LOXAHATCHEE RIVER WATERSHED RESTORATION PROJECT

Project Delivery Team Meeting #03

March 19, 2015

One of the Last Old Growth Cypress Floodplains in the SE Florida

Last Large Freshwater Wetland Corridor in Project Area

Vulnerable estuarine habitats

U.S.ARMY

US Army Corps of Engineers

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Water Quality Sub-team Update

March 19,2015

Work Efforts to Date

1) Develop Water Quality Evaluation Strategy consistent with CERP guidance and project goals.
2) Develop Evaluation Strategy for Each Flowway.
3) Evaluate / update the Existing Set of Evaluation Criteria.
4) Brainstorm potential management measures in Flowways 1,2 and 3.

WQ Evaluation Strategy

- The LRWRP is a CERP project so the water quality (WQ) evaluation will be done in accordance to CERP Guidance Memorandum #23 (CGM 23). According to CGM 23, CERP projects such as LRWRP can be classified into one of three categories:

  A. Components that includes water quality improvement features
  B. Components that do not contain water quality improvement features but are designed to achieve water quality improvement
  C. Components for which the Comp Plan does not include WQ improvement features or specifically reference water quality improvement to be addressed during design.

LOX is primarily a Category B Project

Category B Evaluation Procedure

1. Characterizing existing WQ conditions.
2. Forecasting base-year WQ conditions.
3. Forecasting future without conditions.
4. Developing evaluation criteria that incorporate WQ constraints to determine extent of WQ improvement.
5. Selecting the least-cost plan that meets WQ restoration objectives.
6. Optimizing design to maximize WQ improvement to the extent this can be done without conflicting with primary project purposes and goals.

- As a Category B project, the development of PMs for WQ intended for use in selecting the preferred alternative is not required. That does not mean that post-project implementation performance metrics are not necessary. Even though the WQ team does not need WQ PMs for alternative evaluation we do need an evaluation strategy for assessing the alternative in terms of their ability to:

1. Cause or contribute to WQ standard violations
2. Increase pollutant loads (particularly where there might be a TMDL)
3. Degrade water quality in OFW or other water bodies.

Evaluation Strategy (Strawdog)

Flowway 1 (L-8 to GWP)

- Evaluation method is under development
  - Have to develop the alternatives before creating the evaluation methodology.
- The team has done some initial work looking at annual load to GWP and the potential additional load that would enter GWP to meet water quantity goals for discharge at G161.
- Team kicked around some management measures within the M-canal and features internal to GWP.
- more to come.

Floway 2 (C-18 West)

Proposed Evaluation:

1. Use hydrologic data and existing WQ data to compute a flow-weighted mean inflow concentration into Mecca. To do this, we need to know the relative sources of inflow (L-8, Corbett, C-18) and their average WQ concentrations.

2. Use standard WQ nutrient removal equations (Kadlec equation for nutrient uptake in wetlands) to compute the average expected outflow concentration. (consider the shallow reservoir and attached polishing cell)

3. Compare the Mecca computed average annual outflow concentration to the PM #6 for WildScenic Lox (Stations 67, 68, 69). If below X ppb for TP, and X for TN, then meets WQ expectations.

Flowway 3 (Cypress Creek Basin)

Proposed Evaluation.

