A G E N D A

Caloosahatchee River Watershed Protection Plan
Working Team Meeting
Wednesday, May 21, 2008
1:30 – 4:45 p.m.

SFWMD Lower West Coast Service Center
2301 McGregor Boulevard
Fort Myers, FL
First Floor Conference Room

Cisco MeetingPlace 6700 || Local 561-682-6700 || Toll Free 866-433-6299 || Meeting ID 5908

1:30	Introduction and Opening Remarks	Janet Starnes
1:45	Regulatory Measures	
	Introduction	Susan Martin
	History and Technical Background of Statewide Stormwater Rule	Damon Meiers
	Benefits of Proposed Statewide Stormwater Rule	Susan Martin
	Works of the District Rule	Steffany Gornak
2:45	Management Measures	Janet Starnes
	Alternative 1 - Complete	
	Alternative 2 - Draft	
	Alternative 3 - Schedule	
3:00	Water Quality	
	BMP Efficiency Report	Del Bottcher
	Base Run and Alternative 1	Tim Liebermann
4:00	Hydrologic Modeling	John Mitnik
	Status of Hydrologic Modeling	
	Base Run: CRWPP Base Run	
	(Base from which all alternatives will be run for hydrology)	

4:20	Public Comment	All
4:40	Schedule	Janet Starnes
4:45	Closing Remarks/Next Meeting	Janet Starnes

Next Meeting is June 18th
Interim Products (between May and June)

Meeting Summary

Northern Everglades
Caloosahatchee River Watershed Protection Plan
Working Team Meeting
May 21, 2008

The Working Team for the Caloosahatchee River Watershed Protection Plan(CRWPP) met on Wednesday, May 21, 2008, at 1:30 p.m. at the South Florida Water Management District's Lower West Coast Service Center in Fort Myers, Florida. A copy of the sign-in sheet is attached.

Attendee	Organization	Attendee	Organization
Janet Starnes	SFWMD	Katie Higgs	FDEP
Tara Bamber	JJG	Bob Howard	Agnoli, Barber & Brundage, Inc.
Craig Bartoshuk		Scott Legg	SFWMD
Jim Beever	SWFRPC	Tim Liebermann	SFWMD
Terrance Bengtsson	SFWMD	Jan Mandrup-Punlsim	FDEP
Karen Bickford	FDEP	Joyce Mazourek	FWS
Jose Caraballo	CES Consultants	Linda McCarthy	Lykes Brothers, Inc.
John Cassani	Lee Co. Hyacinth CD	Sally McPherson	SFWMD
Bob Chamberlain	SFWMD	John Mitnik	SFWMD
Michael Cook	ECWCD	Temperince Morgan	SFWMD
Clyde Dabbs	SFWMD	Judith Northdurft	SFWMD
Wayne Daltry	Lee County	Kevin O'Donnell	FDEP
Peter Doering	SFWMD	Roland Ottolini	Lee County
Liz Donley	SWFRPC	Tony Pellicer	Lee County
James Evans	City of Sanibel	Steve Sentes	SFWMD
Bud Goblisch	JJG	Geordie Smith	Lee Co. Health Dept.
Steffany Gornak	SFWMD	Jennifer Thera	FDEP
Kurt Harclerode	Lee County	Rae Ann Wessel	SCCF
Joy Hazell	Lee County		

1. Introduction and Opening Remarks

The Project Manager, Janet Starnes extended a warm welcome to the participants and introductions were performed around the room.

2. Regulatory Measures

Susan Martin and Damon Meiers presented the "New Rule Development for Unified Stormwater Quality Rules "ERP Phase Two". Ms. Martin introduced the rule and some of the benefits that it will provide. Mr. Meiers presented a history of the stormwater program in Florida as well as the current rules on protecting impaired water bodies. He explained how the new rule would provide increased environmental

protection to water bodies by emphasizing nutrient reduction. The Lake Okeechobee and Estuary Special Basin Rule was also explained which will focus on discharge volumes. The timeline of both new rules was outlined. Ms. Martin explained the reasoning for development of the new stormwater rules. The new stormwater rule will bring certainty and consistency to the methodologies used when carrying out stormwater calculations. New Best Management Practices (BMPs) were described which would receive credit under the new Stormwater Rule. (Presentation attached)

Questions/Comments

Q: Does the new rule use the Harper Methodology?
A: The new rule used the newest versions of the Harper Methodology, but improvements are still being made to wetland data since isolated wetlands discharge nutrients naturally. DEP is working on the wetland research.

Q: Does the new rule set any requirements on ground water?
A: No, it just looks at stormwater. SFWMD recognizes that ground water is an issue.

Q: Does the new rule address cumulative impacts?
A: Cumulative impacts will not occur since the new rules limits nutrient loads allowed to be released from the site based on the natural state of the site. It is thought that there will be a net decrease in the overall nutrient loads. The Works of the District Rule will address cumulative impacts.

Q: How will natural conditions of the site be determined?
A: Tables will be made available that will look at the soils of the site. The soils will indicate the natural conditions of the site.

Q: Will there be discharge regulations? In theory new development could just hold the water on site to reduce loads.
A: Discharge will be necessary to meet flood plain requirements.

Steffany Gornak presented "Proposed Source Control Program in support of the Northern Everglades and Estuaries Protection Program." The objective of the Program is to develop a source control program as a component of the overall River Watershed restoration program. The Northern Everglades and Estuaries Legislation expanded the restoration boundaries to include the Caloosahatchee River, St. Lucie River, Upper Kissimmee, and Lake Istokpoga Sub-watersheds. The Source Control Programs for the estuaries will implement, monitor and optimize the BMP programs within the watershed. (Presentation attached)

Questions/Comments

Q/Comment: Lake Okeechobee (LO) is monitoring loads right now. If a sub-watershed is not meeting criteria, then each program needs to look at their existing .reduction efforts and monitoring to determine the source of the problem.
A: The sub-watersheds for the Caloosahatchee River are not yet defined. Once they have been defined, appropriate nutrient reduction targets can be established for each.

Q: What are Works of the District (WOD)?
A: WOD are anything that discharges into District canals, rivers, etc. Management Measures (MM) are WOD only if the District owns it and operates it. Anything owned by the ACOE is not a WOD.

3. Management Measures

Janet updated on the status of the management measures. Alternative 1 is nearly complete with the exception of a few temporary storage facilities that will be added at a later time. The modeling efforts are underway. The missing management measures will not affect the modeling effects. The missing management measures will be sent to the team once ready.

A package of the Alternative 2 management measures was handed out as well as a draft list of both Alternatives 1 and 2. Alternative 1 management measures will always be included in the management measures lists associated with any of the alternatives since Alternative 1 is a part of all alternatives as the common elements alternative. Alternative 2 is focused on storage management measures. The current estimated storage need in the basin is 250,000 acre feet of storage including the West Reservoir.

Alternative 3 management measures will be determined in the next two weeks. Alternative 3 is focused on the water quality management measures.

By the next Working Team Meeting, Alternative 1 and 2 modeling will be complete. If you have been submitted a management measure which is incomplete, JJG will be calling you to finish the data input.

4. Water Quality

Del Bottcher. Water Solutions, Inc. presented the “Nutrient Loading Rates, Reduction Factors and Implementation Costs Associated with BMPs and Technologies” Draft Report. The report is a working document used to improve the unit nutrient load and BMP reduction numbers for the St. Lucie and Caloosahatchee River watersheds. The two watersheds were broken down into twenty-five major land use categories. Then unit loads of Nitrogen (N) and Phosphorus (P) were calculated for each land use category. The concentrations of N and P were checked by comparing the measured

amounts at S-79 (W. P. Franklin Lock) and S-78 (Ortona Lock) to the calculated amounts. (Presentation attached)

Questions/Comments

Q: The urban BMP's are required by law, but what about the agricultural BMP's that are not required by law. How will they be enforced?
A: BMP's will have to be implemented per the new rule regardless of the type of land use.

Q: Who will cover the costs?
A: At this point it is unknown who will specifically cover the costs. Some of the costs will be covered by the land owner and some by other funding sources. The annual costs include the capitol and operation and maintenance costs.

Tim Liebermann presented the status of water quality spreadsheet analysis for Alternative 1. He reviewed the plan boundary maps. Tim reviewed the landuse table with the total N and P loading rates and BMP efficiencies. (Presentation attached)

Questions/Comments

Q: On the landuse table, are the "Unit Source Load" values loading rate reductions or loading rates?
A: They are loading rates. The BMP Efficiencies are the reductions. They are combined for each BMP.

Q: Is the CRE 10 management measure the BOMA (Caloosahatchee River Water Quality and Testing Facility) project? How were the loads calculated?
A: Yes, CRE 10 is the BOMA project. The loads were taken from the feasibility report that was prepared for the project. A copy of the report can be provided upon request.

5. Hydrologic Modeling

John Mitnik presented an update on hydrologic modeling. He went over the model setup and assumptions. He reviewed the performance measures and indicators specific to CRWPP. He showed charts and diagrams of the modeling results comparing the Lake Okeechobee Watershed Construction Plan base run (CBASE) and the Draft CRWPP base run (RWPPB).

Now that the base model is calibrated, the next step is to incorporate the Alternative 1 management measures into the model. The model will then be integrated with the St. Lucie River Watershed portion of the model. (Presentation attached)

Questions/Comments

Q: How is this model different than models used for TMDL's?
A: The Regional Simulation Model was chosen because it can model regions and works as a water budget system as shown on Slide 10.

Q: Why is the BOMA project not shown on Slide 10?
A: The nodal diagram is only for the base model, therefore no Caloosahatchee management measures are shown.

6. Public Comment

None

7. Schedule

A CRWPP schedule was handed out. The October 2008 "Release Draft Plan for Public Review" is an absolute date. The January 2009 "Submit Plan to the Florida Legislature" is also an absolute date.

8. Closing Remarks/Next Meeting

The next meeting is scheduled for June 18, 2008 at 1:30 p.m. at the Lower West Coast Service Center. The focus of the meeting will be on Alternative 1 and 2. We look forward to seeing you then, if not sooner. Interim meetings may be held if needed.

Sign In Sheet

Caloosahatchee River Watershed Protection Plan Working Team Meeting

SFWMD LWC Service Center
May 21, 2008
1:30 to 4:30 PM

Name	Signature/Via Phone	Agency
Abtew, Wossenu		SFWMD
Bailey, Nathaniel		FDEP
Balci, Pinar		SFWMD
Bamber, Tara		Jordan, Jones & Goulding
Bartolone, Frank		SFWMD
Bartoshuk, Craig		~~A Duda & Sons~~
Beever, Jim		SWFRPC
Beever, Lisa		SWFRPC/Charlotte Harbor NEP
Bengtsson, Terrance		SFWMD
Bennett, Susan		SFWMD
Bickford, Karen		Lee County
Bokor, Matt		Youngquist Brothers, Inc.
Bologna, Lizabeth		SFWMD
Boyle, Michael		City of Labelle
Brion, Lehar		SFWMD
Budell, Richard		DACS
Calder, Fred		FDEP
Capece, John		Southern Datastream
Cassani, John		Lee Co Hyacinth CD
Chamberlain, Robert	682-2086	SFWMD
Chang, Miao-Li		SFWMD
Conner, Jenny		The Nature Conservancy
Cook, Michael		ECWCD
Copp, Roger		ECWCD and Lehigh Acres
Cornell, Brad		Audubon
Cressman, Kim		City of Cape Coral
Dabbs, Clyde		SFWMD
Dabral, Sandeep		SFWMD
Daltry, Marti		Sierra Club & Riverwatch

Sign In Sheet

Caloosahatchee River Watershed Protection Plan Working Team Meeting

SFWMD LWC Service Center
May 21, 2008
1:30 to 4:30 PM

Name	Signature	Agency
Daltry, Wayne		Lee County
Dantzler, Rick		Frost, O'Toole & Saunders
Dauray, Charles		SFWMD
Denger, Tim		SFWMD
Denham, Mick		City of Sanibel
Doering, Peter		SFWMD
Donley, Liz		SWFRPC
Elliott, Rebecca		SFWMD
Evans, James		City of Sanibel
Everham, Edwin		FGCU
Feken, Stacey		FDEP
Ferguson, Randy		Jordan, Jones & Goulding
Flood, Phil		SFWMD
Fricano, Pat		FDEP
Gerry, Lawrence		SFWMD
Gihring, Jennifer		FDEP
Goblisch, Bud		Jordan, Jones & Goulding
Hamel, Ron		Gulf Citrus Growers
Hammond, Bill		Gulf Citrus
Hanlon, Ed		UFL SWFREC IFAS
Harclerode, Kurt		Lee County
Hazell, Joy		Lee County
Heatherington, Ken		SWFRPC
Hecker, Jennifer		Conservancy of SW FL
Higgs, Katie		FDEP
Howard, Bob		Agnoli, Barber & Brundage, Inc.
Hughes, Eric		USEPA
Iricanin, Nenad		SFWMD
Irizarry-Oritz, Michelle		SFWMD

Sign In Sheet

Caloosahatchee River Watershed Protection Plan Working Team Meeting

SFWMD LWC Service Center
May 21, 2008
1:30 to 4:30 PM

Name	Signature	Agency
Jarvis, Connie		City of Cape Coral
Kelly, Alison		SFWMD
Kennedy, Sally		SFWMD
Kibbey, Keith		Lee County
Lamb, Steve		MacVicar, Federico & Lamb
Laskis, Kristina		FDEP
Legg, Scott		SFWMD
Lewis, Beth		SFWMD
Liebermann, Tim		SFWMD
Lindblad, Erick		SCCF
Lindsay, David		ECWCD
Loflin, Rob		City of Sanibel
Love, Jim		Lee County/Health Dept
Love, Kim		Tetra Tech
MacLaughlin, Doug		SFWMD
MacVicar, Tom		MacVicar Federico & Lamb
Marks, Ernie		FDEP
Marlowe, Beth		USACE
Martin, Patrick		SFWMD
Marton, Noel		SWFWMD
Mazourek, Joyce		FWS
McCarthy, Linda		Lykes Brothers, Inc.
McCullers, Ed		Youngquist Brothers, Inc.
McPherson, Peggy		Everglades Foundation
McPherson, Sally		SFWMD
Meiers, Damon		SFWMD
Mitnik, John		SFWMD
Morgan, John		SFWMD
Morgan, Temperince		SFWMD

Sign In Sheet

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SFWMD LWC Service Center
May 21, 2008
1:30 to 4:30 PM

Name	Signature/Via Phone	Agency
Murphy, Jerry		Town of Fort Myers Beach
Nearhoof, Frank		FDEP
Neidrauer, Cal		SFWMD
Nelson, Jennifer		FDEP
Nothdurft, Judith		SFWMD
O'Donnell, Kevin		FDEP
Olson, Cathy		Lee County
Ottolini, Roland		Lee County
Parker, Shane		Hendry County
Pellicer, Tony		Lee County
Quasius, Peter		Audubon
Ramirez, Armando		SFWMD
Ramsey, Agnes		SFWMD
Romeis, Gordon		FDEP
Rumbold, Darren		FGCU
Rutledge, Dan		USDA
Sanchez, Judy		US Sugar
Sanders, Susan		SFWMD
Sculley, Séan		SFWMD
Sentes, Steven		SFWMD
Sheng, Yan		Jordan, Jones & Goulding
Shukla, Sonjay		UFL SWFREC IFAS
Smith, Geordie		Lee County/Health Dept
Spencer, Niki		SFWMD
Spratt, Jim		FL Nurserymen Growers
Starnes, Janet		SFWMD
Teasley, Debra		SFWMD
Teets, Tom		SFWMD
Thomas, Daryl		USFWS

Sign In Sheet

Caloosahatchee River Watershed Protection Plan Working Team Meeting

SFWMD LWC Service Center
May 21, 2008
1:30 to 4:30 PM

Name	Signature/Via Phone	Agency
Tritaik, Paul		FWS/NWR
Vacarr, Palma		SFWMD
Vanzee, Randy		SFWMD
Verrastro, Bob		SFWMD
Voich, Michael		SFWMD
Volety, Aswani		FGCU
Wade, Pam		SFWMD
Wessel, Rae Ann	[signature]	Sanibel-Captiva Conservation Foundation
Willams, Beth		SFWMD
Young, Linda		Clean Water Network of FL
Steffany Gorsak	863-462-5260 ext 3010	SFWMD
Jennifer Mera	Jennifer Mera	FDEP
Jose Caraballo	[signature]	CES Consultants, Inc.
Jan Mandrup-Poulsen	[signature]	FDEP

Environmental Resource Permit Rulemaking Update

CRWPP & SLRWPP

May 21 and 27, 2008

Two Initiatives Underway

The Unified Statewide Rule (DEP & WMDs)

- Provides a consistent process to ensure appropriate water quality Environmental Resource Permitting (ERP) criteria (nutrient reduction) are used for stormwater runoff from new developments

Lake Okeechobee & Estuaries Watersheds Basin Rule (SFWMD)

- Rule to address discharge volume from new development in the Lake Okeechobee, Caloosahatchee & St. Lucie Watersheds

Compare Differences

Existing Criteria

Statewide Stormwater Rule Criteria

Lake Okeechobee & Estuary Watersheds Basin Rule Criteria

CURRENT ERP RULES

Discharges to impaired water bodies, Outstanding Florida Waters (OFWs), Class I and Class II water bodies must provide additional reasonable assurances that the activity **will not contribute** to the existing violation or **cause degradation**

Additional reasonable assurances historically provided

- Additional water quality treatment volumes (50% more)
- Other Best Management Practices (BMPs) (maintenance, fertilizers, waste management, etc.)
- Analysis methods that estimate the existing nutrient loads compared to proposed nutrient loads (proposed loads must not exceed existing loads)

CURRENT ERP RULES

Discharge off-site at a rate no greater than the existing conditions or a discharge formula for a specified event

The rate criteria addresses the potential for flood impacts to off-site property during design storm events

While existing criteria does not specifically address the volume of stormwater discharged off-site there are water conservation criteria requiring the control elevations be set at the wet season water levels and specific requirements for water management system recovery

UNIFIED STATEWIDE STORMWATER RULE

Develop one consistent water quality criteria, taking into account regional differences such as:

- rainfall distribution (5 separate regions)
- regional soil conditions

Reduce nutrient loads discharging from new development

Require post development nutrient loads (total phosphorus & total nitrogen) to be less than or equal to undeveloped condition on an average annual basis

Treatment train approach with additional BMPs available to fit proposed project

UNIFIED STATEWIDE STORMWATER RULE

Rule is more protective of the environment

Provides more certainty for applicants, stakeholders and review staff

Addresses new development in the TMDL Basin Management Action Plan (BMAP) process

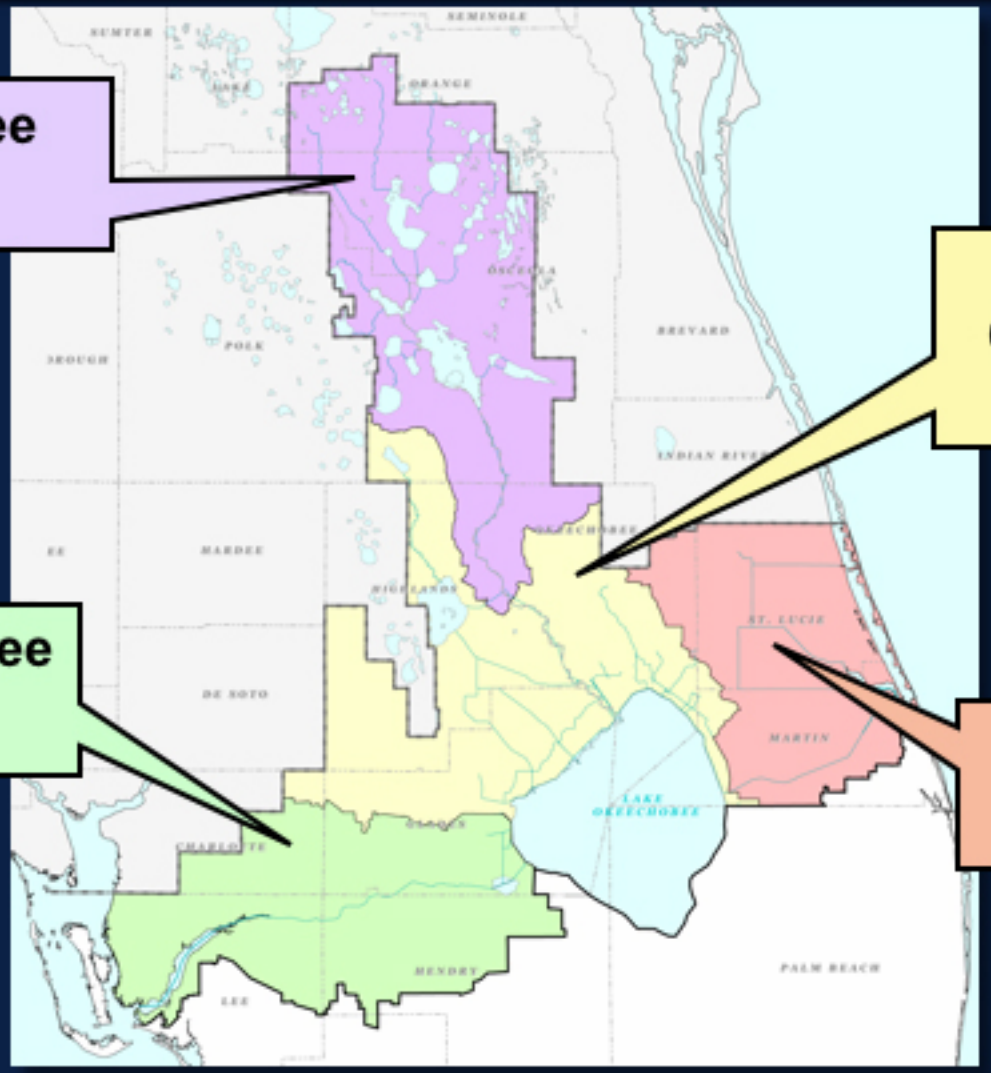
Quantifies and provides for more water quality treatment options including low impact design concepts

- Stormwater Recycling
- Florida Friendly Landscaping
- Pervious Pavements
- Green Roofs

TAC Members

Florida Audubon Society
1000 Friends of Florida
Conservancy of Southwest Florida
FLERA
Florida Stormwater Association
Florida Engineering Society
Florida Association of Counties
Florida League of Cities
Florida Chamber of Commerce
Florida Homebuilders Association
Urban Redevelopers
Mixed Use Developers
Reuse Utilities
Florida Department of Agriculture and Consumer Services

Northern Everglades



LAKE OKEECHOBEE & ESTUARY WATERSHEDS BASIN RULE

Previous water quality basin rule efforts initiated as a component of the LOER Plan faced extensive technical development and research

Since the Statewide Rule will address nutrient load reduction goals similar to the previous basin rule efforts, the basin rule will instead emphasize Northern Everglades Legislation (373.4595, F.S.) requirements for improvements in hydrology (quantity)

The new basin rule will provide supplemental basin protection on top of existing criteria and the new water quality protections to be provided in the Statewide Rule

LAKE OKEECHOBEE & ESTUARY WATERSHEDS BASIN RULE

Requires that discharges are not harmful to the resources of the district and not inconsistent with the objectives of the District pertaining to hydrology within the Northern Everglades watersheds (volume of discharge)

Two scenarios: average annual discharge volumes and specific storm event discharge volumes

Although the Lake O & Estuaries Rule is a volume based rule it will have significant water quality benefits similar to the Statewide Rule

Timeline Goals

Statewide Rule

TAC Workshops
(March – Sept. 2008)

Rule Workshops
(Oct. 08 – Feb. 09)

Rule Adoption
(May 2009)

Rule Effective
(July 2009)

Lake O & Estuaries Rule

Criteria Development
(March – July 2008)

Rule Workshops
(Aug. 08 – April 09)

Rule Adoption
(July 2009)

Rule Effective
(Sept. 2009)

New Rule Development for Unified Stormwater Quality Rules "ERP Phase Two"

Caloosahatchee River Watershed Protection Plan Working Team Meeting
Wednesday, May 21, 2008

Damon Meiers and
Susan Roeder Martin
South Florida Water Management District

Introduction

DEP, in coordination with the water management districts (WMDs), initiated rule development to provide additional protection of water quality.

Jurisdictional Limitations

Pursuant to Part IV of Chapter 373, Fla. Stat.:

- **Rule pertains to treatment of stormwater from new development.**
- **Retrofit component will be included.**

- **A new Chapter, 62-347, F.A.C., will be promulgated.**
- **The SFWMD also authorized the initiation of rule development to incorporate new Rule 62-347, F.A.C.**

Format of Presentation

Damon will discuss:

- The history of the stormwater program;
- How we currently protect impaired waters;
- Additional protection provide to water quality in the new rule; and
- Lake Okeechobee & Estuary Special Basin Rule.

Susan will discuss:

- If we already protect impaired waters, why do we need a new rule?

Unified Statewide Stormwater Rule

Benefits:

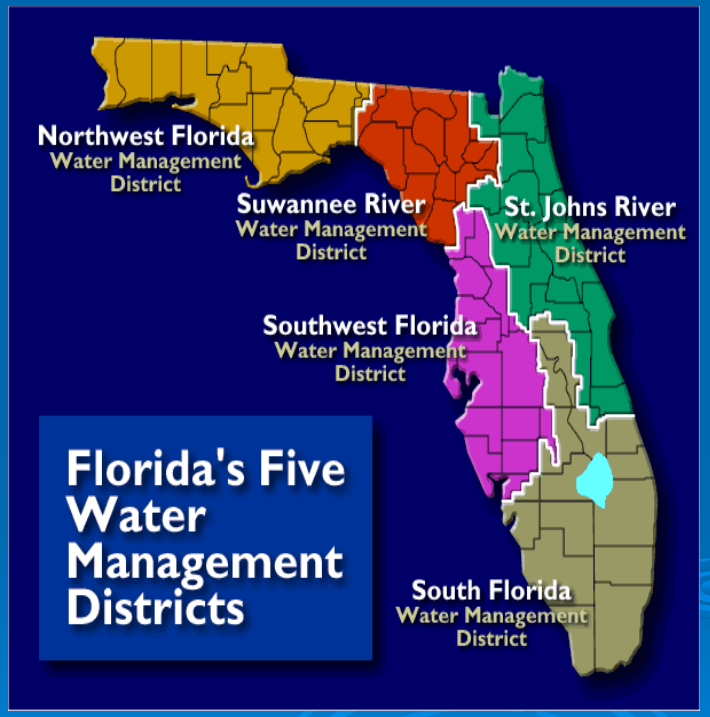
- **Rule is more protective of the environment;**
- **Provides more certainty;**
- **Quantifies and provides for more beneficial water quality treatment options;**
- **May address new development in the TMDL Basin Management Action Plan (BMAP) process.**

History of Stormwater Rules

- Florida was the first state in the country to require the treatment of stormwater from new development.
- Original rule was promulgated in 1982.
- Focus was on Total Suspended Solids (TSS).
- At that time, this rule required state-of-the-art treatment.

Delegation to Districts

In the mid-1980s, authority for the permitting program was delegated to the WMDs (except NWFWMD).



Independent ERP Water Quality Rules

- Each WMD then promulgated its own rules.
- Each WMD has technology based rules which include performance standards or desired level of treatment.
- Design and performance criteria vary greatly.
- Compliance with the criteria results in a rebuttable presumption that water quality standards will be met.

