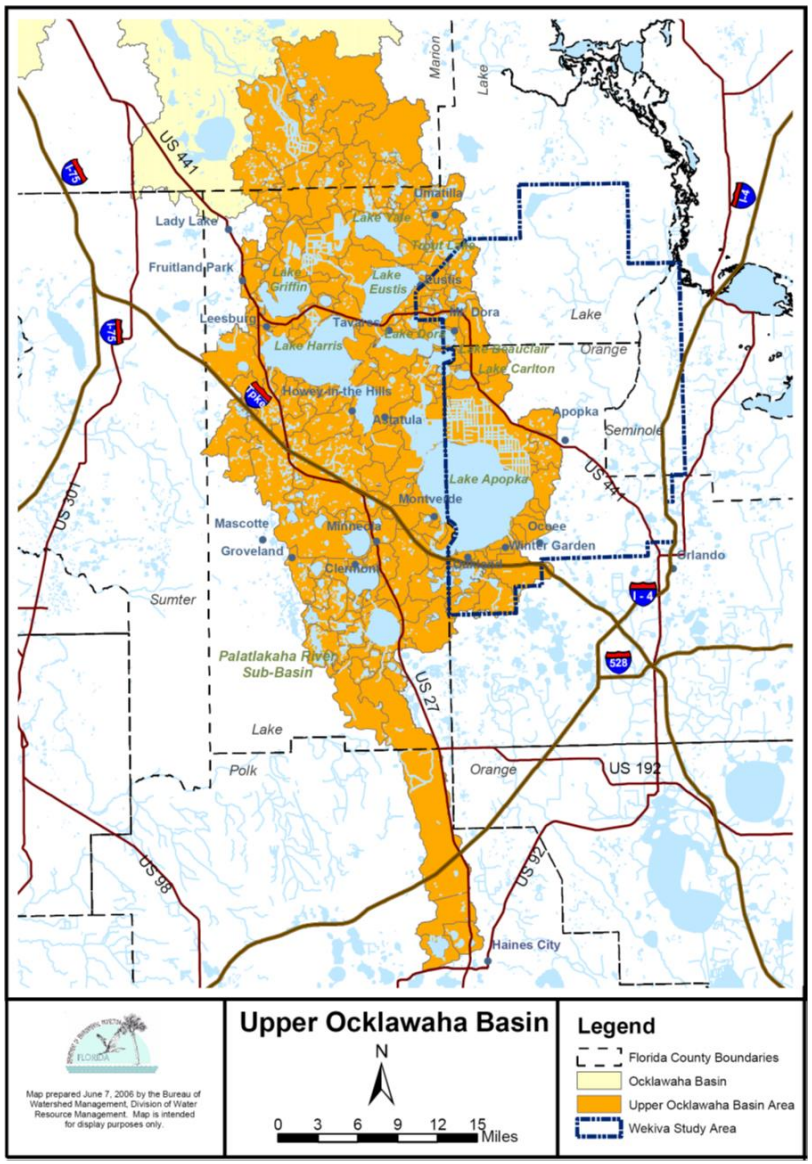
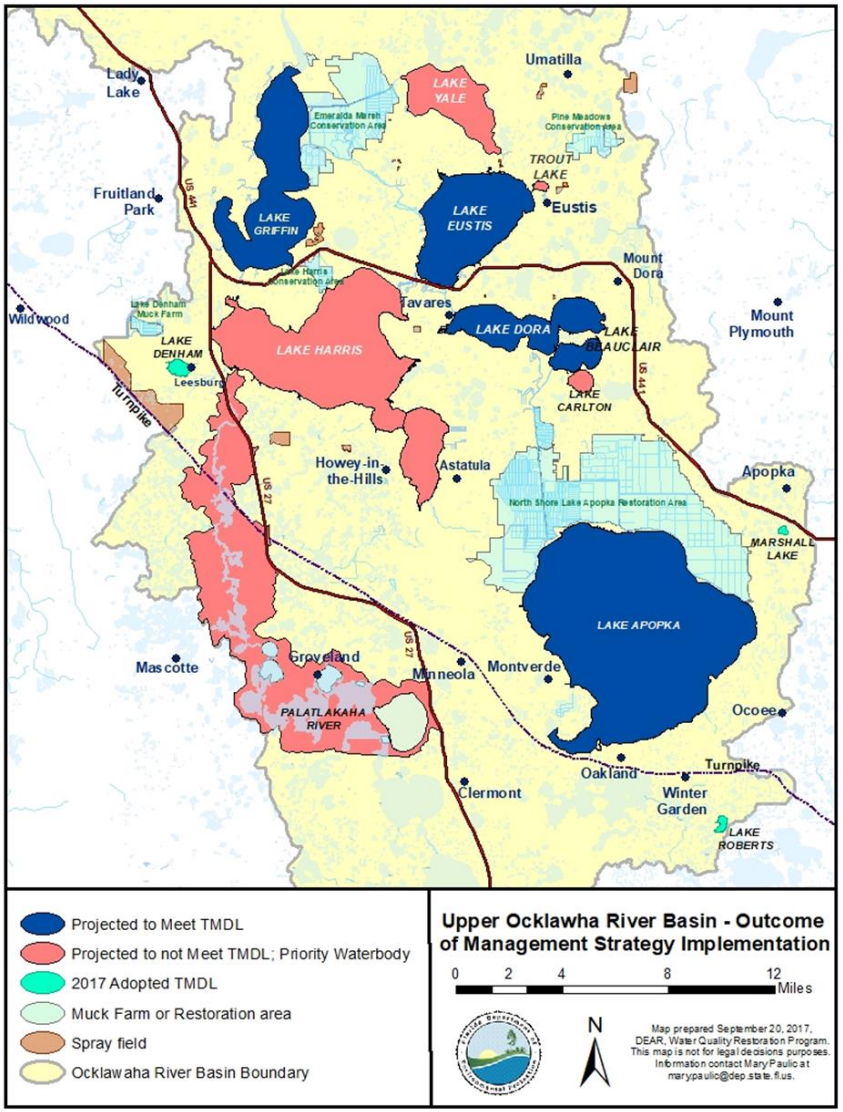
Agenda