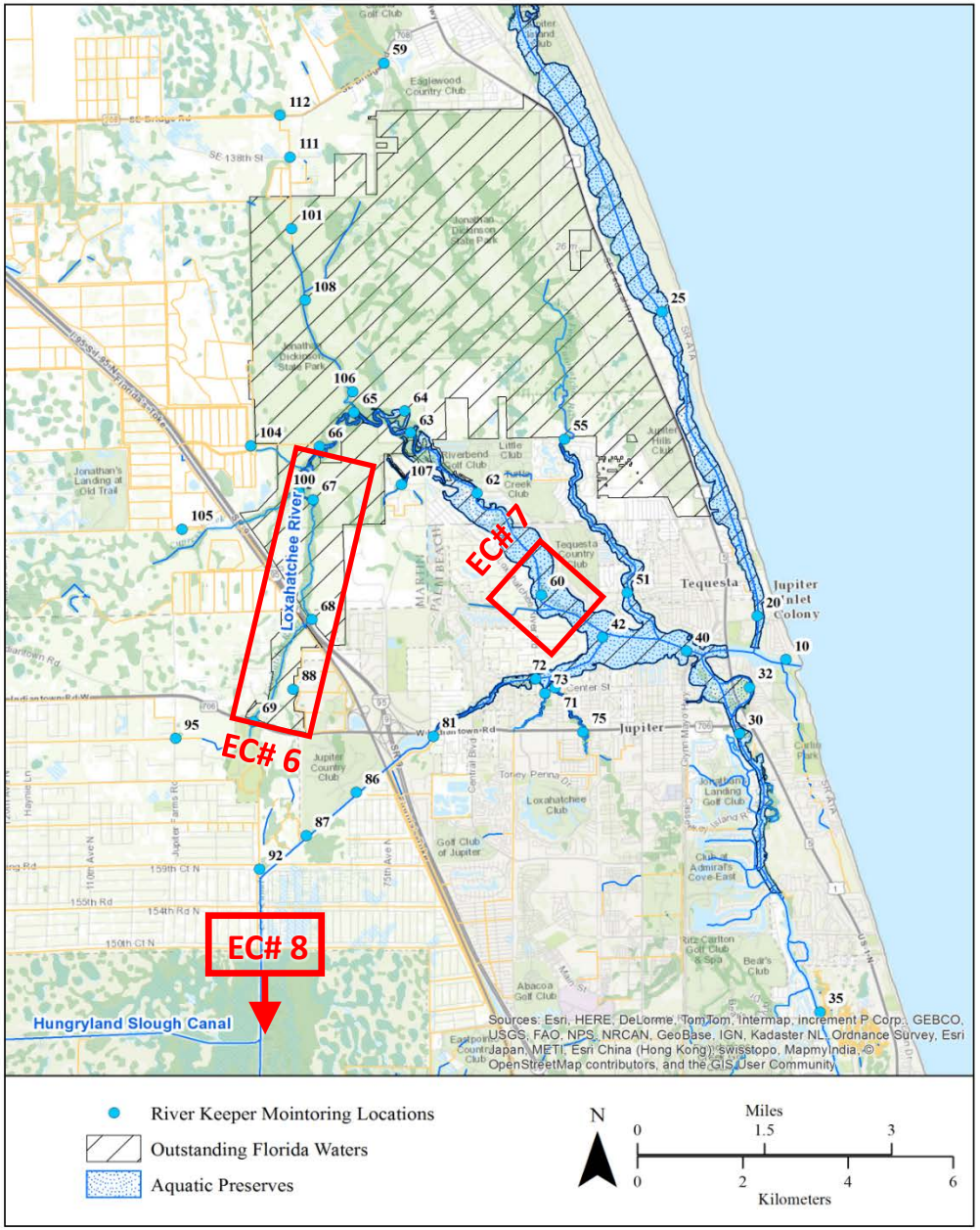
1. Look at pre-, and post-, flow estimates. Timing of flows, etc.
2. Compute pre-, and post- annual, seasonal loads, use DEP WAM model data to estimate runoff quality using land use loading parameters from that model (kg/acre/yr).
3. Compare computed flow-weighted mean concentration to PM for Lox (station 67,68, 69).

Need to understand, FWO, and future with land use assumptions. Is it year 2000 conditions for lands bought specifically for this project as FWO land use, or do we assume 2014 land use for FWO and with project conditions for all lands?

This requires both Hydrologic output for alternatives and WQ loading info from WAM or other sources.

