Figure 4-6***. This area includes portions of Okeechobee, Glades and portions of Highlands Counties (located southeast of Lake Istokpoga) that lie within the project study area. Section 4.8.2 presents data for areas shown in ***Figure 4-7***, which includes portion of Highlands County (located west and north of Lake Istokpoga) and Polk Counties that are included in the project study area.

4.9.1 Demographic Forecasts for Lower Half of the Project Study Area

This section contains forecasts for areas shown in ***Figure 4-6***.

4.9.1.1 Population Projections

Table 4-11 shows the population projections for the project watershed by County for the years 2010 to 2050. Overall the population within the project study area is projected to grow approximately 66% between the year 2000 and the year 2050. This projected rate of growth is slower than the State of Florida's rate of growth.

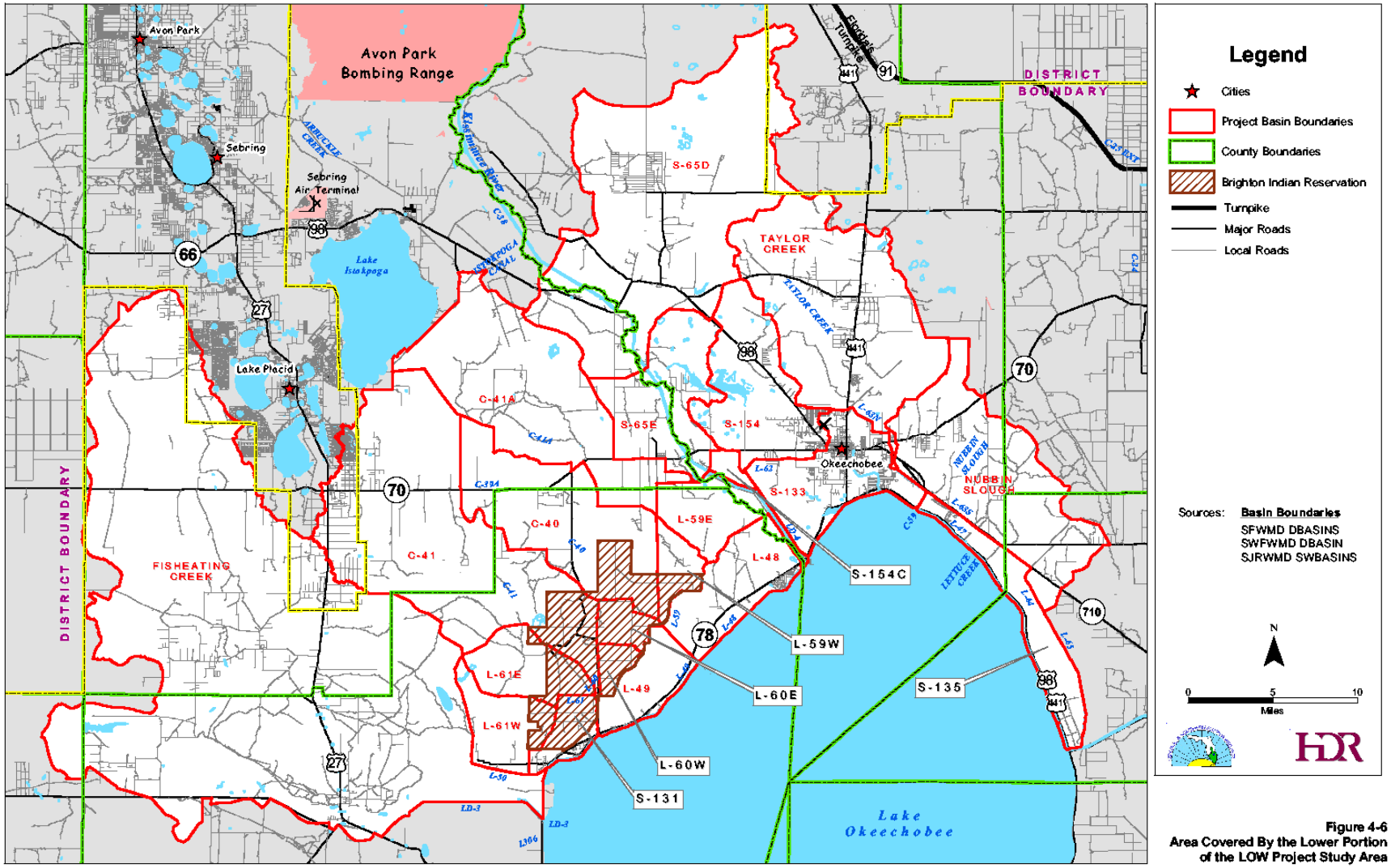


Figure 4-6
Area Covered By the Lower Portion of the LOW Project Study Area

This comparison is based on the medium population projections for the State of Florida through the year 2030 as presented in the 2001 *Florida Statistical Abstract*. Based on these projections, the State of Florida is anticipated to grow approximately 53% between 2000 and 2030. In comparison, the projections below indicate that the project study area is anticipated to grow approximately 36% between the years 2000 and 2030. This is primarily due to the rural/agricultural nature of the project watershed including only one true urban area, Okeechobee City.

TABLE 4-11
POPULATION PROJECTIONS – LOWER PORTION OF THE PROJECT STUDY AREA

Year	Total Project Study Area Population	Okeechobee County Population	Highlands County Population	Glades County Population
Existing (2000)	54,789	35,910	10,748	8,131
2010	60,900	39,800	12,000	9,100
2020	67,900	44,200	13,500	10,200
2030	74,400	48,300	14,900	11,200
2040	82,400	53,300	16,600	12,500
2050	91,300	58,800	18,500	14,000

Source: BEBR Population Projections 2000-2020, modified.

As identified in ***Table 4-11***, the greatest increase in population will be in Okeechobee County with an estimated population increase of 22,900 people. The population of Highlands and Glades Counties within the project watershed is estimated to increase by 7,700 and 5,900 people, respectively.

Seasonal Residents – Within the study area, seasonal residents primarily affect the population within Okeechobee County. According to the Okeechobee County Comprehensive Plan, the population of the overall county increases approximately 43% during peak seasonal months. The County's Comprehensive Plan also projected this increase in population due to seasonal residents at 42% in the year 2005.

Future seasonal population projections through 2050 will assume a 42% increase in population within Okeechobee County thereby bringing the peak population of the county to 43,780 in 2010, 62,764 in 2020, 68,586 in 2030, 75,686 in 2040, and 83,496 in 2050.

4.9.1.2 Age Distribution Projections

The future age distribution projections are based on extrapolations of projections from BEBR's *Population Projections by Age, Sex, and Race for Florida and Its Counties, 2001-2020*. ***Table 4-12*** provides projections of the population's age distribution through the year 2020.

The age distribution projections for the project watershed indicate that overall the population in this area will be getting older between the year 2000 and the year 2020. The percentages of the population under the age of 18 and between the ages 18 to 64 are projected to decline slightly from 24% to 22% and from 59% to 55%, respectively. The percentage of the population in the project watershed over 65 years of age is projected to increase from 17% to 23% of the population.

TABLE 4-12
AGE DISTRIBUTION PROJECTIONS – LOWER PORTION OF THE PROJECT STUDY AREA

Age Distribution	2000		2010		2020	
	Pop.	%	Pop.	%	Pop.	%
Total – Lower Portion of the Project Study Area						
Under 18	13,258	24%	13,938	23%	15,105	22%
18 – 64	32,131	58%	35,168	58%	37,285	55%
65 and Over	9,400	17%	11,794	19%	15,510	23%
Okeechobee County						
Under 18	9,089	25%	9,711	24%	10,608	24%
18 – 64	20,985	59%	22,686	57%	23,515	53%
65 and Over	5,836	16%	7,403	19%	10,077	23%
Highlands County						
Under 18	2,365	22%	2,400	20%	2,565	19%
18 – 64	6,341	59%	7,080	59%	7,830	58%
65 and Over	2,042	19%	2,520	21%	3,105	23%
Glades County						
Under 18	1,804	22%	1,827	20%	1,932	19%
18 – 64	4,805	59%	5,402	59%	5,940	58%
65 and Over	1,522	19%	1,871	21%	2,328	23%

Source: BEBR, *Population Projections by Age, Sex, and Race for Florida and Its Counties, 2001-2020,* modified to the Project Watershed.

Based on these projections, the greatest change in the age distribution between the year 2000 and 2020 will occur in Okeechobee County. In Okeechobee County, the projections indicate that while the percentage of the population under the age of 18 will remain fairly consistent, the population over the age of 65 is projected to increase from 16% of the population to 23% in the year 2020. In Highlands and Glades Counties, the projections also indicate that the population will get older.

However, it appears that this aging of the population will be at a more gradual rate. One reason why the population of Okeechobee County is projected to age at a faster rate is the appeal this area has to the retirement population with the recreation associated with Lake Okeechobee and the presence of the urban Okeechobee City. In contrast, the portions of the project watershed in Highlands and Glades Counties are more rural and tend to be more agricultural and less appealing to

retirees. Overall the projected age distribution of the project watershed is consistent with the projected age distribution for the State of Florida.