- Welcome, Introduction, and Purpose (*Tiffany Busby*)
- Harris Chain of Lakes Fish, Wildlife and Habitat Management Plan (*Scott Bisping*)
- Baseline Water Quality of Lake Denham, Lake Roberts, and Marshall Lake (*Mary Paulic*)
- Crediting of Agriculture Best Management Practices and Projects (*Mary Paulic)*
- Updates and BMAP Next Steps (*Mary Paulic*)
- Agency Updates (*All)*
- Next Steps (*Tiffany Busby*)

Upper Ocklawaha River Basin



Impaired Waterbodies



Baseline Water Quality of Lake Denham, Lake Roberts, and Marshall Lake

Mary Paulic
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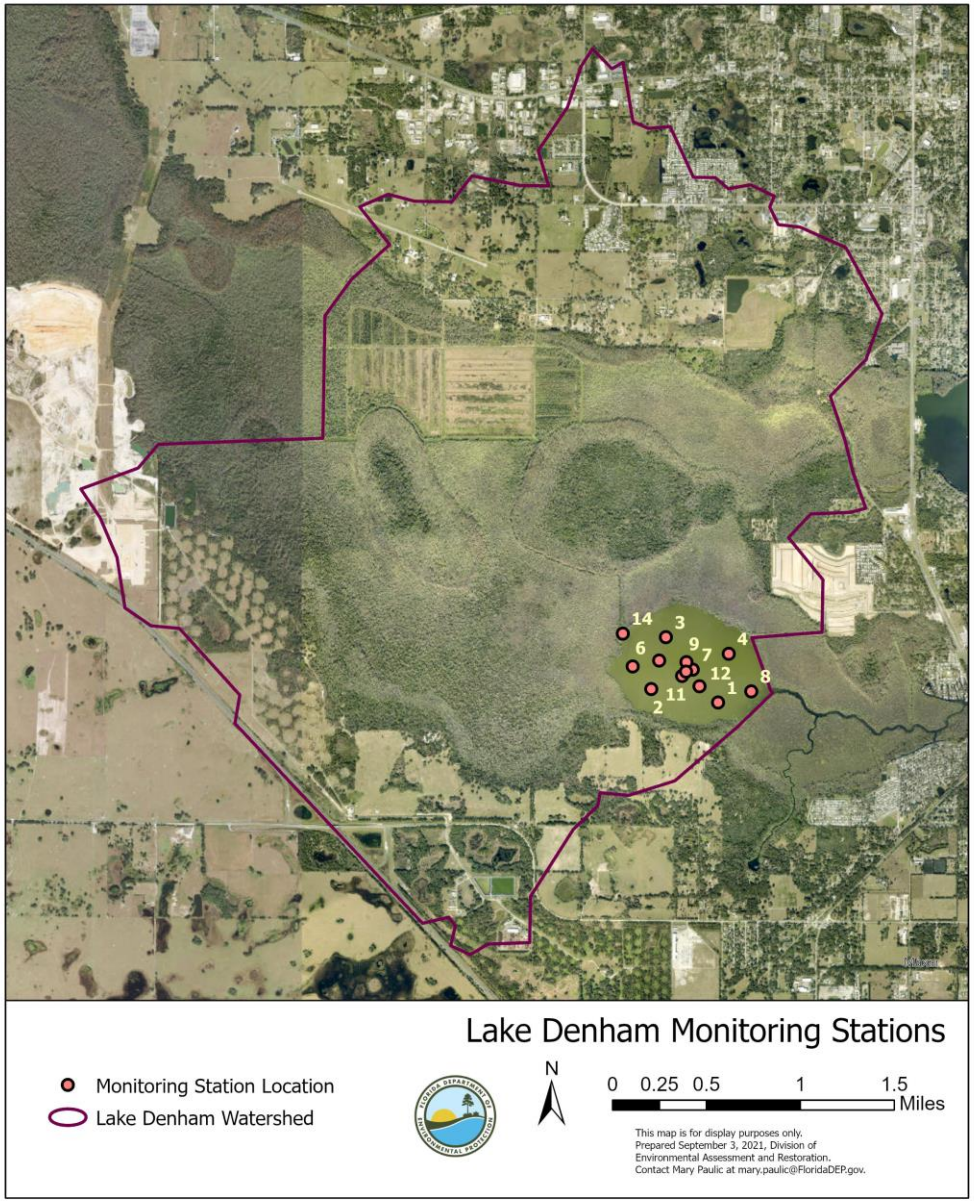
September 7, 2021

Water Quality Update

- Data source Impaired Waters Database August 2021 and used data period 2000 to 2020
- Annual geomean (AGM) for corrected chlorophyll *a,* total nitrogen (TN), and total phosphorus (TP)
  - Require minimum of 4 samples per year
  - At least one sample collected May 1 to September 30
- For comparison calculated annual arithmetic average