Emphasis of the Rule

- **The rules emphasize the removal of TSS.**
- **This is primarily done through retaining and detaining surface water in swales, lakes, canals, etc.**
- **In SFWMD, applicants treat first inch of runoff or 2½ times the impervious area, whichever is greater.**

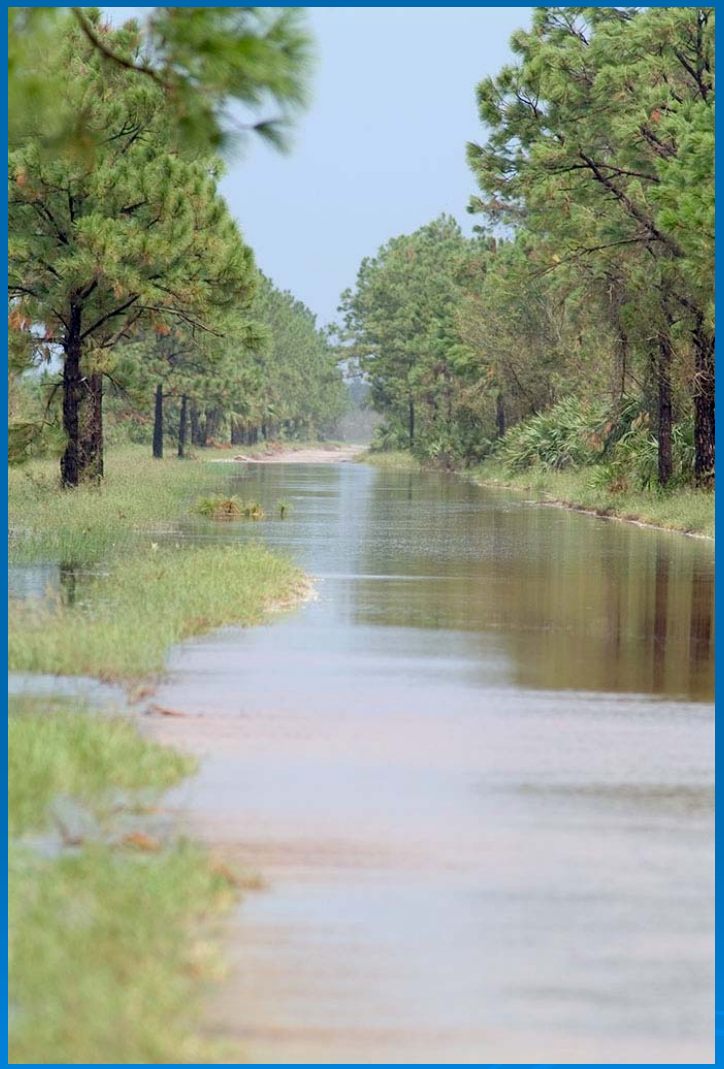
Old Surface Water Management Rules

- **Required applicants to provide reasonable assurances that the surface water management system will not cause adverse water quality and quantity impacts on receiving water and adjacent lands regulated pursuant to Chapter 373, F.S.**
- **“Impaired Water Bodies” were not specifically addressed.**

Rule 40E-4.301(b), F.A.C. (1994)

ERP Program

- In 1994, the Environmental Reorganization Act provided the WMDs independent authority to regulate stormwater quality under the Environmental Resource Permit (ERP) program.
- The Act requires the Department and the WMDs to seek to achieve a statewide, coordinated and consistent permitting approach to activities regulated under Part IV of Chapter 373, F.S.

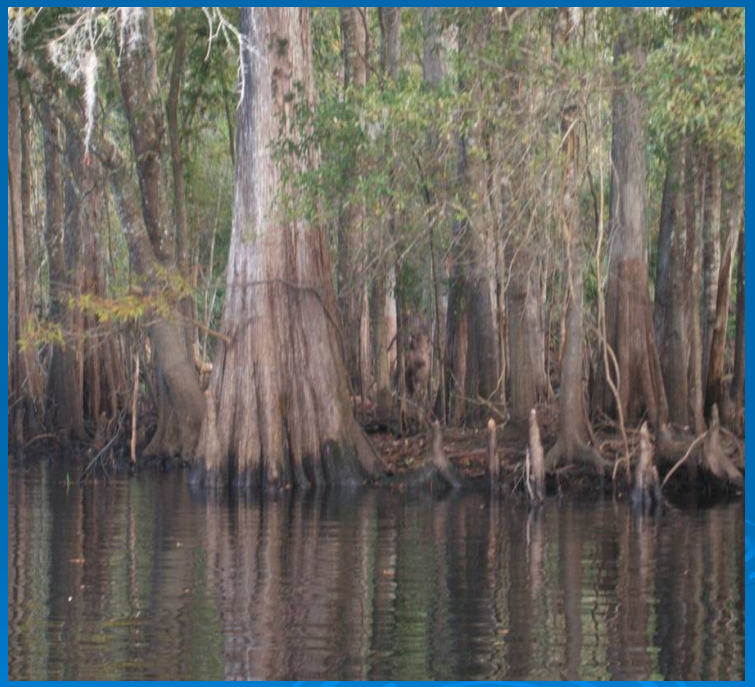


Consistent wetlands environmental permitting criteria was adopted in 1995, but consistent statewide rules pertaining to the regulation of stormwater have not yet been developed.

WETLAND CRITERIA PROVIDES A VEHICLE FOR THE DISTRICT TO PROTECT IMPAIRED WATERBODIES UNDER EXISTING CRITERIA

Water Management Districts Adopted New ERP Conditions for Issuance

Applicants must provide reasonable assurances that the proposed surface water management system will not adversely affect the quality of receiving waters such that state water quality standards will be violated.



Rule 40X-4.301(1)(e), F.A.C.

Environmental Criteria Provides Additional Protection for Impaired Waters

- **ERP environmental criteria must also be applied in conjunction with the design and performance standards.**
- **The ERP environmental criteria is “in addition” to the performance standards.**
- **ERP environmental criteria provides “…an applicant must provide reasonable assurance that the regulated activity will not violate water quality standards.”**

4.2.4, SFWMD BOR, 12.2.4, SJRWMD Applicant’s Handbook, 3.2.4 SWFWMD BOR.

Environmental Criteria Provides Additional Protection for Impaired Waters (continued)

- **"The applicant must demonstrate that the proposed activity will not contribute to the existing violation."**

  4.2.4.5, SFWMD BOR; 12.2.4.5 SJRWMD Applicant's Handbook; 3.2.4.5, SWFWMD BOR.

- **Environmental criteria gives the Districts the ability to require additional reasonable assurances to protect impaired waters.**

Historically

- Applicants have provided an additional 50% treatment when discharging to an Outstanding Florida Water (OFW) or Class I or II waterbodies.
- Same additional criteria may be used to address impaired waters.
- Other source controls, BMPs and other protective measures should also be considered for impaired waters under existing rules.

Existing Rules

The existing rules do not set forth specific criteria on how to protect impaired waters.

Potential Measures to Aid in Demonstrating that an Activity will not Degrade an OFW or Contribute to a Violation of an Impaired Water

- stormwater pollution prevention plan - during construction
- operation plan - long term plan addressing routine maintenance of the system
- planted littoral zones or constructed wetlands
- increased contact time with in-water baffle systems or increased lake width and travel distance
- utilize on-site wetlands for additional treatment downstream of SWM system
- site specific water quality evaluation pre and post treatment
- WQ monitoring

(This is not an exhaustive list)

Existing BMPS

- **BMPs do provide additional water quality protection and/or treatment.**
- **However, under the current rules, the amount of treatment is not quantified.**

HOW IS INCREASED ENVIRONMENTAL PROTECTION PROVIDED BY THE NEW PROPOSED RULE?

Direction of New Rule Will Provide Increased Environmental Protection

- **Main issue for most impaired water bodies is nutrients.**
- **New rules will emphasize nutrient reduction.**

Unified Stormwater Rule Development

- New rule will reflect new research on design and performance standards.
- The focus should not be on total suspended solids.
- Rules will emphasize today's understanding of the impact of nutrient discharges from surface water management systems on water quality.

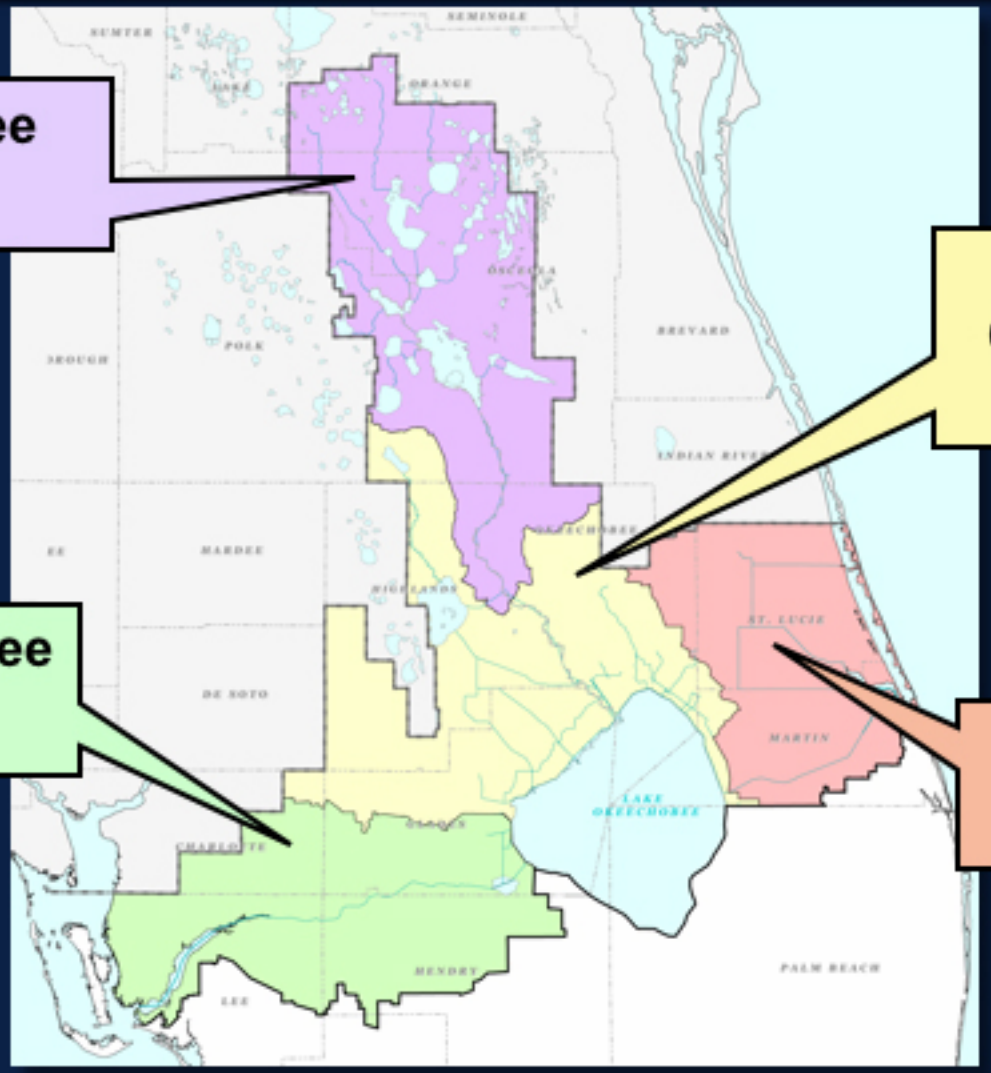
Greater Protection of Water Quality

- **Goal: no net increase in pollutants from what would be discharged in a pre-development/natural condition.**
- **Post-development nutrient loads (total phosphorus (TP) and total nitrogen (TN) will be less than or equal to an undeveloped/ natural condition on an average annual basis.**
- **TP and TN are generally the most difficult to address. Presumption that other pollutants will be sufficiently treated removal requirements are based on the 2 most difficult.**

Lake Okeechobee & Estuary Special Basin Rule

- **This rule will supplement existing criteria and new criteria in the statewide stormwater rule.**
- **Since the statewide stormwater rule will address quality, this rule will address focus on volume.**
- **A focus on volume will also provide incidental water quality benefits.**

Northern Everglades



Current ERP Rules

QUANTITY

- Discharge off-site at a rate no greater than the existing conditions or a discharge formula for a specified event
- The rate criteria addresses the potential for flood impacts to off-site property during design storm events

Lake Okeechobee & Estuary Watersheds Basin Rule

- **Proposed rule will supplement existing quantity requirements.**
- **Proposed rule will require that discharge volumes are reduced.**
- **Two scenarios: average annual discharge volumes and specific storm event discharge volumes.**

Timeline Goals

Statewide Rule

- TAC Workshops
  - (March – Sept. 2008)
- Rule Workshops
  - (Oct. 2008 – Feb. 2009)
- Rule Adoption (May 2009)
- Rule Effective (July 2009)

Lake O & Estuaries Rule

- Criteria Development
  - (March – July 2008)
- Rule Workshops
  - (Aug. 2008 – April 2009)
- Rule Adoption (July 2009)
- Rule Effective (Sept. 2009)

IF WE ALREADY ADDRESS IMPAIRED WATER BODIES, WHY DO WE NEED A NEW STORMWATER QUALITY RULE?

Treatment to Existing Conditions

- **Under our current criteria, we require applicants to demonstrate that they will not contribute to the existing impairment.**
- **Discharge cannot exceed the current discharge for the impaired parameter.**
- **Under the new rule, applicants will be required to demonstrate that they will not exceed the amount of TP and TN that would be discharged from a pre-developed natural condition.**

Uncertainty

- **Goal is to address uncertainty by providing stormwater quality treatment design and performance standards that can be applied statewide.**
- **Current criteria is only narrative, leaving everyone wondering if impaired waters are getting the correct level of protection.**
- **Rules do not currently demonstrate how much removal efficiency is attained by various BMPs.**

4 Permit Challenges on the Southwest Coast of Florida Challenge to Adequacy of the Protection of the Impaired Waterbody

- ***National Audubon Society, Inc., et al. v. I.M. Collier J.V. and SFWMD*, DOAH Case No. 06-4157**
- ***Conservancy of Southwest Florida v. G.L. Homes of Naples Associates II, Ltd. and SFWMD*, DOAH Case No. 06-4922**
- ***Captiva Civic Association, Inc. & Sanibel Captiva Conservation Foundation v. SFWMD and Plantation Development, Ltd.*, DOAH Case No. 06-0805**
- ***Brian DiVentura vs. The Gables at Stuart and South Florida Water Management District,* DOAH Case No. 03-2838**

- **These applicants also did a pre v. post analysis demonstrating that the proposed post-development discharge will be no greater than the pre-development (current condition) discharge for the parameter that's impaired.**
- **Final orders totally upheld SFWMD's review with respect to the protection of impaired waters.**

Certainty

- Standard methodologies will be set forth for the calculation of pre-development hydrology and loading.
- Standard calculations for determining how much credit is provided by each BMP.
- There will be a consistent statewide criteria taking into account regional differences in rainfall and soil.

TMDL

- DEP is developing Basin Management Action Plans (BMAPs).
- Certainty in BMAP process for development using new Stormwater Rule.
- Treatment to level of natural predevelopment condition should satisfy requirements for new development.

Will the New Rule Create an Unreasonable Burden on Development?

- No – more options will be available to meet criteria
- Reduction in stormwater volume
  - Low Impact Design and BMPs
  - Reuse – recycling of stormwater
- Treatment Train

How Does the Treatment Train Work?

- A treatment train is a series of BMPs or other treatment options set forth in a series, like cars on a train.
- At each state there are less nutrients to be removed.
- Our rules do not currently encourage the use of treatment trains.

Best Management Practices (BMPs)

BMPs are expected to include:

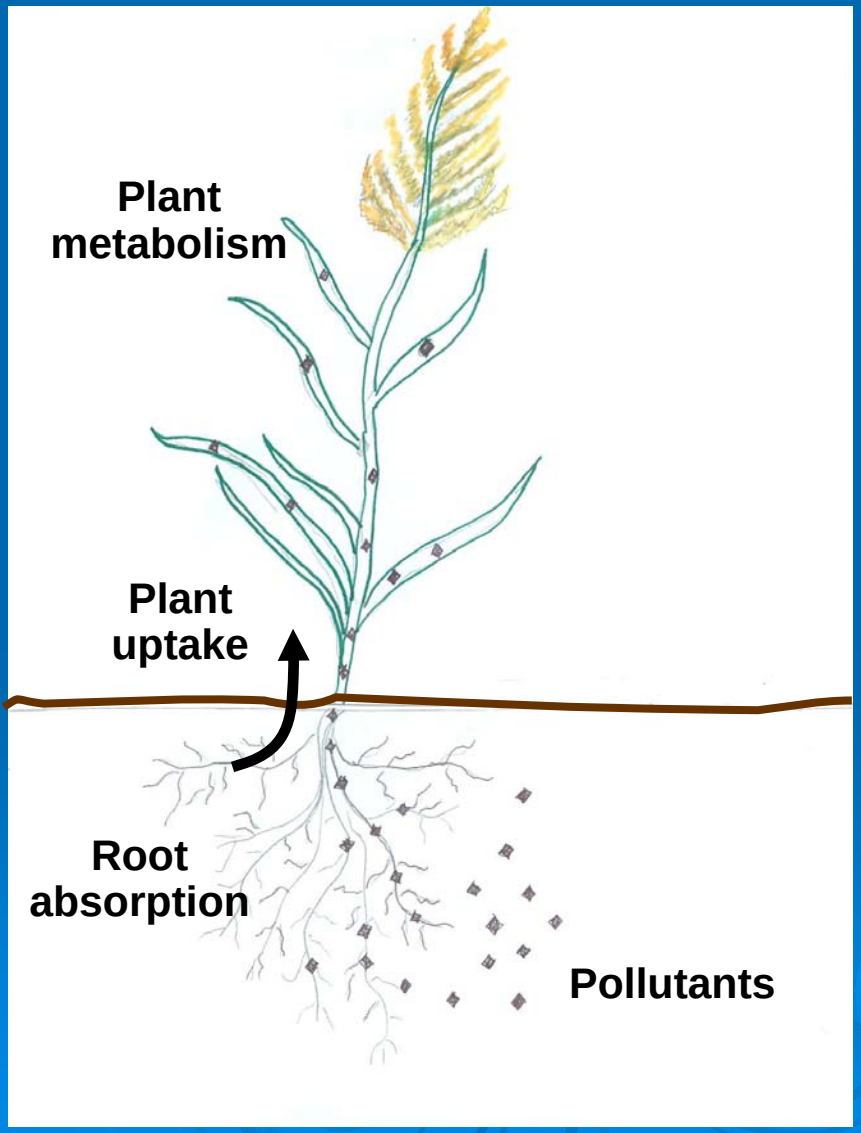
- Retention systems
- Biofiltration systems
- Exfiltration trenches
- Swale systems
- Wet detention
- Wetland SWM systems
- Reuse
- Vegetated natural buffers

New Credit Options Available Under the Stormwater Rule Will Make the Rule Effective

- Pervious pavement
- Green roofs
- Treatment train
- Bioretention swales
- Stormwater recycling (reuse)

- **These options have been available and improved over the years.**
- **No credit has been given in the past.**
- **Stormwater rule will set forth the amount of treatment expected to be provided by these options.**

How do Plants Remove Pollutants?



Green Roofs – Provide Water Quality and Other Public Benefits

- Reduces Storm water runoff that contains pollution
- Reduces air temperature and heat island effect (Chicago 90/170)
- Cleans the air of dust and gases

- Beautifies the roof
- Provides open space for recreation/agriculture
- Creates habitat for birds, bees, and butterflies
- Reduces Carbon Footprint

Green Roofs - Private Benefits

- Saves on energy costs
- Ambient temperature on roof is lower
- 3º cooler in top story
- Extends the life of the roof
- Sound insulation
- Increases property values
- Attractive

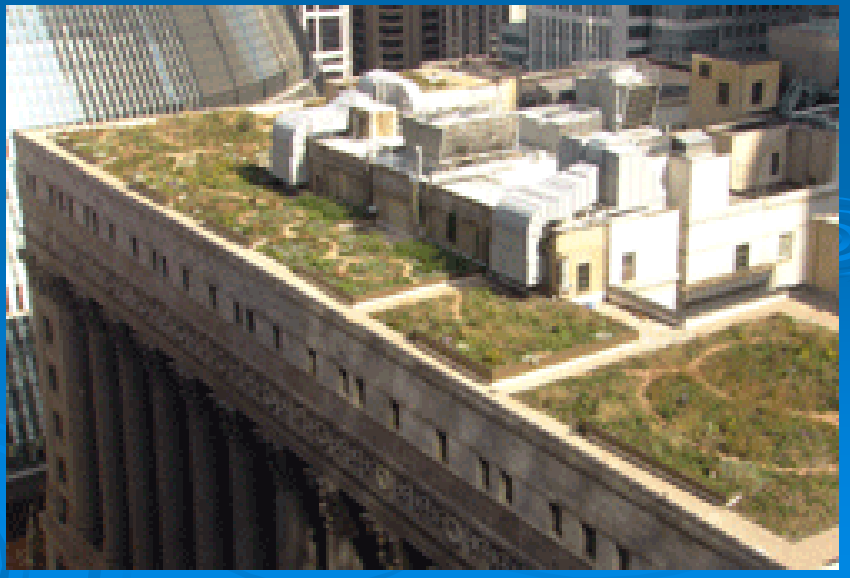
Typical Roof – appliances, gray gravel, ugly.

Green Roof - Case Study

Chicago City Hall

Before Green Roof Installed

After Green Roof Installed, 2001

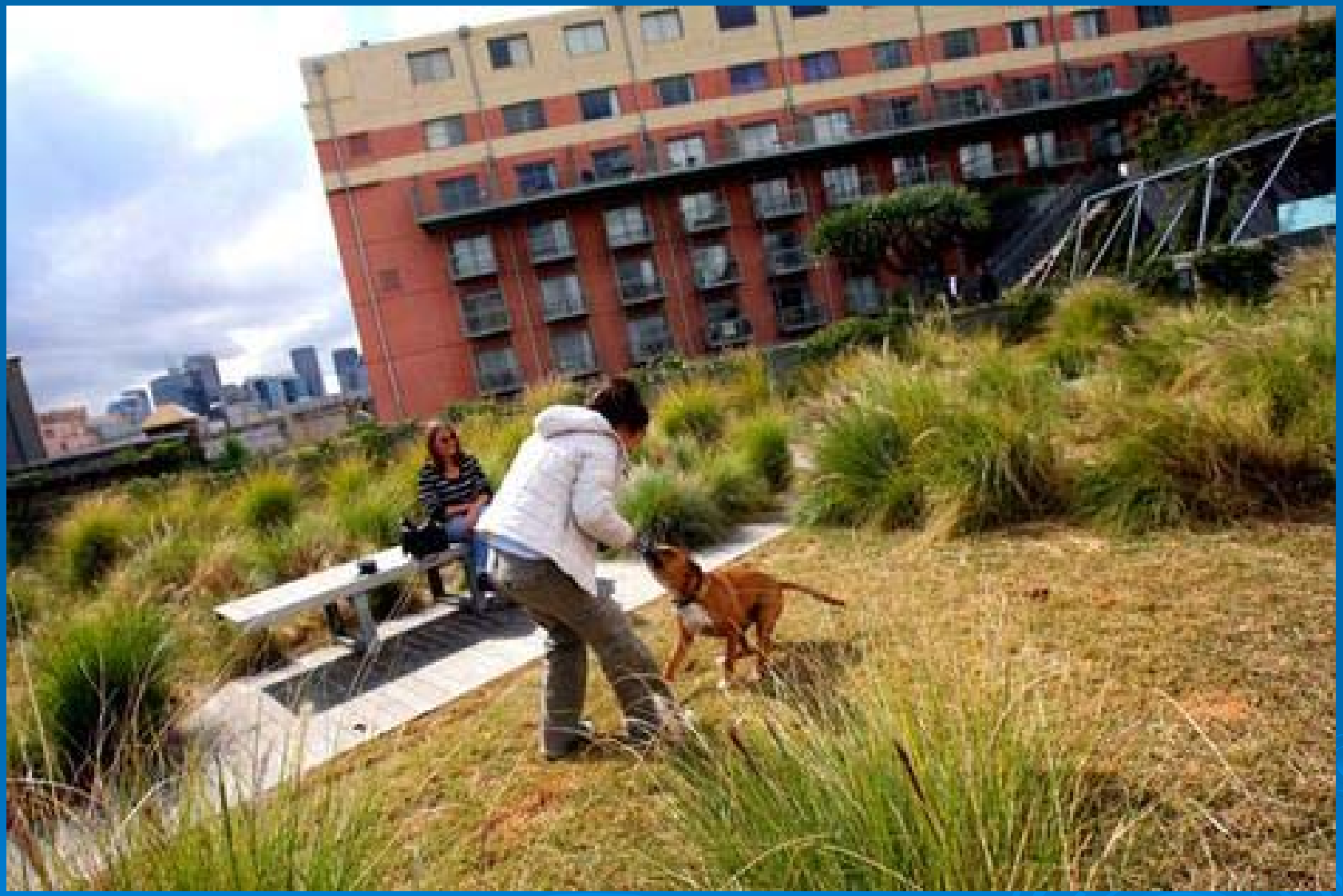


The Green Roof Attracts Birds and Insects – there are even Beehives – and 150 types of plant were installed!

WHY WOULD A DEVELOPER MAKE THE INVESTMENT TO INCLUDE A GREEN ROOF?

Putting Green

Green roofs for socializing



Dog parks on the roof

Florida Green Roof

- Requirements of Success
- Native Vegetation
- Rain Barrel or Cistern
- Hydration of plants

Green Architecture – Romano Law Group
City of Lake Worth

University of Central Florida Student Union

Summary
Why Should You Support the New Rule?

- **Water quality will receive a greater degree of protection.**
- **Treatment will be required to a pre-development natural condition.**
- **Certainty - Specific information is set forth on what is necessary to protect water quality.**
- **The rule will effectively use available and new options:**
  - **Existing and new options will be assigned a removal efficiency assuring that the correct level of treatment is proposed by the applicant;**
  - **Treatment trains will increase removal efficiency; and**
  - **Stormwater recycling for irrigation will be encouraged.**

Proposed Source Control Program in support of the Northern Everglades and Estuaries Protection Program

Proposed Source Control Program in support of the Northern Everglades and Estuaries Protection Program

- **Objective:**

  To develop a source control program as a component of the overall River Watershed restoration program.