Because of the uncertainty and limitations in available data, actual age distribution projections for the years 2030 to 2050 have not been calculated. However, it is reasonable to assume that the exchange of the population age 65 and older will increase. This assumption is reasonable to make given the movement of the baby boomer generation into this age cohort and the national trend of an extended life expectancy.

4.9.1.3 Sex Distribution Projections

Sex distribution projections for the project watershed were calculated for the years 2010 and 2020, based on an extrapolation of projections provided by BEBR. These projections indicate that in Okeechobee County the percentage of males will decrease from 54% of the population in the year 2000 to 52% in the year 2020. The projections for both Glades County and Highlands County indicate that the percentage of males will decrease from 55% of the population in the year 2000 to 52% in the year 2020. As a result, the percentage of females in the project watershed is projected to increase from 46% (Okeechobee County) and 45% (Glades and Highlands Counties) to 48% for all three counties in the year 2020.

The sex distribution projections for the State of Florida indicate the opposite of these findings. Currently, the State of Florida population is comprised of 51% of females and 49% males. This distribution is projected to remain consistent through the year 2020, according to the BEBR projections.

As with the age distribution projections, because of uncertainty and limitations in available data, actual sex distribution projections for the years 2030 to 2050 have not been calculated. However, it is reasonable to assume that the sex distribution within the project watershed will be consistent with the 2020 sex distribution projections stated above.

4.9.1.4 Race and Ethnicity Projections

Projections for race distribution were calculated for the years 2010 and 2020, based on an extrapolation of projections provided by BEBR. Projections were developed for two race categories, white and non-white and the results are summarized in ***Table 4-13***.
The projections indicate that the percentage of the white population will be slightly decreasing in the project watershed from 81% to 78% between the year 2000 and 2002. Therefore, the non-white population is

projected to increase from 19% to 22% within the project watershed between the year 2000 and 2020. This trend is primarily influenced by the projections for Okeechobee County. The projections indicate that the racial distribution of the county will change from 79% white and 21% non-white in 2000 to 75% white and 25% non-white in the year 2020.

The racial distribution projections for both Highlands and Glades Counties indicate a slight increase in the white population from 88% and 78%, respectively, in the year 2000 to 89% and 79%, respectively, in the year 2020. The non-white population in Highlands and Glades Counties are projected to decrease slightly from 12% and 22%, respectively, in the year 2000 to 11% and 21%, respectively, in the year 2020.

The State of Florida race distribution projections are the same as those for Okeechobee County. Therefore, the overall project watershed's racial distribution projections to the year 2020 are consistent with the State's projection with a slight decrease in the white population and a slight increase in the non-white population.

TABLE 4-13
RACE DISTRIBUTION PROJECTIONS – LOWER PORTION OF THE PROJECT STUDY AREA

	2000		2010		2020	
	Person	**%**	**Persons**	**%**	**Persons**	**%**
Total – Lower Portion of the Project Study Area						
White	44,347	81%	48,435	79%	53,267	78%
Non-White	10,442	19%	12,465	21%	14,633	22%
Okeechobee County						
White	28,468	79%	30,566	77%	33,194	75%
Non-White	7,442	21%	9,234	23%	11,006	25%
Highlands County						
White	9,479	88%	10,680	89%	12,015	89%
Non-White	1,269	12%	1,320	11%	1,485	11%
Glades County						
White	6,400	78%	7,189	79%	8,058	79%
Non-White	1,731	22%	1,911	21%	2,142	21%

Source**:** BEBR, *Population Projections by Age, Sex, and Race for Florida and Its Counties, 2001-2020,* modified to the Project Watershed.

This trend of an increasing number of the non-white population is anticipated to continue between 2020 and 2050. However, because of uncertainty and limitations of the data available, calculations have not been included as to the exact percentages for the years 2030, 2040, and 2050.

According to the 2000 US Census, the national Hispanic population grew from 22 million to 35 million between 1990 and 2000. Statistics show that the Hispanic population has a higher birth rate and immigration

rates than other minorities. Therefore, this phenomenal growth is anticipated to continue in the future. Florida, particularly the South Florida region, has a large Hispanic population. The Hispanic population in Okeechobee, Highlands, and Glades Counties increased 6.8%, 7%, and 7.1%, respectively, between 1990 and 2000.

No current future projections for the State of Florida or individual counties have been completed. Projections for the Hispanic populations increase within the project study area were developed based on the above level of growth consistency between 2000 and 2050. Overall Hispanic population within the study area is anticipated to increase 39.4% between 2000 and 2050 (***Table 4-14)***.

TABLE 4-14
HISPANIC POPULATION PROJECTIONS – LOWER PORTION OF THE PROJECT STUDY AREA

Year	Total Study Area Population	Okeechobee County Population	Highlands County Population	Glades County Population
2000	9,995	6,684	2,255	1,056
2010	10,683	7,139	2,413	1,131
2020	11,417	7,624	2,582	1,211
2030	12,201	8,142	2,762	1,297
2040	13,041	8,696	2,956	1,389
2050	13,938	9,287	3,163	1,488

Source: US Census, 2000, modified to project 2010-2050.

4.9.1.5 Household Size and Number of Households Projections

The number of household projections and average household size projections are based on data from the BEBR that has been extrapolated for the project watershed to the year 2020. Average household size projections after the year 2020 were held constant due to the uncertainties in projecting this element.

The average household size for each of the counties within the project watershed is projected to decline between the year 2000 and 2050. For Okeechobee County, the existing average household size is 2.7 and is projected to decrease to 2.6 in 2010, 2.5 in 2020, 2.4 in 2030, and will continue to be 2.4 through 2050. For Highlands and Glades Counties, the existing average household size is 2.5 and is projected to decrease to 2.4 in 2020 and to 2.3 in 2030. The average household size in these counties is anticipated to remain at 2.3 through 2050.

In Okeechobee County, the total number of households is anticipated to increase from 12,600 in 2000 to 24,500 in 2050. In Highlands County, the total number of households is anticipated to increase from 4,300 in

2000 to 8,000 in 2050. Finally, in Glades County, the total number of households is anticipated to increase from 3000 in 2000 to 6000 in 2050.

4.9.1.6 Housing Projections

Within the project watershed, the number of housing units are anticipated to double between 2000 and 2050, based on the projected increase in the number of households identified in Section 5.3.6. Most of this growth is anticipated to occur in those areas designated as Urban on the Future Land Use Projections Map (***Figure 4-4*** *and* ***Figure 4-5***).

4.9.2 Demographic Forecasts for Upper Portion of the Project Study Area

This section contains forecasts for areas shown in ***Figure 4-6***.

4.9.2.1 Population Projections from 2000 to 2050

Table 4-15 presents the population projections for the project study area shown in ***Figure 4-6*** by County for the years 2010 to 2050. Overall the population growth within the project watershed is projected to double between the year 2000 and the year 2050. This projected rate of growth is faster than the State of Florida's rate of growth. This comparison is based on the medium population projections for the State of Florida through the year 2030 as presented in the 2001 *Florida Statistical Abstract*.

Based on these projections, the State of Florida is anticipated to grow approximately 53% between 2000 and 2030. In comparison, the projections below indicate that the project watershed is anticipated to grow approximately 55% between the years 2000 and 2030. This is primarily due to the urban/residential nature of portions of the project watershed including the five incorporated municipalities of Lake Placid, Sebring, Avon Park, Frostproof, and Hillcrest Heights.

