Central District • Kissimmee River Basin

Final Report

Nutrient TMDLs for Lakes Condel and Anderson (WBIDs 3168X5 and 3168E)

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Executive Summary

This report presents the total maximum daily load (TMDL) developed to address the nutrient impairments for Lakes Condel and Anderson located in the upper Kissimmee River Basin in Orange County. Both waterbodies were identified as impaired for nutrients based on elevated chlorophyll *a* concentrations and, in Lake Condel, total nitrogen (TN) and total phosphorus (TP) concentrations exceeding numeric nutrient criteria. These lakes were added to the 303(d) list by Secretarial Order in June 2017 as segments with waterbody identification (WBID) numbers 3168X5 and 3168E, respectively.

The TMDLs are based on the generally applicable NNC in subsection 62-302.531(2), F.A.C. TMDLs for TN and TP have been developed, and **Table EX-1** lists supporting information for the TMDLs. These were developed in accordance with Section 303(d) of the federal Clean Water Act and guidance developed by the U.S. Environmental Protection Agency.

Table EX-1. Summary of TMDL supporting information for Lakes Condel and Anderson

Type of Information	Description
Waterbody name/ Waterbody Identification (WBID) number	Lake Condel/WBID 3168X5 and Lake Anderson/WBID 3168E
Hydrologic Unit Code (HUC) 8	03090101
Use classification/ Waterbody designation	Class III/Fresh
Targeted beneficial uses	Fish consumption; recreation; and propagation and maintenance of a healthy, well-balanced population of fish and wildlife
303(d) listing status	Verified List of Impaired Waters for the Group 4 basins (Kissimmee River Basin) adopted via Secretarial Order dated June 27, 2017
TMDL pollutants	TN and TP
Generally applicable chlorophyll *a* criterion	**TN:** 1.05 milligrams per liter (mg/L), expressed as an annual geometric mean (AGM) not to be exceeded more than once in a 3-year period **TP:** 0.03 mg/L, expressed as an AGM not to be exceeded more than once in a 3-year period
Total Maximum Daily Loads (TMDLs)	**Lake Condel (WBID 3168X5)**: 59 % TN reduction and 86 % TP reduction to achieve the generally applicable chlorophyll *a* criterion of 20 micrograms per liter (µg/L) for low-color, high alkalinity lakes **Lake Anderson (WBID 3168E)**: 22 % TN reduction and 52 % TP reduction to achieve the generally applicable chlorophyll *a* criterion of 20 µg/L for low-color, high alkalinity lakes

Acknowledgments

This analysis was accomplished thanks to significant contributions from staff in the Florida Department of Environmental Protection (DEP) Division of Environmental Assessment and Restoration, specifically, the Office of Watershed Services, Watershed Assessment Section, Standards Development Section, Water Quality Restoration Program, Central Regional Operations Center, and Watershed Evaluation and TMDL Section.

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µg/L	Micrograms Per Liter
AGM	Annual Geometric Mean
ASL	Above Sea Level
BMAP	Basin Management Action Plan
BMP	Best Management Practice
$CaCO_3$	Calcium Carbonate
CFR	Code of Federal Regulations
cm	Centimeter
CWA	Clean Water Act
DEP	Florida Department of Environmental Protection
EPA	U.S. Environmental
ERD	Environmental Research & Design
ESA	Endangered Species Act
F.A.C.	Florida Administrative Code
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
F.S.	Florida Statutes
FWRA	Florida Watershed Restoration Act
FWS	U.S. Fish and Wildlife Service
Ha	Hectare
HUC	Hydrologic Unit Code
HSG	Hydrologic Soil Group
ID	Insufficient Data
IWR	Impaired Surface Waters Rule
km^2	Square Kilometer
LA	Load Allocation
m	Meter
m^3	Cubic Meter
MDL	Minimum Detection Limit
Mg/L	Milligrams Per Liter
MOS	Margin of Safety
MS4	Municipal Separate Storm Sewer System
NA	Not Available
NHWE	Normal High-Water Elevation
NMFE	National Marine Fisheries Service
NNC	Numeric Nutrient Criteria
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System

OSTDS	Onsite Sewage Treatment and Disposal System
PCU	Platinum Cobalt Unit
PLRG	Pollutant Load Reduction Goal
POR	Period of Record
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement and Management (Program)
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
U.S.	United States
WBID	Waterbody Identification (Number)
WLA	Wasteload Allocation
WQS	Water Quality Standards
WWTF	Wastewater Treatment Facility

Chapter 1: Introduction

1.1 Purpose of Report

This report presents the total maximum daily loads (TMDLs) developed to address the nutrient impairment of Lakes Condel and Anderson, located in the upper Kissimmee River Basin in Orange County. The TMDLs are based on the generally applicable numeric nutrient criteria (NNC) in subsection 62-302.531(2), F.A.C. The TMDL targets are not being adopted as hierarchy 1 site specific interpretations of the numeric nutrient criterion because the generally applicable low color high alkalinity NNC fully protect designated uses.

Both waterbodies were verified as impaired for nutrients using the methodology in the Identification of Impaired Surface Waters Rule (IWR) (Chapter 62-303, F.A.C.), and were included on the Verified List of Impaired Waters for the Kissimmee River Basin that was adopted by Secretarial Order in June 2017.

The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and provides water quality targets needed to achieve compliance with applicable water quality criteria based on the relationship between pollutant sources and water quality in the receiving waterbody. The TMDLs establish the allowable nutrient concentrations for Lakes Condel and Anderson and associated nutrient reductions that would restore the waterbodies so that they meet their applicable water quality criteria for nutrients.

1.2 Identification of Waterbody

For assessment purposes, the Florida Department of Environmental Protection (DEP) divided the Kissimmee River Basin (Hydrologic Unit Code [HUC] 8 – 03090101) into watershed assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or surface water segment. Lake Condel is WBID 3168X5, and Lake Anderson is WBID 3168E. **Figure 1.1** shows the locations of the WBIDs in their watersheds and the major geopolitical and hydrologic features in the region, and **Figures 1.2** and **1.2** contain more detailed maps of the WBIDs.

Lake Condel is a small residential lake with a surface area of 1.38 hectares (ha), while Lake Anderson is somewhat larger, with a surface area of 5.14 ha. Both are roughly oval lakes completely surrounded by single-family residences. Lake Condel is bounded on the west by Condel Drive, on the north by Dublin Street, on the east by Rogan Road, and on the south by Condel Drive and Condel Court. Lake Anderson is bounded on the west by Conway Gardens Road, on the north by Anderson Road, on the east by South Conway Road, and on the south by Gatlin Avenue.

Historically these were closed-basin seepage lakes with no surface outflows; however, stormwater improvements have connected them, allowing for interlake flow at higher seasonal water levels. Based on recommendations from a 1991 study conducted by PEC, Inc., Orange County altered the "land-locked" lake to provide a dedicated surface water outfall to downstream receiving waterbodies. This was effected via the construction of a discharge pipe and pumping station in 2001 (Tucker and Lumbard 2012). As part of stormwater improvements to Lake Condel there is also a connection to Lake Tennessee (WBID 3168X1) which is an unimpaired lake located to the northeast of Lake Condel. As there is not normally a discharge into Lake Condel, Lake Tennessee is not included as part of the Lake Condel watershed.

The Lake Condel outfall conveys water from Lake Condel via underground pipes to the southwest to a stormwater pond before it enters Lake Anderson. Recently this pond was outfitted with an alum treatment system installed by Environmental Research & Design (ERD) that commenced operation in 2018. In addition to the discharge from Lake Condel, Lake Anderson also can potentially receive discharge from Lake Inwood, to the southeast of Lake Anderson. The Lake Condel contribution is greater than that coming from Lake Inwood. Harper et al. (2014) estimated that 21 % of the average annual hydrologic inputs to Lake Anderson originate as a result of inflow from Lake Condel, with 3 % of the inflow to Lake Anderson originating from Lake Inwood.

Lake Anderson in turn has its own outlet and pumping station to control its water level, and water from Lake Anderson is discharged to the southwest to the much larger (~259-ha surface area) receiving waterbody of Little Lake Conway (Harper et al. 2014). **Figure 1.4** shows the individual watersheds for each lake and the interwatershed connections.

In terms of regional hydrology, the two lakes are part of the Boggy Creek Watershed, a 220-square-kilometer (km^2) basin containing 53 named lakes and 8 flowing streams. The Boggy Creek Watershed connects to the larger Kissimmee River Watershed via its discharge to Lake Tohopekaliga.

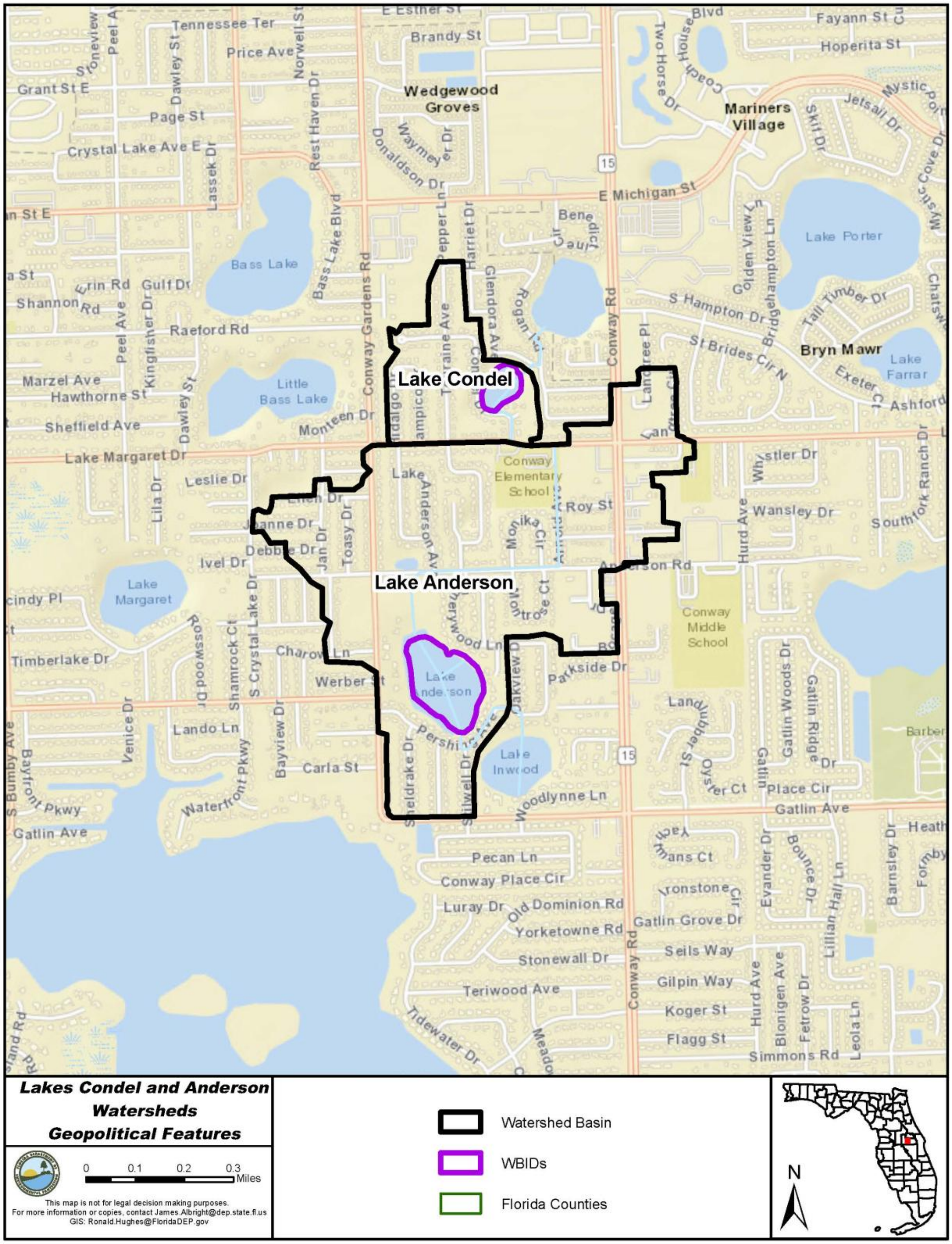

Figure 1.1. Location of Lakes Condel and Anderson in the Kissimmee River Basin and major hydrologic and geopolitical features in the area

