



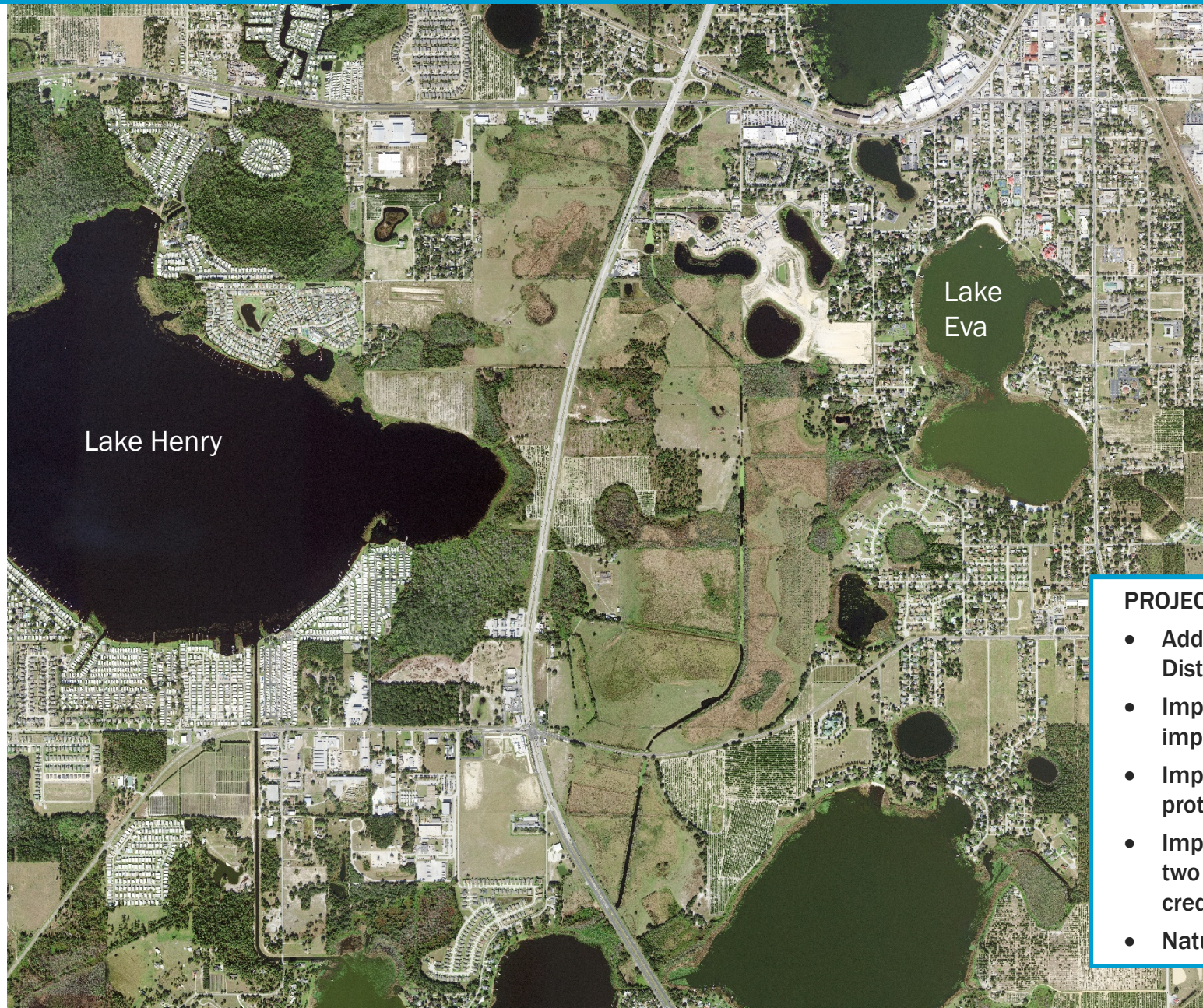
Integrated Hydrologic, Water Quality, and Ecological Restoration at Lake Eva

SESWA 16th Annual Conference, October 2021

Jeff Herr, PE, Brown and Caldwell

Acknowledgements

- City of Haines City
Nelson Vega, Project Manager
James Keene, Public Infrastructure Director
- SWFWMD
Yuan Li, PEE, Project Manager
- Applied Sciences
Elie Araj, PE
Kevin Albrecht, PE



PROJECT OBJECTIVES

- Address Lake Eva Minimum Level (MFL) and District guidance levels
- Improve water quality in Lake Eva (verified impaired for nitrogen and chlorophyll-a)
- Improve flood protection for Lake Henry, while protecting water recreation opportunities
- Improve groundwater recharge between the two lakes and potentially obtain water supply credits
- Natural systems enhancement/improvement

Project Approach and Timeline

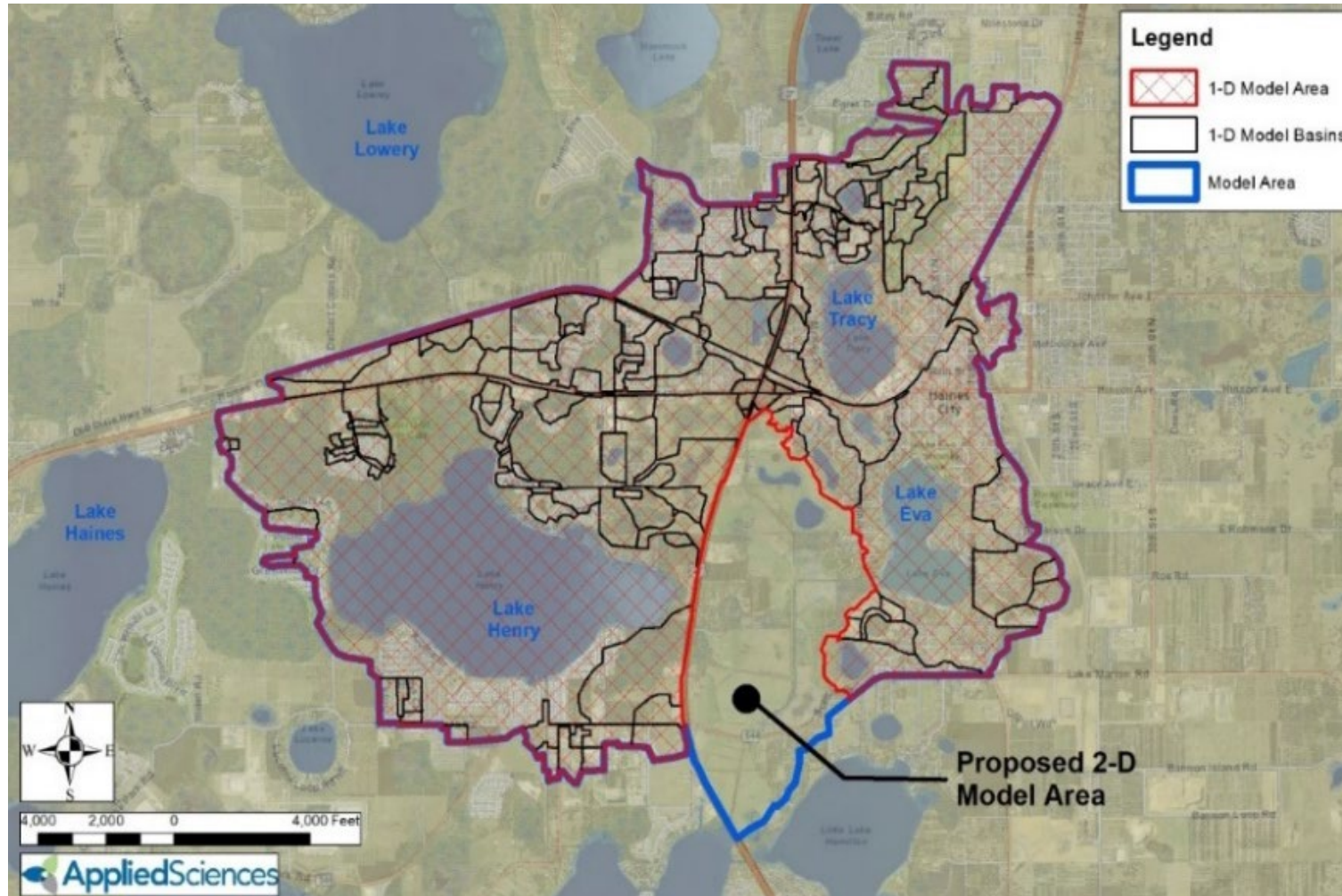
- Conduct **Feasibility Study** to assess existing conditions and restoration alternatives, and complete conceptual design for selected alternative. Includes stakeholder meetings and input. (Complete)
- Complete **30 Percent Design Package** including survey, geotech, design, regulatory coordination, benefits, and cost estimates. (Complete)
- **3rd Party Review**
- **Design and Submit Permit Applications**
- **Final Construction Bid Documents and Permits Issued**
- **Project Bidding**
- **Construction**