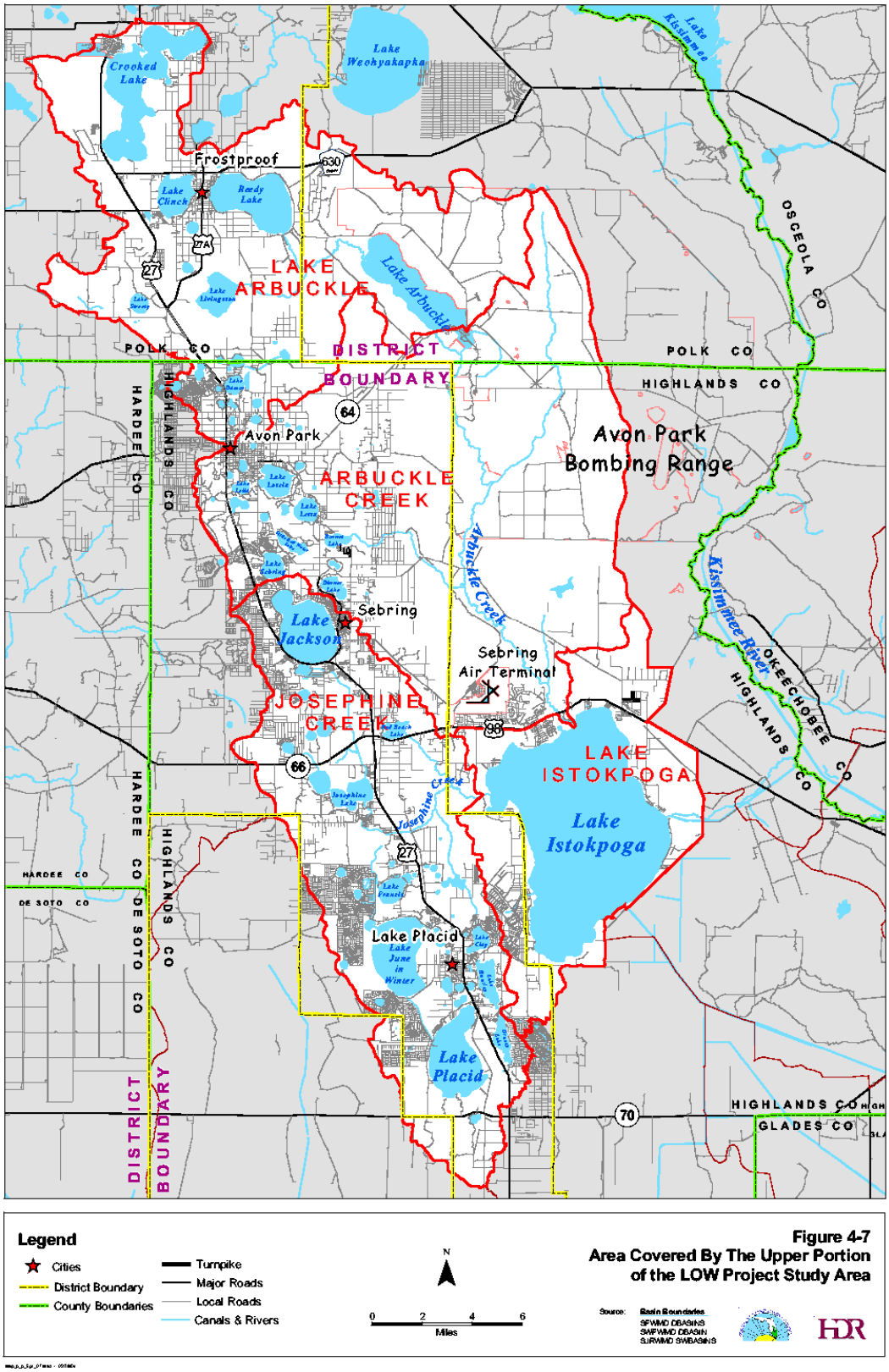


Figure 4-7
Area Covered By The Upper Portion of the LOW Project Study Area

TABLE 4-15
POPULATION PROJECTIONS – UPPER PORTION OF THE PROJECT STUDY AREA

Year	Total Study Area Population	Highlands County Population	Polk County Population
Existing (2000)	96,780	82,301	14,479
2010	113,910	96,868	17,042
2020	132,685	112,834	19,851
2030	150,009	127,567	22,442
2040	173,623	147,648	25,975
2050	201,109	171,022	30,087

Source: BEBR Population Projections 2000-2020, modified.

As identified in ***Table 4-15***, the greatest increase in population will be in Highlands County with an estimated population increase of 88,700 people. The population of Polk County within the project watershed is estimated to increase by 15,600.

4.9.2.2 Age Distribution Projections from 2000 to 2050

The future age distribution projections are based on extrapolations of projections from BEBR's *Population Projections by Age, Sex, and Race for Florida and Its Counties, 2001-2020.* ***Table 4-16*** provides projections of the population's age distribution through the year 2020.

TABLE 4-16
AGE DISTRIBUTION PROJECTIONS – UPPER PORTION OF THE PROJECT STUDY AREA

Age Distribution	2000		2010		2020	
	Pop	%	Pop	%	Pop	%
Total – Upper Portion of the Study Area						
Under 18	18,558	19.2	19,655	17.3	21,203	16.0
18 – 64	47,366	48.9	56,753	49.8	60,318	45.5
65 and Over	30,856	31.9	37,502	32.9	51,164	38.5
Highlands County						
Under 18	15,519	18.9	16,438	17.0	17,670	15.6
18 – 64	38,882	47.2	46,778	48.3	49,376	43.8
65 and Over	27,900	33.9	33,652	34.7	45,788	40.6
Polk County						
Under 18	3,039	21.0	3,217	18.9	3,533	17.8
18 – 64	8,484	58.6	9,975	58.5	10,942	55.1
65 and Over	2,956	20.4	3,850	22.6	5,376	27.1

Source: BEBR, *Population Projections by Age, Sex, and Race for Florida and Its Counties, 2001-2020,* modified to the Project Watershed.

The age distribution projections for the project watershed indicate that overall the population in this area will be getting older between the year 2000 and the year 2020. The percentages of the population under the age of 18 and between the ages 18 to 64 are projected to decline slightly from 19% to 16% and from 49% to 46%, respectively. The percentage of the population in the project watershed over 65 years of age is projected to increase from 32% to 38% of the population.

Based on these projections, both Highlands and Polk Counties will see similar changes in the age distribution between the year 2000 and 2020. In both of these counties, the projections indicate a three to four percent decrease in the population under the age of 18 and the population between 18 and 64 years of age. The projections also indicate an increase of approximately six to seven percent in the population over the age of 65. Overall the projected age distribution of the project watershed is consistent with the projected age distribution for the State of Florida.

Because of the uncertainty and limitations in available data, actual age distribution projections for the years 2030 to 2050 have **not** been calculated. However, it is reasonable to assume that the exchange of the population age 65 and older will increase. This assumption is reasonable to make given the movement of the baby boomer generation into this age cohort and the national trend of an extended life expectancy.

4.9.2.3 Sex Distribution Projections from 2000 to 2050

Sex distribution projections for the project watershed were calculated for the years 2010 and 2020, based on an extrapolation of projections provided by BEBR. These projections indicate that in both Highlands and Polk Counties the percentage of males and females will remain fairly constant between the year 2000 and 2020. As a result, the percentage of males and females in the project watershed is projected to change less than one percent through the year 2020. Overall the projected sex distribution is consistent with the State of Florida BEBR projections.

As with the age distribution projections, because of uncertainty and limitations in available data, actual sex distribution projections for the years 2030 to 2050 have not been calculated. However, it is reasonable to assume that the sex distribution within the project watershed will be consistent with the 2020 sex distribution projections stated above.

4.9.2.4 Race and Ethnicity Projections from 2000 to 2050

Projections for race distribution were calculated for the years 2010 and 2020, based on an extrapolation of projections provided by BEBR. Projections were provided for two race categories, white and non-white. ***Table 4-17*** provides the race distribution projections through the year 2020.

The projections indicate that the percentage of the white population will be slightly increasing in the project watershed from 81.8% to 83.1% between the year 2000 and 2002 (shouldn't this be 2020?. Therefore, the non-white population is projected to decrease from 18.2% to 16.9% within the project watershed between the year 2000 and 2020. This trend is primarily influenced by the projections for Highlands County. The projections indicate that the racial distribution of the county will change from 83.4% white and 16.6% non-white in 2000 to 84.9% white and 15.0% non-white in the year 2020.
The racial distribution projections for Polk County indicates almost no change in the percentages of the white and non-white populations between the year 2000 and 2020.

The State of Florida race distribution projections are different than those for the overall Lake Istokpoga Watershed. The State's projections indicate a slight decrease in the white population and a slight increase in the non-white population between 2000 and 2020. It should be noted that because of the uncertainty and limitations of the data available, calculations have not been included as to the exact percentages for the years 2030, 2040, and 2050.

TABLE 4-17
RACE DISTRIBUTION PROJECTIONS – UPPER PORTION OF THE PROJECT STUDY AREA

	2000		2010		2020	
	Persons	**%**	**Persons**	**%**	**Persons**	**%**
Total – Upper Portion of the Study Area						
White	79,174	81.8	94,040	82.6	110,309	83.1
Non-White	17,606	18.2	19,870	17.4	22,376	16.9
Highlands County						
White	68,623	83.4	81,611	84.2	95,830	84.9
Non-White	13,678	16.6	15,257	15.8	17,004	15.1
Polk County						
White	10,551	72.9	12,429	72.9	14,479	72.9
Non-White	3,928	27.1	4,613	27.1	5,372	27.1

Source: BEBR, *Population Projections by Age, Sex, and Race for Florida and Its Counties, 2001-2020,* modified to the Project Watershed.

According to the 2000 US Census, the national Hispanic population grew from 22 million to 35 million between 1990 and 2000. Statistics show that the Hispanic population has a higher birth rate and immigration rates than other minorities. Therefore, this phenomenal growth is anticipated to continue in the future.

Florida, particularly the South Florida region, has a large Hispanic population. The Hispanic population in Highlands and Polk County increased 7% and 5.4%, respectively between 1990 and 2000. Although, no current future projections for the State of Florida or these individual counties has been completed. The conservative projections for the future Hispanic Population within the project watershed were developed based on this level of growth consistently between 2000 and 2050. ***Table 4-18*** shows the projections for the Hispanic population within the project watershed between 2000 and 2050. Overall the Hispanic population within this portion of the project study area is anticipated to increase 38.1% between 2000 and 2050.

TABLE 4-18
HISPANIC POPULATION PROJECTIONS – UPPER PORTION OF THE PROJECT STUDY AREA

Year	Total Study Area Population	Highlands County Population	Polk County Population
Existing (2000)	12,075	9,530	2,545
2010	12,879	10,197	2,682
2020	13,738	10,911	2,827
2030	14,654	11,675	2,979
2040	15,632	12,492	3,140
2050	16,676	13,366	3,310

Source: US Census, 2000, modified to project 2010-2050.