Program History

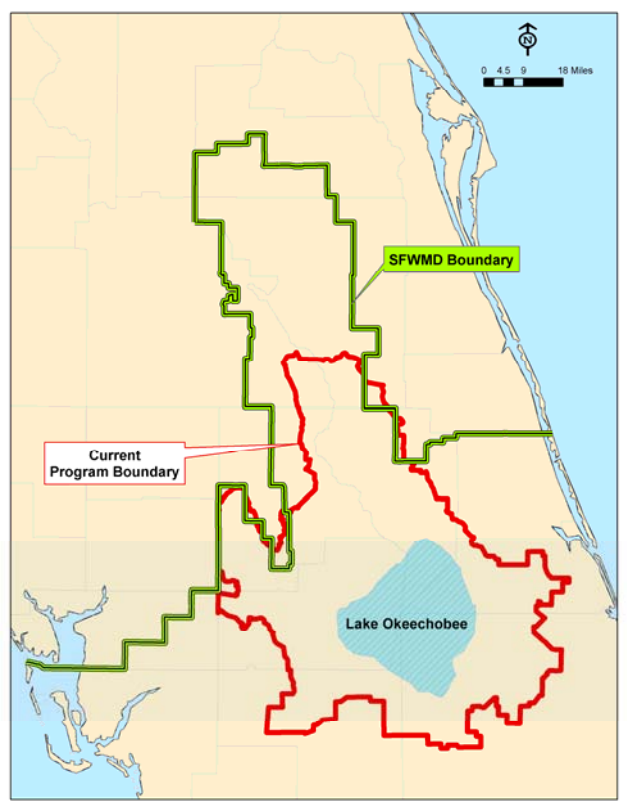
- **Surface Water Improvement and Management (SWIM) Act -1987**
  - **Chapter 40E-61 – Lake Okeechobee Works of the District rule - 1989**
- **The Lake Okeechobee Protection Act (LOPA) – 2000**
- **The Northern Everglades and Estuaries Protection Program (NEEPP) - 2007**

District Mandates

- **The Lake Okeechobee Protection Act (LOPA) and the Northern Everglades and Estuaries Legislation**
  - **Establish relationship of coordinating agencies**
    - **Florida Dept. of Environmental Protection**
    - **Florida Dept. of Agriculture and Consumer Services**
    - **South Florida Water Management District**
  - **Expand the restoration boundaries**
  - **Develop protection plans for the estuaries by January 1, 2009**

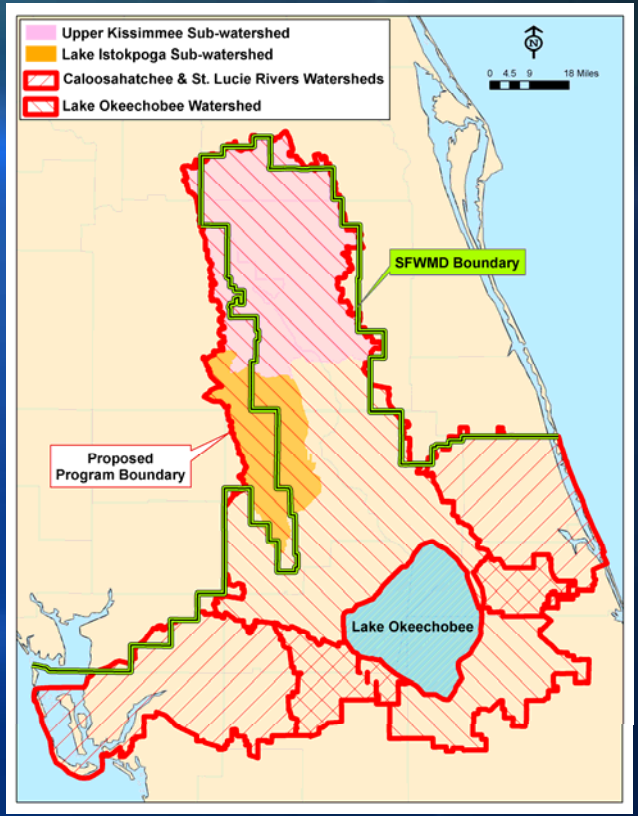
Expanded Program Boundary

Current Boundary



- Upper Kissimmee Sub-watershed
- Lake Istokpoga Sub-watershed
- Caloosahatchee River Sub-watershed
- St. Lucie River Sub-Watershed

Expanded Boundary



Steps to expanded WOD program in the Estuaries

- **Amend Chapter 40E-61 FAC to include Estuary Watersheds**
- **Request notice of rule development for the river watersheds from the District's Governing Board – by early 2009**
- **Develop a source control program using best management practices for existing and future land uses**

The Estuaries Source Control Program Concept

- **Implement BMPs for all lands within the watershed.**
- **Ensure complementary efforts by agencies, e.g. Include a provision for agricultural land uses participating with FDACS to meet WOD regulatory requirements.**
- **Establish incentives for Demonstration Projects**
- **Establish a plan for verifying implementation and program effectiveness**

Define the monitoring network necessary to:

- **Monitor collective source control program effectiveness**
- **Use performance measures for the combined BMP source control programs.**
- **Optimize the BMP programs if WQ problems are detected.**
- **Identify priority areas of water quality concern.**
- **Provide data to enhance performance of downstream treatment facilities.**

Summary

- Estuary WOD programs will be similar to Lake Okeechobee BMP Program
- It will address agricultural and non-agricultural land uses
- It will be based on the estuary protection plan
- Rule development should begin by early 2009

Questions?

CRWPP MANAGEMENT MEASURES

ALT 2 (Does not include ALT 1 or "Common Elements")

May 21, 2008

Northern Everglades – Potential Management Measure

Project Feature/Activity: Lake Hicpochee

Level: 4

General Description/Background: The Lake Hicpochee Project is located on approximately 7500 acres which is currently in private ownership. This project comprises a reservoir and stormwater treatment area along the C-19 and C-43 Canals, degradation of berms, and exotic removal and control. This project could potentially create 55,090 ac-ft of above ground storage.

Purpose: The project objectives are to restore the ecological functioning of Lake Hicpochee. Some of the benefits that would be achieved are use of less water during the dry season due to altered operation of water levels which might involve higher water levels during the wet season and lower wet season and lower water levels during the dry season that currently occurs. Slowly drawing down the pool during the dry season would provide more water for the estuary during that time of year. Additional benefits include improved areas for potential recreation and public use, improvement of an already diverse area of wildlife, and improvement of lake fisheries.

Location/Size/Capacity: The project is located in Glades County, directly west of Lake Hicpochee on the west side of C-19 north of the Lake and along the Caloosahatchee River on the south side, west of the Lake. The project components include a reservoir and STA, degradation of berms, exotic plant removal, stormwater treatment areas, canals, embankments, structures, roads, and the temporary reconfiguration of TIWCD canals:

Initiative Status:

- Advance planning phase and associated field work TBD
- PIR/BODR TBD
- Preliminary Plans and specifications TBD
- Intermediate Design for the PS and Reservoir TBD
- Intermediate Design for the STA TBD
- Pre-final Design TBD

Cost: Not yet determined

Documentation: For more information, please see Evergladesplan.org, C-43 Basin Storage Reservoir Project

Estimate of Water Quality Benefits

- Minimum: Unknown
- Maximum: Unknown
- Most Likely: Unknown
- Level of Certainty: Unknown

- Assumptions: It is assumed that there will be some level of water quality treatment by simply holding water for a period of time before releasing in to the river. Level of treatment is unknown at this time.

Estimate of Water Quantity Benefits

- Minimum: 21,490 ac-ft of above ground storage (2,880 acres)
- Maximum: 55,090 ac-ft of above ground storage (7,500 acres)
- Most Likely: 21,490 ac-ft
- Level of Certainty: Conceptual
- Assumptions: Acquisition of approximately 7500 acres immediately adjacent to Lake Hicpochee.

Screening Criteria

- Proof of Concept: 0
- Other Impacts: 1

Contact: Janet Starnes; SFWMD; 239-338-2929 *7735

Northern Everglades – Potential Management Measure

Project: Recyclable Water Containment Areas (RWCA) in the Freshwater Caloosahatchee SouthEast sub-basin

Description: A distributed reservoir system within agricultural lands. Constructed with earthen berms from on-site material with ~2' water depth. RWCAs will remain in operation for approximately 5 years, at which time the area will come back into production of traditional ag products utilizing the nutrients that have built up in the soil through settling when water was present in the RWCA.
Note: This project is one of many developed by the SWFFS WQ sub-team to address the nutrient enrichment issues of the Caloosahatchee Basin. The strategy of this effort was to formulate both structural and non-structural features that, once implemented, will collectively lead to restoration through pollutant load reductions (primarily nutrients). The cumulative effect of these pollutant reductions are to achieve water quality targets set forth by the SWFFS WQ sub-team (based either on an ecological resource, historical conditions, or reference conditions).

Purpose: The purpose of this feature is reduction of nutrient loads into the Caloosahatchee River.

Location/Size/Capacity:
- Sub-basin: Freshwater Caloosahatchee SouthEast
- Location: Agricultural properties within the sub-basin
- Size and Capacity: RWCAs will be implemented on a percentage of ag properties an any given time, and the capacity will be dependent upon that percentage and the acreage of ag land in the sub-basin.

Initiative Status: Conceptual

Cost: TBD

Documentation: Southwest Florida Feasibility Study (SWFFS) Water Quality Sub-team: Water Quality Plan Formulation Document (work in progress)
Also see documents produced by IFAS (Sanjay Shukla and Ed Hanlon)

Estimate of Water Quality Benefits:
- Nutrient load reduction to Caloosahatchee River and Estuary. The specific water quality benefits will be dependent upon the total area of ag lands operating RWCAs
- Level of Certainty- Conceptual
- Assumptions leading to benefit estimate- Work by UF and IFAS has shown this system to have potential water quality benefits as well as benefits to agricultural operations.

Estimate of Water Quantity Benefits:
- Water quantity benefits include the storage of water during peak flows on land that would otherwise continue down the River to the Estuary. This system has the potential for very large quantities of water to be stored.

- Level of Certainty- Conceptual
- Assumptions leading to benefit estimate- Work by UF and IFAS has shown this system to have potential water quantity benefits as well as benefits to agricultural operations.

Level of Certainty: (select one)
Level 4- implementation certainty unknown; conceptual idea; may have rough order of magnitude cost and/or general basin location

Contact Person – Jennifer Nelson

Northern Everglades – Potential Management Measure

Project: Centralized Recycled Water Containment Area in the S-4 Basin

Description: The Recycled Water Containment Area (RWCA) concept utilizes agricultural or other lands for temporary water storage for water quality and storage benefits. The land is later returned to other uses after a period of time. This concept could be rotated through lands within the S-4 basin so that one land is not taken out of production for an extended period of time. RWCAs have numerous benefits including recycling nutrients, water storage, aquifer recharge, and decreasing excessive flows to the estuaries. In addition, this concept could be used as backup water supply for agriculture and eliminate the need for back pumping into Lake Okeechobee. Currently the S-4 basin, depending on hydrologic conditions, drains into or uses irrigation water from the Caloosahatchee River.

Purpose: Remove nutrients and treat agricultural stormwater runoff from the S-4 basin to help reduce nutrient loading to the Caloosahatchee, aquifer recharge, and add a temporary back-up water supply for irrigation.

Location/Size/Capacity: Located in S-4 Basin. Size and capacity to be determined by discharge volume during peak rain events.

Initiative Status: Conceptual Phase

Cost: N/A
Documentation:

Estimate of Water Quality Benefits:

- **Minimum –** Remove agricultural runoff from the S-4 basin and reduce nutrient loading to the eastern Caloosahatchee. Reduce high flows during rain events and when the S-4 basin is pumping water off agricultural lands into adjacent canals that empty into the Caloosahatchee.
- **Maximum**- N/A
- **Most Likely**- N/A
- **Level of Certainty**- conceptual/final/unknown
- **Assumptions leading to benefit estimate**- (e.g. for features- sub-watershed; period of record; inflow concentration/load; did you assume bmps were implemented or not) (e.g. for activities- location/sub-watershed where activity will apply; what does % reduction apply to-which land uses, only new development, etc.)

Estimate of Water Quantity Benefits:

- **Minimum –** May add additional storage for irrigation by adjacent land owners.
- **Maximum**- N/A
- **Most Likely**- N/A
- **Level of Certainty**- conceptual/final/unknown
- **Assumptions leading to benefit estimate**- (e.g., sub-watershed; period of record; flow/volume; operational assumptions)

Level of Certainty: (select one) Level 5

Northern Everglades – Potential Management Measure

Project Feature: Gator Slough Phase 1 (Project #3060 – FY 1994-1996)

Level: 1

General Description/Background: Improve channel from station 490+00 to US41 and beyond by 1410', a total distance of 4410', and install a weir 1410' upstream of US41.

Purpose: Improvements per the Gator Slough Surface Water Management Master Plan to adequately convey the 25 year storm event, enhance aquifer recharge and water quality.

Location/Size/Capacity: West of US41 and North of Pine Island Road.

Initiative Status: Complete

Cost: $1,208,000

Documentation: Natural Resources CIP Budget Guide, Gator Slough Surface Water Management Master Plan

Estimate of Water Quality Benefit: unknown
Minimum:
Maximum:
Most Likely:
Level of Certainty:
Assumptions: Channel improvements and the addition of a weir are expected to improve water flow off of adjacent properties, while increasing capacity and residency which should improve water quality.

Estimate of Water Quantity Benefit: unknown
Minimum:
Maximum:
Most Likely:
Level of Certainty:
Assumptions: Improved capacity should help with adjacent flooding and increased residency will help with groundwater recharge.

Screening Criteria:
Proof of Concept:
Other Impacts:

Contact: Roland Ottolini – 239-533-8127

CRE 77

Northern Everglades – Potential Management Measure

Project: Canal Stormwater Recovery and Treatment by ASR – Cape Coral

Description: At present the City of Cape Coral experiences a shortfall of water during the dry season and freshwater resources are lost to tidally influence estuaries and waterways during the rainy season. During this rainy season approximately 200 Million gallons per day of freshwater is lost impacting these areas.

By capturing and storing surface flows using planned ASR wells, the volume of fresh water escaping the canals at weirs and locks is reduced. This reduces, and in some cases may eliminate, point source discharge to riparian areas and estuaries in the watershed. ASR will also reduce the potential threat of saltwater intrusion by eliminating over-pumping of irrigation water from the Mid Hawthorne Aquifer.

Development of ASR wells provides a feasible solution to reduce or eliminate point source discharge and the growing water storage concern. This project is being implemented as a phased project, which has funding identified in the City's Capital Improvement Plan for the next eight years.

Funding requested will be used for construction of conveyance and/or surface water treatment necessary under Florida Statue for ASR.

Purpose: In addition to prevention of saltwater intrusion and creation of more reliable water resource availability, anticipated benefits to the Caloosahatchee River watershed include:

- Flood attenuation
- Water quality improvements to an impaired waterbody
- Protection of existing wetlands
- Reduction of sediment and nutrient loading

Location/Size/Capacity:

Initiative Status:

- Advance planning phase and associated field work TBD
- Preliminary Plans and Specification (30% complete) TBD
- Intermediate Design (60% complete) TBD
- Pre-final Design (90% complete) TBD
- Final Design TBD
- Permit submittals TBD

Cost: Total Construction Costs: $15 million - Requested Funding: $500,000

Documentation:

Estimate of Water Quality Benefits:

- Minimum –
- Maximum-
- Most Likely-
- Level of Certainty- conceptual/final/unknown
- Assumptions leading to benefit estimate- (e.g. for features- sub-watershed; period of record; inflow concentration/load; did you assume bmps were implemented or not) (e.g. for activities- location/sub-watershed where activity will apply; what does % reduction apply to-which land uses, only new development, etc.)

Estimate of Water Quantity Benefits:

- Minimum –
- Maximum-
- Most Likely-
- Level of Certainty- conceptual/final/unknown
- Assumptions leading to benefit estimate- (e.g., sub-watershed; period of record; flow/volume; operational assumptions)

Level of Certainty: (select one)

Level 1- already constructed/implemented or construction/implementation imminent.
Planning, system modeling and preliminary design have been completed. Engineering and construction is currently on-going with three ASR wells being drilled during 2007-2008 and three wells being permitted for construction during 2008-2009. Conveyance and water quality treatment systems will be constructed during the same timeframes in a phased manner.

Northern Everglades – Potential Management Measure

Project: Cape Coral Canal Weir System

Description: This project consists of a system of weirs in the Cape Coral canal system that will hold stormwater within for longer periods of time and at higher levels.

Purpose: The purpose of this project is to reduce discharges of stormwater to the Caloosahatchee Estuary.
Note: This project is one of many developed by the SWFFS WQ sub-team to address the nutrient enrichment issues of the Caloosahatchee Basin. The strategy of this effort was to formulate both structural and non-structural features that, once implemented, will collectively lead to restoration through pollutant load reductions (primarily nutrients). The cumulative effect of these pollutant reductions are to achieve water quality targets set forth by the SWFFS WQ sub-team (based either on an ecological resource, historical conditions, or reference conditions).

Location/Size/Capacity:

- Sub-basin: Cape Coral
- Location: Cape Coral canals
- Size and Capacity:
-

Initiative Status: Conceptual

Cost: TBD

Documentation: Southwest Florida Feasibility Study (SWFFS) Water Quality Sub-team: Water Quality Plan Formulation Document (work in progress)

Estimate of Water Quality Benefits:

- Nutrient load reduction to Caloosahatchee River and Estuary.
- Level of Certainty- Conceptual
- Assumptions leading to benefit estimate- Holding water for longer periods of time within the canals and limiting exchange with estuarine waters will allow some pollutant settling/uptake and reduce loads of certain pollutants to the estuary from the canals.

Estimate of Water Quantity Benefits:

- Reduce unnatural flows of stormwater to the Caloosahatchee Estuary
- Level of Certainty- Conceptual
- Assumptions leading to benefit estimate- Holding water within the canal system will reduce unnatural discharges to the Estuary

Level of Certainty: (select one)

Level 4- implementation certainty unknown; conceptual idea; may have rough order of magnitude cost and/or general basin location

Northern Everglades – Potential Management Measure

Project: RWCAs (Recyclable Water Containment Areas) - Agricultural Suite

Description: This project consists of several specific management measures/features that can be applied to agricultural areas for reduction of nutrients to receiving waters. These features can be applied in sub-basins (list below) with significant agricultural land use. Which feature is applied will be dependent upon the suitability of the features for the specific area/grower. The following are management measures that may be included within the agricultural suite:

- RWCAs (Recyclable Water Containment Areas) - A distributed reservoir system within agricultural lands. Constructed with earthen berms from on-site material with ~2' water depth. RWCAs will remain in operation for approximately 5 years, at which time the area will come back into production of traditional ag products utilizing the nutrients that have built up in the soil through settling when water was present in the RWCA.

Note: This project is one of many developed by the SWFFS WQ sub-team to address the nutrient enrichment issues of the Caloosahatchee Basin. The strategy of this effort was to formulate both structural and non-structural features that, once implemented, will collectively lead to restoration through pollutant load reductions (primarily nutrients). The cumulative effect of these pollutant reductions are to achieve water quality targets set forth by the SWFFS WQ sub-team (based either on an ecological resource, historical conditions, or reference conditions).

Purpose: The purpose of this feature is reduction of nutrient loads into the Caloosahatchee River.

Location/Size/Capacity:

- Sub-basin:
  - Freshwater Caloosahatchee SouthEast
  - Okaloacoochee Slough North
  - Gum Slough
  - Freshwater Caloosahatchee SouthWest
  - Hickey Creek
  - Freshwater Caloosahatchee NorthEast
  - Freshwater Caloosahatchee Tributaries
  - Bee Branch
  - Jacks Branch
  - Otter Creek
  - Freshwater Caloosahatchee Okeechobee
  - Telegraph Swamp
  - Tidal Caloosahatchee Tributaries
- Location: Agricultural properties within each of these sub-basins
- Size and Capacity: Specific management measures from the ag suite will be implemented on a percentage of ag properties an any given time, and the capacity will be dependent upon that percentage, the measure implemented, and the acreage of ag land in the sub-basin.

Initiative Status: Conceptual

Cost: TBD

Documentation: Southwest Florida Feasibility Study (SWFFS) Water Quality Sub-team: Water Quality Plan Formulation Document (work in progress)
Also see documents produced by IFAS (Sanjay Shukla and Ed Hanlon)

Estimate of Water Quality Benefits:

- Nutrient load reduction to Caloosahatchee River and Estuary. The specific water quality benefits will be dependent upon the total area of ag lands implementing this, and the specific measure used
- Level of Certainty- Conceptual

Estimate of Water Quantity Benefits:

- Water quantity benefits include the storage of water during peak flows on land that would otherwise continue down the River to the Estuary. This system has the potential for very large quantities of water to be stored.
- Level of Certainty- Conceptual

Level of Certainty: (select one)
Level 4- implementation certainty unknown; conceptual idea; may have rough order of magnitude cost and/or general basin location

Northern Everglades – Potential Management Measure

Project: HWCAs (Harvestable Water Containment Areas) - Agricultural Suite

Description: This project consists of several specific management measures/features that can be applied to agricultural areas for reduction of nutrients to receiving waters. These features can be applied in sub-basins (list below) with significant agricultural land use. Which feature is applied will be dependent upon the suitability of the features for the specific area/grower. The following are management measures that may be included within the agricultural suite:

HWCAs (Harvestable Water Containment Areas) - Essentially the same structural framework as the RWCAs, but with different management. The HWCAs will be managed to sell water on demand and may be more permanent features than RWCAs.

Note: This project is one of many developed by the SWFFS WQ sub-team to address the nutrient enrichment issues of the Caloosahatchee Basin. The strategy of this effort was to formulate both structural and non-structural features that, once implemented, will collectively lead to restoration through pollutant load reductions (primarily nutrients). The cumulative effect of these pollutant reductions are to achieve water quality targets set forth by the SWFFS WQ sub-team (based either on an ecological resource, historical conditions, or reference conditions).

Purpose: The purpose of this feature is reduction of nutrient loads into the Caloosahatchee River.

Location/Size/Capacity:

- Sub-basin:
  - Freshwater Caloosahatchee SouthEast
  - Okaloacoochee Slough North
  - Gum Slough
  - Freshwater Caloosahatchee SouthWest
  - Hickey Creek
  - Freshwater Caloosahatchee NorthEast
  - Freshwater Caloosahatchee Tributaries
  - Bee Branch
  - Jacks Branch
  - Otter Creek
  - Freshwater Caloosahatchee Okeechobee
  - Telegraph Swamp
  - Tidal Caloosahatchee Tributaries
- Location: Agricultural properties within each of these sub-basins
- Size and Capacity: Specific management measures from the ag suite will be implemented on a percentage of ag properties an any given time, and the capacity will be dependent upon that percentage, the measure implemented, and the acreage of ag land in the sub-basin.

Initiative Status: Conceptual

Cost: TBD

Documentation: Southwest Florida Feasibility Study (SWFFS) Water Quality Sub-team: Water Quality Plan Formulation Document (work in progress)
Also see documents produced by IFAS (Sanjay Shukla and Ed Hanlon)

Estimate of Water Quality Benefits:

- Nutrient load reduction to Caloosahatchee River and Estuary. The specific water quality benefits will be dependent upon the total area of ag lands implementing this, and the specific measure used
- Level of Certainty- Conceptual

Estimate of Water Quantity Benefits:

- Water quantity benefits include the storage of water during peak flows on land that would otherwise continue down the River to the Estuary. This system has the potential for very large quantities of water to be stored.
- Level of Certainty- Conceptual

Level of Certainty: (select one)
Level 4- implementation certainty unknown; conceptual idea; may have rough order of magnitude cost and/or general basin location

Northern Everglades – Potential Management Measure

Project: Modified Water Retention - Agricultural Suite

Description: This project consists of several specific management measures/features that can be applied to agricultural areas for reduction of nutrients to receiving waters. These features can be applied in sub-basins (list below) with significant agricultural land use. Which feature is applied will be dependent upon the suitability of the features for the specific area/grower. The following are management measures that may be included within the agricultural suite:

- Modified Water Retention - Utilization of existing agricultural stormwater r/detention areas (many are former wetland areas). The management of the existing r/detention areas will be modified to increase water storage. This will likely require an agreement/regulatory authorization from the SFWMD and any other agency that approved the r/detention areas as mitigation for wetlands.

Note: This project is one of many developed by the SWFFS WQ sub-team to address the nutrient enrichment issues of the Caloosahatchee Basin. The strategy of this effort was to formulate both structural and non-structural features that, once implemented, will collectively lead to restoration through pollutant load reductions (primarily nutrients). The cumulative effect of these pollutant reductions are to achieve water quality targets set forth by the SWFFS WQ sub-team (based either on an ecological resource, historical conditions, or reference conditions).

Purpose: The purpose of this feature is reduction of nutrient loads into the Caloosahatchee River.

Location/Size/Capacity:

- Sub-basin:
  - Freshwater Caloosahatchee SouthEast
  - Okaloacoochee Slough North
  - Gum Slough
  - Freshwater Caloosahatchee SouthWest
  - Hickey Creek
  - Freshwater Caloosahatchee NorthEast
  - Freshwater Caloosahatchee Tributaries
  - Bee Branch
  - Jacks Branch
  - Otter Creek
  - Freshwater Caloosahatchee Okeechobee
  - Telegraph Swamp
  - Tidal Caloosahatchee Tributaries
- Location: Agricultural properties within each of these sub-basins
- Size and Capacity: Specific management measures from the ag suite will be implemented on a percentage of ag properties an any given time, and the capacity will be dependent upon that percentage, the measure implemented, and the acreage of ag land in the sub-basin.

Initiative Status: Conceptual

Cost: TBD

Documentation: Southwest Florida Feasibility Study (SWFFS) Water Quality Sub-team: Water Quality Plan Formulation Document (work in progress)
Also see documents produced by IFAS (Sanjay Shukla and Ed Hanlon)

Estimate of Water Quality Benefits:

- Nutrient load reduction to Caloosahatchee River and Estuary. The specific water quality benefits will be dependent upon the total area of ag lands implementing this, and the specific measure used
- Level of Certainty- Conceptual

Estimate of Water Quantity Benefits:

- Water quantity benefits include the storage of water during peak flows on land that would otherwise continue down the River to the Estuary. This system has the potential for very large quantities of water to be stored.
- Level of Certainty- Conceptual

Level of Certainty: (select one)
Level 4- implementation certainty unknown; conceptual idea; may have rough order of magnitude cost and/or general basin location

Northern Everglades – Potential Management Measure

Project: Rehydrate Lee County Well Fields - "Move Water South" (Study and Preliminary Design) - East County Water Control District

Description: East County Water Control District (ECWCD) is a Florida Statutes 298 Special District created in 1958 to build, operate, and maintain drainage facilities in eastern Lee County and western Hendry County. The boundaries of the ECWCD are essentially the same as that of unincorporated Lehigh Acres with the addition of three square miles of adjacent land in Hendry County. The District encompasses over 63,000 acres of land and approximately 311 miles of primary and secondary freshwater canals with numerous culverts, water control structures and bridges.

The ECWCD has three natural and one man-made outfall(s) that convey stormwater runoff to the C-43 Canal (Caloosahatchee River). The three natural outfalls, the Orange River, Hickeys Creek, and Bedman Creek are meandering water bodies that begin at various locations along the ECWCD boundary and flow into the C-43 Canal. The development of the ECWCD canal system modified the historic flow patterns of surface water that feed these natural outfalls. Prior to the establishment of the ECWCD, surface water entered the natural outfalls via overland sheet flow and natural tributaries. The construction of the ECWCD canal network reduced the storage capacity of the ECWCD headwaters area and changed the volume and intensity of storm water entering the Orange River, Hickeys Creek, and Bedman Creek.

The ECWCD system was designed when excess surface water was considered the "common enemy", and the intent was to significantly reduce water table levels so Lehigh Acres could be developed. No significant sized parcels of land were set aside for water detention or impoundment to reduce the surface water flow impacts on the three natural outfalls from the ECWCD. Given the current deficiency of available surface water storage areas within the ECWCD system, additional route(s) of stormwater discharge from the ECWCD along with basin interconnections and additional storage within the system are needed to reduce the impacts to the three natural outfalls.

The recently completed work under the ongoing Lehigh Headwaters Initiative Study is recommending that ECWCD proceed with increasing the amount of storage volume available for storm events, provide for additional water quality treatment in the canals and increase groundwater recharge. This proposed project could help ECWCD address all three of these needs in the Lehigh Acres area if it determined that the project is feasible.

Purpose: To reconnect and rehydrate the area south (well fields) of SR 82. Historically the southern portion of the District drained to the south of SR 82 but the existing canal system drains everything to the north. This project would try to restore the historic conditions and divert more water to the south which could help recharge groundwater in the Lee County "DR/GR" area. By sending stormwater to drained wetlands outside of the Caloosahatchee estuary watershed, this project will reduce nutrient loads to the estuary while providing appropriate treatment in drained wetlands of the Estero and Imperial River watersheds.

Location/Size/Capacity: This project would involve the area along the southern boundary of the District on both sides of SR 82 between the Hendry County Line and Gunnery Road. The current

request is for diversion of runoff from southern ECWCD lands (In the vicinity of Mirror Lakes) to Lee County Port Authority mitigation lands and ultimately to the Green Meadows well fields.

Initiative Status: This project has been preliminarily discussed in the Lehigh Headwaters Initiative Meetings and should be studied further to determine its feasibility. ECWCD has has positive discussions with Lee County Port Authority, Lee County Natural Resources, and Lee County Utilites.

Cost: Estimated Study and Preliminary Design Cost: $100,000.00

Documentation:

Estimate of Water Quality Benefits:

- Minimum: 0 pounds TN/year
- Maximum: 5,600 pounds TN/yr (assumes 25% TN removal)
- Most Likely: 2,800 pounds TN/yr
- Level of Certainty – conceptual
- Assumptions leading to benefit estimate-(e.g. for features- sub-watershed; period of record; inflow concentration/load; did you assume bmps were implemented or not) (e.g. for activities – location/sub-watershed where activity will apply; what does % reduction apply to which land uses, only new development, etc.)

The anticipated benefits to the Caloosahatchee River include:

- Flood attenuation
- Water quality improvements
- Rehydration of existing wetlands
- Rehydration of existing well fields
- Reduction of sediment and nutrient loading to the estuary
- Provide aquifer recharge
- Protect public health and safety

Estimate of Water Quantity Benefits:

- Minimum: 0 acre feet/yr, 0 cfs peak flow
- Maximum: 8,000 acre-feet/yr, 70 cfs peak flow
- Most Likely: 4,000 acre-feet/yr, 35 cfs peak flow
- Level of Certainty – conceptual
- Assumptions leading to benefit estimate- (e.g., sub-watershed; period of record; flow/volume; operational assumptions)

Level of Certainty: (select one) This project is at Level 3 to 4.