  - 1 sample in each of 4 quarters preferred (estimate if only 3 seasons)
- Lake Watch data not used for calculation

Monitoring Locations Lake Denham



Lake Denham

Monitoring Stations

Draft

Map Number	Station ID	Period of Record	Number of Sampling Events
1	DEP-21FLCEN 20020257	2006-2006	5
2	DEP-21FLCEN 20020258	2006-2006	5
3	DEP-21FLCEN 20020259	2006-2006	5
4	DEP-21FLCEN 20020260	2006-2006	4
5	DEP-21FLCEN 20020540	2008-2010	2
9	Lake County-21FLLCPC733	2011-2011	3
10	Lake ounty-21FLLCPCLKDENHAM	2004-2011	4
11	SJRWMD-21FLSJWMDNCY	1998-1999	13
12/15	SJRWMD-21FLSJWMDNEY/53885	1997-2017	211
13	SJRWMD-21FLSJWMDNWY	1997-2002	60
16	DEP-21FLWET WETG1021	2013	1
6	Lake Watch-21FLKWATLAK-DENHAM-1	1998-2020	30
7	Lake Watch-21FLKWATLAK-DENHAM-2	1998-2020	30
8	Lake Watch-21FLKWATLAK-DENHAM-3	1998-2020	30

- Site 14 is a canal from the muck farm and was not used

Lake Denham

Annual Means

Draft

AGM=annual geometric mean; µg/L=micrograms per liter; mg/L = milligrams per liter