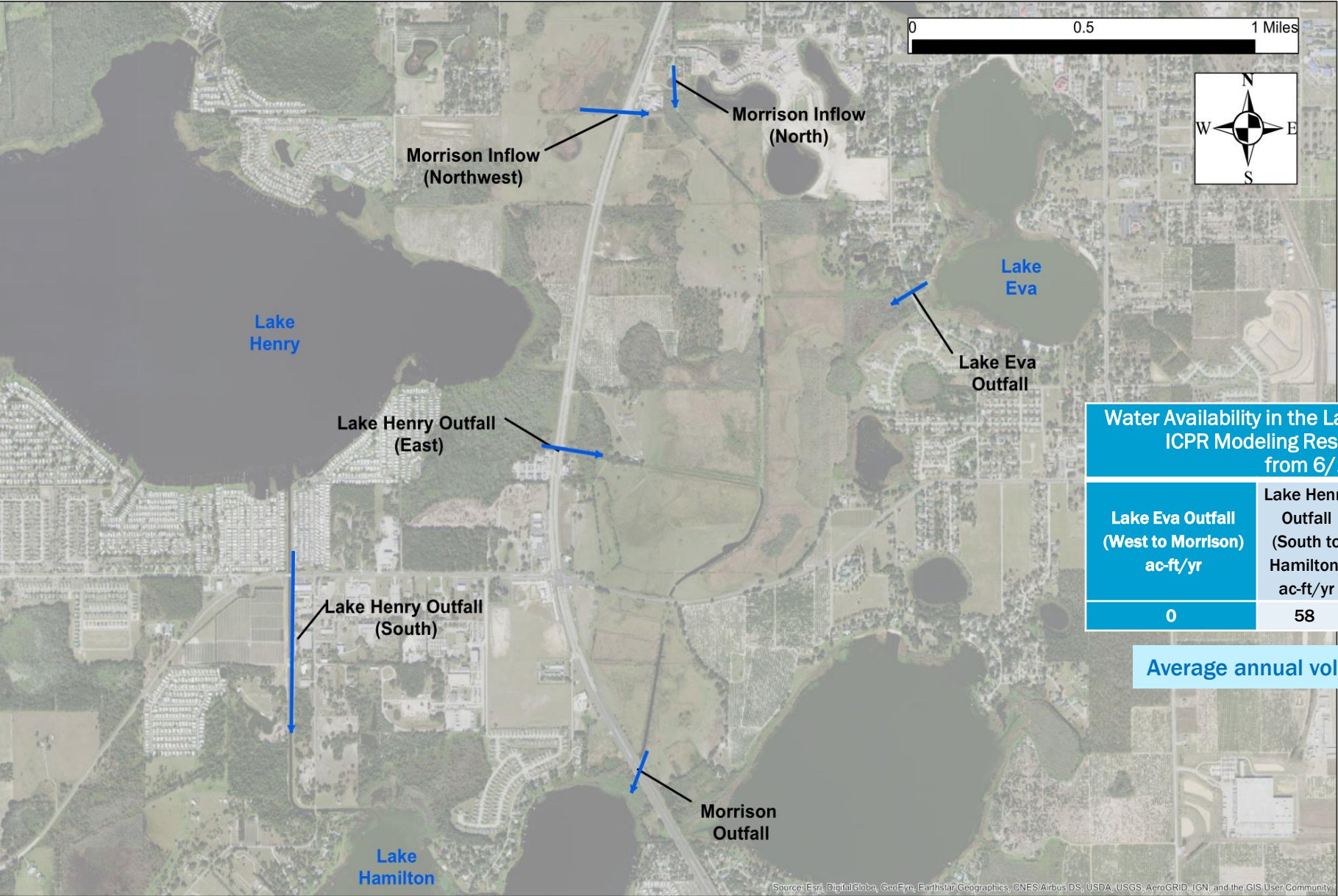
Existing Wetland/Muck Areas

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Project Modeling Area - ICPRv4



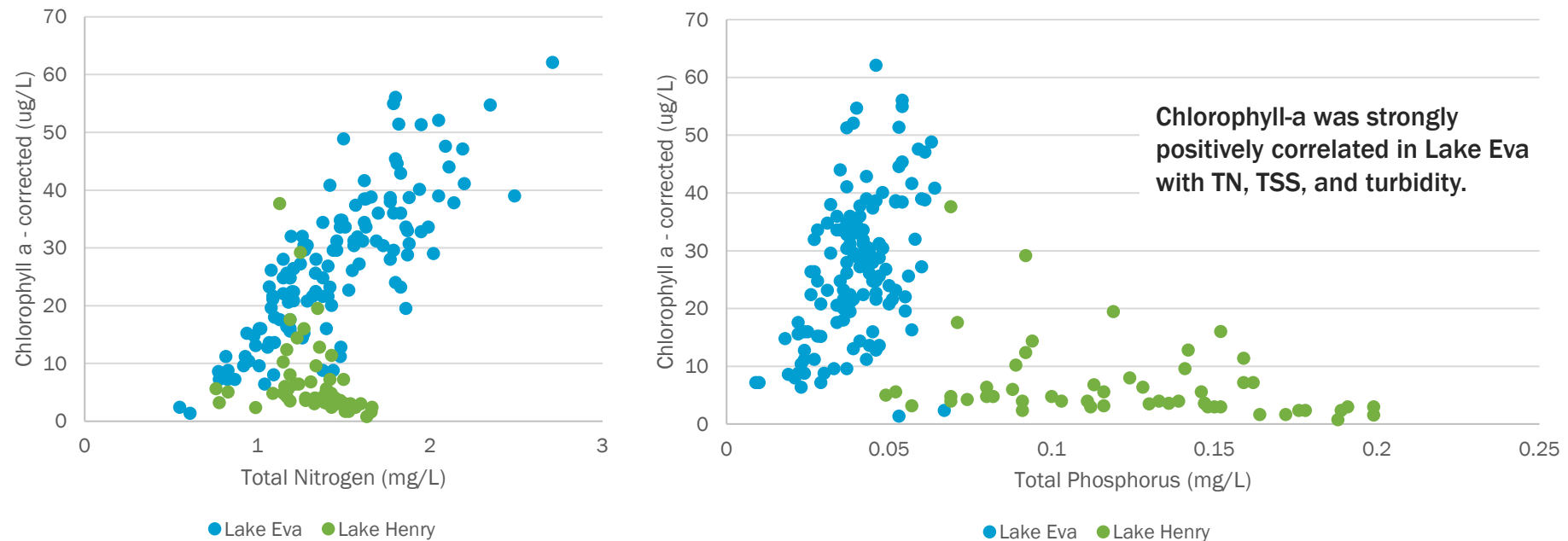
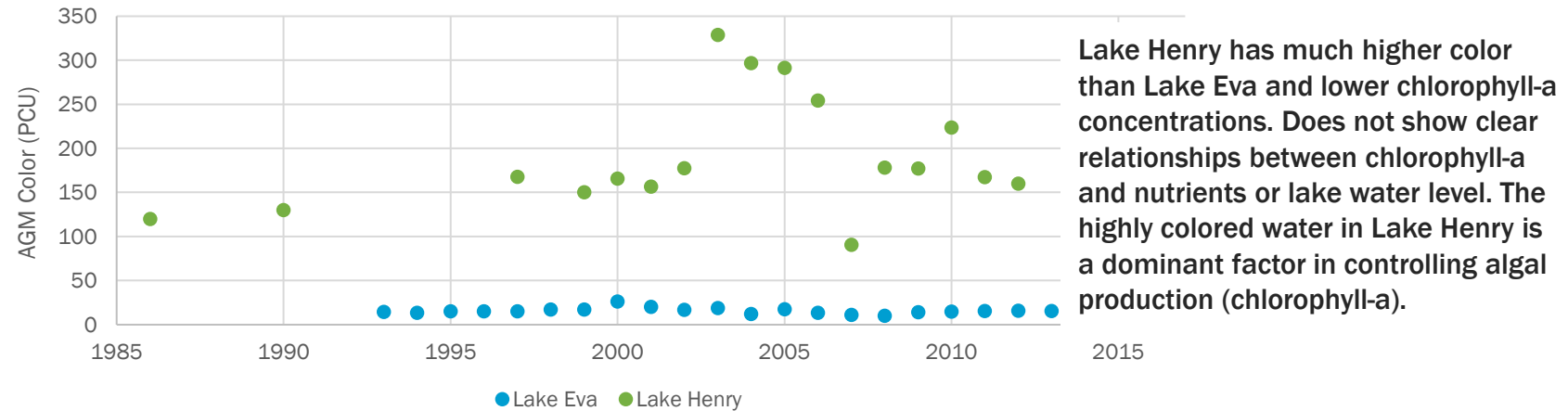


Water Availability in the Lake Eva - Lake Henry Study Area Based on ICPR Modeling Results (average annual water volume from 6/1/2002 to 5/31/2016)