4.9.2.5 Household Size and Number of Households Projections from 2000 to 2050

The number of household projections and average household size projections are based on data from the BEBR that has been extrapolated for the project watershed to the year 2030. Average household size projections after the year 2030 were held constant due to the uncertainties in projecting this element.

Overall within this portion of the project study area, the number of households is expected to increase from 40,319 in 2000 to 91,282 in 2050. The majority of the new households are anticipated in Highlands County, where the total number of households is anticipated to increase from 35,605 in 2000 to 4,714 in 2050. In Polk County, the total number

of households is anticipated to increase from 4,714 in 2000 to 10,672 in 2050.

The average household size for each of the counties within the project watershed is projected to decline between the year 2000 and 2050. For the overall watershed, the existing household size is 2.3 and is expected to decline to 2.2 by 2030. For Highlands County, the existing average household size is 2.3 and is projected to decrease to 2.2 in 2030. For Polk County, the existing average household size is 2.6 and is also projected to decrease to 2.5 by 2030. The average household size in these counties is projected to remain constant at the projected 2030 level through 2050, due to uncertainties in projecting this element.

4.9.2.6 Housing Projections from 2000 to 2050

Within the project watershed, the number of housing units is anticipated to double between 2000 and 2050, based on the projected increase in the number of households identified in Section 4.8.2.5. Most of this growth is anticipated to occur in those areas designated as Urban on the Future Land Use map, (***Figure 4-4*** *and* ***Figure 4-5***).

4.10 Forecasted Economic Profiles

Economic projections presented in this section are in large part based on data presented in "Florida Long – Term Economic Forecast 2001, Volume 2 – State and Counties" published by the University of Florida through the Bureau of Economic and Business Research (BEBR) in September 2001. The BEBR projections covered the period from 1998 to 2015. Projections for the period 2020 through 2050 were developed by extrapolating the BEBR growth rates developed for each economic parameter.

In coordinating these projections with Regional and County planners, Trade organizations, Agricultural Extension Services, SFWMD Service Center and others it was found that there were concerns about the future growth of citrus groves within the watershed area. These concerns center around the high cost of capitalizing a citrus grove, low citrus prices, and competition from foreign citrus growers. In response to this, a sensitivity analysis was made of citrus production and will be presented in a later section of this report.

Economic forecast data are presented in two discrete sections. Section 4.9.1 presents data for the area shown in ***Figure 4-6***. This area includes portions of Okeechobee, Glades and portions of Highlands Counties (located southeast of Lake Istokpoga) that lie within the project study

area. Section 4.9.2 presents data for areas shown in ***Figure 4-7***, which includes portion of Highlands County (located west and north of Lake Istokpoga) and Polk Counties that are included in the project study area.

4.10.1 Economic Forecasts for Lower Portion of the Project Study Area

This section contains forecasts for areas shown in ***Figure 4-6***.

Land use projections for this portion of the project study area are based on the land use conversions presented in the progress reports and Draft Summary Report entitled "Natural Resource Analysis of Lake Okeechobee Phosphorus Management Strategies" prepared for the SFWMD by Hazen and Sawyer, dated June 2002 (Hazen and Sawyer, 2002). The "rates" of land use changes and the "distribution" of these changes to basins within the watershed were applied to the updated land use plan presented in Section 3 of the Hazen and Sawyer report. The Hazen and Sawyer land use projections covered the period from 1995 to 2021.

Projections for the period 2030 to 2050 were developed by extrapolating the rates of land use conversions for each of the land use categories considered. Adjustments were made to reflect data developed in the field on land use conversions to tree orchards, row crops and field crops, particularly, citrus, sugarcane, and sod.

4.10.1.1 Total Income and Earnings

Total personal income within the watershed is expected to increase from an estimated $1.055 billion dollars in the year 2000 to 3.026 billion over the 50- year projection period ending in the year 2050. The rate of income growth for the watershed is estimated at 2.13% per year. This growth rate represents the weighted average income growth rates of Glades, Highlands and Okeechobee Counties. BEBR estimates income growth in Glades, Highlands and Okeechobee Counties at 2.91%, 1.99% and 2.22%, respectively.

It is estimated that about 65% of total projected personal income will be derived from wages and salaries, 26% from proprietors' income and the remaining 9% of income is from "other labor". Of the estimated proprietors' income, 57% is estimated to be farm income and the remaining 43% non-farm income. ***Table 4-19*** shows the income and earnings projections for the various income categories.

4.10.1.2 Per Capita Income

Weighted average per capita income estimates were developed for the watershed area. As shown on ***Table 4-19*** per capita income is projected to increase from $18,954 to $53,518 over the fifty-year projection period. This represents an annual growth rate of 2.10%.

4.10.1.3 Poverty

Land use studies conducted in the watershed for the projection period indicate that the rural character of the watershed will undergo very little change. A majority of the land use changes are expected to occur within the agricultural sector of the economy. This is to say that pasture and dairy lands will be converted to tree, row, and field crops. From this it is concluded that there will be little improvement in poverty levels over the projection period.

TABLE 4-19
INCOME PROJECTIONS – LOWER PORTION OF THE PROJECT STUDY AREA (In millions of dollars except as noted)

Year	Total Personal Income	Income From Wages And Salaries	Proprietors Income	Other Labor	Farm Income	Non-Farm Income	Per Capita Income (In Dollars)
2000	$1,054.7	$685.6	$274.2	$94.9	$156.3	$117.9	$18,654
2010	$1,298.3	$843.9	$337.6	$116.8	$192.4	$145.2	$22,962
2020	$1,607.4	$1,044.8	$417.9	$144.7	$238.2	$179.7	$28,429
2030	$1,985.0	$1,290.3	$516.1	$178.6	$294.2	$221.9	$35,107
2040	$2,450.2	$1,592.6	$637.1	$220.5	$363.1	$274.0	$43,333
2050	$3,026.0	$1,966.9	$786.8	$272.3	$448.5	$338.3	$53,518

Source: Bureau of Economic and Business Research (BEBR) "Florida Long – Term Economic Forecast 2001, Volume 2 State and Counties", September 2001.

4.10.1.4 Income and Wage Distribution

In the year 2000 agricultural activities represented 62.1% of all land use activities. These activities are projected to decline and are expected to represent 57.6% of all land use activities at the end of the fifty-year projection period. However, projected agricultural land use changes

should bring about more intense use of lands as pasture and dairy lands are converted to tree, row, and field crops. While about 41,000 acres of agricultural lands will be taken out of production and converted to urban uses within the watershed, the remaining lands will be farmed with more profitable crops. Little or no change is expected in the distribution of income and wages among the economic sectors of the watershed.

4.10.1.5 Employment by Sector

Table 4-20 shows the projection of total employment within the three county area. Also shown are projections of employment in the Agricultural, Forestry and Fishery Sector. Virtually all the projected employment in this sector is associated with the agricultural industry. The growth of agricultural employment is consistent with the conversion of pasture and dairy land to intense tree orchards, row crops, and field crops.

TABLE 4-20
EMPLOYMENT PROJECTIONS – LOWER PORTION OF THE PROJECT STUDY AREA

Year	Glades County		Highlands County		Okeechobee County		Totals	
	Total	Agri	Total	Agri	Total	Agri	Total	Agri
2000	1,089	244	22,985	3,643	9,785	1,792	33,859	5,679
2010	1,300	290	25,630	4,060	11,790	2,160	38,720	6,510
2020	1,550	350	28,550	4,530	14,200	2,600	44,300	7,480
2030	1,850	410	31,810	5,040	17,110	3,130	50,770	8,580
2040	2,200	490	35,470	5,620	20,610	3,770	58,280	9,880
2050	2,620	590	39,530	6,270	24,740	4,530	66,890	11,390

Source: State of Florida Enterprise, Florida Website www.eflorida.com/profiles/county/report.asp; BEBR, "Florida Long – Term Economic Forecast 2 001, Volume 2 – State and Counties, September 2001

4.10.1.6 Future Land Use

As stated earlier, land use projections for this portion of the project study area were developed based in large part on data generated by Hazen and Sawyer for the SFWMD.

The land use data developed included not only changes in land uses for the period 1995 through 2021, but also included how these changes were distributed among the 24 sub-basins in their study area. This portion of the study area consists of 20 of the 24 sub-basins analyzed. While the capability exists to individually analyze the land use changes in each of the 20 sub-basins, specific individual analyses were limited to the four priority basins, namely S-65D, S-65E, S-154 and S-191. All other basins were grouped together. ***Table 4-21*** through ***Table 4-26*** show the projected land use changes over the fifty-year projection period.

Table 4-21 shows the projected land use changes for the whole watershed area. As shown, acreages devoted to urban development are projected to increase from about 26,000 acres to about 63,000 during the projection period. Most of this growth will be at the expense of lands presently classified as pasture. Lands classified as Urban presently constitute about 2.9% of the total lands in the watershed. This is projected to increase to about 6.9% by the end of the projection period. The Urban land use classification includes residential, commercial, services, industrial, extractive, institutional, recreational, and open land categories of land use.