Year	Corrected Chlorophyll *a* Annual Average µg/L	Corrected Chlorophyll *a* AGM µg/L	Number of Samples	Total Nitrogen Annual Average mg/L	Total Nitrogen AGM mg/L	Number of Samples	Total Phosphorus Annual Average mg/L	Total Phosphorus AGM mg/L	Number of Samples
2000	65.1	62.1	24	3.15	3.08	24	0.084	0.081	24
2001	65.1	48.7	24	3.31	3.13	22	0.113	0.104	24
2002	62.8	50.3	8	2.85	2.83	8	0.109	0.106	8
2003	84.0	77.4	10	2.31	2.28	8	0.111	0.113	10
2004	60.6	54.7	14	2.17	2.14	11	0.108	0.092	14
2005	99.5	87.5	13	2.49	2.43	12	0.117	0.115	13
2006	130.2	118.2	26	3.12	2.95	24	0.095	0.092	24
2007	111.0	103.0	14	4.01	3.95	12	0.112	0.113	14
2008	110.3	96.8	12	4.04	3.96	10	0.107	0.102	13
2009	73.7	70.2	10	3.20	3.07	9	0.099	0.097	10
2010	64.6	61.1	7	2.20	2.13	6	0.076	0.075	6
2011	58.4	39.7	9	2.82	2.74	9	0.068	0.067	12
2012	86.6	76.6	7	3.51	3.42	7	0.088	0.086	7
2013	74.4	66.7	13	2.85	2.77	13	0.063	0.062	13
2014	54.4	37.4	8	2.49	2.14	7	0.063	0.066	8
2015	67.6	62.6	9	2.34	2.27	7	0.069	0.072	9
2016	44.7	43.6	5	2.21	2.12	6	0.058	0.054	6
2017	54.4	41.9	5	1.86	1.74	6	0.113	0.099	6
2018	54.7	44.7	6	1.70	1.63	5	0.087	0.090	6
2019	84.5	77.9	6	2.08	2.05	5	0.086	0.088	6
2020	84.6	77.4	5	2.57	2.48	5	0.111	0.107	5

Lake Denham

Water Quality Summary

Draft

	Range of Annual Geometric Means		
	Corrected Chlorophyll *a* µg/L	**Total Nitrogen mg/L**	**Total Phosphorus mg/l**
TMDL Period	39.7-118.2	2.13-3.95	0.068-0.117
2013-2020	37.4-77.9	1.63-2.77	0.054-0.107
	Average Annual Geometric Mean		
TMDL Period*	72.8	2.93	0.096
2013-2020	56.5	2.15	0.079
	TMDL Targets		
	26.8	1.1	0.04

*Averages from TMDL document: 73.3, Chla; 2.856, TN; 0.095, TP
TMDL=total maximum daily load

Lake Denham TMDL

- Lake Denham is a seven-year average of annual loads of 16,468 kilograms per year (kg/year) Total Nitrogen and 593 kg/year Total Phosphorus, which are intended to achieve an annual geometric mean chlorophyll *a* concentration of 26.8 µg/L [62-304.500(21), F.A.C.]
- Propose comparison of annual geometric means to targets
- Propose 7-year water quality average for tracking water quality and loading
- Most recent 7-year AGM average is 2014-2020: draft estimates, subject to change
  - Chlorophyll *a* = 52.7 µg/L
  - TN = 2.05 mg/L
  - TP = 0.076 mg/L

Monitoring Locations Marshall Lake

Monitoring Stations

Marshall Lake

Draft

Map Number	Station ID	Period of Record	Number of Sampling Events
1	USGS-112WRD 284034081315700	2001-2001	1
6	DEP-21FLCEN 20020571	2011-2011	6
7	DEP-21FLCEN 20020572	2011-2011	6
2	DEP-21FLCEN 20020643	2011-2011	2
3	DEP-21FLCEN 20020647	2011-2011	4
4	DEP-21FLCEN 20020648	2011-2011	4
5	DEP-21FLCEN G1CE0110	2020-2020	5
11	Orange County-21FLORANA25	1994-2020	48
12	DEP-21FLWET WETG1026	2013-2013	1
8	Lake Watch-ORA-MARSHALL-1	2000-2001	11
9	Lake Watch-ORA-MARSHALL-1	2000-2001	11
10	Lake Watch-ORA-MARSHALL-1	2000-2001	11