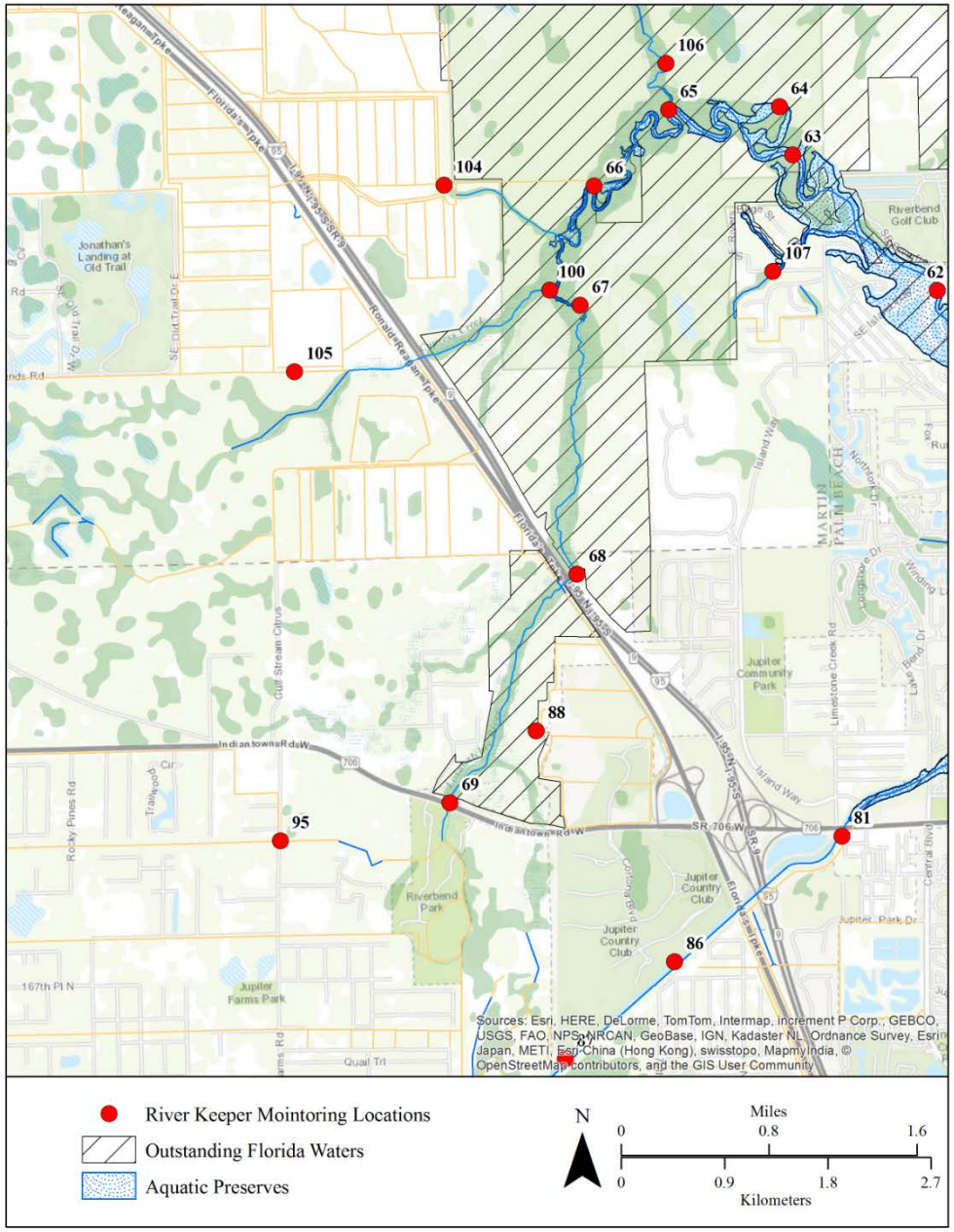
Review and Updating of Existing Performance Measures

Geographic Location of WQ Performance Metrics



EC #6:

Nutrient Concentration (Nitrogen and Phosphorus) and Other Water Quality Parameters for the Northwest Fork of the Loxahatchee River.



Confirming Original Evaluation Target Development:

Time Period: WY1998 – WY2002 (May 1, 1997 - April 30, 2002)
Stations: Sites 67, 68 and 69

Explanation	*Parameter*	*Total Phosphorus (µg/L)*	*Total Nitrogen (mg/L)*
Arithmetic Mean reference period, m :	*Mean*	*44.6*	*1.04*
Standard deviation of reference period, s :	*StDev*	*25.4*	*0.33*
Number of Data Points used in the analysis, N :	*N*	*90*	*90*
Deg. Of Freedom (Df) = N-1 :	*Df*	*89*	*89*
Probability for Prediction Interval :	*1-tail Prob*	*0.05*	*0.05*
Student-t Statistic (t_p) :	*t_p*	*1.662*	*1.662*
Upper Bound of the 95% CI of the Mean, $m+s*t_p/(N)^{0.5}$:	*Limit (95% C.I.)*	*49*	*1.09*

From Appendix B: Performance Measures and Evaluation Criteria

CERP Evaluation Target

1. Five year rolling average of Total Phosphorus concentration shall not exceed 49 ppb (upper bound of the 95% confidence interval of the mean) measured at in-stream monitoring stations #67, 68 and 69.
2. Five year rolling average of Total Nitrogen concentration shall not exceed 1.07 mg/L (upper bound of the 95% confidence interval of the mean) measured at in-stream monitoring stations #67, 68 and 69.