Northern Everglades – Potential Management Measure

Project Feature/Activity: East Caloosahatchee Storage

Level: 4

General Description/Background: The East Caloosahatchee Storage Project is located on approximately 7500 acres which is currently in private ownership. This project comprises a series of distributed reservoirs located in the East Caloosahatchee basin. This project could potentially create 100,000 ac-ft of above ground storage.

Purpose: The project objectives are to provide additional storage in the East Caloosahatchee Basin to meet unmet demands. The distributed reservoirs would be smaller localized reservoirs to supply irrigation demands.

Location/Size/Capacity: The project is located in the East Caloosahatchee Basin. A series of potential reservoir sites have been located with a total are of approximately 8,000 acres. The distributed reservoirs will provide above ground storage to meet unmet demand in the basin:

Initiative Status:

- Advance planning phase and associated field work TBD
- PIR/BODR TBD
- Preliminary Plans and specifications TBD
- Intermediate Design for the PS and Reservoir TBD
- Pre-final Design TBD

Cost: Not yet determined

Documentation: For more information, please see CWMP Planning document.

Estimate of Water Quality Benefits

- Minimum: Unknown
- Maximum: Unknown
- Most Likely: Unknown
- Level of Certainty: Unknown
- Assumptions: It is assumed that there will be some level of water quality treatment by simply holding water for a period of time before releasing in to the river. Level of treatment is unknown at this time.

Estimate of Water Quantity Benefits

- Minimum: 50,000 ac-ft of above ground storage
- Maximum: 100,000 ac-ft of above ground storage
- Most Likely: 70,000 ac-ft
- Level of Certainty: Conceptual
- Assumptions: Acquisition of approximately 8,000 acres in the East Caloosahatchee Basin

Screening Criteria

- Proof of Concept: 0
- Other Impacts: 1

Contact: Clyde Dabbs; SFWMD; 239-338-2929 *7759

Caloosahatchee River Watershed Protection Plan

Draft Alternative 1 and 2

MM#	Sub-Watershed	Management Measures	Level	Alternative
		Baseline		
	FSW	C-43 Reservoir	B	0
		Alternative 1		
CRE10	FSE	C-43 Water Quality Treatment Demonstration Project (BOMA Property)	4	1
CRE 18	TS	Harns Marsh Improvements Phase I & II	1	1
CRE 19	TS	Harns Marsh Improvements, Phase II Final Design - ECWCD	2	1
CRE 20	TS	Yellowtail Structure Construction - ECWCD	2	1
CRE 21	FSW	Hendry County Storage	3	1
CRE 22	FSW	Hendry Extension Canal Widening (Construction) - ECWCD	2	1
CRE 30	TS	Aquifer Benefit and Storage for Orange River Basin (ABSORB) - ECWCD	2	1
CRE 44	FNW	Spanish Creek Four Corners Environmental Restoration	2	1
CRE 45	TS	Billy Creek Filter Marsh Phase I & II	1	1
CRE 48	TS	Manuel's Branch Silt Reduction Structure	2	1
CRE 49	TS	Manuel's Branch East & West Weirs	2	1
CRE 53	TN	Caloosahatchee Creeks Preserve Hydrological Restoration	2	1
CRE 57	TN	Powell Creek Algal Turf Scrubber	2	1
CRE 59	TN	N Ft Myers Surface Water Restoration	1	1
CRE 64	TN	Yellowfever Creek / Gator Slough Transfer Facility	1	1
CRE 121	FSW	City of LaBelle Stormwater Master Plan Implementation	2	1
		Alt 1 MM adopted from LO Plan		
CRE-LO 01,02, 49	All	Agricultural BMP's	1	1
CRE-LO 03	All	Urban Turf Fertilizer Rule (LOER)	1	1
CRE-LO 04	All	Land Application of Residuals	1	1
CRE-LO 05	All	Florida Yards and Neighborhoods	1	1
CRE-LO 08	All	NPDES Stormwater Program	1	1
CRE-LO 09	TS, EST, NC, NS	Coastal and Estuarine Land Conservation Program	1	1
CRE-LO 12g	FSW	Alternative Water Storage (LOER) - Barron Water Control District (BWCD)	1	1
CRE-LO 15	All	Caloosahatchee River Watershed Works of the District Rule Regulatory Phosphorus Source Control Program	2	1
CRE-LO 21	All	Lake Okeechobee And Estuary Watershed Basin Rule (LOER)	3	1
CRE-LO 41	FSE, FNE	C-43 Distributed Reservoirs	4	1
CRE-LO 63	All	Wastewater & Stormwater Master Plans	4	1
CRE-LO 64	All	Unified Statewide Stormwater Rule	4	1
CRE-LO 68	All	Comprehensive Planning - Land Development Regulation (LDR)	3	1
CRE-LO 87c	All	Florida Ranchlands Environmental Services Project (FRESP)	1	1
CRE-LO 92	S-4	Clewiston STA	4	1
		Alternative 2		
CRE 01	All	Recyclable Water Containment Areas (RWCA) in the Freshwater Caloosahatchee Southeast sub-basin	4	2
CRE 02	S-4	Centralized Recycled Water Containemnt Area in S-4 Basin	5	2
CRE 66	TN	Gator Slough Phase 1 (Project #3060)	1	2
CRE 77	TN, NC	Cape Coral - Canal Stormwater Recovery and Treatment by ASW	1	2
CRE 78	TN, NC	Cape Coral Canal Weir System	4	2
CRE 93	All	Recyclable Water Containment Areas (RWCA) Agricultural Suite	4	2
CRE 94	All	Harvestable Water Containment Areas (HWCA) Agricultural Suite	4	2
CRE 95	All	Modified Water Retention Ag Suite	4	2
CRE 122	TS	Rehydrate Lee County Well Fields (south of Hwy 82)	3	2
CRE 128	FSE	East Caloosahatchee Storage	4	2
		Alternative 2 MM adopted from LO Plan		
CRE-LO 40	FNE	Lake Hicpochee	4	2

Yellow = Alt 1 Common Elements (in all subsequent alternatives)
Blue = Alt 2 Water Storage

Caloosahatchee River Watershed Protection Plan

Draft Alternative 1 and 2

Abbreviations

Management Measures (MM) Numbering System

CRE - MM submitted and adopted for the CRWPP
CRE-LO - MM adopted from Lake Okeechobee Plan
MM - numbers were originally assigned from east to west. MM's added after the initial meeting were numbered sequentially.

Sub-Watersheds

S-4 - S-4 sub-basin
FNE - Caloosahatchee River Freshwater Northeast of S-78
FSE - Caloosahatchee River Freshwater Southeast of S-78
FNW - Caloosahatchee River Freshwater Northwest of S-78
FSW - Caloosahatchee River Freshwater Southwest of S-78
TN - Caloosahatchee River - Tidal North of River
TS - Tidal Caloosahatchee South of River
EST - Caloosahatchee Estuary
NC - North Coastal
NS - Nearshore

Levels

Base- Included in base condition
Level 1- Already constructed/implemented or construction/implementation imminent
Level 2- Construction/implementation likely; Detailed design/activity development ongoing; Location well defined
Level 3- Implementation certainty unknown; Conceptual level of design/activity development complete; Location defined
Level 4- Implementation certainty unknown- Conceptual idea; May have rough order of magnitude cost and/or general basin location
Level 5- Implementation certainty unknown-Conceptual idea with limited information

Caloosahatchee River Watershed Protection Plan

Draft Alternative 1 and 2

Caloosahatchee River Watershed Protection Plan

Draft Alternative 1 and 2

Nutrient Loading Rates, Reduction Factors and Implementation Costs Associated with BMPs and Technologies

Caloosahatchee River Watershed

Prepared by

Soil and Water Engineering Technology, Inc

For

South Florida Water Management District

Objectives

- ***Task 1.*** Develop N and P Loading Rate Factors for Caloosahatchee and St. Lucie Watersheds
- ***Task 2.*** Develop BMP N and P Load Reduction and Cost Factors
- ***Task 3.*** Conduct a Detailed Literature Review and Data Analysis for BMPs (Statewide)

Six New Land Use Categories

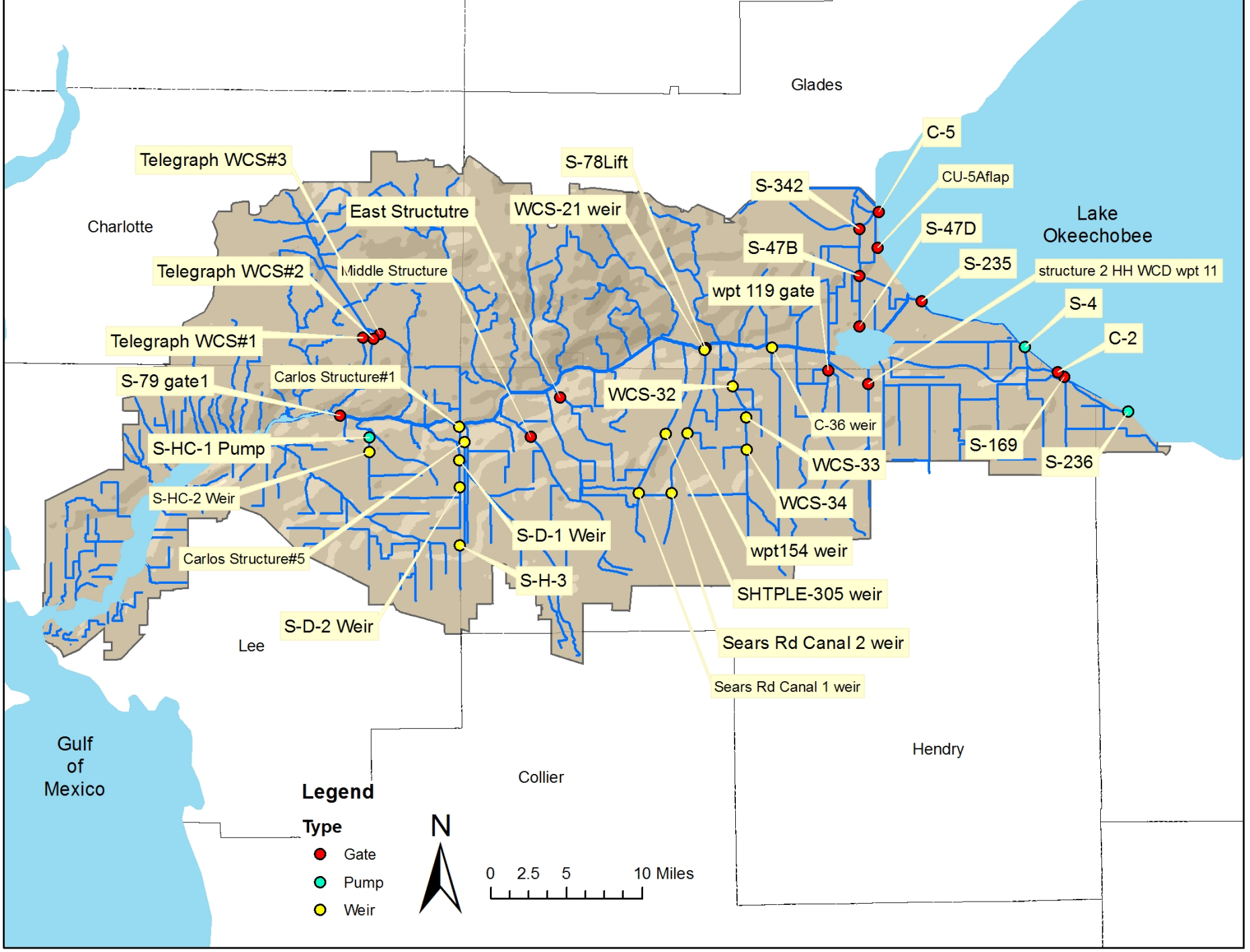
- low density residential
- medium density residential
- high density residential
- horse farms
- transportation
- utilities.

Methodology – Units Loads

- Start with Okeechobee P Units Loads
- Search literature and data resources for N and P units within Caloosahatchee Basin
- Update N and P Units Loads and Compare Net Loads to Measured Data
- Iteratively adjust unit loads until reasonable net load agreement was reached

Data Sources

- BMP Letter Report (Bottcher, 2006)
- Harper and Baker (2003 and 2007)
- WMM EMC estimates developed by CDM (2007)
- WAM modeling results for the USACE (SWET, 2008).


Glades
Charlotte
Lee
Collier
Hendry
Gulf of Mexico
Lake Okeechobee
Telegraph WCS#3
Telegraph WCS#2
Telegraph WCS#1
East Structutre
Middle Structure
Carlos Structure#1
Carlos Structure#5
S-79 gate1
S-HC-1 Pump
S-HC-2 Weir
S-D-1 Weir
S-D-2 Weir
S-H-3
S-78Lift
WCS-21 weir
WCS-32
WCS-33
WCS-34
wpt154 weir
SHTPLE-305 weir
Sears Rd Canal 2 weir
Sears Rd Canal 1 weir
C-36 weir
wpt 119 gate
S-342
S-47B
S-47D
S-235
C-5
CU-5Aflap
structure 2 HH WCD wpt 11
S-4
C-2
S-169
S-236
Legend
Type
Gate
Pump
Weir
N
0 2.5 5 10 Miles

Caloosahatchee River Watershed Assessment Model

C-43 Basin

EXISTING LAND USE SCENARIO

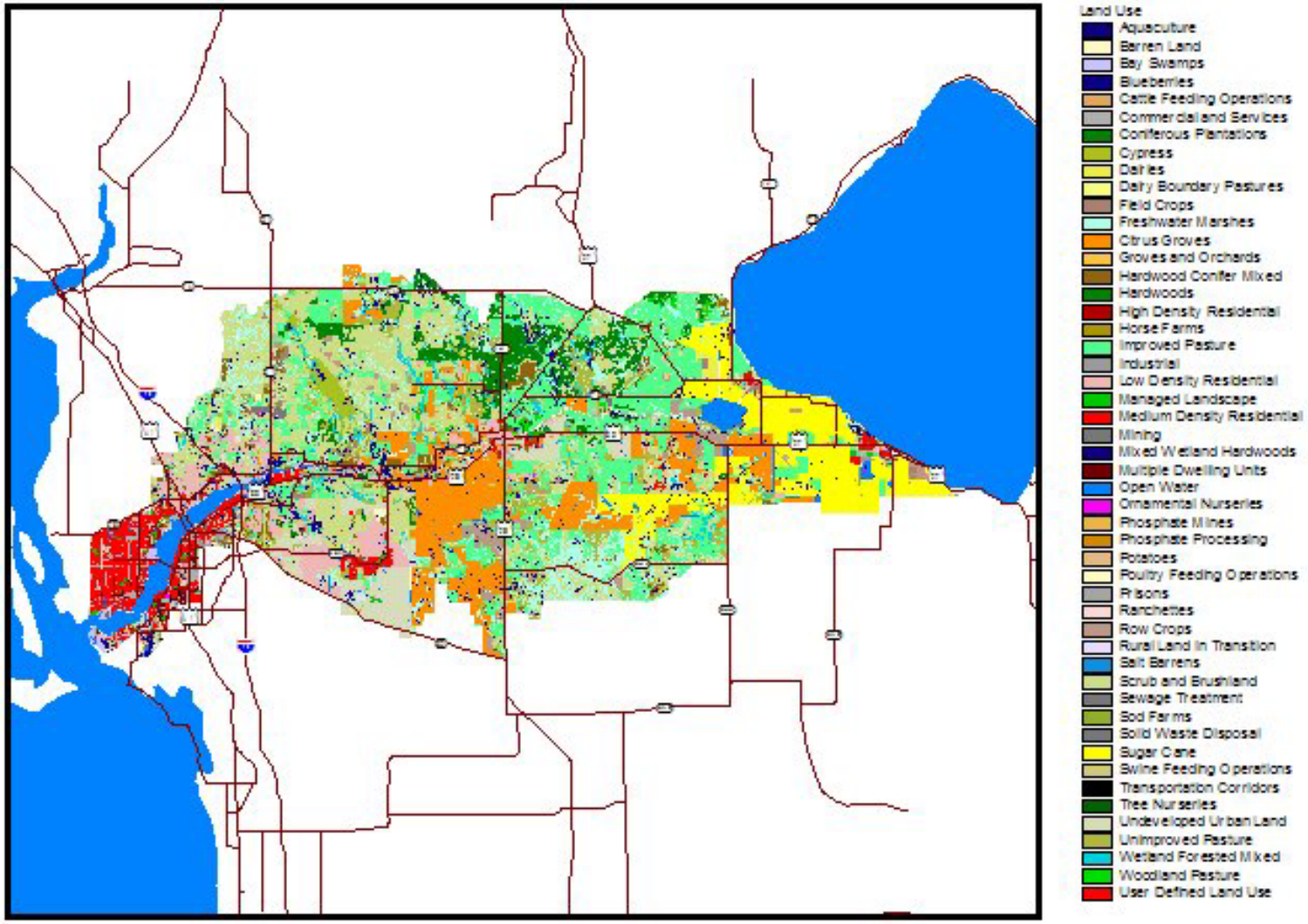
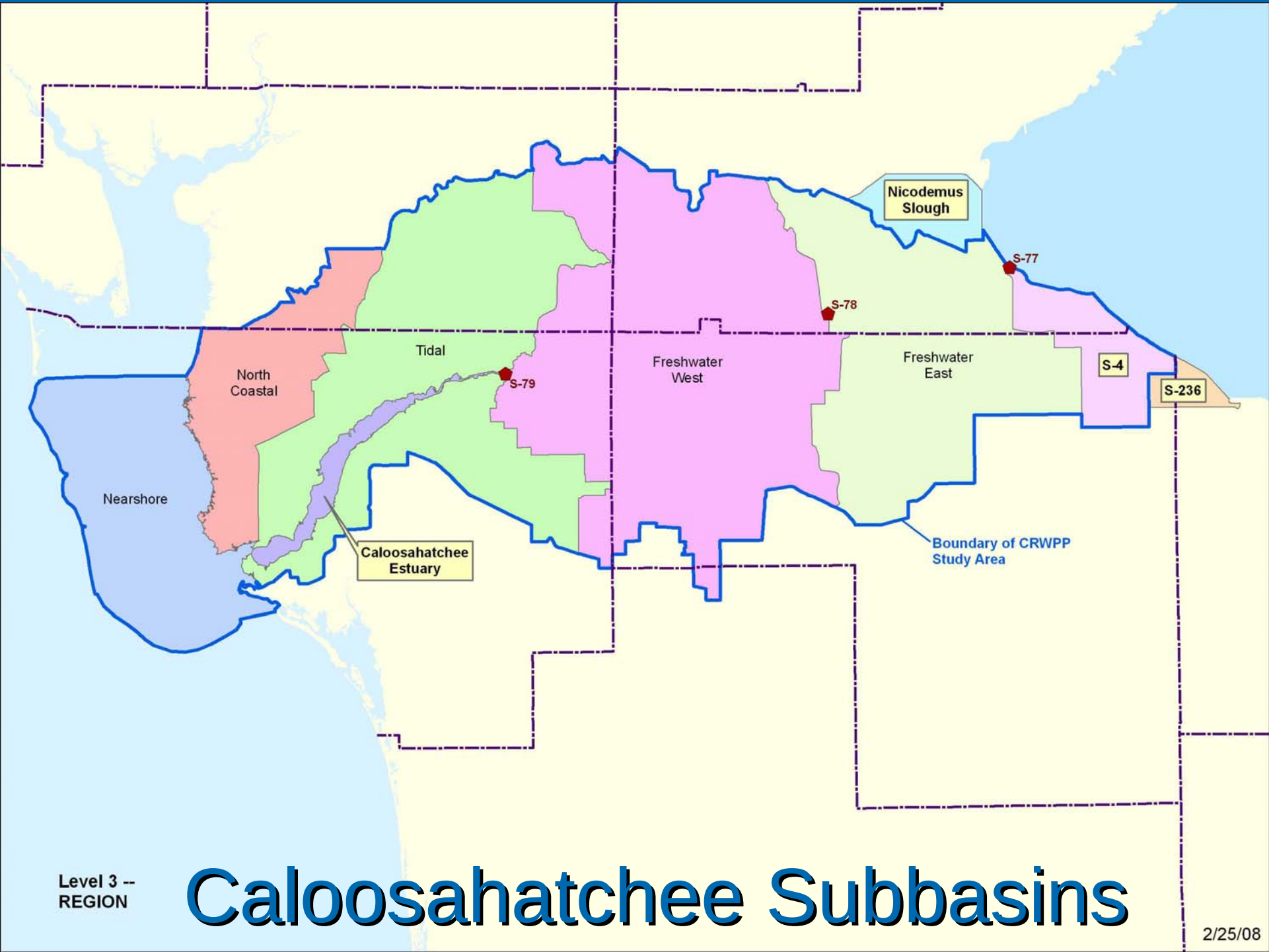


Table 12. Land Use Distribution for the Caloosahatchee Watershed

Land Use Category	Land Use Description	FLUCCS	Area (ac)	Percent	Area (ac)	Percent
Residential Low Density	Residential Low Density	1100	76,863	7.12%	76,863	7.10%
Residential Medium Density	Residential Medium Density	1200	33,396	3.09%	33,396	3.10%
Residential High Density	Residential High Density	1300	11,453	1.06%	11,453	1.10%
	Commercial and Services	1400	8,906	0.82%		
	Industrial	1500	2,648	0.25%		
	Extractive	1600	2,278	0.21%		
	Institutional	1700	3,675	0.34%		
Other Urban	Recreational	1800	6,062	0.56%	23,568	2.20%
Improved Pastures	Improved Pastures	2110	117,152	10.85%	117,152	10.80%
Unimproved Pastures	Unimproved Pastures	2120	23,827	2.21%	23,827	2.20%
	Woodland Pastures	2130	20,280	1.88%		
Woodland Pastures/Rangeland	Rangeland	3000	57,850	5.36%	78,130	7.20%
Row Crops	Row Crops	2140	9,656	0.89%	9,656	0.90%
Sugar Cane	Sugar Cane	2156	87,741	8.13%	87,741	8.10%
Citrus	Citrus	2210	96,684	8.95%	96,684	9.00%
Sod Farms	Sod Farms	2420	5,070	0.47%	5,070	0.50%
Ornamentals	Ornamentals	2430	861	0.08%	861	0.10%
Horse Farms	Horse Farms	2510	202	0.02%	202	0.00%
Dairies	Dairies	2520	56	0.01%	56	0.00%
	Field Crops	2150	5,326	0.49%		
	Mixed Crops	2160	17	0.00%		
	Fruit Orchards	2220	12	0.00%		
	Other Groves	2230	1,995	0.18%		
	Tree Nurseries	2410	971	0.09%		
	Specialty Farms	2500	165	0.02%		
	Aquaculture	2540	215	0.02%		
Other Areas	Fallow Crop Land	2610	2,209	0.20%	10,909	1.00%
Tree Plantations	Tree Plantations	4400	42,498	3.94%	42,498	3.90%
Water	Water	5000	130,368	12.07%	130,368	12.10%
	Upland Forests (not including 4400's)	4000	84,379	7.81%		
	Wetlands	6000	184,666	17.10%		
	Barren Land	7000	5,866	0.54%		
Natural Areas	Open Land	1900	49,378	4.57%	324,289	30.00%
Transportation	Transportation	8100	4,915	0.46%	4,915	0.50%
	Communications	8200	96	0.01%		
Communication/Utilities	Utilities	8300	2,063	0.19%	2,159	0.20%
Total			**1,079,796**	**100.00%**	**1,079,796**	**100.00%**

Table 15. Acreage of Land Uses within the Caloosahatchee Watershed

FLUCCS	Caloosahatchee Estuary	Freshwater East	Freshwater West	Nearshore	North Coastal	S-4	Tidal	Grand Total
1100	19	3,015	14,869	4236	24,084	548	30,092	76,863
1200	65	383	1,758	1741	1,825	1,506	26,118	33,396
1300	15	59	398	983	1,434	77	8,486	11,453
1400	8	191	688	421	384	428	6,787	8,906
1500		236	445	6	23	1,264	673	2,648
1600		553	22	3	340	68	1,292	2,278
1700	0	105	245	91	475	213	2,545	3,675
1800	11	76	472	1193	1,039	257	3,014	6,062
1900	1	2,437	25,047	522	6,947	204	14,220	49,378
2110	1	36,795	55,555	231	2,381	797	21,392	117,152
2120		5,752	12,736	30	436		4,873	23,827
2130	3	5,924	10,033	67	83		4,171	20,280
2140		1,080	6,354	363	228		1,632	9,656
2150		422	1,269	8	56	38	3,533	5,326
2156		52,751	2,058			32,932		87,741
2160			17					17
2210		26,593	69,008	193		66	824	96,684
2220							12	12
2230			53	1793	6		143	1,995
2410		174	111	185		270	230	971
2420		289	2,947				1,833	5,070
2430		16	369	160	15		300	861
2500			79			17	68	165
2510		140	38				24	202
2520		18					38	56
2540		27	91				97	215
2610		133	1,124	80	68		803	2,209
3000	50	4,966	21,510	3087	8,929	278	19,030	57,850
4000	51	7,791	23,793	3396	10,881	359	38,108	84,379
4400		12,923	28,403		69		1,103	42,498
5000	15780	2,061	3,639	94206	6,848	717	7,117	130,368
6000	275	30,329	63,513	24493	21,682	1,193	43,181	184,666
7000		1,910	2,244	67	456	675	514	5,866
8100	6	741	645	36	488	330	2,668	4,915
8200		20	24		10		42	96
8300	1	388	171	62	395	268	777	2,063
Grand Tota	16,285	198,299	349,734	137653	89,583	42,504	245,738	1,079,796


Nicodemus Slough
S-77
S-78
S-79
S-4
S-236
Tidal
North Coastal
Freshwater West
Freshwater East
Nearshore
Caloosahatchee Estuary
Boundary of CRWPP Study Area
Level 3 -- REGION
Caloosahatchee Subbasins
2/25/08

Summary of Measured Annual Flow and Loads for TP and TN along the main stem of the Caloosahatchee River (C-43 Canal)