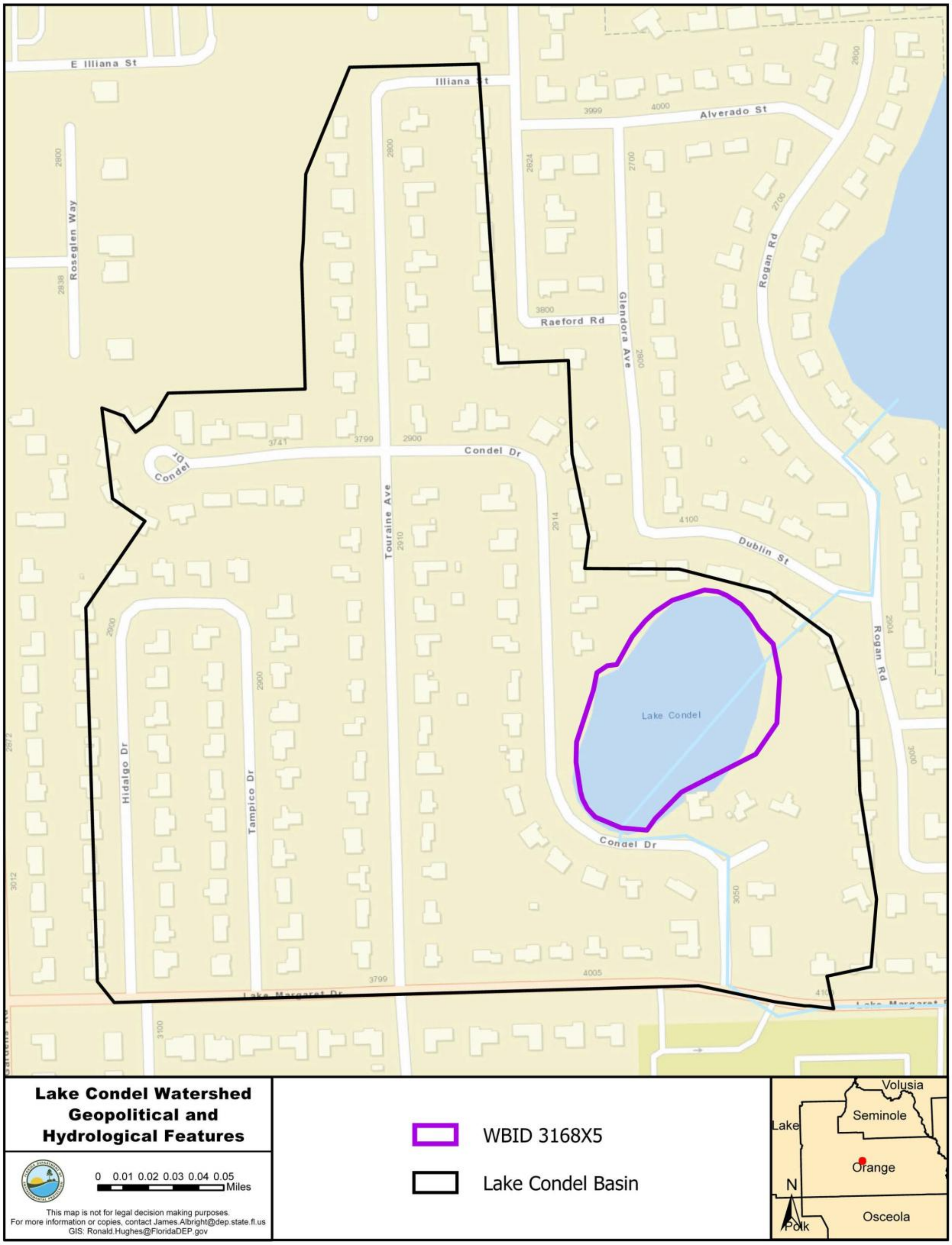

Figure 1.2. Lake Condel (WBID 3168X5) and the Lake Condel Watershed

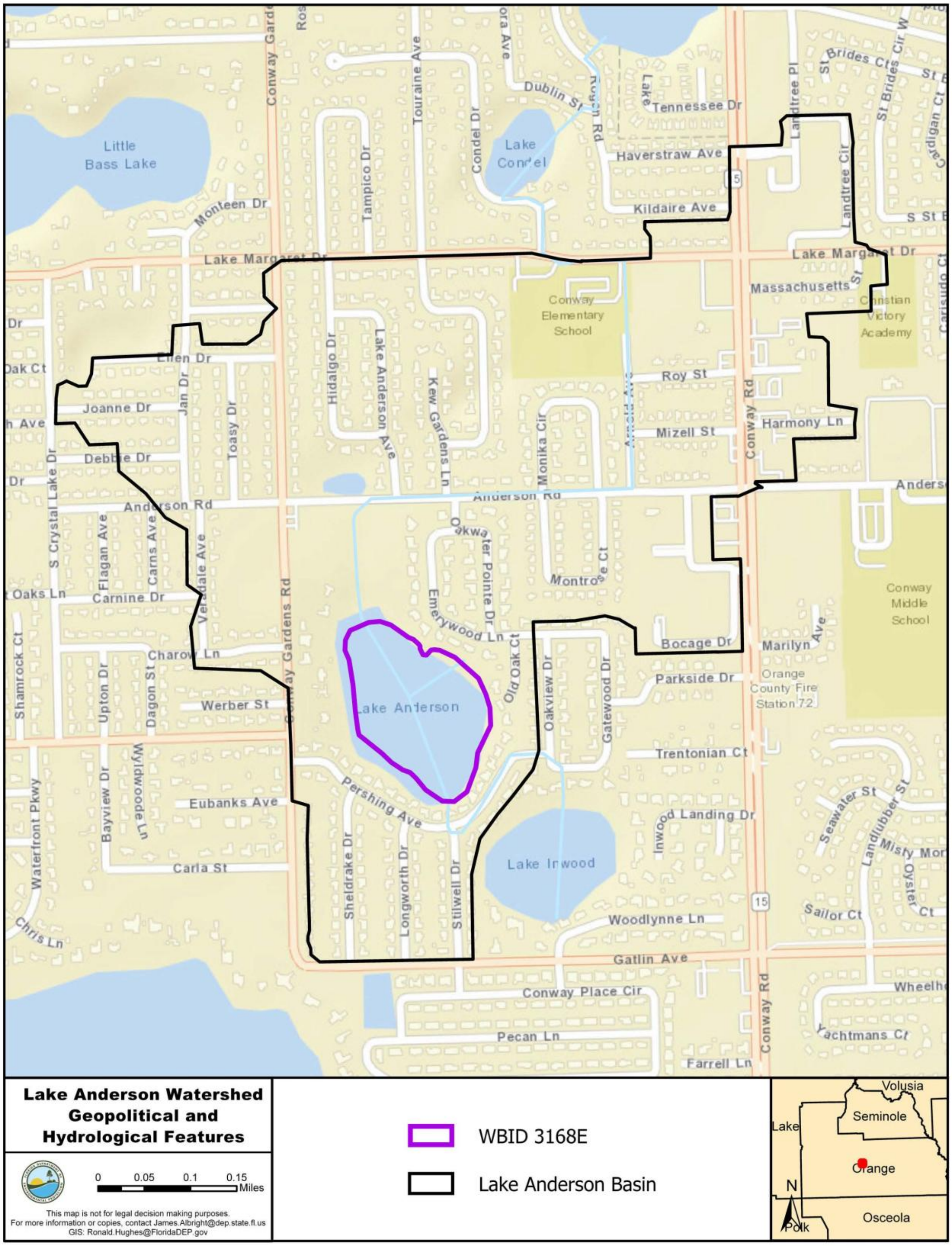

Figure 1.3. Lake Anderson (WBID 3168E) and the Lake Anderson Watershed

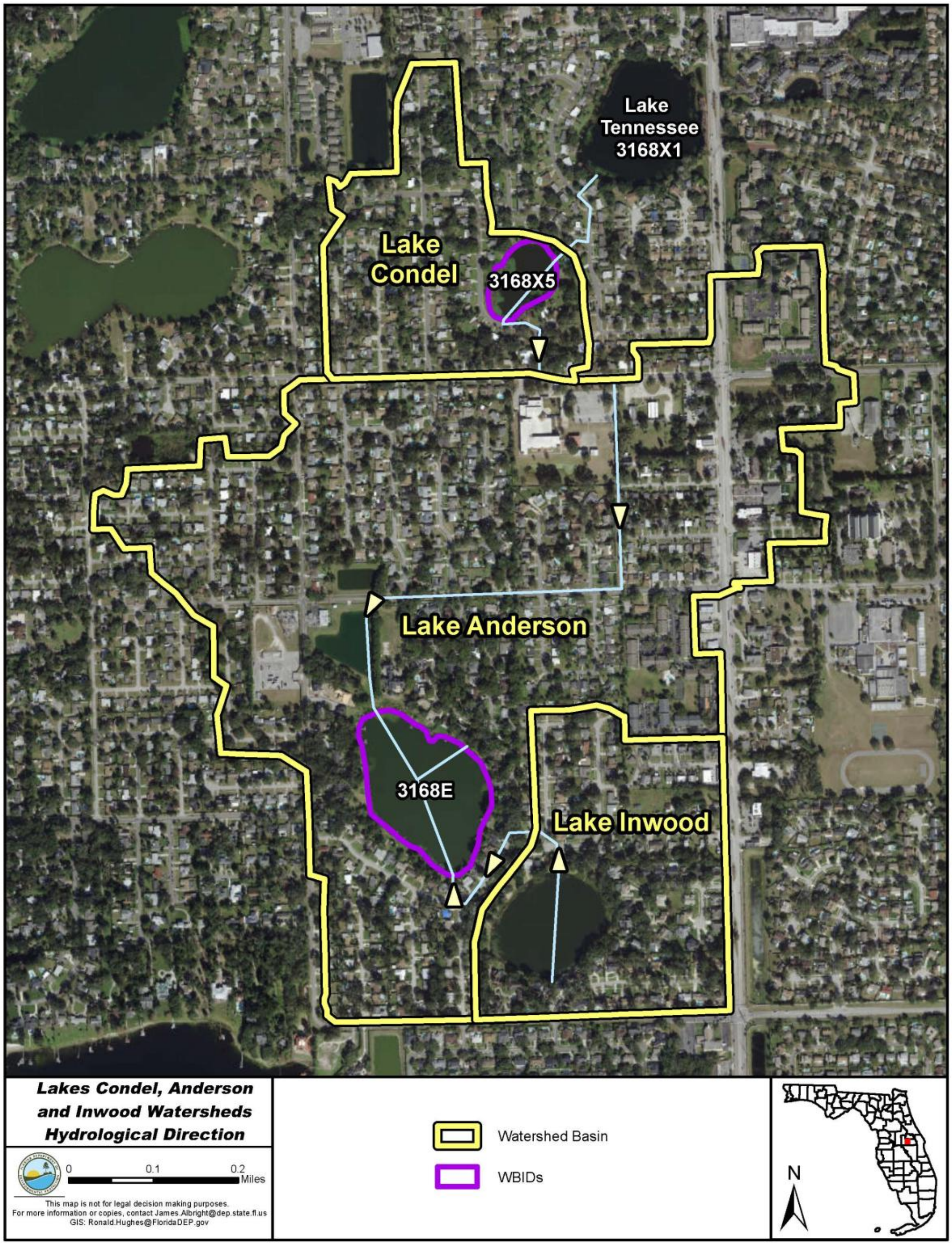

Figure 1.4. Human-modified hydrology of the Lakes Condel, Inwood, and Anderson Watersheds, showing interbasin connections (conveyance pipes are shown in light blue and yellow arrows indicate flow direction)

1.3 Watershed Information

1.3.1 Population and Geopolitical Setting

Lakes Condel and Anderson are located in unincorporated portions of south-central Orange County. Lake Condel lies immediately south of the city limits of Orlando, and Lake Anderson is situated just north of the northern boundary of the City of Belle Isle. At the time of the last census in 2010, Orange County had a population of 1,145,956, with an estimated population of 1,393,452 in 2019 (U.S. Census Bureau July 2019). The City of Orlando had an estimated population of 287,442 in 2019, and the City of Belle Isle had an estimated population of 7,240 in 2019.

The development of the Lakes Condel and Anderson Watersheds began in the early 20th century and accelerated significantly during the 1950s and 1960s. Land use in these drainage basins has now been converted almost entirely to urban types, including single-family residential, commercial, and office uses (Harper et al. 2014).

1.3.2 Topography

Lakes Condel and Anderson are located on the Orlando Ridge of the Central Florida Highlands. This promontory is part of a system of high sand ridges (relict paleodunes) running in roughly parallel north–south lines in central Florida. The ridges are characterized by high-infiltration-rate soils and xerophytic pine or oak forest or scrub habitat climax communities.

The elevations in the watersheds for these two lakes range from 27 meters (m) above sea level (ASL) on the southwest near Little Lake Conway to 32 m ASL in the northeast around Lake Condel. Lake Condel has a volume of 14,431 cubic meters (m^3), an average depth of 1.2 m, and a normal high-water elevation (NHWE) of 29 m. Lake Anderson has a volume of 184,405 m^3, an average depth of 3.5 m, and an NHWE of 23 m.

1.3.3 Hydrological Setting

The hydrogeology of this system is driven by soil geology, aquifer/groundwater interactions, and climate, in addition to the topographic elements described above.

The climate of the region is classed as humid subtropical in the Köppen classification system. It is characterized by warm, relatively wet summers and mild, relatively dry winters. Annual average temperatures in the region are 23° Celsius. Annual rainfall averages 129 centimeters (cm), and the majority of the rainfall occurs from June through September.

Soils are classified by the National Cooperative Soil Survey into four hydrologic soil groups (HSGs)—Types A, B, C, and or D—based on their runoff potential. "A" type soils are typically well-drained, have deep water tables, and consist of sandy textured soils with relatively low runoff potential. "B" type soils are typically loamy with some silt component, a moderately coarse texture, and a lower infiltration rate than Type A soils and are therefore classed as moderately well-drained. "C" type soils are sand, clay, and loam with more fine textures and lower infiltration rates, especially when wet. "D" type soils are variable in texture but generally have a greater clay component and are often found at lower topography with higher water tables that generate a higher hydrologic runoff response. Multiclassed soils vary in their hydrologic response depending on in situ drainage improvements.

As part of the Orlando Ridge of the Central Florida Highlands, the soils in the area are for the most part composed of various sands and sandy clay, with high infiltration rates. **Table 1.1** shows the breakdown of soil types in the combined Condel–Anderson–Inwood Watersheds. **Figure 1.5** displays the distribution of soil types in the Lakes Condel and Anderson Watersheds.

The majority of soils in the lake watersheds consists of a mix of well-drained Type A and A/D soils. These soils, by virtue of their infiltration characteristics and the watershed elevation, are principally aquifer recharge areas where a portion of the annual hydrologic inputs to Lakes Condel and Anderson is lost as a result of the downward migration of water in deeper permeable portions of the lakes in the intermediate aquifer layers and ultimately the Floridan aquifer (Harper et al. 2014).