4.10.1.7 Future Agricultural Land Use

In terms of agricultural land use, it is projected that about 41,000 acres of land presently classified as agricultural will be converted to other uses. As stated earlier agricultural land presently represents about 62.1% of all land uses within the watershed. It is estimated that at the end of the projection period agricultural lands will represent 57.6% of all land uses. However, shifts in agricultural land uses are expected. It is expected that the number of acres devoted to dairy operations will decline significantly as the result of restrictive operating rules.

Dairy production is not expected to decline, but will be concentrated on fewer acres. Unused dairy lands are expected to be converted to improved pasture. It should be noted that some dairy operators outside of the watershed are experimenting with the "exporting" of animal waste that is then processed into fertilizer. By "exporting" nutrients, particularly phosphorus, dairy operators can increase the size of their dairy herds. This practice has not yet been adopted in this study area.

Projected agricultural land uses for the total watershed and the (S-65D, S-65E, S-154, and S-191 (Taylor Creek/Nubbin Slough)) basins based on the Hazen and Sawyer Study are shown in ***Tables 4-21*** through ***4-26***. ***Figures 4-8*** and ***4-9*** graphically illustrate for selected years the land use changes in the total watershed and changes in agricultural uses.

TABLE 4-21
LAND USE PROJECTIONS – LOWER PORTION OF THE PROJECT STUDY AREA
(in acres)

LAND USE CATEGORY	YEAR					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Urban	26,079	33,476	40,873	48,270	55,667	63,064
Improved Pasture	350,591	338,930	327,707	316,484	305,136	293,664
Unimproved Pasture	63,679	58,871	54,062	49,253	44,444	39,535
Row Crops	8,077	9,907	11,051	12,195	13,339	14,484
Field Crops	19,059	19,713	20,989	22,303	23,616	24,923
Tree Orchards	56,087	65,818	75,178	84,500	93,822	102,777
Poultry Feed Operator	49	49	49	49	49	49
Tree Nurseries	443	443	443	443	443	443
Sod Farms	12,033	12,292	12,551	12,810	13,069	13,328
Ornamentals	5,246	5,256	5,266	5,276	5,287	5,297
Floriculture	21	22	23	24	25	26
Horse Farms	302	302	302	302	302	302
Dairies	28,347	23,653	18,957	14,261	9,690	5,716
Silviculture	23,525	23,525	23,525	23,525	23,525	23,525
Aquaculture	802	1,187	1,572	1,957	2,342	2,727
Rangeland	50,635	50,499	50,363	50,227	50,091	49,955
Upland Forests	91,836	91,678	91,520	91,362	91,204	91,046
Open Water	11,713	11,713	11,713	11,713	11,713	11,713
Wetlands	153,715	153,405	153,095	152,785	152,475	152,165
Barren	7,550	7,550	7,550	7,550	7,550	7,550
Trans.,Util., Comm.	4,639	6,139	7,639	9,139	10,639	12,139
TOTALS	914,428	914,428	914,428	914,428	914,428	914,428
AGRICULTURAL ONLY	568,261	559,968	551,675	543,382	535,089	526,796

Source: Hazen & Sawyer, 2002

TABLE 4-22
LAND USE PROJECTIONS – BASIN S-65D
(in acres)

LAND USE CATEGORY	YEAR					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Urban	1,568	2,225	2,882	3,539	4,196	4,853
Improved Pasture	56,092	53,412	50,732	48,052	45,372	42,692
Unimproved Pasture	1,781	1,745	1,709	1,673	1,637	1,601
Row Crops	3,436	3,847	4,258	4,669	5,080	5,491
Field Crops	28	84	140	196	251	307
Tree Orchards	5,234	7,444	9,654	11,864	14,074	16,284
Poultry Feed Operator	0	0	0	0	0	0
Tree Nurseries	0	0	0	0	0	0
Sod Farms	0	0	0	0	0	0
Ornamentals	12	13	14	15	17	18
Floriculture	21	22	23	24	25	26
Horse Farms	95	95	95	95	95	95
Dairies	3,669	2,955	2,241	1,527	813	99
Silvaculture	0	0	0	0	0	0
Aquaculture	0	0	0	0	0	0
Rangeland	6,842	6,746	6,650	6,554	6,458	6,362
Upland Forests	4,200	4,146	4,092	4,038	3,984	3,930
Open Water	2,510	2,510	2,510	2,510	2,510	2,510
Wetlands	26,422	26,251	26,080	25,909	25,738	25,567
Barren	582	582	582	582	582	582
Trans.,Util., Comm.	473	888	1,303	1,718	2,133	2,548
TOTALS	112,965	112,965	112,965	112,965	112,965	112,965
AGRICULTURAL ONLY	70,368	69,617	68,866	68,115	67,364	66,613

Source: Hazen & Sawyer, 2002

TABLE 4-23
LAND USE PROJECTIONS – BASIN 65E
(in acres)

LAND USE CATEGORY	YEAR					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Urban	580	860	1,140	1,420	1,700	1,980
Improved Pasture	12,102	11,322	10,542	9,762	8,857	7,828
Unimproved Pasture	1,424	1,396	1,368	1,340	1,312	1,184
Row Crops	2,179	2,524	2,869	3,214	3,559	3,904
Field Crops	0	46	92	138	184	230
Tree Orchards	2,949	3,649	4,349	5,049	5,749	6,083
Poultry Feed Operator	0	0	0	0	0	0
Tree Nurseries	12	12	12	12	12	12
Sod Farms	0	0	0	0	0	0
Ornamentals	0	0	0	0	0	0
Floriculture	0	0	0	0	0	0
Horse Farms	0	0	0	0	0	0
Dairies	2,735	2,020	1,305	590	0	0
Silvaculture	0	0	0	0	0	0
Aquaculture	0	0	0	0	0	0
Rangeland	439	435	431	427	423	419
Upland Forests	2,447	2,431	2,415	2,399	2,383	2,367
Open Water	529	529	529	529	529	529
Wetlands	2,795	2,777	2,759	2,741	2,723	2,705
Barren	588	588	588	588	588	588
Trans.,Util., Comm.	379	569	759	949	1,139	1,329
TOTALS	29,158	29,158	29,158	29,158	29,158	29,158
AGRICULTURAL ONLY	21,401	20,969	20,537	20,105	19,673	19,241

Source: Hazen & Sawyer, 2002

TABLE 4-24
LAND USE PROJECTIONS – BASIN S-154
(in acres)

LAND USE CATEGORY	YEAR					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Urban	2,639	3,217	3,795	4,373	4,951	5,529
Improved Pasture	16,702	15,860	15,018	14,176	13,334	12,492
Unimproved Pasture	848	844	840	836	832	828
Row Crops	0	269	288	307	326	346
Field Crops	0	0	621	1,280	1,939	2,591
Tree Orchards	12	798	1,213	1,590	1,967	2,343
Poultry Feed Operator	0	0	0	0	0	0
Tree Nurseries	20	20	20	20	20	20
Sod Farms	0	0	0	0	0	0
Ornamentals	0	0	0	0	0	0
Floriculture	0	0	0	0	0	0
Horse Farms	103	103	103	103	103	103
Dairies	4,113	3,289	2,465	1,641	817	0
Silviculture	0	0	0	0	0	0
Aquaculture	0	0	0	0	0	0
Rangeland	1,250	1,236	1,222	1,208	1,194	1,180
Upland Forests	1,088	1,081	1,074	1,067	1,060	1,053
Open Water	167	167	167	167	167	167
Wetlands	4,373	4,343	4,313	4,283	4,253	4,223
Barren	0	0	0	0	0	0
Trans.,Util., Comm.	304	392	480	568	656	744
TOTALS	31,619	31,619	31,619	31,619	31,619	31,619
AGRICULTURAL ONLY	21,798	21,183	20,568	19,953	19,338	18,723

Source: Hazen & Sawyer, 2002

TABLE 4-25
LAND USE PROJECTIONS – BASIN S191
(in acres)

LAND USE CATEGORY	YEAR					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Urban	5,874	7,041	8,208	9,375	10,542	11,709
Improved Pasture	58,081	56,596	55,111	53,626	52,141	50,656
Unimproved Pasture	5,696	5,608	5,520	5,432	5,344	5,256
Row Crops	739	839	939	1,039	1,139	1,239
Field Crops	547	1,100	1,653	2,206	2,759	3,312
Tree Orchards	3,251	5,276	7,301	9,326	11,351	13,376
Poultry Feed Operator	49	49	49	49	49	49
Tree Nurseries	232	232	232	232	232	232
Sod Farms	1,022	1,222	1,422	1,622	1,822	2,022
Ornamentals	141	141	141	141	141	141
Floriculture	0	0	0	0	0	0
Horse Farms	33	33	33	33	33	33
Dairies	16,779	14,336	11,893	9,450	7,007	4,564
Silviculture	0	0	0	0	0	0
Aquaculture	149	245	341	437	533	629
Rangeland	2,243	2,225	2,207	2,189	2,171	2,153
Upland Forests	12,620	12,553	12,486	12,419	12,352	12,285
Open Water	1,389	1,389	1,389	1,389	1,389	1,389
Wetlands	11,385	11,312	11,239	11,166	11,093	11,020
Barren	4	4	4	4	4	4
Trans.,Util., Comm.	120	153	186	219	252	285
TOTALS	120,354	120,354	120,354	120,354	120,354	120,354
AGRICULTURAL ONLY	86,719	85,677	84,635	83,593	82,551	81,509