Furthermore, all other water quality parameters shall comply with Class III water quality standards.

Dent et al. 2004

Reference Period Approach: Loxahatchee River

- Long Term Limit
  - Time Period: WY2005 – WY2014
  - Stations: Sites 67, 68 and 69
- Biological End-point: Achievement of Class III freshwater dissolved oxygen criterion (62-302.533 FAC).

Explanation	*Parameter*		
Long Term (5-Year) Geometric Mean Limit		***Total Phosphorus (µg/L)***	***Total Nitrogen (mg/L)***
Arithmetic Mean of Annual Geometric Means, m :	***Mean***	***42.7***	***1.03***
Standard deviation of annual Geometric Means, s :	***StDev***	***7.72***	***0.22***
Number of Water Years used in the analysis, N :	***N***	***9***	***9***
Deg. Of Freedom (Df) = N-1 :	***Df***	***8***	***8***
Probability for Prediction Interval :	***1-tail Prob***	***0.10***	***0.10***
Student-t Statistic (t_p) :	***t_p***	***1.397***	***1.397***
Annual GM = m + s*t_p/(N)$^{0.5}$:	***Long Term GM Limit (90% C.I.)***	***46***	***1.13***

*Six samples per WY. Atleast one in both the wet and dry seasons.

Reference Period Approach: Loxahatchee River

- Long Term Limit
  - Time Period: WY2005 – WY2014
  - Stations: Sites 67, 68 and 69
- Biological End-point: Achievement of Class III freshwater dissolved oxygen criterion (62-302.533 FAC).

Explanation	Parameter		
Annual Station Limit		***Total Phosphorus (µg/L)***	***Total Nitrogen (mg/L)***
Overall Geometric Mean, gm :	***Geometric Mean***	***41.8***	***0.94***
Mean Ln(Geometric Mean), m :	***Mean Ln(GM)***	***3.7***	***-0.07***
Standard Deviation Ln(Geometric Mean), s :	***StDev Ln(GM)***	***0.193***	***0.185***
Σ(No. of water years per station), WYN_s:	***WYN_s***	***18***	***18***
Number of Stations, NS :	***NS***	***3***	***3***
Deg. Of Freedom (Df) = WYN_s-NS :	***Df***	***15***	***15***
Probability for Prediction Interval :	***1-tail Prob***	***0.10***	***0.10***
Student-t Statistic (t_p) :	***t_p***	***1.341***	***1.341***
Limit = exp(m + s*t_p)	***Annual Station GM Limit***	***54***	***1.20***

*Six samples per WY. Atleast one in both the wet and dry seasons.