Table 1.1. Soil type area and percent in the Lakes Condel, Anderson, and Inwood Watersheds

N/A = Not available

Soil Type	Watershed Total (ha)	Watershed Total (%)
A	98	69
A/D	33	23
B/D	2	2
N/A	8	6
Total	**141**	**100**

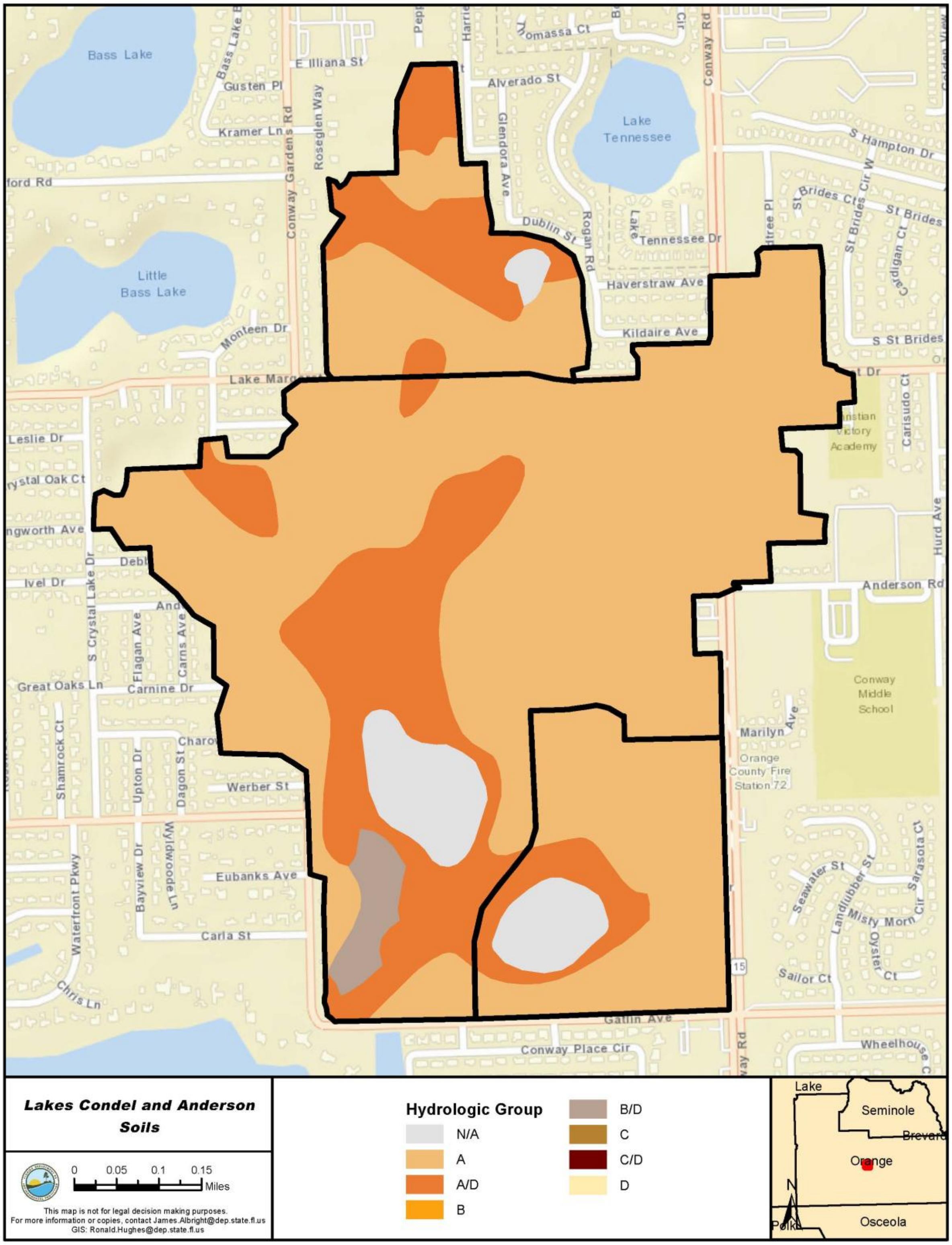

Figure 1.5. Hydrologic soil classifications in the Lakes Condel and Anderson Watersheds

Chapter 2: Water Quality Assessment and Identification of Pollutants of Concern

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act (CWA) requires states to submit to the U.S. Environmental Protection Agency (EPA) lists of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing the impairment of listed waters on a schedule. DEP has developed such lists, commonly referred to as 303(d) lists, since 1992.

The Florida Watershed Restoration Act (FWRA), Section 403.067, Florida Statutes (F.S.), directed DEP to develop, and adopt by rule, a science-based methodology to identify impaired waters. The Environmental Regulation Commission adopted the methodology as Chapter 62-303, F.A.C. (the IWR), in 2001. The rule was amended in 2006, 2007, 2012, 2013, and 2016.

The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA, subsection 403.067(4), F.S. In the past, the state's 303(d) list has been amended annually to include basin updates for 20% of the state every year, conducted as part of a rotating basin approach to cover the whole state every five years. However, beginning with the 2022 biennial assessment, the state's 303(d) list is now amended biennially and will consist of a statewide assessment every two years.

2.2 Classification of the Waterbody and Applicable Water Quality Standards

Lakes Condel and Anderson are Class III (fresh) waterbodies, both with a designated use of fish consumption, recreation, and propagation and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III water quality criterion applicable to the verified impairment (nutrients) for the waterbodies is Florida's nutrient criterion provided in paragraph 62-302.530(48)(b), F.A.C. Florida adopted NNC for lakes, spring vents, and streams in 2011. These were approved by the EPA in 2012 and became effective in 2014.

The applicable lake NNC are dependent on alkalinity, measured in milligrams per liter as calcium carbonate (mg/L $CaCO_3$), and true color (color), measured in platinum cobalt units (PCU), based on long-term period of record (POR) geometric means (**Table 2.1**). Long-term mean alkalinity was similar in the two lakes. The POR geometric mean alkalinity was 42 and 38 mg/L $CaCO_3$ for Lakes Condel and Anderson, respectively. The POR geometric mean color was 32 and 10 PCU for Lakes Condel and Anderson, respectively. The geometric means were calculated based on the results in the IWR Run 59 database. Using this methodology, the lakes are classified as low-color ($\leq$ 40 PCU), high-alkalinity (> 20 mg/L $CaCO_3$).

Table 2.1 lists the NNC for all Florida lake types specified in subparagraph 62-302.531(2)(b)1., F.A.C. The relevant row for Lakes Condel and Anderson is the gray shaded middle row corresponding to low-color, high alkalinity lakes (color < 40 PCU; alkalinity >20 mg/L $CaCO_3$). The chlorophyll *a* NNC for low-color, high alkalinity lakes is an annual geometric mean (AGM) value of 20 micrograms per liter (µg/L), not to be exceeded more than once in any consecutive 3-year period. The associated TN and TP criteria for a lake can vary annually, depending on the availability of data for chlorophyll *a* and the concentrations of chlorophyll *a* in the lake.

If there are sufficient data to calculate an AGM for chlorophyll *a* and the mean does not exceed the chlorophyll *a* criterion for the lake type listed in **Table 2.1**, then the TN and TP numeric interpretations for that calendar year are the AGMs of lake TN and TP samples, subject to the minimum and maximum TN and TP limits in the table.

If there are insufficient data to calculate the AGM for chlorophyll *a* for a given year, or the AGM for chlorophyll *a* exceeds the values in the table for the lake type, then the applicable numeric interpretations for TN and TP are the minimum values in the table. The minimum AGM limits for TN and TP are 0.03 and 1.05 mg/L, respectively. The maximum AGM limits for TN and TP are 0.09 and 1.91 mg/L, respectively.

Table 2.1. Chlorophyll *a*, TN, and TP criteria for Florida lakes, subparagraph 62-302.531(2)(b)1., F.A.C.

* For lakes with color > 40 PCU in the West Central Nutrient Region, the maximum TP limit is the 0.49 mg/L TP streams threshold for the region.

Long-Term Geometric Mean Lake Color and Alkalinity	AGM Chlorophyll *a* (µg/L)	Minimum Calculated AGM TP NNC (mg/L)	Minimum Calculated AGM TN NNC (mg/L)	Maximum Calculated AGM TP NNC (mg/L)	Maximum Calculated AGM TN NNC (mg/L)
>40 PCU	20	0.05	1.27	0.16*	2.23
≤ 40 PCU and > 20 mg/L $CaCO_3$	20	0.03	1.05	0.09	1.91
≤ 40 PCU and ≤ 20 mg/L $CaCO_3$	6	0.01	0.51	0.03	0.93

2.3 Determination of the Pollutants of Concern

2.3.1 Data Providers

The sources of lake nutrient data used in the most recent assessment period, beginning in 2009, are stations sampled by Orange County (21FLORAN…) and DEP (21FLCEN…). However, the majority of the nutrient data are from monitoring conducted by Orange County. **Figures 2.1** and **2.2** show the sampling locations in Lakes Condel and Anderson, respectively.

Almost all of the data used in the assessment of Lake Condel come from Orange County Station 21FLORANBC31, with some additional data from 2014 and 2015 coming from DEP Station 21FLCEN 26011445. Both stations are located at the center of Lake Condel.

The data used in the assessment of Lake Anderson were all from Orange County Station 21FLORANBC1, located in the center of the lake. Additional data were available from 2004 (prior to the verified assessment period) from two DEP stations (21FLCEN 26011047 and 21FLCEN 26011048), located at the northwest and southeast ends of the lake, respectively.

The individual water quality measurements discussed in this report are available in IWR Database Run 59 and are available on request.