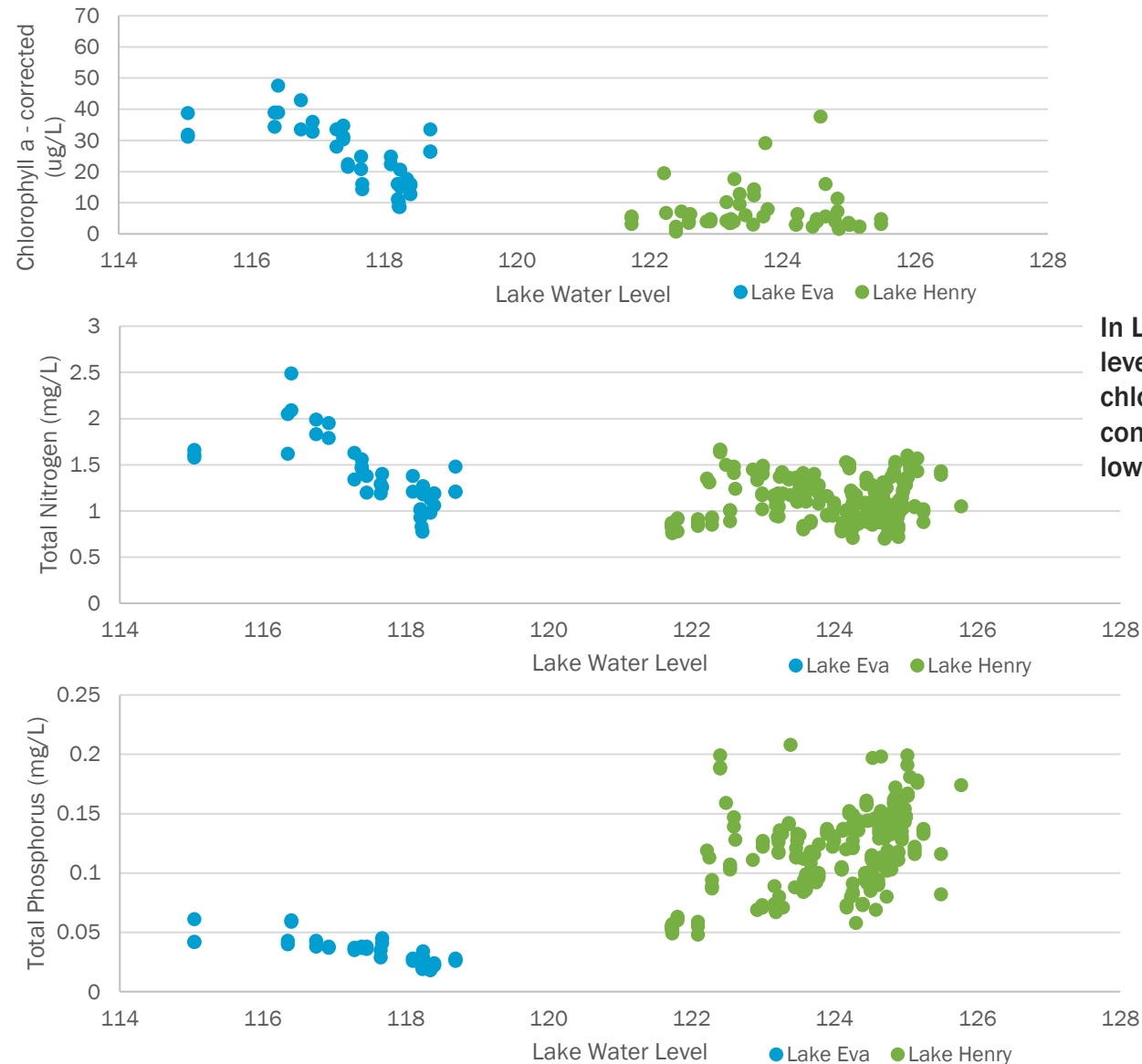
Lake Eva Outfall (West to Morrison) ac-ft/yr	Lake Henry Outfall (South to Hamilton) ac-ft/yr	Lake Henry Outfall (East to Morrison) ac-ft/yr	Morrison Inflow (from North) ac-ft/yr	Morrison Inflow (from Northwest) ac-ft/yr	Morrison Outfall (South to Hamilton) ac-ft/yr
0	58	399	1,638	102	2,754

Average annual volume to Morrison = 2,139 ac-ft

Water Quality Statistical Analysis



Water Quality Statistical Analysis



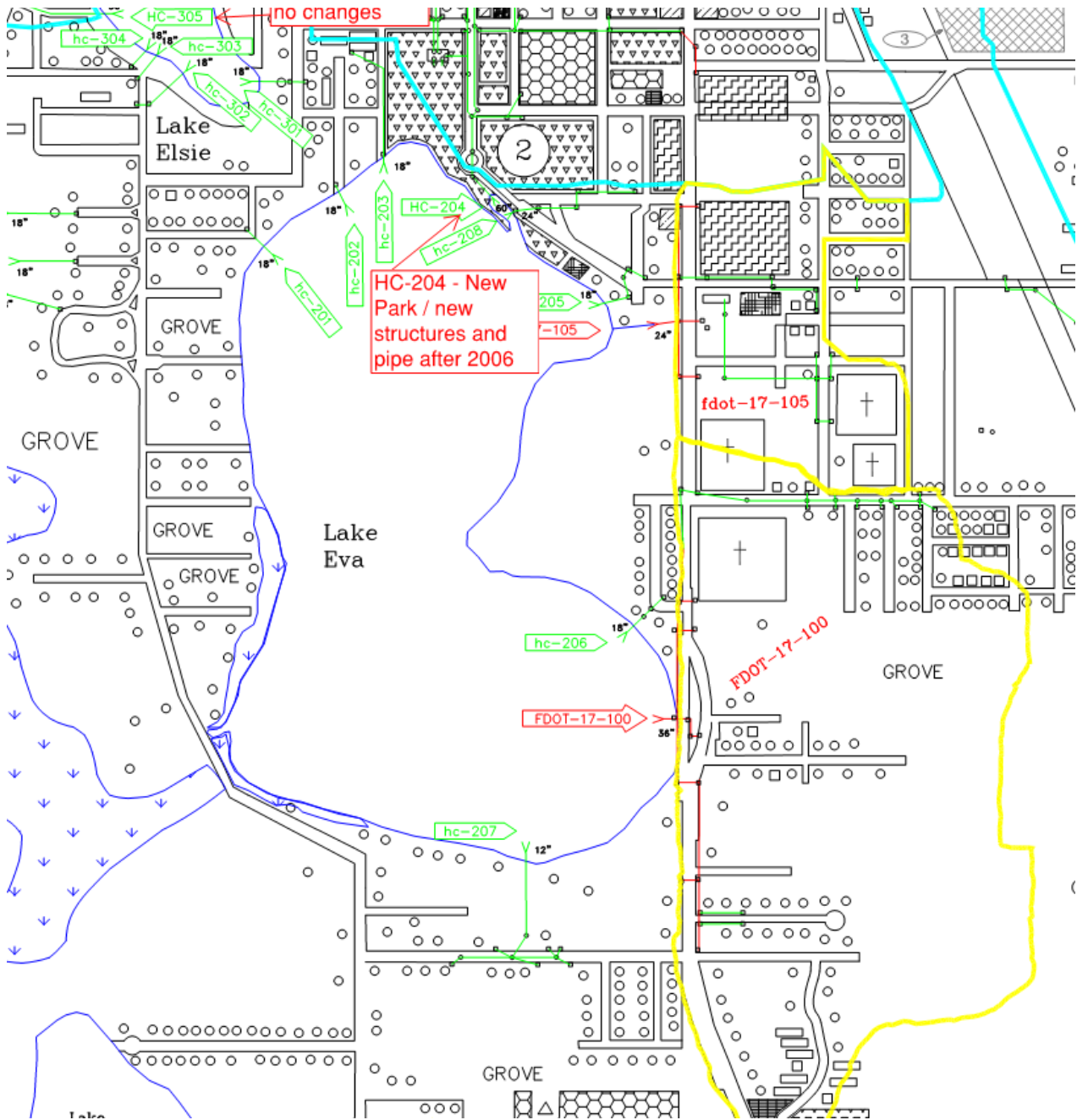
In Lake Eva, higher lake water levels are associated with lower chlorophyll-a and lower TN concentrations (and to some extent lower TP concentrations).