Source: Hazen & Sawyer, 2002

TABLE 4-26
LAND USE PROJECTIONS – NON-PRIORITY BASINS, LOWER PORTION OF THE PROJECT STUDY AREA
(in acres)

LAND USE CATEGORY	YEAR					
	2000	**2010**	**2020**	**2030**	**2040**	**2050**
Urban	15,418	20,133	24,848	29,563	34,278	38,993
Improved Pasture	207,176	201,740	196,304	190,868	185,432	179,996
Unimproved Pasture	53,931	49,278	44,625	39,972	35,319	30,666
Row Crops	2,159	2,428	2,697	2,966	3,235	3,504
Field Crops	18,483	18,483	18,483	18,483	18,483	18,483
Tree Orchards	44,641	48,651	52,661	56,671	60,681	64,691
Poultry Feed Operator	0	0	0	0	0	0
Tree Nurseries	179	179	179	179	179	179
Sod Farms	11,011	11,070	11,129	11,188	11,247	11,306
Ornamentals	5,093	5,102	5,111	5,120	5,129	5,138
Floriculture	0	0	0	0	0	0
Horse Farms	71	71	71	71	71	71
Dairies	1,053	1,053	1,053	1,053	1,053	1,053
Silviculture	23,525	23,525	23,525	23,525	23,525	23,525
Aquaculture	653	942	1,231	1,520	1,809	2,098
Rangeland	39,861	39,857	39,853	39,849	39,845	39,841
Upland Forests	71,481	71,467	71,453	71,439	71,425	71,411
Open Water	7,118	7,118	7,118	7,118	7,118	7,118
Wetlands	108,740	108,722	108,704	108,686	108,668	108,650
Barren	6,376	6,376	6,376	6,376	6,376	6,376
Trans.,Util., Comm.	3,363	4,137	4,911	5,685	6,459	7,233
TOTALS	620,332	620,332	620,332	620,332	620,332	620,332
AGRICULTURAL ONLY	367,975	362,522	357,069	351,616	346,163	340,710

Source: Hazen & Sawyer, 2002

FIGURE 4-8
LAND USE PROJECTIONS – LOWER PORTION OF THE PROJECT STUDY AREA

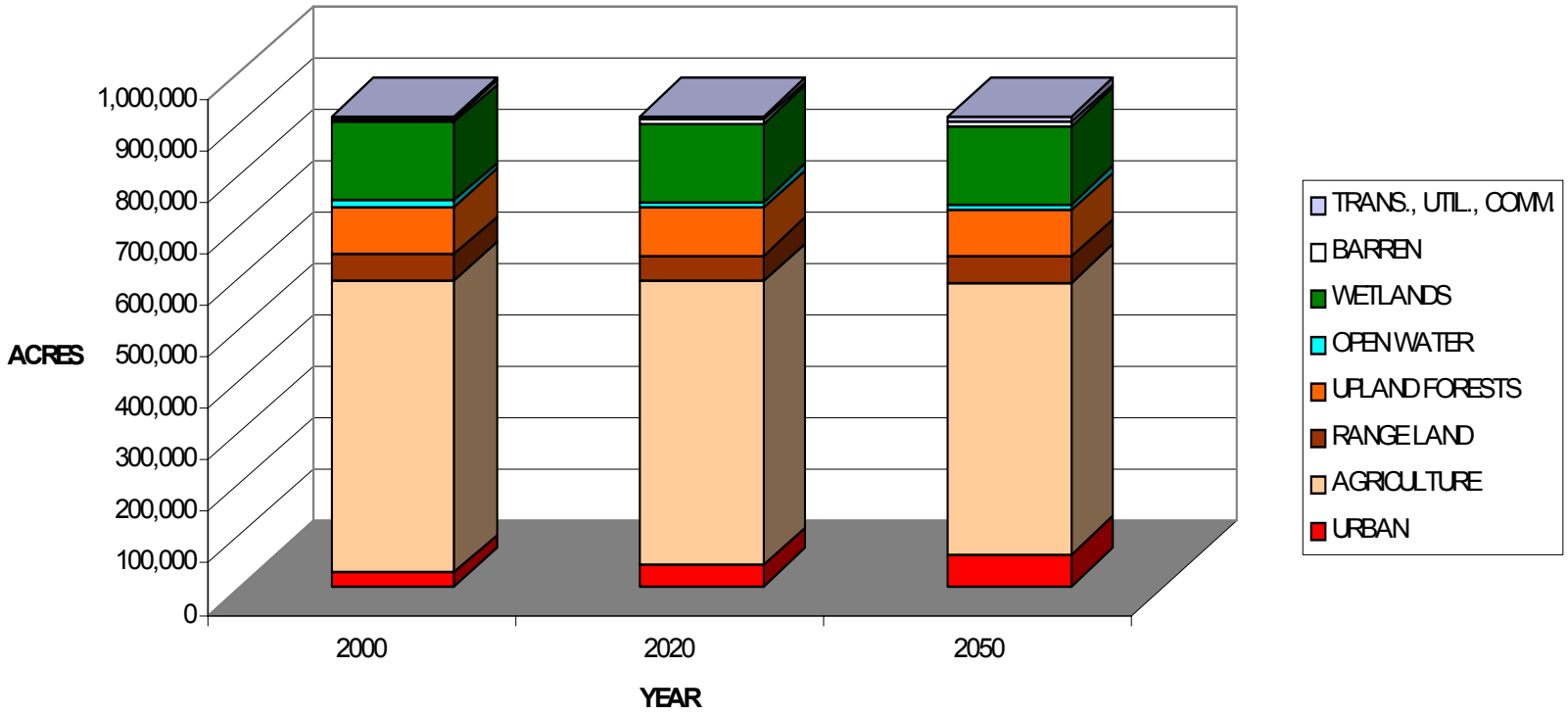
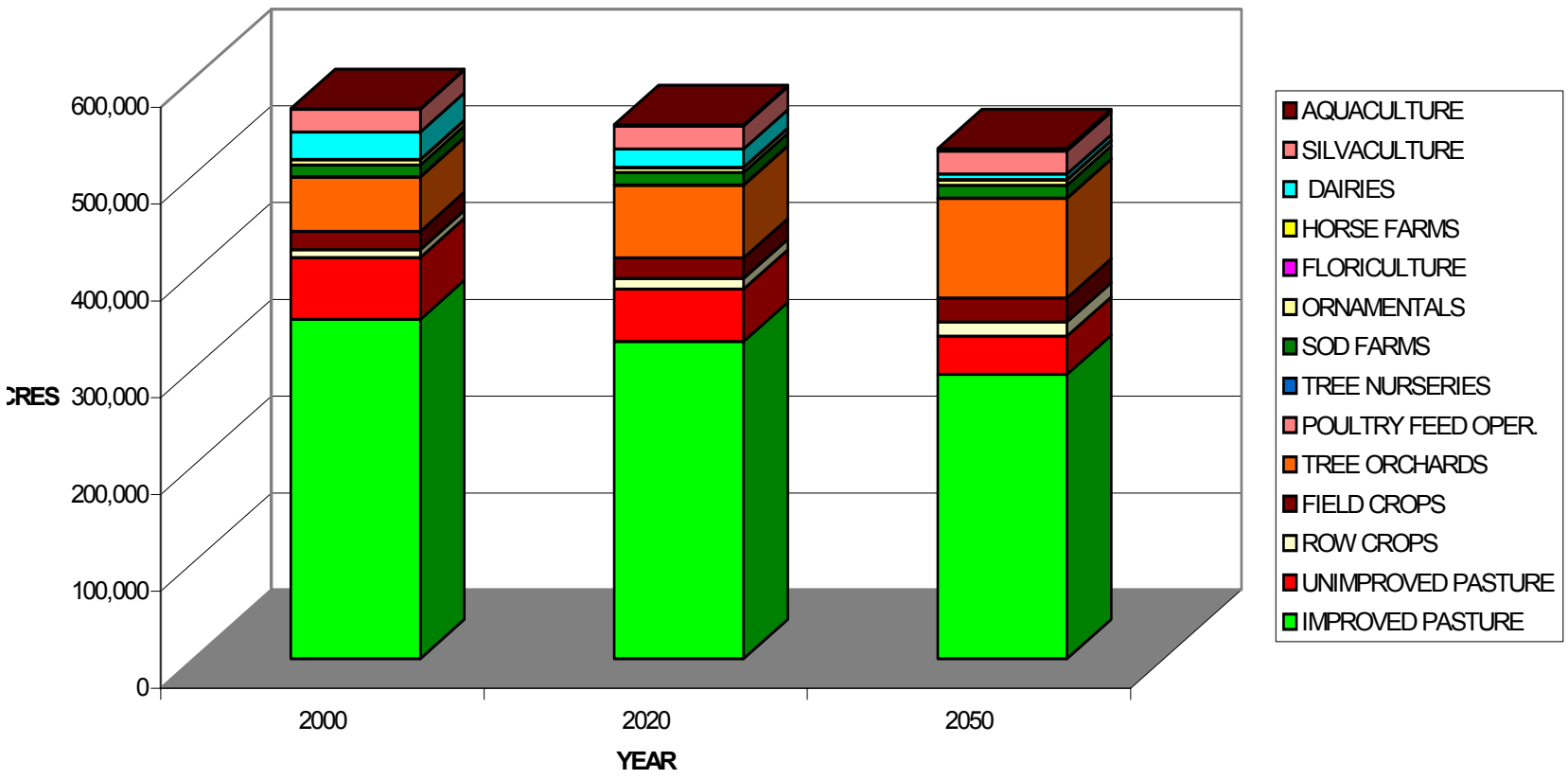