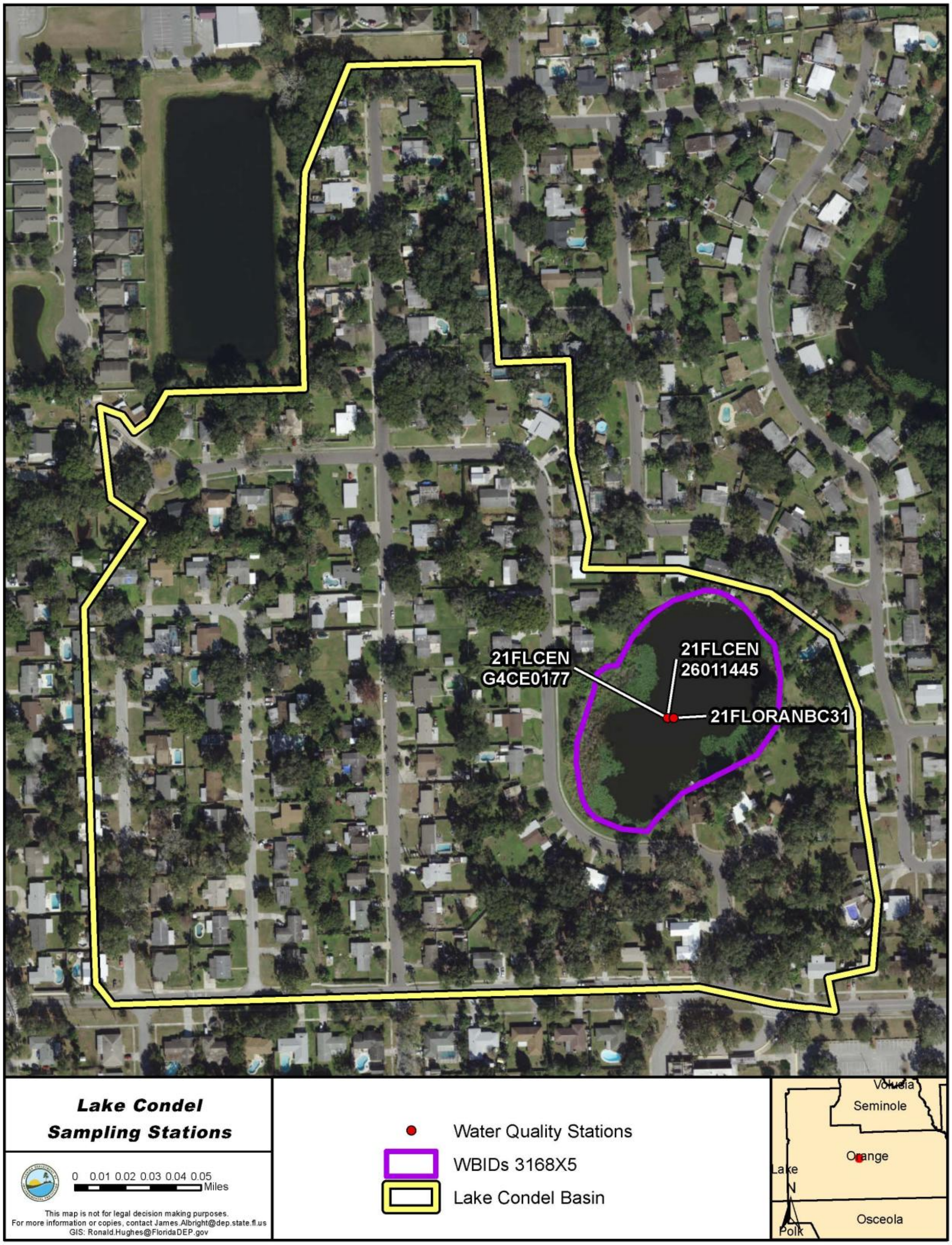

Figure 2.1. Monitoring stations in Lake Condel

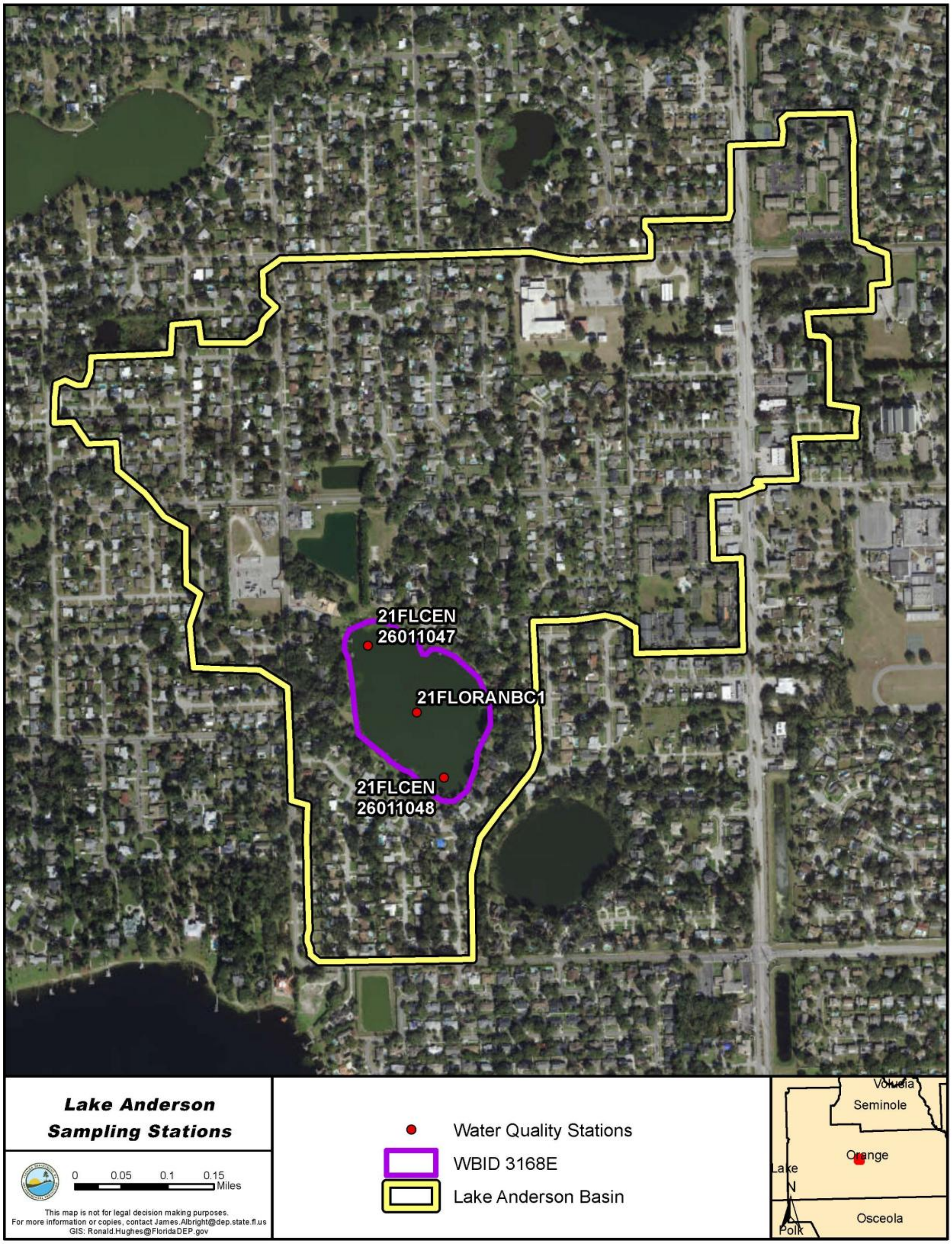

Figure 2.2. Monitoring stations in Lake Anderson

2.3.2 Information on Verified Impairment

The NNC were used to assess the lakes for the Group 4 basin assessment that was completed in 2017. Data for the assessment were derived from the IWR Run 53 Database, and the verified period for the assessment was January 1, 2009, to June 30, 2016. Lake Condel was assessed as impaired (Category 5) for chlorophyll *a*, TN, and TP because the AGMs exceeded the NNC more than once in a three-year period. Lake Anderson was found to be impaired for chlorophyll *a*, but not for TN and TP because each had only one exceedance in the verified period at the time of the assessment (more recent data allow for the calculation of an AGM in 2016 that is above the associated NNC). **Tables 2.2** and **2.3** list the chlorophyll a, TN, and TP AGMs for Lakes Condel and Anderson, respectively. These values were calculated using the most recent results found in the IWR Run 59 Database.

Table 2.2. Lake Condel nutrient AGM values, 2009–16

ID = Insufficient data
µg/L = Micrograms per liter
mg/L = Milligrams per liter
Note: Values shown in boldface type and shaded are greater than the NNC for lakes. Rule 62-302.531, F.A.C., states that the applicable numeric interpretations for TN, TP, and chlorophyll *a* shall not be exceeded more than once in any consecutive three-year period.

Year	Chlorophyll *a* (µg/L)	TN (mg/L)	TP (mg/L)
2009	**71**	**2.55**	**0.11**
2010	ID	ID	ID
2011	ID	ID	ID
2012	ID	ID	ID
2013	ID	ID	ID
2014	**74**	**1.87**	**0.21**
2015	**39**	**1.17**	**0.11**
2016	ID	ID	ID

Table 2.3. Lake Anderson nutrient AGM values, 2009–16

ID = Insufficient data
µg/L = Micrograms per liter
mg/L = Milligrams per liter
Note: Values shown in boldface type and shaded are greater than the NNC for lakes. Rule 62-302.531, F.A.C., states that the applicable numeric interpretations for TN, TP, and chlorophyll *a* shall not be exceeded more than once in any consecutive three-year period.

Year	Chlorophyll *a* (µg/L)	TN (mg/L)	TP (mg/L)
2009	19	1.00	0.02
2010	**29**	**1.09**	0.02
2011	**27**	ID	ID
2012	**23**	1.03	0.03
2013	ID	ID	ID
2014	**21**	0.74	**0.04***
2015	15	1.04	ID
2016	**25**	0.90	**0.04***

Chapter 3: Assessment of Sources

3.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of the pollutant of concern in the target watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either point sources or nonpoint sources. Historically, the term "point sources" has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term "nonpoint sources" was used to describe intermittent, rainfall-driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from septic systems; and atmospheric deposition.

However, the 1987 amendments to the CWA redefined certain nonpoint sources of pollution as point sources subject to regulation under the EPA's National Pollutant Discharge Elimination System (NPDES) Program. These nonpoint sources included certain urban stormwater discharges, such as those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

To be consistent with CWA definitions, the term "point source" is used to describe traditional point sources (such as domestic and industrial wastewater discharges) and stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a TMDL (see **Section 6.1** on **Expression and Allocation of the TMDL**). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

3.2 Point Sources

3.2.1 Wastewater Point Sources

There are no NPDES-permitted wastewater facilities that discharge to Lakes Condel or Anderson, or that discharge to surface waters in the Lakes Condel and Anderson Watersheds.

3.2.2 Municipal Separate Storm Sewer System (MS4) Permittees

The Lakes Condel and Anderson Watersheds are covered by the NPDES MS4 Phase I permit for Orange County, FLS000011. For more information on MS4s in the watersheds, send an email to NPDES-stormwater@dep.state.fl.us. **Table 3.1** lists the permittees/co-permittees and their MS4 permit numbers.

Table 3.1. NPDES MS4 permits with jurisdiction in the Lakes Condel and Anderson Watersheds

Permit Number	Permittee/Co-permittees	Phase
FLS000011	Orange County	I

3.3 Nonpoint Sources

Pollutant sources that are not NPDES wastewater or stormwater dischargers are generally considered to be nonpoint sources. Nonpoint sources addressed in this analysis primarily include loadings from surface runoff, groundwater seepage entering the lake, and precipitation directly onto the lake surface (atmospheric deposition).

3.3.1 Land Uses

Land use is one of the most important factors in determining nutrient loadings from the Lakes Condel and Anderson Watersheds. Nutrients can be flushed into a receiving water through surface runoff and stormwater conveyance systems during stormwater events. Both human land use areas and natural land areas generate nutrients. However, human land uses typically generate greater nutrient loads per unit of land surface area than natural lands can produce.

Tables 3.2 and **3.3** list land use in the respective watersheds in 2014, based on data from the Southwest Florida Water Management District (SWFWMD), and **Figure 3.1** shows this information graphically. The Lake Anderson Watershed captures runoff contributions from both its immediate watershed and the Lakes Condel and Inwood Watersheds that flow into the lake.

In the overall combined Condel–Inwood–Anderson Watersheds, over 75 % of the area is dedicated to medium-density residential land use, and with both low-density and high-density residential land uses included, the total rises to nearly 82 % of the watershed area. If the Lake Condel Watershed is considered on its own, medium-density residential housing comprises over 92 % of land use. The immediate surroundings of each lake are completely encompassed by residential housing, with riparian wetland fringes around both lakes. Commercial land use is entirely restricted to the western end of the Lake Anderson Watershed.

Table 3.2. SWFWMD land use in the Lake Condel Watershed in 2014

Land Use Code	Land Use Classification	Area (ha)	% of Watershed
1100	Low-Density Residential	0.004	0.02
1200	Medium-Density Residential	17.50	92.65
5000	Water	0.91	4.82
6000	Wetlands	0.47	2.49
Total		**18.89**	**100**

Table 3.3. SWFWMD land use in the Lake Anderson Watershed in 2014 (including the Lakes Condel and Inwood Watersheds)

Land Use Code	Land Use Classification	Area (ha)	% of Watershed
1100	Low-Density Residential	0.004	0.003
1200	Medium-Density Residential	106.29	75.56
1300	High-Density Residential	8.50	6.04
1400	Commercial	6.70	4.76
1700	Institutional	5.55	3.94
5000	Water	10.23	7.27
6000	Wetlands	0.92	0.65
8000	Communication and Transportation	2.44	1.73
Total		**140.67**	**100**

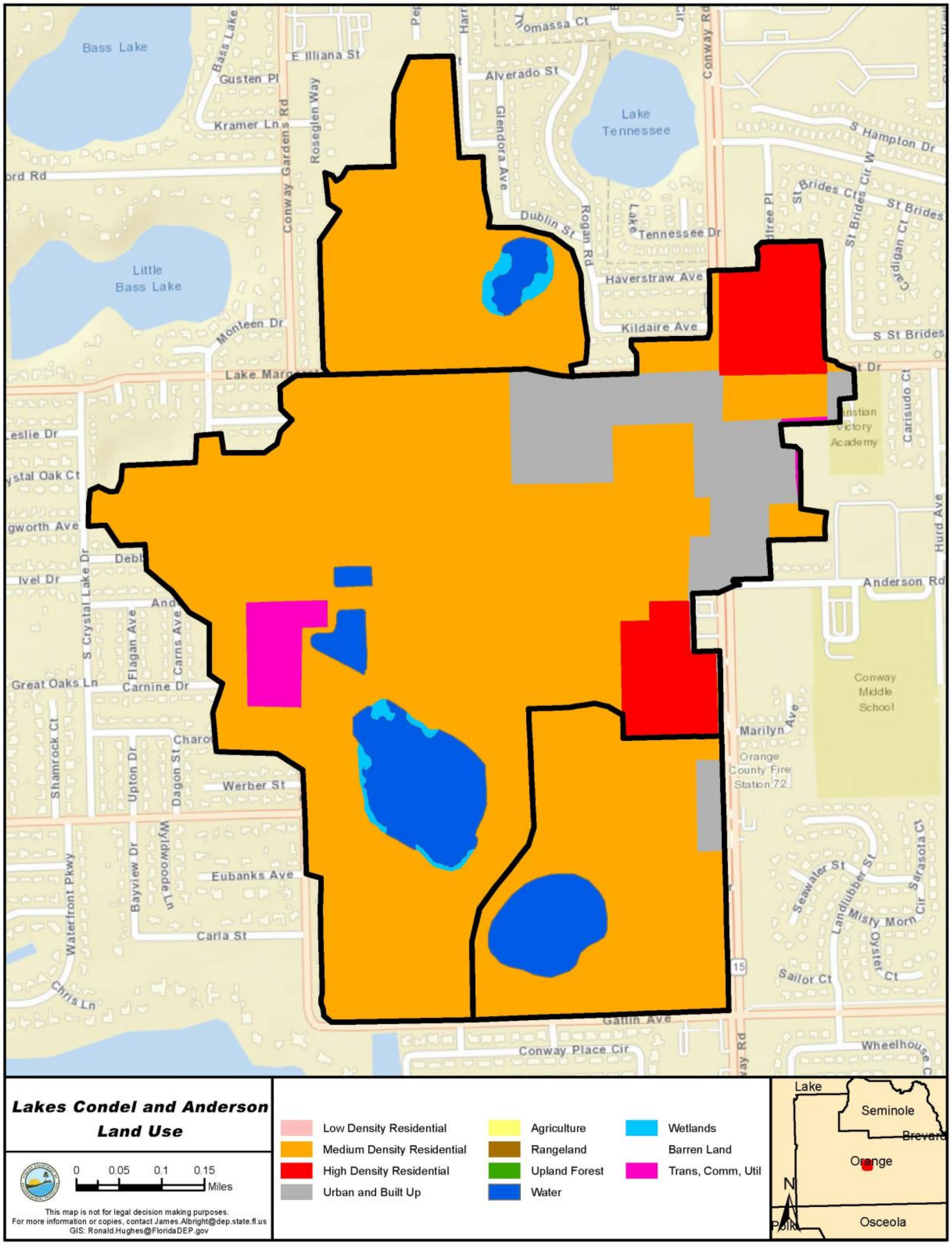

Figure 3.1. Land use in the Lake Anderson Watershed (including the Lakes Condel and Inwood Watersheds) in 2014

3.3.2 Onsite Sewage Treatment and Disposal Systems (OSTDS)

OSTDS, including septic systems, are commonly used where providing central sewer service is not cost-effective or practical. When properly sited, designed, constructed, maintained, and operated, OSTDS are a safe means of disposing of domestic waste. The effluent from a well-functioning OSTDS is comparable to secondarily treated wastewater from a sewage treatment plant. OSTDS can be a source of nutrients (nitrogen and phosphorus), pathogens, and other pollutants to both groundwater and surface water. **Figure 3.2** shows the approximate locations of OSTDS in the watershed based on centroids of parcels with known septic systems.