Marshall Lake

Annual Means

Draft

Year	Corrected Chloro-phyll *a* Annual Average µg/L	Corrected Chlorophyll *a* AGM µg/L	Number of Samples	Total Nitrogen Annual Average mg/L	Total Nitrogen AGM mg/L	Number of Samples	Total Phosphorus Annual Average mg/L	Total Phosphorus AGM mg/L	Number of Samples
2000	ND	ND	ND	ID	ID	2	ID	ID	1
2001	ND	ND	ND	ID	ID	1	ID	ID	1
2003	ND	ND	ND	ID	ID	1	ID	ID	1
2004	ID	ID	1	ND	ND	ND	ND	ND	ND
2005	52.4	ID	3	0.93	ID	3	0.121	ID	3
2006	43.0	42.4	4	1.60	1.59	4	0.108	0.104	4
2007	43.3	ID	3	1.74	1.73	4	0.080	0.079	4
2008	ID	ID	2	ND	ND	ND	ND	ND	ND
2009	54.8	ID	3	2.09	ID	3	0.063	ID	3
2010	24.5	ID	3	1.25	ID	3	0.046	ID	3
2011	28.4	28.3	17	1.45	1.44	17	0.045	0.044	17
2013	ID	ID	2	ID	ID	2	ID	ID	2
2017	ID	ID	1	ID	ID	1	ID	ID	1
2018	28.7	27.8	4	1.24	1.23	4	0.031	0.030	4
2019	23.2	22.4	4	0.65	0.62	4	0.027	0.027	4
2020	24.7	24.4	8	0.95	0.95	9	0.025	0.025	9

ID= insufficient data
ND=no data
AGM=annual geometric mean; µg/L=micrograms per liter; mg/L = milligrams per liter

Marshall Lake

Water Quality Summary

Draft

	Range of Annual Geometric Means		
	Corrected Chlorophyll *a* µg/L	**Total Nitrogen mg/L**	**Total Phosphorus mg/l**
TMDL Period*	28.3-42.4	1.44-1.73	0.044-0.104
2013-2020*	22.4-27.8	0.62-1.24	0.025-0.030
	TMDL Targets		
	20	0.90	0.037

*Missing years
TMDL=total maximum daily load

Marshall Lake TMDL

- The nutrient TMDL for Marshall Lake is a seven-year average of annual loads of 2,046 kg/year TN and 97 kg/year TP, which are intended to achieve the applicable annual geometric mean chlorophyll *a* criterion for low color and high alkalinity lakes, and is allocated as follows [63-304.500(23), F.A.C.]
- Propose comparison of annual geometric mean to targets
- Propose 7-year water quality average for tracking water quality and loading (not calculated due to lack of data)

Monitoring Locations Lake Roberts

Lake Roberts

Monitoring Stations

Draft

Map Number	Station ID	Period of Record	Number of Sampling Events
1	Orange County-21FLORANA33	1994-2020	94
2	DEP-21FLWET WETG1018	2013	1

Lake Roberts

Annual Means

Draft

Year	Corrected Chlorophyll a Annual Average µg/L	Corrected Chlorophyll a AGM µg/L	Number of Samples	Total Nitrogen Annual Average mg/L	Total Nitrogen AGM mg/L	Number of Samples	Total Phosphorus Annual Average mg/L	Total Phosphorus AGM mg/L	Number of Samples
2000	ND	ND	ND	1.10	ID	3	0.017	0.017	4
2001	ID	ID	1	ID	ID	2	ID	ID	2
2002	ID	ID	1	ID	ID	1	ID	ID	1
2003	ID	ID	1	ID	ID	2	ID	ID	2
2005	32.7	27.2	4	1.08	1.07	4	0.063	0.061	4
2006	19.3	ID	3	0.97	0.96	4	0.040	0.040	4
2007	15.5	15.1	4	0.96	0.96	4	0.035	0.034	4
2008	32.3	30.6	4	1.26	1.25	4	0.054	0.054	4
2009	48.9	35.5	4	1.43	1.41	4	0.062	0.061	4
2010	21.6	20.4	4	1.27	1.20	4	0.045	0.043	4
2011	31.4	ID	3	1.20	ID	3	0.046	ID	3
2012	18.7	ID	3	1.08	1.07	4	0.040	0.040	4
2013	ID	ID	2	1.64	1.59	6	0.091	0.075	6
2014	ND	ND	ND	1.11	ID	3	0.307	ID	3
2015	ND	ND	ND	1.21	ID	3	0.067	ID	3
2016	ND	ND	ND	1.36	1.34	4	0.049	0.048	4
2017	ID	ID	2	1.37	1.37	4	0.067	0.066	4
2018	31.6	30.7	6	1.26	1.19	6	0.057	0.056	6
2019	29.9	28.5	4	1.04	ID	3	0.062	0.060	4
2020	77.3	59.4	4	1.25	1.05	4	0.065	0.062	4

ID= insufficient data
ND=no data
AGM=annual geometric mean; µg/L=micrograms per liter; mg/L = milligrams per liter