Calendar Year	S-77 (02292000)					S-78 (02292480)					S-79 (02292900)					Basin Between S78 and S79				
	Flow	TP Load	TP Conc.	TN Load	TN Conc.	Flow	TP Load	TP Conc.	TN Load	TN Conc.	Flow	TP Load	TP Conc.	TN Load	TN Conc.	Flow	TP Load	TP Conc.	TN Load	TN Conc.
	acre-feet	mtons	ug/L	mtons	mg/L	acre-feet	mtons	ug/L	mtons	mg/L	acre-feet	mtons	ug/L	mtons	mg/L	acre-feet	mtons	ug/L	mtons	mg/L
1990	120,575	14.0	94	237.6	1.60	174,966	33.0	153	322.4	1.49	423,951	101.0	193	936.9	1.79	248,986	68	222	614	2.00
1991	63,594	7.3	93	136.2	1.74	288,783	72.1	202	670.0	1.88	922,265	193.2	170	1,890.5	1.66	633,481	121	155	1,221	1.56
1992	193,275	22.9	96	344.7	1.45	437,933	93.2	172	756.4	1.40	943,491	406.5	349	2,198.8	1.89	505,559	313	502	1,442	2.31
1993	500,243	30.7	50	1,382.3	2.24	645,118	68.2	86	972.4	1.22	1,230,588	182.0	120	2,334.1	1.54	585,470	114	158	1,362	1.89
1994	770,253	50.7	53	1,345.0	1.42	1,044,125	119.2	93	2,201.9	1.71	1,633,414	216.6	108	3,380.2	1.68	589,289	97	134	1,178	1.62
1995	2,110,116	113.5	44	4,311.3	1.66	2,381,744	186.4	63	3,244.1	1.10	3,379,883	314.1	75	5,482.4	1.32	998,139	128	104	2,238	1.82
1996	474,489	47.0	80	797.6	1.36	568,330	58.2	83	853.6	1.22	941,009	129.5	112	1,647.2	1.42	372,680	71	155	794	1.73
1997	158,049	16.2	83	393.5	2.02	290,448	36.2	101	661.3	1.85	756,311	114.8	123	1,413.3	1.51	465,864	79	137	752	1.31
1998	1,618,473	135.5	68	2,988.8	1.50	1,831,790	204.9	91	3,216.9	1.42	2,613,724	296.8	92	4,309.0	1.34	781,933	92	95	1,092	1.13
1999	564,104	52.4	75	945.3	1.36	848,093	123.6	118	1,602.2	1.53	1,578,821	324.1	166	3,041.8	1.56	730,729	201	222	1,440	1.60
2000	477,520	104.7	178	1,683.5	2.86	409,244	47.1	93	687.8	1.36	619,878	118.6	155	1,061.9	1.39	210,634	71	275	374	1.44
2001	72,771	9.0	101	172.2	1.92	176,661	66.0	303	462.5	2.12	835,815	232.8	226	1,694.6	1.64	659,154	167	205	1,232	1.52
2002	466,052	57.4	100	969.6	1.69	888,496	154.4	141	1,774.4	1.62	1,491,120	318.2	173	3,166.7	1.72	602,624	164	220	1,392	1.87
2003	1,396,713	101.5	59	2,454.0	1.42	1,745,887	209.3	97	3,239.4	1.50	2,589,761	335.0	105	4,529.1	1.42	843,874	126	121	1,290	1.24
2004	1,120,739	127.3	92	2,146.6	1.55	1,247,980	128.0	83	1,996.4	1.30	1,853,038	230.2	101	2,815.2	1.23	605,058	102	137	819	1.10
2005	2,266,435	384.6	138	4,597.7	1.64	2,898,397	476.4	133	5,821.6	1.63	3,734,684	577.7	125	6,740.1	1.46	836,287	101	98	918	0.89
2006	353,758	65.1	149	732.9	1.68	463,033	88.2	154	856.5	1.50	920,989	193.0	170	1,689.2	1.49	457,956	105	186	833	1.47
1990-2006	**748,656**	**78.8**	**85**	**1,508.2**	**1.63**	**961,237**	**127.3**	**107**	**1,725.9**	**1.46**	**1,556,985**	**252.0**	**131**	**2,843.0**	**1.48**	**595,748**	**125**	**170**	**1,117**	**1.52**
1995-2005	**975,042**	**104.5**	**87**	**1,950.9**	**1.62**	**1,207,915**	**153.7**	**103**	**2,141.8**	**1.44**	**1,854,004**	**272.0**	**119**	**3,263.7**	**1.43**	**646,089**	**118**	**148**	**1,122**	**1.41**

Table 14. Estimated Runoff, Unit N and P Loads and Concentration for 2004 Land Uses in the Caloosahatchee Watershed

Land Use Category	Land Use Description	FLUCCS	Runoff (in/yr)	Unit N Load (lbs/acre/yr)	N Conc. (mg/l)	Unit P Load (lbs/acre/yr)	P Conc. (mg/l)
Residential Low Density	Residential Low Density[1]	1100	27.4313	7.26	1.17	0.68	0.11
Residential Medium Density	Residential Medium Density[2]	1200	32.4188	10.56	1.44	1.93	0.26
Residential High Density	Residential High Density[2]	1300	39.9	15.84	1.75	4.14	0.46
	Commercial and Services[2]	1400	39.9	14.52	1.61	1.93	0.21
	Industrial[2]	1500	42.3938	13.20	1.38	3.31	0.35
	Extractive[2]	1600	37.4063	9.24	1.09	0.91	0.11
	Institutional[2]	1700	37.4063	9.24	1.09	3.31	0.39
Other Urban	Recreational[2]	1800	27.4313	9.24	1.49	1.32	0.21
Improved Pastures	Improved Pastures	2110	29.925	14.65	2.16	1.93	0.29
Unimproved Pastures	Unimproved Pastures	2120	24.9375	7.26	1.29	0.99	0.18
	Woodland Pastures	2130	24.9375	5.41	0.96	0.83	0.15
Woodland Pastures/Rangeland	Rangeland	3000	19.95	5.41	1.20	0.25	0.06
Row Crops	Row Crops	2140	34.9125	19.80	2.51	3.45	0.44
Sugar Cane	Sugar Cane	2156	29.925	10.56	1.56	0.55	0.08
Citrus	Citrus	2210	29.925	11.22	1.66	0.90	0.13
Sod Farms	Sod Farms	2420	29.925	11.88	1.75	2.79	0.41
Ornamentals	Ornamentals	2430	29.925	15.84	2.34	4.00	0.59
Horse Farms	Horse Farms	2510	24.9375	21.12	3.74	2.51	0.45
Dairies	Dairies	2520	24.9375	26.40	4.68	12.94	2.29
	Field Crops	2150	24.9375	8.74	1.55	4.09	0.73
	Mixed Crops	2160	29.925	14.52	2.14	4.83	0.71
	Fruit Orchards	2220	29.925	11.88	1.75	3.17	0.47
	Other Groves	2230	29.925	11.88	1.75	3.17	0.47
	Cattle Feeding Operations	2310	29.925	71.35	10.54	12.37	1.83
	Poultry Feeding Operations	2320	29.925	13.20	1.95	2.07	0.31
	Tree Nurseries	2410	24.9375	15.84	2.81	4.00	0.71
	Specialty Farms	2500	24.9375	10.56	1.87	2.51	0.45
	Aquaculture	2540	12.4688	13.20	4.68	0.97	0.34
Other Areas	Fallow Crop Land	2610	29.925	9.24	1.36	0.97	0.14
Tree Plantations	Tree Plantations	4400	14.9625	4.09	1.21	0.21	0.06
Water	Water	5000	4.9875	1.19	1.05	0.07	0.06
	Upland Forests (not including 4400's)	4000	14.9625	3.30	0.97	0.10	0.03
	Wetlands	6000	7.48125	1.98	1.17	0.01	0.01
	Barren Land	7000	37.4063	9.24	1.09	1.04	0.12
Natural Areas	Open Land	1900	24.9375	5.28	0.94	0.39	0.07
Transportation	Transportation	8100	49.875	12.14	1.08	2.28	0.20
	Communications	8200	27.4313	7.92	1.28	0.66	0.11
Communication/Utilities	Utilities	8300	24.9375	7.92	1.40	0.66	0.12

1 Assumed on Septic
2 Assumed about 70% of Discharge from WWT outside basin

Comparison of Measured vs Calculated Runoff, TN, and TP for Freshwater West Subbasin

Constituent		**Measured**	**Calculated**
Runoff	ac-ft/yr	646,089	645,938
TN	lbs/yr	2,468,224	2,709,474
	mg/l	1.41	1.54
TP	lbs/yr	260,240	277,903
	mg/l	0.15	0.16

Table 16. Runoff in Acre-ft/year to Streams within the Caloosahatchee Watershed

FLUCCS	Caloosahatchee Estuary	Freshwater East	Freshwater West	Nearshore	North Coastal	S-4	Tidal	Grand Total
1100	43	6892	33990	9683	55055	1253	68788	175704
1200	176	1035	4749	4703	4930	4069	70559	90221
1300	50	196	1323	3268	4768	256	28216	38081
1400	27	635	2288	1400	1277	1423	22567	29612
1500	0	834	1572	21	81	4465	2378	9355
1600	0	1724	69	9	1060	212	4027	7101
1700	0	327	764	284	1481	664	7933	11456
1800	25	174	1079	2727	2375	587	6890	13857
1900	2	5064	52051	1085	14437	424	29551	102614
2110	2	91758	138540	576	5938	1988	53346	292148
2120	0	11953	26467	62	906	0	10127	49515
2130	6	12311	20850	139	172	0	8668	42144
2140	0	3142	18486	1056	663	0	4748	28093
2150	0	877	2637	17	116	79	7342	11068
2156	0	131548	5132	0	0	82124	0	218804
2160	0	0	42	0	0	0	0	42
2210	0	66316	172089	481	0	165	2055	241106
2220	0	0	0	0	0	0	30	30
2230	0	0	132	4471	15	0	357	4975
2410	0	362	231	384	0	561	478	2018
2420	0	721	7349	0	0	0	4571	12643
2430	0	40	920	399	37	0	748	2147
2500	0	0	164	0	0	35	141	343
2510	0	291	79	0	0	0	50	420
2520	0	37	0	0	0	0	79	116
2540	0	28	95	0	0	0	101	223
2610	0	332	2803	200	170	0	2002	5509
3000	83	8256	35760	5132	14844	462	31637	96176
4000	64	9714	29667	4234	13567	448	47516	105210
4400	0	16113	35415	0	86	0	1375	52990
5000	6559	857	1512	39154	2846	298	2958	54184
6000	171	18908	39596	15270	13517	744	26921	115128
7000	0	5954	6995	209	1421	2104	1602	18285
8100	25	3080	2681	150	2028	1372	11089	20428
8200	0	46	55	0	23	0	96	219
8300	2	806	355	129	821	557	1615	4287
Total (ac-ft)	7,235	400,330	645,938	95,245	142,636	104,289	460,562	1,856,254

Table 17. Net P Loads in Pounds/year to Stream within the Caloosahatchee watershed

FLUCCS	Caloosahatchee Estuary	Freshwater East	Freshwater West	Nearshore	North Coastal	S-4	Tidal	Grand Total
1100	12.8	2038.7	10054.4	2864.4	16285.6	370.6	20348.2	51974.8
1200	125.6	740.0	3396.5	3363.6	3525.9	2909.6	50460.0	64521.1
1300	62.1	244.3	1647.7	4069.6	5936.8	318.8	35132.0	47415.4
1400	15.5	369.0	1329.2	813.4	741.9	826.9	13112.5	17206.4
1500	0.0	781.6	1473.8	19.9	76.2	4186.4	2229.0	8770.2
1600	0.0	503.7	20.0	2.7	309.7	61.9	1176.8	2074.8
1700	0.0	347.8	811.4	301.4	1573.2	705.5	8429.0	12171.6
1800	14.6	100.7	625.3	1580.5	1376.5	340.5	3992.9	8030.9
1900	0.4	941.7	9678.2	201.7	2684.3	78.8	5494.6	19079.7
2110	1.9	71087.9	107332.3	446.3	4600.1	1539.8	41329.3	226337.7
2120	0.0	5715.2	12654.5	29.8	433.2	0.0	4841.8	23674.5
2130	2.5	4905.1	8307.3	55.5	68.7	0.0	3453.6	16791.8
2140	0.0	3726.0	21921.3	1252.4	786.6	0.0	5630.4	33313.2
2150	0.0	1726.5	5191.6	32.7	229.1	155.5	14454.0	21789.4
2156	0.0	29118.6	1136.0	0.0	0.0	18178.5	0.0	48433.0
2160	0.0	0.0	82.1	0.0	0.0	0.0	0.0	82.1
2210	0.0	23853.9	61900.2	173.1	0.0	59.2	739.1	86725.5
2220	0.0	0.0	0.0	0.0	0.0	0.0	38.1	38.1
2230	0.0	0.0	168.2	5691.0	19.0	0.0	453.9	6332.1
2410	0.0	696.3	444.2	740.4	0.0	1080.5	920.5	3885.9
2420	0.0	805.6	8215.1	0.0	0.0	0.0	5109.7	14133.1
2430	0.0	64.0	1476.7	640.3	60.0	0.0	1200.6	3445.7
2500	0.0	0.0	198.4	0.0	0.0	42.7	170.8	414.4
2510	0.0	351.6	95.4	0.0	0.0	0.0	60.3	507.3
2520	0.0	233.0	0.0	0.0	0.0	0.0	491.9	724.9
2540	0.0	26.1	87.9	0.0	0.0	0.0	93.7	207.7
2610	0.0	128.5	1085.8	77.3	65.7	0.0	775.7	2133.9
3000	12.4	1233.6	5343.1	766.8	2218.0	69.1	4727.1	14369.9
4000	4.9	752.6	2298.4	328.1	1051.1	34.7	3681.2	8151.0
4400	0.0	2675.1	5879.4	0.0	14.3	0.0	228.3	8797.1
5000	1088.8	142.2	251.1	6500.2	472.5	49.5	491.1	8995.4
6000	3.8	418.5	876.5	338.0	299.2	16.5	595.9	2548.4
7000	0.0	1976.9	2322.5	69.3	472.0	698.6	532.0	6071.3
8100	13.7	1687.3	1468.7	82.0	1111.2	751.4	6075.0	11191.5
8200	0.0	13.2	15.9	0.0	6.6	0.0	27.8	63.6
8300	0.7	257.0	113.3	41.1	261.6	177.5	514.7	1366.5
Grand Tota	1359.6	157662.0	277902.6	30481.4	44679.0	32652.3	237011.4	781770.1

Table 18. Net N Loads in Pounds/year to Stream within the Caloosahatchee Watershed

FLUCCS	Caloosahatchee Estuary	Freshwater East	Freshwater West	Nearshore	North Coastal	S-4	Tidal	Grand Total
1100	137.9	21888.9	107948.9	30753.4	174849.8	3978.5	218467.9	558025.4
1200	686.4	4044.5	18564.5	18385.0	19272.0	15903.4	275806.1	352661.8
1300	237.6	934.6	6304.3	15570.7	22714.6	1219.7	134418.2	181415.5
1400	116.2	2773.3	9989.8	6112.9	5575.7	6214.6	98547.2	129315.1
1500	0.0	3115.2	5874.0	79.2	303.6	16684.8	8883.6	34953.6
1600	0.0	5109.7	203.3	27.7	3141.6	628.3	11938.1	21048.7
1700	0.0	970.2	2263.8	840.8	4389.0	1968.1	23515.8	33957.0
1800	101.6	702.2	4361.3	11023.3	9600.4	2374.7	27849.4	56012.9
1900	5.3	12867.4	132248.2	2756.2	36680.2	1077.1	75081.6	260715.8
2110	14.7	539120.3	813991.9	3384.6	34886.4	11677.6	313435.6	1716511.1
2120	0.0	41759.5	92463.4	217.8	3165.4	0.0	35378.0	172984.0
2130	16.2	32060.7	54298.6	362.6	449.2	0.0	22573.5	109755.4
2140	0.0	21384.0	125809.2	7187.4	4514.4	0.0	32313.6	191188.8
2150	0.0	3688.8	11092.6	69.9	489.5	332.2	30882.7	46555.7
2156	0.0	557050.6	21732.5	0.0	0.0	347761.9	0.0	926545.0
2160	0.0	0.0	246.8	0.0	0.0	0.0	0.0	246.8
2210	0.0	298373.5	774269.8	2165.5	0.0	740.5	9245.3	1084794.5
2220	0.0	0.0	0.0	0.0	0.0	0.0	142.6	142.6
2230	0.0	0.0	629.6	21300.8	71.3	0.0	1698.8	23700.6
2410	0.0	2756.2	1758.2	2930.4	0.0	4276.8	3643.2	15380.6
2420	0.0	3433.3	35010.4	0.0	0.0	0.0	21776.0	60231.6
2430	0.0	253.4	5845.0	2534.4	237.6	0.0	4752.0	13638.2
2500	0.0	0.0	834.2	0.0	0.0	179.5	718.1	1742.4
2510	0.0	2956.8	802.6	0.0	0.0	0.0	506.9	4266.2
2520	0.0	475.2	0.0	0.0	0.0	0.0	1003.2	1478.4
2540	0.0	356.4	1201.2	0.0	0.0	0.0	1280.4	2838.0
2610	0.0	1228.9	10385.8	739.2	628.3	0.0	7419.7	20411.2
3000	270.6	26876.0	116412.1	16706.8	48323.7	1504.5	102990.4	313084.2
4000	168.3	25710.3	78516.9	11206.8	35907.3	1184.7	125756.4	278450.7
4400	0.0	52880.9	116225.1	0.0	282.3	0.0	4513.5	173901.8
5000	18746.6	2448.5	4323.1	111916.7	8135.4	851.8	8455.0	154877.2
6000	544.5	60051.4	125755.7	48496.1	42930.4	2362.1	85498.4	365638.7
7000	0.0	17648.4	20734.6	619.1	4213.4	6237.0	4749.4	54201.8
8100	72.9	8998.7	7832.9	437.2	5926.3	4007.5	32400.2	59687.8
8200	0.0	158.4	190.1	0.0	79.2	0.0	332.6	760.3
8300	7.9	3073.0	1354.3	491.0	3128.4	2122.6	6153.8	16339.0
Grand Tota	21126.7	1755149.1	2709474.5	316315.7	469895.4	433287.9	1732127.1	7437458.4

Methodology – BMP Reductions

- Start with BMP Letter Report (P only)
- Review new literature and data resources for N and updated P BMP effectiveness
- Adjust to updated N and P unit loads for C-43
- Review and update BMP effectiveness and cost data based on literature
- Link to land use data for determining potential N and P reductions due to BMP implementation
- Link to cost factors for determining total cost for potential BMP program

BMPs for Citrus

Phosphorus

Assume for Typical Condition		
Two row crown bedded		
Assumed average farm size of 200 ac		
Grass Management between Trees		
Pond retention with limited wetland restoration		
Micro jet irrigation and fertigation of young stock		
Existing P Load	0.90	lbs-P/ac/yr
Existing P Concentration	0.13	mg/l
Average Annual Runoff	29.93	in/yr

BMPs	Type	P Reduction[1]		Initial Cost of BMP[2] ($/ac)	Annual Cost[3]		Quickness of Response
		Range %	Typical %		per acre ($/ac/yr)	P Removed ($/lb/ac/yr)	
Fertility							
Reduced P Fertilization (testing, placement, and type)	Owner	0 to 25	10	0	0	0	Slow
Better N and Micros Fertilization	Owner	0 to 5	2	0	0	0	Slow
Water Management (irrigation and drainage)	Typical	0 to 20	5	0	0	0	Fast
Water Reuse from Retention/Detention Ponds[4]	Typical	0 to 50	10	33	10.56	118	Fast
Grass Management between Trees	Owner	0 to 5	2	22	7.04	392	Moderate
Grassed Waterways	Alternative	0 to 15	5	110	35.2	785	Fast
Stormwater R/D[5]	Typical	10 to 60	40	440	140.8	392	Fast
Wetland Restoration	Typical	5 to 20	10	44	14.08	157	Fast
Edge-of-farm Stormwater R/D and Chemical Treatment[6]	Alternative	20 to 90	70	220	70.4	112	Fast

1 Estimated values assume no other BMPs applied. Note, combined BMPs will reduce effectiveness of individual BMP
2 Costs presented on per acre of entire farm basis unless otherwise noted. Costs value only include implementation cost, i.e. does not include O&M Costs.
3 The annual cost include amortized capital costs at 10% interest over a twenty-year life span and a 20% per year of capital cost for annual O&M.
4 Values shown are for using existing ponds for water reuse, if new facilities are needed then cost would increase significantly.
5 Average of pre/post 1984 stormwater management requirements, i.e. P > .6ppm if developed prior to 1984 and less if developed after 1984. Groves developed after 1984 would probably have stormwater R/D systems, so little addition benefit would be expected for newer groves.
6 High O&M Costs

Typical/Owner BMP Program Reduced P Fertilization, Better N Management, Grass Management between Trees, additional Stormwater Retention, and limited Wetland Restoration/Retention	10 to 50	32	75	24	261	Moderate
Owner BMP Program Reduced P Fertilization, Better N Management, and Grass Management between Trees	0 to 25	12	5.5	0	0	Slow
Typical BMP Program Stormwater R/D and Wetland Restoration	5 to 50	20	77	24.64	137	Fast
Alternative BMP Program Fertigation, Grassed Waterways, and Edge-of-farm Stormwater R/D with Chemical Treatment	20 to 90	42	242	77	206	Fast

BMPs for Medium Density Residential

Nitrogen

Assume for Typical Condition

Medium Density Residential
Assumed average development size of 200 ac
Moderately Managed Lawns Mid-IFAS 3.5 lb-N/1000ft2
Limited Pond retention
Limited Lawn Irrigation

Existing N Load	10.56	lbs-N/ac/yr
Existing N Concentration	1.44	mg/l
Average Annual Runoff	32.42	in/yr

BMPs	Type	N Reduction[1] Range %	N Reduction[1] Typical %	Initial Cost of BMP[2] ($/ac)	Annual Cost[3] per acre ($/ac/yr)	Annual Cost[3] N Removed ($/lb/ac/yr)	Quickness of Response
Fertility							
Reduced N Fertilization (IFAS low, placement, and type)	Owner	0 to 50	25	15	4.8	2	Fast
Dry Retention/Swales[4] 0.25"	Typical	10 to 50	25	6400	2048	776	Fast
Wet Detention - 0.25"	Typical	10 to 40	20	8000	2560	1212	Fast
Street Sweeping	Typical	0 to 10	2	20	6.4	30	Fast
Sediment/Baffle Boxes	Typical	2 to 30	15	440	140.8	89	Fast
Dry Detention - Regional	Alternative	5 to 35	15	3200	1024	646	Fast
Wet Detention - Regional	Alternative	5 to 30	15	4000	1280	808	Fast

1 Estimated values assume no other BMPs applied. Note, combined BMPs will reduce effectiveness of individual BMPs
2 Costs presented on per acre of entire development basis unless otherwise noted. Costs value only include implementation cost, i.e. does not include O&M Costs.
3 The annual cost include amortized capital costs at 10% interest over a twenty-year life span and a 20% per year of capital cost for annual O&M.
4 Adjusted down to correct for reported Dry Detention reductions not including ground water re-emergent N loads.

Typical/Owner BMP Program Reduced N Fertilization, Swales, and limited Dry Retention/Sweeping	0 to 70	50	6415	2052.8	389	Fast
Owner BMP Program Reduced N Fertilization	0 to 60	25	15	4.8	2	Fast
Typical BMP Program Limited Dry Retention, Street Sweeping, Sediment R/D and Wetland Restoration	5 to 50	25	6400	2048	776	Fast
Alternative BMP Program Stormwater R/D with Chemical Treatment	5 to 35	15	3200	1024	646	Fast

P Units Loads and Reduction Factors

Table 19. Land Use Categories, Unit Load Factors, and P Reduction Factors for the Caloosahatchee Watershed

Land Use Category	Land Use Description	FLUCCS	Unit P Load (lbs/acre/yr)	Estimated Phosphorus Reduction		
				Owner Implemented BMPs	Typical Incentive BMPs	Alternative Practices
Residential Low Density	Residential Low Density[1]	1100	0.68	5%	5%	0%
Residential Medium Density	Residential Medium Density[2]	1200	1.93	5%	5%	0%
Residential High Density	Residential High Density[2]	1300	4.14	5%	5%	0%
Other Urban	Commercial/Industrial[2]	1400-1800	2.05	5%	5%	0%
Improved Pastures	Improved Pastures	2110	1.93	11%	19%	49%
Unimproved Pastures	Unimproved Pastures	2120	0.99	7%	13%	44%
Woodland Pastures/Rangeland	Woodland/Range Pastures	2130/3000	0.40	4%	6%	35%
Row Crops	Row Crops	2140	3.45	30%	30%	50%
Sugar Cane	Sugar Cane	2156	0.55	10%	23%	52%
Citrus	Citrus	2210	0.90	12%	20%	42%
Sod Farms	Sod Farms	2420	2.79	20%	27%	50%
Ornamentals	Ornamentals	2430	4.00	32%	35%	50%
Horse Farms	Horse Farms	2510	2.51	20%	22%	49%
Dairies	Dairies	2520	12.94	9%	28%	48%
Other Areas	Other Areas	2150-2610	3.20	15%	25%	36%
Tree Plantations	Tree Plantations	4400	0.21	1%	10%	50%
Water	Water	5000	0.07	0%	0%	0%
Natural Areas	Forrests/wetlands/Open	4000/6000	0.11	0%	0%	0%
Transportation	Transportation	8100	2.28	10%	23%	52%
Communication/Utilities	Communication/Utilities	8200/8300	0.66	5%	5%	0%

1 Assumed on Septic

2 Assumed about 70% of Discharge from WWT outside basin

P Reductions and Costs

Table 20. Land Use Categories, Unit Load Factors, and Estimated P Reduction Factors Using 2004 Land Use for the Caloosahatchee Watershed

Land Use Category	Land Use Description	FLUCCS	Percent of Basin	Unit P Load (lbs/acre/yr)	Total P (MT/yr)	Estimated P Reduction (percent)	Estimated P Reduction (MT/yr)	Annual Cost ($)
Residential Low Density	Residential Low Density[1]	1100	7.12%	0.68	23.6	10%	2.4	176,305,275
Residential Medium Density	Residential Medium Density[2]	1200	3.09%	1.93	29.3	10%	2.9	76,602,409
Residential High Density	Residential High Density[2]	1300	1.06%	4.14	21.6	10%	2.2	26,270,433
Other Urban	Commercial/Industrial2	1400-1800	2.18%	2.05	21.9	10%	2.2	54,061,629
Improved Pastures	Improved Pastures	2110	10.85%	1.93	102.9	30%	30.9	2,078,370
Unimproved Pastures	Unimproved Pastures	2120	2.21%	0.99	10.8	20%	2.2	112,723
Woodland Pastures/Rangeland	Woodland/Range Pastures	2130/3000	7.24%	0.40	14.2	10%	1.4	369,624
Row Crops	Row Crops	2140	0.89%	3.45	15.1	60%	9.1	761,356
Sugar Cane	Sugar Cane	2156	8.13%	0.55	22.0	33%	7.3	3,459,101
Citrus	Citrus	2210	8.95%	0.90	39.4	32%	12.6	8,121,456
Sod Farms	Sod Farms	2420	0.47%	2.79	6.4	47%	3.0	199,880
Ornamentals	Ornamentals	2430	0.08%	4.00	1.6	67%	1.0	67,888
Horse Farms	Horse Farms	2510	0.02%	2.51	0.2	42%	0.1	3,345
Dairies	Dairies	2520	0.01%	12.94	0.3	37%	0.1	65,542
Other Areas	Other Areas	2150-2610	1.01%	3.20	15.9	40%	6.3	193,552
Tree Plantations	Tree Plantations	4400	3.94%	0.21	4.0	11%	0.4	1,204,103
Water	Water	5000	12.07%	0.07	4.1	0%	0.0	0
Natural Areas	Forrests/wetlands/Open	4000/6000	30.03%	0.11	16.3	0%	0.0	0
Transportation	Transportation	8100	0.46%	2.28	5.1	33%	1.7	193,769
Communication/Utilities	Communication/Utilities	8200/8300	0.20%	0.66	0.7	10%	0.1	1,602,248
Total Basin			**100%**	**0.68**	**334**	**25%**	**84**	**325,402,270**

1 Assumed on Septic

2 Assumed about 70% of Discharge from WWT outside basin

N Units Loads and Reduction Factors

Table 21. Land Use Categories, Unit Load Factors, and N Reduction Factors for the Caloosahatchee Watershed

Land Use Category	Land Use Description	FLUCCS	Unit N Load (lbs/acre/yr)	Estimated Nitrogen Reduction		
				Owner Implemented BMPs	Typical Incentive BMPs	Alternative Practices
Residential Low Density	Residential Low Density[1]	1100	7.26	15%	15%	15%
Residential Medium Density	Residential Medium Density[2]	1200	10.56	25%	25%	15%
Residential High Density	Residential High Density[2]	1300	15.84	30%	25%	15%
Other Urban	Commercial/Industrial[2]	1400-1800	11.68	25%	25%	15%
Improved Pastures	Improved Pastures	2110	14.65	17%	10%	30%
Unimproved Pastures	Unimproved Pastures	2120	7.26	11%	8%	30%
Woodland Pastures/Rangeland	Woodland/Range Pastures	2130/3000	5.41	4%	6%	20%
Row Crops	Row Crops	2140	19.80	30%	30%	50%
Sugar Cane	Sugar Cane	2156	10.56	10%	23%	52%
Citrus	Citrus	2210	11.22	10%	20%	42%
Sod Farms	Sod Farms	2420	11.88	20%	27%	50%
Ornamentals	Ornamentals	2430	15.84	25%	25%	25%
Horse Farms	Horse Farms	2510	21.12	30%	22%	30%
Dairies	Dairies	2520	26.40	20%	40%	48%
Other Areas	Other Areas	2150-2610	10.18	15%	25%	36%
Tree Plantations	Tree Plantations	4400	4.09	5%	10%	25%
Water	Water	5000	1.19	0%	0%	0%
Natural Areas	Forrests/wetlands/Open	4000/6000	2.96	0%	0%	0%
Transportation	Transportation	8100	12.14	20%	23%	25%
Communication/Utilities	Communication/Utilities	8200/8300	7.92	30%	25%	15%