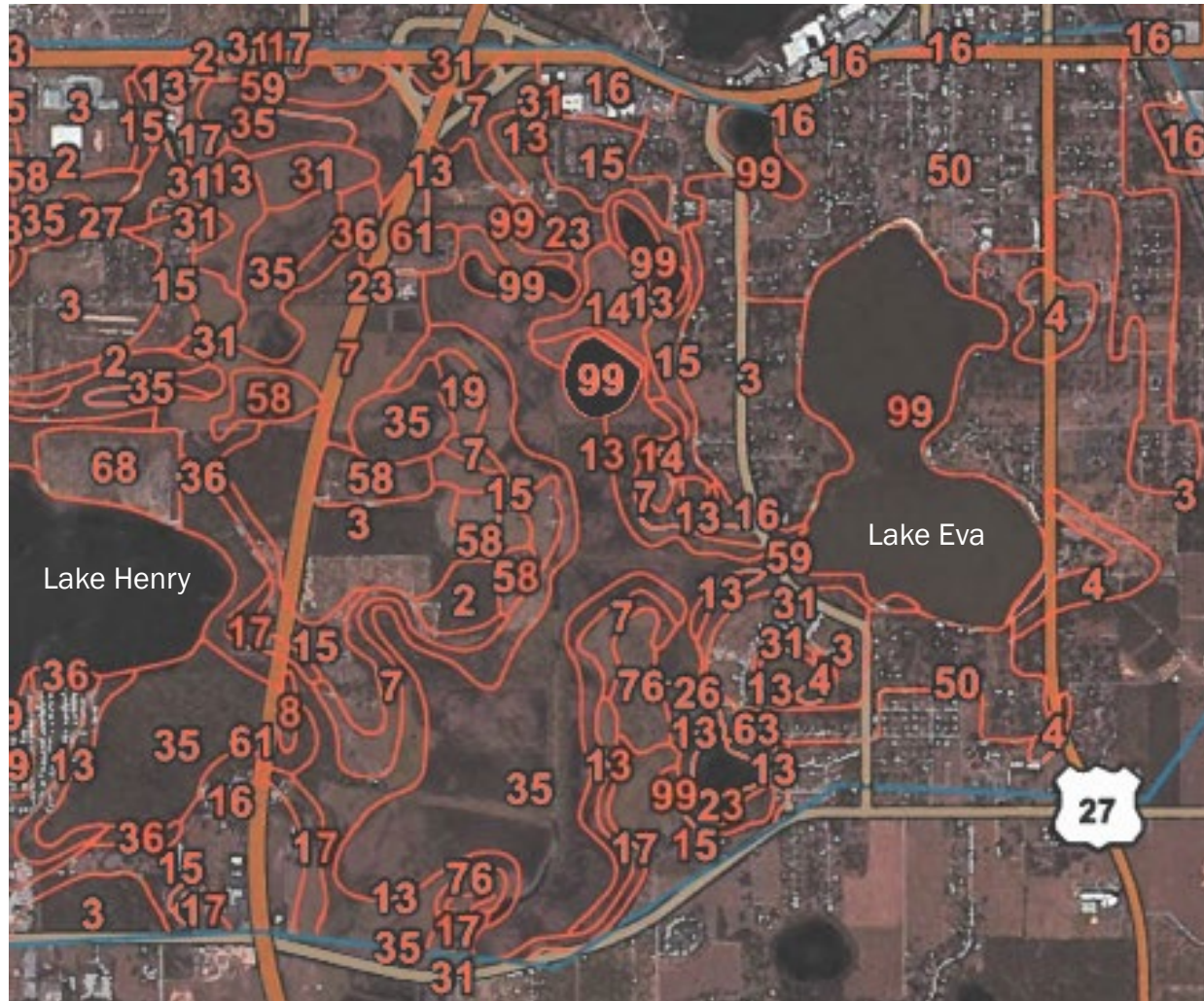
Input Variable	Value
Overland Flow Watershed Size (acres)	620.2
SCS CN for watershed	61
Percent Directly Connected Area	11%

	Stormwater	Groundwater	Precipitation	Total
Annual Volume (ac-ft)	484	170	656	1,310
Annual TP Load (kg/yr)	143	21	54	218
Annual TN Load (kg/yr)	953	335	420	1,708

- Major city outfall
- Minor city outfall
- City drainage catchment area
- Major FDOT outfall
- Minor FDOT outfall
- FDOT drainage catchment area
- Potential Source Control Site (Table 3-E)
- Lakes, streams, etc. (waters of the U.S.)
- Existing Structural Control (SC)
- Primary industrial facility (refer to application Section 3.0 for listing)



Project Area Soils Match Objectives



- 35, Hontoon muck
- 13, Samsula muck
- 100% hydric, very poorly drained
- 3 and 4, Candler sand
- 50, Candler – urban land complex
- 0% hydric, low fines content, excessively drained, rapid to very rapid permeability

Option 1 Wetland Restoration (13 Functional Gain Units)

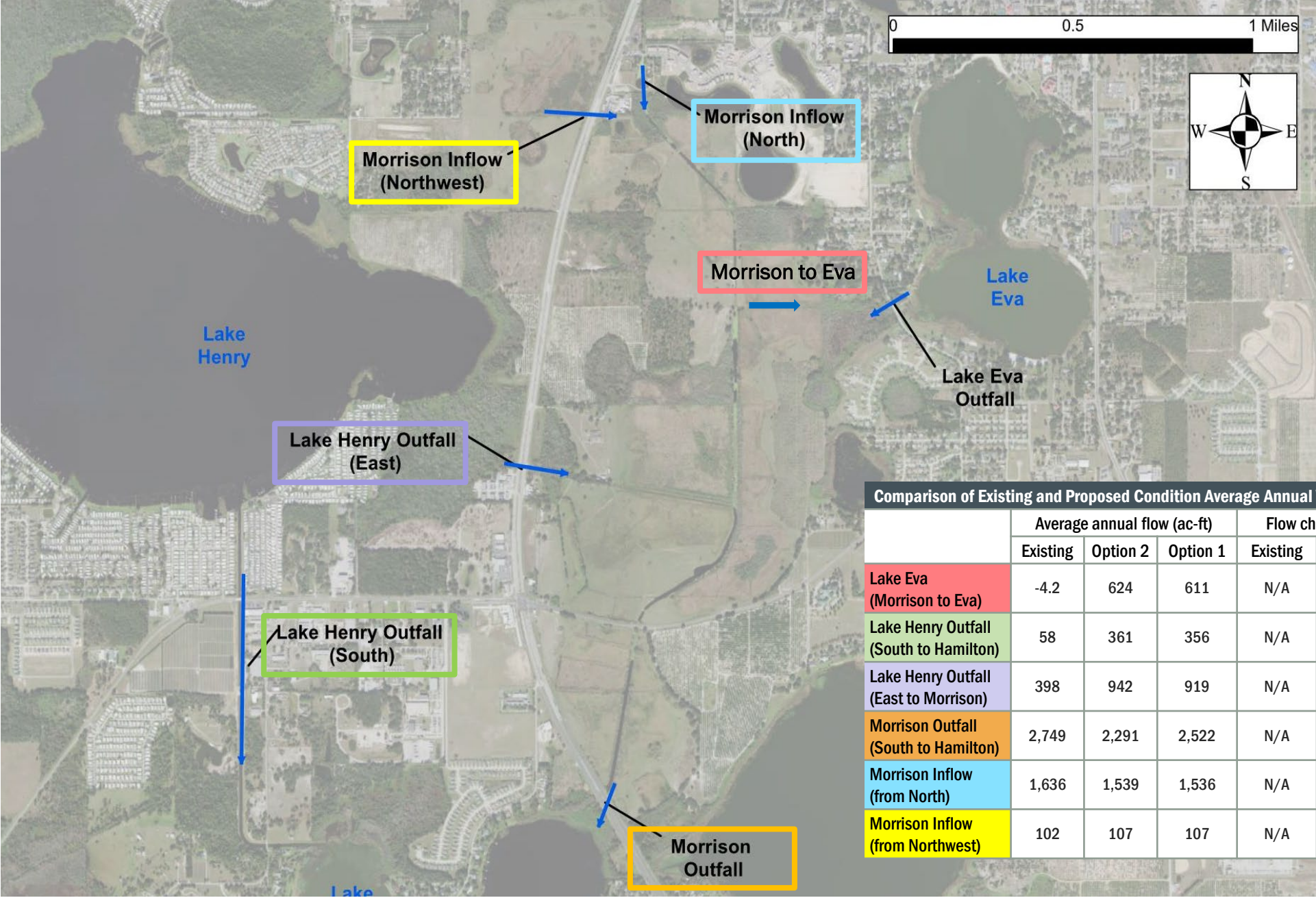
Integrated Hydrologic, Water Quality, and Ecological Restoration at Lake Eva



Option 2 Wetland Restoration (34 Functional Gain Units)