Lake Roberts

Water Quality Summary

Draft

	Range of Annual Geometric Means		
	Corrected Chlorophyll a ug/L	**TN mg/L**	**TP mg/l**
TMDL Period*	15.1-35.5	0.96-1.41	0.017-0.061
2013-2020*	28.5-59.4	1.05-1.59	0.048-0.075
	Average Annual Geometric Mean		
TMDL Period*	25.7	1.13	0.044
2013-2020*	39.5	1.31	0.061
	TMDL Targets		
	20	1.02	0.044

*Missing years

TMDL=total maximum daily load

Lake Roberts TMDL

- The nutrient TMDL for Lake Roberts is a seven-year average of annual loads of 1,655 kg/year TN and 100 kg/year TP, which are intended to achieve the applicable annual geometric mean chlorophyll *a* criterion for high color and high alkalinity lakes [62-304.500(26), F.A.C.]
- Propose comparison of annual geometric mean to targets
- Propose 7-year water quality average for tracking water quality and loading
- Most recent 7-year AGM average for 2014-2020: draft estimates, subject to change
  - Chlorophyll *a (2017-2020) = 34.9 u*g/L
  - TN = 1.02 mg/L
  - TP = 0.064 mg/L

Crediting of Agriculture Best Management Practices and Projects

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September 2, 2021

Agriculture

Best Management Practice (BMP) Enrollment Credits

- Calculated credits for BMP enrollment
- Change in methodology
  - No longer use straight 30% efficiency for all BMPs to estimate reductions in nutrient loading
  - Based on Florida Statewide Agricultural Irrigation Demand (FSAID) crop information and Del Bottcher's work relating efficiency of BMP to land use
  - Not necessarily what is listed as commodity in the Notice of Intent

Modeled Agriculture Landuse

- Palatlakaha used 1 category for all types of agriculture
- With the exception of Lake Apopka, other lakes have multiply categories each with a different modeled load
  - Cropland
  - Tree Crop
  - Other Agriculture (includes golf courses)
  - Pasture
  - Feeding Operations

BMP Efficiency

Total Phosphorus (TP) and Total Nitrogen (TN)

Bottcher Commodity	TP Efficiency %	TN Efficiency %
Citrus	12	10
Hay	15	15
Row Crops	30	30
Cow Calf, Improved	11	17
Cow Calf, Unimproved	7	11
Cow Calf, Woodland	4	4
Ornamentals	32	25
Dairies	9	20
Equine	20	30
Sod	20	20

*Efficiencies from Del Bottcher

Agriculture BMP Reductions

Calculation of Credits

- Reduction calculated as percent (enrolled acres/total enrollable acres) of initial modeled agriculture loading:

  For Ornamentals (Palatlakaha)

  Ex. (580 ac/5,511 ac) * 405.2 lbs TP = 42.65 lbs TP

- Credit calculated by applying BMP efficiency to loading:

  Ex. 42.65 lbs TP * 32 % efficiency = 13.7 lbs TP

Agriculture BMP Credits

Palatlakaha River

DRAFT

WBID 2839	Total Phosphorus lbs/yr	Total Nitrogen lbs/yr
Palatlakaha River (WBID 2839)	16	87

Modeled Loading

Agriculture

Agriculture Type	Lake Loading by Agricultural Type lbs/yr Total Phosphorus							
	Beauclair	Carlton	Dora	Eustis	Trout	Harris	Yale	Griffin
Cropland	180.6	44.8	26.4	45.6	15.7	194.7	29.2	50.2
Feeding Operation				20.4	0.1	13.9	141.3	
Other Agriculture	17.0	8.1	2.8	0.3	2.2	34.7	11.7	8.9
Pasture	138.5	8.4	6.9	89.8	46.0	182.9	156.0	280.6
Tree Crops	51.8	38.3	5.2	15.1	5.9	46.8	22.9	4.5
Total Loading	387.9	99.7	41.2	171.2	69.9	473.0	361.1	344.2
Golf Course	10.0		4.2	7.1		15.0		7.3
Forest/Rangeland	324	69	245	992	16.9	2,253	610	1,687

Agriculture Type	Lake Loading by Agricultural Type lbs/yr Total Phosphorus		
	Denham	Marshall	Roberts
Cropland	319.9	22.7	
Feeding Operations			
Other Agriculture	7.7	51.8	0
Pasture	187.6	22.7	5.3
Tree Crops	1.5		0.6
Total Loading	516.7	97.2	6.0
Forest/Rangeland	15.9	0	0.1