1 Assumed on Septic

2 Assumed about 70% of Discharge from WWT outside basin

N Reductions and Costs

Table 22. Land Use Categories, Unit Load Factors, and Estimated N Reduction Factors Using 2004 Land Use for the Caloosahatchee Watershed

Land Use Category	Land Use Description	FLUCCS	Percent of Basin	Unit N Load (lbs/acre/yr)	Total N (MT/yr)	Estimated N Reduction (percent)	Estimated N Reduction (MT/yr)	Annual Cost ($)
Residential Low Density	Residential Low Density[1]	1100	7.12%	7.26	253.6	30%	76.1	176,608,300
Residential Medium Density	Residential Medium Density[2]	1200	3.09%	10.56	160.3	50%	80.2	76,781,946
Residential High Density	Residential High Density[2]	1300	1.06%	15.84	82.5	55%	45.4	26,332,005
Other Urban	Commercial/Industrial2	1400-1800	2.18%	11.68	125.1	55%	68.8	59,607,170
Improved Pastures	Improved Pastures	2110	10.85%	14.65	780.2	27%	210.7	2,078,370
Unimproved Pastures	Unimproved Pastures	2120	2.21%	7.26	78.6	19%	14.9	101,987
Woodland Pastures/Rangeland	Woodland/Range Pastures	2130/3000	7.24%	5.41	192.2	10%	19.2	369,624
Row Crops	Row Crops	2140	0.89%	19.80	86.9	60%	52.1	761,356
Sugar Cane	Sugar Cane	2156	8.13%	10.56	421.2	33%	139.0	3,484,258
Citrus	Citrus	2210	8.95%	11.22	493.1	30%	147.9	16,979,257
Sod Farms	Sod Farms	2420	0.47%	11.88	27.4	47%	12.9	199,880
Ornamentals	Ornamentals	2430	0.08%	15.84	6.2	50%	3.1	50,663
Horse Farms	Horse Farms	2510	0.02%	21.12	1.9	52%	1.0	3,584
Dairies	Dairies	2520	0.01%	26.40	0.7	60%	0.4	65,542
Other Areas	Other Areas	2150-2610	1.01%	10.18	50.5	40%	20.2	226,788
Tree Plantations	Tree Plantations	4400	3.94%	4.09	79.0	15%	11.9	1,427,933
Water	Water	5000	12.07%	1.19	70.4	0%	0.0	0
Natural Areas	Forrests/wetlands/Open	4000/6000	30.03%	2.96	435.9	0%	0.0	0
Transportation	Transportation	8100	0.46%	12.14	27.1	43%	11.7	256,618
Communication/Utilities	Communication/Utilities	8200/8300	0.20%	7.92	7.8	55%	4.3	3,702,458
Total Basin			**100%**	**6.72**	**3,298**	**27%**	**874**	**342,705,734**

1 Assumed on Septic

2 Assumed about 70% of Discharge from WWT outside basin

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

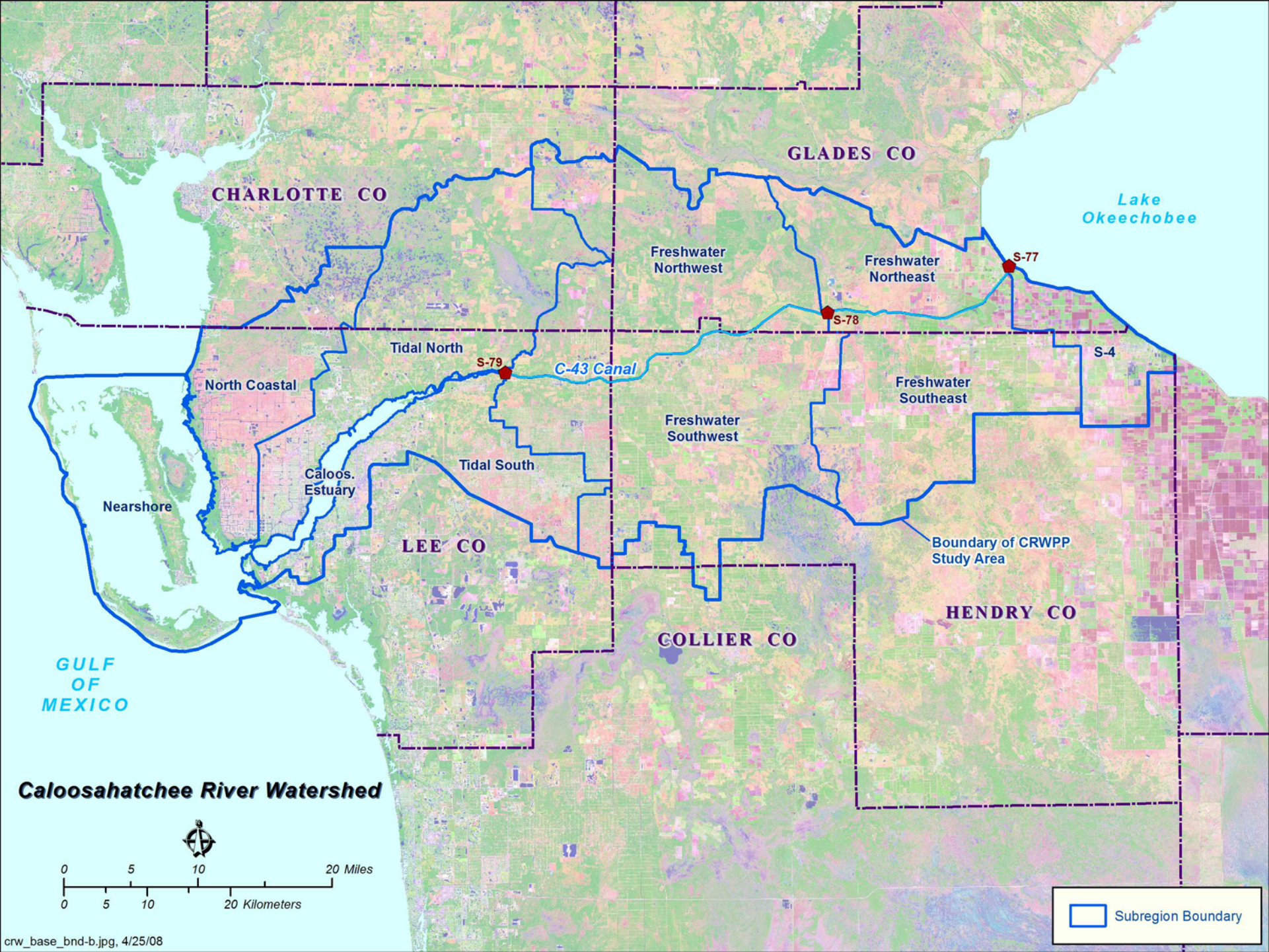
Caloosahatchee River Watershed Protection Plan

Status of Water-Quality Spreadsheet:

Alternative 1

May 21, 2008

sfwmd.gov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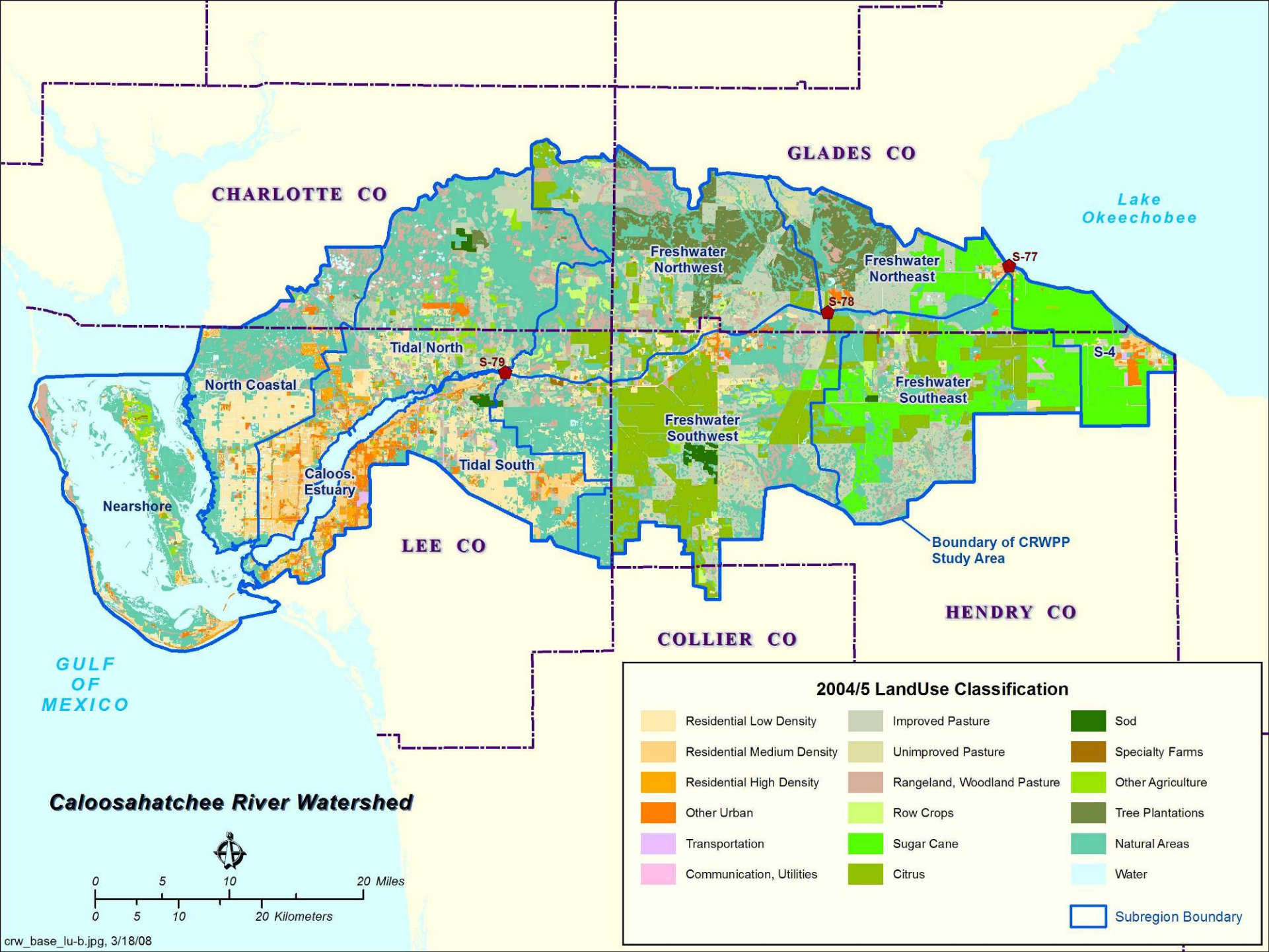
CHARLOTTE CO
Lake Okeechobee
Freshwater Northwest
Freshwater Northeast
S-77
S-78
Tidal North
S-79
C-43 Canal
S-4
North Coastal
Freshwater Southeast
Freshwater Southwest
Caloos. Estuary
Tidal South
Nearshore
LEE CO
Boundary of CRWPP Study Area
HENDRY CO
COLLIER CO
GULF OF MEXICO
Caloosahatchee River Watershed
0 5 10 20 Miles
0 5 10 20 Kilometers
Subregion Boundary
crw_base_bnd-b.jpg, 4/25/08


GLADES CO
CHARLOTTE CO
Lake Okeechobee
Freshwater Northwest
Freshwater Northeast
S-77
S-78
Tidal North
S-79
S-4
North Coastal
Freshwater Southeast
Freshwater Southwest
Caloos. Estuary
Tidal South
Nearshore
LEE CO
Boundary of CRWPP Study Area
HENDRY CO
COLLIER CO
GULF OF MEXICO
2004/5 LandUse Classification
Residential Low Density
Residential Medium Density
Residential High Density
Other Urban
Transportation
Communication, Utilities
Improved Pasture
Unimproved Pasture
Rangeland, Woodland Pasture
Row Crops
Sugar Cane
Citrus
Sod
Specialty Farms
Other Agriculture
Tree Plantations
Natural Areas
Water
Subregion Boundary
Caloosahatchee River Watershed
0 5 10 20 Miles
0 5 10 20 Kilometers
crw_base_lu-b.jpg, 3/18/08

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

	Total Nitrogen			Total Phosphorus		
	Loading Rates and BMP Efficiencies			Loading Rates and BMP Efficiencies		
Landuse Category	Unit Source Load (lb/ac/yr)	BMP #1, Owner-Implemented BMP Efficiencies	BMP #2, Cost-Share BMP Efficiencies	Unit Source Load (lb/ac/yr)	BMP #1, Owner-Implemented BMP Efficiencies	BMP #2, Cost-Share BMP Efficiencies
Residential Low Density	7.26	15%	15%	0.68	5%	5%
Residential Medium Density	10.56	25%	25%	1.93	5%	5%
Residential High Density	15.84	30%	25%	4.14	5%	5%
Other Urban	11.68	25%	25%	2.05	5%	5%
Improved Pasture	14.65	17%	10%	1.93	11%	19%
Unimproved Pasture	7.26	11%	8%	0.99	7%	13%
Rangeland, Woodland Pasture	5.41	4%	6%	0.40	4%	6%
Row Crops	19.80	30%	30%	3.45	30%	30%
Sugar Cane	10.56	10%	23%	0.55	10%	23%
Citrus	11.22	10%	20%	0.90	12%	20%
Sod	11.88	20%	27%	2.79	20%	27%
Ornamentals	15.84	25%	25%	4.00	32%	35%
Horse Farms	21.12	30%	22%	2.51	20%	22%
Dairies	26.40	20%	40%	12.94	9%	28%
Other Agriculture	10.18	15%	25%	3.20	15%	25%
Tree Plantations	4.09	5%	10%	0.21	1%	10%
Water	1.19	0%	0%	0.07	0%	0%
Natural Areas	2.96	0%	0%	0.11	0%	0%
Transportation	12.14	20%	23%	2.28	10%	23%
Communication, Utilities	7.92	30%	25%	0.66	5%	5%

					Load Reduction	
MM Number	Management Measure (MM) Name	SubRegion	Level	Scope	Total Nitrogen (Mton/yr)	Total Phosphorus (Mton/yr)
CRE-LO 12g	Alternative Water Storage (LOER) -- Barron WCD	Freshwater Southwest	1	Local	0.00	0.00
CRE-LO 41	C-43 Distributed Reservoirs	Freshwater Southeast	4	Regional	28.35	4.25
CRE-LO 92	Clewiston STA	S-4	4	Regional	0.0	0.0
CRE 10	C-43 WQ Treatment and Demonstration Project	Freshwater Southeast	3	Regional	47.85	9.21
CRE 18	Harnes Marsh Improvements, Phase I	Tidal South	1	Local	1.52	0.24
CRE 19	Harnes Marsh Improvements, Phase II	Tidal South	2	Local	0.61	0.09
CRE 20	Yellowtail Structure Construction	Tidal South	2	Local	0.32	0.03
CRE 21	Hendry County Storage	Freshwater Southwest	4	Local	2.72	0.68
CRE 22	Hendry Extension Canal Widening	Freshwater Southwest	2	Local	0.00	0.00
CRE 30	Aquifer Benefit and Storage for Orange River Basin (ABSORB)	Tidal South	2	Local	3.72	0.37
CRE 44	Spanish Creek Four Corners Environmental Restoration	Freshwater Northwest	3	Regional	9.58	1.08
CRE 45	Billy Creek Filter Marsh and Ford Canal Filter Marsh	Tidal South	2	Local	2.05	0.51
CRE 48	Manuel's Branch Silt Reduction Structure	Tidal South	2	Local	0.14	0.11
CRE 49	Manuel's Branch East and West Weirs	Tidal South	2	Local	0.42	0.16
CRE 53	Caloosahatchee Creeks Preserve Hydrologic Restoration	Tidal North	2	Local	21.77	5.44
CRE 57	Powell Creek Algal Turf Scrubber	Tidal North	3	Local	0.06	0.02
CRE 59	N. Ft. Myers Surface Water Restoration, Powell Creek	Tidal North	1	Local	0.68	0.06
CRE 64	Yellow Fever Creek/Gator Slough Transfer Facility	North Coastal	1	Local	1.26	0.15
CRE 64 *	Yellow Fever Creek/Gator Slough Transfer Facility	Tidal North	1	Local	-1.26	-0.15
CRE 121	City of LaBelle Stormwater Quality Improvements	Freshwater Southwest	3	Local	34.78	5.80

Total Nitrogen	Existing Water-Quality Conditions				Baseline Water-Quality Conditions			
SubRegion	Area (acres)	Average Annual Discharge (1995-2005) (acre-ft)	Average Annual Total Nitrogen Load (1995-2005) (Mtons)	Average Annual Total Nitrogen Concentration (1995-2005) (mg/L)	Load Reduction (Mtons)	Remain. Concen-tration (mg/L)	Adjusted Remain. Load (Mtons)	Baseline Load Reduction (percent)
Caloosahatchee Estuary	16,285	7,062	10.4	1.196	0.0	1.196	10.4	0.0%
Freshwater Northeast	63,724	69,203	135.9	1.593	0.0	1.593	135.9	0.0%
Freshwater Northwest	162,141	267,065	464.4	1.410	0.0	1.410	464.4	0.0%
Freshwater Southeast	134,575	163,671	324.5	1.607	0.0	1.607	324.5	0.0%
Freshwater Southwest	187,593	379,024	657.5	1.406	49.4	1.336	608.1	7.5%
Nearshore	137,653	85,735	129.2	1.222	0.0	1.222	129.2	0.0%
North Coastal	89,583	139,217	231.5	1.348	0.0	1.348	231.5	0.0%
S-4	42,504	45,698	93.0	1.650	0.0	1.650	93.0	0.0%
Tidal North	163,505	269,380	522.2	1.572	0.0	1.572	522.2	0.0%
Tidal South	82,234	180,138	330.9	1.489	0.0	1.489	330.9	0.0%
Lake Okeechobee input	n.a.	975,042	1,950.9	1.622	735.9	1.460	1,215.0	37.7%
Total for CRWPP	**1,079,796**	**1,606,192**	**2,899.7**	**1.464**	**49.4**	**1.448**	**2,850.3**	**1.7%**
Total for S-77 to Shell Point	852,560	1,381,240	2,538.9	1.490	49.4	1.472	2,489.6	1.9%
Total for S-77 to S-79	590,537	924,660	1,675.4	1.469	49.4	1.441	1,626.0	2.9%
Total above Shell Point	n.a.	2,356,282	4,489.9	1.545	785.3	1.468	3,704.5	17.5%
Total above S-79	n.a.	1,899,702	3,626.3	1.548	785.3	1.449	2,841.0	21.7%
Total for CRWPP plus Lake Okee	n.a.	2,581,234	4,850.6	1.523	785.3	1.451	4,065.3	16.2%

Total Nitrogen

	Nutrient-Load Reductions for Alternative 1										
	Owner-Implemented BMPs		Cost-Share BMPs		Local Projects		Regional Projects		Summary of Alt 1 Reductions for Total Nitrogen		
SubRegion	Load Reduction (Mtons)	Remain. Load (Mtons)	Load Reduction (Mtons)	Remain. Load (Mtons)	Load Reduction (Mtons)	Remain. Load (Mtons)	Load Reduction (Mtons)	Remain. Load (Mtons)	Remain. Concen-tration (mg/L)	Adjusted Remain. Load (Mtons)	Alt 1 Load Reduction (percent)
Caloosahatchee Estuary	0.2	10.2	0.1	10.1	0.0	10.1	0.0	10.1	1.162	10.1	2.9%
Freshwater Northeast	16.6	119.4	14.5	104.9	0.0	104.9	0.0	104.9	1.229	104.9	22.8%
Freshwater Northwest	54.9	409.5	41.9	367.6	0.0	367.6	9.6	358.0	1.089	358.0	22.9%
Freshwater Southeast	37.3	287.2	47.8	239.4	0.0	239.4	76.2	163.2	0.847	163.2	49.7%
Freshwater Southwest	71.2	536.9	74.4	462.6	37.5	425.1	0.0	425.1	0.936	425.1	30.1%
Nearshore	10.9	118.3	9.2	109.1	0.0	109.1	0.0	109.1	1.031	109.1	15.6%
North Coastal	27.4	204.2	21.2	183.0	1.3	181.7	0.0	181.7	1.070	181.7	21.5%
S-4	10.9	82.1	18.1	64.0	0.0	64.0	0.0	64.0	1.135	64.0	31.2%
Tidal North	75.7	446.5	54.2	392.3	21.3	371.0	0.0	371.0	1.115	371.0	29.0%
Tidal South	61.6	269.3	45.4	223.9	8.8	215.1	0.0	215.1	0.973	215.1	35.0%
Lake Okeechobee input	n.a.	1,215.0	n.a.	1,215.0	0.0	1,215.0	0.0	1,215.0	1.460	1,215.0	0.0%
Total for CRWPP	**366.7**	**2,483.6**	**326.8**	**2,156.8**	**68.8**	**2,088.0**	**85.8**	**2,002.3**	**1.024**	**2,002.3**	**29.8%**
Total for S-77 to Shell Point	328.4	2,161.2	296.4	1,864.8	67.5	1,797.3	85.8	1,711.5	1.019	1,711.5	31.3%
Total for S-77 to S-79	190.8	1,435.1	196.6	1,238.5	37.5	1,201.0	85.8	1,115.2	0.998	1,115.2	31.4%
Total above Shell Point	328.4	3,376.2	296.4	3,079.8	67.5	3,012.3	85.8	2,926.5	1.165	2,926.5	21.0%
Total above S-79	190.8	2,650.1	196.6	2,453.5	37.5	2,416.0	85.8	2,330.2	1.195	2,330.2	18.0%
Total for CRWPP plus Lake Okee	n.a.	3,698.6	n.a.	3,371.8	68.8	3,303.0	86	3,217.2	1.154	3,217.2	20.9%

Total Phosphorus	Existing Water-Quality Conditions				Baseline Water-Quality Conditions			
SubRegion	Area (acres)	Average Annual Discharge (1995-2005) (acre-ft)	Average Annual Total Phosphorus Load (1995-2005) (Mtons)	Average Annual Total Phosphorus Concentration (1995-2005) (mg/L)	Load Reduction (Mtons)	Remain. Concen-tration (mg/L)	Adjusted Remain. Load (Mtons)	Baseline Load Reduction (percent)
Caloosahatchee Estuary	16,285	7,062	0.7	0.078	0.0	0.078	0.7	0.0%
Freshwater Northeast	63,724	69,203	13.1	0.153	0.0	0.153	13.1	0.0%
Freshwater Northwest	162,141	267,065	47.4	0.144	0.0	0.144	47.4	0.0%
Freshwater Southeast	134,575	163,671	28.2	0.139	0.0	0.139	28.2	0.0%
Freshwater Southwest	187,593	379,024	70.9	0.152	7.1	0.140	63.8	10.0%
Nearshore	137,653	85,735	12.5	0.118	0.0	0.118	12.5	0.0%
North Coastal	89,583	139,217	22.2	0.130	0.0	0.130	22.2	0.0%
S-4	42,504	45,698	13.6	0.241	0.0	0.241	13.6	0.0%
Tidal North	163,505	269,380	67.6	0.203	0.0	0.203	67.6	0.0%
Tidal South	82,234	180,138	50.0	0.225	0.0	0.225	50.0	0.0%
Lake Okeechobee input	n.a.	975,042	104.5	0.087	37.9	0.080	66.6	36.3%
Total for CRWPP	**1,079,796**	**1,606,192**	**326.1**	**0.165**	**7.1**	**0.162**	**319.0**	**2.2%**
Total for S-77 to Shell Point	852,560	1,381,240	291.4	0.171	7.1	0.168	284.3	2.4%
Total for S-77 to S-79	590,537	924,660	173.1	0.152	7.1	0.147	166.0	4.1%
Total above Shell Point	n.a.	2,356,282	395.8	0.136	45.0	0.136	350.8	11.4%
Total above S-79	n.a.	1,899,702	277.6	0.118	45.0	0.114	232.6	16.2%
Total for CRWPP plus Lake Okee	n.a.	2,581,234	430.6	0.135	45.0	0.138	385.6	10.4%

Total Phosphorus	Nutrient-Load Reductions for Alternative 1										
	Owner-Implemented BMPs		Cost-Share BMPs		Local Projects		Regional Projects		Summary of Alt 1 Reductions for Total Phosphorus		
SubRegion	Load Reduction (Mtons)	Remain. Load (Mtons)	Load Reduction (Mtons)	Remain. Load (Mtons)	Load Reduction (Mtons)	Remain. Load (Mtons)	Load Reduction (Mtons)	Remain. Load (Mtons)	Remain. Concen-tration (mg/L)	Adjusted Remain. Load (Mtons)	Alt 1 Load Reduction (percent)
Caloosahatchee Estuary	0.0	0.7	0.0	0.7	0.0	0.7	0.0	0.7	0.078	0.7	0.0%
Freshwater Northeast	1.3	11.8	2.0	9.8	0.0	9.8	0.0	9.8	0.115	9.8	25.2%
Freshwater Northwest	5.6	41.9	7.1	34.7	0.0	34.7	1.1	33.7	0.102	33.7	29.0%
Freshwater Southeast	3.1	25.1	4.7	20.4	0.0	20.4	13.5	6.9	0.080	15.4	45.2%
Freshwater Southwest	7.3	56.5	9.5	47.0	6.5	40.5	0.0	40.5	0.089	40.5	36.4%
Nearshore	0.9	11.6	1.1	10.5	0.0	10.5	0.0	10.5	0.099	10.5	16.1%
North Coastal	1.3	21.0	1.4	19.6	0.2	19.4	0.0	19.4	0.114	19.4	12.8%
S-4	1.1	12.4	2.1	10.4	0.0	10.4	0.0	10.4	0.184	10.4	23.5%
Tidal North	5.9	61.6	7.6	54.1	5.4	48.7	0.0	48.7	0.146	48.7	27.9%
Tidal South	3.2	46.8	3.4	43.4	1.5	41.9	0.0	41.9	0.189	41.9	16.2%
Lake Okeechobee input	n.a.	66.6	n.a.	66.6	0.0	66.6	0.0	66.6	0.080	66.6	0.0%
Total for CRWPP	**29.6**	**289.4**	**38.9**	**250.5**	**13.5**	**237.0**	**14.5**	**222.5**	**0.114**	**231.0**	**27.6%**
Total for S-77 to Shell Point	27.4	256.9	36.4	220.5	13.4	207.1	14.5	192.6	0.115	201.1	29.3%
Total for S-77 to S-79	18.3	147.7	25.4	122.3	6.5	115.9	14.5	101.3	0.091	109.8	33.9%
Total above Shell Point	27.4	323.4	36.4	287.0	13.4	273.7	14.5	259.1	0.103	267.6	23.7%
Total above S-79	18.3	214.3	25.4	188.9	6.5	182.4	14.5	167.9	0.086	176.4	24.2%
Total for CRWPP plus Lake Okee	n.a.	356.0	n.a.	317.1	13.5	303.6	15	289.1	0.107	297.6	22.8%

Caloosahatchee River Watershed Protection Plan

Status of Water-Quality Spreadsheet: Alternative 1

What's Next ?

- **Continue to improve nutrient-reduction estimates for Alternative 1 (as practical)**
- **Finalize results for Alternative 1, with summaries and documentation**
- **Develop nutrient-reduction estimates for Alternative 2 management measures**
- **Formulate and evaluate management measures for Alternative 3 (water-quality alternative)**

Questions ?

Update on Hydrologic Modeling For Caloosahatchee River Watershed Protection Plan

5/21/08

Presentation Outline

- Initial Model Run Assumptions
- Performance Measures
- Performance Indicators
- Initial Modeling Results:
  - LOWCP P2TP Current Base
  - Draft CRWPP Base Run

5/21/08

Model Setup

- The link-node version of the Regional Simulation Model (RSM) is the regional tool used to evaluate alternatives for Caloosahatchee River Watershed Protection Plan (CRWPP)
- NERSM = specific implementation of RSM covering the northern extent of the District down to Lake Okeechobee and then east and west to the estuaries
- Current Base:
  - Represents conditions as they exist in the Northern Everglades Watershed in 2005.
  - Assumes no projects as defined by the Comprehensive Everglades Restoration Plan (CERP).
  - Period of record: 1970 to 2005.
  - Lake Okeechobee flood control releases to estuary and Water Conservation Areas are based on the WSE regulation schedule.
  - Same as Lake Okeechobee Watershed Construction Project Phase 2 Technical Plan current base scenario.

