



Lake Tohopekaliga Nutrient Reduction Plan First Biennial Update

FINAL

January 2014

**CDM
Smith**

Lake Tohopekaliga Nutrient Reduction Plan

First Biennial Report Update

1.0 Introduction

This document constitutes the first biennial report update required as part of the Lake Tohopekaliga Nutrient Reduction Plan (NRP). The NRP stakeholders committed to prepare a report every two years since the acceptance of the NRP and the revised 4e listing of Lake Tohopekaliga and East Lake Tohopekaliga by the Florida Department of Environmental Protection (FDEP) in early 2012.

1.1 Purpose

The purpose of this biennial report is to provide an update to FDEP on the progress made by the NRP stakeholders since the acceptance of the NRP. Progress on project implementation, monitoring and research are summarized in this biennial report.

1.2 Nutrient Reduction Plan

In the 2010 adopted verified listing of impaired waters, FDEP determined that Lake Tohopekaliga was impaired for nutrients based on an increasing trend in trophic state index (TSI). Local stakeholders including Osceola County and the City of Kissimmee disagreed with the listing and entered into discussions with FDEP over the justification for the impairment listing. Due to the complex interactions between ambient water quality, hydrilla and management activities within Lake Tohopekaliga, the effects of which still have yet to be completely understood, FDEP agreed that more research and a better understanding of lake dynamics is needed before appropriate water quality targets (i.e., total maximum daily load (TMDL)) can be set for the lake. Therefore, in addition to modifying the cause for impairment, FDEP agreed to modify the lake's assessment status from Category 5 (i.e., water quality standards are not attained and a TMDL is required) to Category 4e (i.e., impaired, but recently completed or on-going restoration activities are underway to restore the designated uses of the waterbody) if FDEP was provided assurance that various measures are implemented by local stakeholders to reduce nutrients to the lake. As a result of this decision, local stakeholders developed the Lake Tohopekaliga Nutrient Reduction Plan (CDM Smith, 2011) to address FDEP's requirements to facilitate the change in assessment category. The plan contained the following components: 1) an estimation of nutrient loading to the lake by jurisdiction; 2) identification of stakeholder projects and activities since 2009 that result in overall nutrient reduction to Lake Tohopekaliga; 3) development of a monitoring plan; and 4) identification of research needs to improve the understanding of nutrient dynamics in the lake. The plan was subsequently accepted by FDEP and a change in assessment category from 5 to 4e was adopted by FDEP in early 2012.

1.3 Participants

Osceola County is responsible for the preparation of this biennial report with the input of NRP participants including the City of Kissimmee, the City of St. Cloud, City of Orlando, Orange County and the Florida Department of Transportation (FDOT) District 5. Several agency partners participated in the original development of the NRP including FDEP, South Florida Water Management District (SFWMD), Florida Fish and Wildlife Conservation Commission (FWC), Florida Department of Agricultural and Consumer Services (FDACS), Florida Farm Bureau, Reedy Creek Improvement

District (RCID) and the University of Florida Institute of Food and Agricultural Sciences (IFAS). These agency partners have continued to provide technical support and input since acceptance of the NRP.

2.0 Accomplishments

In the original NRP, a number of management actions to reduce nutrients within the watershed were identified by NRP Participants. Load reductions for these management actions (projects) were also estimated where feasible. Since acceptance of the NRP, Participants have continued with implementation of projects. Participants provided updates to the management actions and project lists originally included in the Lake Tohopekaliga NRP. Many of these project updates are included in information recently submitted by NRP Participants for the Lake Okeechobee Basin Management Action Plan (BMAP) process.

2.1 Accomplishments by Participant

Below is a brief summary of accomplishments by individual NRP Participants since the acceptance of the Lake Tohopekaliga NRP. Detailed project lists organized by Participant are included in **Attachment A**.

Osceola County

Osceola has complete five projects originally included in the NRP including Narcoossee Rd III (Pond C3A & C3B), Narcoossee Rd III (Pond D3), Narcoossee Rd III (Pond E1), Hoagland Blvd I (Pond 100 and Hoagland Blvd I (Pond 200). The County has also identified an additional 16 projects in the watershed, 12 of which have been completed.

City of Kissimmee

The City continues to make progress on its Lakefront Park Redevelopment project. Installation of three nutrient separating baffle boxes and three filter boxes have already been installed as part of this project which is directly adjacent to Lake Tohopekaliga. Two projects (Oak Street Widening and MLK Boulevard Phase III) have moved into the construction phase.

City of St. Cloud

The City of St. Cloud continues to implement its current projects as well as public education and outreach. Street sweeping was also added to the project list as an ongoing activity where the City sweeps approximately 2,750 miles per year.

Orange County

Orange County re-classified several of its alum injection projects originally identified in the NRP to sediment activation projects. Several of these have been completed including the Lake Pineloch, Lake Cane and Lake Floy Alum Treatment projects. Four projects were added to the original project list, three of which have been completed (Lake Mary Jess Pond, Lake Jessamine Alum and Lake Tyner Alum projects).

City of Orlando

The City has completed six projects included on the original project list. Two projects by the City have also been added (Lake Angel Drainage Improvements and Cemex - S. Division Ave. Roadway and Drainage Improvements) since the development of the NRP.

FDOT District 5

FDOT District 5 has completed the widening and resurfacing of Sand Lake Road (from President's Drive to Orange Blossom Trail). FDOT continues to move forward with other projects included on the management action list.

3.0 Research and Monitoring

As part of the NRP, the Participants also committed to routine water quality monitoring and establishing research priorities. This section summarizes the accomplishments related to those two components and also discusses recent water quality trends within the Lake Tohopekaliga Watershed.

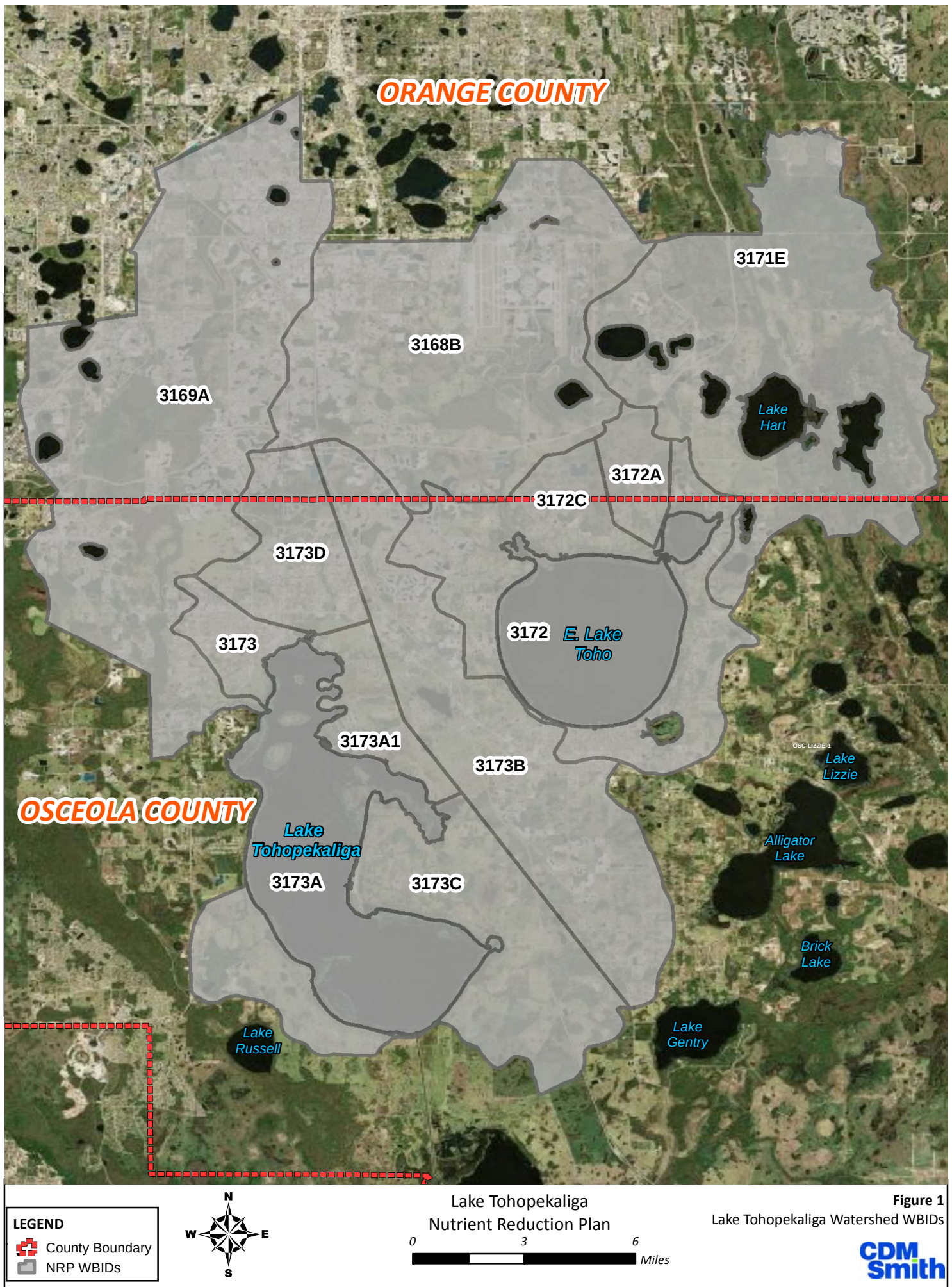
3.1 Monitoring Program

As part of the NRP, Participants committed to routine monitoring of water quality stations throughout the watershed (i.e., network) with the objective of identifying major inputs to Lake Tohopekaliga and East Lake Tohopekaliga to calculate the loading to the impaired water bodies and to identify areas of high nutrient inputs to the watershed. Core and supplemental parameters were identified in the NRP and in the last two years, Participants have solely focused on collecting the core parameters for the stations identified in the monitoring network (28 stations). The 28 monitoring stations are associated with twelve water body identification (WBIDs) units within the watershed as shown in **Figure 1**. The locations of monitoring stations shown by individual WBID are included in **Attachment B**. To date, Osceola County, the City of Kissimmee, the City of Orlando and Orange County have completed sampling collection for the specified stations. Additionally, the SFWMD continued to collect samples for several stations throughout the watershed as well as in Lake Tohopekaliga and East Lake Tohopekaliga.

Due to timing of data collection and availability, NRP monitoring data were obtained (where available) from STORET and supplemented by the Participants through the SFWMD's DBHYDRO database as well as individual data submittals. The data were imported into a Microsoft Access database and rectified to ensure consistency with field definitions and formats (the STORET field definitions were retained for this purpose). It is recommended for future biennial reports that the NRP data are routinely uploaded to STORET and obtained from one data repository for consistency and quality assurance purposes.

3.2 Monitoring Results and Trends

Since the NRP has only been in effect since early 2012, the Participants elected to consider the water quality data for trends using the monitoring results from the last 10 years (2003 – 2012 and 2013 where data were available) since many of the NRP stations were already part of several of the local governments' sampling programs. Data for Lake Tohopekaliga (WBID 3173A), however, were analyzed for the last 8 years of available data (2005 – 2012 and 2013 where data were available). This period of record for WBID 3173A was selected due to the fact that the artificial drawdown occurred in Lake Tohopekaliga in 2003/2004. The Participants wanted to eliminate additional anthropogenic influences potentially affecting trends since the impacts of lake drawdown on water quality are not well understood. Also, three major hurricanes occurred in 2004 which could also potentially impact water quality results in addition to the effects of the drawdown. To be consistent with the impaired waters rule (IWR) (Sections 62-303.351 and 62-303.352 of the Florida Administrative Code (FAC)), the Mann's one-sided, upper-tail test to determine statistically significant increasing trend at the 95 percent confidence level was used. This test is also referred to as the Mann Kendall test.



Water quality trends were analyzed by major WBID for the core parameters identified in the NRP. Specifically, water quality results for WBIDs that are tributary to Lake Tohopekaliga were analyzed for the following:

- Total phosphorus as P
- Nitrate/nitrite as N
- Total Kjeldahl nitrogen (TKN) as N
- Dissolved oxygen (DO)
- pH
- Temperature
- Conductivity

For Lake Tohopekaliga itself (WBID 3173A), water quality trends were analyzed for the following parameters:

- Total phosphorus as P
- Orthophosphate as P
- Nitrate/nitrite as N
- TKN
- Chlorophyll
- Alkalinity
- Turbidity
- Chloride
- Color
- TSS

Nitrogen dioxide and ammonium were included as parameters in the original monitoring plan for Lake Tohopekaliga but the results were not available in the current dataset and were therefore not analyzed. Additionally, for two of the WBIDs (3172A and 3173C), only data for total phosphorus (TP) were available in the dataset. A summary of the statistical analysis is provided in **Tables 1 and 2**. Graphs of the water quality data are also provided in **Attachment C**.

** It should be noted that several potential outliers were observed in the dataset. While these outliers were identified, their legitimacy was not examined further and were included in the analysis.*

Table 1
Lake Tohopekaliga Nutrient Reduction Plan
First Biennial Report Update
Tributary WBIDs - Water Quality Summary Statistics

	Hart Branch: 3171E						Boggy Creek: 3168B						Shingle Creek: 3169A						East Lake Tohopokeliga: 3172					
Parameter	Mean	P	Trend	Slope (units/day)	Δ/year	Count	Mean	P	Trend	Slope (units/day)	Δ/year	Count	Mean	P	Trend	Slope (units/day)	Δ/year	Count	Mean	P	Trend	Slope (units/day)	Δ/year	Count
Total Phosphorus as P (mg/l)	0.04	0.07	none	--	--	10	0.03	0.60	none	--	--	94	0.06	0.01	decreasing	-0.000005	-0.002	155	0.02	0.00	decreasing	-0.000002	-0.001	113
Nitrate/Nitrite as N (mg/l)	0.15	0.48	none	--	--	10	0.03	0.02	decreasing	-0.000003	-0.001	75	0.04	0.96	none	--	--	148	0.01	0.00	decreasing	-0.000002	-0.001	96
Total Kjeldahl Nitrogen as N (mg/l)	1.19	0.04	decreasing	-0.0026	-0.941	10	0.74	0.00	decreasing	-0.000148	-0.054	89	0.83	0.00	increasing	0.000075	0.027	154	0.65	0.12	none	--	--	114
Dissolved Oxygen (mg/l)	6.97	0.27	none	--	--	11	6.93	0.39	none	--	--	80	5.88	0.49	none	--	--	149	8.07	0.15	none	--	--	95
pH (SU)	6.84	0.88	none	--	--	11	6.93	0.05	none	--	--	76	7.01	0.00	increasing	0.000112	0.041	153	7.12	0.00	increasing	0.000392	0.143	99
Temperature (deg C)	23.85	1.00	none	--	--	11	21.80	0.02	decreasing	-0.0013	-0.474	86	27.39	0.01	increasing	0.001670	0.610	154	23.33	0.63	none	--	--	96
Conductivity (umhos/cm)	140.82	0.44	none	--	--	11	167.58	0.00	decreasing	-0.0165	-6.007	79	221.63	0.87	none	--	--	152	139.55	0.00	increasing	0.017300	6.314	100
Chlorophyll-a (corrected) (ug/l)																			4.00	0.04	increasing	0.000527	0.193	89

	St. Cloud Canal: 3173B						East Lake Tohopokelaliga Drain: 3172C						Jim Branch: 3172A						Partin Canal: 3173A1					
Parameter	Mean	P	Trend	Slope (units/day)	Δ/year	Count	Mean	P	Trend	Slope (units/day)	Δ/year	Count	Mean	P	Trend	Slope (units/day)	Δ/year	Count	Mean	P	Trend	Slope (units/day)	Δ/year	Count
Total Phosphorus as P (mg/l)	0.02	0.03	decreasing	-0.000001	0.000	126	0.04	0.59	none	--	--	77	0.08	0.65	none	--	--	133	0.11	1.00	none	--	--	22
Nitrate/Nitrite as N (mg/l)	0.02	0.96	none	--	--	126	0.05	0.82	none	--	--	29	No Data						0.04	0.34	none	--	--	24
Total Kjeldahl Nitrogen as N (mg/l)	0.76	0.00	increasing	0.000030	0.011	128	1.04	0.17	none	--	--	29	No Data						1.08	0.55	none	--	--	24
Dissolved Oxygen (mg/l)	7.17	0.86	none	--	--	126	4.54	0.48	none	--	--	5	No Data						2.70	1.00	none	--	--	4
pH (SU)	7.01	0.00	increasing	0.000332	0.121	128	6.72	0.36	none	--	--	5	No Data						7.35	1.00	none	--	--	4
Temperature (deg C)	28.13	0.02	increasing	0.001061	0.387	130	24.71	0.03	increasing	0.05	16.97	7	No Data						24.64	0.23	none	--	--	5
Conductivity (umhos/cm)	143.30	0.00	increasing	0.018849	6.880	128	168.12	0.82	none	--	--	5	No Data						204.53	0.75	none	--	--	4

	Lake Toho (South Segment): 3173C						Mill Slough: 3173D						City Ditch Canal: 3173					
Parameter	Mean	P	Trend	Slope (units/day)	Δ/year	Count	Mean	P	Trend	Slope (units/day)	Δ/year	Count	Mean	P	Trend	Slope (units/day)	Δ/year	Count
Total Phosphorus as P (mg/l)	0.16	0.13	none	--	--	79	0.03	0.07	none	--	--	12	0.05	1.00	none	--	--	6
Nitrate/Nitrite as N (mg/l)	No Data						0.04	0.73	none	--	--	12	0.16	0.60	none	--	--	6
Total Kjeldahl Nitrogen as N (mg/l)	No Data						0.65	0.03	decreasing	-0.001	-0.206	12	1.93	1.00	none	--	--	6
Dissolved Oxygen (mg/l)	No Data						6.48	0.94	none	--	--	11	4.52	0.48	none	--	--	5
pH (SU)	No Data						7.24	0.24	none	--	--	12	7.44	0.47	none	--	--	6
Temperature (deg C)	No Data						66.67	0.10	none	--	--	11	69.04	0.23	none	--	--	5
Conductivity (umhos/cm)	No Data						207.18	0.07	none	--	--	11	275.40	0.82	none	--	--	5

Note: "Δ/year" means change per year based on Slope x 365 days.

Table 2 Lake Tohopekaliga WBID – Water Quality Summary Statistics (2005 -2013)

Parameter	Mean	Probability (P)	Statistical Trend	Slope (units / day)	Δ/year	Sample Count
Total Phosphorus as P (mg/l)	0.05	0.00	decreasing	-0.00001	-0.002	263
Nitrate/Nitrite as N (mg/l)	0.01	0.51	none	0.00000	0.000	223
Total Kjeldahl Nitrogen as N (mg/l)	1.17	0.00	increasing	0.00007	0.026	233
Dissolved Oxygen (mg/l)	8.31	0.07	none	0.00023	0.085	212
pH (SU)	7.84	0.00	increasing	0.00025	0.092	219
Temperature (deg C)	23.70	0.20	none	-0.00043	-0.157	221
Conductivity (umhos/cm)	188.06	0.01	increasing	0.00586	2.140	222
Orthophosphate as P (mg/l)	0.01	0.00	decreasing	0.00000	0.000	200
Chlorophyll-a (corrected) (ug/l)	25.13	0.94	none	0.0000	0.000	148
Alkalinity (mg/l)	41.96	0.13	none	0.0010	0.353	233
Turbidity (NTU)	5.23	0.01	increasing	0.0006	0.203	233
Chloride (mg/l)	24.20	0.18	none	0.0005	0.176	232
Color (PCU)	76.39	0.00	decreasing	-0.0119	-4.355	231
TSS (mg/l)	8.74	0.24	none	0.0000	0.000	225

Note: "Δ/year" means change per year based on Slope x 365 days.

Trend Analysis Results

The results in Tables 1 and 2 indicate whether or not a statistically significant trend was observed for each analyzed parameter for each WBID. For the tributary WBIDs, the following observations were made:

- Statistically significant increases in water quality concentrations over the last 10 years occurred for Shingle Creek (TKN, pH and temperature), East Lake Tohopekaliga (pH, conductivity and chlorophyll-a), St. Cloud Canal (TKN, pH, temperature and conductivity) and East Lake Tohopekaliga Drain (temperature).
- Statistically significant decreases in water quality concentrations over time were observed for Hart Branch (TKN), Boggy Creek (nitrate/nitrite, TKN, temperature and conductivity), Shingle Creek (TP), East Lake Tohopekaliga (TP, nitrate/nitrite), St. Cloud Canal (TP) and Mill Slough (TKN).

For Lake Tohopekaliga, the following trends over the last 8 years were found to be statistically significant:

- TP, orthophosphate and color (decreasing with time)
- TKN, pH, conductivity and turbidity, (increasing with time)

In order to gain a sense of how quickly or slowly the concentrations are changing over time, the slope of the trend line and the change per year is included in Tables 1 and 2. The change per year for those WBIDs with a shorter period of record (e.g., WBID 3173E) should be interpreted with caution as they may exhibit rates of change that are not sustainable.

3.3 Research Accomplishments

In the NRP, a number of ideas for future research were identified for consideration by the Participants. Since the completion of the NRP, a literature search funded by Osceola County regarding the linkage between submerged aquatic vegetation and nutrients (with an emphasis on hydrilla) was completed by the University of Florida. The results of the literature search were summarized in the paper entitled *Water Column Nutrient and Abundant Hydrilla Growth on Lake Tohopekaliga* (Netherland et. al., 2012). In this paper, a number of conclusions were drawn between nutrients and hydrilla, several of which are highlighted below:

- Extensive Florida data suggest that factors other than nutrients are determining abundance of aquatic macrophytes in Florida lakes;
- Hydrilla is viewed as crucial habitat as well as indicator of impairment;
- Information on the impact of large scale aquatic plant management on water quality is not readily available;
- Evidence is strong enough to show that hydrilla has the ability to retrieve nutrients from both roots & shoots to varying degrees;
- Hydrilla can obtain a large fraction of nutrients from sediment;
- Nutrients in scraped materials represent 3.1 - 6.5 times the annual inflow of nutrients;
- While nutrients play a role in growth, water column nutrients have minimal influence on the ability of hydrilla to colonize large areas of the Kissimmee Chain of Lakes given the current sediment conditions;
- The literature is clear hydrilla can utilize nutrients from the water column; however, the consensus is that hydrilla derives primary nutrition (nitrogen and phosphorus) from the bottom sediments;
- Reduced water levels fluctuations are favorable for hydrilla expansion;
- Estimated sediment reserves of nitrogen and phosphorus and internal cycling of nutrients are adequate to sustain populations throughout the lake for extended periods of time.
- The shallow nature of Lake Tohopekaliga and large sediment pools of N&P, continued expansion of hydrilla into open waters is distinct possibility, even if inflowing N&P are reduced;
- Aggressive hydrilla growth on Lake Tohopekaliga is promoted by favorable bottom substrates, water schedules that promote stabilization, shallow lake morphology and physiological adaptations;
- Hydrilla growth and coverage on Lake Tohopekaliga are more strongly related to the invasive traits of the plant rather than to nutrient enrichment of incoming waters; and,

- While nitrogen and phosphorus reductions will have a positive benefit, the subsequent reduction of hydrilla growth would not likely occur;
- Short-term external nutrient reductions could lead to further increase in hydrilla growth;

At the time of completion, this report was concurrently shared with FDEP who also had an opportunity to review and provide comments.

The NRP Participants continue to attend and engage in the periodic Kissimmee Chain of Lakes (KCOL) Science and Management meetings that are conducted by the SFWMD. In addition to local governments within the KCOL, state agencies also attend to discuss ongoing activities within the KCOL related to water resource management. The Lake Tohopekaliga NRP has also become an important component of the meeting discussion items.

As part of continued research under the NRP effort, the Participants will coordinate with FWC and other agencies to compile and review available biological data for Lake Tohopekaliga. Such data may include snail kite nesting and success rates, fish catch rates and macroinvertebrate data.

4.0 Issues

Several issues have been identified since the completion of the NRP. The original objective of the Lake Tohopekaliga NRP monitoring plan was to *“identify major inputs to Lake Tohopekaliga and East Lake Tohopekaliga to calculate the loading to the impaired water bodies and identify areas of high nutrients in the watershed.”* While Participants are able to identify locations of high nutrients (i.e., concentrations) in the watershed, the NRP monitoring plan currently only calls for continued flow monitoring at 3 locations (Shingle Creek, Boggy Creek and the outlet of Lake Tohopekaliga) by USGS and/or SFWMD. Participants are still in the process of evaluating the feasibility of measuring flow at the tributary locations. Osceola County has identified a number of stations where “no-flow” conditions are frequently observed; therefore no samples are collected at these locations during “no-flow” events. Funding and available resources for continued monitoring also continue to be a challenge for several of the NRP Participants.

5.0 Future Activities

As part of the NRP, the Participants are committed to moving forward with implementation of identified planned and/or funded projects (Attachment A). Implementation also includes frequent evaluation of projects proposed in the NRP to make sure the projects are economically feasible and “make sense” in terms of meeting the NRP goals for reducing external nutrient loads to the lake.

ATTACHMENT A

Lake Tohopekaliga Nutrient Reduction Plan - First Biennial Report Update – City of Kissimmee Management Actions by Stakeholder

Project Number	Project Name	Project Detail	Project Type	Treatment Acres	End Date	Status	TN Reduction (lbs/yr)	TP Reduction (lbs/yr)
City of Kissimmee								
KS-1	Education and Outreach ¹	PSAs, pamphlets, presentations, website, illicit discharge program	Education	N/A	Ongoing	Ongoing	701.8	73.6
KS-2	Street Sweeping ¹	Sweep 8,500 miles/yr	Street Sweeping	N/A	Ongoing	Ongoing	1,530.0	1,020.0
KS-3	Lake Tivoli	Addition of stormwater treatment	Wet detention pond	132.8	Envisioned but not funded	Envisioned but not funded	285.1	50.9
KS-4	Lakefront Park Redevelopment	Addition of stormwater treatment	Swales/Rain Gardens	14.7	Unknown	Construction	7.3	1.0
KS-5	Lakefront Park Redevelopment	Addition of stormwater treatment	2 nd generation baffle boxes	N/A	2015	Three baffle boxes and 3 filter boxes have been installed. City plans to install an additional 2 baffle boxes in the next 5 years.	Not quantified	Not quantified
KS-6	Judge Farms Feasibility Analysis	Feasibility study for large scale surface water retrofit / alternative water supply	Feasibility Study	~10,000	2012	Ongoing Evaluation	See Project OSC-23	See Project OSC-23
KS-7	Oak Street Widening from West of Main Street to US 192	Wet detention pond	150% requirement met	6.3	2015	Under Construction	Not quantified	Not quantified
KS-8	Expansion of MLK Boulevard pond	Wet detention pond	150% requirement met	4.6	Unknown	Planned and Funded	Not quantified	Not quantified
KS-9	MLK Boulevard Phase III from Thacker Avenue to Dyer Boulevard	Dry detention/wet detention pond	150% requirement met	33.2	2015	Under Construction	Not quantified	Not quantified
Totals:				615.2			3,069.6	1,204.1

1. Activities began before 2009.

Lake Tohopekaliga Nutrient Reduction Plan - First Biennial Report Update – City of St. Cloud
Management Actions by Stakeholder

Project Number	Project Name	Project Detail	Project Type	Treatment Acres	End Date	Status	TN Reduction (lbs/yr)	TP Reduction (lbs/yr)
City of St. Cloud								
SC-1	Lakeshore Reclaim Augmentation	Stormwater harvesting (permitted up to 2 MGD)	Stormwater harvesting	N/A	09/11	Ongoing	Not quantified ²	Not quantified ²
SC-2	Education and Outreach ¹	FYN; landscaping, irrigation, fertilizer, pet waste management ordinances; PSAs; pamphlets; website; illicit discharge program	Education	N/A	Ongoing	Ongoing	2,529.1	220.9
SC-3	Judge Farms Feasibility Analysis	Feasibility study for large scale surface water retrofit / alternative water supply	Feasibility Study	~10,000	2012	Ongoing Evaluation	See Project OSC-23	See Project OSC-23
SC-4	Street Sweeping ¹	Sweep 2,750 miles/yr	Street Sweeping	N/A	Ongoing	Ongoing	Not quantified	Not quantified
Totals:				N/A			2,529.1	220.9

1. Activities began before 2009.

2. The city will need to collect information on the amount of stormwater that goes to reuse annually to quantify credit.

**Lake Tohopekaliga Nutrient Reduction Plan - First Biennial Report Update – Osceola County
Management Actions by Stakeholder**

Project Number	Project Name	Project Description	Treatment Acres	Project Cost	End Date	Status	TN Reduction (lbs/yr)	TP Reduction (lbs/yr)
Osceola County								
OSC-1 ¹	Boggy Creek II - Pond 1 (150% plus additional treatment)	Wet detention pond	8.2	\$6,712,156 (Ponds 1, 2, 3)	Unknown	Envisioned, Not Funded	0.5	0.0
OSC-2 ¹	Boggy Creek II - Pond 2 (150% plus additional treatment)	Wet detention pond	6.2	\$6,712,156 (Ponds 1, 2, 3)	Unknown	Envisioned, Not Funded	0.1	0.0
OSC-3 ¹	Boggy Creek II - Pond 3 (150% plus additional treatment)	Wet detention pond	5.9	\$6,712,156 (Ponds 1, 2, 3)	Unknown	Envisioned, Not Funded	0.3	0.0
OSC-4	John Young Pwy Widening Parnell St. to Osceola Pkwy Pond A	Wet detention pond	23.8	Unknown	04/2011	Completed	0.9	0.3
OSC-5	Narcoossee Rd IB - Pond 2 and 3	Wet detention pond	21.6	Unknown	09/2011	Completed	4.9	0.3
OSC-6	Narcoossee Rd III - Pond C3A & C3B	Wet detention pond	19.4	Unknown	2012	Completed	6.9	0.3
OSC-7	Narcoossee Rd III - Pond D3	Wet detention pond	24.2	Unknown	2012	Completed	2.0	0.1
OSC-8	Narcoossee Rd III - Pond E1	Wet detention pond	10.8	Unknown	2012	Completed	1.9	0.1
OSC-9 ¹	Hoagland Blvd II - Pond 3 (150% plus additional treatment)	Wet detention pond	36.7	Unknown	Unknown	Envisioned, Not Funded	21.6	6.4
OSC-10 ¹	Poinciana III –Swales 1, 2, and 3 (150% plus additional treatment)	Swales with blocks or raised culverts	60.6	Unknown	2018	Planned and Funded	0.5	0.0
OSC-11	Stewart Street Regional Pond Retrofit	Wet detention pond	2,300	Unknown	2009	Completed	2,667.0	381.3
OSC-12	East Lake Reserve Reuse ²	Stormwater reuse	3.7	Unknown	12/2028	Ongoing	255.9	5.8
OSC-13	Neptune Road Reuse ²	Stormwater reuse	3.0	\$640,690	09/2027	Ongoing	849.0	62.0
OSC-14	Waterside Vista Reuse	Stormwater reuse	0.3	Unknown	02/2030	Ongoing	29.0	0.7
OSC-15	Bellalago & Isles of Bellalago Reuse	Stormwater reuse	327.0	Unknown	05/2031	Ongoing	3,807.5	277.6
OSC-16	Poinciana Commerce Center Reuse ²	Stormwater reuse	1.3	Unknown	06/2028	Ongoing	33.6	2.8
OSC-17	Kissimmee Bay Reuse ²	Stormwater reuse	130.0	Unknown	10/2030	Ongoing	588.9	13.1
OSC-18	Remington Reuse	Stormwater reuse	139.0	Unknown	11/2015	Ongoing	382.6	15.1
OSC-19	Eagle Lake Reuse ²	Stormwater reuse	17.3	Unknown	07/2023	Ongoing	1,204.6	84.6