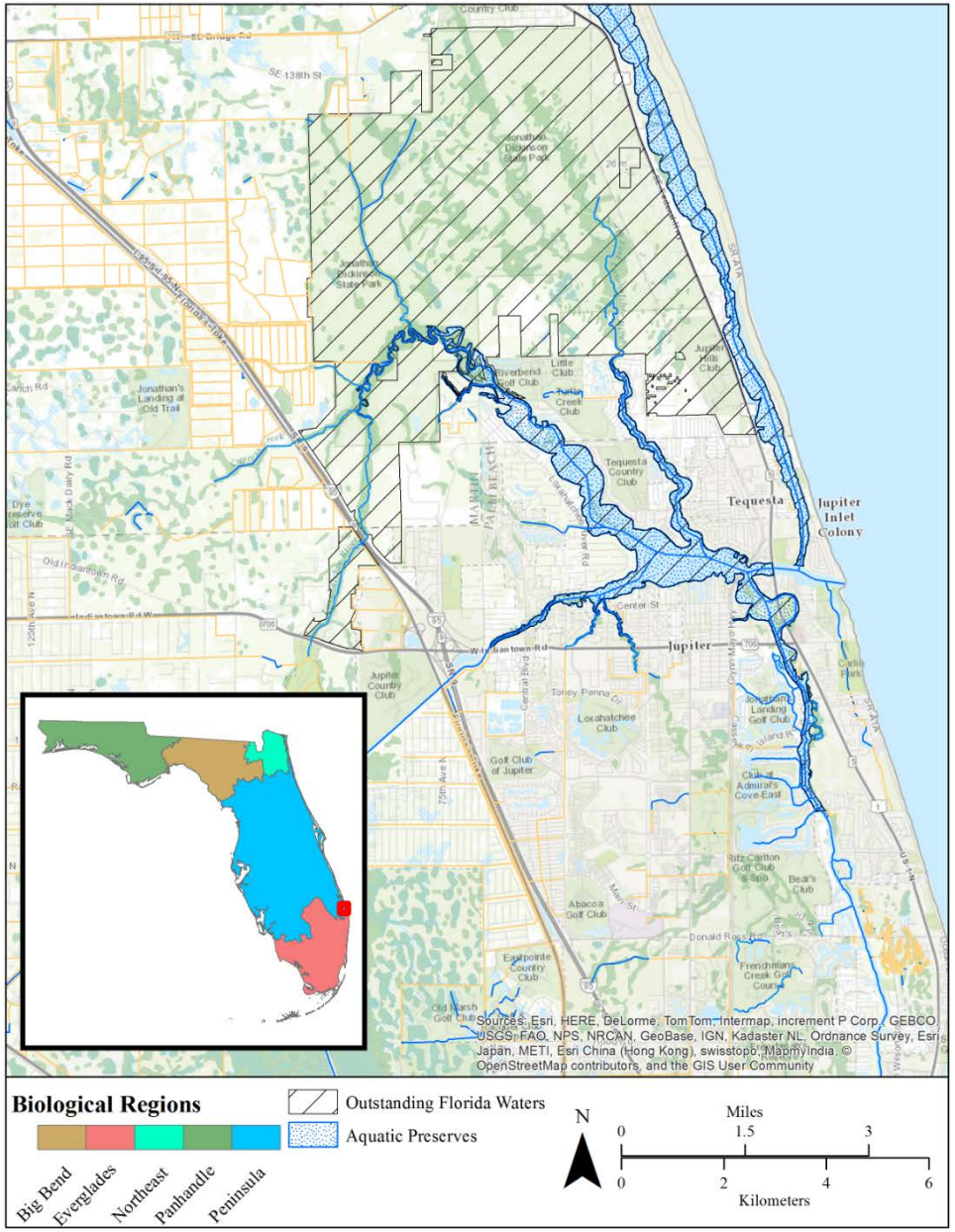
Reference Period Approach: Loxahatchee River