Integrated Hydrologic, Water Quality, and Ecological Restoration at Lake Eva



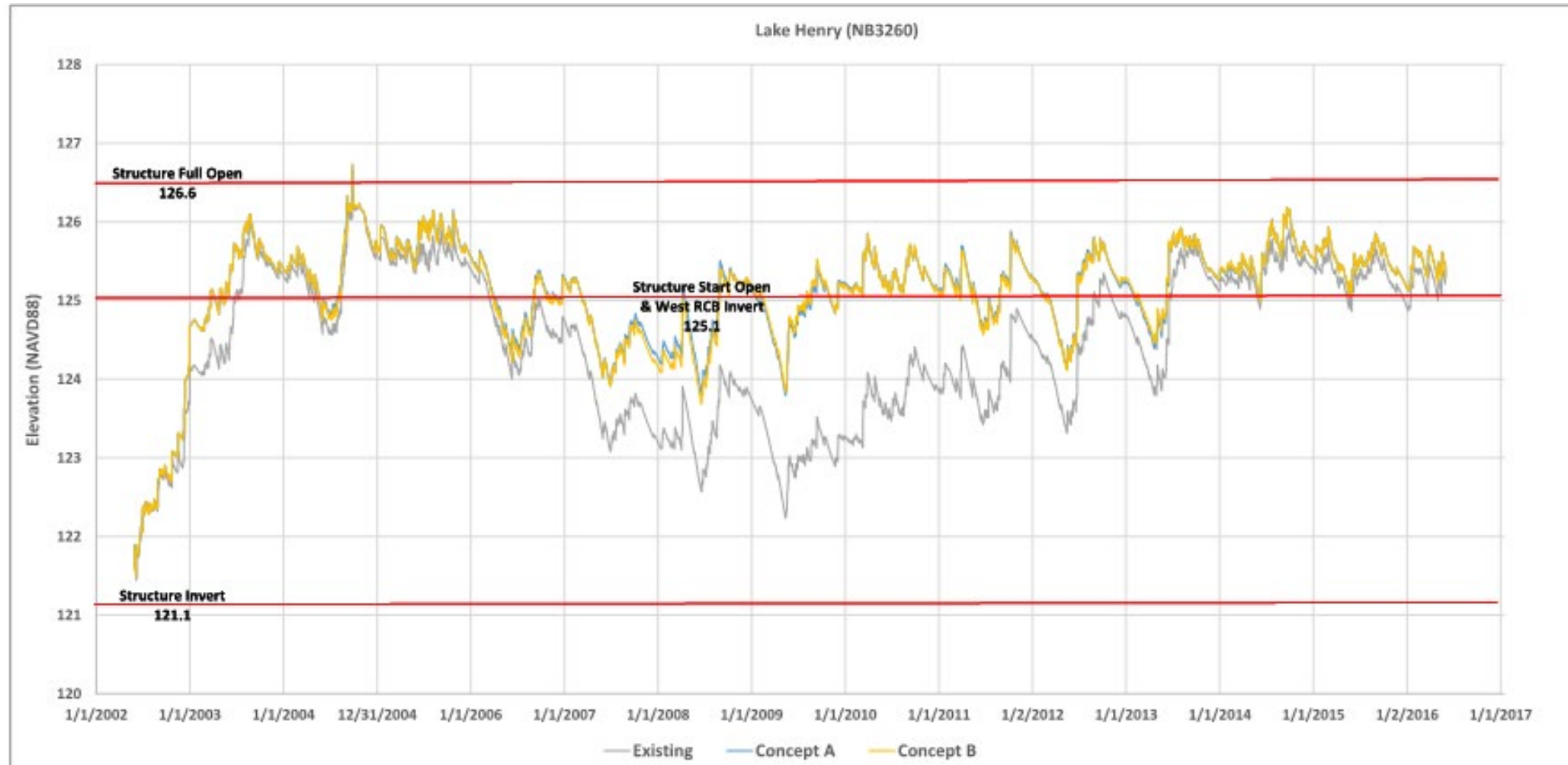


Integrated Hydrologic,
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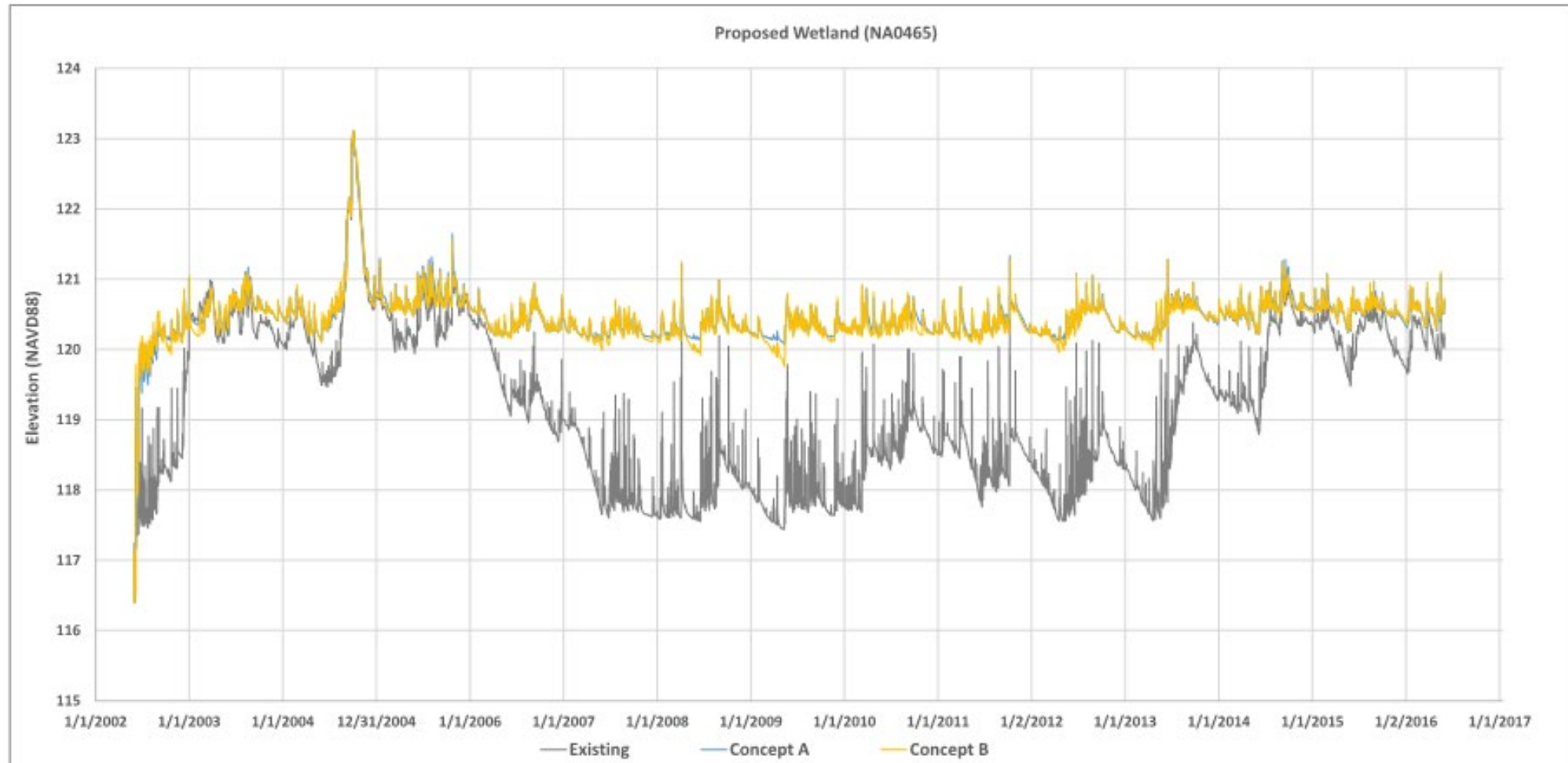
Comparison of Existing and Proposed Condition Average Annual Water Volumes at Lake Eva

	Average annual flow (ac-ft)			Flow change from Existing (ac-ft)		
	Existing	Option 2	Option 1	Existing	Option 2	Option 1
Lake Eva (Morrison to Eva)	-4.2	624	611	N/A	628	615
Lake Henry Outfall (South to Hamilton)	58	361	356	N/A	308	297
Lake Henry Outfall (East to Morrison)	398	942	919	N/A	544	520
Morrison Outfall (South to Hamilton)	2,749	2,291	2,522	N/A	-458	-228
Morrison Inflow (from North)	1,636	1,539	1,536	N/A	-97	-100
Morrison Inflow (from Northwest)	102	107	107	N/A	4	5