The Florida Department of Health (FDOH) maintains a list of septic systems by county, and the Orange County database was used to determine the number of septic systems in the area. The total number of septic systems in the combined Lakes Condel, Anderson, and Inwood Watersheds is 575, with the largest number (337) located in the Lake Anderson Watershed, followed by 140 in the Lake Condel Watershed and 98 in the Lake Inwood Watershed. The highest concentrations occur in the residential areas of each watershed.

Table 3.4. Number of OSTDS in the individual lake watersheds

Watershed	Number of OSTDS
Lake Anderson	337
Lake Condel	140
Lake Inwood	98
Total	**575**

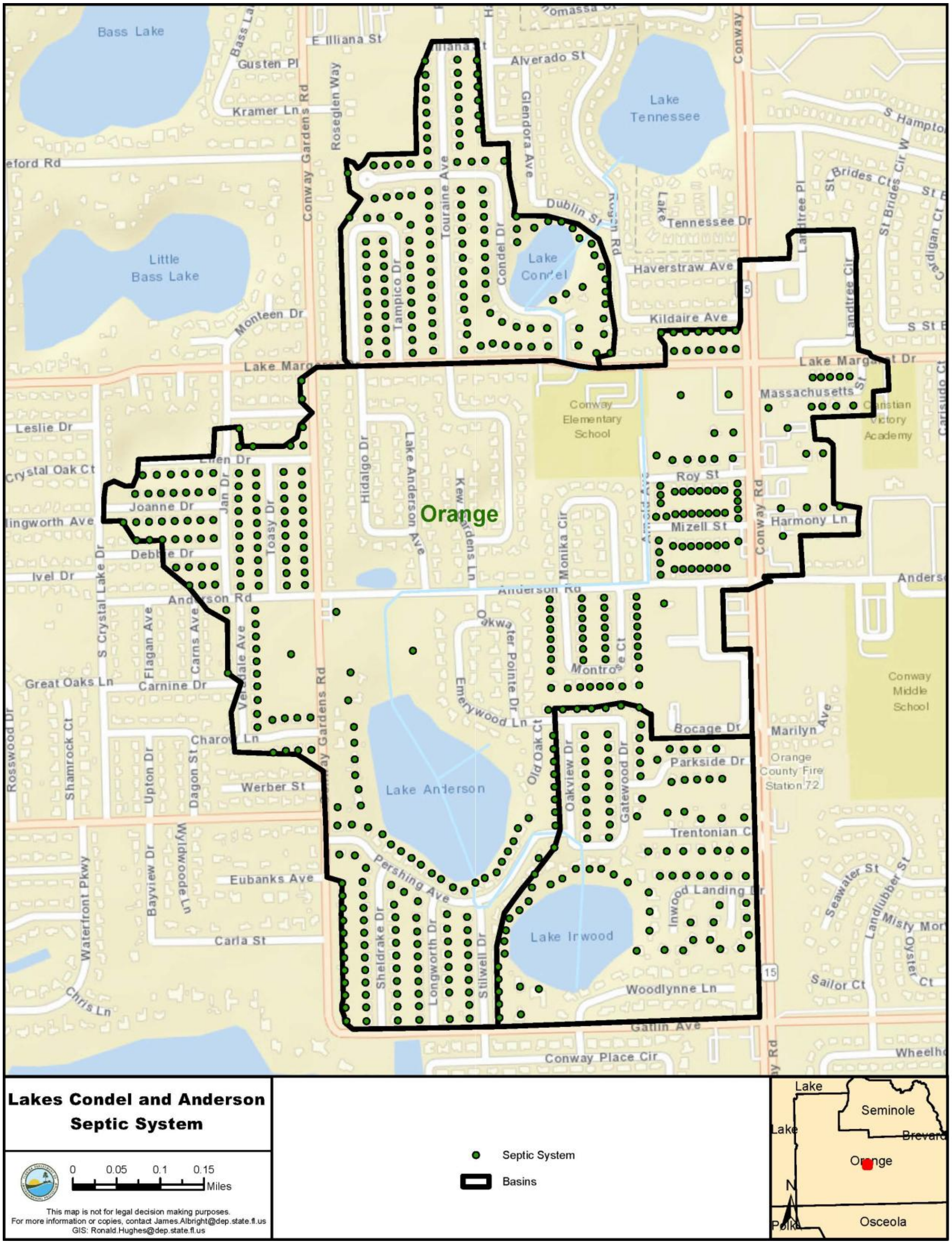

Figure 3.2. OSTDS Locations in the Lakes Condel and Anderson Watersheds

Chapter 4: Determination of Assimilative Capacity

4.1 Determination of Loading Capacity

Nutrient enrichment and the resulting problems related to eutrophication tend to be widespread and are frequently manifested far (in both time and space) from their sources. Addressing eutrophication involves relating water quality and biological effects such as photosynthesis, decomposition, and nutrient recycling as acted on by environmental factors (rainfall, point source discharge, etc.) to the timing and magnitude of constituent loads supplied from various categories of pollution sources. Assimilative capacity should be related to some specific hydrometeorological condition during a selected period or to some range of expected variation in these conditions.

The goal of this TMDL analysis is to identify the maximum allowable lake TN and TP concentrations and the associated nutrient source reductions, so that the lakes will meet the TMDL targets and thus maintain their function and designated use as Class III freshwaters.

4.2 Evaluation of Water Quality Conditions

The water quality results applied in the analysis were from the 2000–16 period, which included years with both above- and below-average precipitation. Rainfall from the National Oceanic and Atmospheric Administration (NOAA) Orlando International Airport station (**Figure 4.1**) indicate that 2000, 2006, 2007, 2010, 2012, and 2013 had below-average precipitation, while 2001–05, 2009, 2011, and 2014–15 had above-average precipitation. **Figure 4.2** overlays chlorophyll *a* AGMs over the annual precipitation sums over time. Relationships between precipitation and chlorophyll *a* were not recovered by regression analysis (Lake Condel R^2=0.09) Lake Anderson R^2=0.10). The lack of a strong relationship between nutrients and rainfall suggests that adjustments for seasonality and rainfall are unlikely to affect TMDL determination.

For the water quality analyses conducted for TMDL development, AGMs were used in order to be consistent with the expression of the adopted NNC for lakes. AGMs were calculated using a minimum of four sample results per year, with at least one of the samples collected in the May to September period and at least one sample collected from other months. Values with an "I" qualifier code were used as reported. Values with "U" or "T" qualifier codes were changed to the minimum detection limit (MDL) divided by the square root of 2. Values with "G" or "V" qualifier codes were removed from the analysis for quality control purposes. Negative values and zero values were also removed. Multiple sample results collected in the same day at the same station were averaged. The AGM calculation method for this purpose is somewhat different than the one used to calculate AGMs for performing water quality assessments, following the methodology in Chapter 62-303, F.A.C. Therefore, the AGMs listed in **Tables 2.2** and **2.3** in **Chapter 2** may not exactly match the AGMs used in these analyses and for TMDL development.

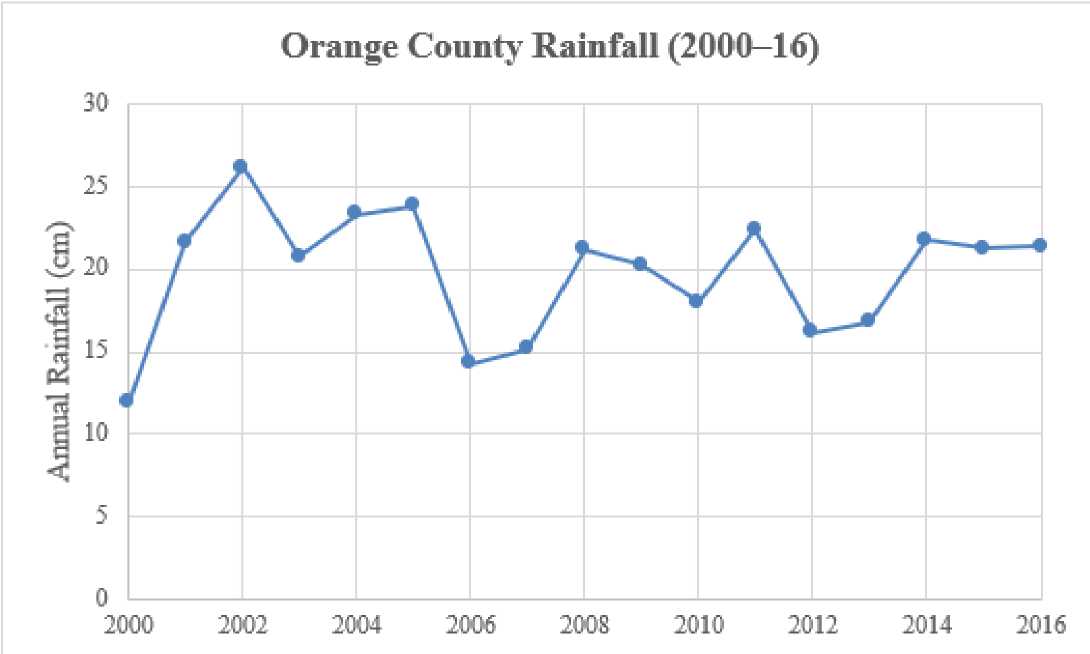

Figure 4.1. **Annual rainfall from the Orlando International Airport NOAA station**

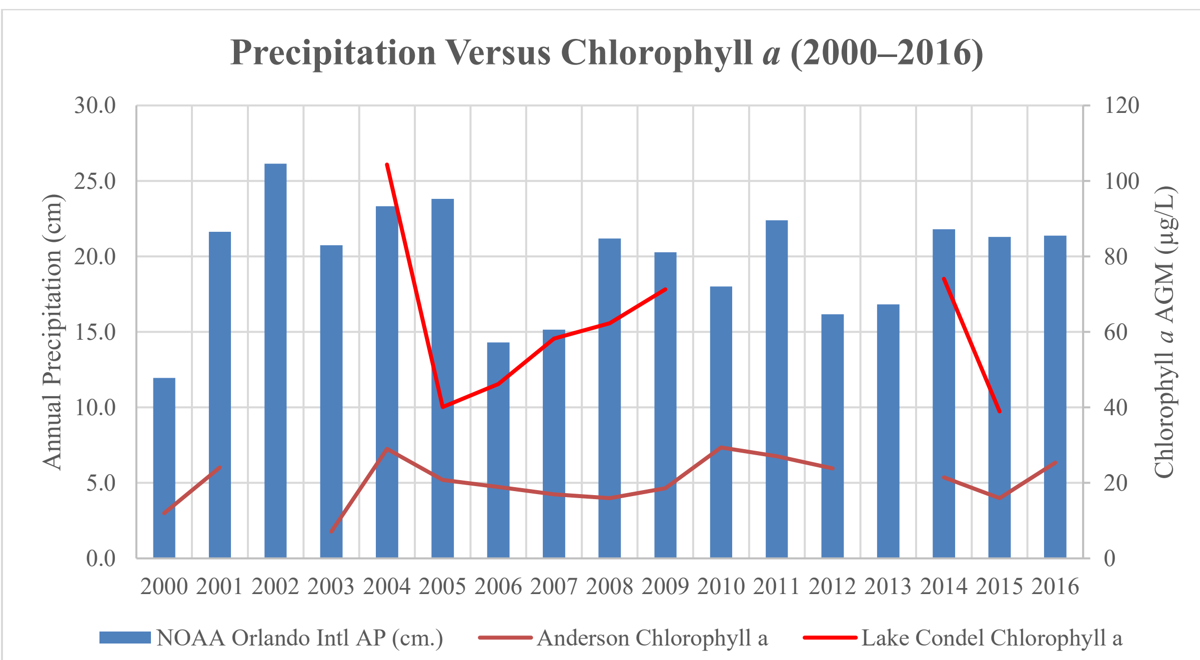

Figure 4.2. **Annual rainfall from the Orlando International Airport NOAA station**

4.3 Critical Conditions and Seasonal Variation

The estimated assimilative capacity is based on annual conditions, rather than critical/seasonal conditions, because (1) the methodology used to determine assimilative capacity does not lend itself very well to short-term assessments, (2) DEP is generally more concerned with the net change in overall primary productivity in the segment, which is better addressed on an annual basis, (3) the methodology used to determine impairment is based on annual conditions, and (4) the chlorophyll *a* criterion used as the TMDL target is expressed as an AGM.

4.4 Relationships Between Water Quality Variables

Ongoing water quality monitoring for nutrients in both lakes has been principally conducted by Orange County (Organization Code 21FLORAN), with supplemental data collected intermittently for short periods by the DEP Central District (Organization Code 21FLCEN). Most of the available data are from monitoring conducted by Orange County, with a long period of record extending to the late 1980s in Lake Anderson and with routine data collection in both lakes beginning in the early 2000s.