Project Number	Project Name	Project Description	Treatment Acres	Project Cost	End Date	Status	TN Reduction (lbs/yr)	TP Reduction (lbs/yr)
Osceola County								
OSC-20	La Quinta Inn Reuse ²	Stormwater reuse	2.8	Unknown	10/2022	Ongoing	90.8	7.0
OSC-21	Street Sweeping ²	Street Sweeping	N/A	\$55,000/yr	Ongoing	Ongoing	232	149
OSC-22	Education ²	FYN; landscaping, irrigation, fertilizer, pet waste ordinances; PSAs; pamphlets; website; illicit discharge program	N/A	Unknown	Ongoing	Ongoing	8,441.9	795.2
OSC-23 ³	Lake Toho Regional Water Storage Facility (fka Judge Farms)	Large scale surface water retrofit/alternative water supply land acquisition & construction	~10,000	Unknown	2016	Ongoing	34,000	3,650
OSC-24	Marydia Sewer Improvements	Septic tank replacement program	N/A	Phase 1 - \$1.4 million	Unknown	Phase 1 Funded	Not quantified	Not quantified
OSC-25	Bill Beck - Ponds A, B and C	Wet detention pond	150% requirement met	\$7,198,754	Unknown	Envisioned, Not Funded	Not quantified	Not quantified
OSC-26	Boggy Creek 1 - Ponds A, C-1, and C-2	Wet detention pond	150% requirement met	\$16,782,823	Unknown	Started	Not quantified	Not quantified
OSC-27	Carrol St. JYP to Thacker Ave (Ph 2)	Wet detention pond	150% requirement met	\$4,221,836	Unknown	Envisioned, Not Funded	Not quantified	Not quantified
OSC-28	Carrol St. JYP to Old Dixie Hwy (Ph 1)	Wet detention pond	150% requirement met	\$14,181,153	Unknown	Envisioned, Not Funded	Not quantified	Not quantified
OSC-29	Neptune Rd II & III (4 ponds)	Wet detention pond	150% requirement met	Unknown	Unknown	Envisioned, Not Funded	Not quantified	Not quantified
OSC-30	Old Canoe Creek Rd – Ponds A and B	Wet detention pond	150% requirement met	Unknown	Unknown	Envisioned, Not Funded	Not quantified	Not quantified
OSC-31	Osceola Parkway II – Pond I	Wet detention pond	150% requirement met	Unknown	Unknown	Envisioned, Not Funded	Not quantified	Not quantified
OSC-32	Hoagland Blvd I (& Airport) – Pond 100	Dry detention	150% requirement met	Unknown	2012	Completed	Not quantified	Not quantified
OSC-33	Hoagland Blvd I (& Airport) – Pond 200	Retention BMPs	150% requirement met	Unknown	2012	Completed	Not quantified	Not quantified
OSC-34	Hoagland Blvd III – Pond 2A	Wet detention pond	150% requirement met	Unknown	Unknown	Envisioned, Not Funded	Not quantified	Not quantified
OSC-35	Shady Lane US-192 to Partin Settlement – Pond 10	Wet detention pond	150% requirement met	Unknown	Unknown	Envisioned, Not Funded	Not quantified	Not quantified
OSC-36	Buenaventura Lakes Golf Course Ponds	Two new ponds (previously a golf course)	NA	N/A	2013	Completed	Not quantified	Not quantified

Project Number	Project Name	Project Description	Treatment Acres	Project Cost	End Date	Status	TN Reduction (lbs/yr)	TP Reduction (lbs/yr)
Osceola County								
OSC-37	Slaman	Conservation Areas	NA	N/A	3/10/2008	Completed	Not quantified	Not quantified
OSC-38	Bagbey	Conservation Areas	NA	N/A	5/5/2008	Completed	Not quantified	Not quantified
OSC-39	Mayo	Conservation Areas	NA	N/A	10/22/2008	Completed	Not quantified	Not quantified
OSC-40	Jim Yates	Conservation Areas	NA	N/A	12/17/2008	Completed	Not quantified	Not quantified
OSC-41	Udstad	Conservation Areas	NA	N/A	7/2/2009	Completed	Not quantified	Not quantified
OSC-42	Proctor	Conservation Areas	NA	N/A	8/6/2009	Completed	Not quantified	Not quantified
OSC-43	Twin Oaks	Conservation Areas	NA	N/A	11/10/2010	Completed	Not quantified	Not quantified
OSC-44	Cherokee Point	Conservation Areas	NA	N/A	6/14/2012	Completed	Not quantified	Not quantified
OSC-45	Encatada Resort	Stormwater Reuse for Landscape Irrigation from pond	0.5 ac irrigated	N/A	10/18/2032	Planned & Funded	Not quantified	Not quantified
OSC-46	Cypress Palms Condos	Stormwater Reuse for Landscape Irrigation from pond	2.0 ac irrigated	N/A	3/16/2032	Planned & Funded	Not quantified	Not quantified
OSC-47	Lake Pointe	Stormwater Reuse for Landscape Irrigation from on-site pond	1.0 ac irrigated	N/A	Unknown	Planned & Funded	Not quantified	Not quantified
OSC-48	Traditions at Westside	Stormwater Reuse for Landscape Irrigation from on-site pond	6.2 ac irrigated	N/A	Unknown	Planned & Funded	Not quantified	Not quantified
OSC-49	Neptune Rd. Phase 1 - Pond 100	Road Improvement	85.2	N/A	10/15/2010	Completed	Not quantified	Not quantified
OSC-50	Neptune Rd. Phase 1 - Pond 200	Road Improvement	51.2	N/A	10/15/2010	Completed	Not quantified	Not quantified
OSC-51	Neptune Rd. Phase 1 - Pond 300	Road Improvement	95.2	N/A	10/15/2010	Completed	Not quantified	Not quantified
Totals:			3,142.7				91,154.3	9,544.1

1. The load reduction shown is for the additional amount beyond the 150% treatment requirement. The credit associated with only the 150% increase in treatment volume has not been quantified.
2. Activities began before 2009.
3. As this project is under design, the County will be routinely re-evaluating load removal capabilities of the proposed facility based on current design configurations.

Lake Tohopekaliga Nutrient Reduction Plan - First Biennial Report Update – City of Orlando
Management Actions by Stakeholder

Project Number	Project Name	Project Detail	Project Type	Treatment Acres	Project Cost	End Date	Status	TN Reduction (lbs/yr)	TP Reduction (lbs/yr)
City of Orlando									
ORL-1	Lake Angel/Conroy Basin Drainage Project - 18th St/Parramore Ave Baffle Box	Baffle box installed to remove gross pollutants, including organic debris, sediment and litter.	2nd generation baffle box – closed basin	5.4	\$578,138 (both ORL-1 and 2)	Aug-09	Completed	0.0	0.0
ORL-2	Lake Angel/Conroy Basin Drainage Project - 19th St/Parramore Ave Baffle Box	Baffle box installed during project to remove gross pollutants, including organic debris, sediment and litter.	2nd generation baffle box – closed basin	10.9	\$578,138 (both ORL-1 and 2)	Aug-09	Completed	0.0	0.0
ORL-3	Miscellaneous Neighborhoods Storm Sewer Improvements Lake Holden - Albert Shores	Storm drainage improvements throughout Lake Holden Terrace, W. Illiana St., Sunrise Court, Wadsworth Ave, Joseph St, Compton Ave., Pineloch Ave, Albert St., and Richard Place.	2nd generation baffle boxes and Storm Flo unit – closed basin	86.23	\$3,511,000	2012	Completed	0.0	0.0
ORL-4	Pine Street/Orange Blossom Trail Corridor Stormwater Improvements	Installation of 1,800 feet of stormwater pipe from Pine Street to Lake Lorna Doone, which includes a baffle box.	2nd generation baffle box	11.49	\$577,822	May-10	Completed	7.1	0.0
ORL-5	Lake Pineloch Basin Inlet Baskets	Remove gross pollutants, including organic debris and sediment, from runoff and suspend from standing water level to prevent leaching.	Catch basin inserts/inlet filters	120.70	\$40,480	2009	Completed	0.2	0.1
ORL-6	Lorna Doone Wetlands	Wetland created to remove pollutants from runoff; a new weir was installed that increased residence time.	Wet detention pond	29.52	Unknown	2011	Completed	Not quantified	Not quantified
ORL-7	Street Sweeping ¹	Street sweeping of 17,903 curb miles/yr	Street sweeping	N/A	\$1,800,000 - annually	Ongoing	Ongoing	3,222.5	2,148.4
ORL-8	Public Education ¹	FYN; landscaping, irrigation, pet waste management ordinances; PSAs; pamphlets; website; illicit discharge program	Public education	N/A	\$80,000	Ongoing	Ongoing	4,775.9	356.6
ORL-9	Lake Angel Drainage Improvements	Expanding permanent pool volume of lake and installing baffle boxes in main inflow pipes	Wet detention pond + 2 nd generation baffle boxes	87	\$2,000,000	Dec-14	Planned & Funded	Not quantified	Not quantified
ORL-10	Cemex-S. Division Ave. Roadway and Drainage Improvements	Pave access road to industrial park and install baffle box to capture sediments; Install curbing along additional areas along Division Avenue to allow street sweepers to capture sediment; Design stormwater system to address water quality and quantity entering Lake Holden basin	2 nd generation baffle box + Street sweeping	N/A	\$1,500,000	Apr-15	Planned & Funded	Not quantified	Not quantified
Totals:				351.2				7,985.6	2,505.1

1. Activities began before 2009.

**Lake Tohopekaliga Nutrient Reduction Plan - First Biennial Report Update – Orange County
Management Actions by Stakeholder**

Project Number	Project Name	Project Type	Project Cost	Annual O&M Costs	End Date	Status	TN Reduction (lbs/yr)	TP Reduction (lbs/yr)
Orange County								
OC-1	Education and Outreach ¹	FYN; landscaping, irrigation, fertilizer, pet waste ordinances; PSAs; pamphlets; website; illicit discharge program	Unknown	\$0	Ongoing	Ongoing	Not quantified	Not quantified
OC-2	Lake Odell Curb Inlet Baskets	Catch basin inserts/inlet filters	\$3,000	\$666	2008	Ongoing	0.8	0.3
OC-3	Lake Conway Inlet Baskets	Catch basin inserts/inlet filters	\$50,000	\$11,100	2009	Ongoing	3.9	1.3
OC-4	Lake Holden Curb Inlet Baskets	Catch basin inserts/inlet filters	\$41,000	\$9,102	2009	Ongoing	22.3	7.3
OC-5	Lake Jessamine Inlet Baskets	Catch basin inserts/inlet filters	\$110,000	\$24,420	2008	Ongoing	13.6	4.5
OC-6	Hansel Avenue Pond Improvements	Treatment train	\$224,713	\$2,500	2008	Completed	Not quantified	Not quantified
OC-7	Lake Conway Street Sweeping ¹	Street sweeping	\$0	\$44,015	Ongoing	Ongoing	115.7	52.1
OC-8	Lake Holden Street Sweeping ¹	Street sweeping	\$0	\$15,198	Ongoing	Ongoing	40.0	18.0
OC-9	Lake Jessamine Street Sweeping ¹	Street sweeping	\$0	\$11,003	Ongoing	Ongoing	28.9	13.0
OC-10	Lisa Waterway CDS	CDS unit	\$225,000	\$5,362	Ongoing	Completed	Not quantified	Not quantified
OC-11	Lake Cane CIB	Catch basin inserts/inlet filters	Unknown	Unknown	2012	Planned and Funded	Not quantified	Not quantified
OC-12	Lake Pineloch Alum Treatment	Sediment Inactivation	\$153,272	\$0	2011	Completed	Not quantified	Not quantified
OC-13	Lake Cane Alum Treatment	Sediment Inactivation	\$80,000	\$0	2012	Completed	Not quantified	Not quantified
OC-14	Lake Floy Lake Alum Treatment	Sediment Inactivation	\$16,000	\$0	2012	Completed	Not quantified	Not quantified
OC-15	Lake Pineloch Alum Injection	Sediment Inactivation	Unknown	Unknown	2013	Envisioned, Not Funded	Not quantified	Not quantified
OC-16	Lake Pineloch Keystone Baffle Box	2nd generation baffle box	Unknown	Unknown	2013	Planned and Funded	Not quantified	Not quantified
OC-17	Bumby Alum Injection	Sediment Inactivation	\$15,000	Unknown	2013	Envisioned, Not Funded	Not quantified	Not quantified
OC-18	Lake Anderson Mobile Alum Injection	Sediment Inactivation	Unknown	Unknown	2012	Envisioned, Not Funded	Not quantified	Not quantified

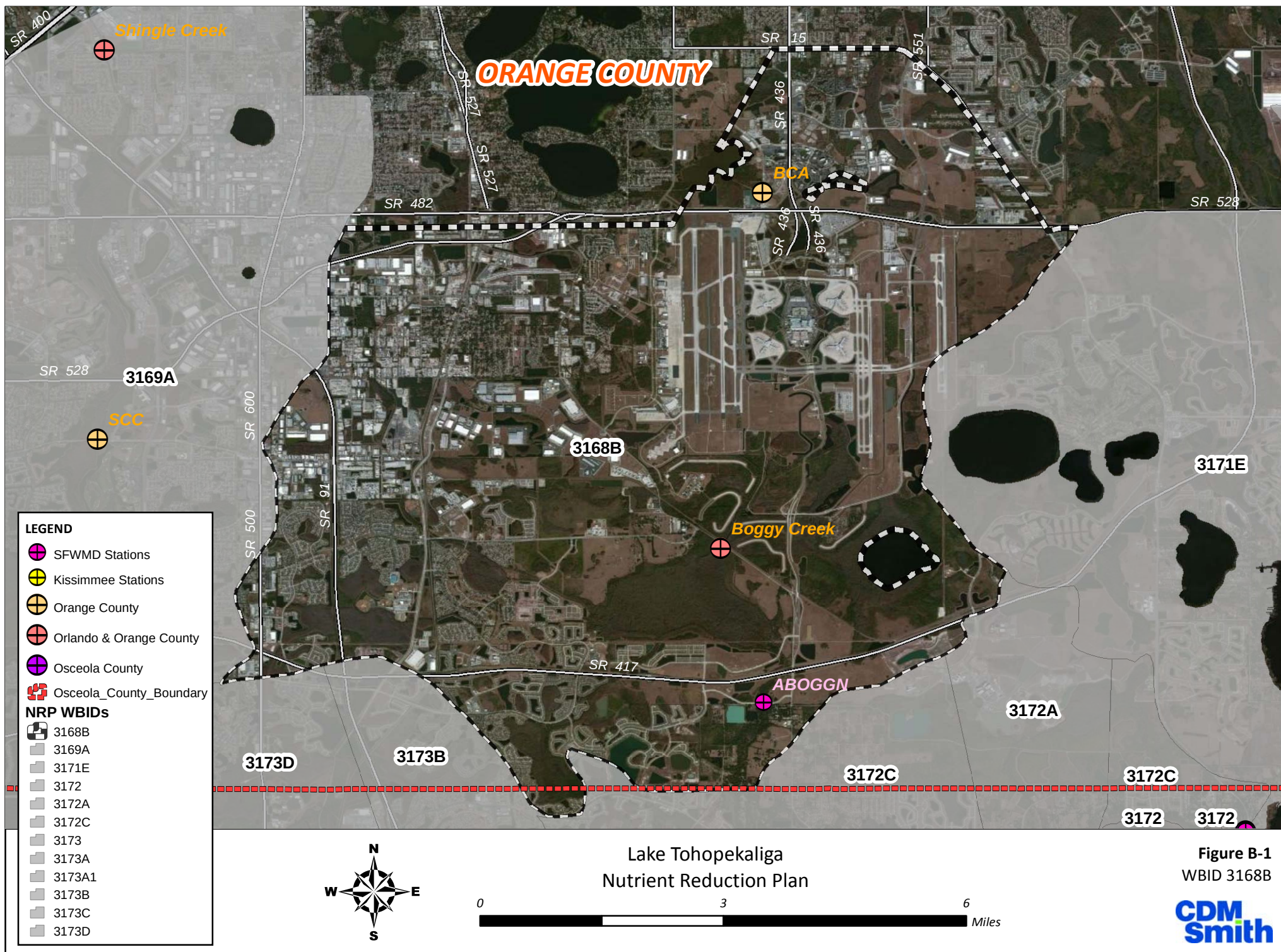
Project Number	Project Name	Project Type	Project Cost	Annual O&M Costs	End Date	Status	TN Reduction (lbs/yr)	TP Reduction (lbs/yr)
Orange County								
OC-19	Lake Gem Mary Alum Injection	Sediment Inactivation	Unknown	Unknown	2013	Envisioned, Not Funded	Not quantified	Not quantified
OC-20	Randolph Ave Stormceptor	Stormceptor	Unknown	Unknown	Unknown	Completed	Not quantified	Not quantified
OC-21	Randolph Ave CDS	CDS unit	Unknown	Unknown	Unknown	Completed	Not quantified	Not quantified
OC-22	Randolph Pond	Dry detention	Unknown	Unknown	Unknown	Completed	Not quantified	Not quantified
OC-23	Lake Anderson Study	Public education	\$83,029	\$0	2012	Completed	Not quantified	Not quantified
OC-24	Lake Christie Study	Public education	\$79,784	\$0	2012	Planned and Funded	Not quantified	Not quantified
OC-25	Lake Jennie Jewel Study	Public education	\$99,970	\$0	2012	Planned and Funded	Not quantified	Not quantified
OC-26	Lake Condel Study	Public education	\$66,061	\$0	2012	Planned and Funded	Not quantified	Not quantified
OC-27	Shingle/Boggy/Hart Basin Street Sweeping ¹	Street sweeping	Unknown	Unknown	Ongoing	Ongoing	Not quantified	Not quantified
OC-28	Lake Mary Jess Pond	Wet detention pond	Unknown	Unknown	2013	Completed	Not quantified	39.0 ²
OC-29	Lake Jessamine Alum	Sediment Inactivation	\$246,000	\$0	2012	Completed	Not quantified	Not quantified
OC-30	Lake Tyner Alum	Sediment Inactivation	\$15,000	\$0	2013	Completed	Not quantified	Not quantified
OC-31	Lake Odell Sediment Sump	Sediment Retention	\$50,000	Unknown	2014	Planned and Funded	Not quantified	Not quantified
Totals:							225.2	135.5

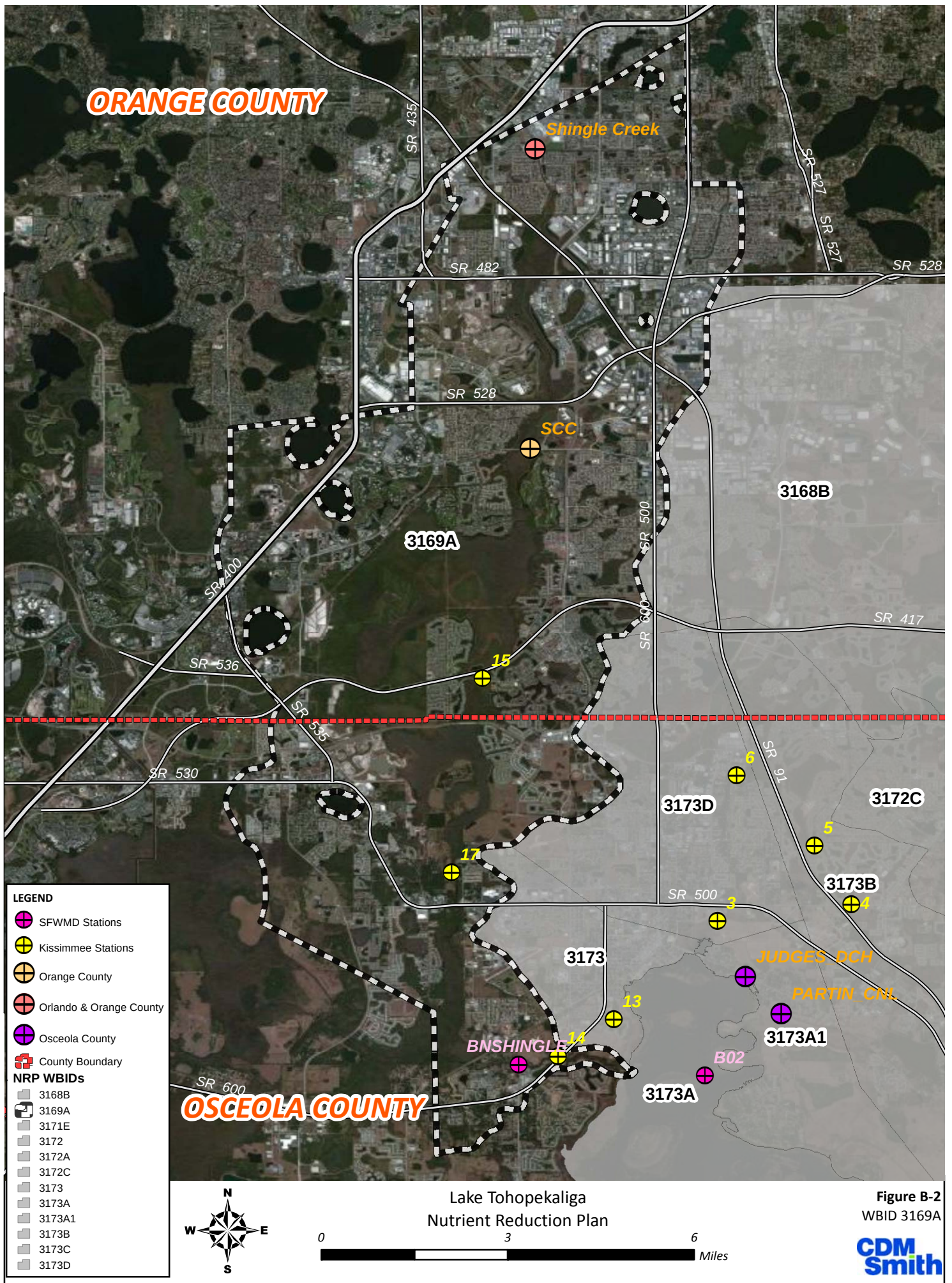
1. Activities began before 2009.
2. TP load reduction based on values provided by Orange County

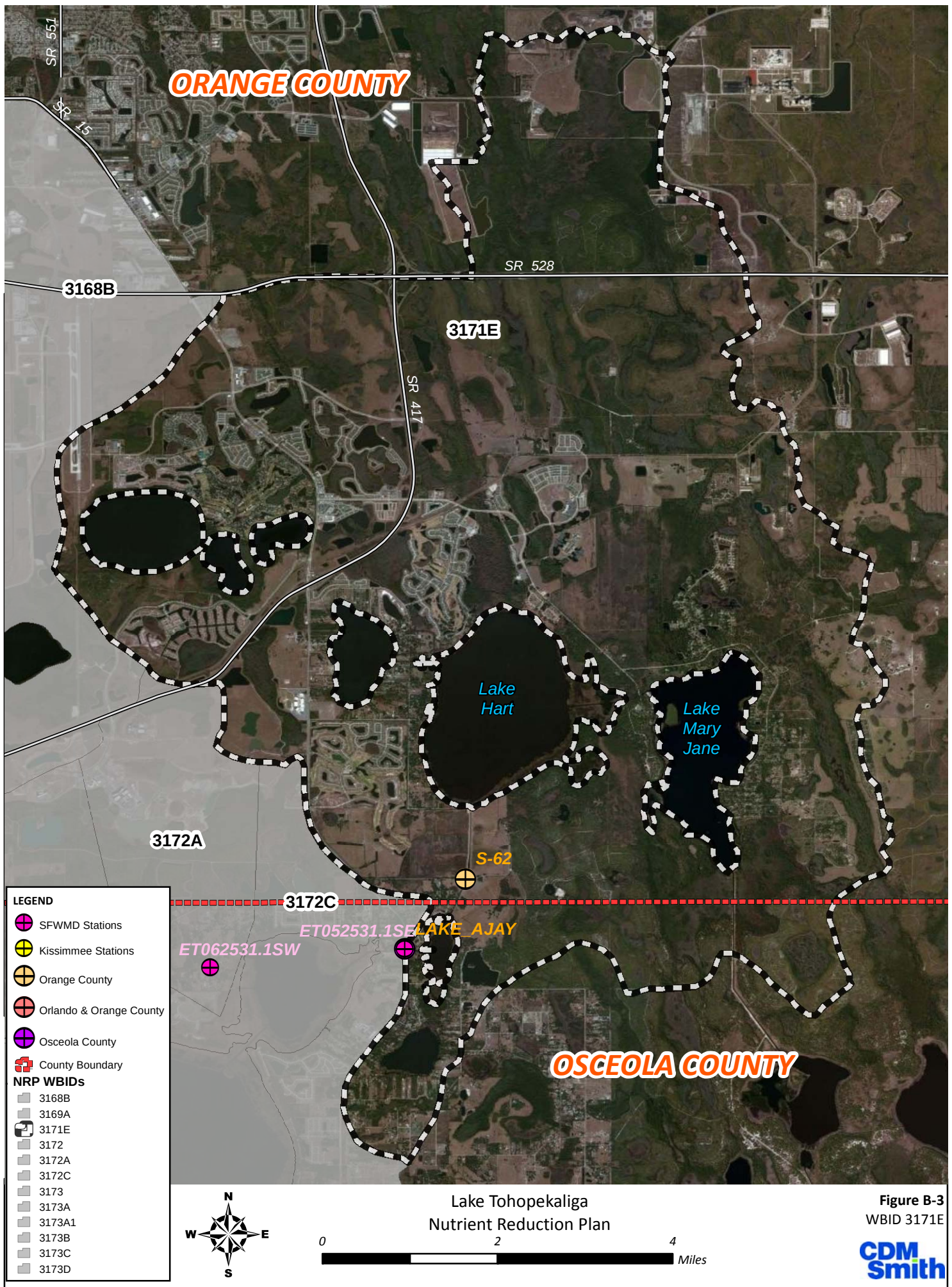
**Lake Tohopekaliga Nutrient Reduction Plan - First Biennial Report Update - FDOT
Management Actions by Stakeholder**

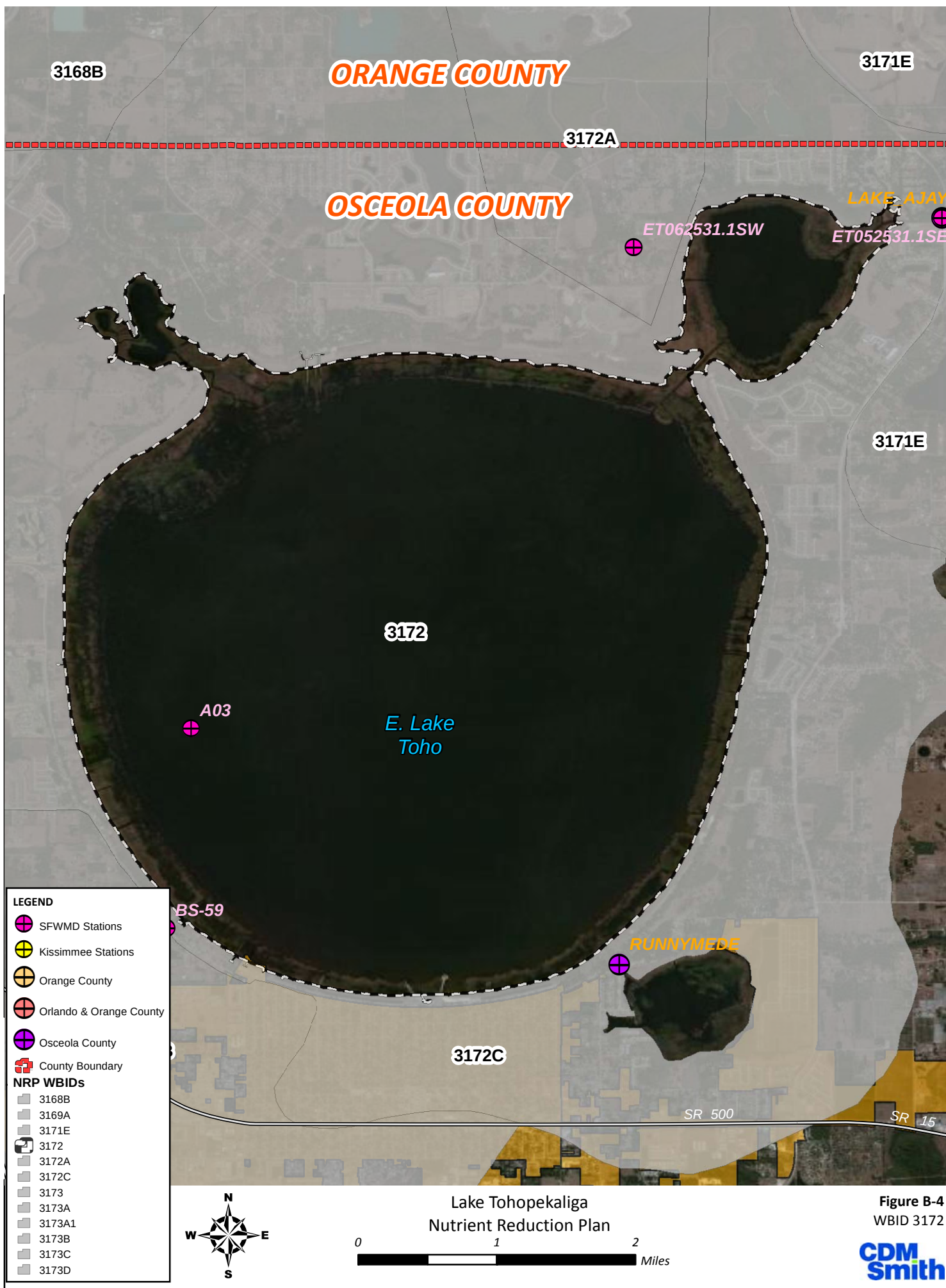
Project Number	Project Name	Project Detail	Project Type	Treatment Acres	End Date	Status	TN Reduction (lbs/yr)	TP Reduction (lbs/yr)
FDOT								
FDOT-1	239266-3-Ponds 1, 2, and 3	SR 15 (Hoffner Ave) widening project	Wet detention pond	33.1	2016	Planned and Funded	23.4	1.4
FDOT-2	239266-4-Pond 4	SR 15 (Hoffner Ave) widening project	Wet detention pond	16.5	2016	Planned and Funded	14.0	0.6
FDOT-3	407143-2	Widen / Resurface Sand Lake Road (SR 482) from Presidents Drive to OBT.	Swales/dry detention	31.8	2011	Construction Complete	45.7	6.2
FDOT-4	407143-3	Six Lane Sand Lake Road (SR 482) from Turkey Creek to West of JYP.	Wet detention pond	63.3	Unknown	Envisioned, Not Funded	183.5	42.9
FDOT-5	239683-1	Widen (4 to 6 lane) SR 500 (US 192) from Eastern Ave. to Nova Road.	Wet detention pond	88.4	2016	Planned and Funded	69.3	5.2
FDOT-6	239682-1	Widen (4 to 6 lane) SR 500 (US 192) from Aeronautical Drive to Budinger Ave.	Wet detention pond	109.6	2016	Planned and Funded	274.6	67.2
FDOT-7	Public Education	Pamphlets, website, illicit discharge program	Public education	N/A	Ongoing	Ongoing	156.4	16.7
FDOT-8	Street Sweeping	Street sweeping – 433,876 kg/yr	Street sweeping	N/A	Ongoing	Ongoing	613.1	276.1
Totals:				342.7			1,379.8	416.2