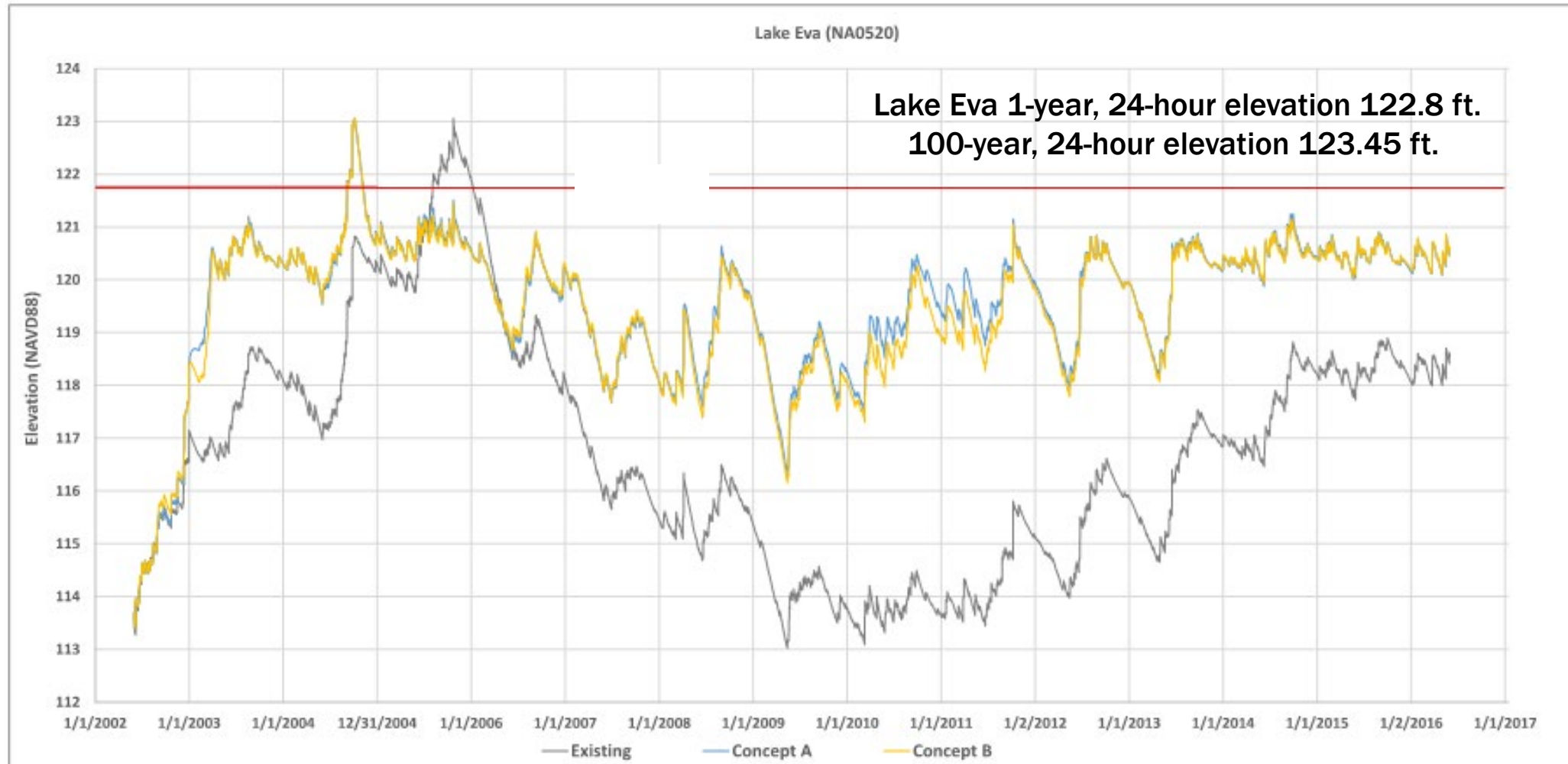
Lake Henry Continuous Simulation



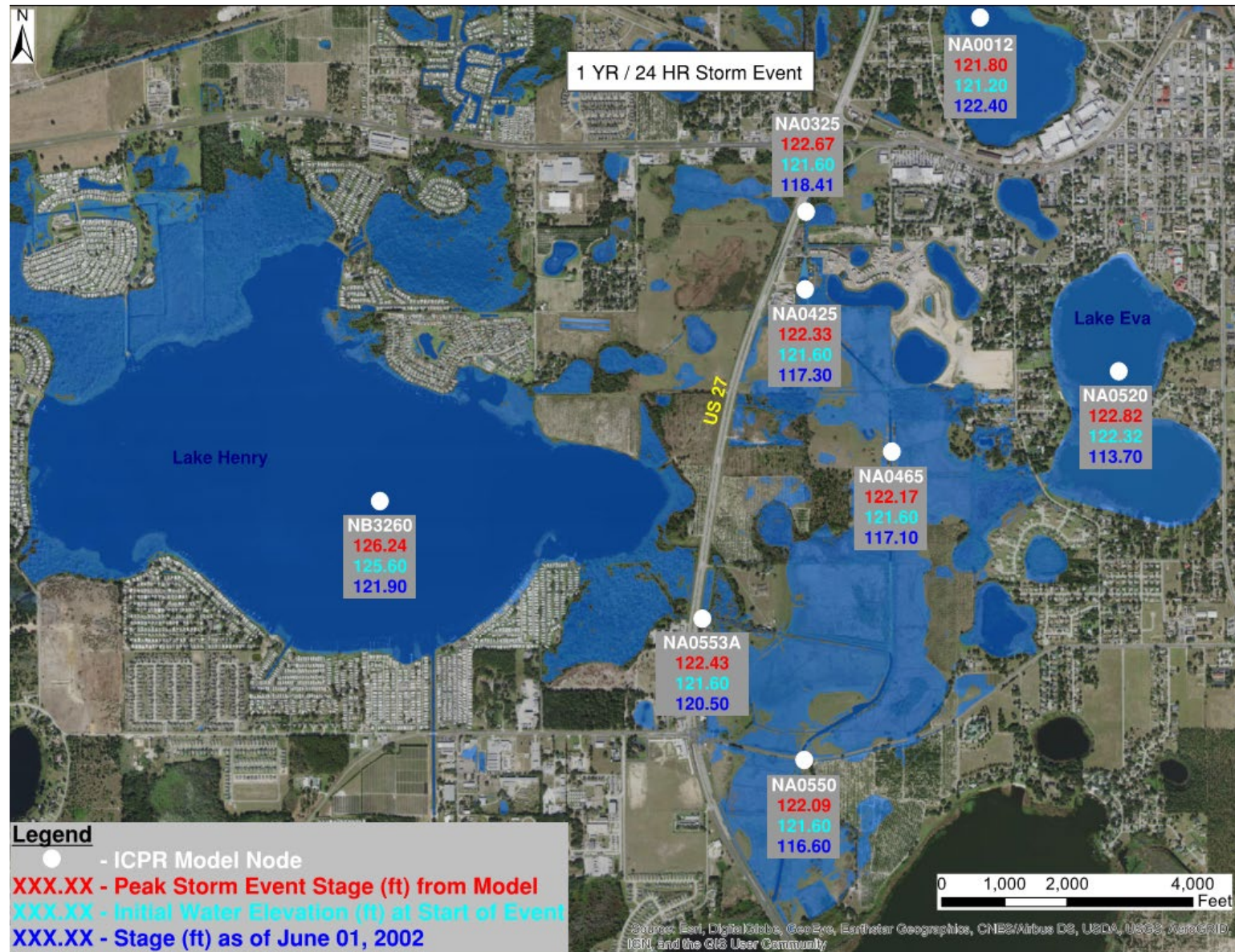
Wetland Continuous Simulation



Lake Eva Continuous Simulation



No Change in Peak Stages for 1 to 100-year Storms



Stormwater BMP Retrofits North of Lake Eva

Integrated Hydrologic, Water
Quality, and Ecological
Restoration at Lake Eva



Stormwater BMP Retrofits South of Lake Eva



Construction and Life Cycle Cost Summary

Option	Construction Cost (\$) ¹	Average Annual O&M Cost (\$) ¹	20 Year Life Cycle Cost (\$) ¹
1	4,749,000 (\$3.3 to 6.2 M)	78,000	6,307,000 (\$4.4 to 8.2 M)
2	5,198,000 (\$3.6 to 6.7 M)	100,000	7,195,000 (\$5.0 to 9.4 M)
BMP retrofits only	3,269,000 (\$2.3 to 4.2 M)	43,000	4,124,000 (\$2.9 to 5.4 M)
Wetland Restoration only (Option 1)	1,480,140 (\$1.0 to 1.9 M)	35,000	3,071,000 (\$2.1 to 4.0 M)
Wetland Restoration only (Option 2)	1,930,000 (\$1.4 to 2.5 M)	57,000	3,071,000 (\$2.1 to 4.0 M)
1. includes 20% contingency (Range is +/- 30%)			

Lake Eva Restoration Project Alternatives Scoring

Evaluation Criteria and Option Scoring 5-15-19							
Selection Criteria	Priority*	Description	Weighting	Option 1 Score	Option 2 Score	Option 1 Points	Option 2 Points
Improve Lake Eva Water Quality	1	Achieve Lake Water Quality Improvement for Key Parameters including Total Phosphorus and Chlorophyll-a	15	6	9	90	135
Address Lake Eva Low Water Level Concerns	2	Address Regulatory Requirements for Maintaining Minimum Level and Flow (MFL) in Lake Eva	12	6	9	72	108
Meet Regional Integrated Water Resources Needs	3	Follow Central Florida Water Initiative (CFWI) guidelines, use regional approach to solving multi-jurisdictional "One Water" needs	10	7	9	70	90
Provide Groundwater Recharge and Water Supply Credits	3	Infiltrate "Excess" Water into project area groundwater system with the goal of generating water supply credits	10	6	6	60	60
Minimize Need for Land Acquisition and Easements	4	Maximize the use of existing public lands and easements for project improvements and minimize the need to acquire additional private land or easements	9	8	7	72	63
Utilize Existing Infrastructure and Natural Conveyances	4	Maximize natural conveyance and maintain existing drainage system infrastructure in such a way that it's compatible with maximizing natural conveyance.	9	8	8	72	72
Public / Stakeholder Acceptance	5	Consensus of acceptance by Stakeholders, Residences, and Businesses	7	7	8	49	56
Life-Cycle Cost	6	Lowest combined Capital and O&M Costs for 20-year life per unit of benefit	6	5	8	30	48
Provide Natural Systems Enhancement	7	Improve ecosystem form and function within the project area	5	5	9	25	45
Recreational Benefits	7	Maintain or improve Lake Recreational Benefits (Swimming, boating, fishing, etc.)	5	7	9	35	45
Social Benefits	7	Provide public benefits such as increased property value, economic development, educational opportunities, aesthetics, etc.	5	7	9	35	45
Reduce Lake Henry Flooding During Wet Weather Periods	8	Reduce extent/depth of flooding for residents adjacent to Lake Henry for the 100-year, 24-hour event based on existing flood maps	4	7	7	28	28
Minimize Impacts (temporary/permanent) to residences and businesses	9	Construction and Operation of Proposed Improvements has minimal impact on residences and businesses	3	7	7	21	21
Likelihood or Ease of Permitting	10	Regulatory Acceptability and Less Time/Lower Cost for Project Permitting	2	7	5	14	10
Proven Treatment/Recharge Approach	11	Use project elements which are effective and meet regulatory requirements	1	8	8	8	8
TOTALS						681	834

* = Rank from 1 to 15, "1" is most preferred

Score 1 to 10:
maximum score is 1030

Lake Eva Project

SWFWMD FY21 CFI Cost Benefit Analysis

Category	Units	Project Value	Rating	Comments	
Water Quality					
Nitrogen reduction	\$/lb	\$114	High	Estimated TN load reduction	3,159 lb/yr
Phosphorus reduction	\$/lb	\$1,025	High	Estimated TN load reduction	351 lb/yr
Suspended solids reduction	\$/lb	\$3.65	High	Estimated TSS load reduction	98,480 lb/yr
Wetland Restoration	\$/ac restored	\$13,308	High	145 acres restored	\$1,929,714
Additional GW recharge	Million Gal /year	155 MG	NA	GW recharge	
Meet Lake Eva MFL	MFL	628 ac ft/yr	NA	Additional flow to Lake Eva	

Note: "High" Rating is best possible CFI rating.