FIGURE 4-9
LAND USE PROJECTIONS – LOWER PORTION OF THE PROJECT STUDY AREA (CONTINUED)



As stated earlier, in coordinating these projections with various interests, it was found that there are concerns about the future growth of citrus not only in the watershed, but also in the state. Concerns were expressed about the long term capital investment required to bring a grove into production, present low prices for citrus, normalizing relations with Cuba (a major citrus producer), and the possibility of extending NAFTA privileges to South American countries, particularly Brazil (another major citrus producer). Recently, a foreign investor within the watershed area cancelled plans to develop a 12,000- acre citrus operation.

The primary reasons were environmental impacts and market conditions. The lands were sold and will remain as improved pasture in a cow-calf operation. The Hazen and Sawyer Study, previously cited, projected citrus growth at about 1.22% per year within the watershed. At this rate over the fifty-year projection period about 46,690 acres of pasture land would be converted to citrus. This almost doubles the amount of land devoted to citrus production.

Because of the concerns expressed above, projections of citrus production were sensitized to identify the impact on the economy of the region. The modified projections of agricultural land use within the watershed are shown in ***Table 4-21***. The modified projections shown represent a growth rate of about half of that projected above or about 19,932 additional acres of citrus over the fifty-year projection period.

4.10.1.8 Economic Impact of Agriculture Land Use Changes

With the exception of citrus production, land use changes within this portion of the project study area are not expected to have a significant effect on the economy of the area. About 36,985 acres of improved and unimproved pasturelands are expected to be converted to urban and built –up uses over the projection period. These lands are considered to be lands in transition.

Figure 4-4 presented lands uses projections for the year 2010 and also shows lands that are in transition to urban and built-up. The lands identified as transition are sufficient to accommodate the projected urban growth within the watershed. Based on a 2001 land value survey conducted by the University of Florida Cooperative Extension Service transitional lands are expected to increase in value from a weighted average value of $1,436 per acre to a weighted average value of $5,504 per acre. The total increase in value over the projection period is estimated at about $146.8 million dollars.

Again, with the exception of citrus production, agricultural land use changes are expected to have a very small effect on agricultural income within the watershed area over the projection period. Only modest increases in field and row crop acreages are expected. Depending on future market conditions and future imports of citrus, income from citrus production within the watershed could remain at the current level of about $71.9 million dollars or increase to $131.8 million, an increase of $59.9 million dollars at the end of the projection period if the Hazen and Sawyer projected rate of growth is correct.

Using the projected change in citrus production shown in ***Table 4-27***, income from citrus production could increase from the current level of about $71.9 million dollars to about $97.5 million dollars, an increase of about $25.6 million dollars per year at the end of the fifty-year projection period.

TABLE 4-27
ALTERNATIVE LAND USE PROJECTIONS – LOWER PORTION OF THE PROJECT STUDY AREA (in Acres)

LAND USE CATEGORY	YEAR					
	2000	2010	2020	2030	2040	2050
Urban	26,079	33,476	40,873	48,270	55,667	63,064
Improved Pasture	350,591	344,187	337,768	331,093	324,082	316,408
Unimproved Pasture	63,679	59,828	55,838	51,831	47,787	43,549
Row Crops	8,077	9,907	11,051	12,195	13,339	14,484
Field Crops	19,059	19,713	20,989	22,303	23,616	24,923
Tree Orchards	56,087	59,604	63,341	67,313	71,533	76,019
Poultry Feed Operator	49	49	49	49	49	49
Tree Nurseries	443	443	443	443	443	443
Sod Farms	12,033	12,292	12,551	12,810	13,069	13,328
Ornamentals	5,246	5,256	5,266	5,276	5,287	5,297
Floriculture	21	22	23	24	25	26
Horse Farms	302	302	302	302	302	302
Dairies	28,347	23,653	18,957	14,261	9,690	5,716
Silviculture	23,525	23,525	23,525	23,525	23,525	23,525
Aquaculture	802	1,187	1,572	1,957	2,342	2,727
Rangeland	50,635	50,499	50,363	50,227	50,091	49,955
Upland Forests	91,836	91,678	91,520	91,362	91,204	91,046
Open Water	11,713	11,713	11,713	11,713	11,713	11,713
Wetlands	153,715	153,405	153,095	152,785	152,475	152,165
Barren	7,550	7,550	7,550	7,550	7,550	7,550
Trans.,Util., Comm.	4,639	6,139	7,639	9,139	10,639	12,139
TOTALS	914,428	914,428	914,428	914,428	914,428	914,428
AGRICULTURAL ONLY	568,261	559,968	551,675	543,382	535,089	526,796

Source: Hazen & Sawyer, 2002.

4.10.2 Economic Forecasts for Upper Portion of the Project Study Area

This section contains economic forecasts for areas shown in ***Figure 4-7***. Land use projections are based on the land use conversions developed in the comprehensive development plans for both Polk and Highlands Counties. Adjustments were made to reflect data developed in the field on land use conversions. These land use changes were coordinated with Regional and County planners, Trade organizations, Agricultural Extension Services, SFWMD Service Center, and others.

Note that the progress reports and Draft Summary Report entitled "Natural Resource Analysis of Lake Okeechobee Phosphorus Management Strategies" prepared for the SFWMD by Hazen and Sawyer, dated June 2002 did not include the four basins in the Lake Istokpoga watershed and therefore were not considered.

4.10.2.1 Total Income and Earnings

Before projecting income and earnings for the upper portion of the project study area it was necessary to adjust the county data to reflect the economic character of the watershed. Simply projecting the Polk County economic data would grossly overstate the economic character of the small rural portion of Polk County located within the watershed. The economic data for both Highlands and Polk Counties were weighted based on area in order to develop composite estimates of economic parameters that would more accurately reflect the economy of the watershed.

Total personal income within this portion of the project study area is expected to increase from an estimated $1.712 billion dollars in the year 2000 to 27.632 billion over the fifty-year projection period ending in the year 2050. The rate of income growth for the watershed is estimated at 5.72% per year. This growth rate represents the weighted average growth rates of Highland and Polk Counties. BEBR estimates income growth in Highlands and Polk Counties at 5.56% and 6.14%, respectively.

It is estimated that earnings represent about 50% of total projected personal income. Of total earnings about 74% will be derived from wages and salaries, 17% from proprietors income and the remaining 9% of income is from "other labor". Of the estimated proprietors income, 38% is estimated to be farm income and the remaining 62% non-farm income. ***Table 4-28*** shows the income and earnings projections for the various income categories.

Table 4-28
INCOME PROJECTIONS – UPPER PORTION OF THE PROJECT STUDY AREA (In millions of dollars except as noted)

Year	Total Personal Income	Income From Wages And Salaries	Proprietors Income	Other Labor	Farm Income	Non-Farm Income	Per Capita Income (In Dollars)
2000	$1,711.9	$633.6	$144.7	$77.5	$55.2	$89.5	$19,777
2010	$2,925.6	$1,082.8	$247.3	$132.5	$94.3	$153.0	$24,227
2020	$5,200.8	$1,924.9	$439.6	$235.4	$167.7	$271.9	$29,745
2030	$8,992.6	$3,328.3	$760.1	$407.1	$290.0	$470.1	$36,489
2040	$15,823.1	$5,856.4	$1,337.5	$713.3	$510.2	$827.2	$44,815
2050	$27,631.8	$10,226.9	$2,335.6	$1,250.9	$891.0	$1,444.6	$53,615

4.10.2.2 Per Capita Income

As shown in ***Table 4-28*** per capita income is projected to increase from $19,777 to $53,615 over the fifty-year projection period. This represents an annual growth rate of 2.02 percent

4.10.2.3 Poverty

Land use studies conducted in the upper portion of the project study area for the projection period indicate that the watershed will continue to urbanize. A majority of the land use changes are expected to affect the agricultural sector of the economy as more lands are converted to urban uses. It is expected that pasture and dairy lands will be the first to be converted. The nature of urban growth is expected to come from "retirement type" communities. It is concluded that there will be improvement in poverty levels over the projection period.