5/21/08

Model Setup

- **Future Base:**
  - **Represents conditions likely to exist in Northern Everglades Watershed after implementation of Acceler8, Lower & Upper Kissimmee water resources projects such as:**
    - **C-43 reservoir**
    - **C-44 reservoir and STA**
    - **EAA Phase A-1 Reservoir**
    - **Kissimmee River Restoration Project and the Kissimmee River Headwaters Revitalization Project**
    - **Other projects south of Lake Okeechobee such as authorized MODWATERs and C-111 projects**
  - **Also referred to as LOWCP P2TP future base.**

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Model Setup

- **CRWPP Base Run:**
  - **Represents future base conditions plus implementation of projects described in the Lake Okeechobee Watershed Construction Project Phase II Technical Plan**
    - **C-43 reservoir operating with 178.6 kaf of storage operating between 20 to 42 ft NGVD; 9,380 acres; 1,500/1,200 cfs inflow/outflow capacity**
    - **C-43 reservoir used solely to meet EST05 targets in the Caloosahatchee estuary as in the C43 reservoir Phase I PIR**
  - **Based on the LOWCP P2TP ALT4 with refinements in the simulation of the Caloosahatchee watershed**
    - **Additional level of detail in conceptualizing the Caloosahatchee basin into Eastern and Western subbasins**
    - **Use of less boundary conditions to drive the model, e.g. backflows are now simulated relative to water level fluctuations in Lake Okeechobee**
    - **Additional performance indicator (Target Flow Index) to aid in the alternative evaluation process**

5/21/08

Performance Measures Specific to CRWPP

- An objective of the Caloosahatchee River Watershed Protection Plan is to reduce frequency and duration of harmful freshwater releases into the Caloosahatchee Estuary at the S-79 structure.
  - Number of Times Caloosahatchee Estuary High Discharge Criteria Exceeded (mean monthly flows > 2800 & 4500 cfs from 1970 – 2005)
    - Goal is to reduce the occurrence of high discharges to a frequency that approximate natural conditions.
    - Specific metric is to have no more than three occurrences of mean monthly flows exceeding 2800 cfs (causes stress to the ecosystem); and avoid mean monthly flows in excess of 4500 cfs (causes severe damage).
  - Number of Times Salinity Envelope Criteria NOT met for the Caloosahatchee Estuary
    - Goal is to maintain salinity concentrations that are conducive to estuary ecology
    - Specific metric is to avoid mean monthly flows less than 450 cfs from October to July and three occurrences of mean monthly flows greater than 2,8000 cfs

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Performance Measures (con't)

- The goal is to establish salinity range favorable to juvenile marine fish, shellfish, oysters and submerged aquatic vegetation;
  - A desired flow distribution (based on the EST05 flow time series) was established to achieve this goal.
  - A metric called target flow index (TFI) was formulated in order to measure deviation from the desired flow distribution. A value of zero signifies a perfect match to EST05. Progressively more negative index values are associated with flows deviating (either above or below) from the target.

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Other Performance Measures and Indicators

- Maintain other water-related needs for the other parts of the system; provides a way to evaluate water supply impacts of different alternatives.
  - Lake Okeechobee performance measures and indicators as used in LOWCP P2TP, e.g. stage duration curve, Minmum Flow and Level
  - Mean annual EAA/LOSA supplementation irrigation (4-in-1)
  - LOSA demand cutback volumes for 7 water years in the simulation period with the largest cutbacks

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- **Modeling Domain**

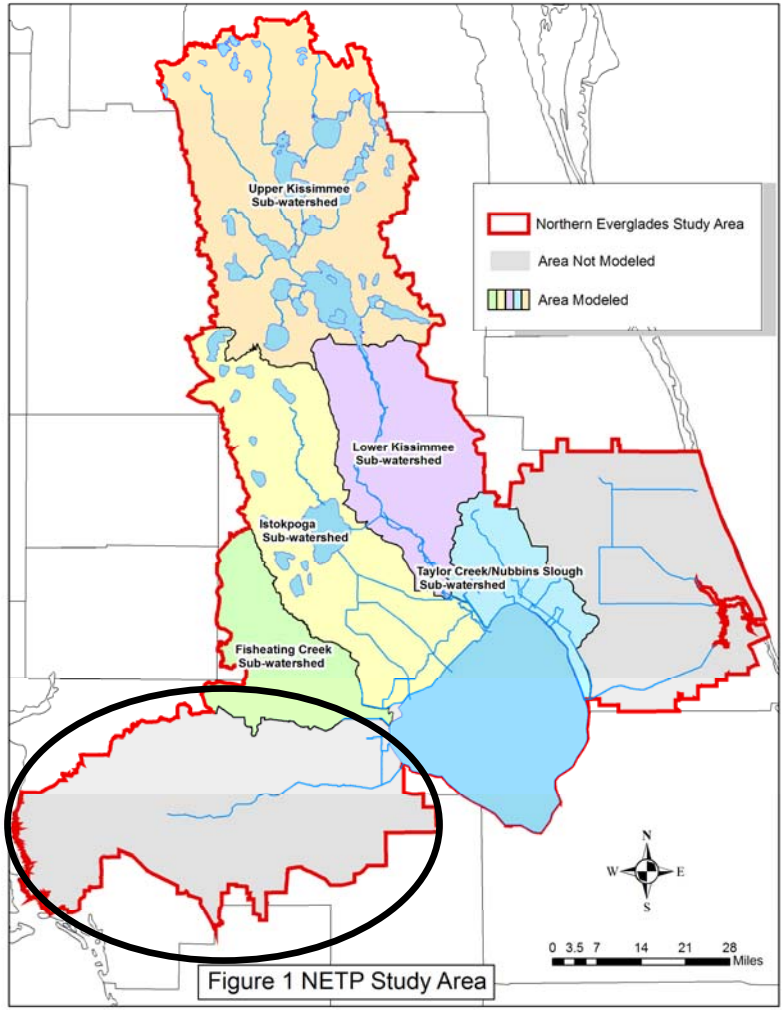

Figure 1 NETP Study Area

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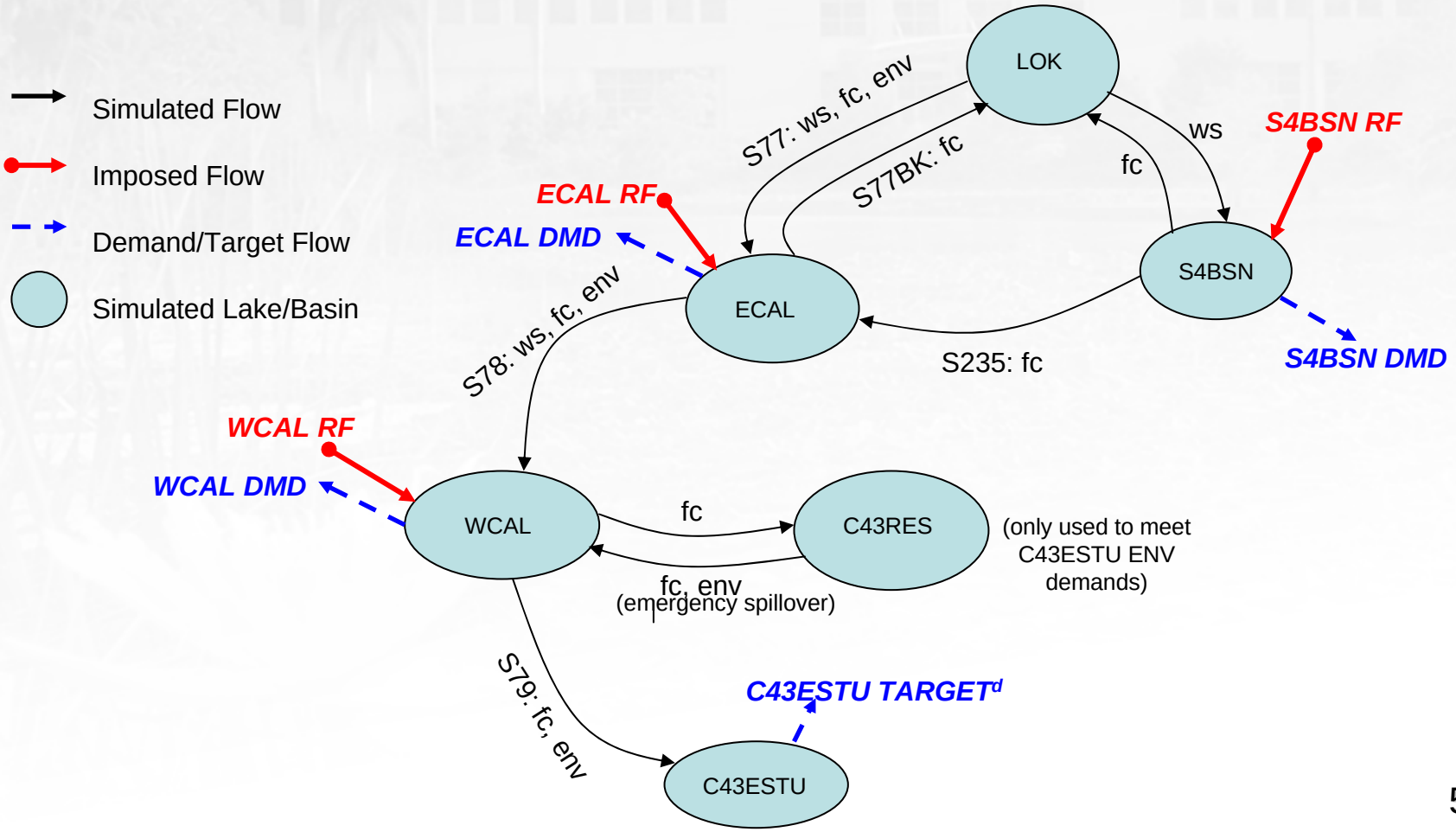
Node-Link Representation of the Caloosahatchee Sub-watershed in the NERSM for Draft CRWPP Base



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Modeling Results

- Comparison of LOWCP P2TP Current Base Scenario {CBASE} and Draft CRWPP Base Run {RWPPB} using performance measures and indicators
- Alternative scenarios will be compared against CBASE and RWPPB incrementally as they become available

5/21/08

Recap: Scenario Comparison Using Performance Measures

- Goal is to re-establish salinity regimes suitable for the maintenance of healthy, naturally-diverse and well-balanced estuarine ecosystems while meeting the other water related needs of the region including water supply.
  - Number of times C-43 Estuary High Discharge Criteria Exceeded
  - Number of times salinity envelope criteria NOT met for C-43 estuary
  - Target Flow Index for Caloosahatchee estuary at S-79
  - Lake Okeechobee Extreme High (17 ft NGVD) and Low Stages (10 ft NGVD)
  - Lake Okeechobee Stage Envelope (Score Below & Above)

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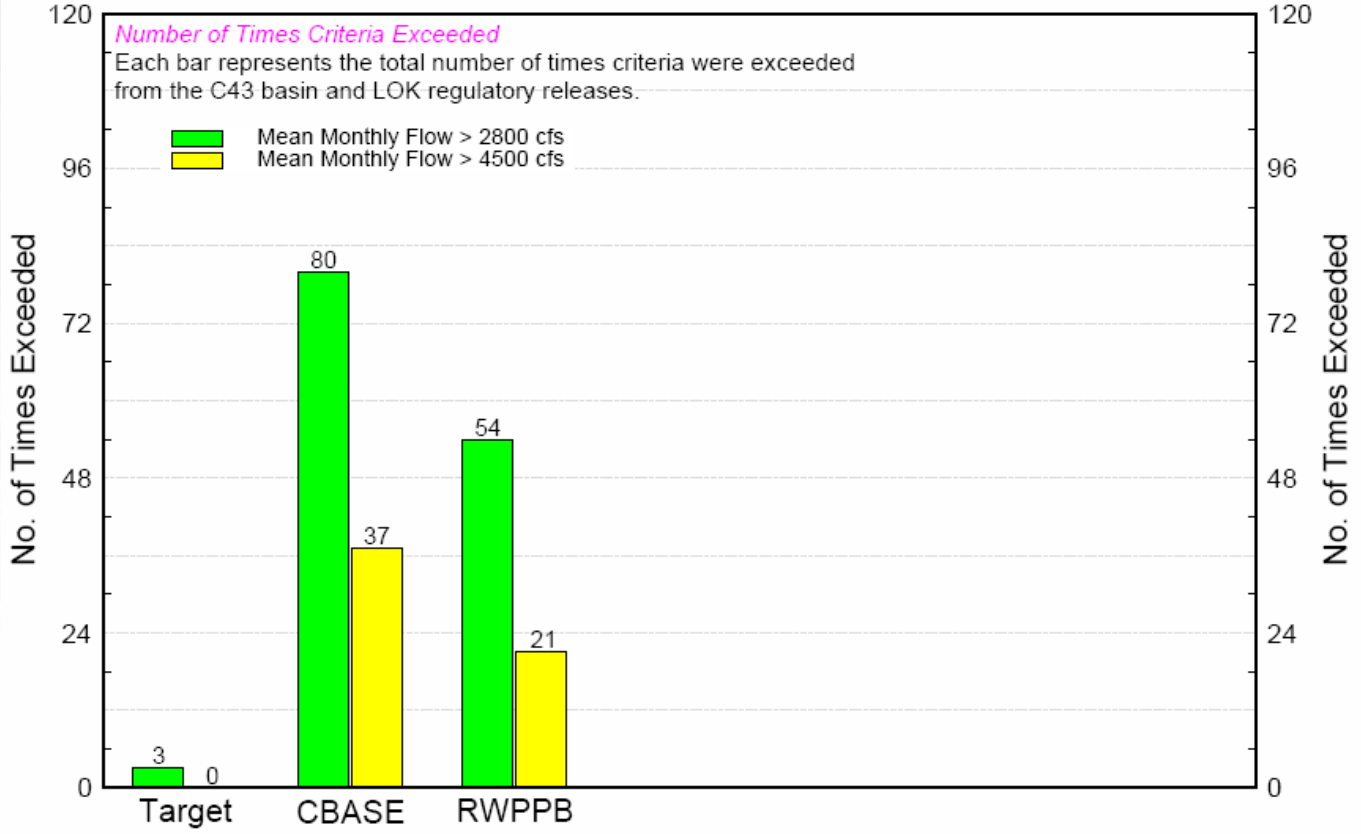
Number of Times Caloosahatchee Estuary High Discharge Criteria Exceeded
(mean monthly flows > 2800 & 4500 cfs from 1970 - 2005)



For Planning Purposes Only
Script used: estuary.scr, ID496
Filename: caloos_2800_4500_flow_bar.out.agr

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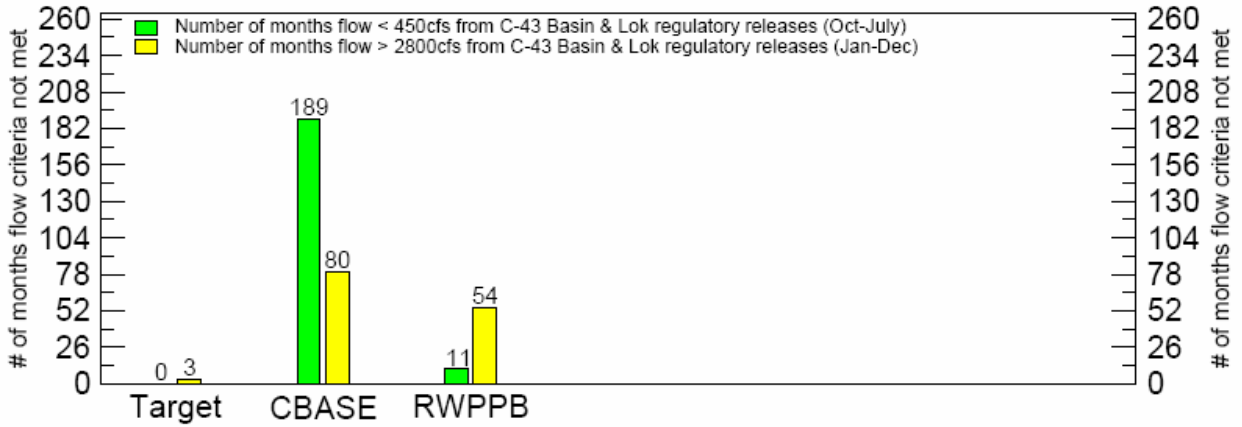
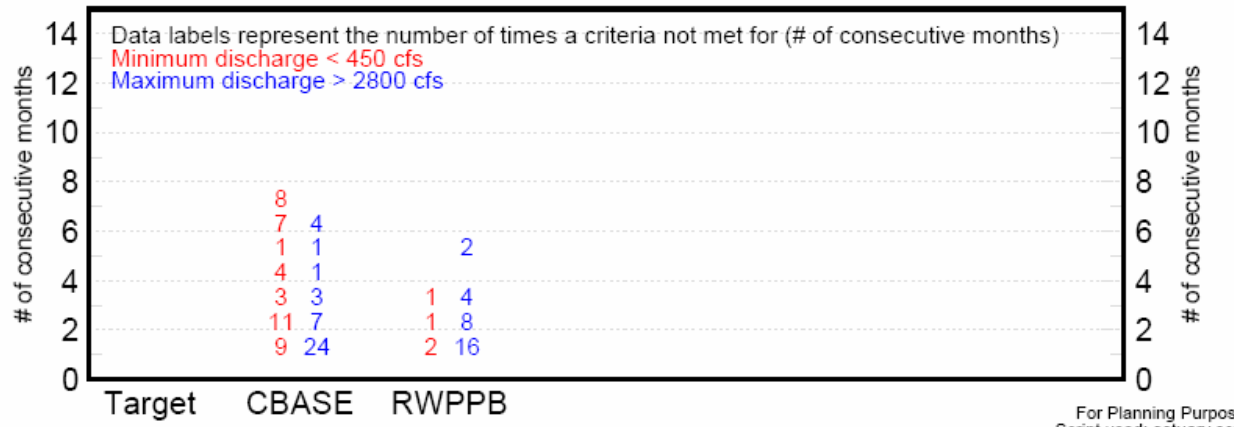
Source	Mean Monthly Flow > 2800 cfs	Mean Monthly Flow > 4500 cfs
Lake Okeechobee	8	2
C-43 Basin	33	7
C-43 Basin + Lake Okeechobee	13	12
Total	54	21

Number of Times Salinity Envelope Criteria NOT Met for the Caloosahatchee Estuary (mean monthly flows 1970 - 2005)





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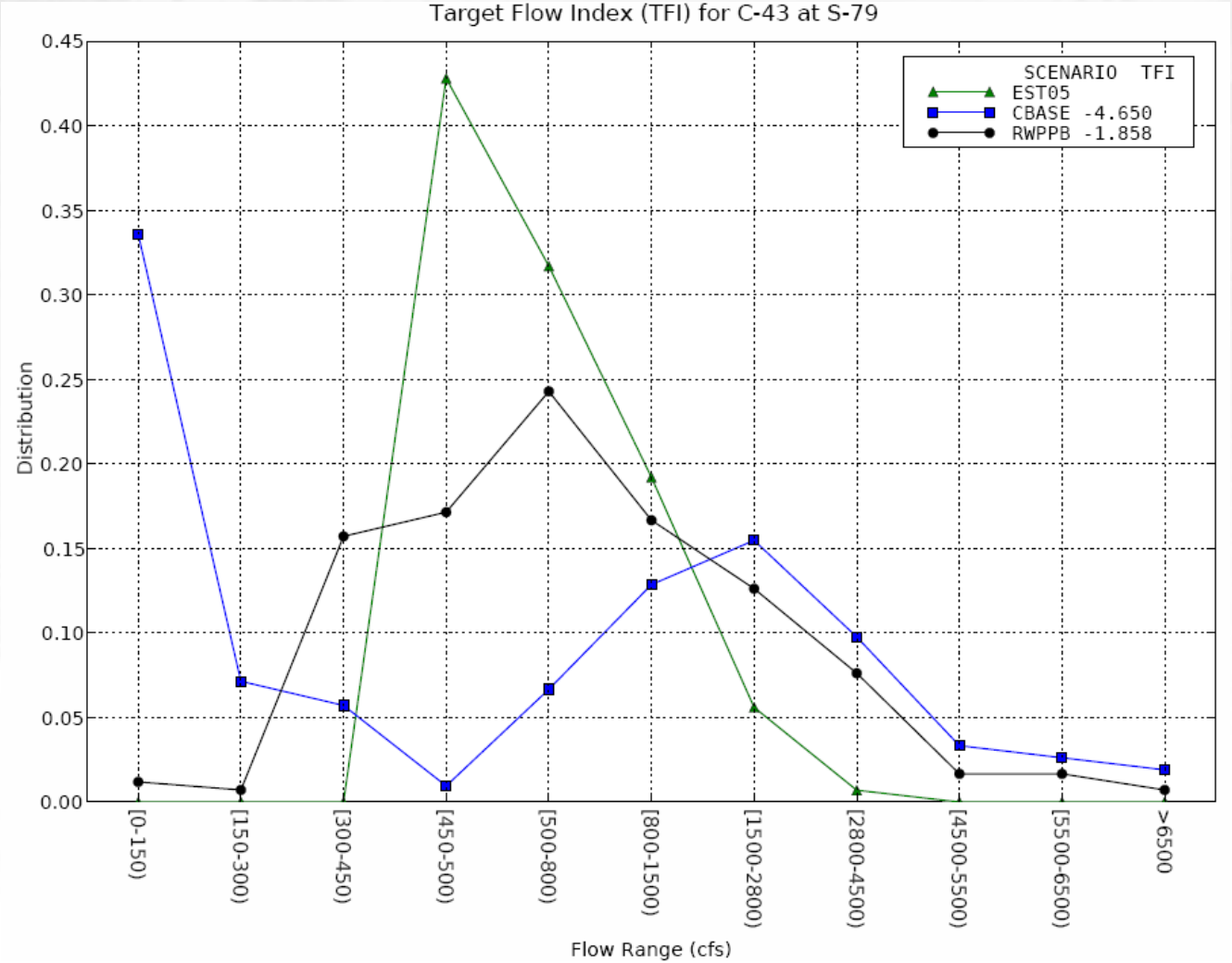
Target Flow Index (TFI) for C-43 at S-79
SCENARIO TFI
EST05
CBASE -4.650
RWPPB -1.858
Distribution
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
[0-150)
[150-300)
[300-450)
[450-500)
[500-800)
[800-1500)
[1500-2800)
[2800-4500)
[4500-5500)
[5500-6500)
>6500
Flow Range (cfs)

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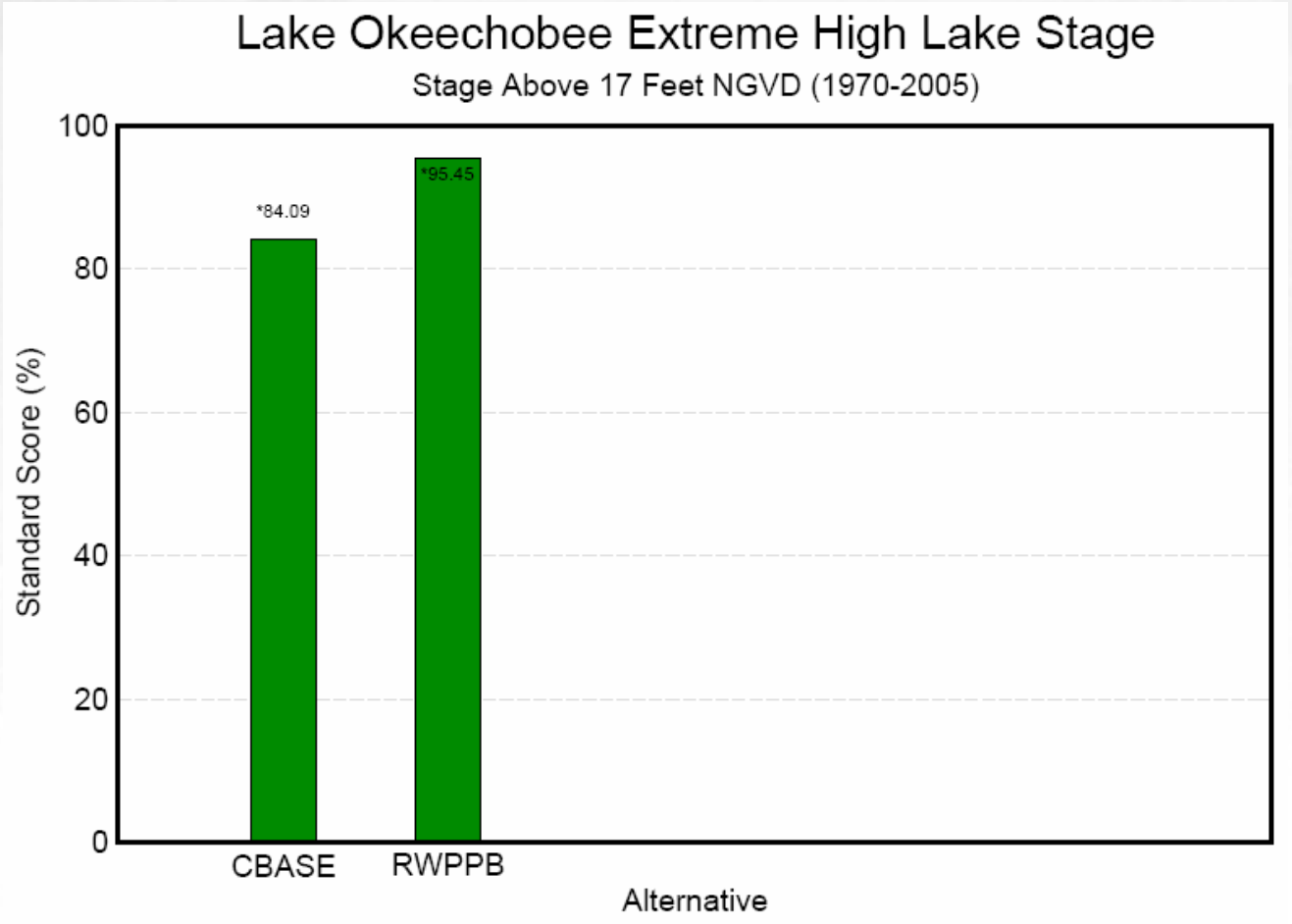
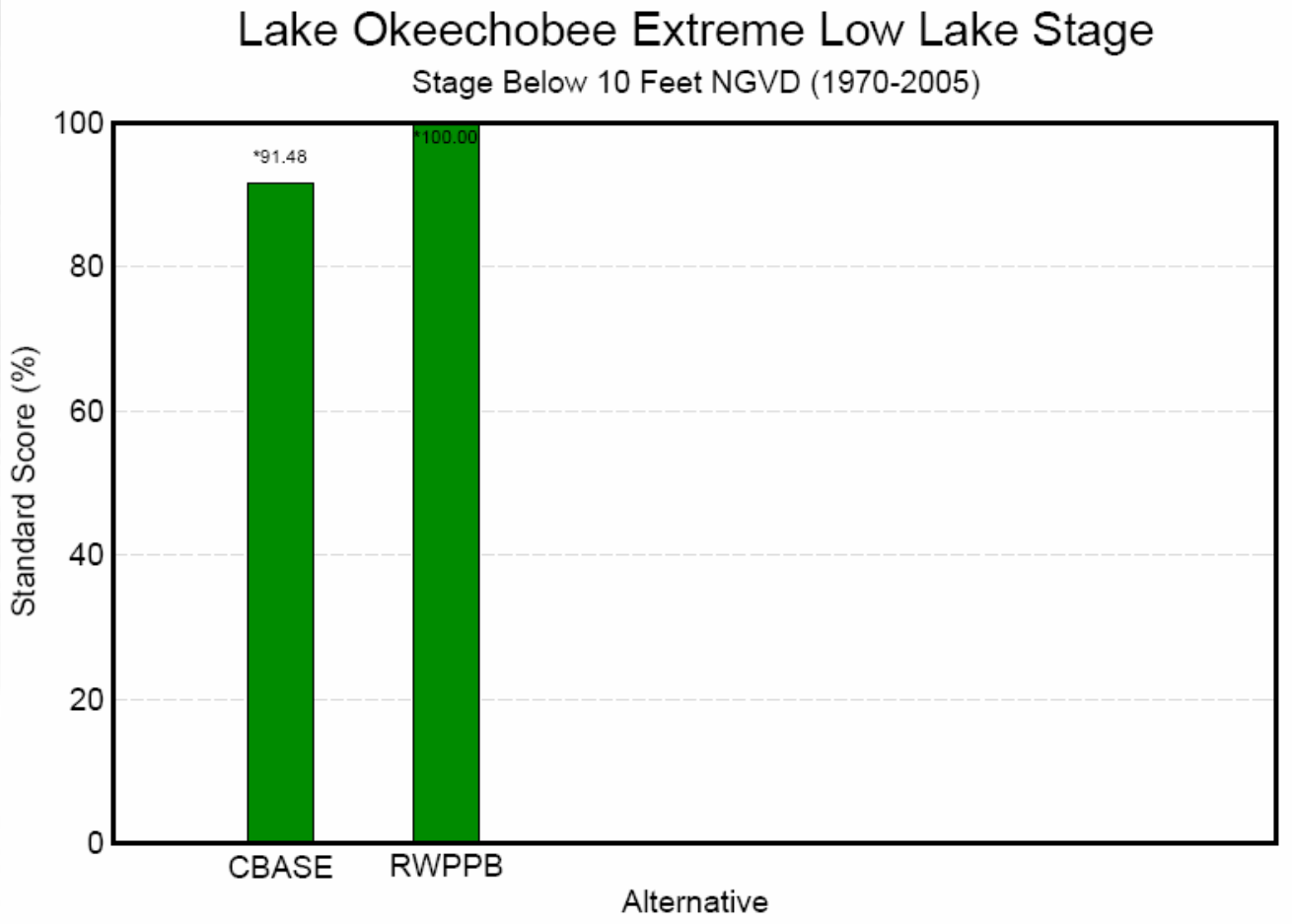


Note: A score of 0% is the worst score. The stage exceeds 17 feet for an average of 11 weeks per year or more.
A score of 100% is the best score. The stage never exceeds 17 feet.