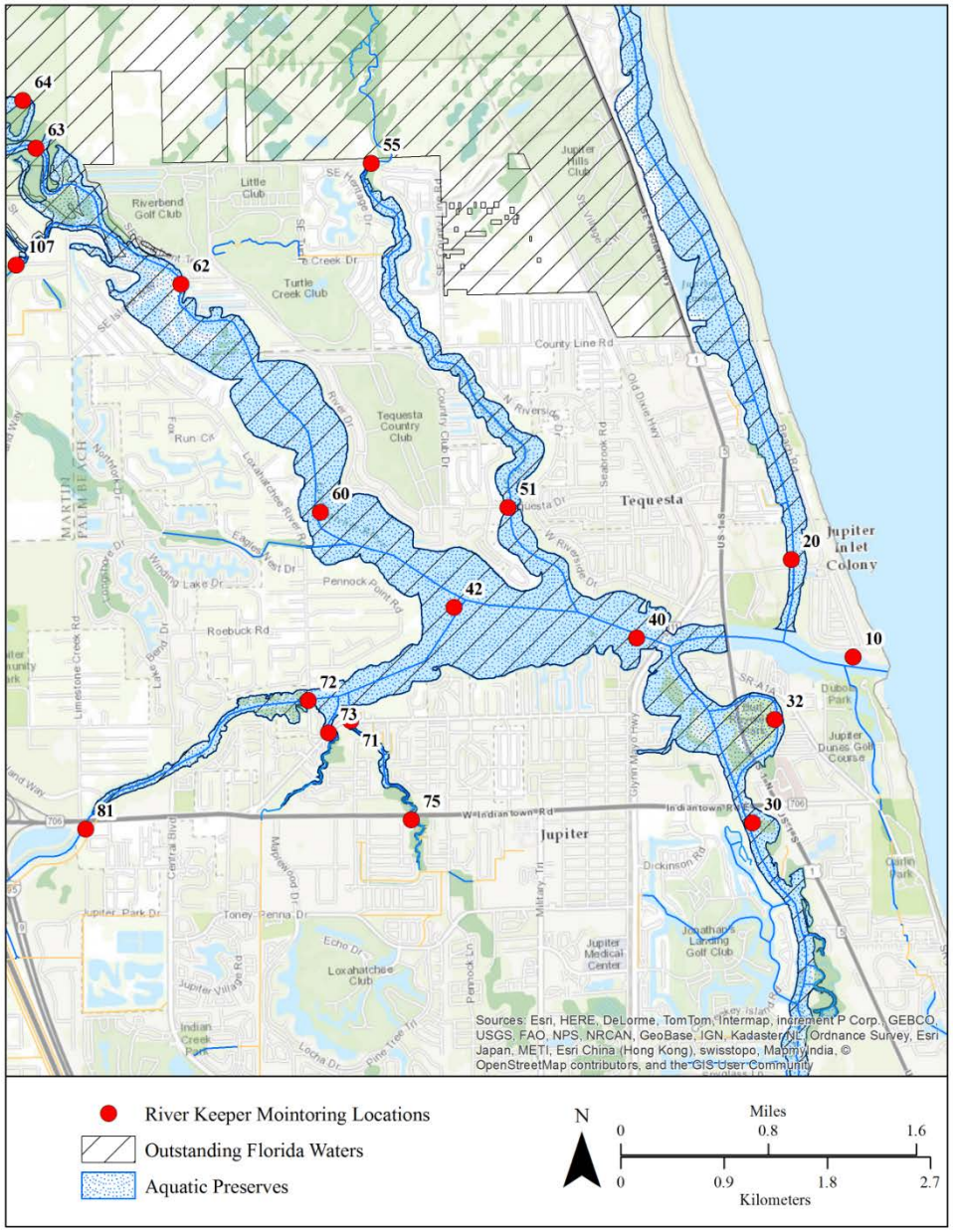
Part	*Explanation*	*Total Phosphorus (µg/L)*	*Total Nitrogen (mg/L)*
1	*The five-year GM averaged across all stations.*	*46*	*1.13*
2	*The annual GM at all individual station.*	*54*	*1.20*

62-302.531 (2)(c) 2 FAC

Nutrient Watershed Region	Total Phosphorus Nutrient Threshold[1]	Total Nitrogen Nutrient Threshold[1]
Panhandle West	0.06 mg/L	0.67 mg/L
Panhandle East	0.18 mg/L	1.03 mg/L
North Central	0.30 mg/L	1.87 mg/L
Peninsular	0.12 mg/L	1.54 mg/L
West Central	0.49 mg/L	1.65 mg/L
South Florida	No numeric nutrient threshold. The narrative criterion in paragraph 62-302.530(47)(b), F.A.C., applies.	No numeric nutrient threshold. The narrative criterion in paragraph 62-302.530(47)(b), F.A.C., applies.