Agriculture BMP Credits

Harris Chain of Lakes

DRAFT

Lake	Total Phosphorus lbs/yr
Lake Beauclair	10.1
Lake Carlton	1.1
Lake Dora	5.5
Lake Harris	2.5
Trout Lake	0.6
Lake Eustis	2.7
Lake Griffin	6.4
Lake Yale	1.2
Lake Total	28.4 (28)

Agriculture Projects

- Management improvements made at the farm level through cost-share dollars
  - Current estimates are for project cost shared with St. Johns River Water Management District (SJRWMD)
  - Water management district provides estimate of nutrient reduction at the farm
  - DEP applies 30 % of that estimated reduction as a project credit

Agriculture Project Credits

Palatlakaha River and Lake Apopka

DRAFT

Waterbody	Total Nitrogen Credit lbs/yr	Total Phosphorus Credit lbs/yr
Palatlakaha River (WBID 2839)	4,591	700
Lake Apopka	619	156
Upper Ocklawaha Basin	2,854	565
2020 Total (BMP Enrollment and Projects)	**Total Nitrogen Credit lbs/yr**	**Total Phosphorus Credit lbs/yr**
Palatlakaha River WBID (2839)	4,678	716

Agriculture Project Credits

Harris Chain of Lakes

DRAFT

Waterbody	Total Nitrogen Credit lbs/yr	Total Phosphorus Credit lbs/yr	Total Phosphorus Total Credit lbs/yr
Lake Beauclair	1,685	185	195
Lake Harris	835	168	170
Trout Lake	1,007	109	110
Lake Yale	2,838	576	577
Lake Griffin	3,260	639	645
Upper Basin	2,854	565	565

Upper Ocklawaha River BMAP Meeting Updates and BMAP Next Steps

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September 7, 2021

Allocation Update

Golf Courses

- Part of Other Agriculture:
  - Lake Beauclair
  - Lake Dora
  - Lake Eustis
  - **Lake Harris**
  - Lake Griffin
  - Lake Roberts modeled as recreation land
- Apportioned Other Agriculture loading into golf course and other agriculture
  - Portion of golf course acreage out of total acreage modeled

Golf Course Loading

Agriculture Type	Lake Loading by Agricultural Type lbs/yr TP							
	Beauclair	Carlton	Dora	Eustis	Trout	Harris	Yale	Griffin
Cropland	180.6	44.8	26.4	45.6	15.7	194.7	29.2	50.2
Feeding Operation				20.4	0.1	13.9	141.3	
Other Agriculture	17.0	8.1	2.8	0.3	2.2	34.7	11.7	8.9
Pasture	138.5	8.4	6.9	89.8	46.0	182.9	156.0	280.6
Tree Crops	51.8	38.3	5.2	15.1	5.9	46.8	22.9	4.5
Total Loading	387.9	99.7	41.2	171.2	69.9	473.0	361.1	344.2
Golf Course	10.0		4.2	7.1		15.0		7.3
Forest/Rangeland	324	69	245	992	16.9	2,253	610	1,687

Where are Golf Courses?

Lake	Entity	Acreage of Golf Course	Percent of Acreage
Beauclair	Lake County	50.6	100.0%
Dora	Lake County	73.4	90.0%
	Mount Dora	8.2	10.0%
Eustis	Lake County	33.3	40.1%
	Tavares	49.8	59.9%
Harris	Howey	1.4	0.6%
	Lake County	219.5	95.4%
	Tavares	7.8	3.4%
	Leesburg	1.2	0.5%
Griffin	Lake County	96.3	100.0%
Yale	Lake County	0.9	100.0%

Adjustment to Allocation

Lake Harris

- Add 15 lbs/yr TP golf course load to developed landuses
- Apportioned the same way as high, low, and medium developed landuses
- Achieve additional 4.7 lbs/yr TP reduction
- Communities affected:
  - Lake County – 95.4%
  - Leesburg – 0.5%
  - Tavares – 3.4%
  - Howey-in-the-Hills – 0.6%