For Planning Purposes Only
Run Date: Tue May 20 09:51:47 2008
Regional Simulation Model (RSM)
Script Used: lo_generator.scr (ID386)
Filename: lo2_weekly_high_lake_annualized.agr

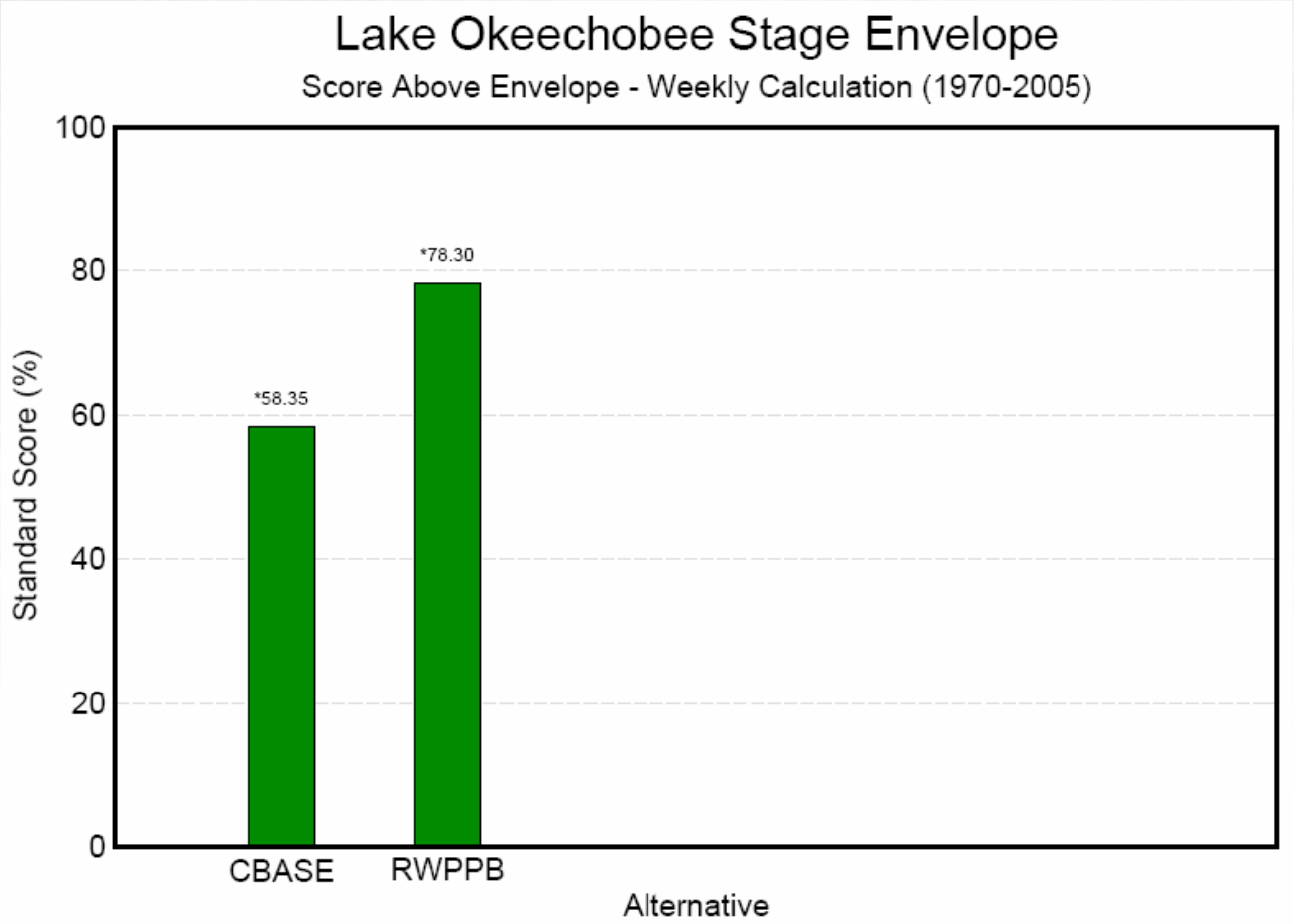
5/21/08



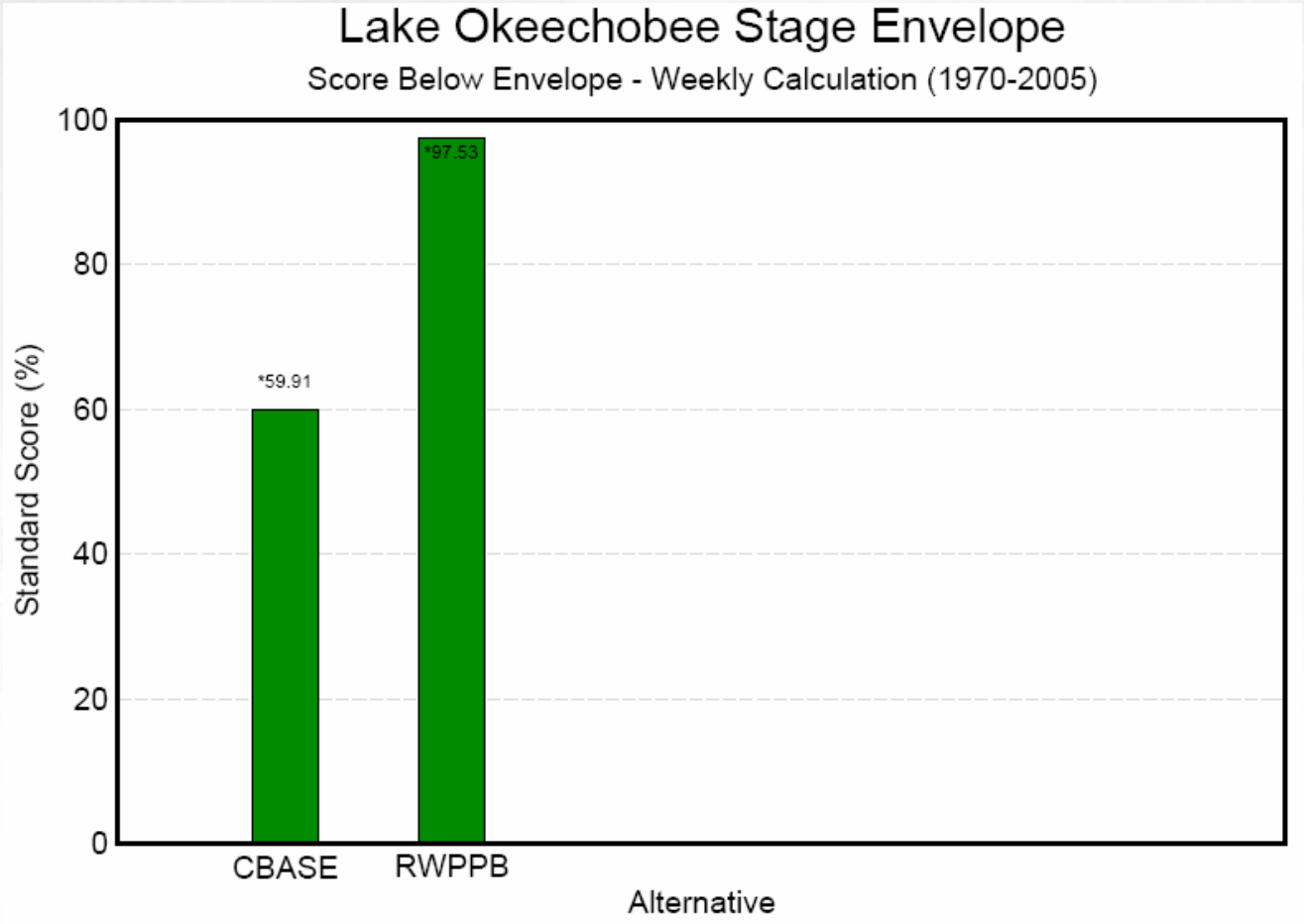
Note: A score of 0% is the worst score. The stage falls below 10 feet for an average of 15 weeks per year or more. A score of 100% is the best score. The stage never falls below 10 feet.

For Planning Purposes Only
Run Date: Tue May 20 09:51:47 2008
Regional Simulation Model (RSM)
Script Used: lo_generator.scr (ID386)
Filename: lo1_weekly_low_lake_annualized.agr

5/21/08


Lake Okeechobee Stage Envelope
Score Above Envelope - Weekly Calculation (1970-2005)
Standard Score (%)
100
80
60
40
20
0
*58.35
*78.30
CBASE
RWPPB
Alternative
Note: A score of 0% is the worst score. The stage exceeds the envelope by 1 ft or more on average.
A score of 100% is the best score. The stage never exceeds the envelope.
For Planning Purposes Only
Run Date: Tue May 20 09:51:47 2008
Regional Simulation Model (RSM)
Script Used: lo_generator.scr (ID386)
Filename: lo3_weekly_high_annualized.agr

5/21/08



Note: A score of 0% is the worst score. The stage falls below the envelope by 1 ft or more on average.
A score of 100% is the best score. The stage never falls below the envelope.

For Planning Purposes Only
Run Date: Tue May 20 09:51:47 2008
Regional Simulation Model (RSM)
Script Used: lo_generator.scr (ID386)
Filename: lo3_weekly_low_annualized.agr

5/21/08

Recap: Scenario Comparison Using Performance Indicators

- Lake Okeechobee Stage Duration Curve
- Lake Okeechobee Minimum Fow and Level
- Water year (Oct-Sep) LOSA demand cutback volumes (7-worst years)
- Mean Annual EAA/LOSA supplemental Irrigation: demands and demands-not-met (4-in-1 WS indicator)

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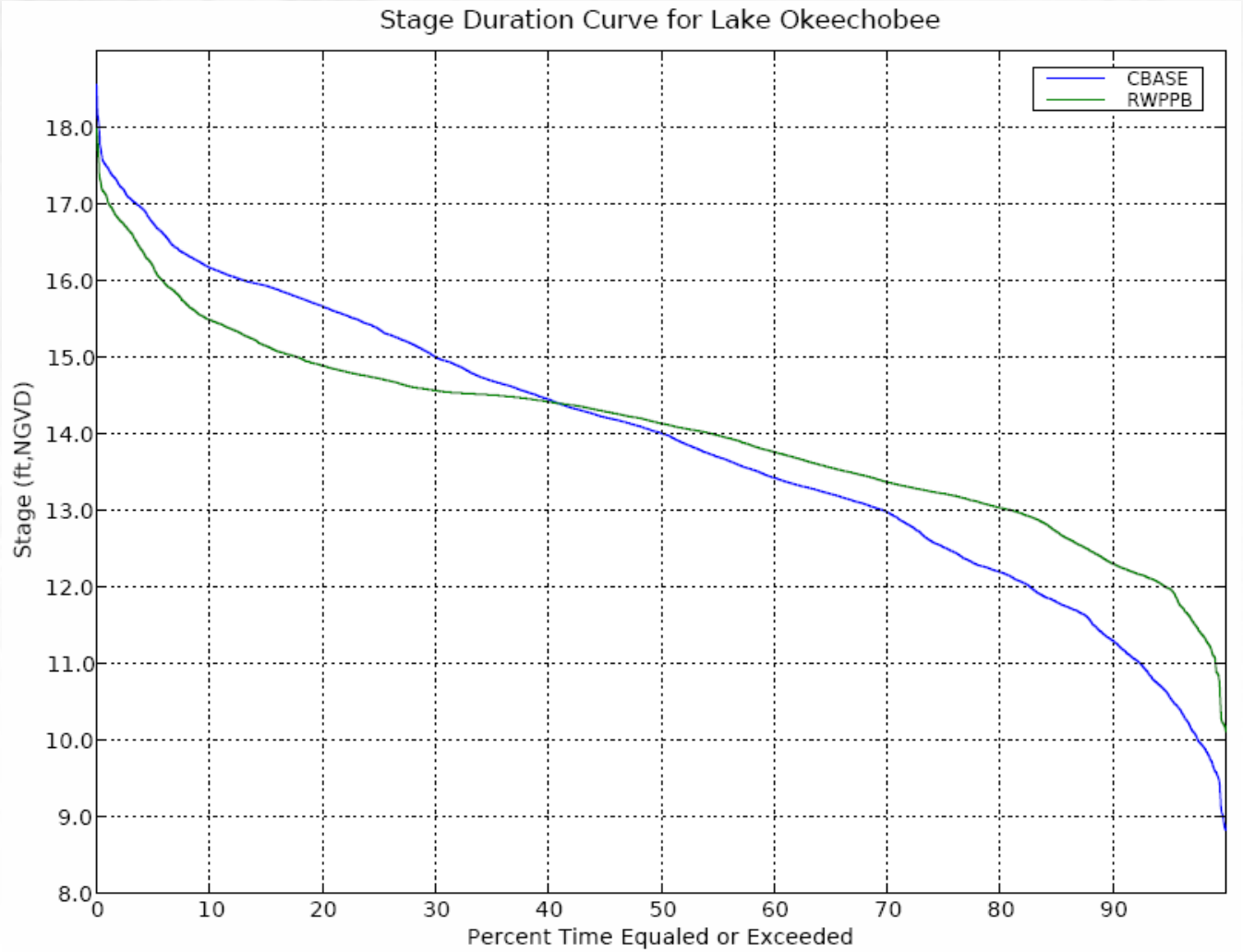
Stage Duration Curve for Lake Okeechobee
CBASE
RWPPB
Stage (ft,NGVD)
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
0
10
20
30
40
50
60
70
80
90
Percent Time Equaled or Exceeded

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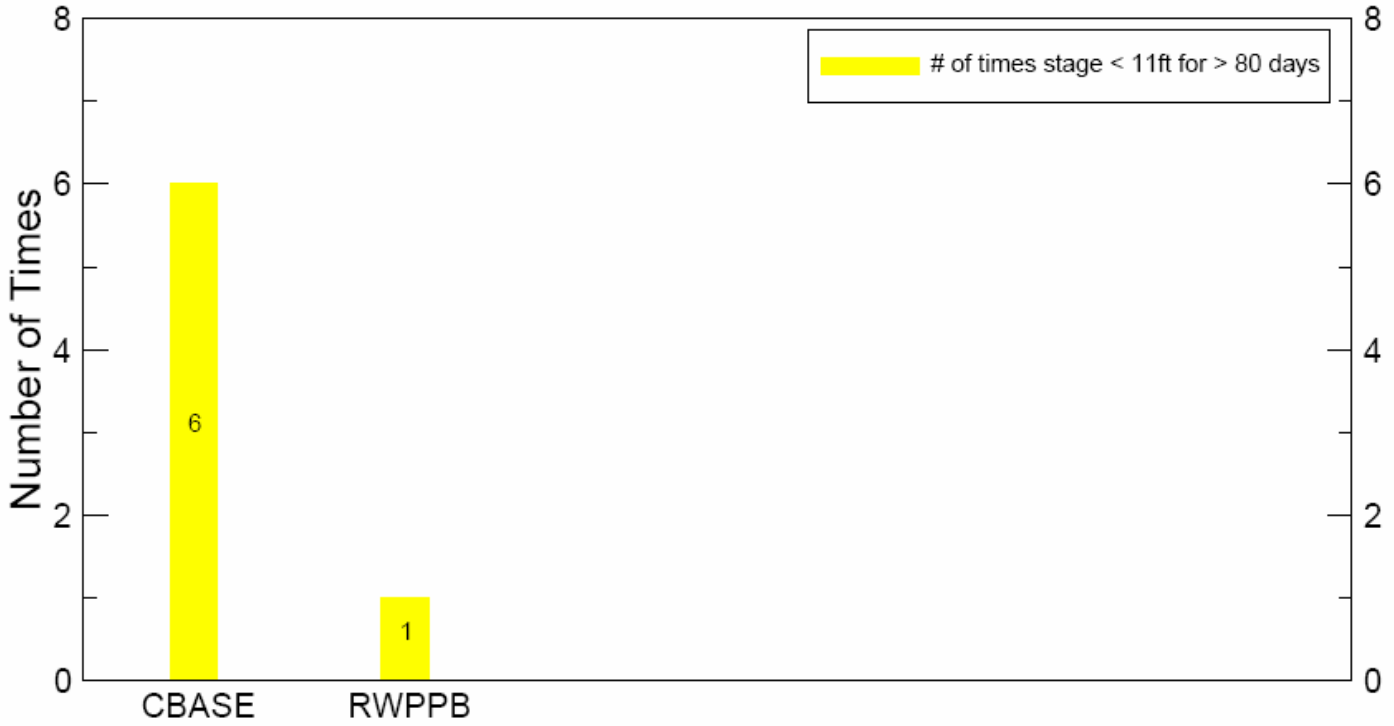
Number of Times LOK Proposed Minimum Water Level & Duration

Criteria were Exceeded During the 1970-2005 Simulation



Note:

Target: Minimum Level, duration and Return Frequency - Water levels in Lake Okeechobee should not fall below 11ft NGVD for greater than 80 days more often than once every six years (Target derived from 1952-1995 historical stage data for Lake Okeechobee).

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Script used: lok_stage_events.scr ID450

Filename: lok_minlvl_bar.agr

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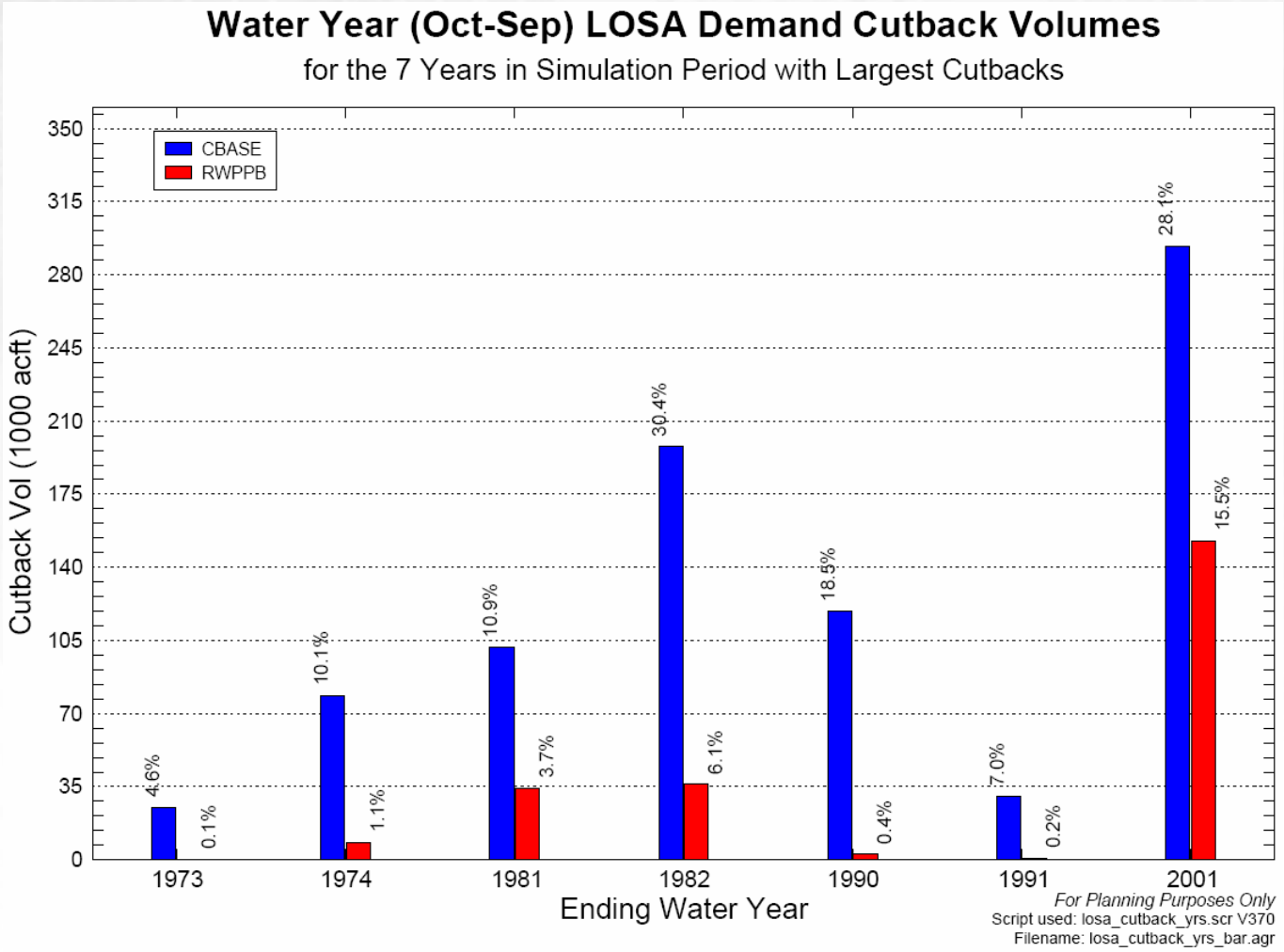
Water Year (Oct-Sep) LOSA Demand Cutback Volumes
for the 7 Years in Simulation Period with Largest Cutbacks
CBASE
RWPPB
Cutback Vol (1000 acft)
350
315
280
245
210
175
140
105
70
35
0
4.6%
0.1%
10.1%
1.1%
10.9%
3.7%
30.4%
6.1%
18.5%
0.4%
7.0%
0.2%
28.1%
15.5%
1973
1974
1981
1982
1990
1991
2001
Ending Water Year
For Planning Purposes Only
Script used: losa_cutback_yrs.scr V370
Filename: losa_cutback_yrs_bar.agr

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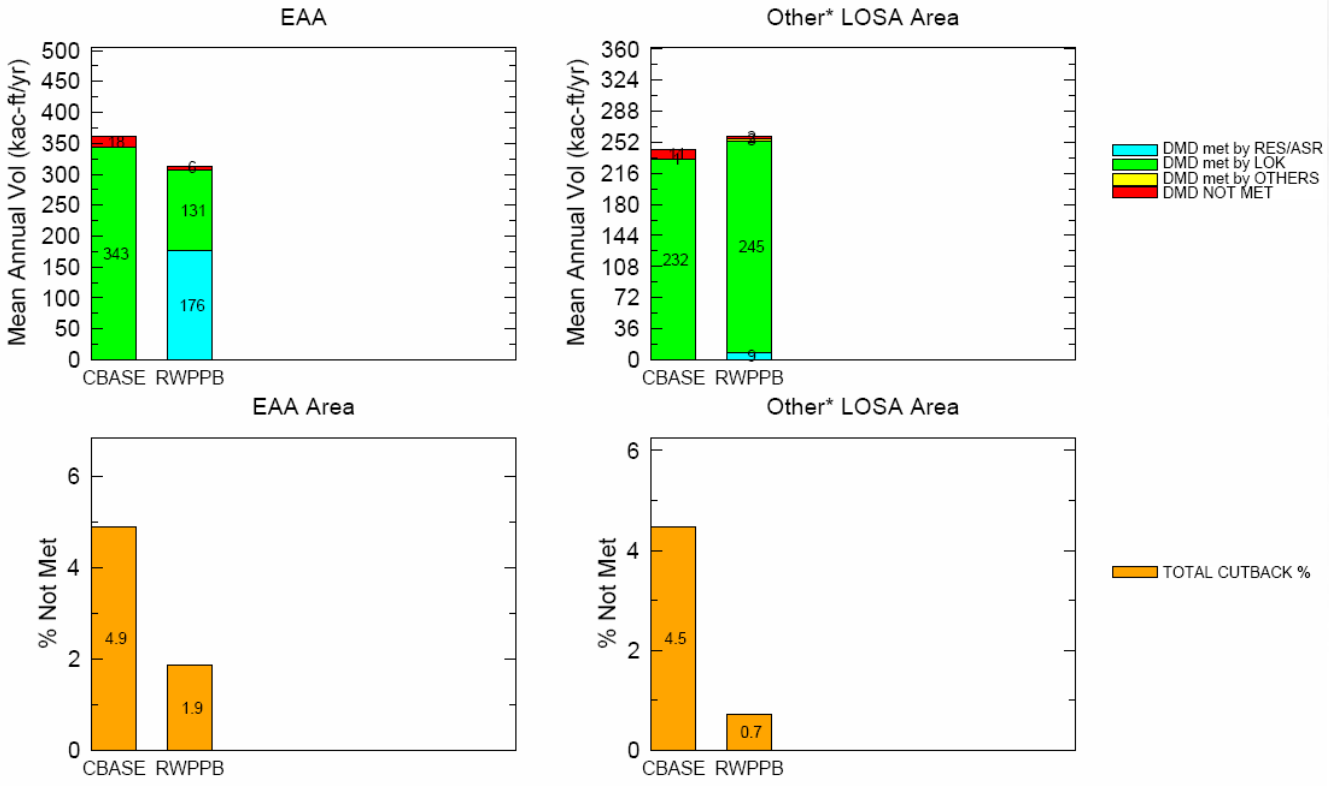
Mean Annual EAA/LOSA Supplemental Irrigation: Demands & Demands Not Met for 1970 - 2005



Other LOSA Areas: S236, S4, L8, C43, C44, North & Northeast Lakeshore, & Lower Istokpoga

For Planning Purposes Only
Script used: ssm_4in1.scr, ID327
Filename: losa_dmd_4in1.agr

5/21/08

- **Future Modeling Using NERSM**
  - **Incorporation of CRWPP-specific Alternative 1 management measures**
  - **Integration with Alternative 1 management measures for the St. Lucie River Watershed Protection Plan (SLRWPP)**
  - **Continued alternative formulation, simulation and evaluation**

5/21/08

- **Website: www.sfwmd.gov/northerneverglades**
- **Questions?**

Caloosahatchee River Watershed Protection Plan Schedule

(As of May 21, 2008)

Formulation of Alternatives

Alternative 1	**April 1-May 20**
Alternative 2	**April 15-June 3**
Alternative 3	**April 22-June 17**
Alternative 4	**April 29-July 1**
Release Draft Plan for Public Review	**October 2008**
Final Plan to Governing Board	**December 2008**
Submit Plan to Legislature	**January 1 2009**