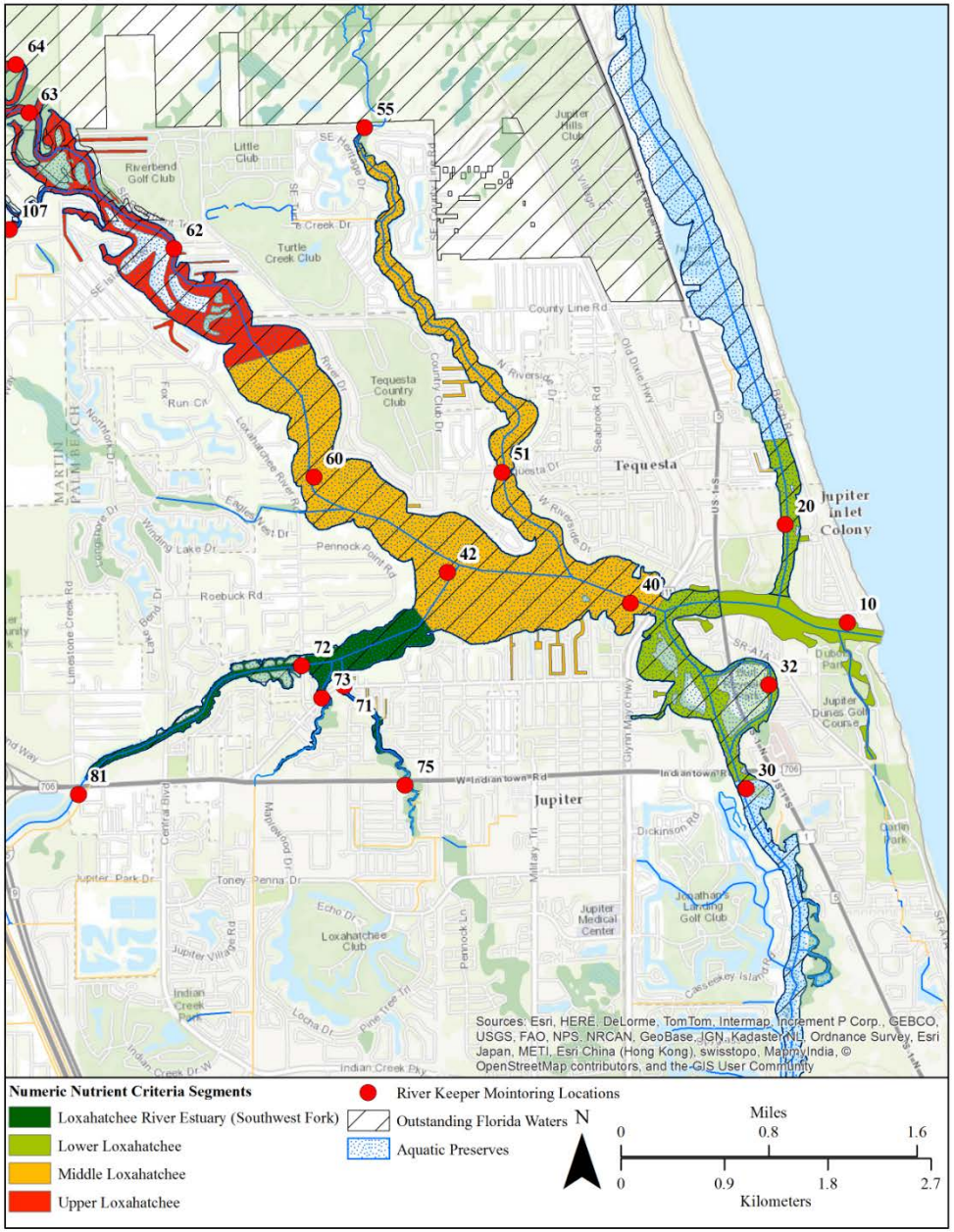
[1] These values are annual geometric mean concentrations, not to be exceeded more than once in any three year period.





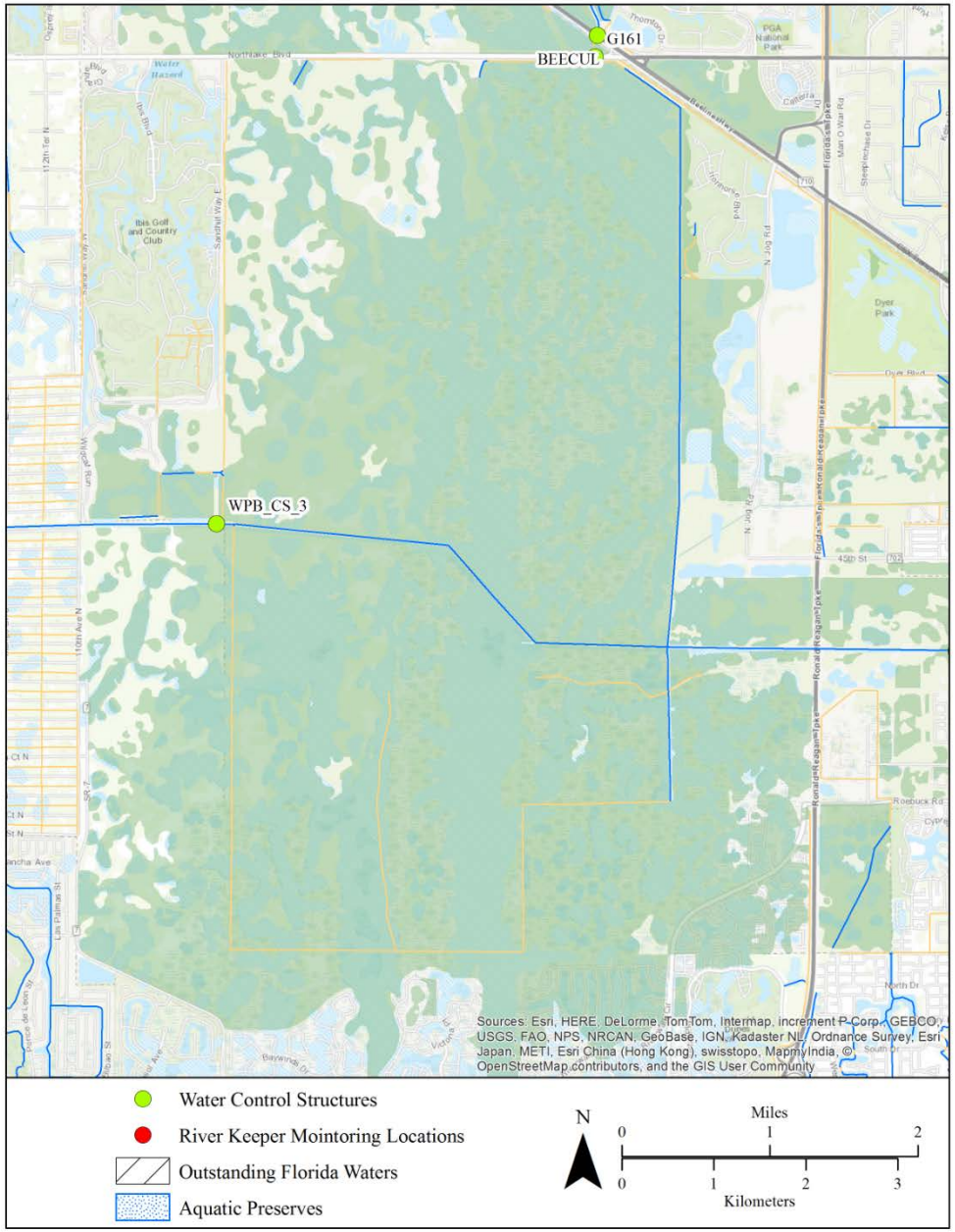
EC #7:
Nutrient Concentration (Nitrogen and Phosphorus) and Other Water Quality Parameters for the Loxahatchee River Estuary.

The team went back and confirmed the original performance measure criteria for this EC. However, we decided to not use this PM going forward as the revised project is not likely to affect WQ at this location



62-302.532(1)(q) F.A.C.

Estuary	Total Phosphorus	Total Nitrogen	Chlorophyll a
Loxahatchee River Estuary	For estuary segments with criteria expressed as annual geometric means (AGM), the values shall not be exceeded more than once in a three year period. For all other estuary segments, the criteria shall not be exceeded in more than 10 percent of the measurements.		
1. Lower Loxahatchee	0.032 mg/L as AGM	0.63 mg/L as AGM	1.8 µg/L as AGM
2. Middle Loxahatchee	0.030 mg/L as AGM	0.80 mg/L as AGM	4.0 µg/L as AGM
3. Upper Loxahatchee	0.075 mg/L as AGM	1.26 mg/L as AGM	5.5 µg/L as AGM



EC #8:
Inflow Concentrations of Total Phosphorus and Other Key Water Quality Parameters for the Catchment Area/Grassy Waters Preserve (WCA/GWP) and Loxahatchee Slough.

Work in progress.

Questions:

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Project Website

http://www.bit.ly/LRWRP_CERP