

LOXAHATCHEE RIVER WATERSHED RESTORATION PROJECT

Project Delivery Team Meeting December 13, 2017

Proposed Water Quality Analysis

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Federally designated as a National Wild and Scenic River, the Loxahatchee River and its watershed are homes to 33 federally threatened and endangered species, 20 federally protected migratory bird species, and 30 additional State's species of concern

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



Last Large Freshwater Wetland Corridor in Project Area



Vulnerable estuarine habitats



Work Efforts to Date



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- 1) Develop Water Quality Evaluation Strategy consistent with CERP guidance and project goals.
- 2) Develop Evaluation Strategy for each flow-way.
- 3) Evaluate / update the existing set of evaluation criteria.
- 4) Brainstorm potential management measures in Flow-ways 1, 2, and 3.



WQ Evaluation Strategy



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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



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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.



Reference Period Approach: Loxahatchee River



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<i>Part</i>	<i>Explanation</i>	<i>Total Phosphorus (micrograms / litre)</i>	<i>Total Nitrogen (milligrams / litre)</i>
<i>1</i>	<i>The five-year GM averaged across all stations.</i>	<i>46</i>	<i>1.13</i>
<i>2</i>	<i>The annual GM at all individual stations.</i>	<i>54</i>	<i>1.20</i>

5



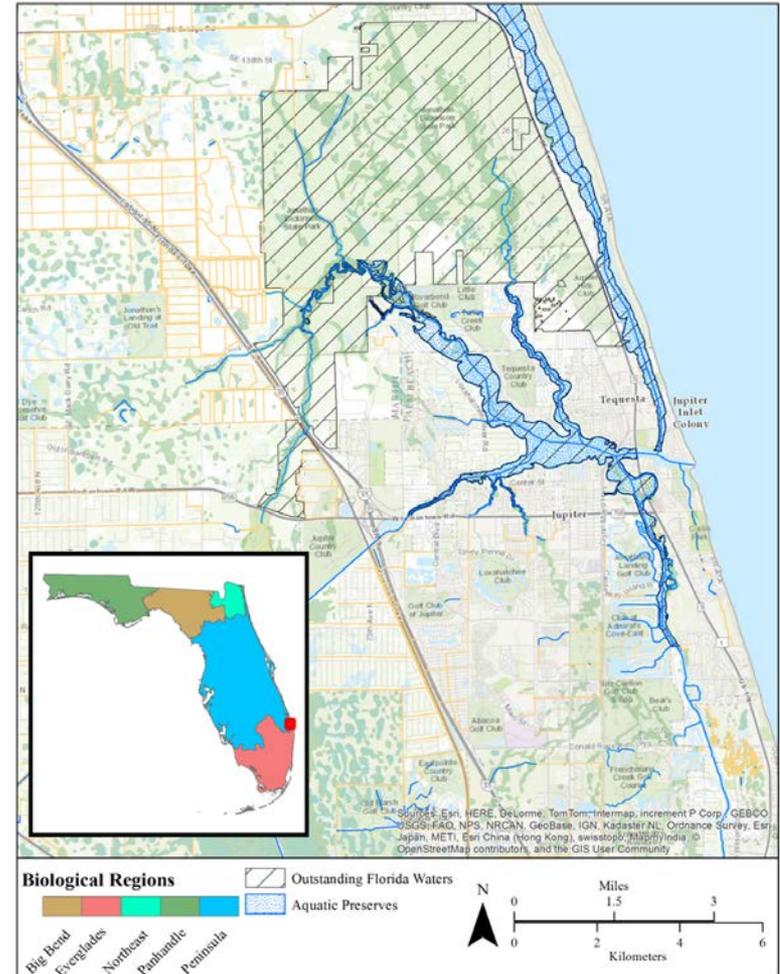
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Nutrient Watershed Region	Total Phosphorus Nutrient Threshold ¹	Total Nitrogen Nutrient Threshold ¹
Panhandle West	0.06 milligram/litre	0.67 milligram/litre
Panhandle East	0.18 milligram/litre	1.03 milligram/litre
North Central	0.30 milligram/litre	1.87 milligram/litre
Peninsular	0.12 milligram/litre	1.54 milligram/litre
West Central	0.49 milligram/litre	1.65 milligram/litre
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.

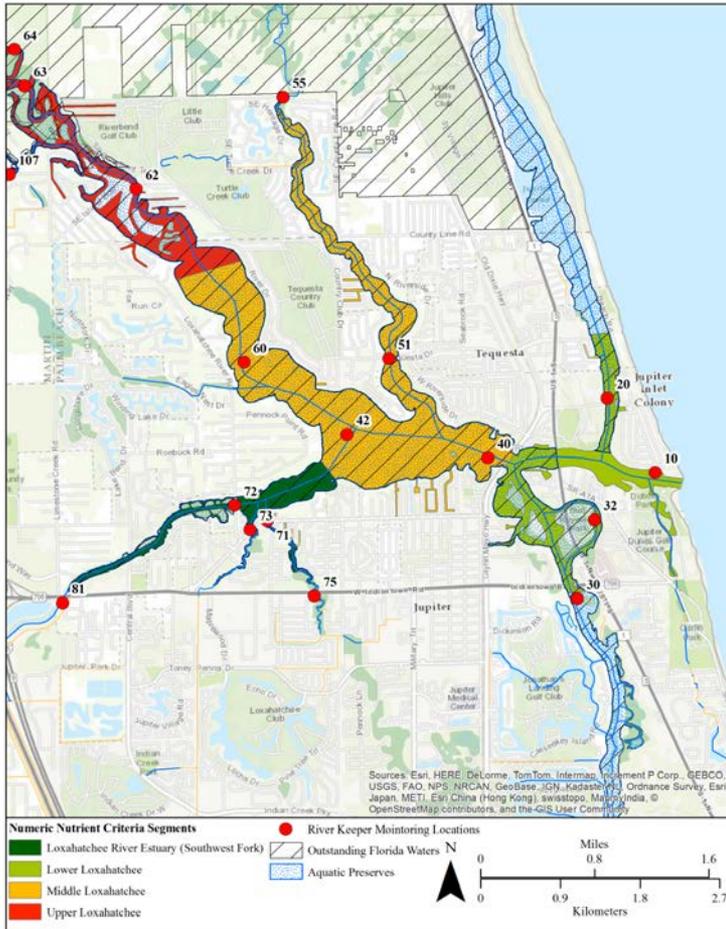




62-302.532(1)(q) F.A.C.



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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 milligram/litre as AGM	0.63 milligram/litre as AGM	1.8 microgram/litre as AGM
2. Middle Loxahatchee	0.030 milligram/litre as AGM	0.80 milligram/litre as AGM	4.0 microgram/litre as AGM
3. Upper Loxahatchee	0.075 milligram/litre as AGM	1.26 milligram/litre as AGM	5.5 microgram/litre as AGM



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Evaluation Tool

Historical data

MODFLOW results

Treatments Assumptions



Evaluation Tool



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- Evaluation tool approach:
 - ✓ Develop schematic diagram for ECB, FWO, and each alternative.
 - ✓ Compile historical data (if available)* to estimate baseline flows, TP/TN concentrations, and TP/TN loads.
 - ✓ Apply MODFLOW results to estimate flows, TP/TN concentrations, and TP/TN loads.
 - ✓ Use conservative treatment assumptions for deep reservoirs, shallow impoundments, and natural storage features.

**Data sources include SFWMD's DBHYDRO database, FDEP, Loxahatchee River District, Indian Trail Improvement District, and Mock Roos.*

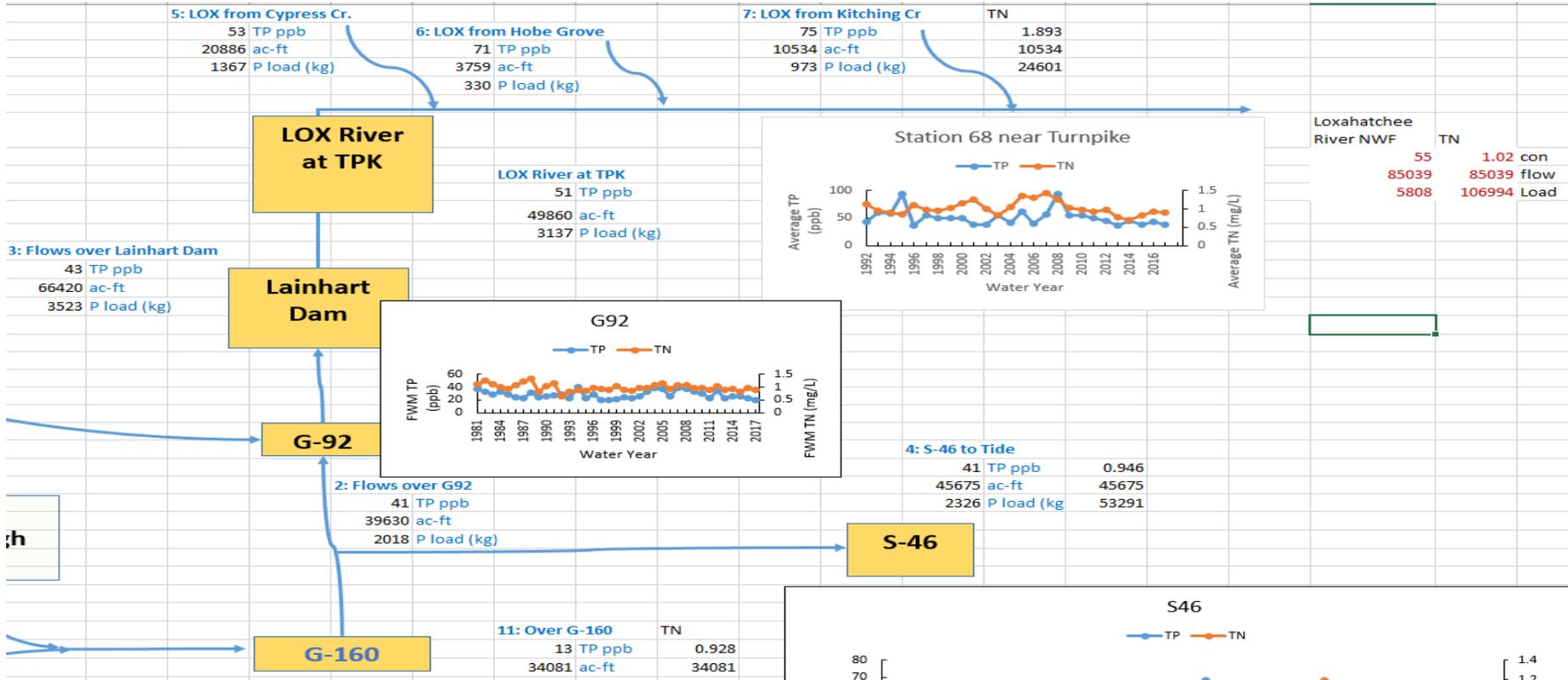


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Evaluation Tool – ECB Example



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Historic Conditions Table



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Flow-way	Basin/area	Inflow			Outflow		
		Volume (acre-feet)	TP (mg/L)	TN (mg/L)	Volume (acre-feet)	TP (mg/L)	TN (mg/L)
3	PalMar	NM	NM	NM	NM	NM	NM
3	Cypress Creek	NM	0.079	1.11	20,886	0.053	<1.54
3	Hobe-St. Lucie	NM	0.110	1.26	3,759	0.071	<1.54
3	Kitching Creek	NM	0.079	1.32	10,534	0.075	1.893
2	C-18 Basin	27,804	0.017	1	44,594	0.017	0.98
2	C-18 Basin	16,790	0.016	1.225	44,594	0.017	1.037
2	Lox Slough	20,639	0.015	1.011	34,081	0.017	0.81
1	Lake Okeechobee	57,503	0.093	2.45	n/a	n/a	n/a
1	L-8+Lake	117,925	0.185	2.3	117,925	0.123	1.636
1	ITID	27,804	0.039	1.352	27,804	0.039	1.352
1	GWP	13,442	0.01	0.839	2,977	0.01	0.839
1	GWP	13,442	0.01	0.839	17,660	0.013	1.011
River	Loxahatchee River NWF	85,039	0.055	1.02	n/a	n/a	n/a
River	Middle Estuary SWF	45,675	0.041	0.946	n/a	n/a	n/a

NM = Not measured mg/L = milligrams per litre



Existing Conditions Example



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- FWO WQ estimated to be similar to ECB WQ:
 - Use MODFLOW outputs for FWO estimates.
 - Calculate TP and TN concentrations for 3 flow-ways.
 - Compare FWO with existing condition (ECB).
- FWO and ECB WQ used as starting point for alternatives evaluation:
 - Use MODFLOW outputs of project features for all alternatives.
 - Calculate TP and TN concentrations for 3 flow-ways.
 - Compare concentrations with ECB, FWO and WQ standards.



Alternatives To Be Evaluated



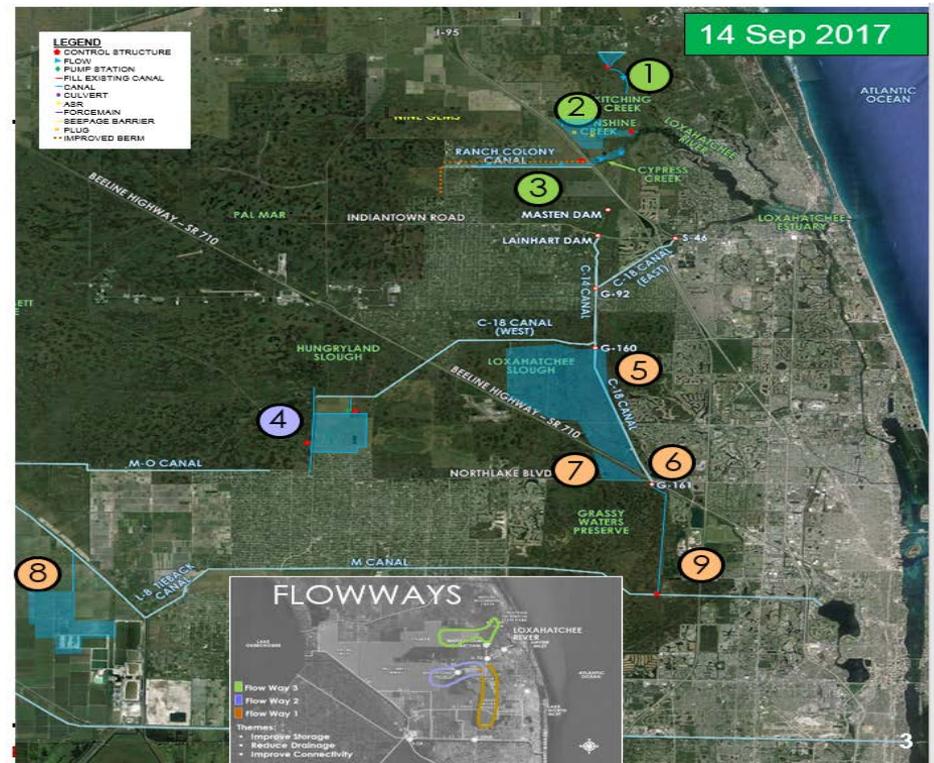
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6 Alternatives evaluated:

- Alternative 2
- Alternative 5
- Alternative 10
- Alternative 12
- Alternative 12-2
- Alternative 13

ALTERNATIVE 10

1. **Kitching Creek (Hydration):** Spreader canal; weir/plug (Jenkins Ditch)
2. **Moonshine Creek (MC) & Gulfstream East (GE) (Restoration):** Connect HSLCD ditch to MC; clear MC vegetation; weir in Hobe Grove Ditch; regrade adjacent area to historic topography
3. **Cypress Creek Canal (CCC) (Reduce Over-drainage):** Replace CCC weir; raise berm at Ranch Colony; automate twin 84" Culverts
4. **C-18W Reservoir (7,200 ac/ft):** Above-ground reservoir; inflow pump; discharge structure; seepage control
5. **G-160 Structure (Reduce Over-drainage):** improve Hydroperiod in Loxahatchee Slough
6. **G-161 Structure (Connectivity):** GWP water to Loxahatchee Slough
7. **GWP Triangle (Connectivity)**
8. **C-51 Deep Reservoir (Storage):** 44,000 ac/ft; includes pump & channels
9. **Force Main (Conveyance):** Pump and pipeline through Grassy Waters Preserve to connect M-Canal to G-161





Alternative 10 Example



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- MODFLOW results used to calculate flow, loads, and TP/TN concentrations for Alternative 10 features:
 - C-51 Deep Reservoir
 - C-18W Reservoir
 - Kitching Creek
 - Moonshine Creek
 - Cypress Creek Canal
- Key Focal Areas
 - GWP in Flow-way 1 **estimated 15% concentration reduction.**
 - West Basin in Flow-way 2 **estimated 20% concentration reduction.**
 - Cypress Creek in Flow-way 3 **estimated 5% concentration reduction.**
 - Downstream Loxahatchee River **estimated 5% concentration reduction.**



WQ Improvement Assumptions



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- Total phosphorus treatment efficiencies conservatively estimated based on literature values, past Everglades performance, and best professional judgment:
 - Deep reservoirs assumed to have a concentration reduction of 15%.
 - Shallow impoundments assumed to have a concentration reduction of 20%.
 - Natural storage features assumed to have a 20% concentration reduction.



Next Steps



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- The next steps for the existing condition (ECB), future without (FWO), and all alternatives are:
 - Finalize MODFLOW outputs.
 - Update the flow, total phosphorous, and total nitrogen diagrams.
 - Prepare water quality condition summary tables for flow, total phosphorous, and total nitrogen diagrams (including assumptions and data sources).
 - Generate overlay maps with flow, total phosphorous, and total nitrogen concentrations and loads diagrams.