4.10.2.4 Income and Wage Distribution

In the year 2000 agricultural represented 36.0% of all land use activities. These activities are projected to decline and are expected to represent 26.2% of all land use activities at the end of the fifty-year projection period. However, projected agricultural land use changes should bring about more intense use of lands as pasture and dairy lands are converted to tree, row, and field crops. While about 38,000 acres of

agricultural lands will be taken out of production within the watershed, the remaining lands will be farmed with more profitable crops. Little or no change is expected in the distribution of income and wages among the economic sectors of the watershed.

4.10.2.5 Employment by Sector

Table 4-29 showed the projection of total employment within the Lake Istokpoga watershed. Also included in this table are projections for employment in the Agricultural, Forestry, and Fishery Sector. Virtually all the projected employment in this sector is associated with the agricultural industry. The growth of agricultural employment is consistent with the conversion of pasture and dairy land to intense tree orchards, row crops, and field crops.

TABLE 4-29
EMPLOYMENT PROJECTIONS – UPPER PORTION OF THE PROJECT STUDY AREA

Year	Total Employment	Agricultural Employment
2000	26,903	3,450
2010	30,000	3,840
2020	33,410	4,280
2030	37,230	4,770
2040	41,510	5,310
2050	46,270	5,920

4.10.2.6 Future Land Use

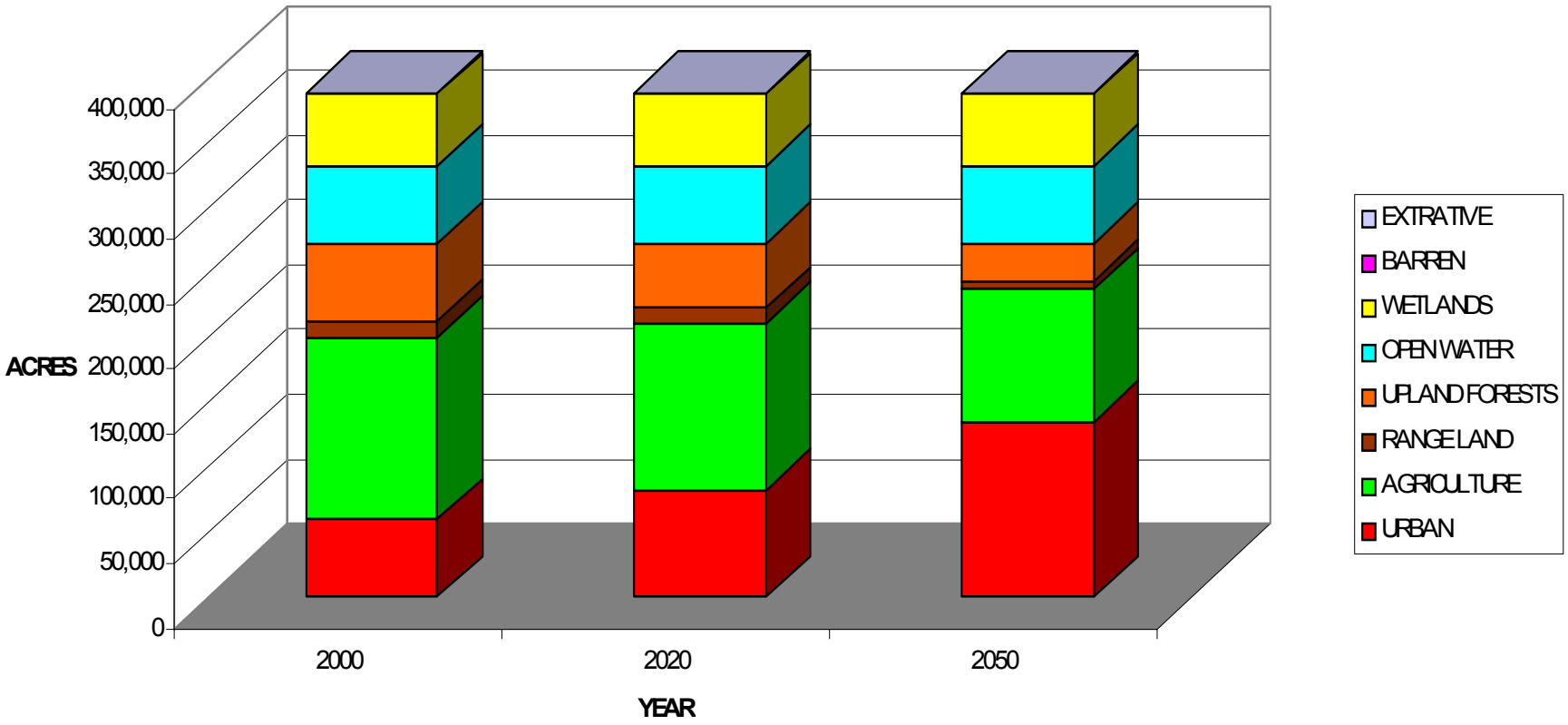
Acreages devoted to urban development are projected to increase from about 59,600 acres to about 135,100 during the planning horizon. Most of this growth is expected to be at the expense of lands presently classified as pasture, rangeland, and upland forests. Lands classified as urban presently constitute about 15.3% of the total lands in the watershed. This is projected to increase to about 34.7% by the end of the projection period.

The urban land use classification includes residential, commercial and industrial, institutional, recreational, transportation, communications, utilities and open land categories of land use. ***Table 4-30*** and ***Figure 4-10*** show projected land uses for selected years.

TABLE 4-30
LAND USE PROJECTIONS – UPPER PORTION OF THE PROJECT STUDY AREA (in acres)

Land Use Category	2000	2020	2050
Urban	59,647	82,765	135,098
Agriculture	140,035	128,384	102,008
Range Land	13,549	11,422	6,607
Upland Forests	59,383	50,043	28,901
Open Water	59,083	59,083	59,083
Wetlands	55,858	55,858	55,858
Barren	1,150	1,150	1,150
Extractive	354	354	354
Totals	389,059	389,059	389,059

FIGURE 4-10
LAND USE PROJECTIONS – UPPER PORTION OF THE PROJECT STUDY AREA



4.10.2.7 Future Agricultural Land Use

In terms of agricultural land use, it is projected that about 38,000 acres of land presently classified as agricultural will be converted to other uses. As stated earlier agricultural land presently represents about 36.0% of all land uses within the watershed. It is estimated that at the end of the projection period agricultural lands will represent 26.2% of all land uses. However, shifts in agricultural land uses are expected. It is expected that the number of acres devoted to dairy operations will decline significantly as the result of restrictive operating rules.

Dairy production is not expected to decline, but will be concentrated on fewer acres. Unused dairy lands are expected to be converted to improved pasture. It should be noted that some dairy operators outside of the watershed are experimenting with the "exporting" of animal waste that is then processed into fertilizer. By "exporting" nutrients, particularly phosphorus, dairy operators can increase the size of their dairy herds. This practice has not as yet been adopted in this study area.

4.10.2.8 Economic Impact of Agriculture Land Use Changes

With the exception of citrus production, land use changes within the watershed are not expected to have a significant effect on the economy of the area. About 38,000 acres of improved and unimproved pasturelands are expected to be converted into urban and built-up uses over the projection period.

4.11 Forecasted Social Profile

4.11.1 Changes in Infrastructure

Based on the projected increase in population within the project study area, it is expected that additions to the basic infrastructure will be required. Increase in water and sewer service areas for the city of Okeechobee and for the five cities located north of Lake Istokpoga will have to be expanded to accommodate a portion of this growth. In the rural areas, many new households will continue to rely on ground water and septic systems for their water and sewage needs.

It is expected that there will be additional requirements for community services, educational facilities, transportation links, medical services, and recreational opportunities throughout the project study area. No attempt was made to quantify the spatial extent of these changes. The comprehensive land use plans for each of the three counties was used to

estimate the location of future urban growth and are shown in ***Figures 4-8*** and ***4-9***.

4.11.2 Changes in Recreational Opportunities

Both large lakes within the project study area, Lake Okeechobee and Lake Istokpoga, offer significant recreational opportunities to residents and visitors alike. Proper management of these resources is critical to the continued recreational use of the two lakes.

According to the Natural Resource Management System of the U. S. Army Corps of Engineers, about 6.7 million visitors per year visit Lake Okeechobee and generate the recreation dollars that are critical to the economy of the surrounding counties. Sightseeing (45%), fishing (27%) and boating (23%) are the major recreational activities at this lake. According to the Statewide Comprehensive Outdoor Recreation Plan (SCORP) the demand for these activities is expected to grow at an annual rate of over 2% per year.

Nature study is expected to grow at an annual rate of nearly 2.8% per year. However, the management of water levels within Lake Okeechobee and nutrient loads to the lake can affect future recreational opportunities. Of particular concern are phosphorus concentrations. According to the SWIM Plan 2002 update, there has been a dramatic increase in phosphorus concentrations since 1973. These concentrations range from a low in the early seventies of 47 ppb to about 145 ppb in the year 2000 despite numerous phosphorus control programs being implemented in the watershed. Continued increases of P concentrations within the Lake Okeechobee could affect visitation to the lake and livelihood of those who depend upon it.

4.11.3 Changes in Well Being Factors

It appears as though the watershed area will maintain its rural character over the projection period and no major changes are anticipated in the factors that measure community cohesion or one's sense of place within the watershed.