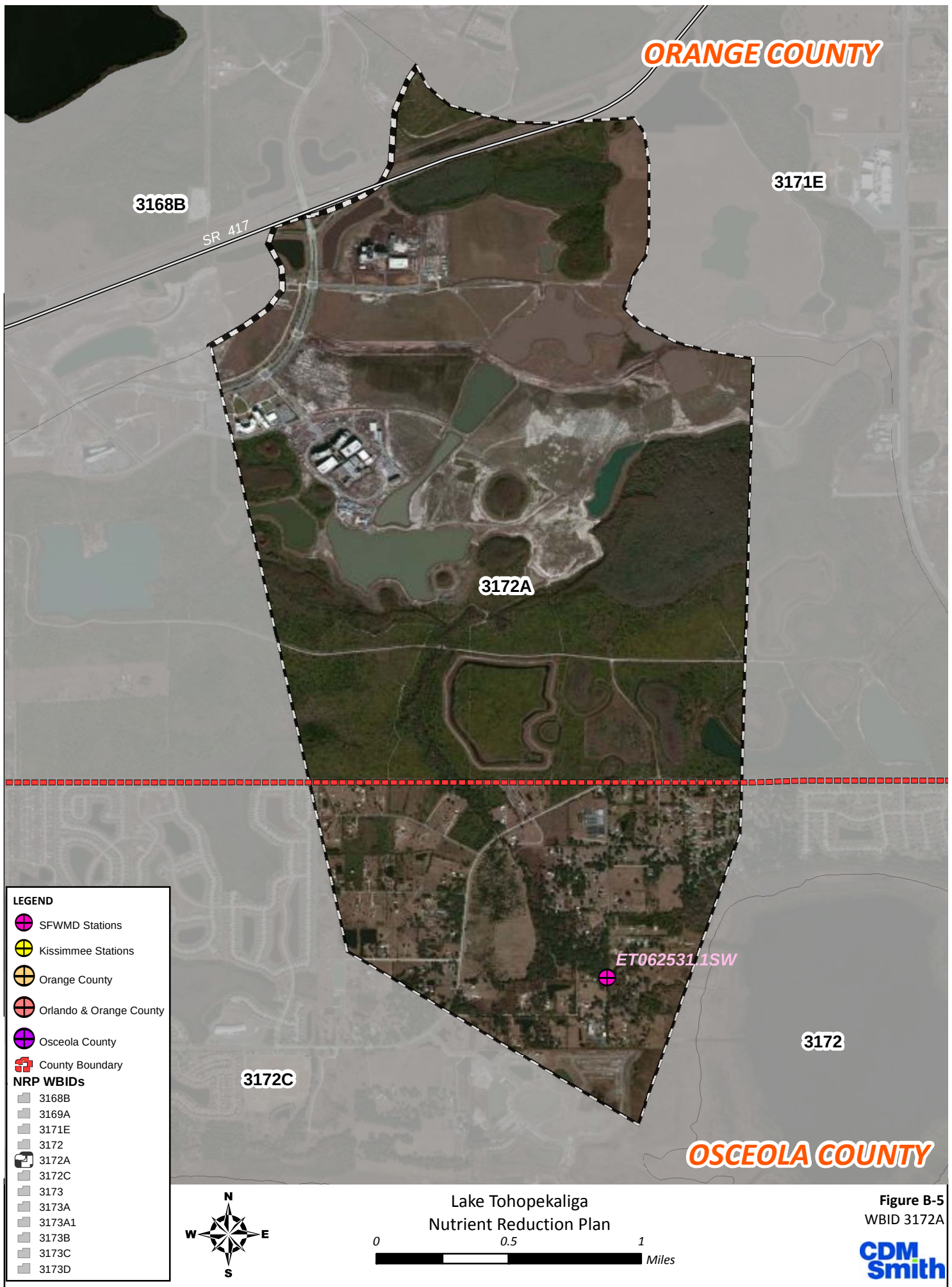
ATTACHMENT B

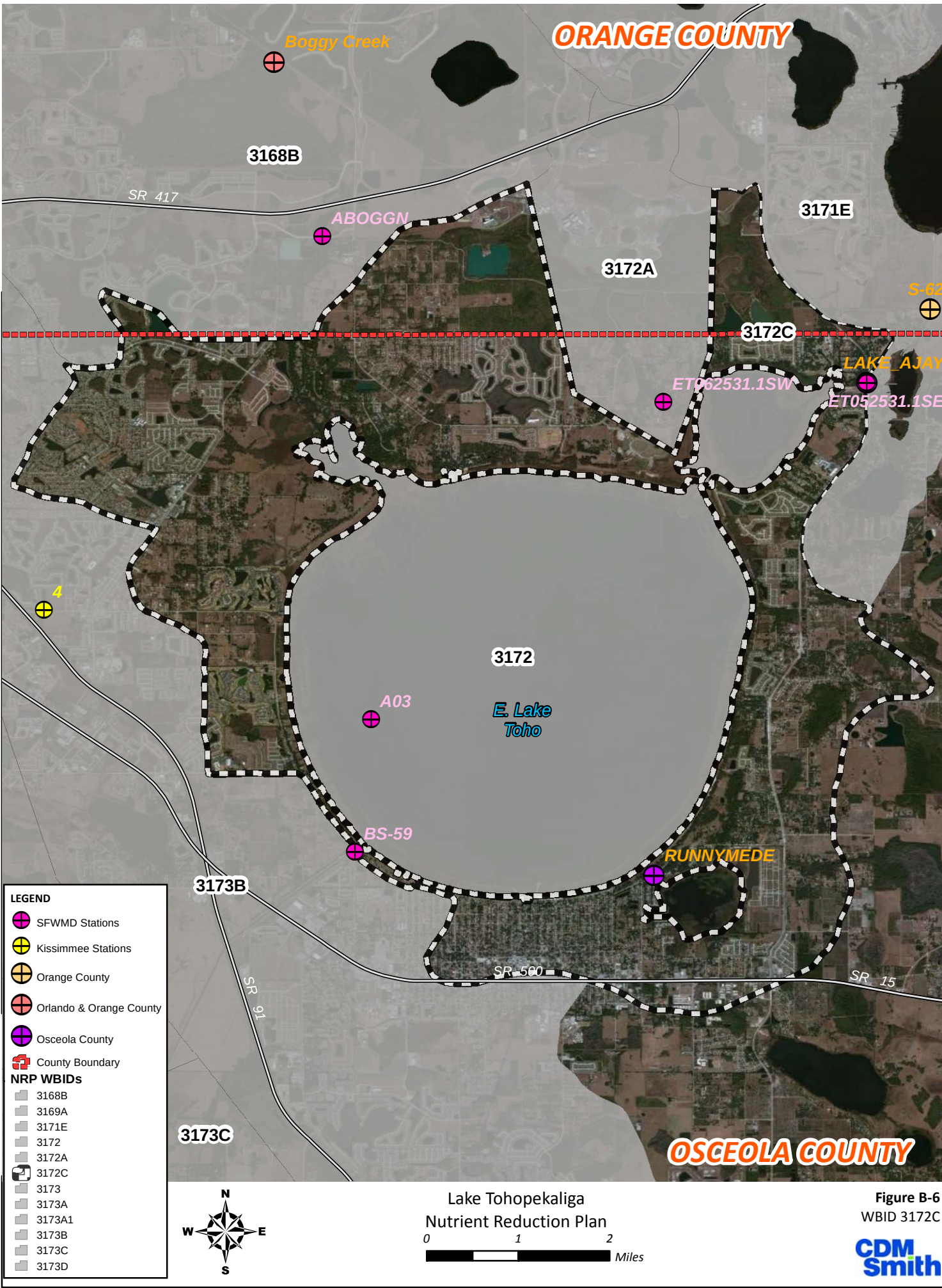


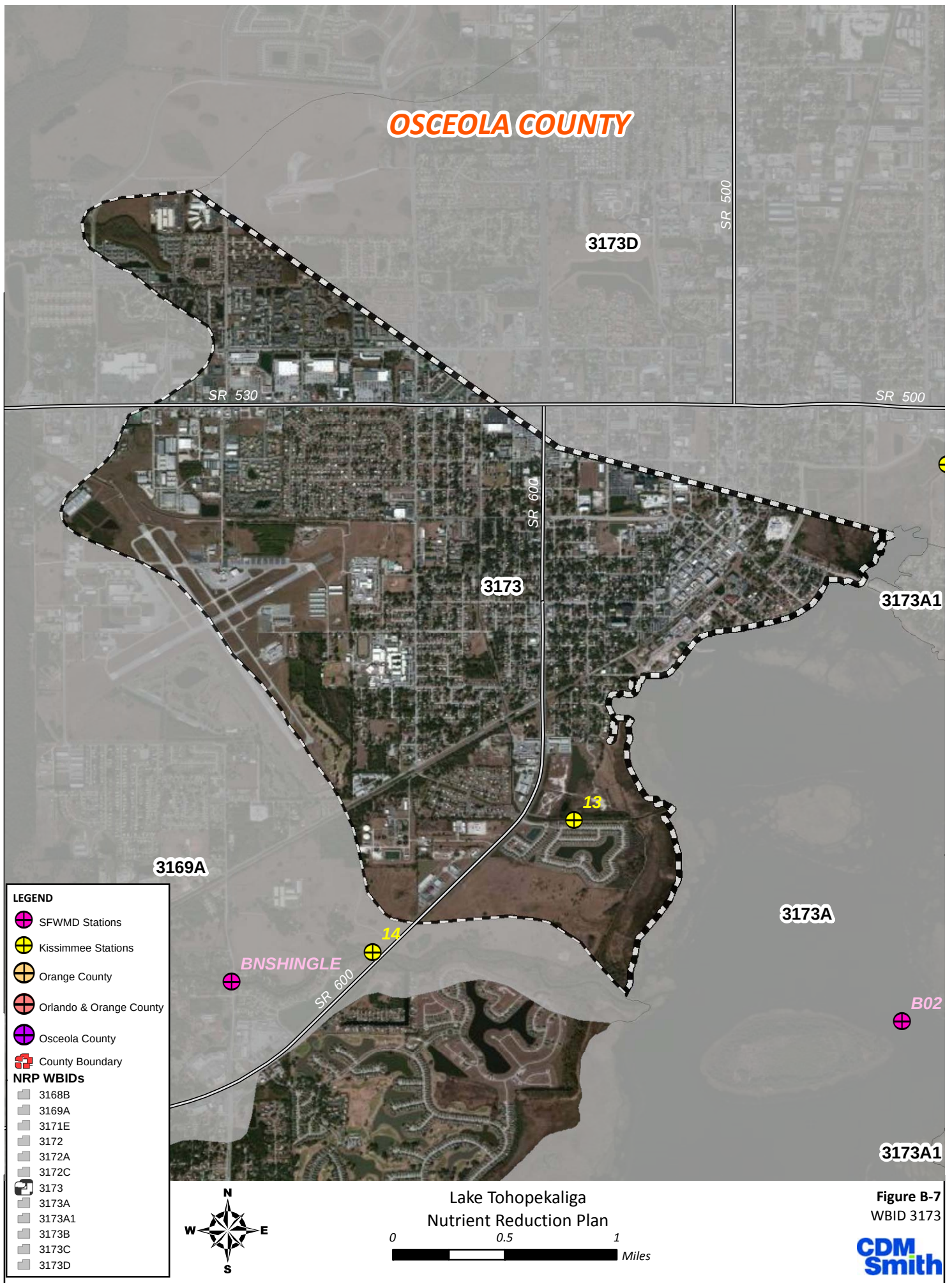


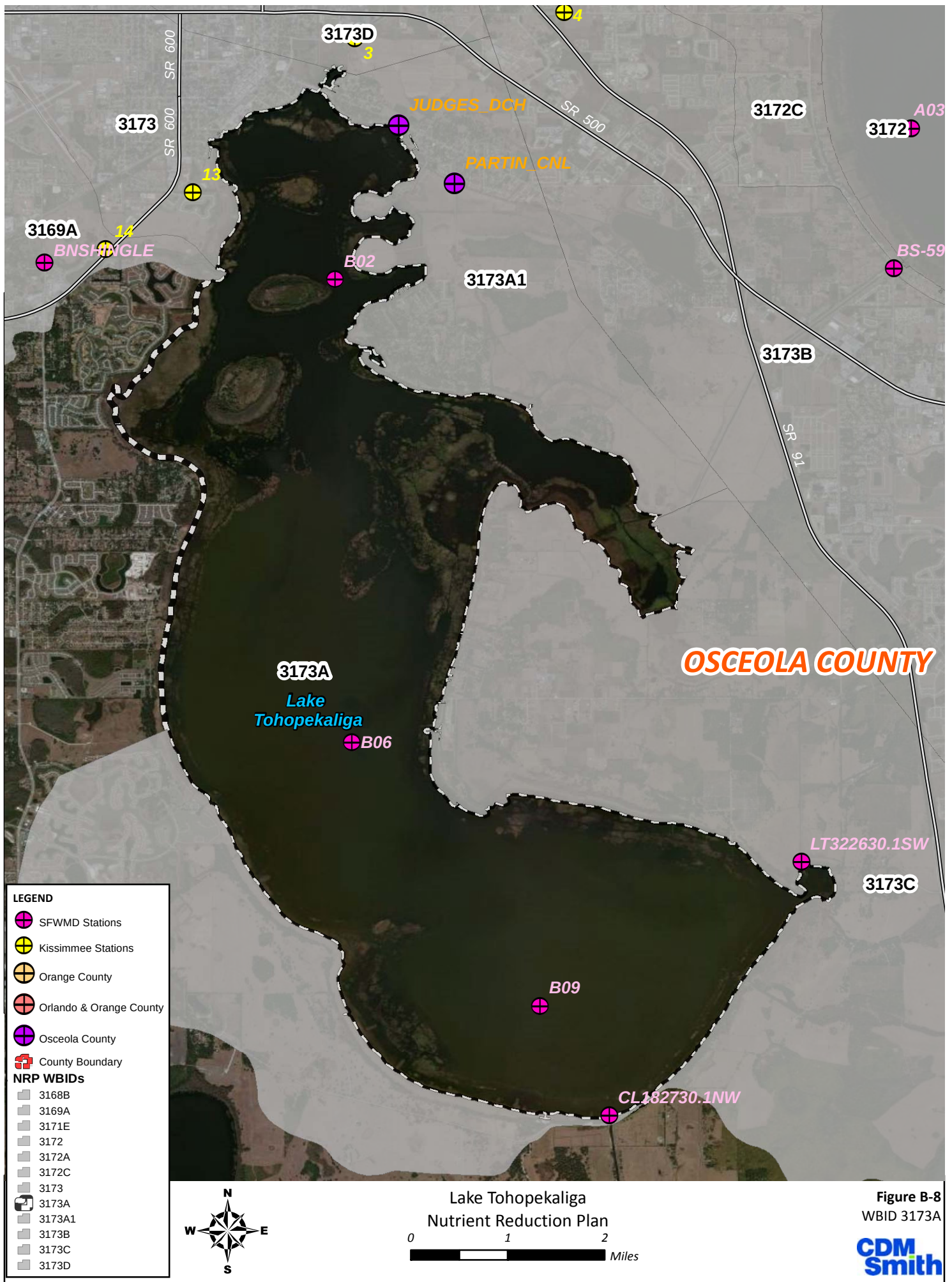












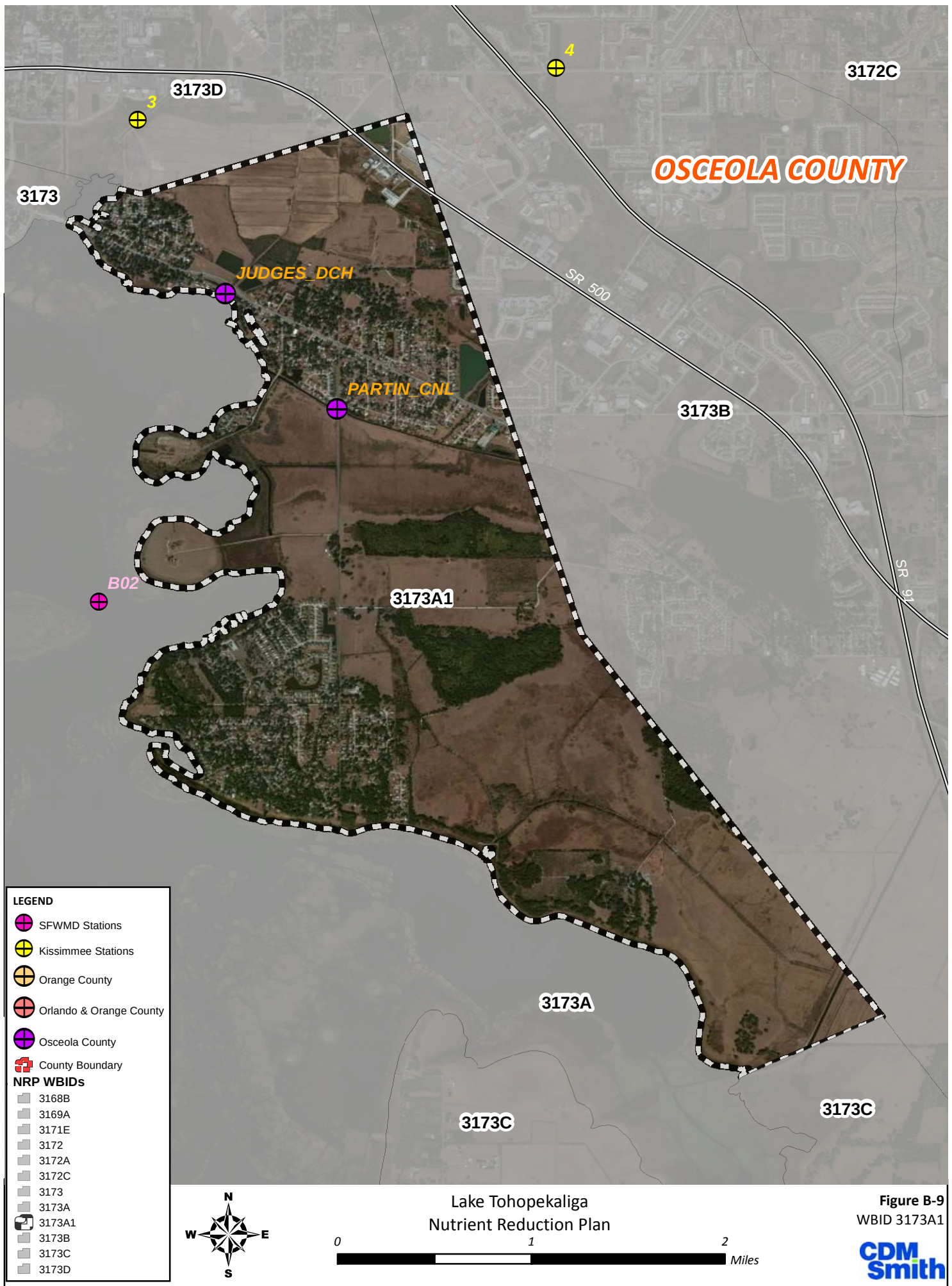
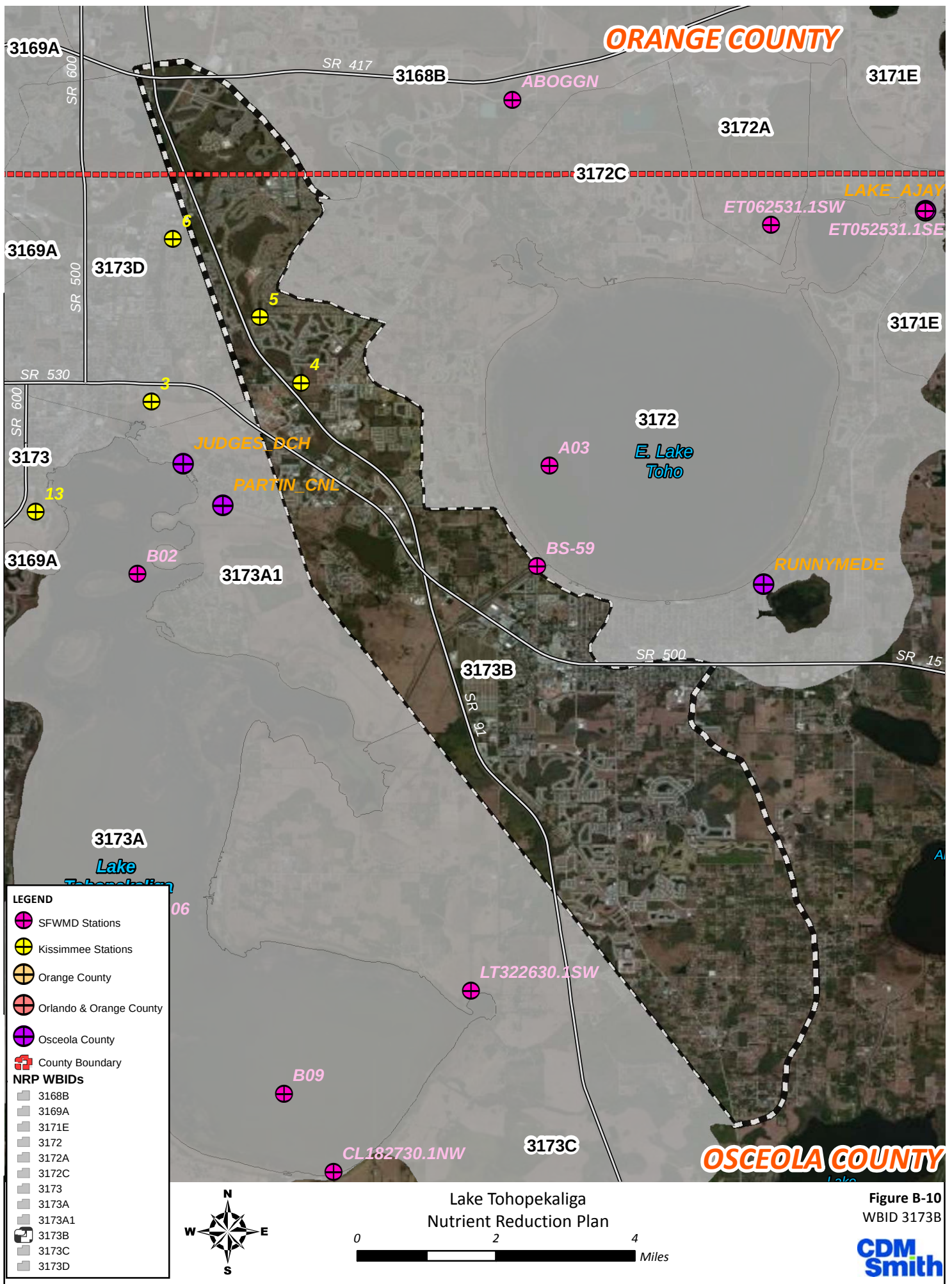
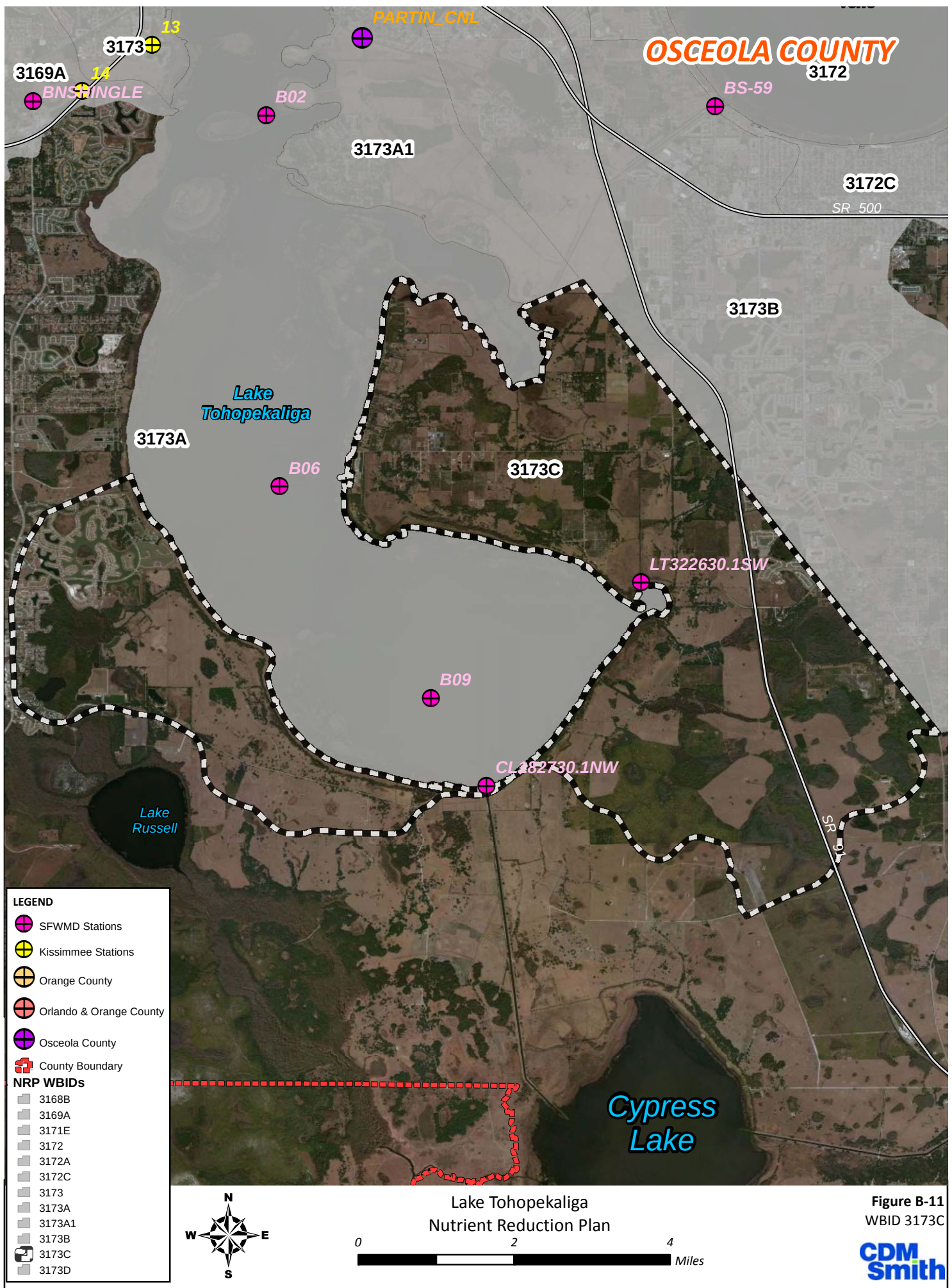
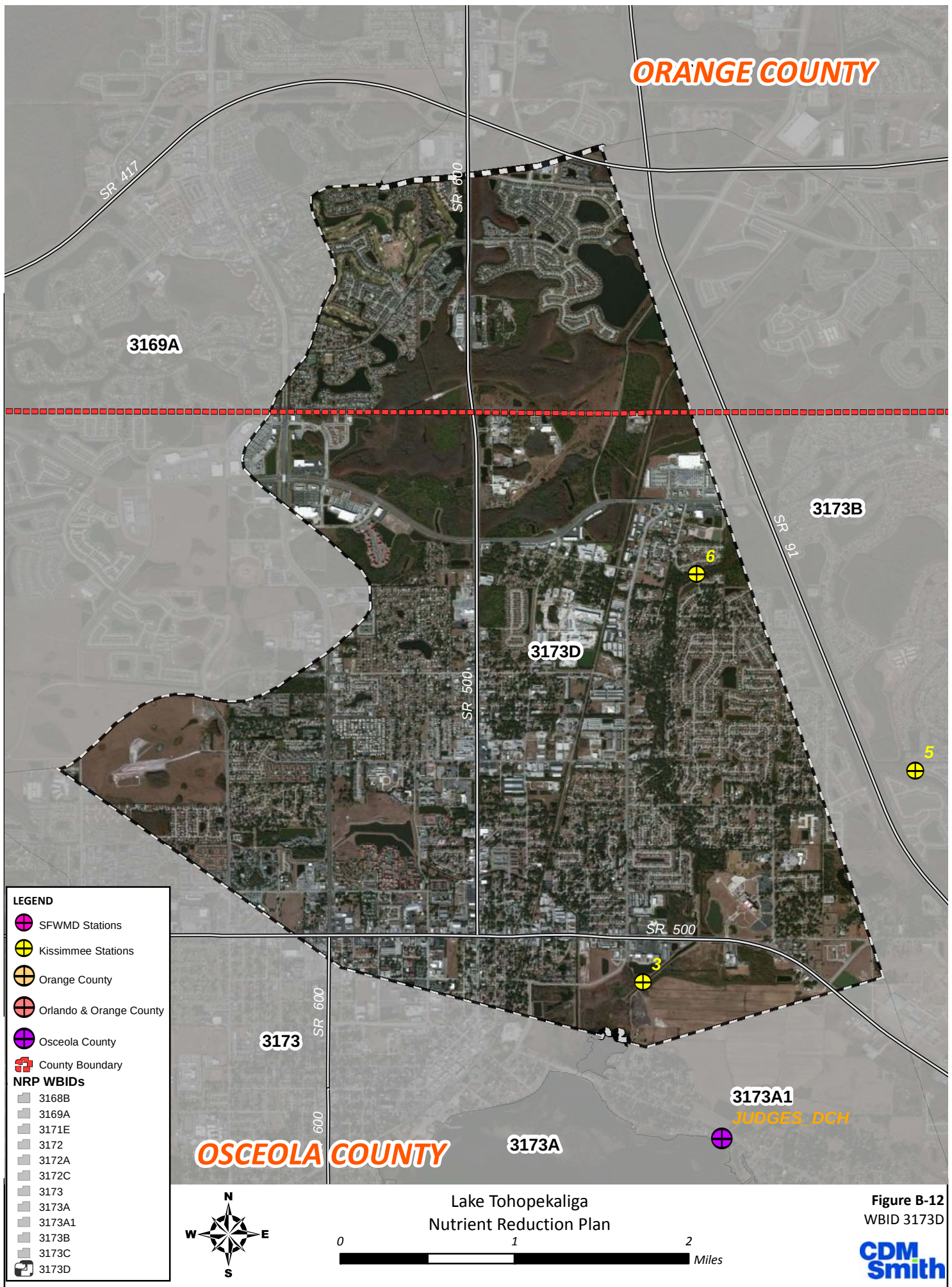


Figure B-9
WBID 3173A1

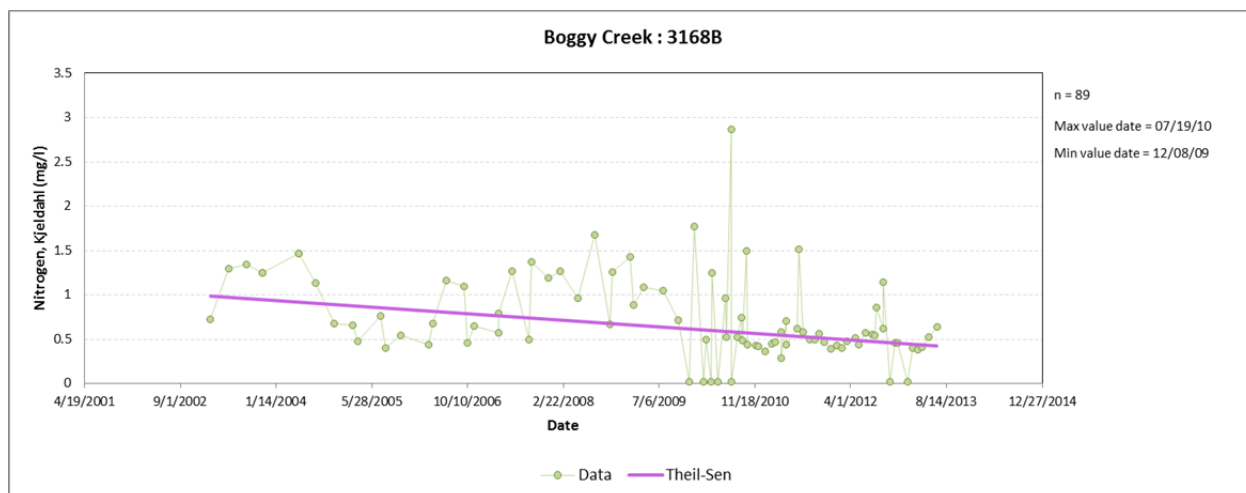
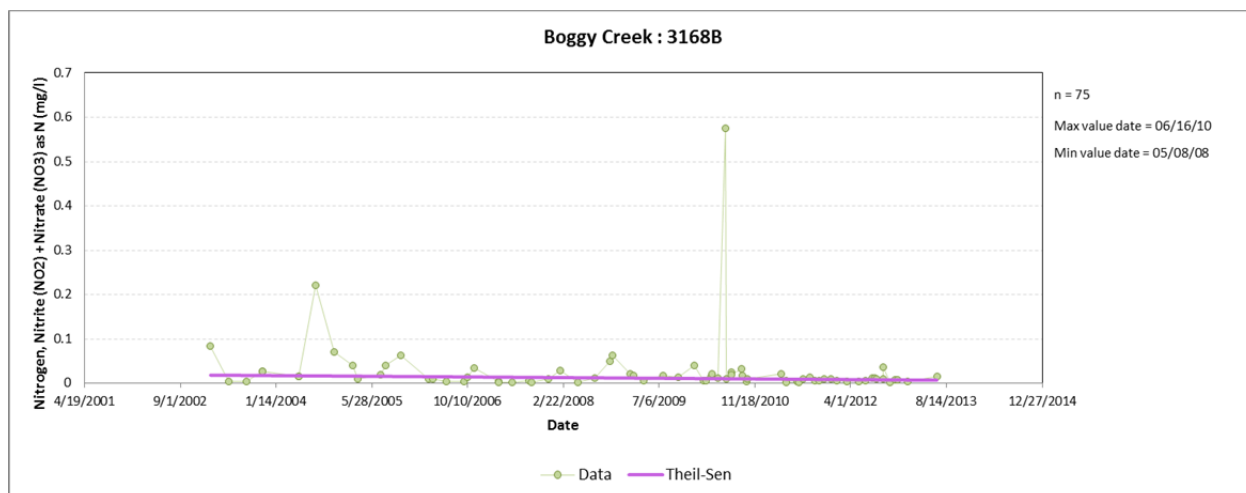
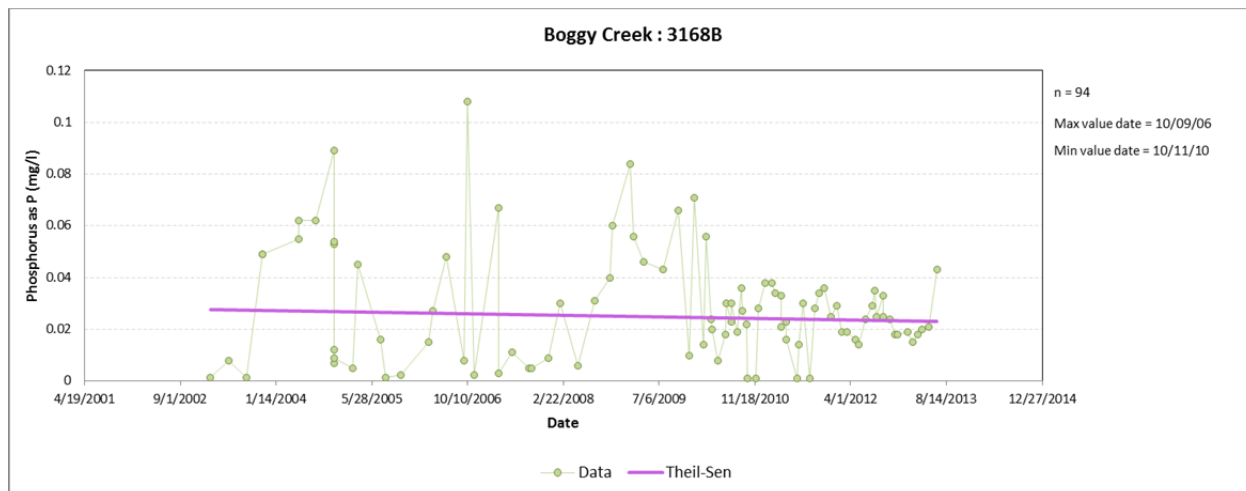




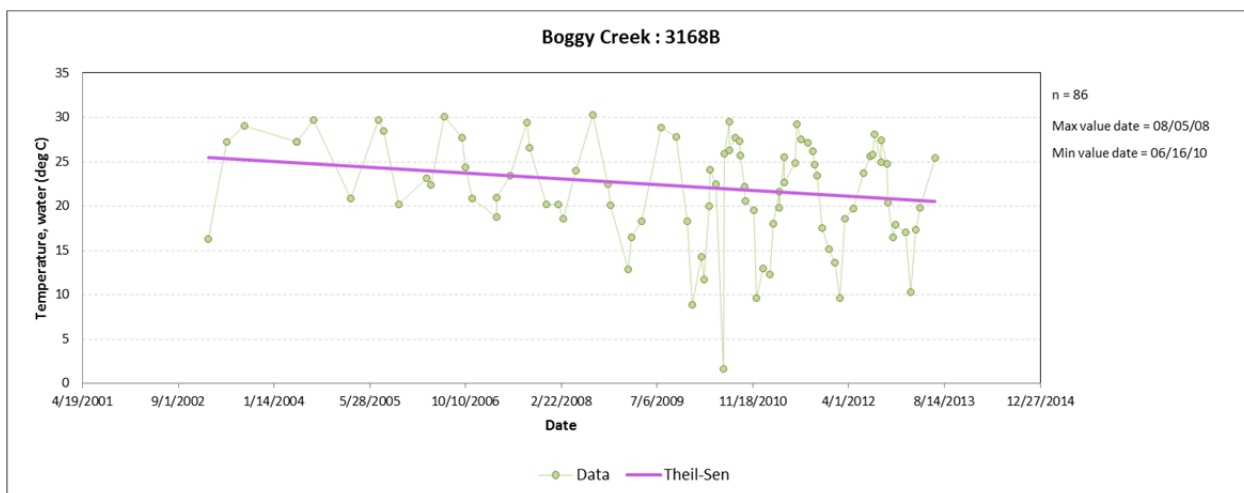
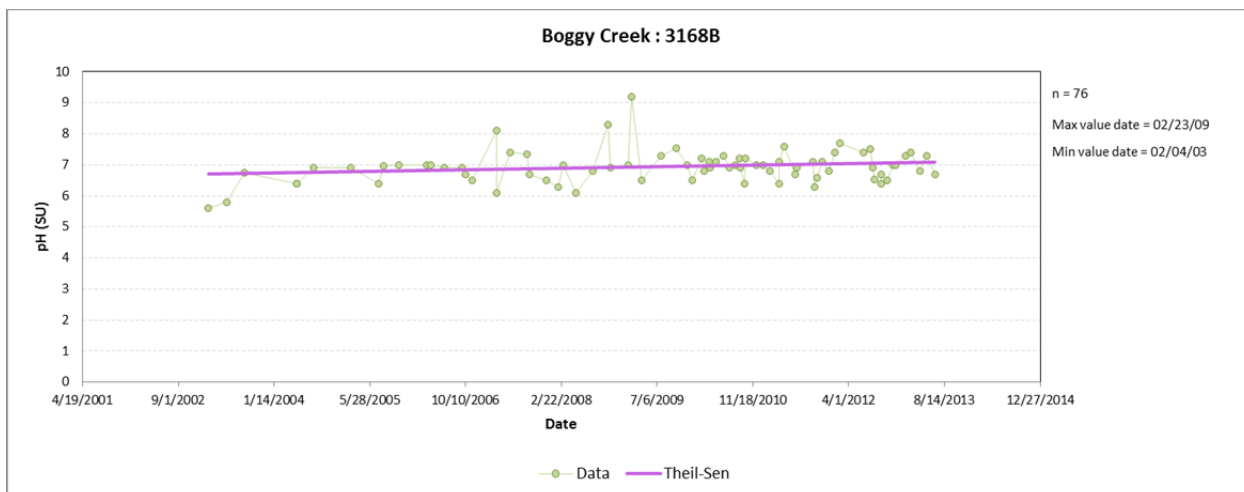
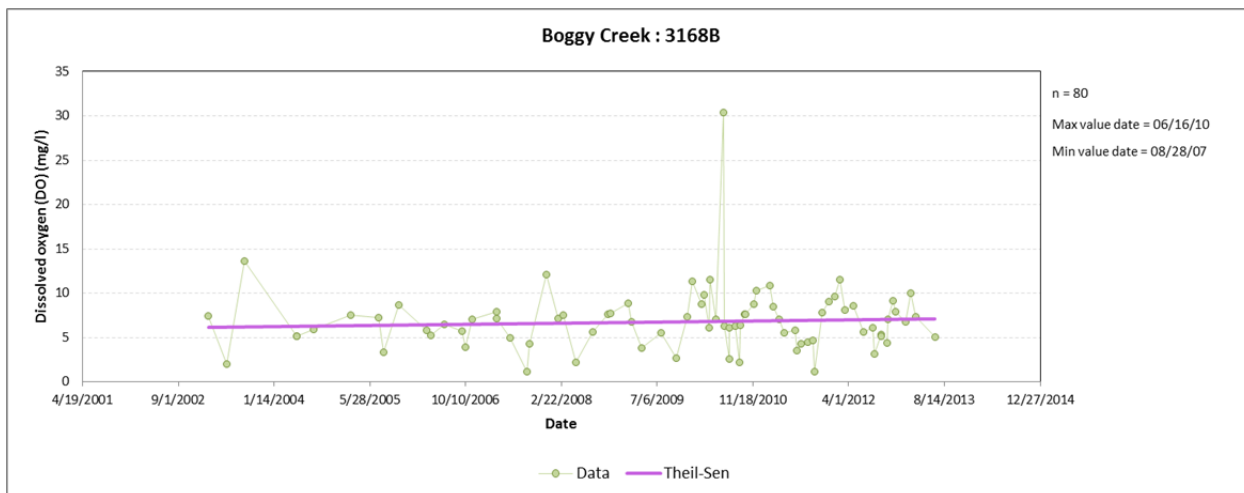


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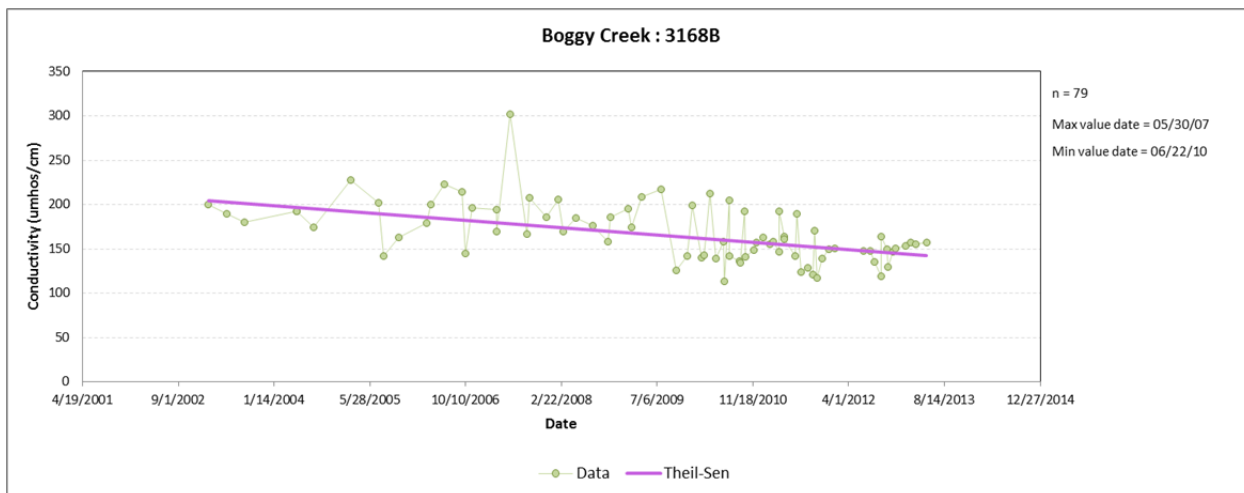
Boggy Creek: WBID 3168B



*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

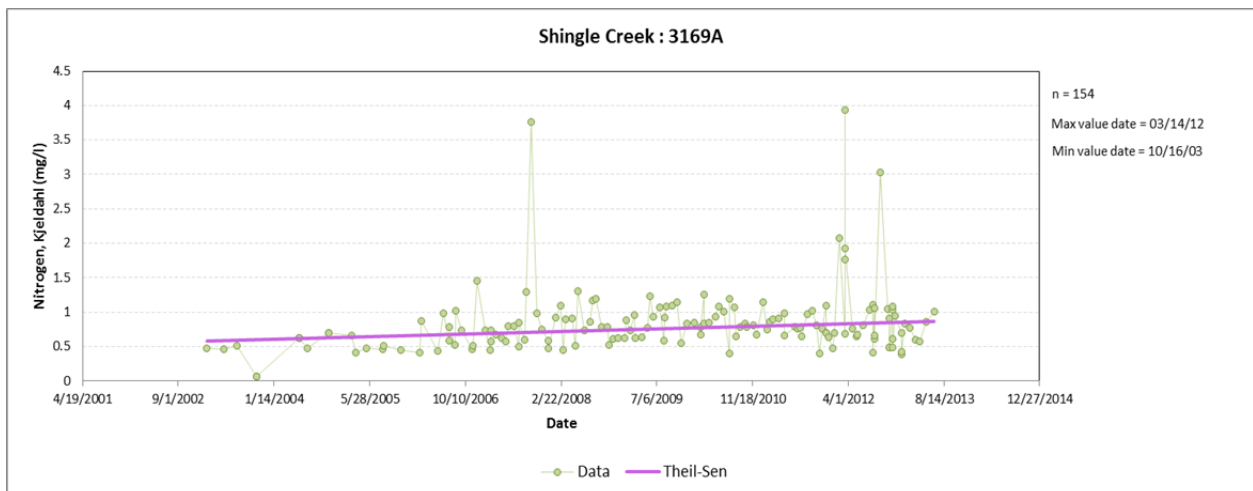
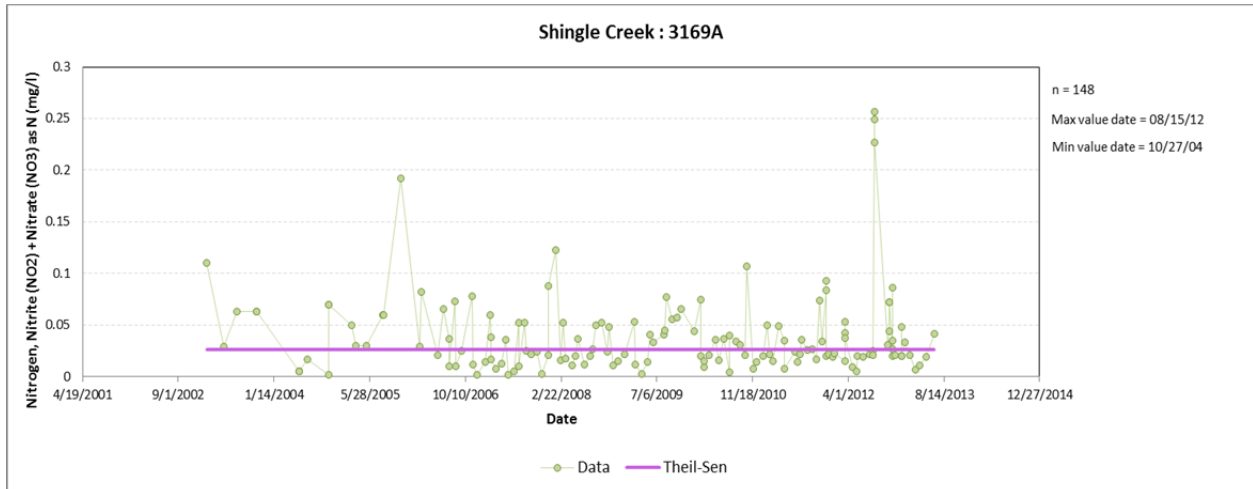
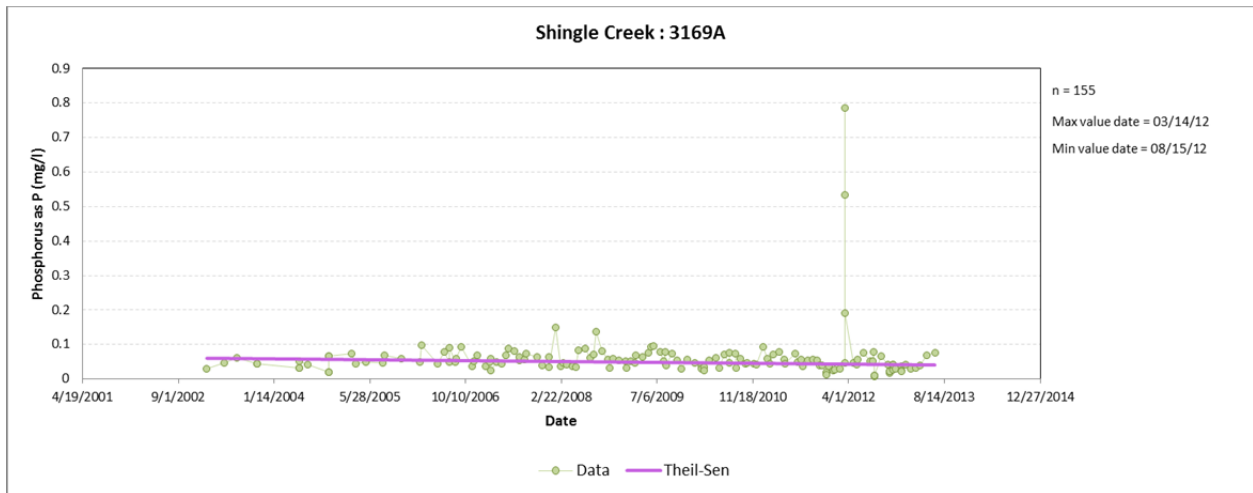


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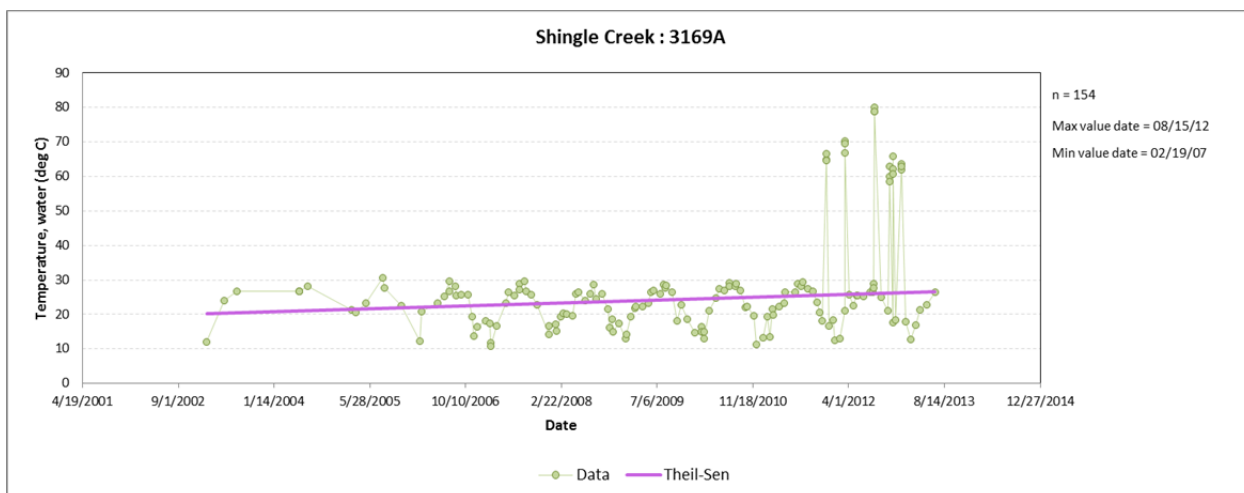
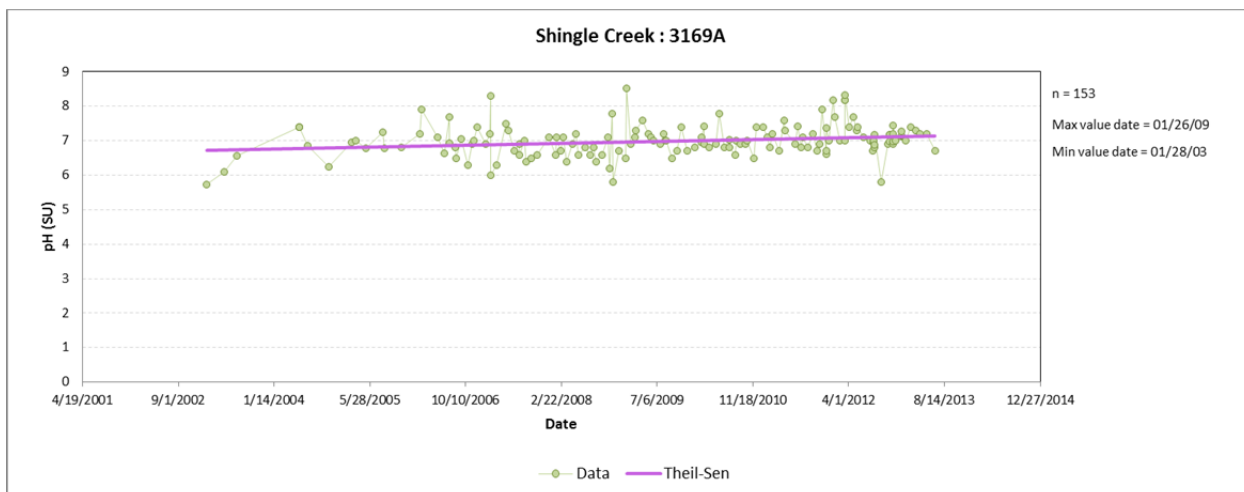
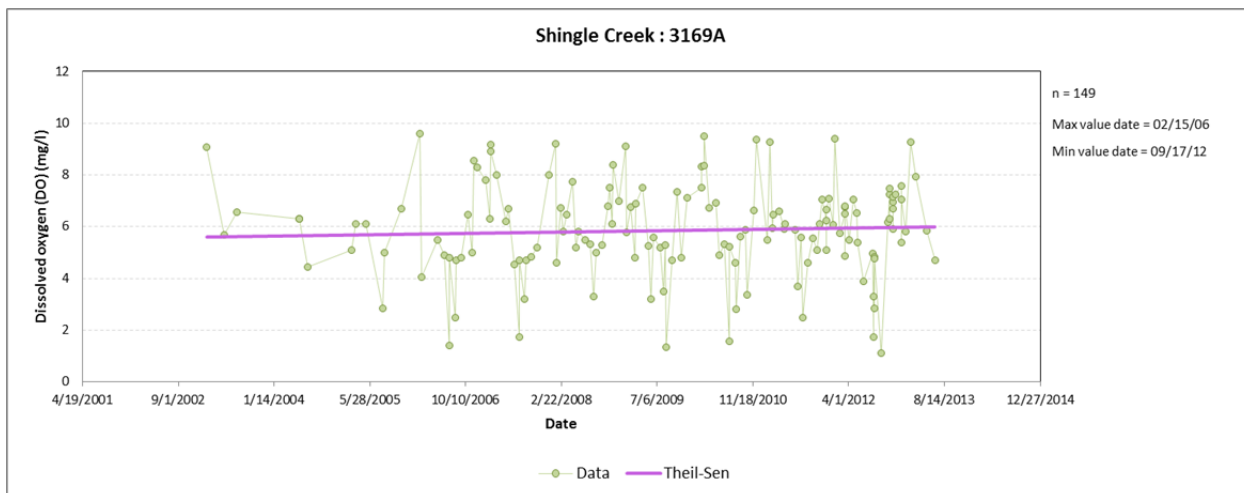


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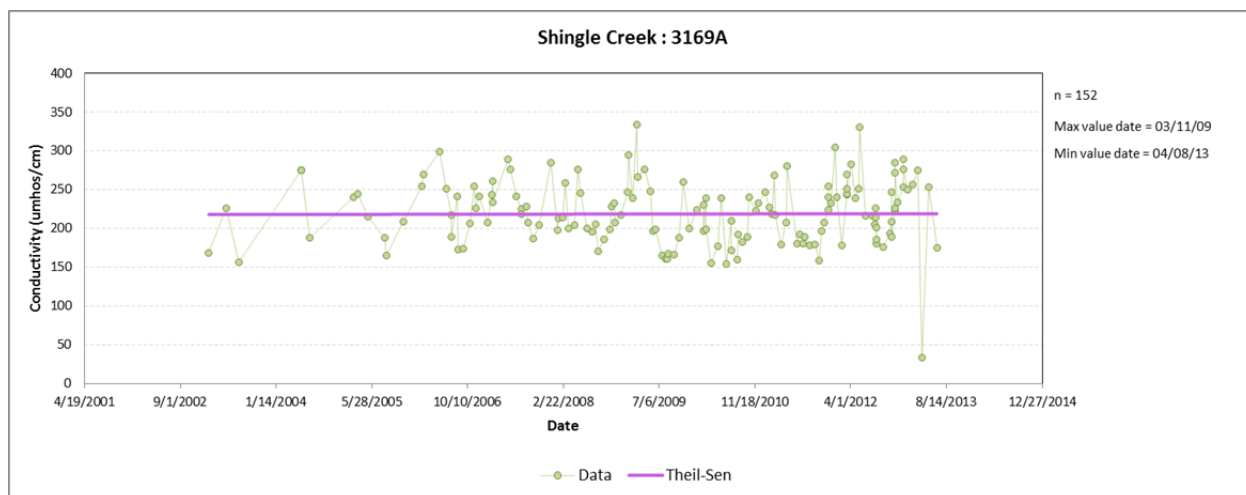
Shingle Creek: WBID 3169A



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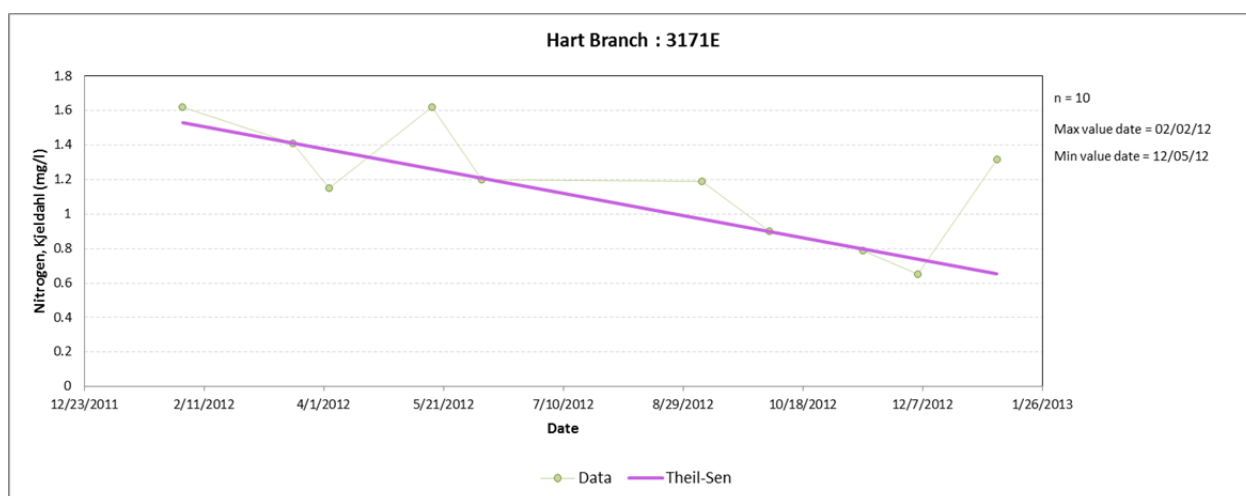
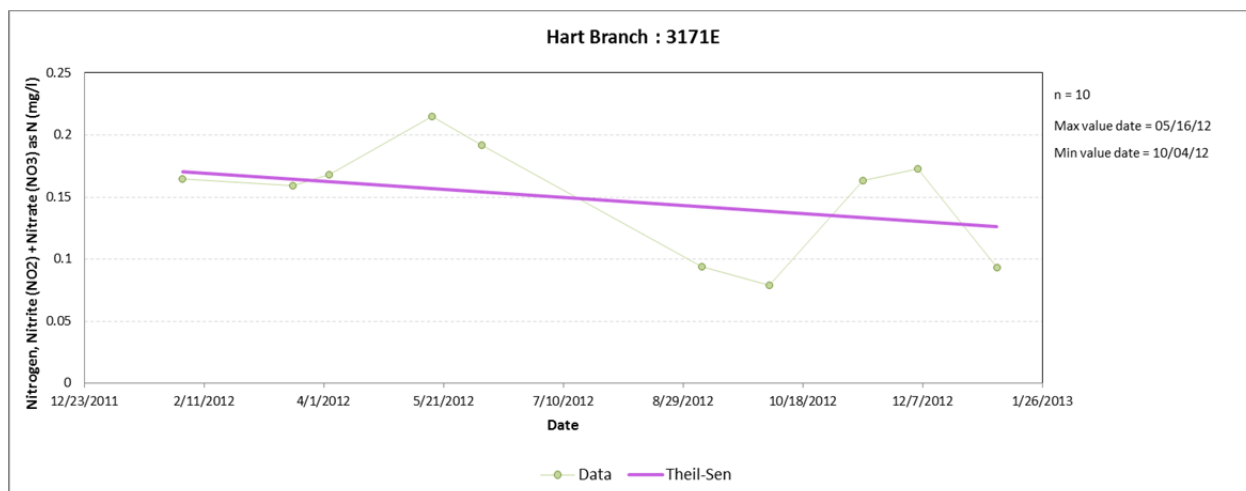
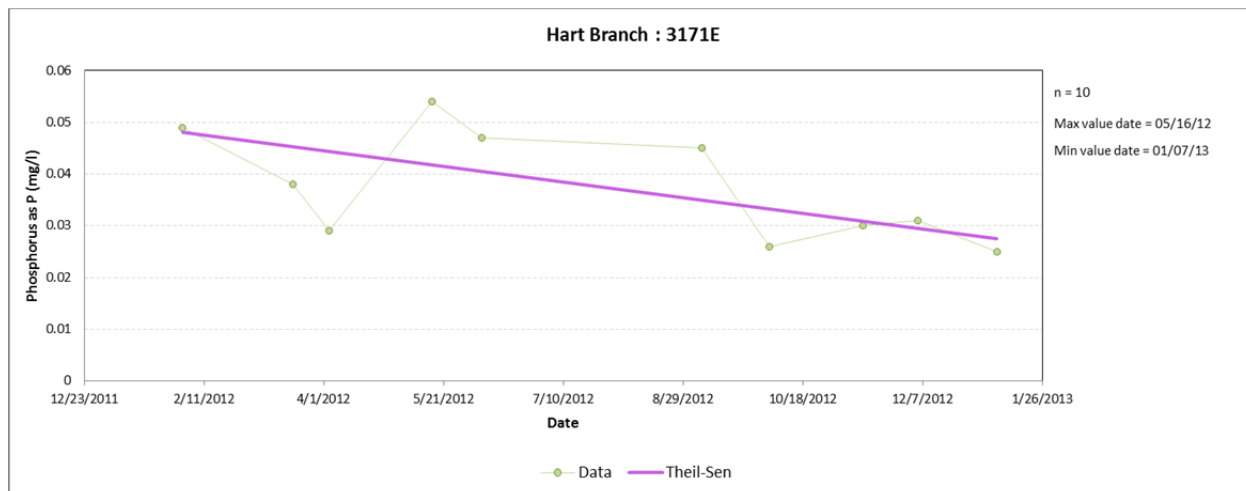


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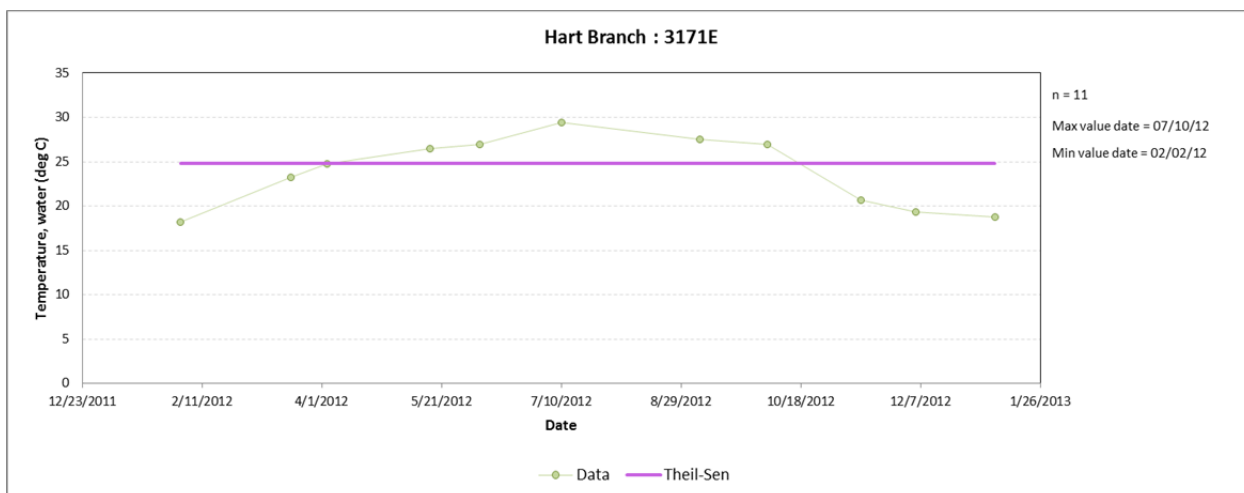
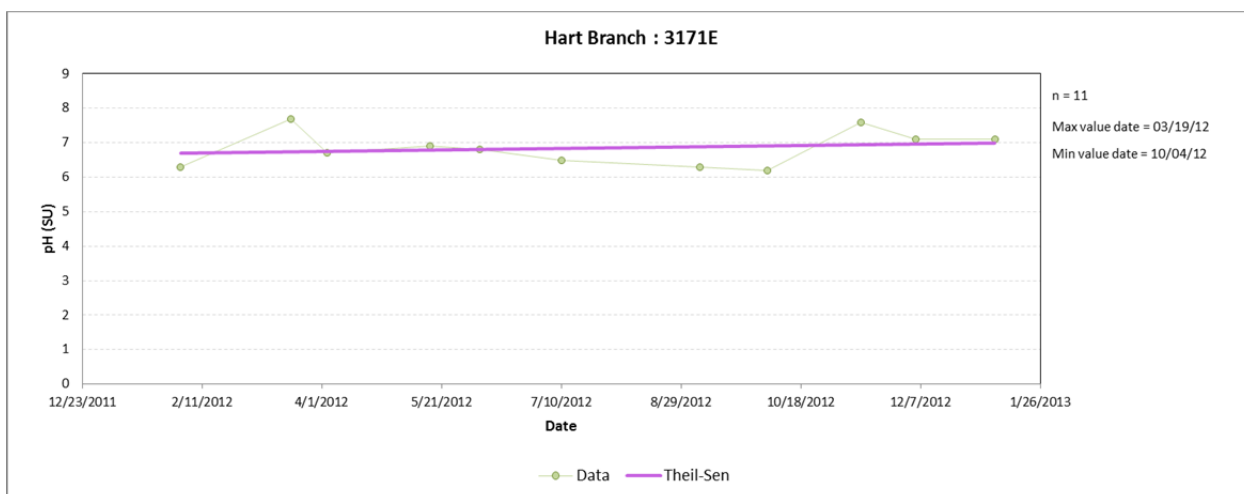
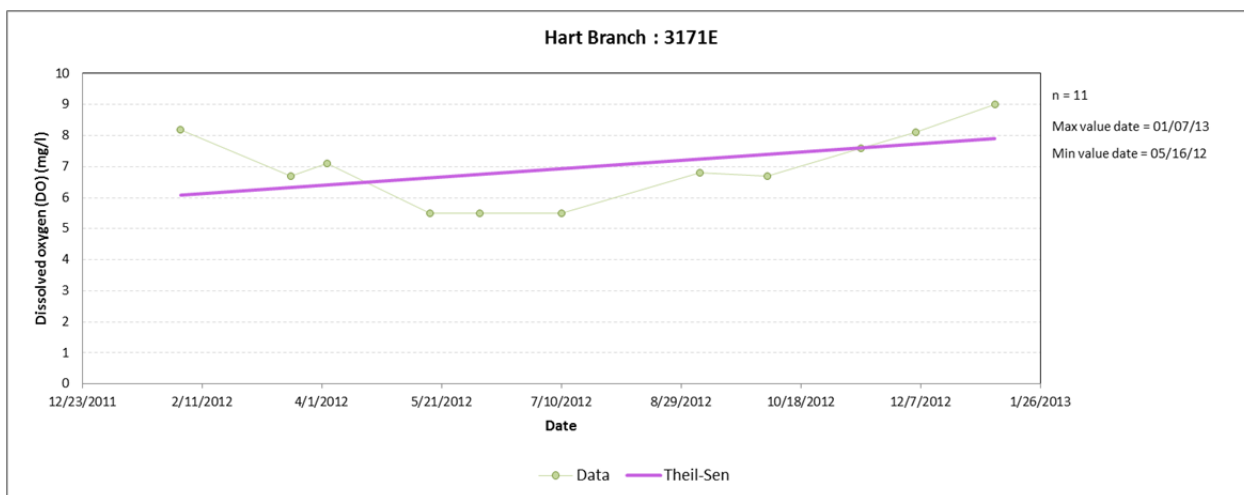


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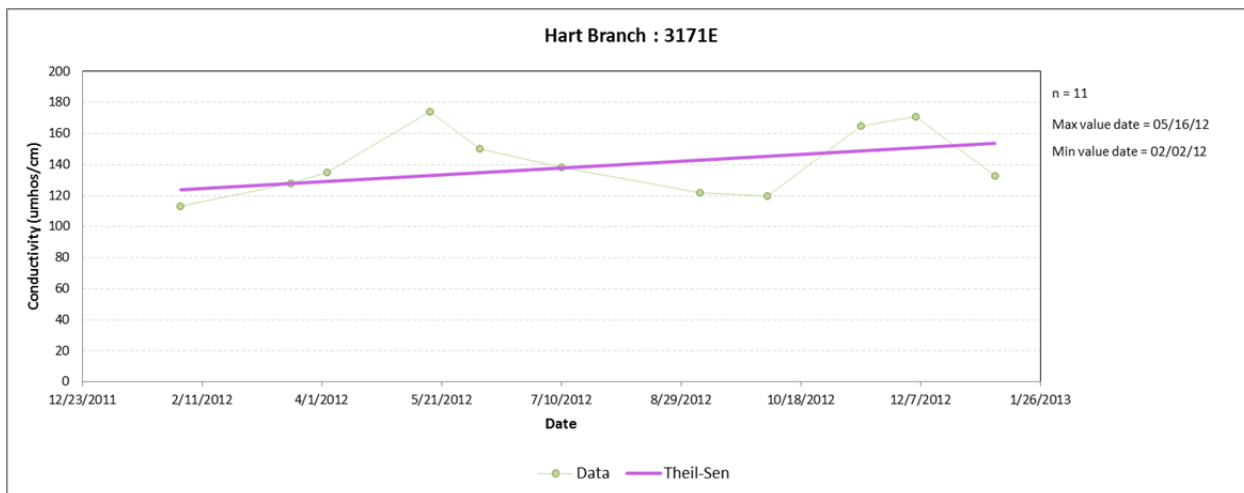
Hart Branch: WBID 3171E



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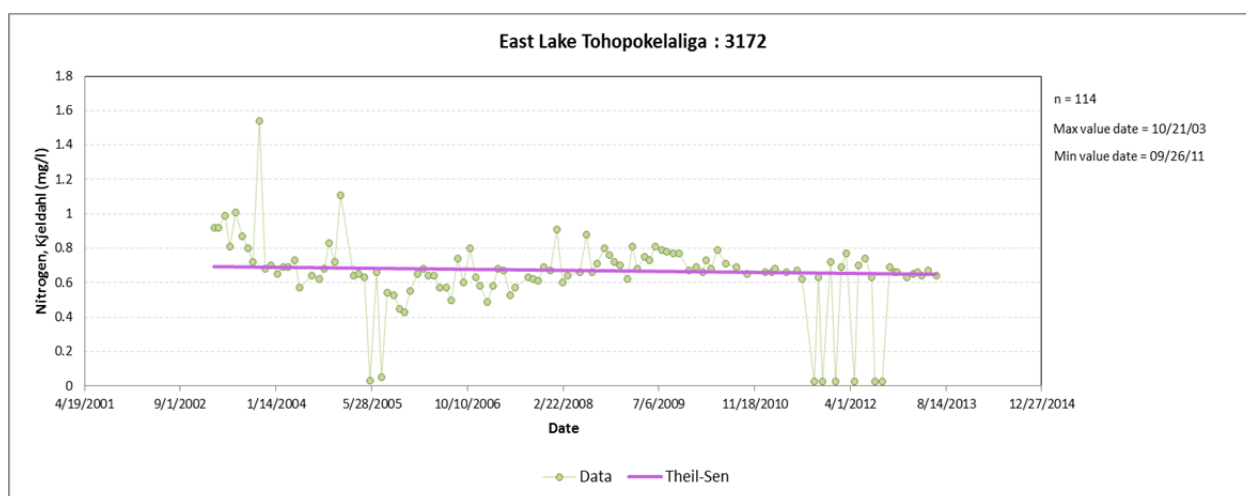
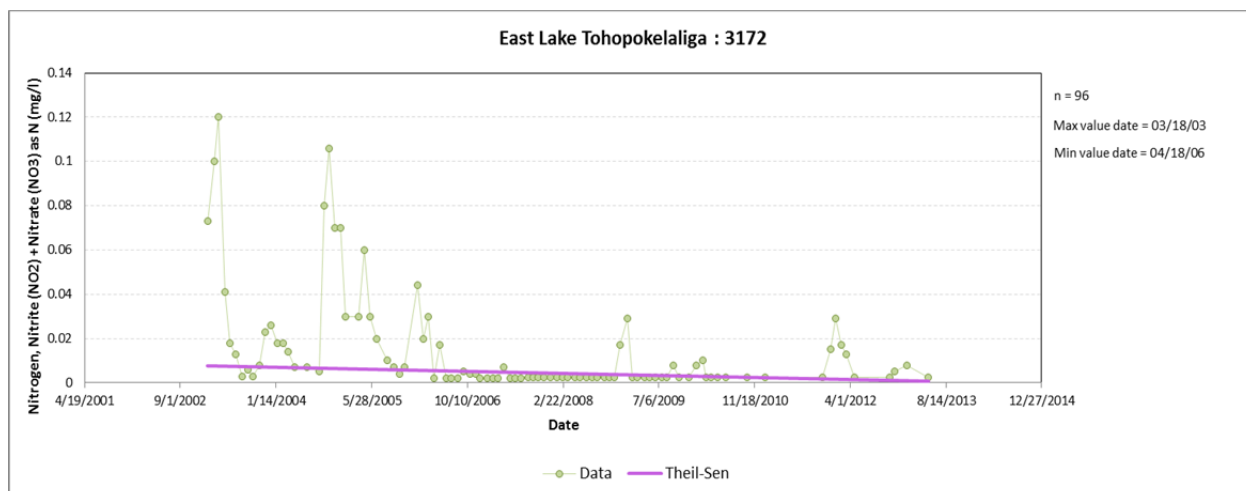
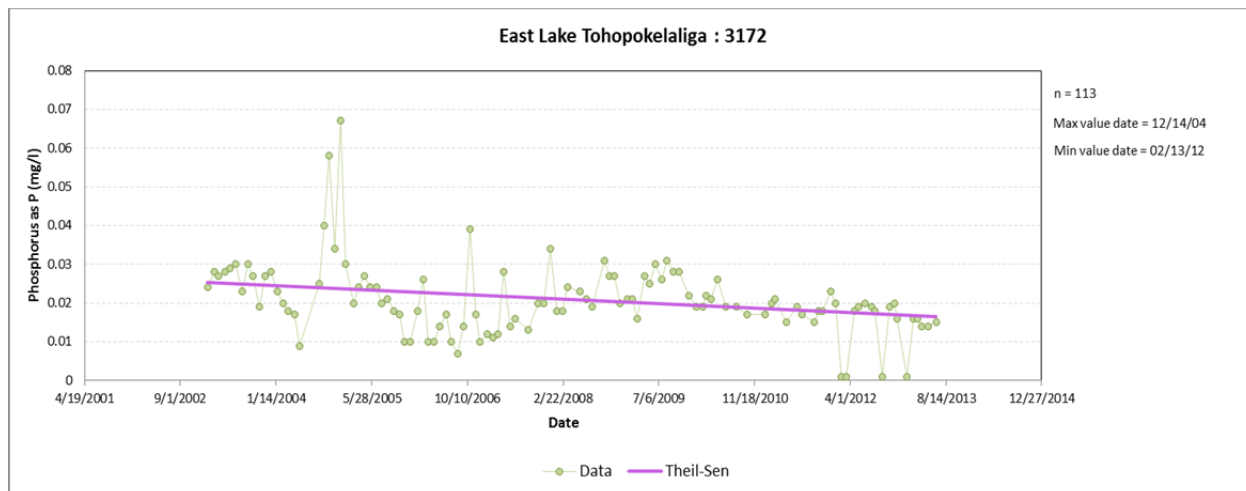


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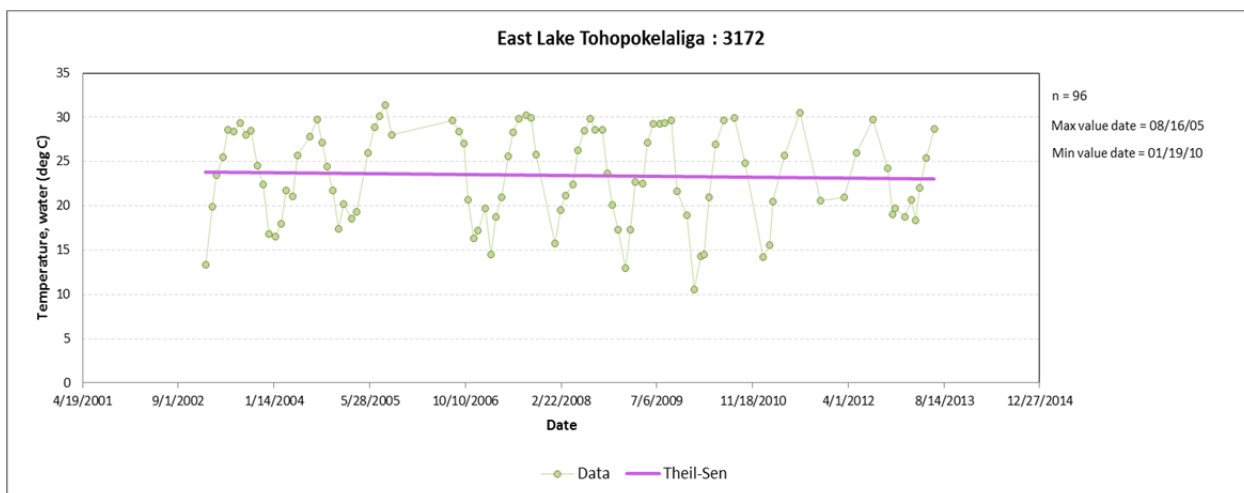
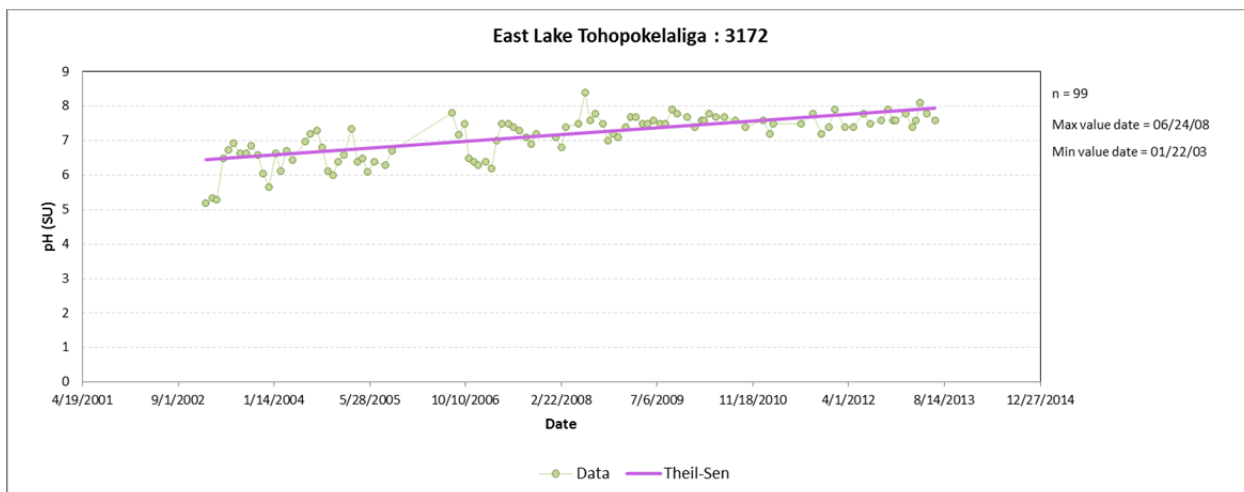
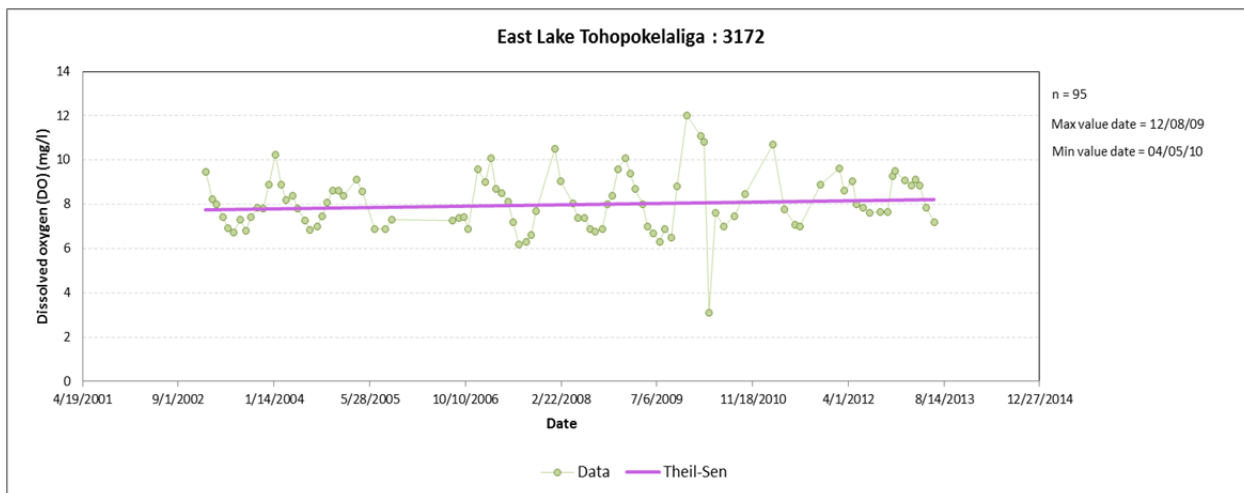


*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

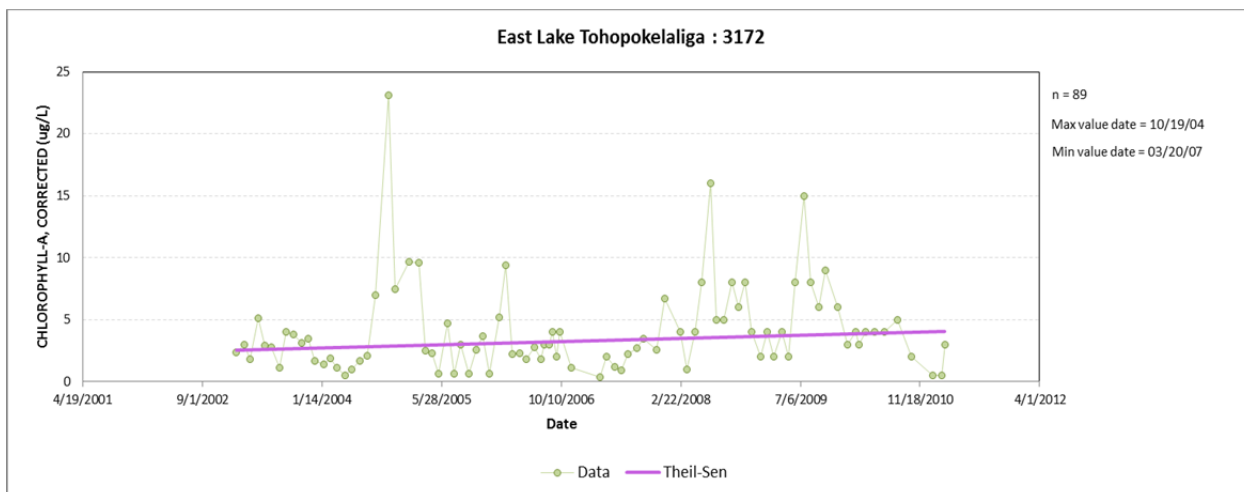
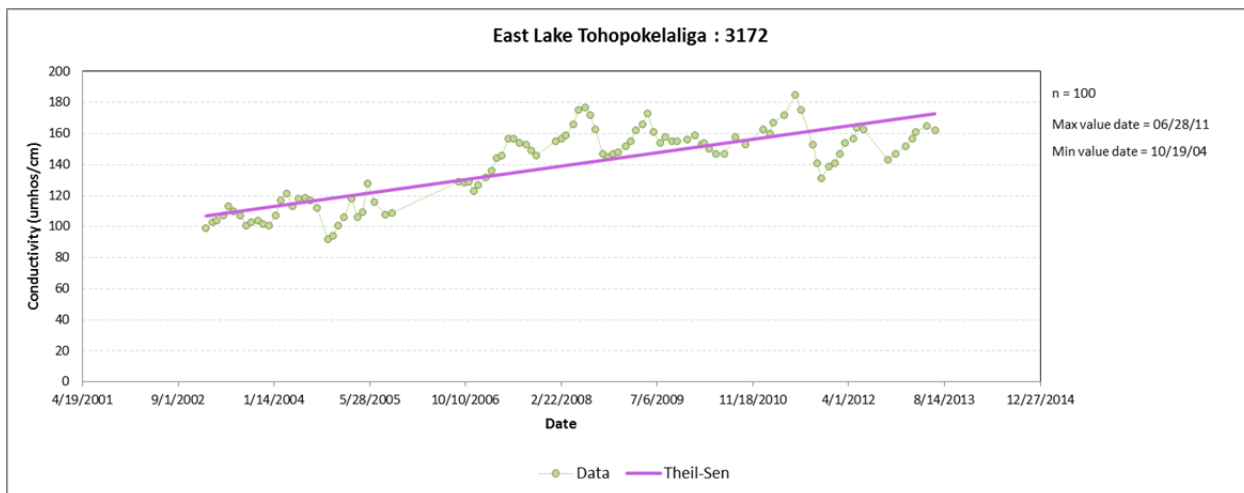
East Lake Tohopekaliga: WBID 3172



*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

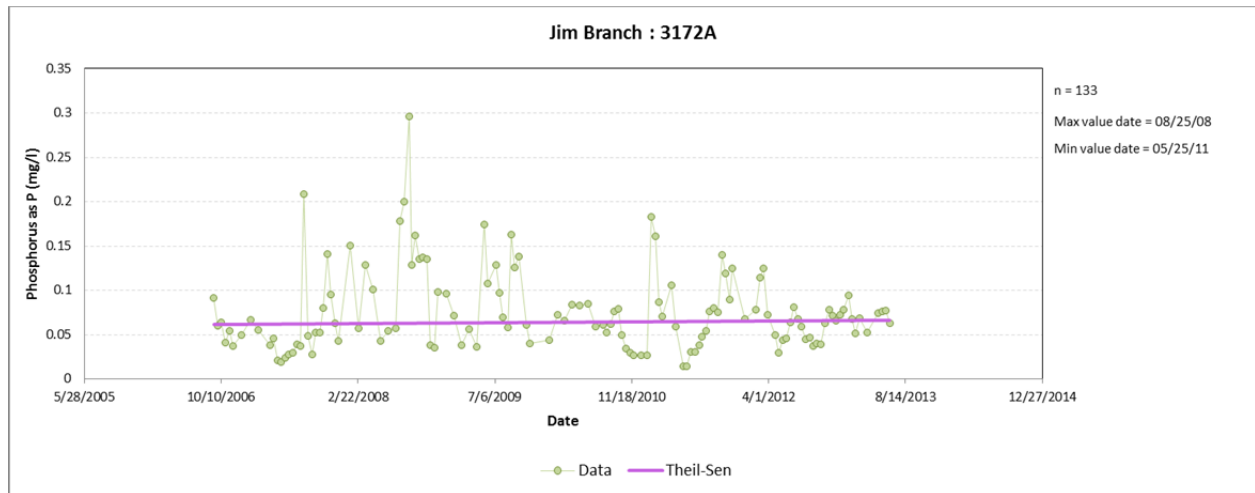


*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.



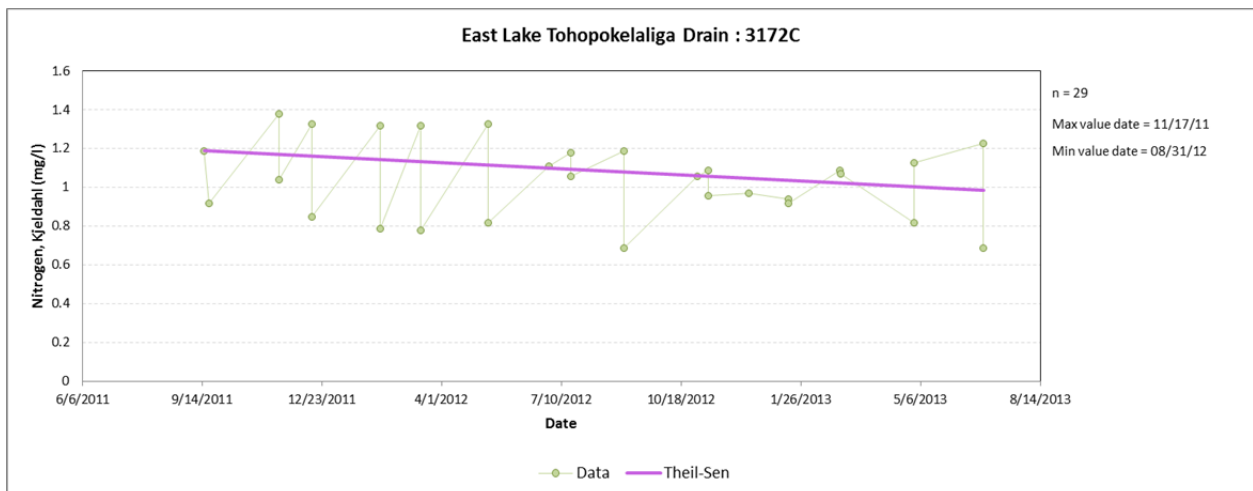
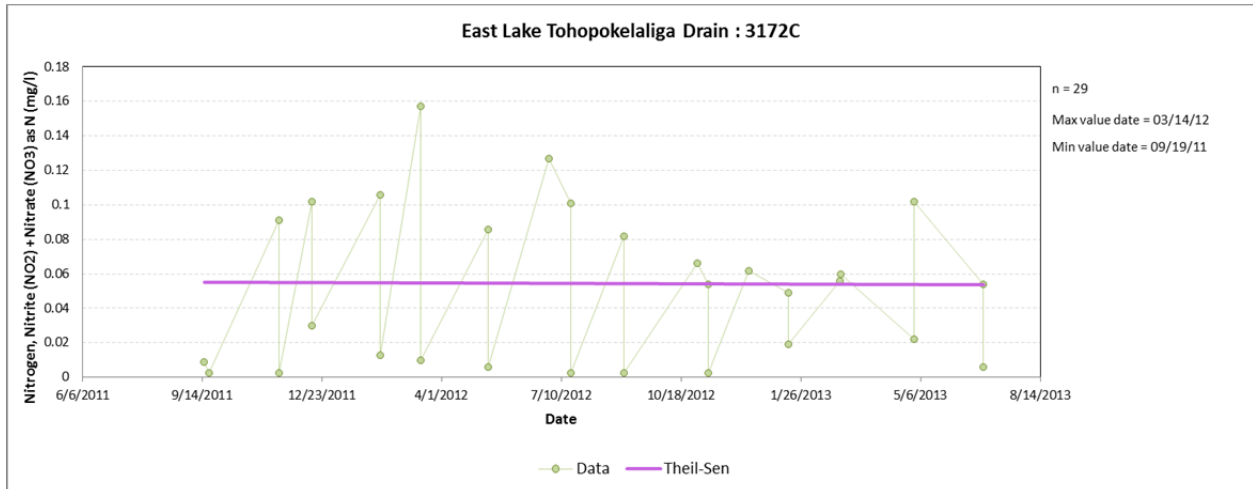
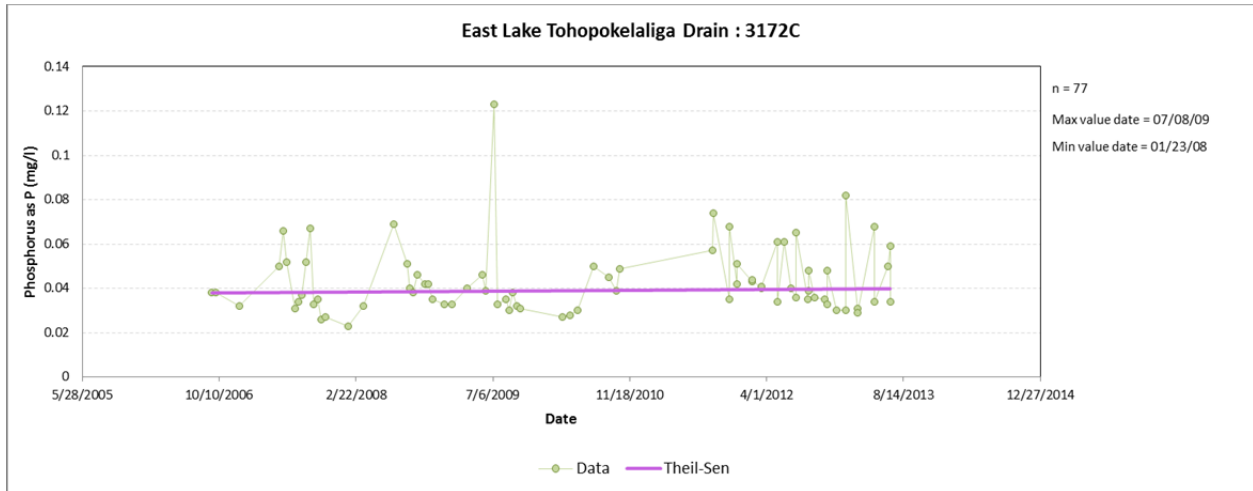
*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

Jim Branch: WBID 3172A

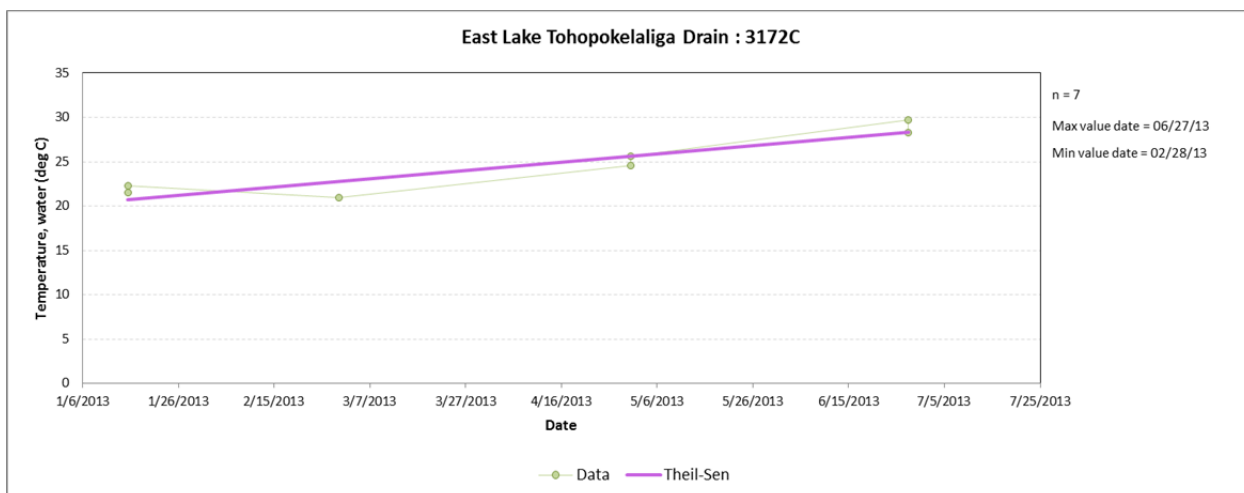
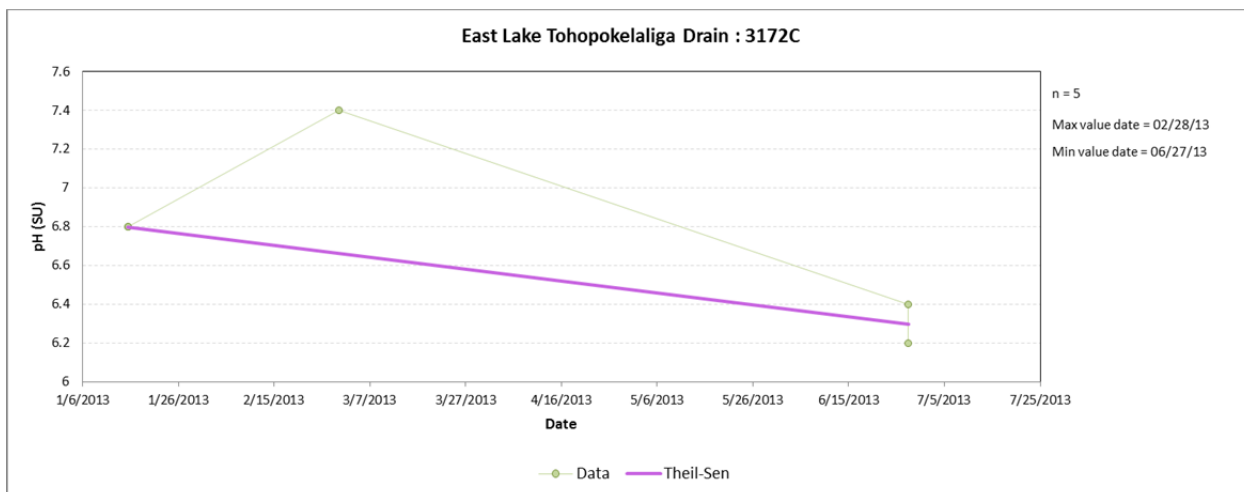
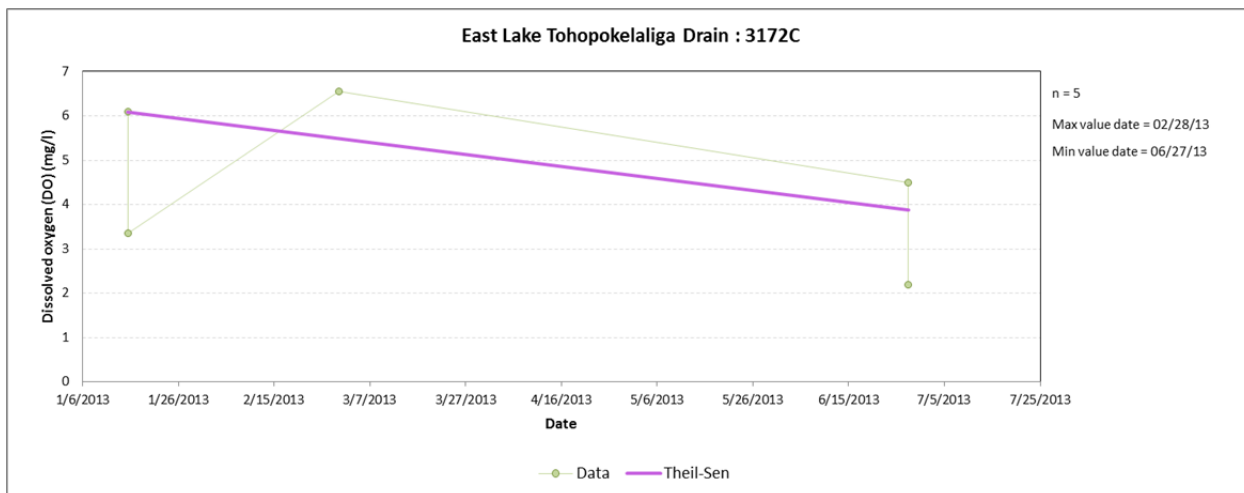


*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

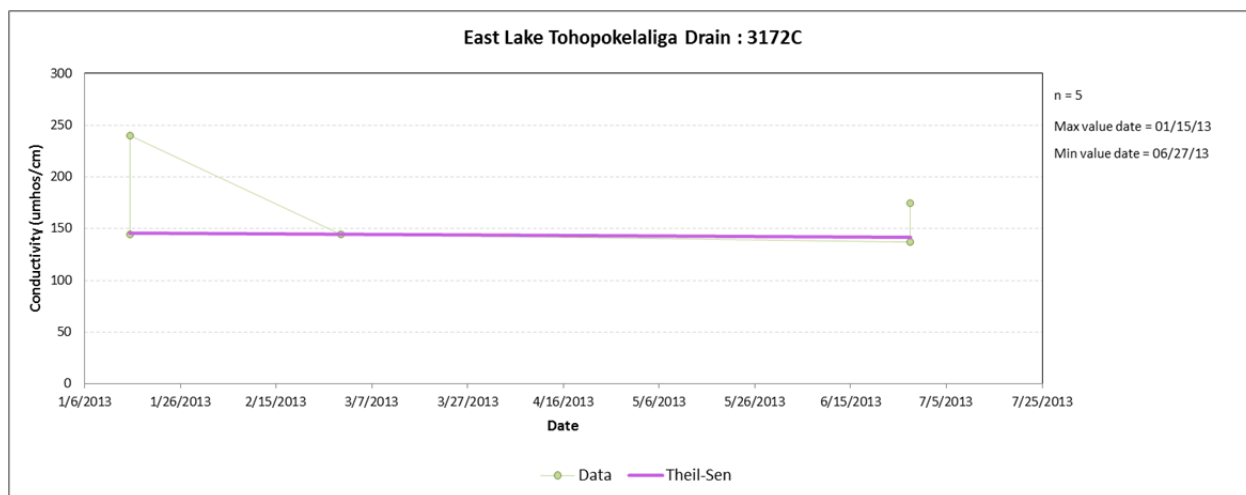
East Lake Tohopekaliga Drain: WBID 3172C



*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

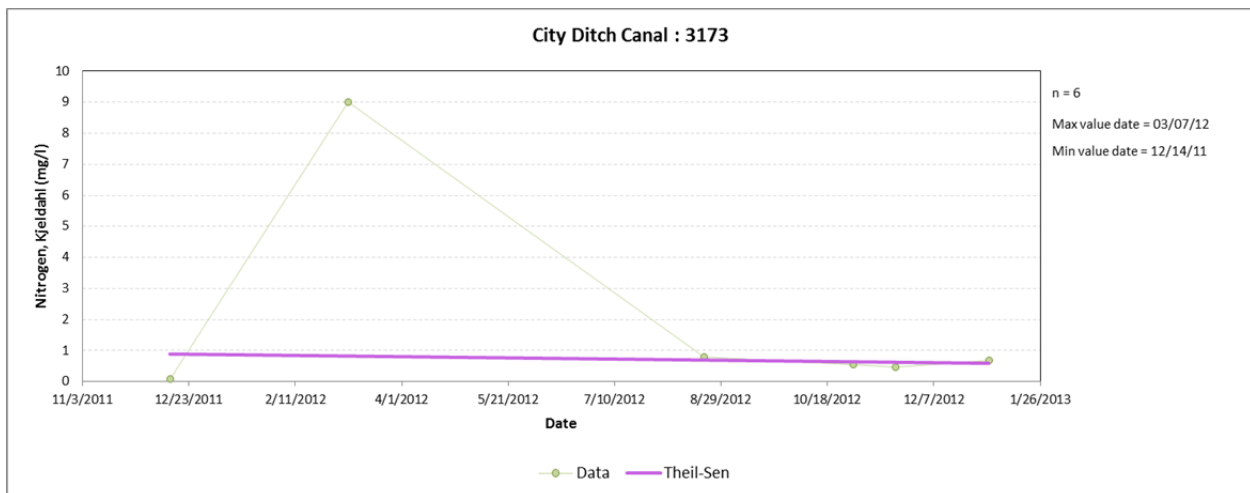
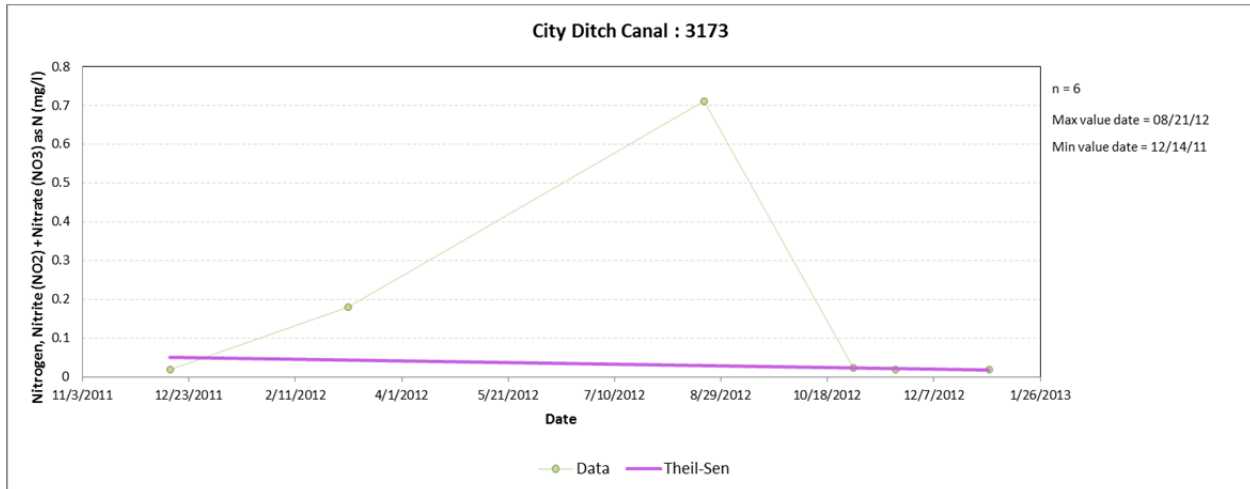
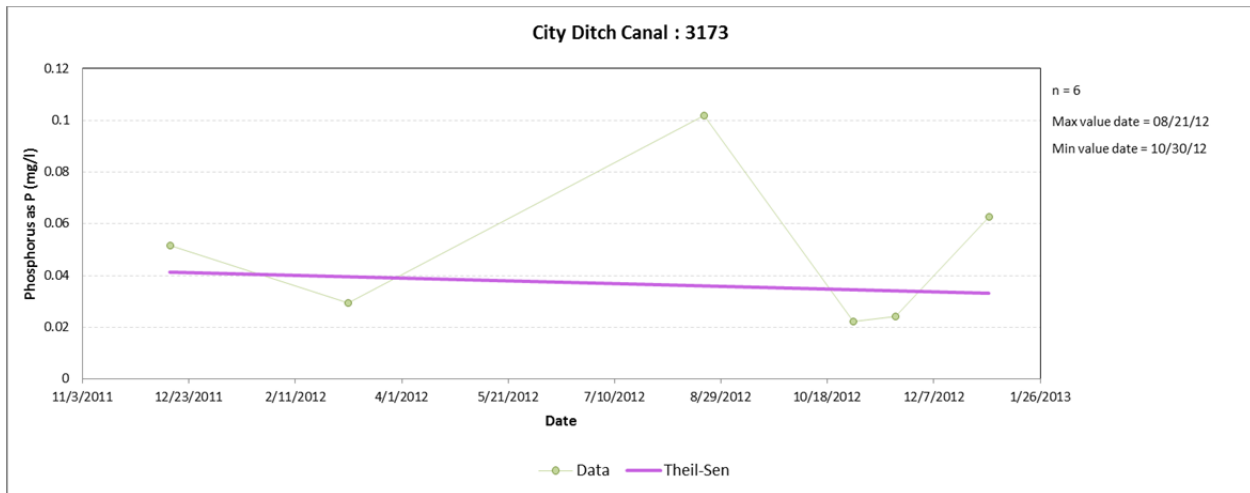


*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

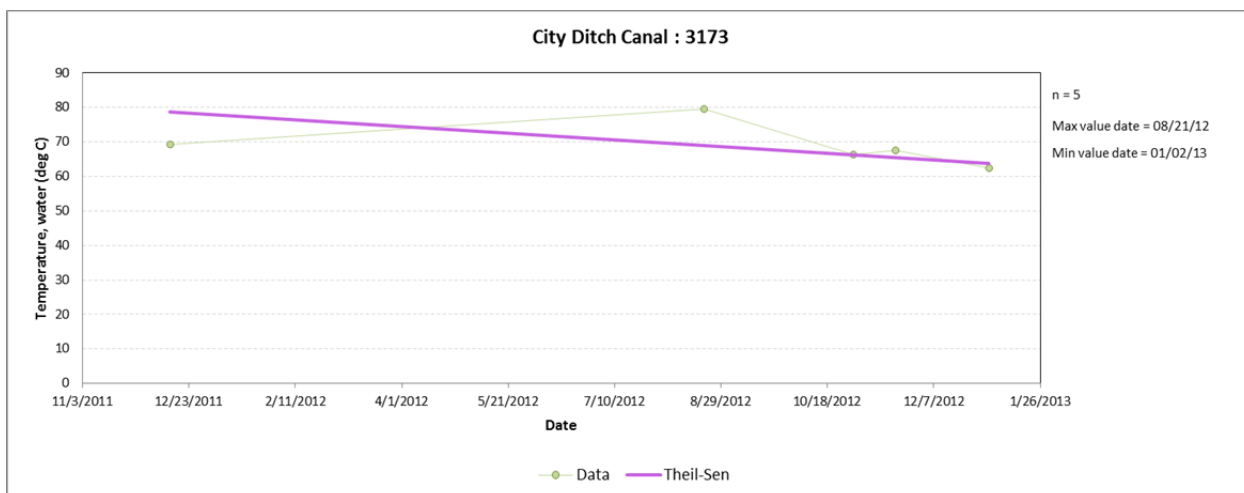
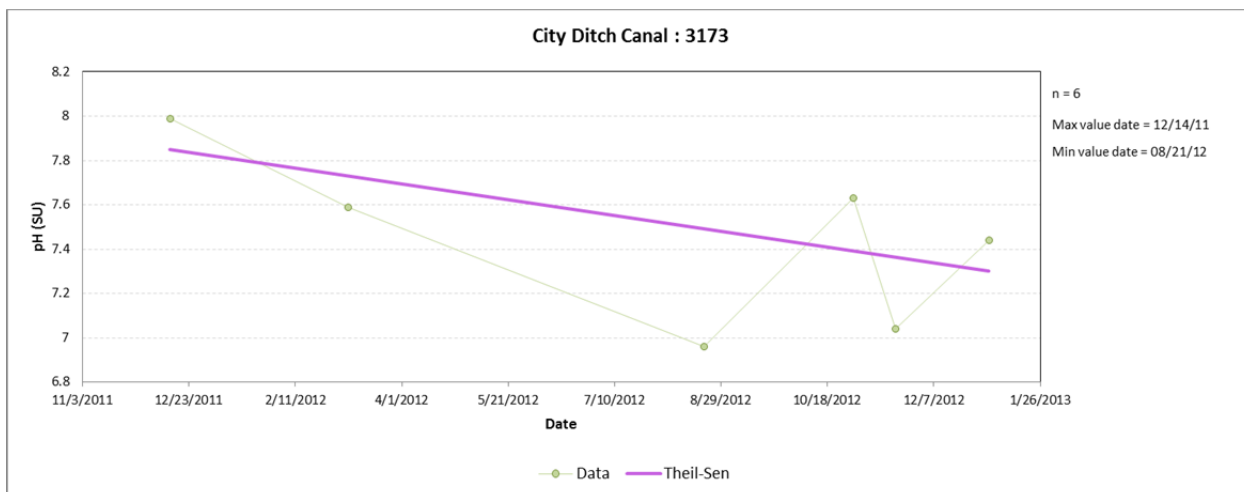
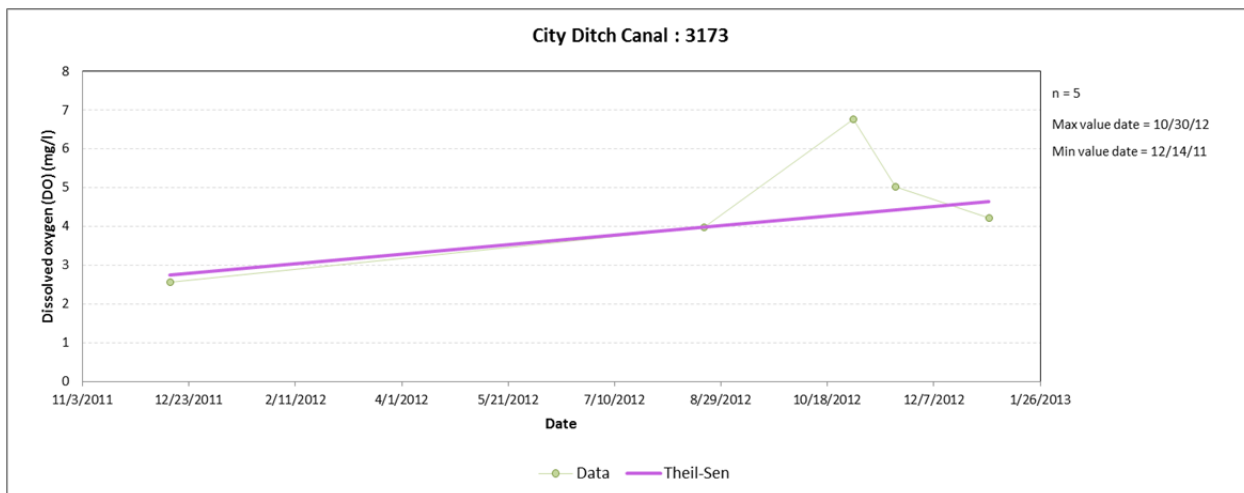


*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

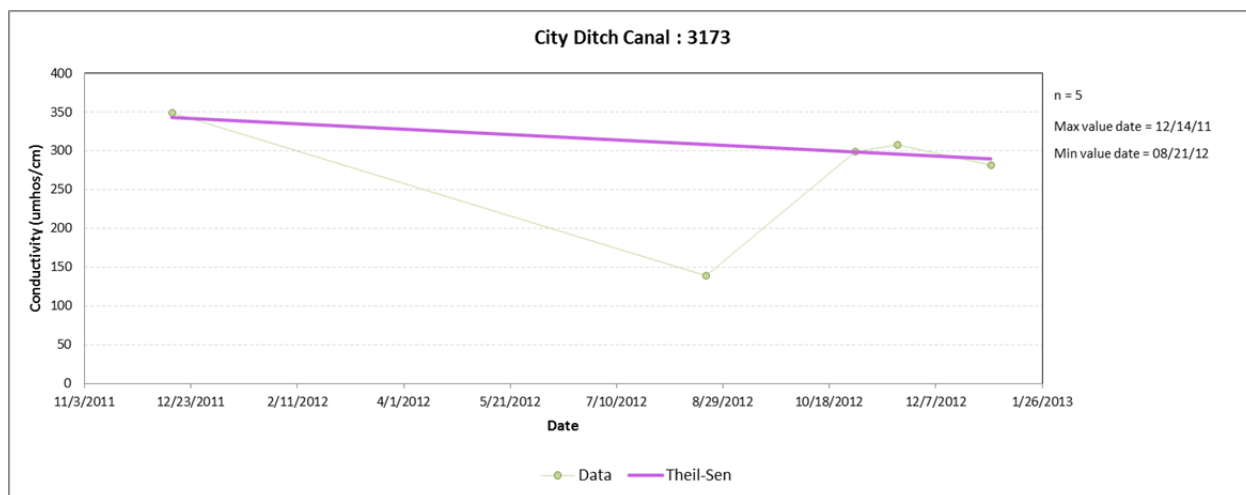
City Ditch Canal: WBID 3173



*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

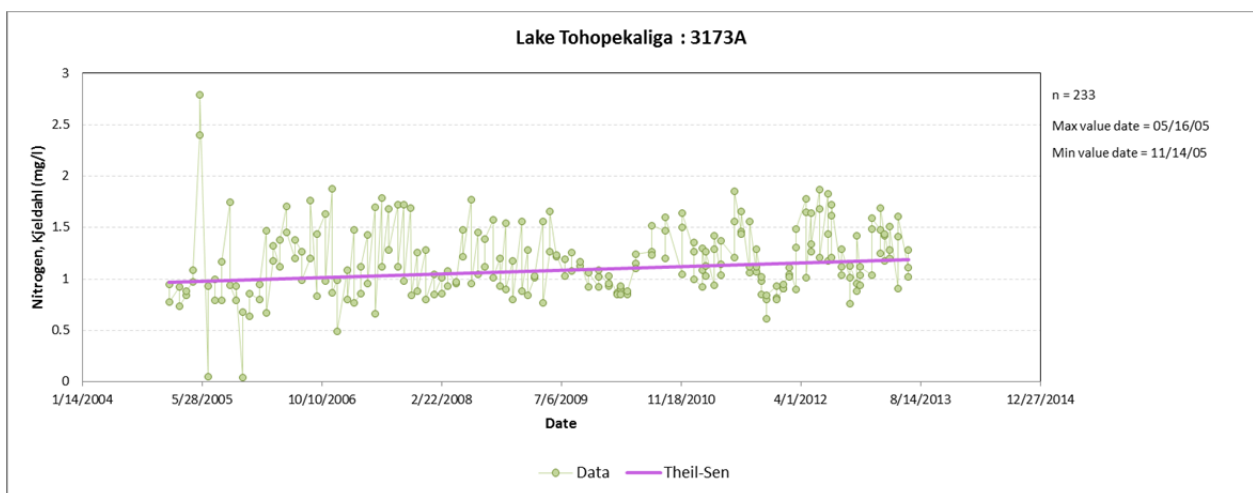
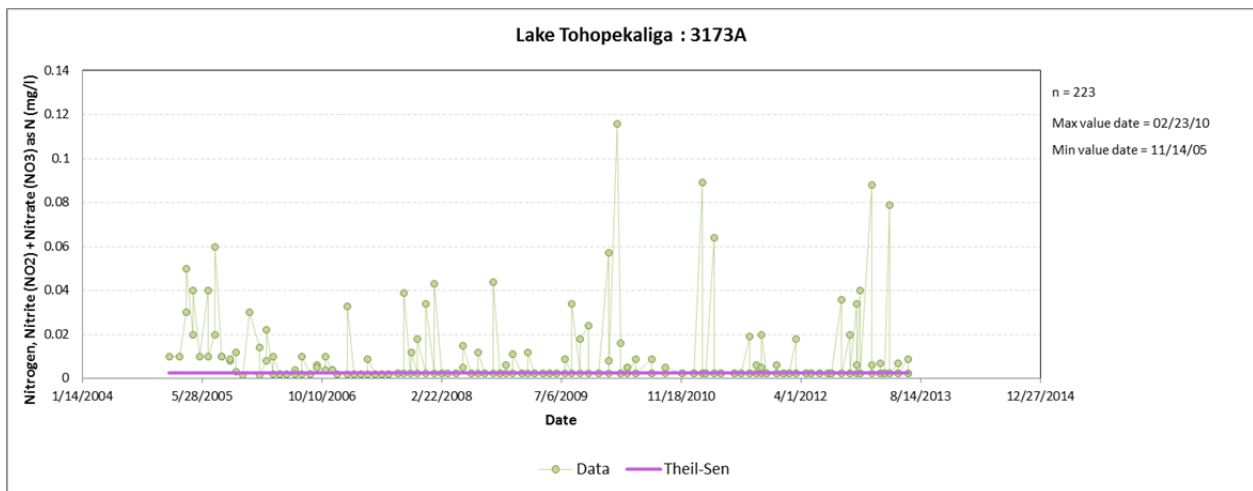
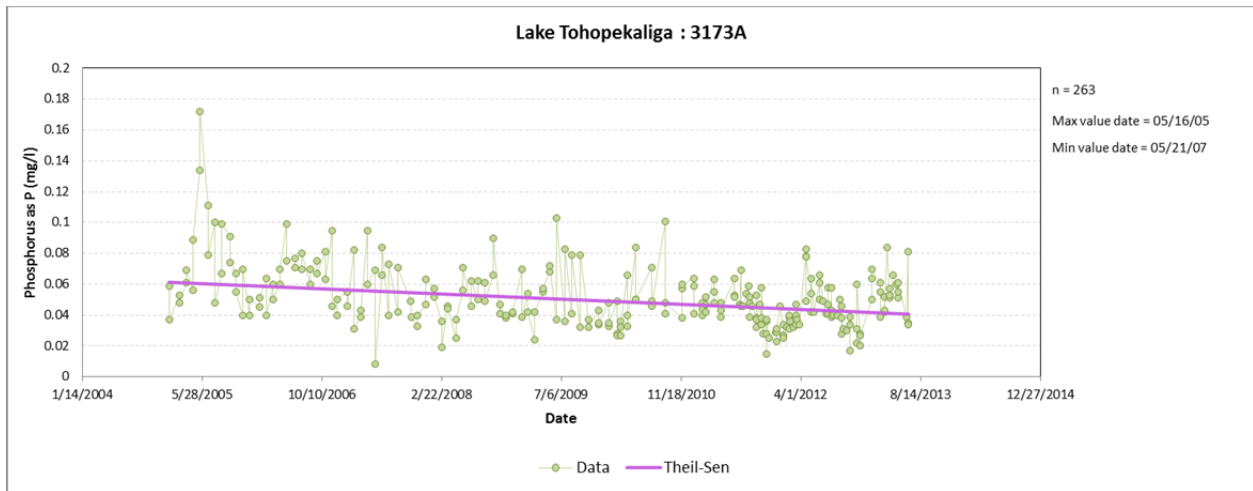


*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

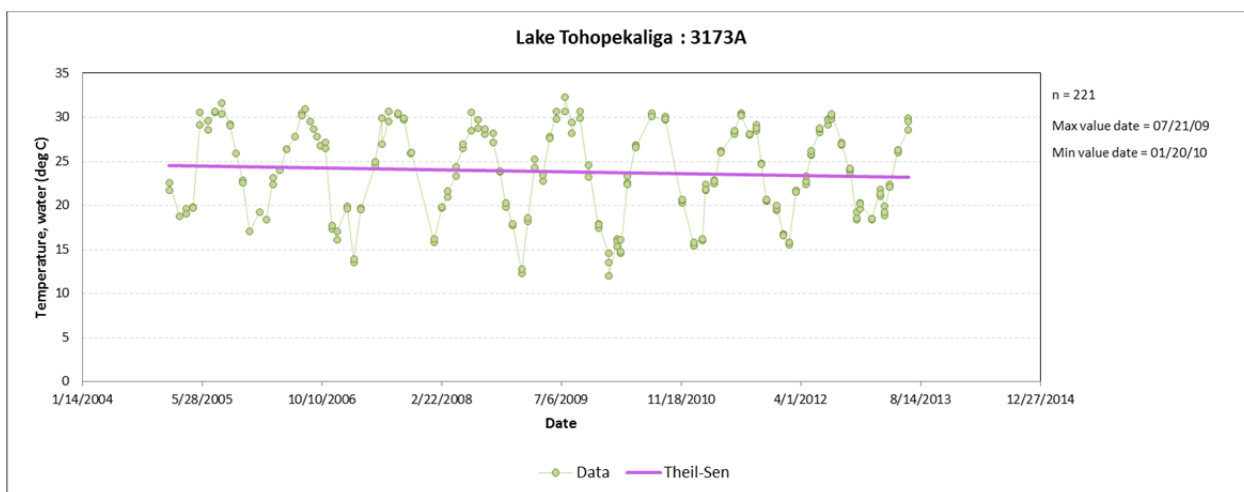
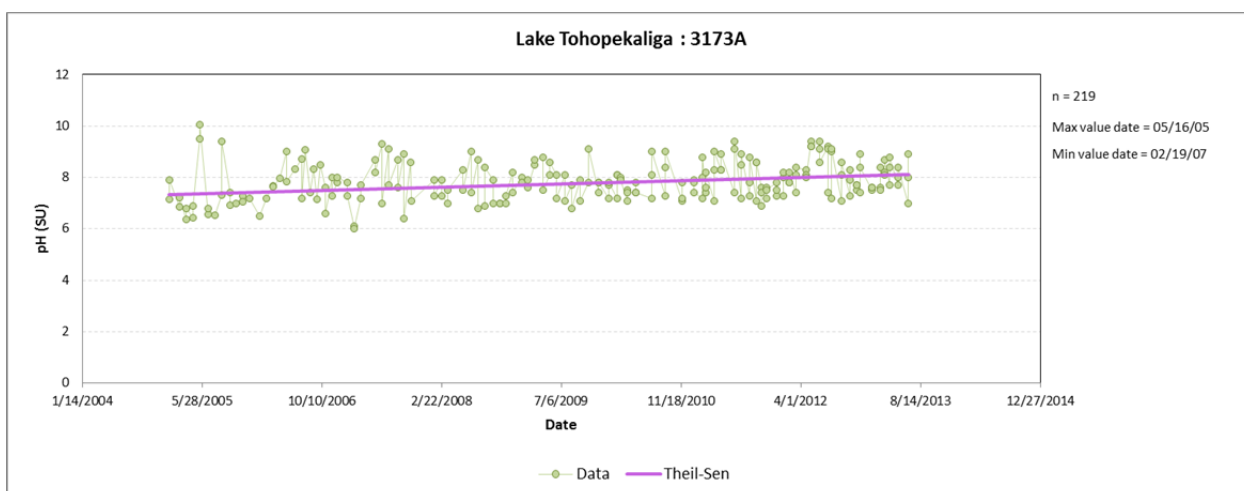
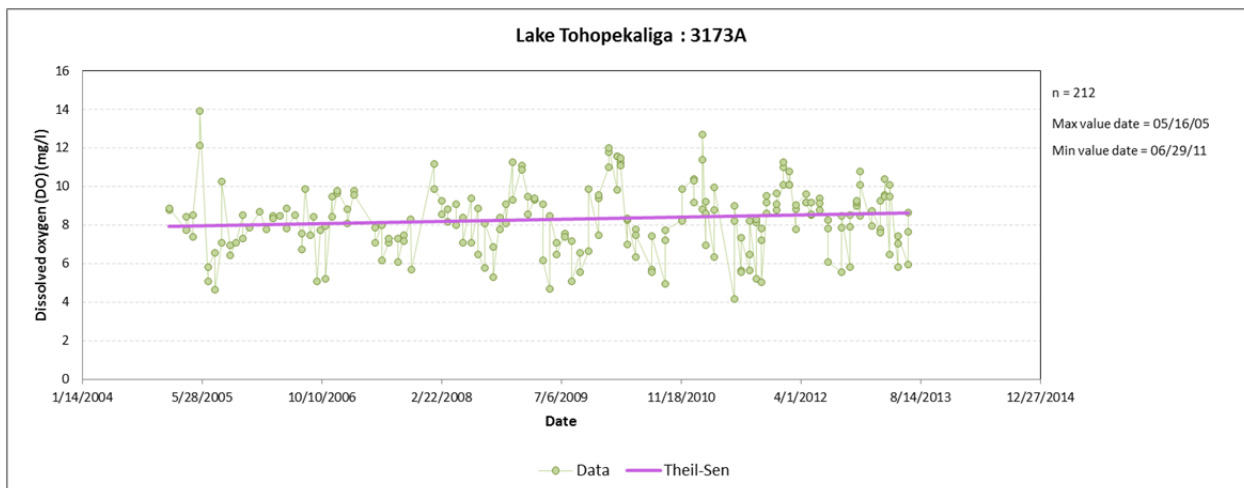


*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

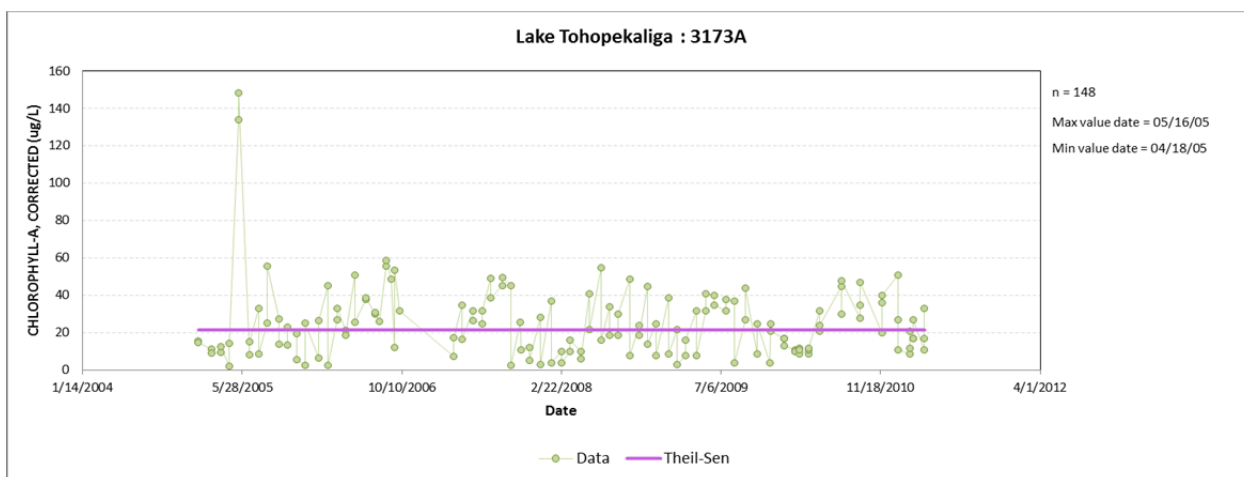
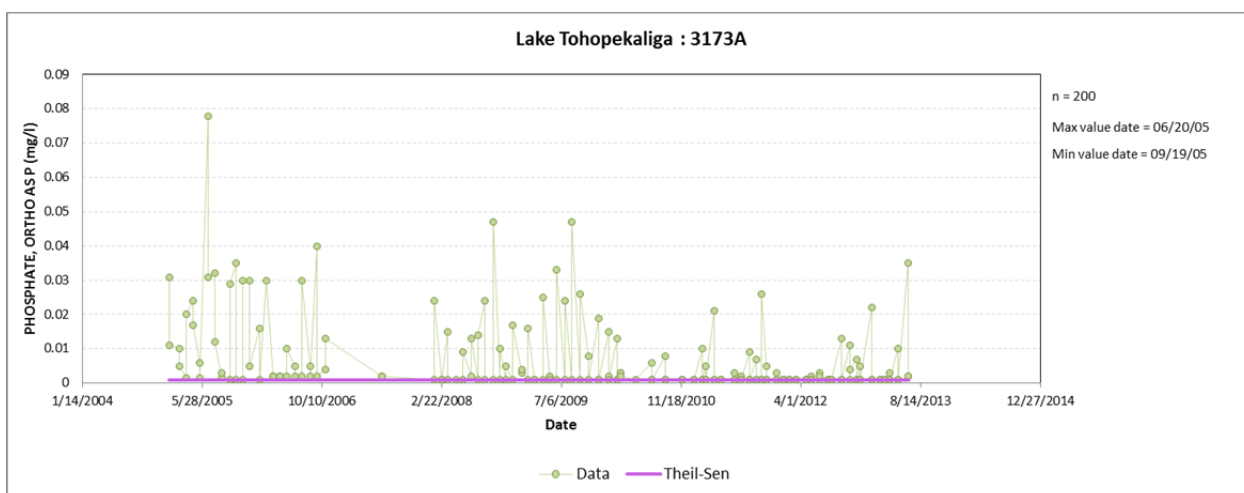
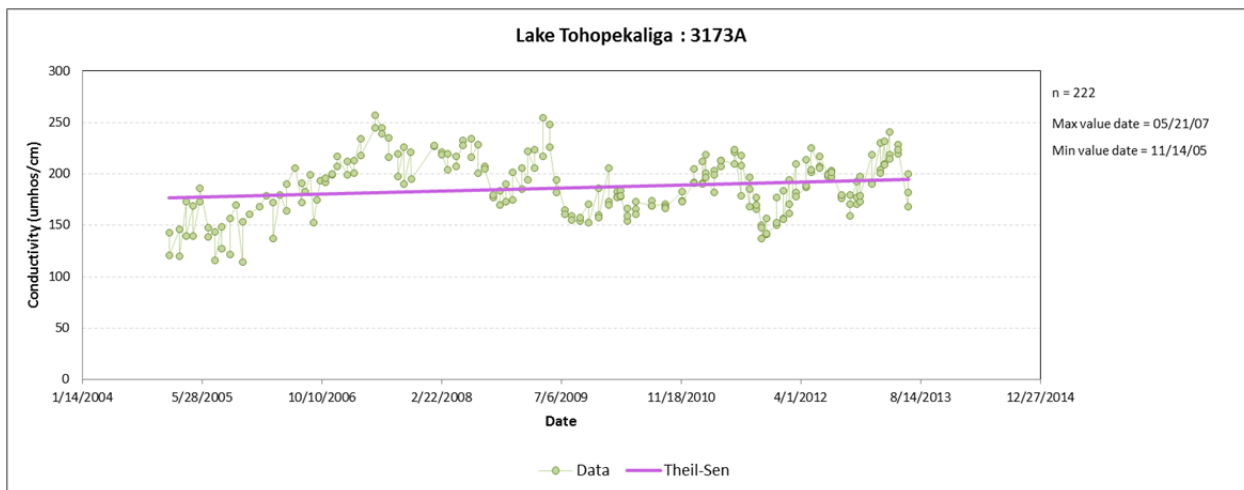
Lake Tohopekcaliga: WBID 3173A



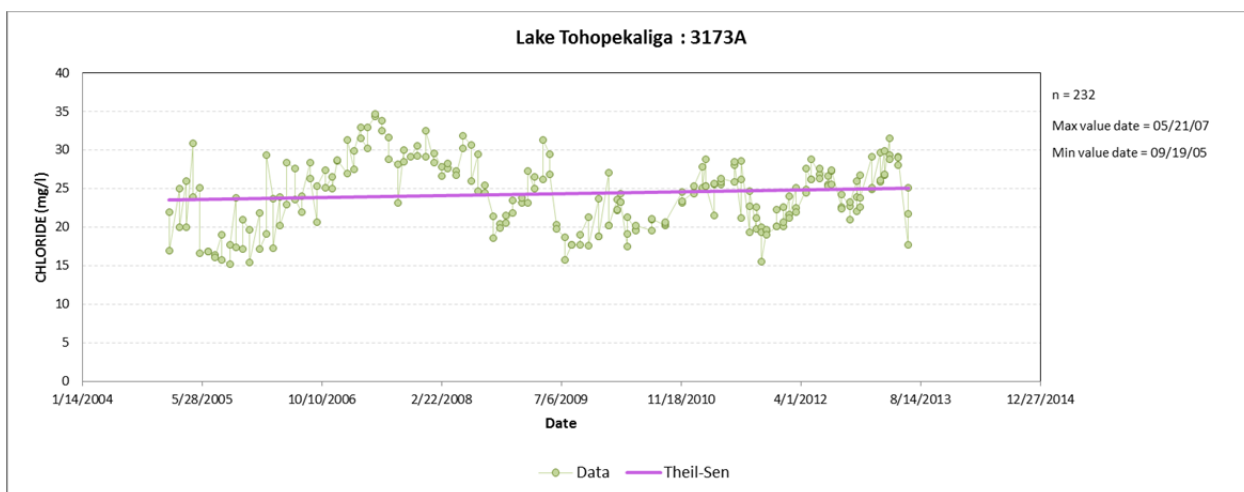
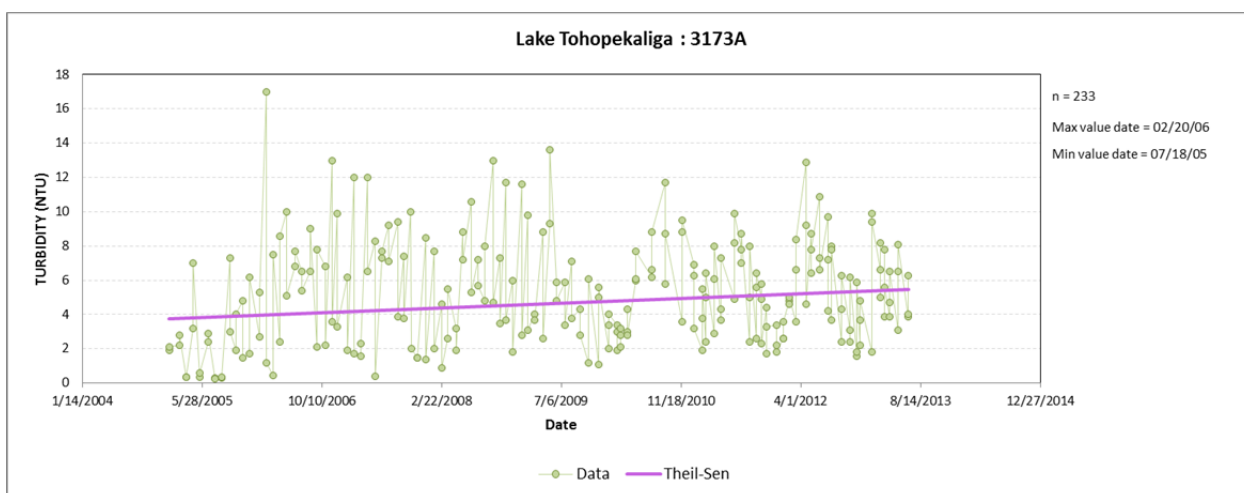
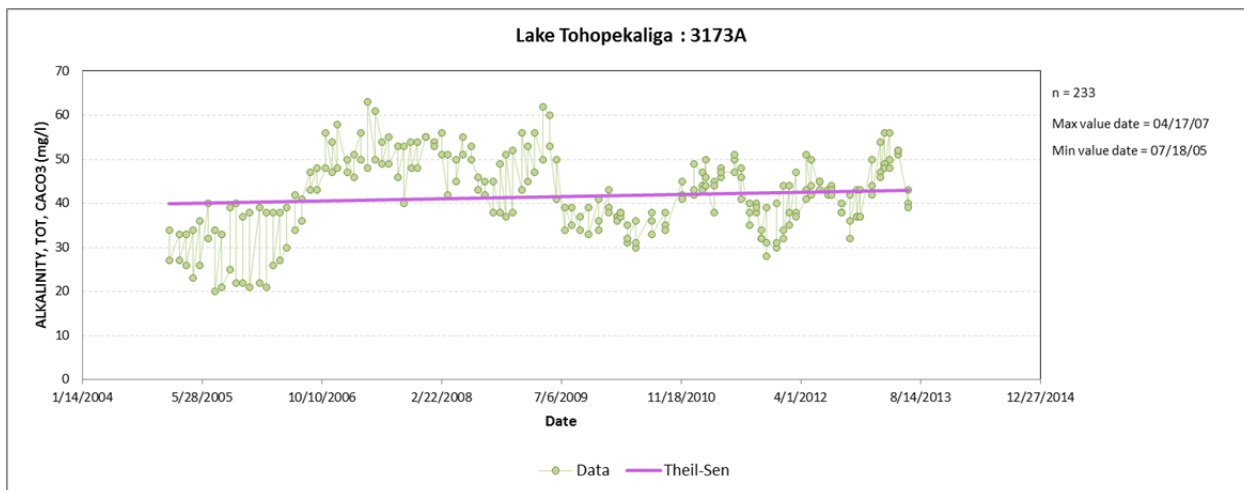
*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.



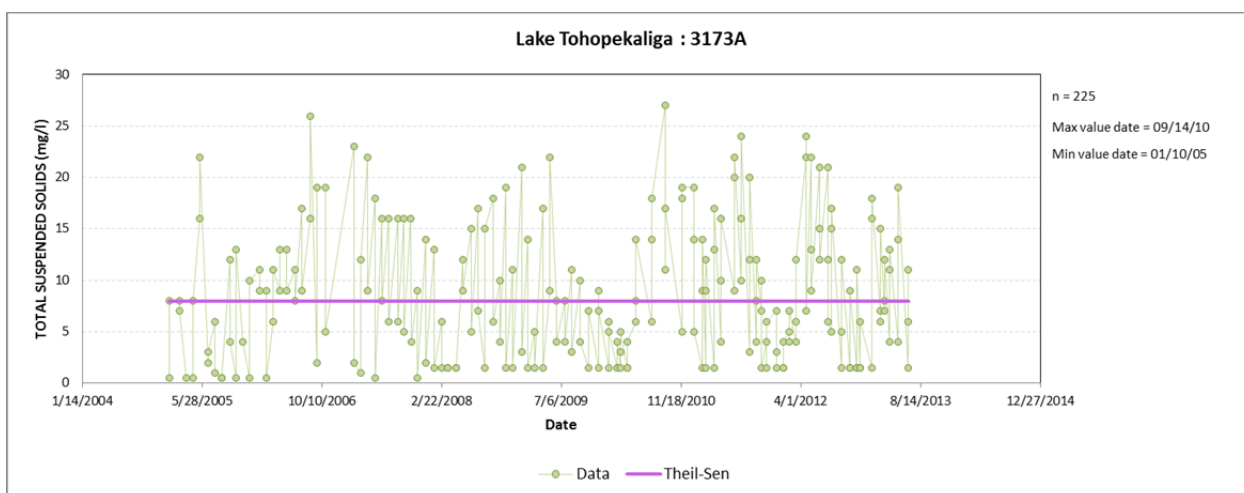
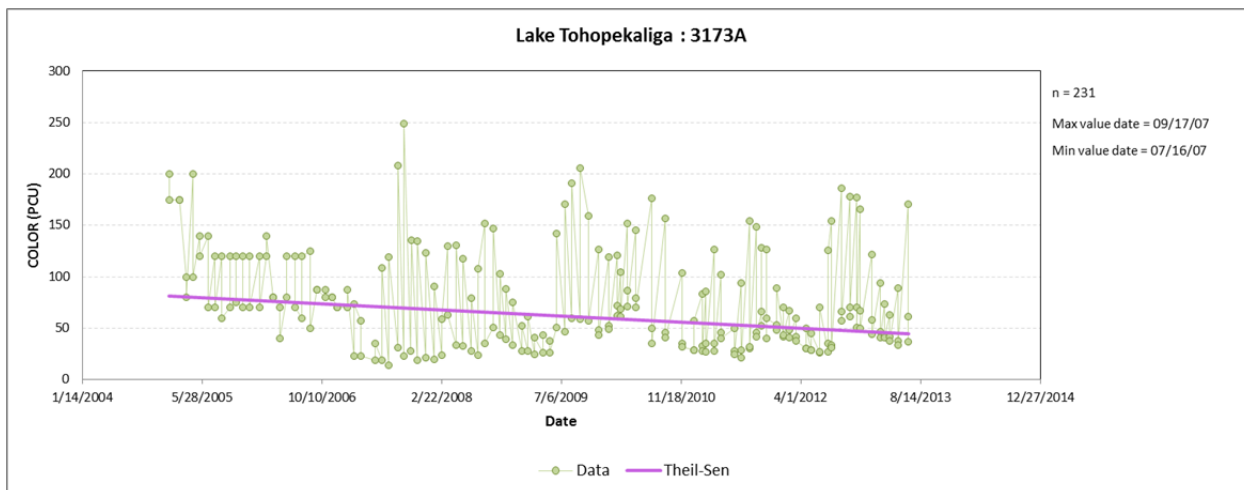
*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.



*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

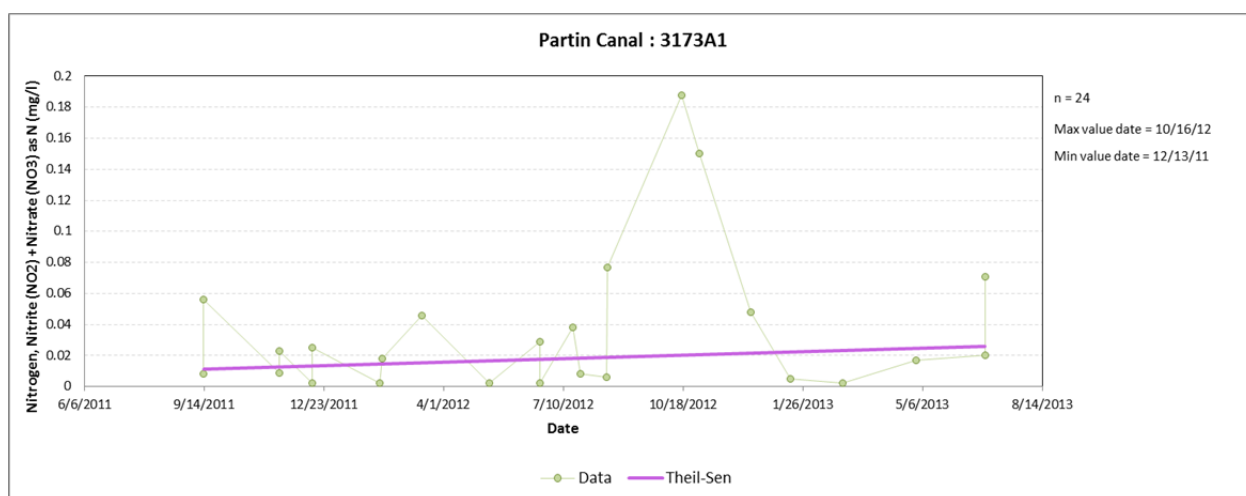
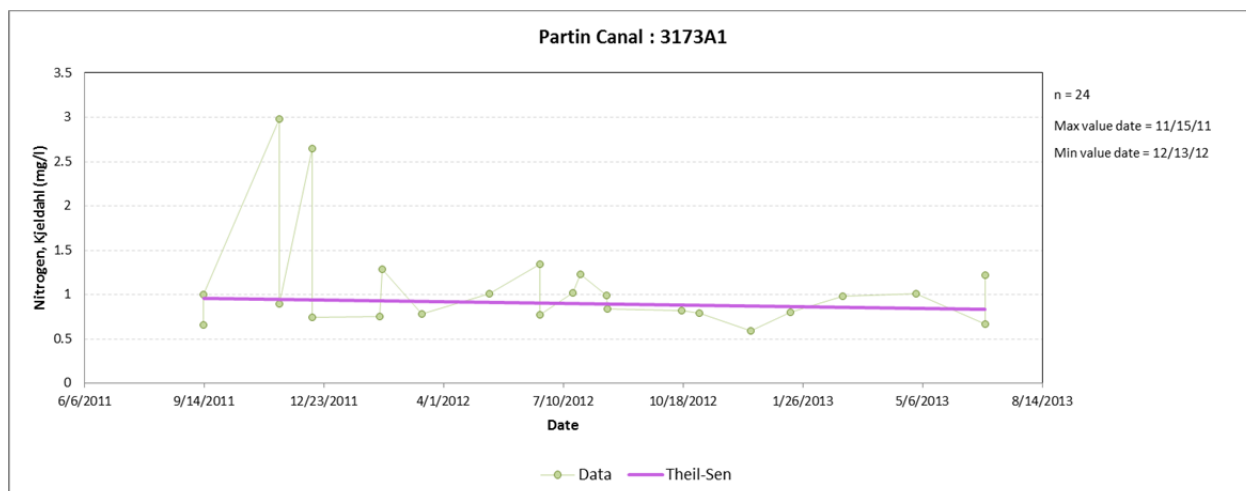
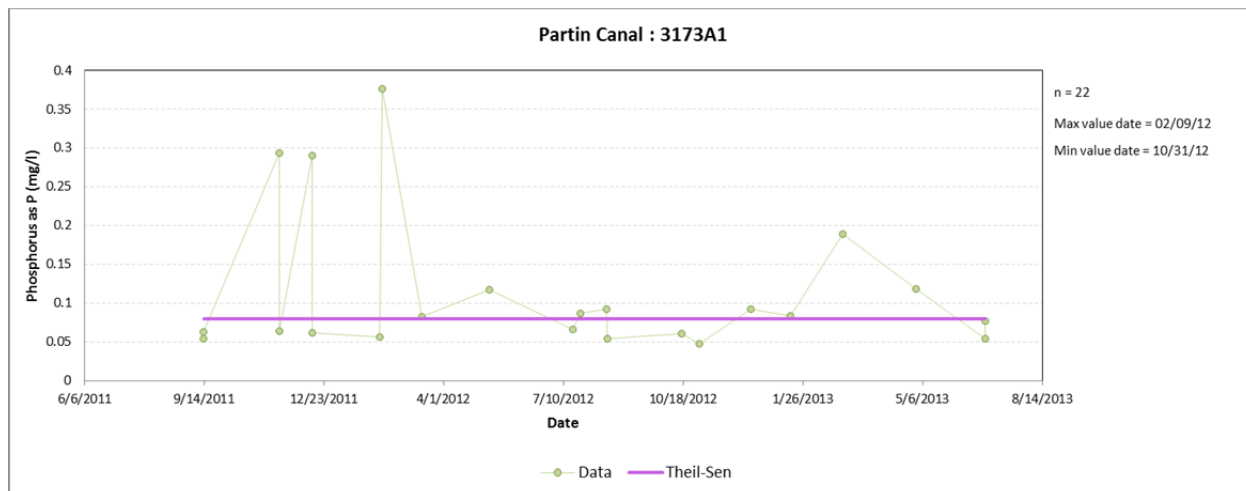


*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

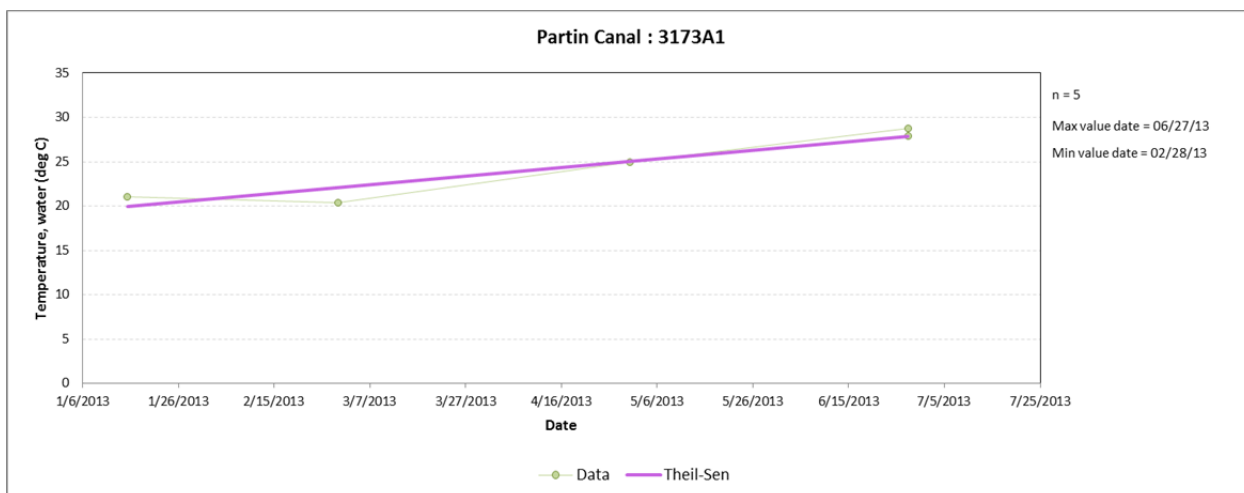
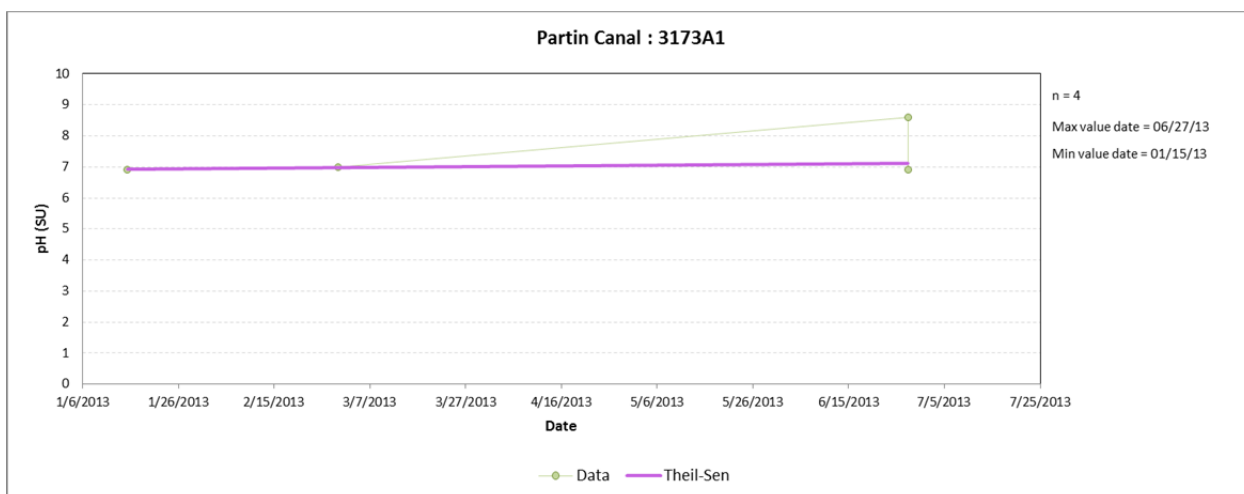
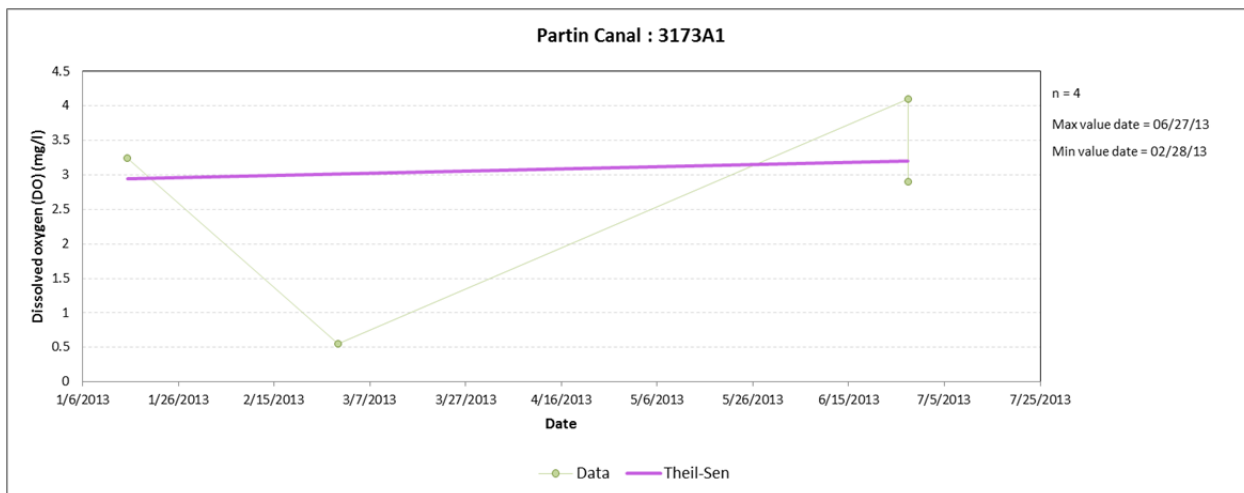


*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

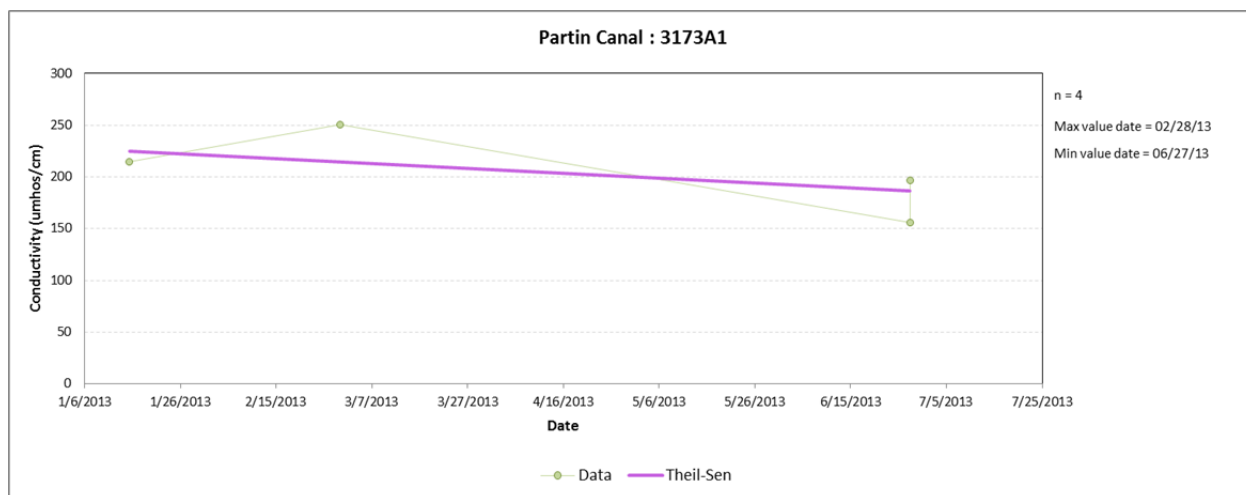
Partin Canal: WBID 3173A1



*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

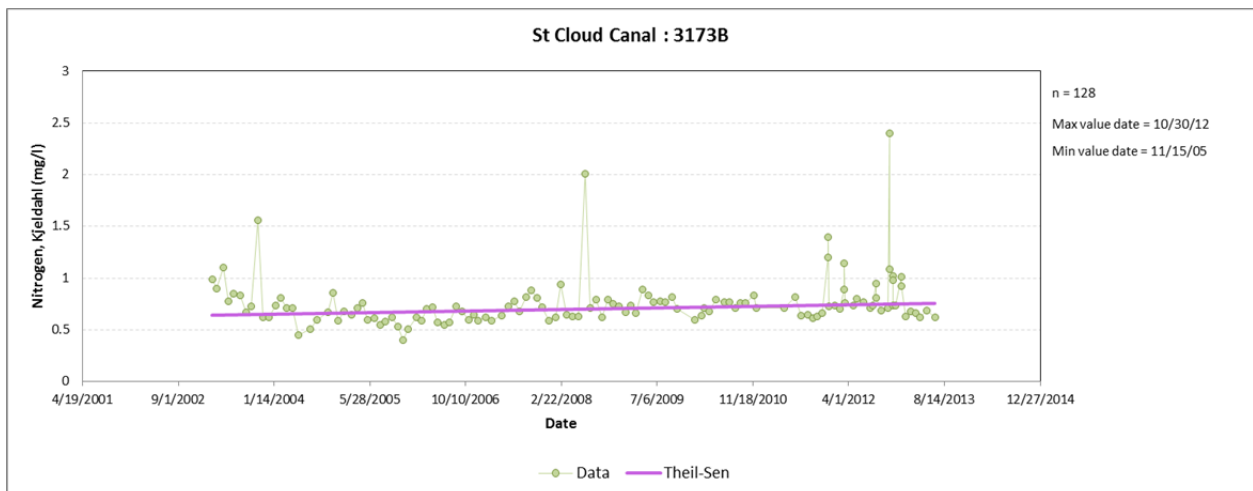
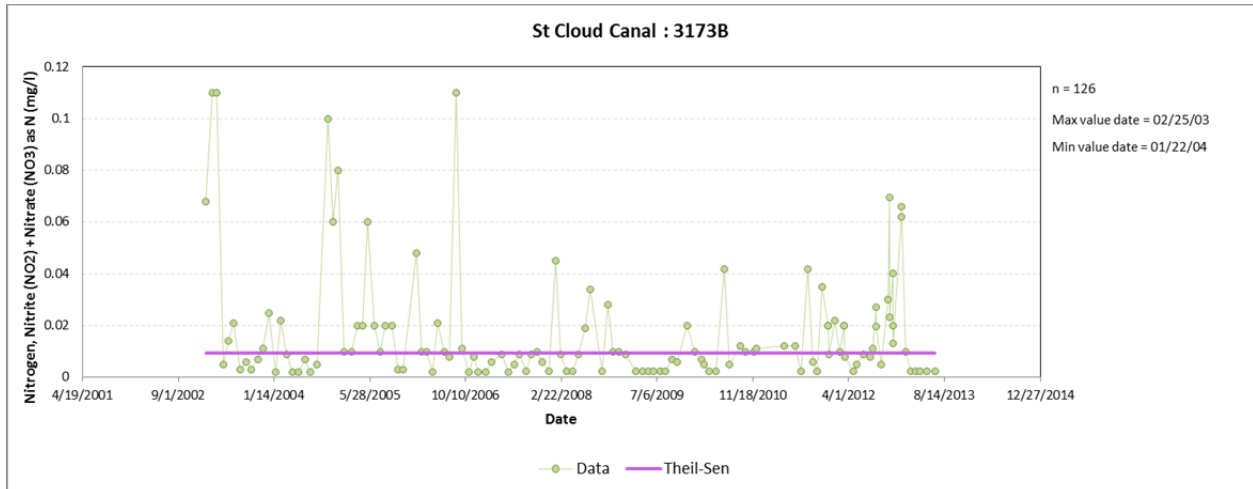
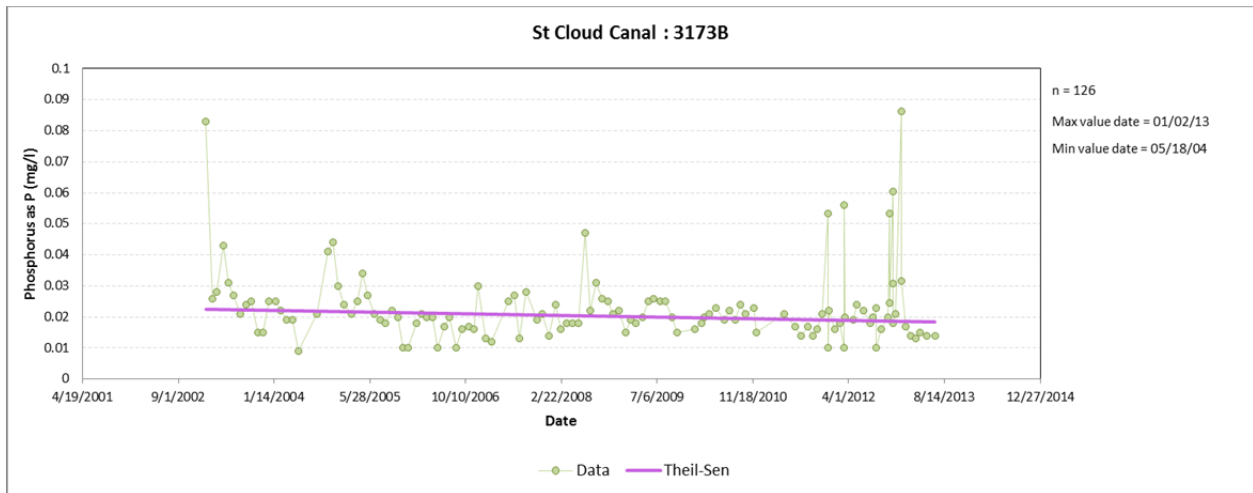


*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

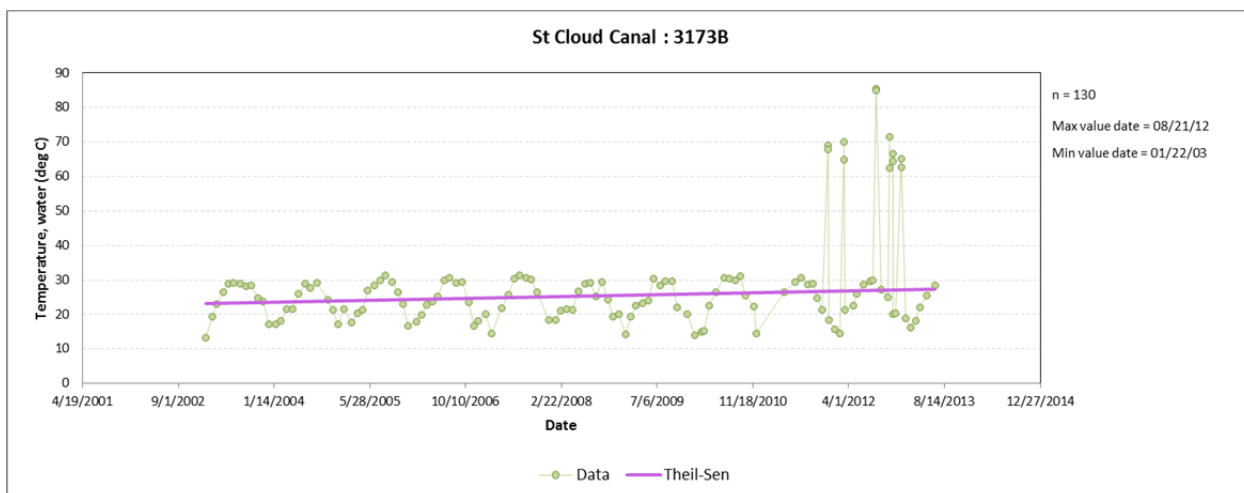
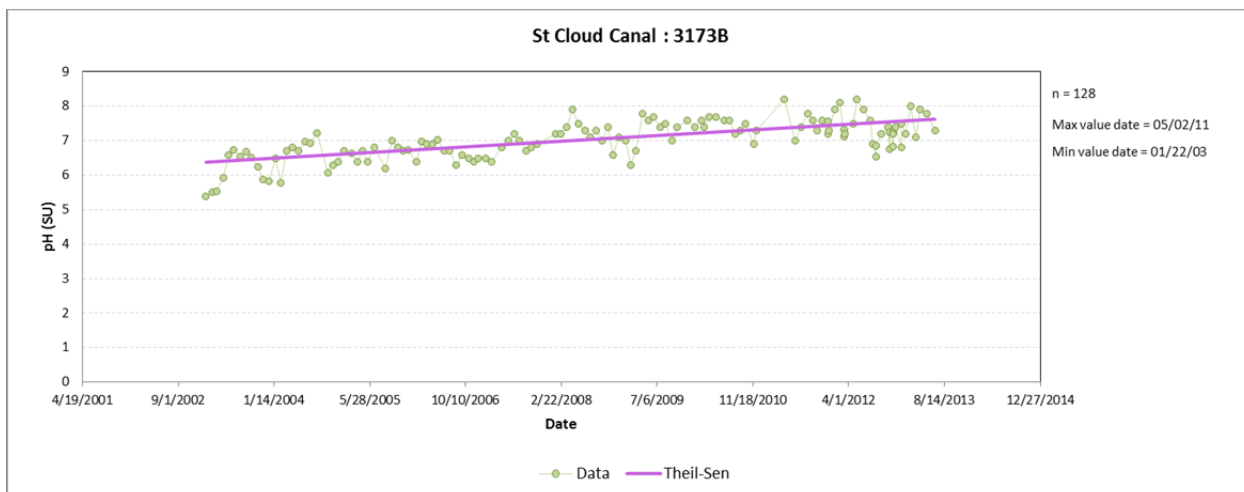
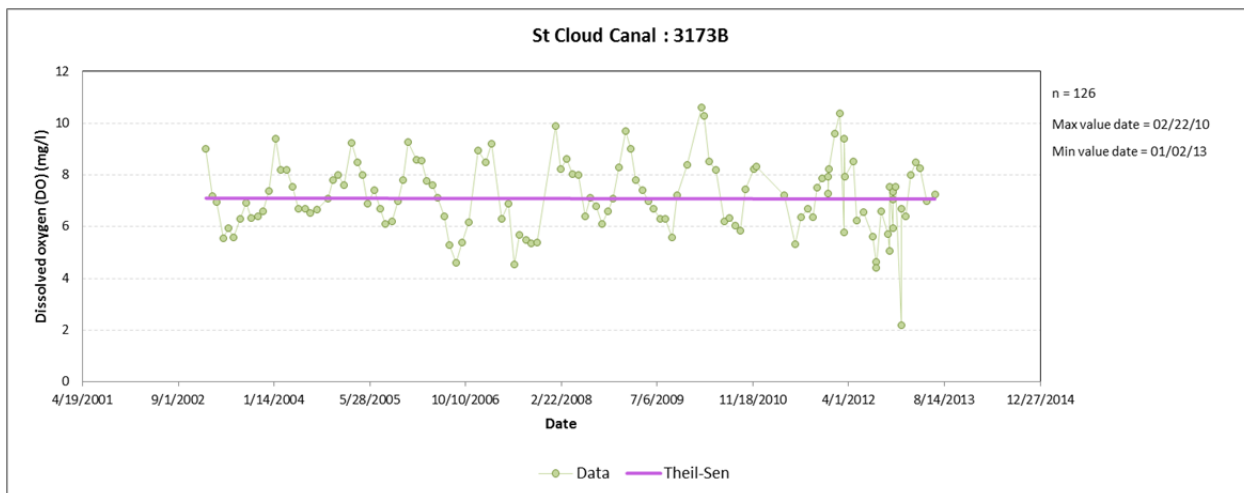


*Please note that the tool used to summarize the graphics does not include the same time scale for each graph. The horizontal and vertical scale should be noted during review or when making comparisons.

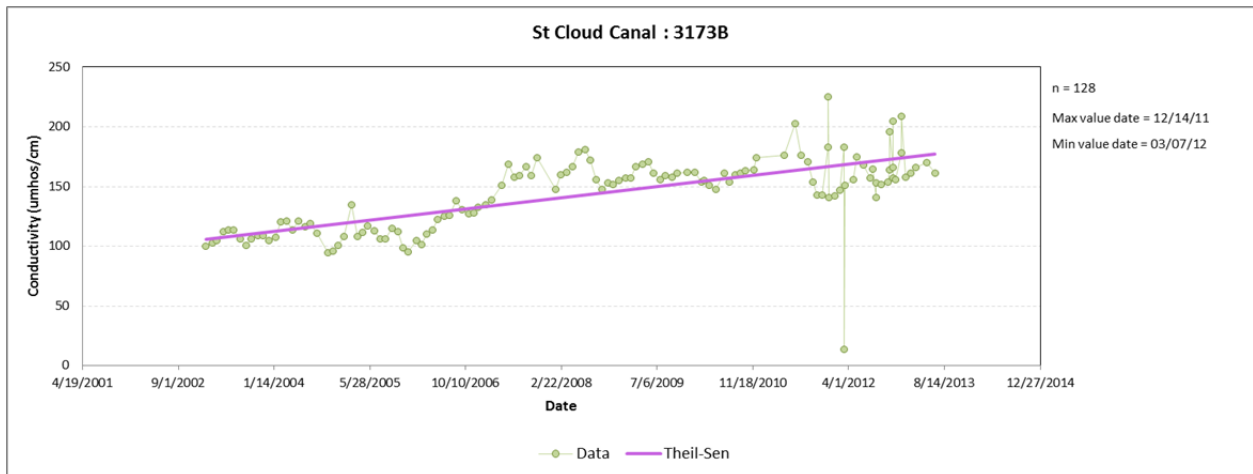
St. Cloud Canal: WBID 3173B



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LAKE TOHOPEKALIGA (SOUTH SEGMENT) : 3173C

Phosphorus as P (mg/l)

Date

n = 79

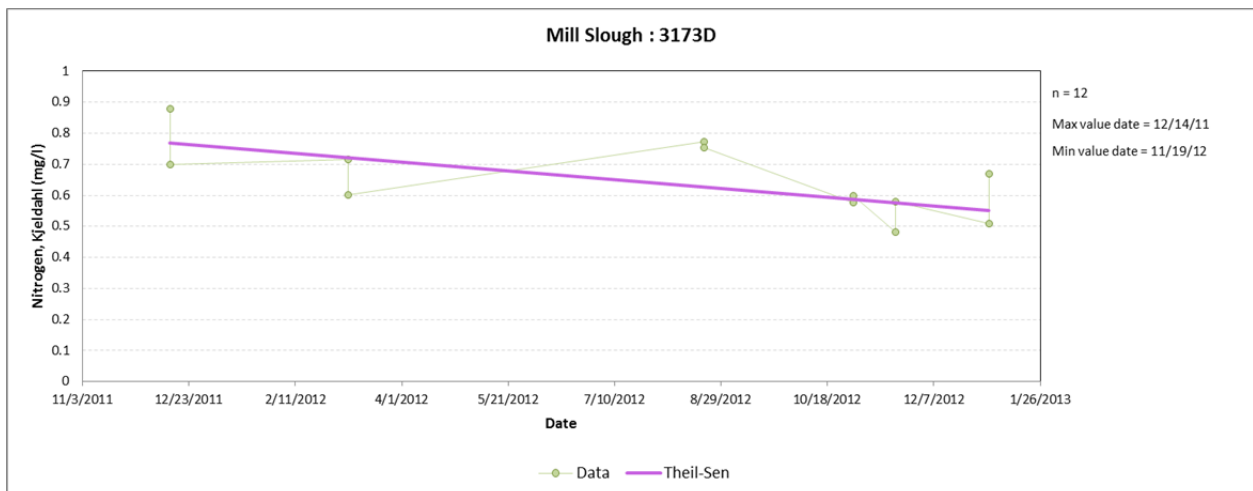
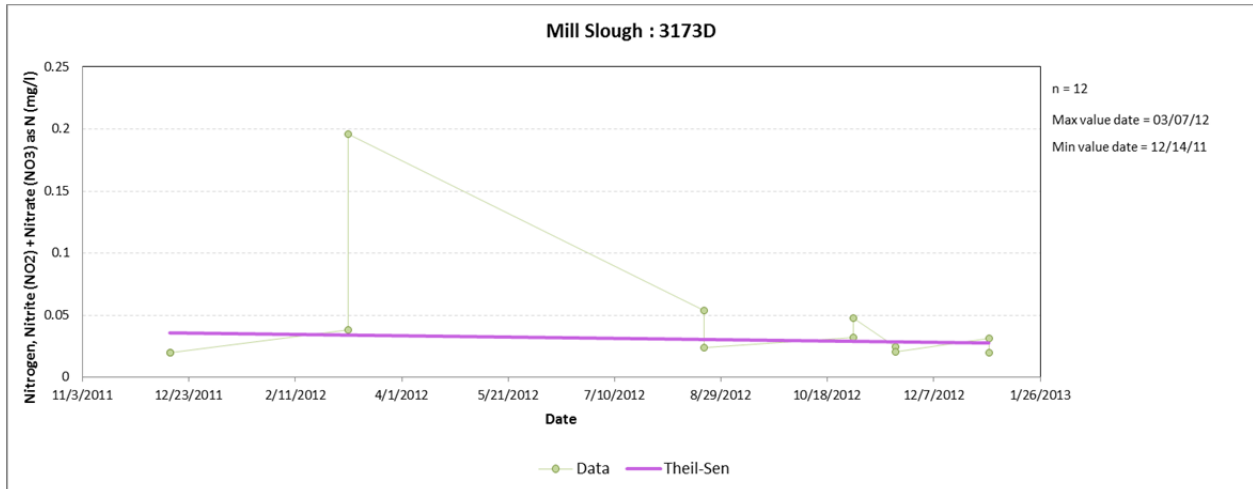
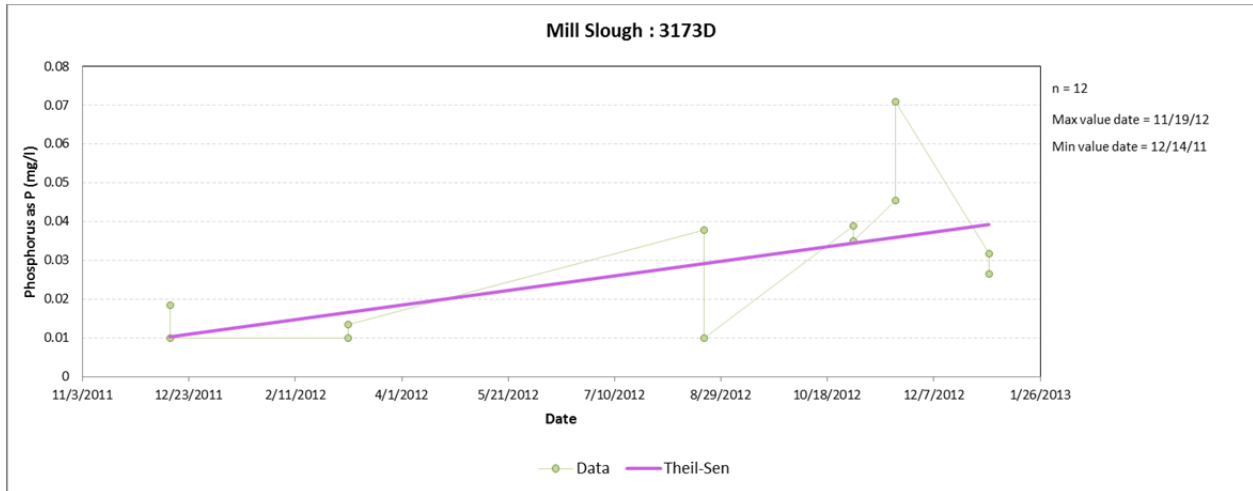
Max value date = 01/23/08

Min value date = 07/08/09

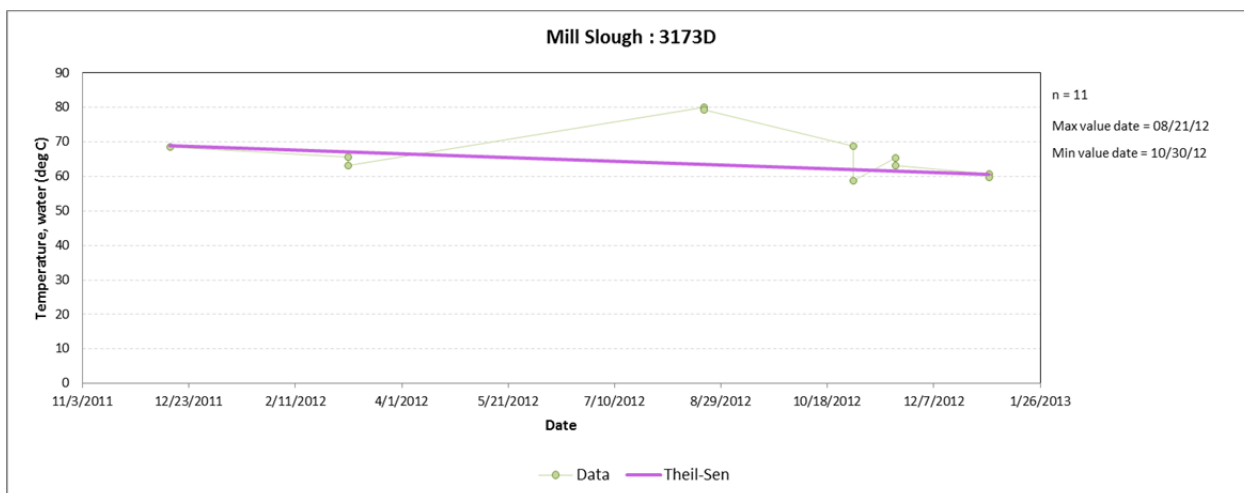
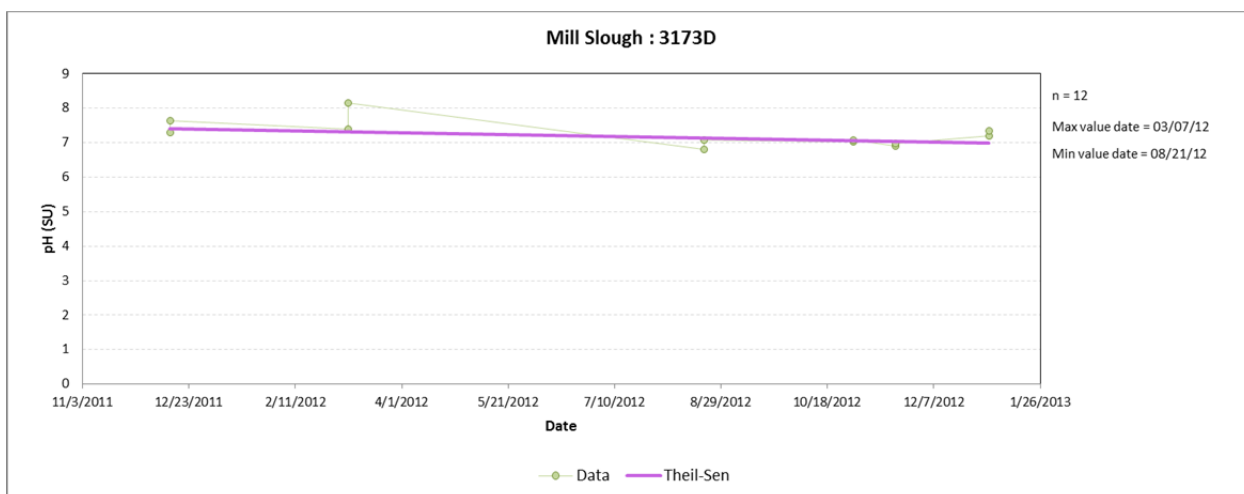
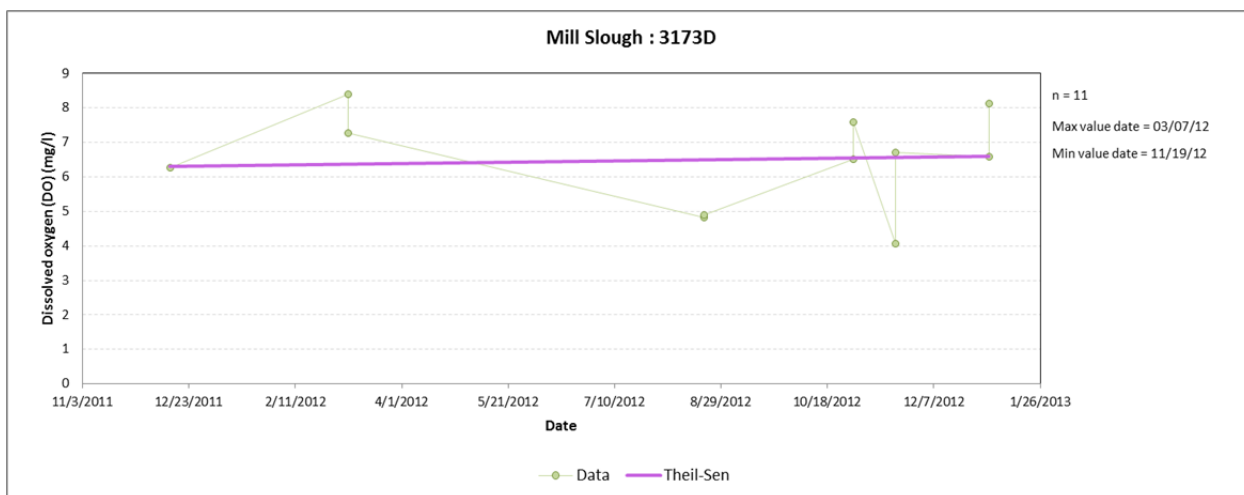
Legend: Data (green circles), Theil-Sen (purple line)

C-31

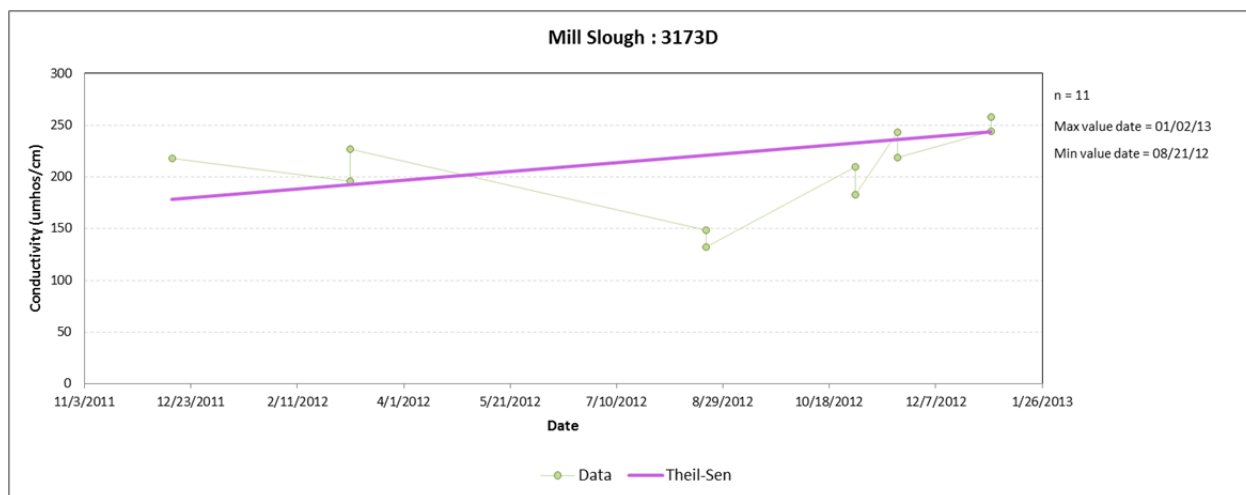
Mill Slough: WBID 3173D



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