Changes

Required Reduction

Total Loading Reduction by Jurisdiction for Lake Harris	Total Reduction Developed Land Use lbs/yr TP	Total Reduction Septic System lbs/yr TP	Total Reduction lbs/yr TP	Total Reduction Without Adjustment lbs/yr TP
Astatula	39.9	25.2	65.1	65.1
FDOT	46.8		46.8	46.8
Howey-in-the-Hills	21.6	41.7	63.3	63.3
Lake County	389.9	401.2	791.1	786.6
Leesburg	389.1	1.0	390.1	390.1
Tavares	147.7	5.4	153.1	152.9
Wildwood	1.5		1.5	1.5
Total lbs/yr TP	1,036.6	474.5	1,511.1	1,506.4

Changes

Education Credit

2009 Developed Land Uses Stormwater Loading by Jurisdiction for Lake Harris	Developed-Golf Course Percent of Area	Total Loading Developed-Golf Course lbs/yr TP	Developed Land Uses (Stormwater) Total Loading lbs/yr TP	Education Credit as Percent	Education Credit in lbs/yr TP	Education Credit Without Adjustment lbs/yr TP
Astatula	0.0%	0.0	127.5	0.0%	0.0	0.0
FDOT	0.0%	0.0	149.5	0.5%	0.7	0.7
Howey-in-the-Hills	0.6%	0.1	69.0	2.5%	1.7	1.7
Lake County	95.4%	14.3	1,244.9	5.5%	68.5	67.7
Leesburg	0.5%	0.1	1,242.4	5.5%	68.3	68.3
Tavares	3.4%	0.5	471.5	1.8%	8.3	8.2
Wildwood	0.0%	0.0	26.8	1.0%	0.3	0.3
Total lbs/yr TP	100.0%	15.0	3,331.6		147.8	

Revised Allocation Table

Reductions and Credits by Jurisdiction for Lake Harris	Total Required Developed Land Use Reduction lbs/yr TP	First Five Year 50% Required Developed Land Use Reduction lbs/yr TP	Education Credit lbs /yr TP	Project Credits lbs /yr TP	First Five Year Remaining Developed Land Use Reduction to be Achieved by 2022 in lbs/yr TP
Astatula	39.9	20.0	0.0	0.0	**20.0**
FDOT	46.8	23.5	0.7	1,224.0	**-1,201.2**
Howey-in-the-Hills	21.6	10.8	1.7	21.7	**-12.6**
Lake County	389.9	195.0	88.5	206.8	**-100.4**
Leesburg	389.1	194.6	68.3	31.0	**95.3**
Tavares	147.7	73.9	8.3	9.9	**55.7**
Wildwood	1.5	0.8	0.3	0.0	**0.5**
Total lbs/yr TP	1,036.6	518.5	167.8	1,493.4	**-1,142.7**

BMAP Next Steps

What is Success?

- Pass 5-year assessment review and not be impaired
- Long-term rolling TP average or chlorophyll *a,* TP, and TN annual means meets target concentration
  - Harris Chain and Lake Apopka are arithmetic means
  - Marshall, Roberts, and Denham are annual geometric means
- Long-term TP loading or annual TP loading meets TMDL target

BMAP Next Steps

How to Ensure Success?

- Amended BMAP in 2019. Establishes a 10 year time frame to address current TMDL waterbodies
  - BMAP first adopted in 2007, BMAP tentative deadline 2027
- Project completions that will improve downstream water quality and further reduce loading
  - Upgrades to NuRF to increase removal of phosphorus loading
  - Restoration of Lake Denham Muck Farm
  - Trout Lake and Lake Yale projects
- Continued stormwater maintenance and improvement
  - Both structural and nonstructural
- Lake friendly landscaping, reduction nutrient at the source

BMAP Next Steps

Potential Emerging Issues

- Elevated nitrate level or algal mats in springs
  - May trigger new set of TMDLs specific to these springs
    - 2019 Verified list included Blue Springs, Holiday Springs, and Bugg Spring Run
- Wastewater as a contributor of nutrients
- Management focus for past approximately 25 years has been reduction/control of total phosphorus
  - Will nitrogen become an issue?

BMAP Next Steps

Denham, Roberts, Marshall, Trout, Palatlakaha River Segment

- TMDL targets were set for TN in addition to TP
  - Complete restoration could require addressing nitrogen removal
- Maintain at least 4 sampling events per year for Denham, Roberts, and Marshall to calculate annual geomeans
- Palatlakaha needs biological assessment (Stream Condition Index) – TMDL based on low dissolved oxygen on older criteria of 5 mg/L

Questions


FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION