COMPREHENSIVE EVERGLADES RESTORATION PLAN

LOXAHATCHEE RIVER WATERSHED RESTORATION PROJECT (LRWRP)

Preview of Evaluation of Alternative Plans
Project Delivery Team Meeting #12

Presented by:
Brad Foster
Watershed Planning Section
U.S. Army Corps of Engineers
Jacksonville District

Date May 9, 2018

South Florida Water Management District — Protection of the Everglades Since 1949

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LOXAHATCHEE RIVER WATERSHED RESTORATION PROJECT (LRWRP)

STUDY SCHEDULE AND RECOMMENDATION

SMART PLANNING PROCESS

1st Waiver

SCOPING | **ALTERNATIVE FORMULATION & ANALYSIS** | **FEASIBILITY-LEVEL ANALYSIS** | **CHIEF'S REPORT**

1	2	3	4	5
Kickoff	**ALTERNATIVES MILESTONE** Vertical Team concurrence on Focused Array of Alternatives	**TENTATIVELY SELECTED PLAN (TSP) MILESTONE** Vertical Team concurrence on TSP Corps-Jack, Atl, DC	**AGENCY DECISION MILESTONE** Agency Endorses Recommended Plan	**SENIOR LDR PANEL** Approve release for State & Agency Review	**CHIEF's REPORT**
21-Jan-2016 (A)	25-Apr-2016 (A)	INITIAL BASELINE	9-Aug-2017	11-Dec-2017	26-Sep-2018	8-Jan-2019
	SCHEDULE RECOMMENDATION		31 JUL 2018	22 JAN 2019	2 NOV 2019	28 JAN 2020

ALTERNATIVE FORMULATION & ANALYSIS

Waiver Needed

UPDATE MODEL FOR THE STUDY AREA | **CALIBRATE MODEL & RUN PROJECT ALTERNATIVES** | **PARTIAL OUTPUTS & EFFECTS** | **UPDATE & RECALIBRATE MODEL** | **RERUN FUTURE WITHOUT & PROJECT ALTERNATIVES** | **RECALCULATE OUTPUTS AND EFFECTS** | **ANALYSIS & COMPARISON** SELECT TSP | **COMPLETE DRAFT REPORT**

THESE HAD TO BE REDONE

LRWRP IS HERE

2 TENTATIVELY SELECTED PLAN (TSP) MILESTONE

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LOXAHATCHEE RIVER WATERSHED RESTORATION PROJECT (LRWRP)

MAJOR FEATURES OF THE ALTERNATIVES

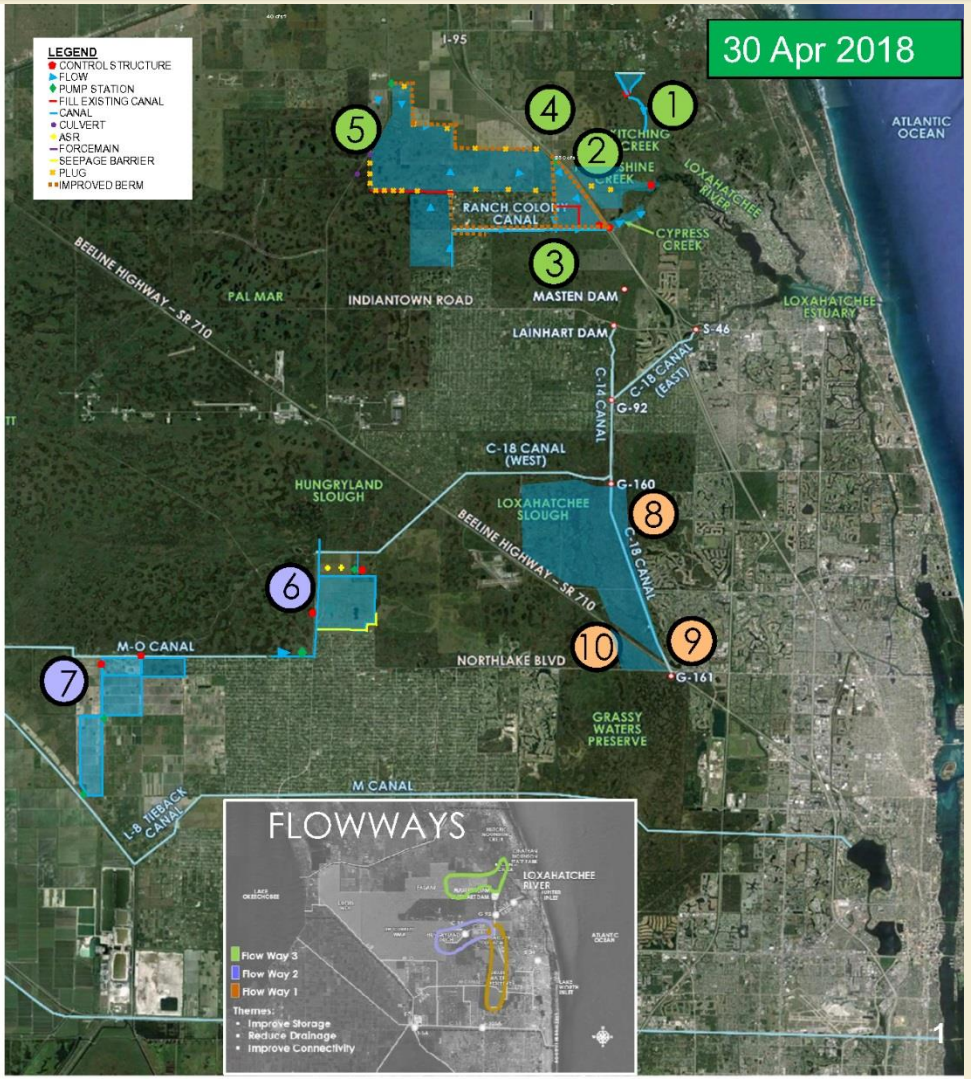
70% Recovery

Alternative	Deep Storage in L-8 Basin	Shallow Storage in L-8 Basin	C-18W Basin Storage	Aquifer Storage and Recovery (ASR)	Primary Delivery Route	Secondary Delivery Route	FW 3 Features
2	None	4,300 ac-ft	7,200 ac-ft reservoir	2 wells at C-18W storage	FW2	FW1	Full range
5	None	None	9,500 ac-ft reservoir	4 wells at C-18W storage	FW2	FW1	Full range
10	44,000 ac-ft	None	7,200 ac-ft reservoir	None	FW1/FW2		Limited
13	None	6,500 ac-ft	Increased wetland elevations to support natural storage	4 wells at L-8 storage	FW2	FW1	Full range

Alternative 2 Project Features

ALTERNATIVE 2

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 to raise control elevation, raise berm at Ranch Colony; automate twin 84" culverts;
4. Gulfstream West (Restoration & Reduce over-drainage): Partial backfill & relocate southern end of HSLCD canal; small pump, construct flow through marsh to attenuate flows
5. Palmar East (Restoration & Connectivity)
   Plug ditches; remove pipes; improve northern berm; construct western berm; improve eastern berm; pumps at Thomas Farm to redirect drainage to GW flow- through marsh via north Nine Gems canal
6. C-18W Reservoir (7,200 ac/ft & 2 ASR wells): Above-ground reservoir; inflow pump; discharge structure; seepage control; M-O Canal connector and pump
7. L-8 Basin Shallow Storage (4,300 ac/ft; includes pumps & channels)
8. G-160 Structure (Reduce Over-drainage): improve hydroperiod in Loxahatchee Slough
9. G-161 Structure (Connectivity): GWP water to Loxahatchee Slough
10. GWP Triangle (Connectivity)

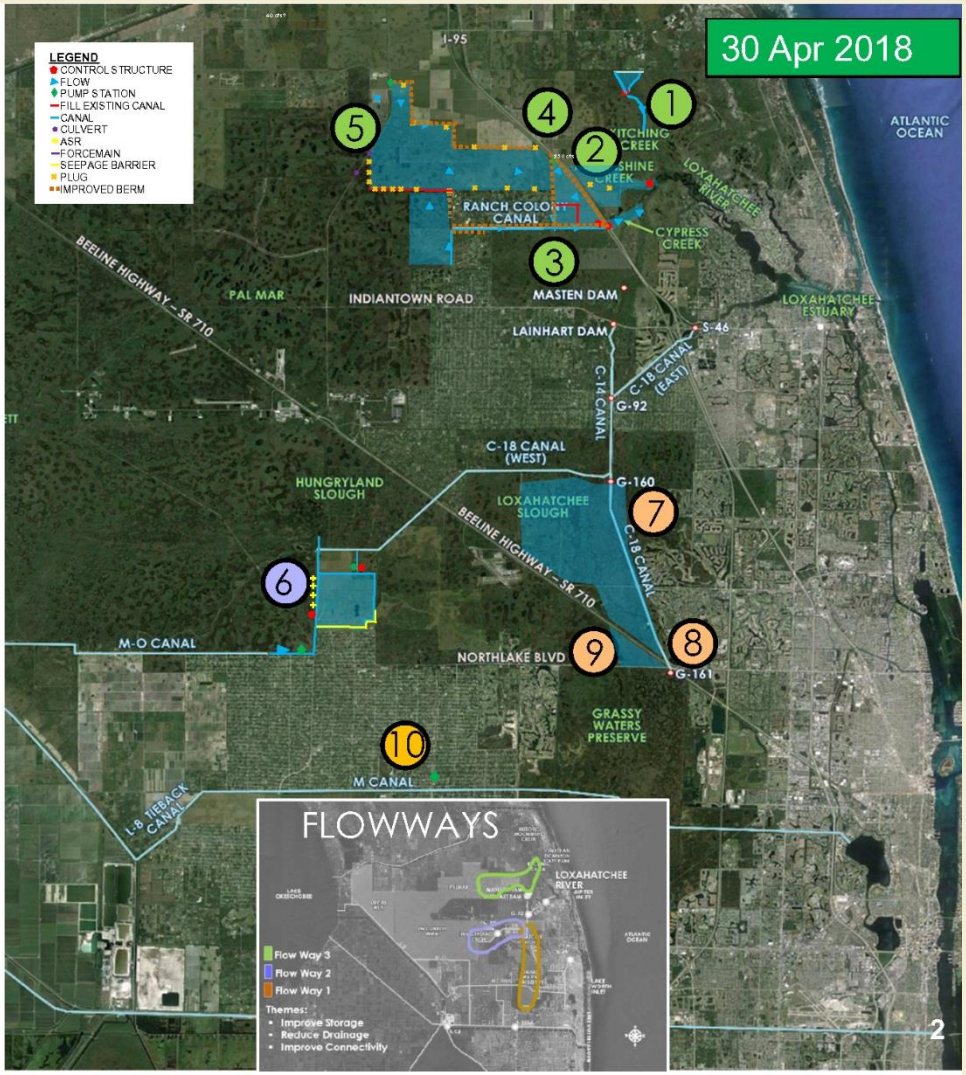


Alternative 5
Alternative 10
Alternative 13

Alternative 5 Project Features

ALTERNATIVE 5

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 to raise control elevation; raise berm at Ranch Colony; automate twin 84" culverts;
4. Gulfstream West (Restoration & Reduce Over-drainage): Partial backfill & relocate southern end of HSLCD canal; small pump; construct flow through marsh to attenuate flow
5. Palmar East (Restoration & Connectivity) Plug ditches; remove pipes; improve northern berm; construct western berm; improve eastern berm; pumps at Thomas Farm; redirect drainage to GW flow-through marsh via north Nine Gems canal
6. C-18W Reservoir (9,500 ac/ft & 4 ASR Wells): Above-ground reservoir; inflow pump; discharge structure; seepage control; M-O Canal Connector and pump
7. G-160 Structure (Reduce Over-drainage): Improve hydroperiod in Loxahatchee Slough
8. G-161 Structure (Connectivity): GWP water to Loxahatchee Slough
9. GWP Triangle (Connectivity)
10. M-1 Pump Station (Conveyance): Deliver Lower M-1 Basin water to M-Canal, GWP, and G-161

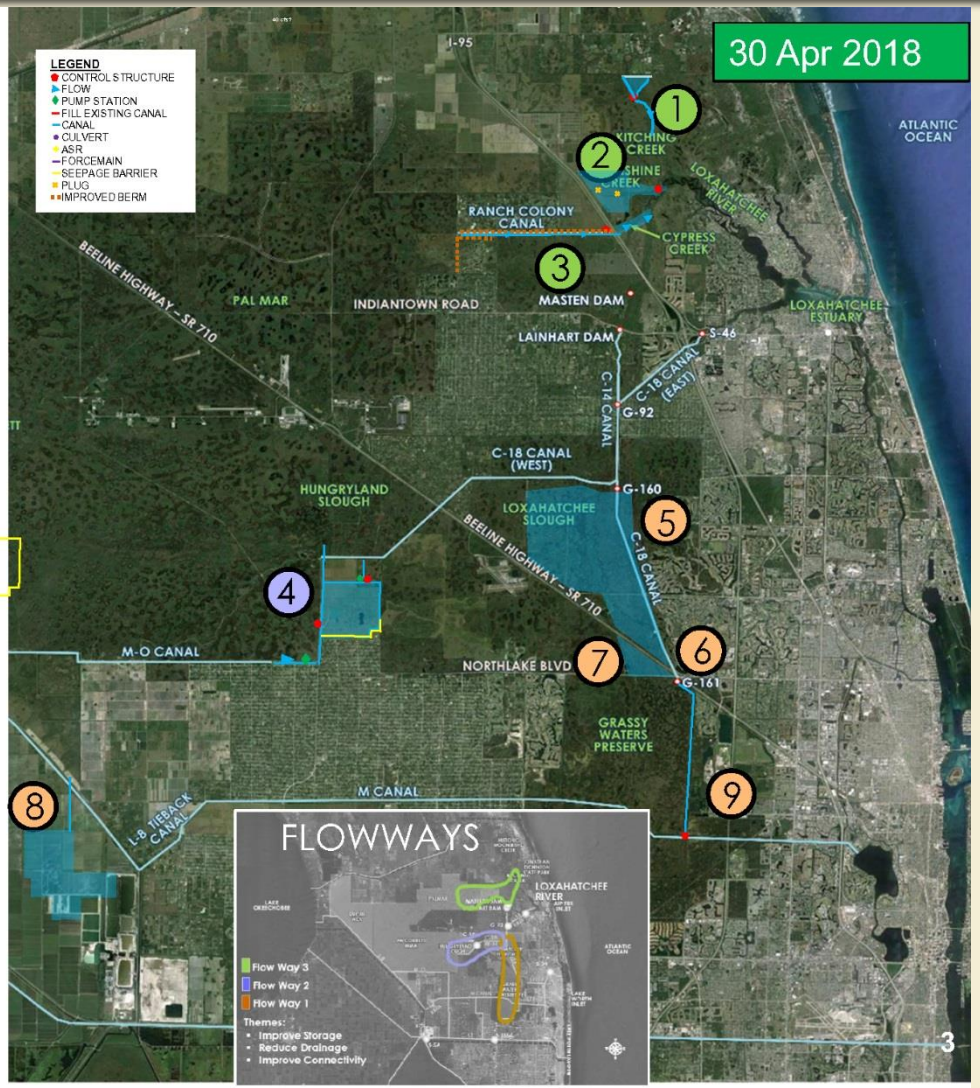


Alternative 2
Alternative 10
Alternative 13

Alternative 10 Project Features

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; M-O Canal Connector and pump
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

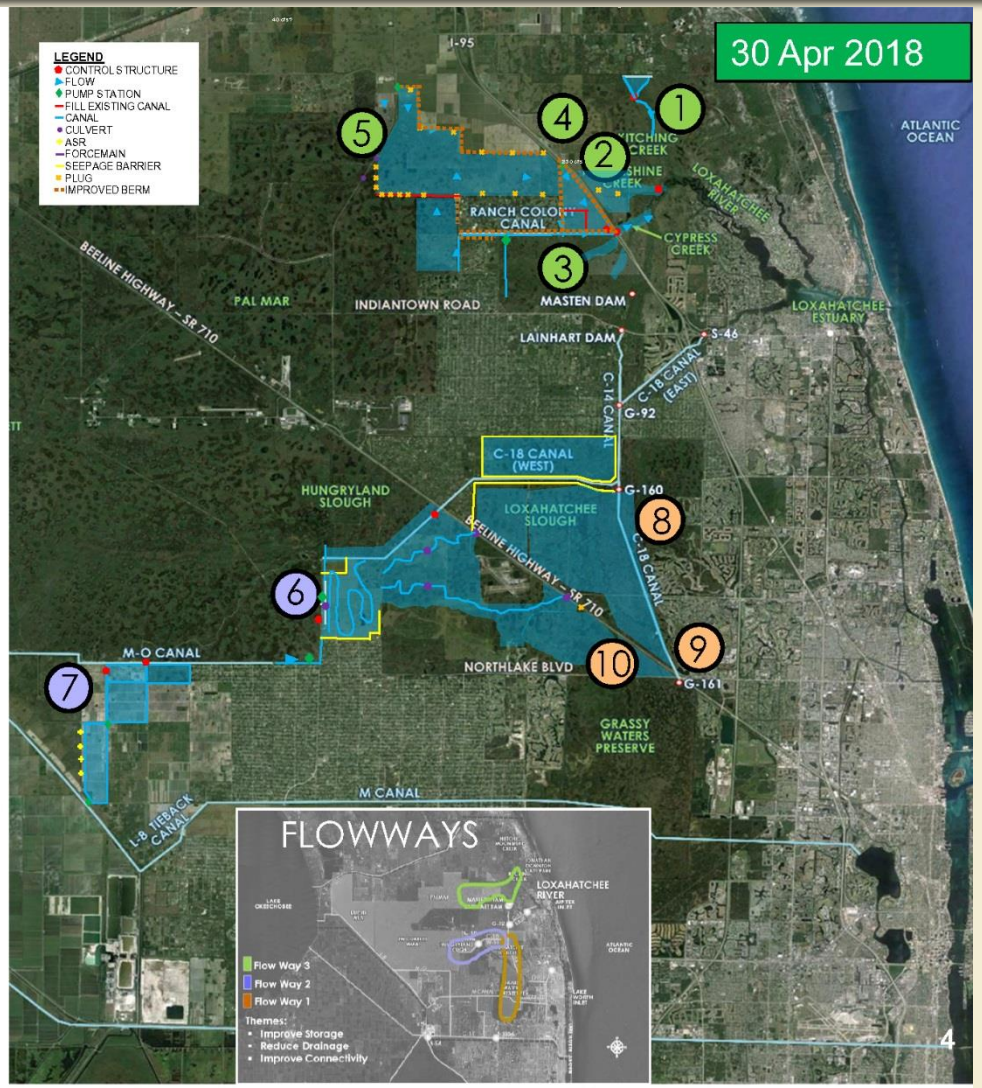


Alternative 2
Alternative 5
Alternative 13

Alternative 13 Project Features

ALTERNATIVE 13

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; pump and spreader swale; regrade CC southern forks
4. Gulfstream West (Restoration & Reduce Over-drainage): Partial backfill & relocate southern end of HSLCD canal; small pump; construct flow through marsh to attenuate flow
5. Palmar East (Restoration & Connectivity): Plug ditches; remove pipes; improve northern berm; construct western berm; improve eastern berm; pumps at Thomas Farm to redirect drainage to GW flow through marsh via north Nine Gems canal
6. Natural Storage C-18W (Basin Restoration): Restore natural topography; seepage barriers; culverts for Beeline Hwy; backfill interior canals south of C-18W Canal; pump station at Mecca; flow-paths through Mecca & Avenir; M-O Canal connector & pump
7. L-8 Basin Shallow Storage (6,500 ac/ft & 4 ASR wells); includes pumps & channels
8. G-160 Structure (Reduce Over-drainage): improve Hydroperiod in Loxahatchee Slough
9. G-161 Structure (Connectivity): GWP water to Loxahatchee Slough
10. GWP Triangle (Connectivity)



Alternative 2
Alternative 5
Alternative 10

AVERAGE ANNUAL HABITAT UNIT LIFT

Alternative	Average Annual Lift			
	WL/ Connectivity HUs	**River Floodplain HUs**	**Tidal River and Estuary HUs**	**Total River and Estuary HUs (floodplain + tidal)**
ALT2	8,054	54	287	341
ALT5	8,095	66	348	414
ALT10	3,320	68	363	431
ALT13	11,133	40	210	250

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Objective 1 - Restore Wet and Dry Season Flows to NW Fork

Flows	ECB	FWO	ALt2	Alt5	ALt10	ALt13
Wet Season	76%	78%	98%	98%	100%	98%
Dry Season	63%	65%	87%	91%	95%	80%

Variable Dry Season Flow between 50 and 110 cfs, with a mean monthly flow of 69 cfs over Lainhart Dam and an additional 30 cfs from the downstream tributaries when needed

Wet Season (August – November) Flows of greater than 110 cfs for a minimum of 120 days

ALTERNATIVES COST ESTIMATES – CLASS 4

	Alternative 2	Alternative 5	Alternative 10	Alternative 13
Real Estate	$112 M	$75 M	$64 M	$185 M
Construction Estimate	$320 M	$294 M	$449 M	$191 M
Planning, Engineering & Design	$14 M	$13 M	$19 M	$9 M
Construction Management	$15 M	$14 M	$20 M	$9 M
Combined Contingency	40%	40%	45%	32%
Total Cost	**$461 M**	**$396 M**	**$552 M**	**$394 M**

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OPERATIONAL AND MAINTENANCE COSTS

- Alternative 2 – $4.248M
- Alternative 5 – $3.689M
- Alternative 10 – $3.483M
- Alternative 13 – $4.074M

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Other

- Water Quality
- Water Supply
- Flood Protection
- Risk

What is a cost-effective plan?

An alternative is defined as non-cost effective if:

1. *The same output level could be produced by another plan at less cost*;
2. *A larger output level could be produced at the same cost*; or
3. *A larger output level could be produced at less cost*.

Simply speaking: DON'T SPEND MORE FOR LESS!
Defining the output is the hard part

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Cost Effectiveness Results

WL/CONNECTIVITY

Alternative	Average Annual Cost CRF (i=2.75%, n=50)	Average Annual NER Benefits	Cost Effective (Yes/No)
No Action Plan	$ -	0	N/A
Alt5	$ 20,547,000	8,095	Yes ★
Alt13	$ 20,832,000	11,133	Yes ★
Alt2	$ 24,527,000	8,054	No
Alt10	$ 27,373,000	3,320	No

RIVER/ESTUARY

Alternative	Average Annual Cost CRF (i=2.75%, n=50)	Average Annual NER Benefits	Cost Effective (Yes/No)
No Action Plan	$ -	0	N/A
Alt5	$ 20,547,000	414	Yes ★
Alt13	$ 20,832,000	250	No
Alt2	$ 24,527,000	341	No
Alt10	$ 27,373,000	431	Yes ★

COST EFFECTIVE ALTERNATIVES ONLY ARE CARRIED FORWARD FOR CONSIDERATION IN THE INCREMENTAL COST ANALYSIS.

*Alternatives shown in order from decreasing to increasing average annual cost.

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Incremental Cost Analysis

WL/CONNECTIVITY

Alternative	Average Annual Plan Cost	Average Annual Plan Outputs (Habitat Units)	Average Annual Incremental Cost per Habitat Unit
No Action Plan	$ -	-	$ -
Alt5	$ 20,547,000	8,095	$ 2,538
Alt13 ★	$ 20,832,000	11,133	$ 1,871

For WL/connectivity benefits, Alternative 13 is the alternative that costs the least per unit of output. This is also the largest cost effective plan in terms of average annual habitat units.

RIVER/ESTUARY

Alternative	Average Annual Plan Cost	Average Annual Plan Outputs (Habitat Units)	Average Annual Incremental Cost per Habitat Unit
No Action Plan	$ -	-	$ -
Alt5 ★	$ 20,547,000	414	$ 50,000
Alt10	$ 27,373,000	431	$ 64,000

For river/estuary benefits, Alternative 5 is the alternative that costs the least per unit of output. What do we get when we go to Alt10, a larger plan in terms of average annual habitat units?

Alt5 to Alt10	
Increase in Average Annual Cost	$ 6,826,000
Incremental Increase in Average Annual Benefit (HUs)	17.3
Average Annual Incremental Cost per Habitat Unit	$ 395,000

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PRINCIPLES AND GUIDELINES CRITERIA

- **Effectiveness:** Extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities
- **Efficiency:** Extent to which an alternative plan is the most cost-effective means of alleviating problems and realizing opportunities. CE/ICA is one method to identify plans that maximize environmental benefits compared to costs
- **Completeness:** Extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects
- **Acceptability:** Workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies

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Alternative 5 Project Features

ALTERNATIVE 5

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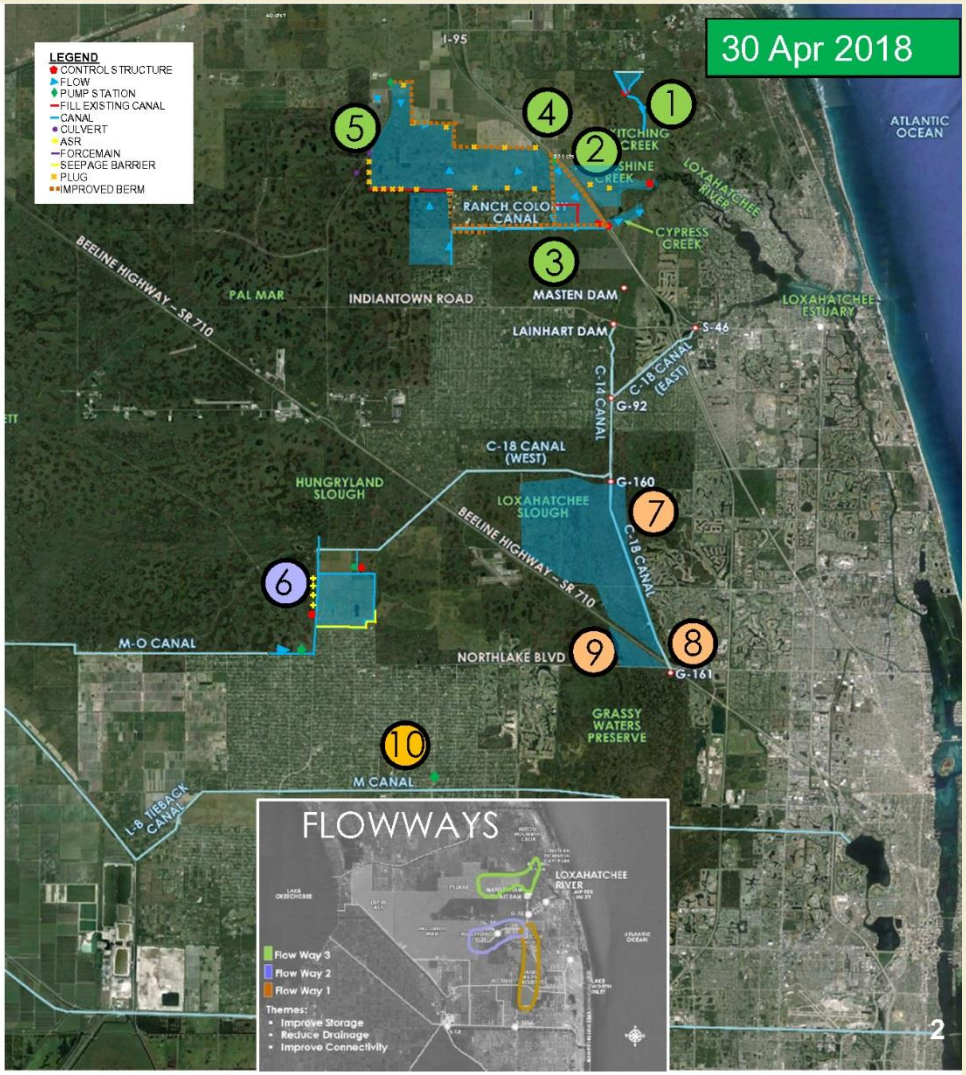

Alternative 2
Alternative 10
Alternative 13

Alternative 5 Project Features

Post PDT Update

ALTERNATIVE 5 R

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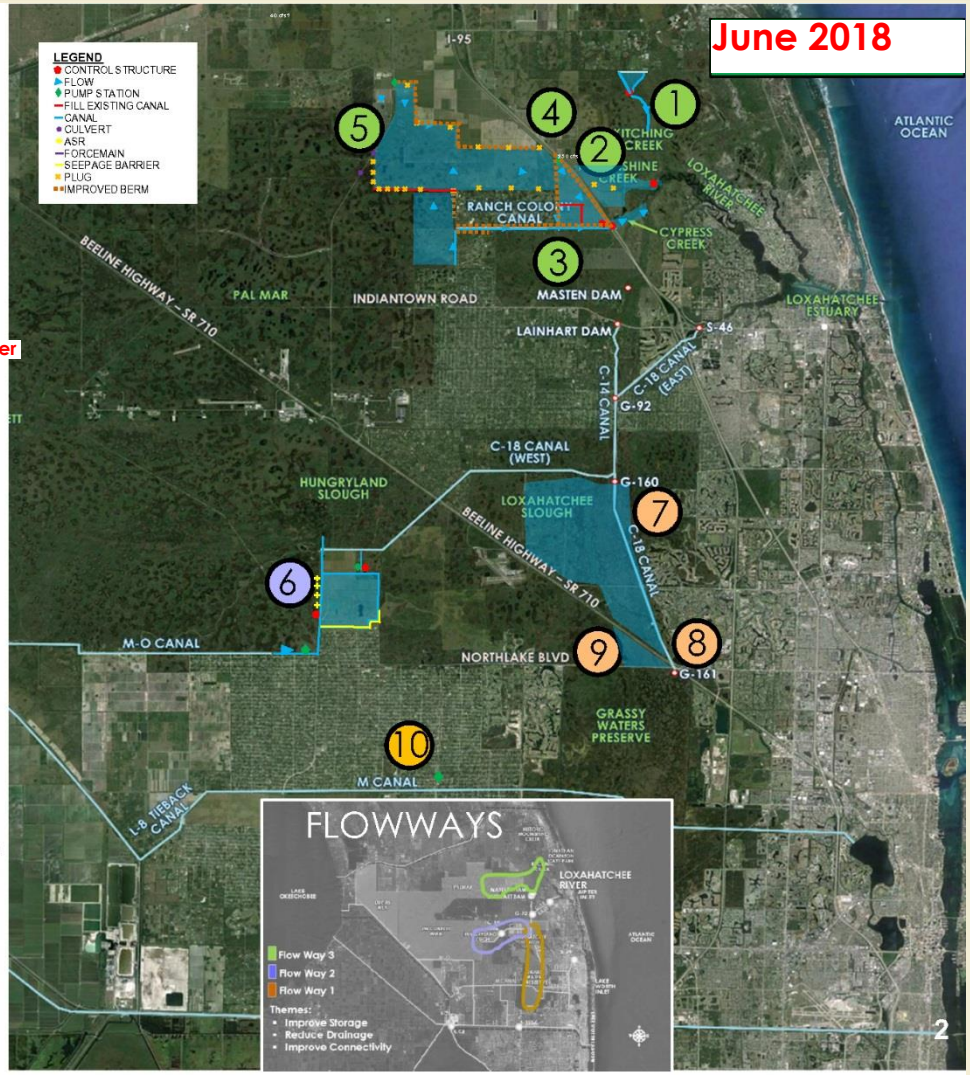

Alternative 2
Alternative 10
Alternative 13

Great for the River if it Works
Not Included from the NPBC Plan

- Water Supply
- Flood Protection
- Reduction of Freshwater Flow to the Lake Worth Lagoon