Number of days Lake Eva is at or above the MFL Minimum Lake Level (P50, 117.18' NAVD88)
over the 14 year continuous simulation period increases from 151 days to 348 days.
Average number of days above P90 elevation increases from 260 to 359 days.

Selected Wetland Restoration Element

(34 Functional Gain Units)



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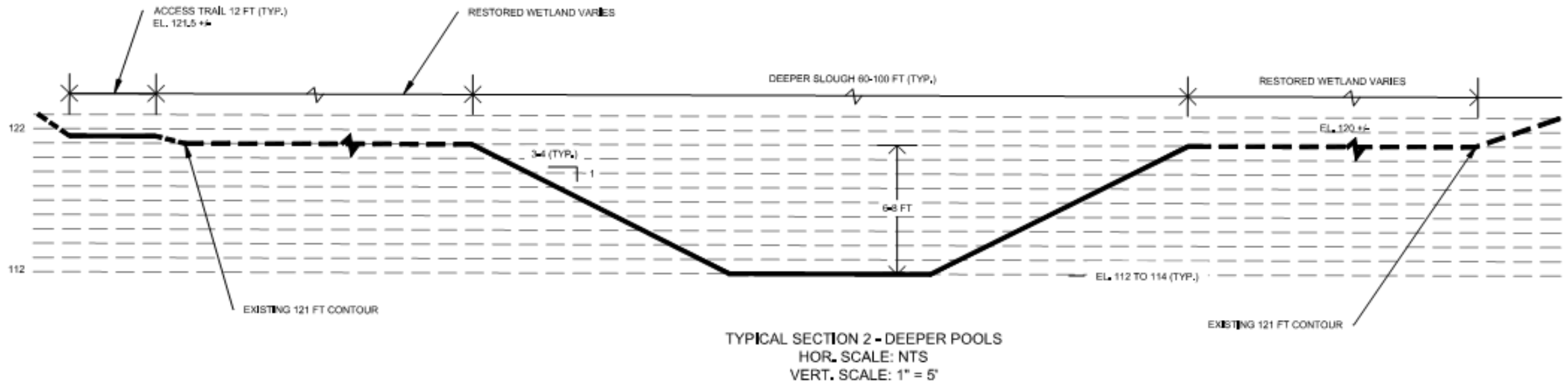
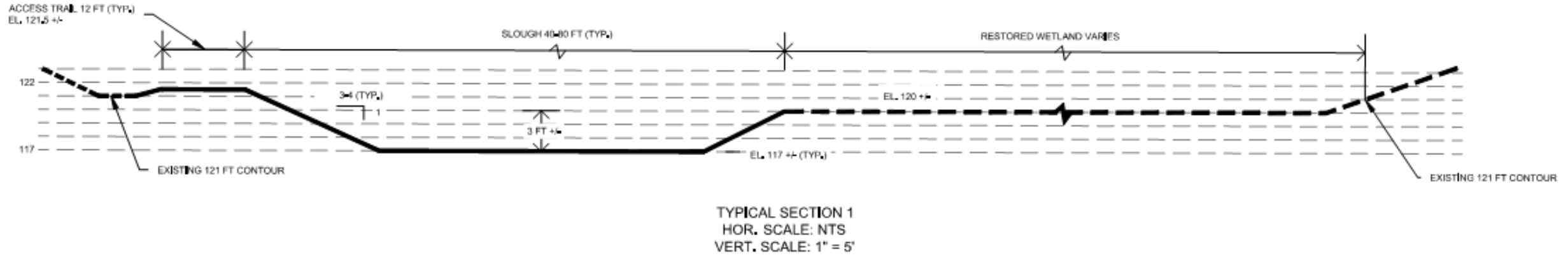
Stormwater BMP Retrofits South of Lake Eva

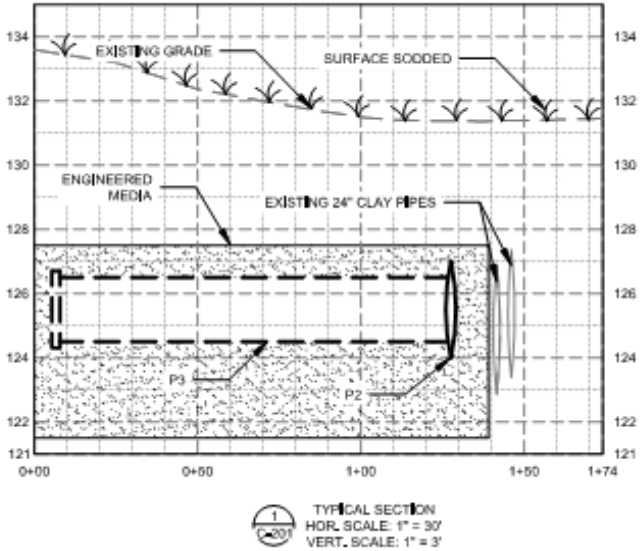
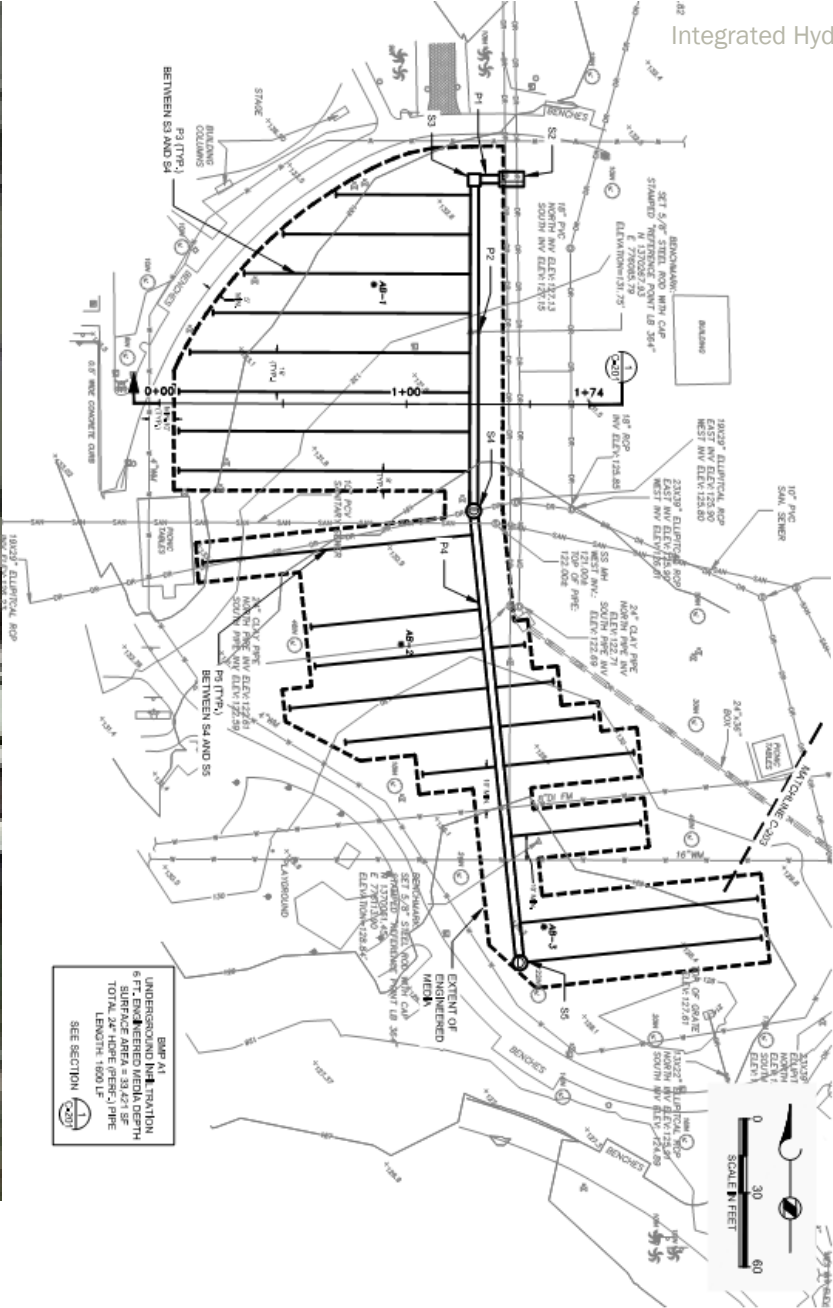


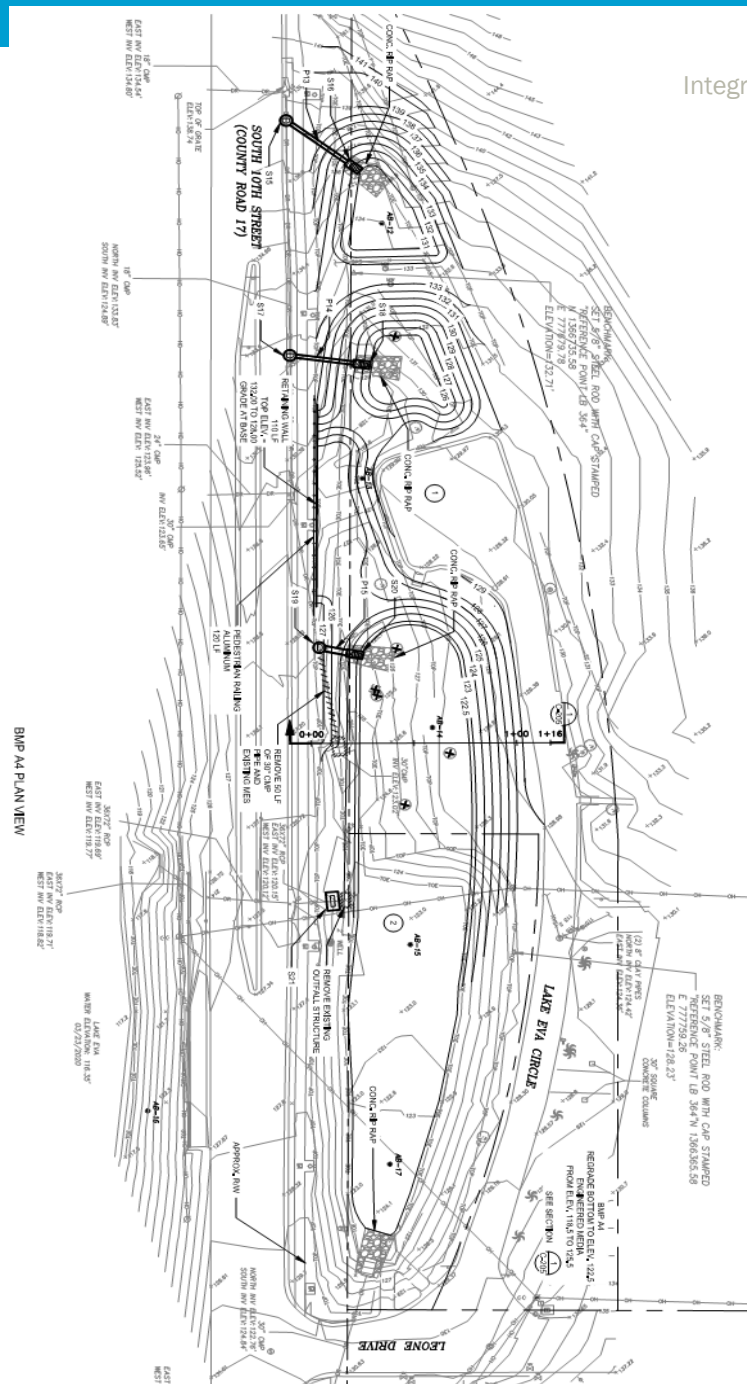
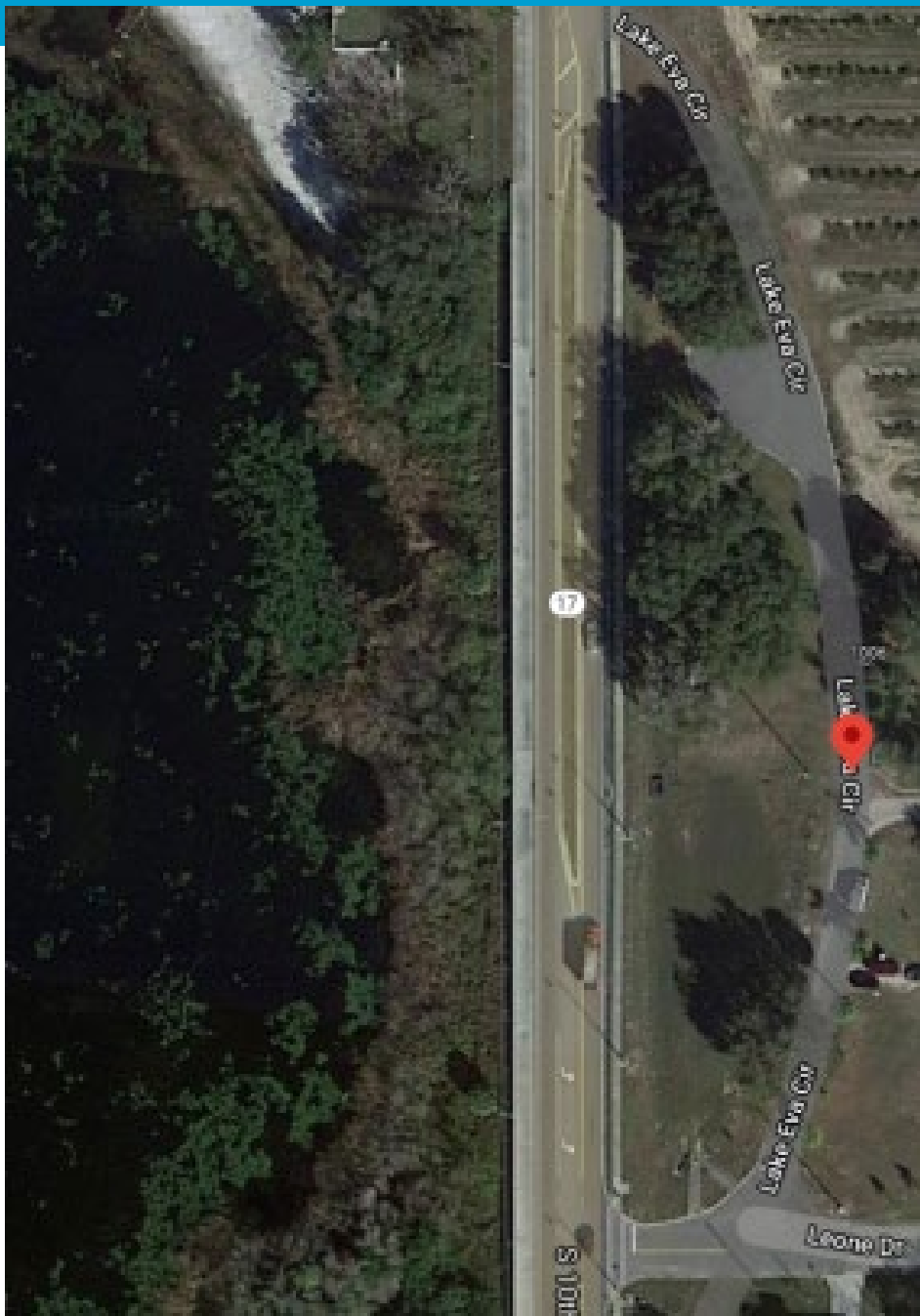
Project Benefits

- Improved drainage connections between Lake Henry, watershed canals, and Lake Eva
- Additional 600 ac-ft of surface water to Lake Eva each year, increasing lake water levels
- Additional 500 ac-ft of groundwater recharge each year
- Restoration of ~145-acres distressed wetlands and provide treatment
- Six regional GI retrofits reduce Lake Eva annual nutrient loads by 70%
- Lake Eva and downstream water quality will improve with improved hydrology, wetland surface water treatment, and GI retrofits.
- Achieved highest ratings for SWFWMD CFI cost benefit

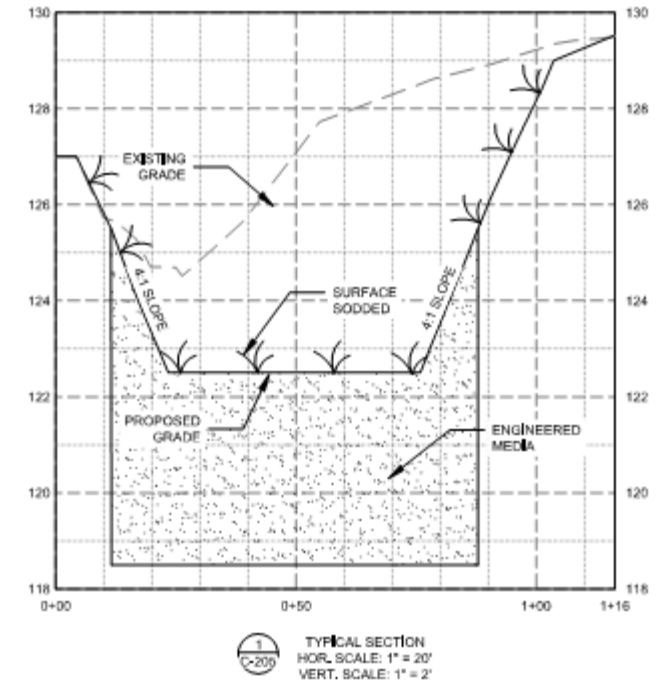








Integrated Hydrologic, Water Quality, and Ecological Restoration at Lake Eva



Questions

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