Figure 4.3 shows the chlorophyll *a* AGM values from 2000 to 2018 for Lakes Condel and Anderson. Chlorophyll *a* AGMs in Lake Condel have consistently been above 40 µg/L and have risen to over 70 µg/L. In Lake Anderson, chlorophyll *a* AGM values have been somewhat more stable, fluctuating above and below the 20 µg/L NNC threshold, ranging between 12 and 32 µg/L. **Figure 4.4** shows the TN AGM values from 2000 to 2018 in the two lakes. TN AGM values in Lake Condel show a pattern of generally increasing concentration similar to that of chlorophyll *a*, AGMs in this lake range from 1.31 mg/L to 2.55 mg/L. TN AGM values in Lake Anderson over the period range from 0.74 mg/L on the low end to 1.34 mg/L on the high end. **Figure 4.5** shows the TP AGM values from 2000 to 2018 in Lakes Condel and Anderson. The overall pattern for both lakes is similar to those of TN and chlorophyll *a*. In Lake Condel, TP AGMs range from 0.11 to 0.21 mg/L and, in Lake Anderson, from 0.01 to 0.06 mg/L. **Figure 4.6** shows the color AGM values (in PCU) from 2000 to 2016 in both Lakes Condel and Anderson. Lake Condel evidenced the largest interannual color variation, ranging from 15 to 57 PCU over the period. Lake Anderson showed a consistent pattern of low color, ranging from 2 to 21 PCU.

Figures 4.7 and **4.8** show the relationships of TN and TP, respectively, on chlorophyll *a* response for the combined Lake Condel Anderson dataset. The datasets were combined because regressions based on individual lakes were weak ($r^2 = x - y$). These graphs display the simple linear regression of each nutrient variable on chlorophyll *a*. Both demonstrate a highly significant positive response of chlorophyll *a* to increased nutrient concentrations (TN p value = 0.0007, TP p value < 0.0001).

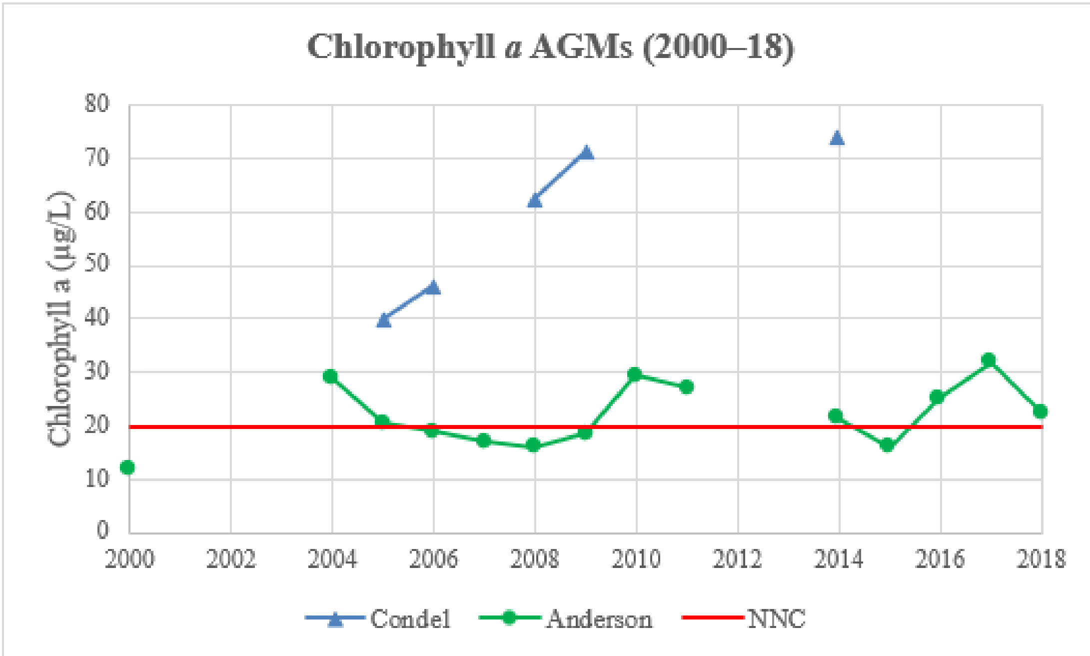

Figure 4.3. Chlorophyll *a* AGM values for Lakes Condel and Anderson

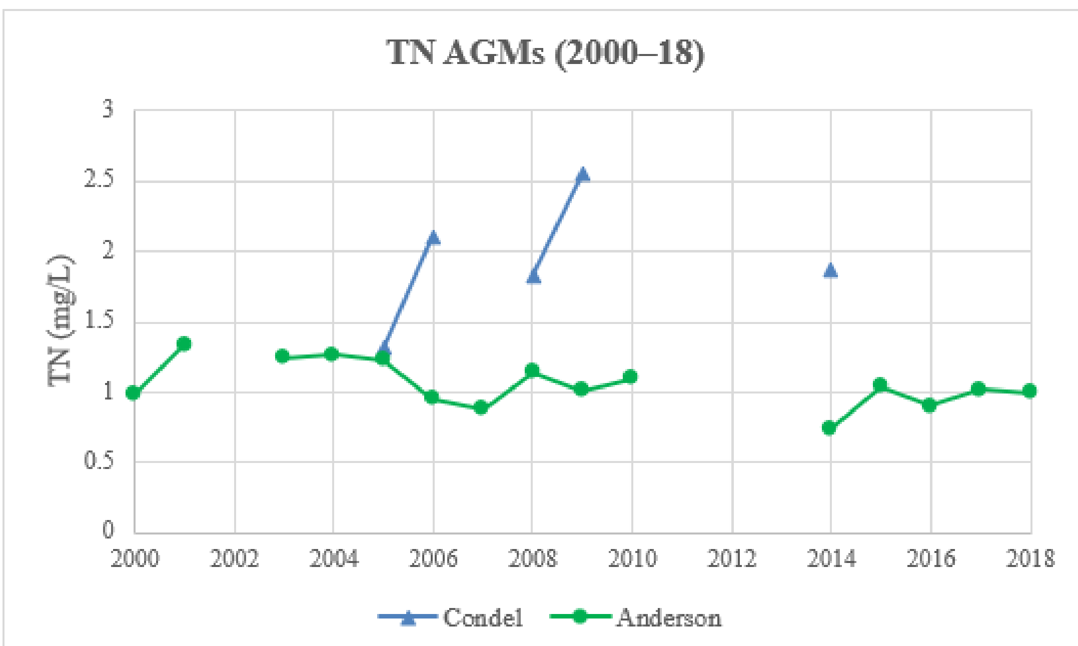

Figure 4.4. TN AGM values for Lakes Condel and Anderson

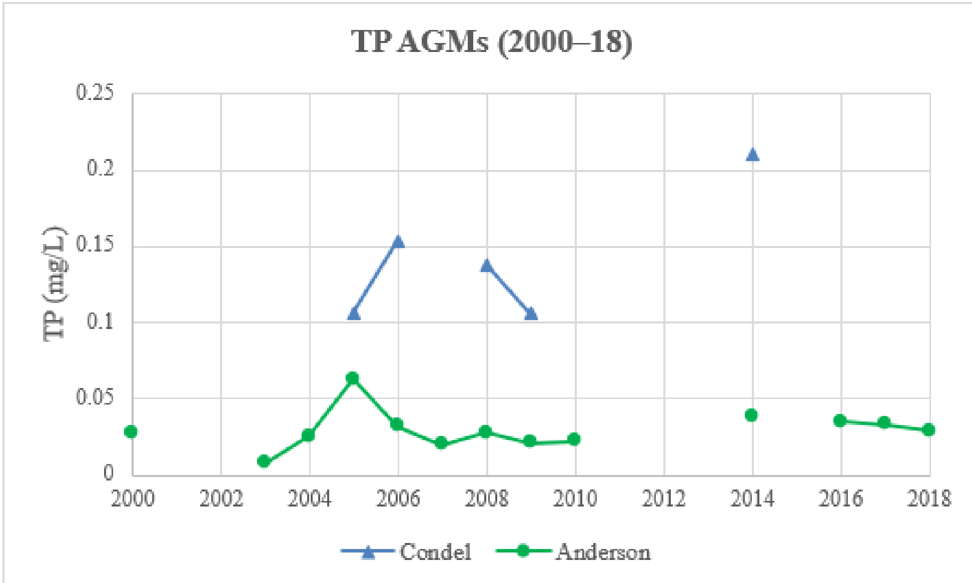

Figure 4.5. TP AGM values for Lakes Condel and Anderson

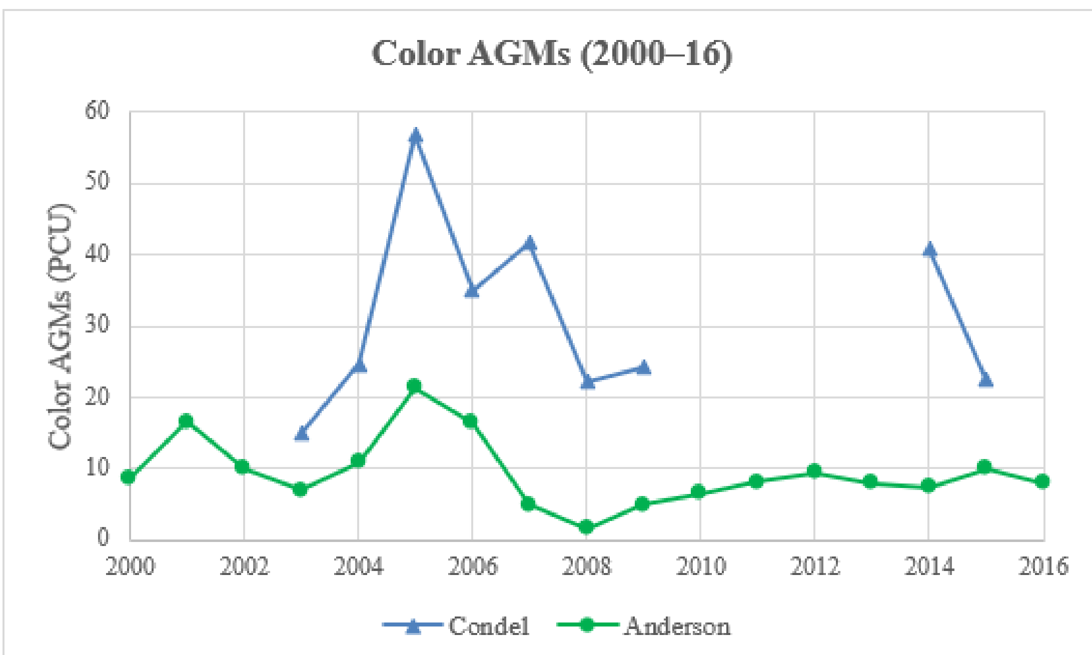

Figure 4.6. Color AGM values for Lakes Condel and Anderson

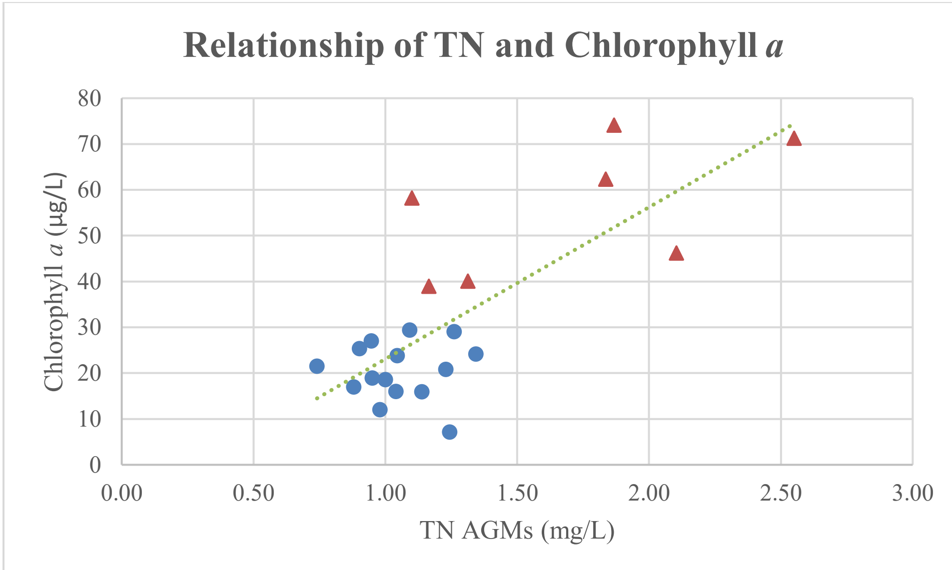

Figure 4.7. Relationship of TN and chlorophyll *a* in Lakes Condel (red triangles) and Lake Anderson (blue circles)

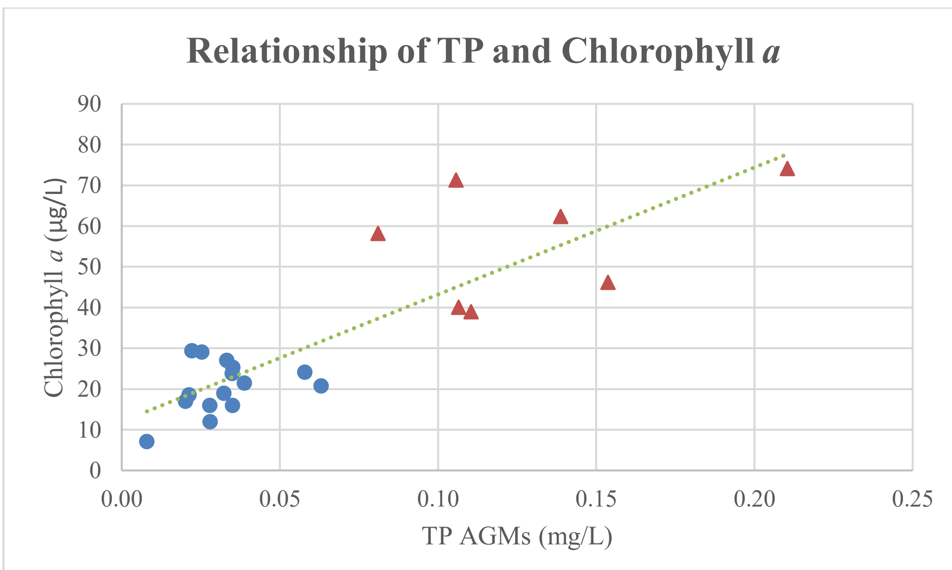

Figure 4.8. Relationship of TP and chlorophyll *a* in Lakes Condel (red triangles) and Lake Anderson (blue circles)

4.5 Basis of the TMDLs

The data collected by Orange County and DEP were used in evaluating the relationships between nutrient and chlorophyll *a* concentrations. The period from 2005 to 2015 had the most complete long-term set of AGM values for evaluating surface water quality for the two lakes. This analysis used nutrient and corrected chlorophyll a AGMs to be consistent with the expression of the adopted NNC for lakes.

The state of Florida developed the generally applicable statewide NNC based on robust empirical relationships between nutrients and chlorophyll *a* derived from a large (195 low-color and 129 high-color) dataset of lakes statewide and an evaluation of the relationship between nutrients and chlorophyll *a* response in those lakes. This was done in order to determine TN and TP concentrations that would be protective of designated uses (DEP 2012). DEP developed a chlorophyll *a* criterion of 20 µg/L for both high color (> 40 PCU) lakes and low color (< 40 PCU) high alkalinity (> 20 mg/L CaCO3) lakes, and a chlorophyll *a* criterion of 6 µg/L for low color (< 40 PCU), low alkalinity (< 20 mg/L CaCO3) lakes. DEP (2012) demonstrated that these chlorophyll *a* criteria are protective of designated uses and maintains the health of a balanced community of aquatic flora and fauna.

The generally applicable TN and TP criteria are subject to a range of AGMs based on whether there are sufficient data to calculate an AGM for chlorophyll *a*, and whether the AGM chlorophyll *a* exceed the criteria for the particular lake type in subparagraph 62-302.531(2)(b)1., F.A.C. If there are insufficient data to calculate the AGM chlorophyll *a* for a given year or the AGM chlorophyll *a* exceeds the criterion for the lake type, then the applicable numeric interpretations for TN and TP are the minimum values. If there are sufficient data to calculate the AGM chlorophyll *a* and the AGM does not exceed the chlorophyll *a* value for the lake type (e.g, 20 µg/L in a high-color lake), then the TN and TP AGMs for that calendar year may not exceed the maximum TN and TP limits for the particular lake type.

For both of these low-color, high alkalinity lakes the criterion range for TN is 1.05–1.91 mg/L, and is 0.03–0.09 mg/L for TP, with an exceedance frequency of no more than once in any three-year period. AGMs for chlorophyll *a* concentrations in both lakes exceeded the NNC values for the applicable lake type; therefore, the applicable numeric interpretations for TN and TP are the minimum values in the criteria ranges, ensuring the attainment of the applicable chlorophyll *a* targets.

The individual nutrient data for the two lakes were compared with the larger statewide nutrient dataset to see if they fell within the range of the data used to establish the generally applicable NNC. This was done to verify that these lakes are operating like the NNC lakes and are exhibiting the same nutrient responses to determine if site-specific criteria would be needed. **Figures 4.9** and **4.10** show the TN and TP data for Lake Condel plotted against chlorophyll *a* along with the statewide population of clear lakes and **Figures 4.11** and **4.12** show the same comparison for Lake Anderson.

These graphs demonstrate that the relationship of TN and TP to chlorophyll a in Lakes Condel and Anderson do not fall outside the range used to develop the generally applicable NNC. The TN values for both lakes are indicated with red triangles and the TP values for both lakes are green circles. The nutrient concentrations of the rest of the statewide population of low-color lakes are indicated by gray “x”s in these plots. The dashed line shown on these graphs bound the distributions at the 90 % prediction intervals. Lakes that plot within these intervals are characteristic of the majority of lakes in the dataset, while as any lakes that plot outside those bounds are not operating in a manner consistent with the majority of lakes in the statewide dataset.

Based on the available information, there is nothing unique about Lakes Condel and Anderson that would either make the use of the chlorophyll *a* threshold of 20 µg/L unprotective or suggest that the lakes respond differently from state-wide generally applicable relationships depicted in **Figures 4.9** through **4.12**. Therefore, it can be concluded that making the conservative assumption of basing the TMDL targets on the low-end TN (1.05 mg/L) and TP (0.03 mg/L) generally applicable NNC will fully protect designated uses within these lakes. Additionally, the TMDL targets do not need to be adopted as hierarchy 1 site specific interpretations of the numeric nutrient criterion because the generally applicable low color high alkalinity lake NNC fully protect designated uses.

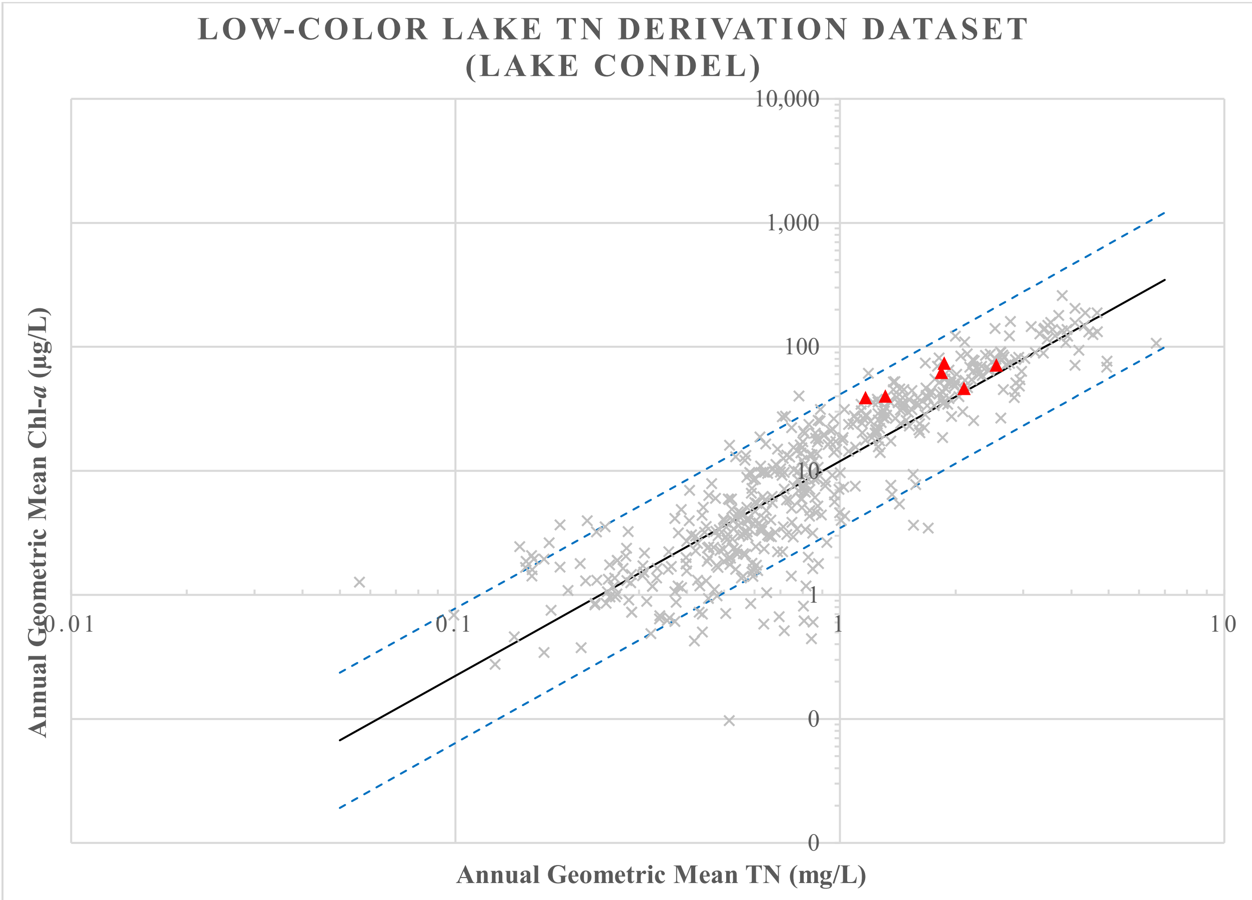

Figure 4.9. Lake Condel TN AGMs (red triangles) plotted against the statewide dataset used to derive the numeric nutrient criteria for low-color lakes

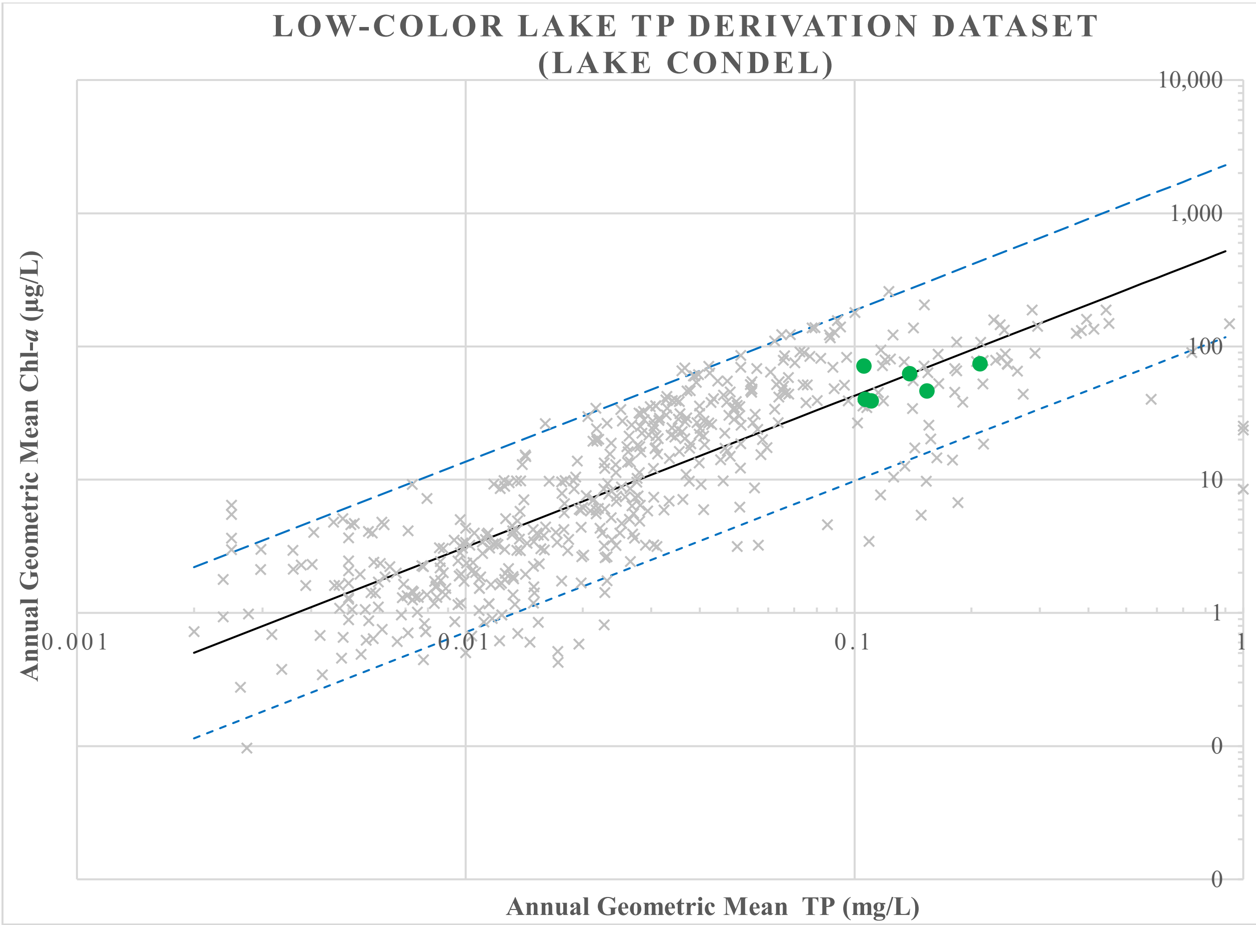

Figure 4.10. Lake Condel TP AGMs (green circles) plotted against the statewide dataset used to derive the numeric nutrient criteria for low-color lakes

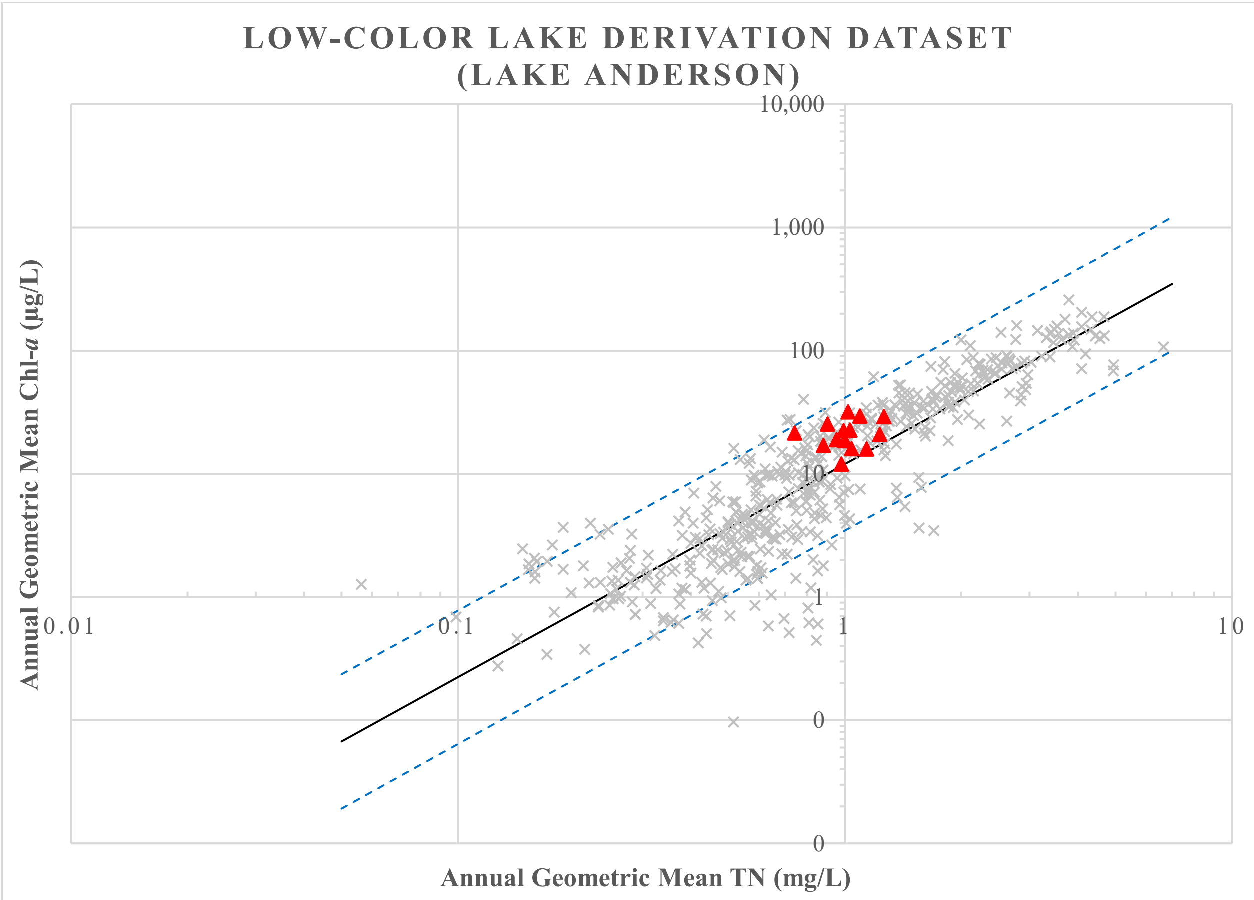

Figure 4.11. Lake Anderson TN AGMs (red triangles) plotted against the statewide dataset used to derive the numeric nutrient criteria for low-color lakes

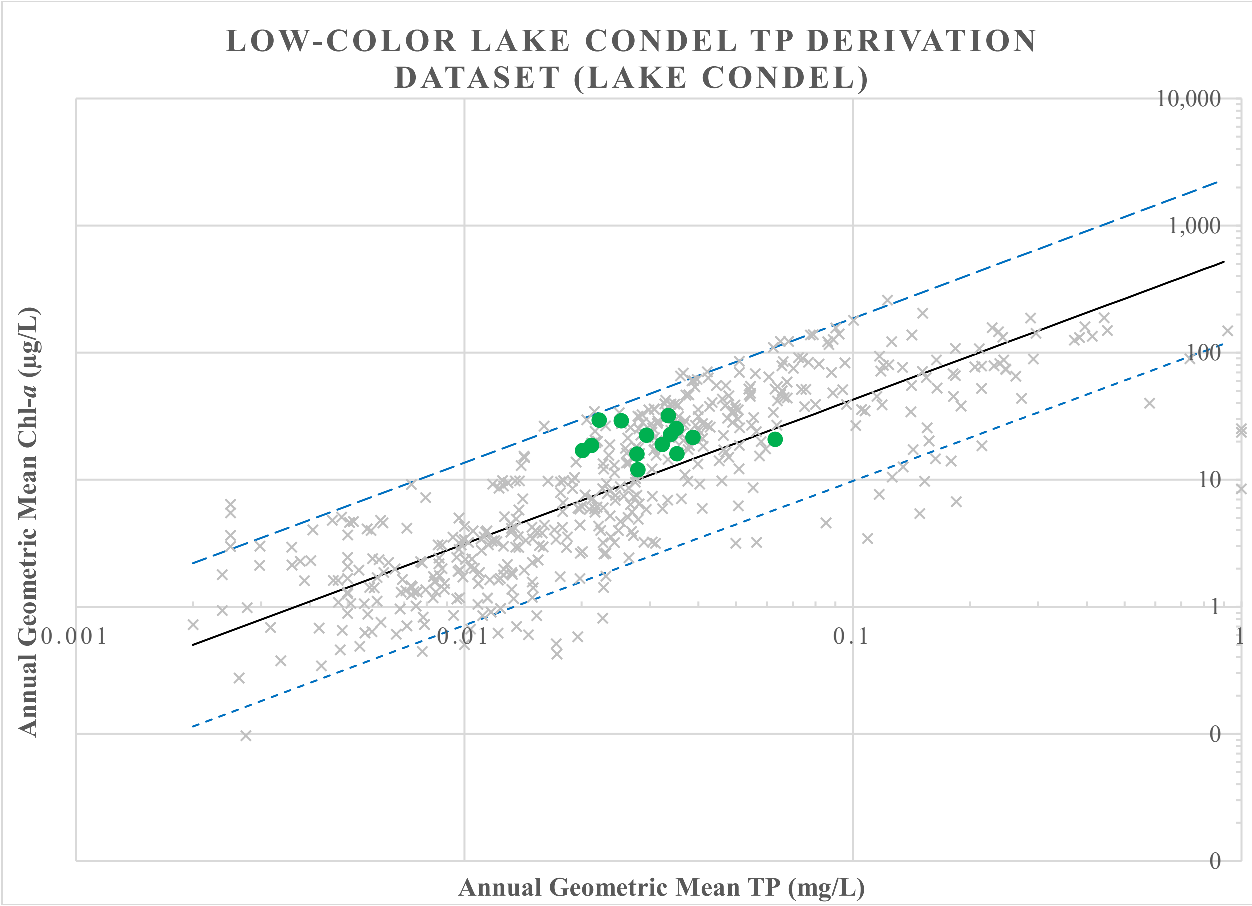

Figure 4.12. Lake Anderson TP AGMs (green circles) plotted against the statewide dataset used to derive the numeric nutrient criteria for low-color lakes

The lakes are expected to meet the applicable nutrient criteria and maintain their function and designated use as Class III freshwater lakes when surface water nutrient concentrations are reduced to the target concentrations, addressing the anthropogenic contributions to the water quality impairments.

The method used to determine the reductions needed to attain the nutrient TMDLs is the percent reduction approach. Existing lake nutrient condition calculations were selected by considering the nutrient concentrations measured in the 2000 to 2015 period, which includes the Cycle 3 verified period (2009–15). The existing nutrient conditions used to calculate the required reductions were the maximum values of the TN and TP AGMs in each lake that exceeded the water quality targets. The geometric means were calculated from nutrient results available in the IWR Run 59 Database.

The equation used to calculate the percent reduction is as follows:

$$\frac{[\text{measured exceedance} - \text{target}]}{\text{measured exceedance}} \times 100$$

Table 4.1 lists the percent reductions in the maximum AGMs needed to achieve the TN AGM target of 1.05 mg/L and the TP AGM target of 0.03 mg/L. The TN percent reductions are 59 % in Lake Condel and 22 % in Lake Anderson. The TP percent reductions are 86 % in Lake Condel and 52 % in Lake Anderson. The nutrient AGM TMDL values and the associated percent reductions address the anthropogenic nutrient inputs contributing to the exceedances of the chlorophyll *a* criterion.

Table 4.1. Reductions required in existing TN and TP concentrations to meet water quality targets

Year	Lake Condel TN AGMs (mg/L)	Lake Condel TP AGMs (mg/L)	Lake Anderson TN AGMs (mg/L)	Lake Anderson TP AGMs (mg/L)
2000	—	—	0.98	0.03
2001	—	—	1.34	—
2002	—	—	—	—
2003	—	—	1.24	0.01
2004	—	—	1.26	0.03
2005	1.31	0.11	1.23	0.06
2006	2.10	0.15	0.95	0.03
2007	—	—	0.88	0.02
2008	1.84	0.14	1.14	0.03
2009	2.55	0.11	1.00	0.02
2010	—	—	1.09	0.02
2011	—	—	—	—
2012	—	—	—	—
2013	—	—	—	—
2014	1.87	0.21	0.74	0.04
2015	—	—	1.04	—
Maximum	**2.55**	**0.21**	**1.34**	**0.06**
TMDL Target	**1.05**	**0.03**	**1.05**	**0.03**
Percent Reduction	**59**	**86**	**22**	**52**

Chapter 5: Determination of Loading Allocations

5.1 Expression and Allocation of the TMDLs

The objective of a TMDL is to provide a basis for allocating loads to all the known pollutant sources in a watershed so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (wasteload allocations, or WLAs), nonpoint source loads (load allocations, or LAs), and an appropriate margin of safety (MOS), which accounts for uncertainty in the relationship between effluent limitations and water quality:

$$\textbf{TMDL} = \sum \textbf{WLAs} + \sum \textbf{LAs} + \textbf{MOS}$$

As discussed earlier, the WLA is broken out into separate subcategories for wastewater discharges and stormwater discharges regulated under the NPDES Program:

$$\textbf{TMDL} \cong \sum \textbf{WLAs}_{\textbf{wastewater}} + \sum \textbf{WLAs}_{\textbf{NPDES Stormwater}} + \sum \textbf{LAs} + \textbf{MOS}$$

It should be noted that the various components of the revised TMDL equation may not sum up to the value of the TMDL because (1) the WLA for NPDES stormwater is typically based on the percent reduction needed for nonpoint sources and is also accounted for within the LA, and (2) TMDL components can be expressed in different terms (for example, the WLA for stormwater is typically expressed as a percent reduction, and the WLA for wastewater is typically expressed as mass per day). Stormwater reductions are included in both the MS4 WLA and LA, as applicable. However, in determining the overall stormwater reductions needed, the Department does not differentiate between the MS4 WLA and the LA, and instead applies the same overall reductions to both as if the two categories were a single category source, unless otherwise specified.

WLAs for stormwater discharges are typically expressed as "percent reduction" because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the "maximum extent practical" through the implementation of best management practices (BMPs).

This approach is consistent with federal regulations, 40 Code of Federal Regulations (CFR) § 130.2(I), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or other appropriate measure. The TMDLs for Lakes Condel and Anderson are expressed in terms of nutrient concentration targets and the percent reductions necessary to meet the target, and represent the lake nutrient concentrations the waterbodies can assimilate while maintain a balanced aquatic flora and fauna (see **Table 5.1**). They are based on the generally applicable NNC in subsection 62-302.531(2), F.A.C. The minimum TN and TP NNC values were applied to establish the percent reduction targets for the in-lake TN and TP concentrations. The restoration goal is to achieve the generally applicable chlorophyll *a* criterion of 20 µg/L, expressed as an AGM not to be exceeded more than once in any consecutive three-year period. This threshold protects the lake's designated use.

Table 5.1 lists the TMDLs for Lakes Condel and Anderson. These will constitute the site-specific numeric interpretation of the narrative nutrient criterion set forth in paragraph 62-302.530(48)(b), F.A.C., that will replace the otherwise applicable NNC in subsection 62-302.531(2), F.A.C., for these particular waters.

Table 5.1. TMDL components for nutrients in Lakes Condel and Anderson (WBIDs 3168X5 and 3168E)

Note: The TMDL represents the AGM lake concentration (mg/L) not to be exceeded.
NA = Not applicable–margin of safety is implicit.
* The required percent reductions listed in this table represent the reduction from all sources.

Waterbody (WBID)	Parameter	TMDL (mg/L)	WLA Wastewater (% reduction)	WLA NPDES Stormwater (% reduction)*	LA (% reduction)*
Lake Condel (3168X5)	TN	1.05	NA	59	59
Lake Condel (3168X5)	TP	0.03	NA	86	86
Lake Anderson (3168E)	TN	1.05	NA	22	22
Lake Anderson (3168E)	TP	0.03	NA	52	52

5.2 Load Allocation

To achieve the LA in Lake Condel, a 59 % and 86 % reduction in current TN and TP concentrations, respectively, will be required, and to achieve the LA in Lake Anderson, a 22 % and 52 % reduction in current TN and TP loads, respectively, will be required.

The TMDLs are based on the percent reduction in total watershed loading; however, it is not DEP's intent to abate natural conditions. The needed reduction from anthropogenic inputs will be calculated based on more detailed source information when a restoration plan is developed. The reductions in nonpoint source nutrient loads are expected to result in reduced sediment nutrient flux, which is commonly a factor in lake eutrophication.

It should be noted that the LA includes loading from stormwater discharges regulated by DEP and the water management districts that are not part of the NPDES stormwater program (see **Appendix A**).

5.3 Wasteload Allocation

5.3.1 NPDES Wastewater Discharges

As noted in **Chapter 4**, no active NPDES-permitted facilities in the Lakes Condel or Anderson Watersheds discharge either into the waterbodies or their watersheds. Therefore, a WLA for wastewater discharges is not applicable.

5.3.2 NPDES Stormwater Discharges

The MS4 permittee in the Lakes Condel and Anderson Watersheds is Orange County. Areas within this jurisdiction in the Lake Condel Watershed are responsible for a 59 % reduction in TN and an 86 % reduction in TP from the current anthropogenic loading. Similarly, areas in the Lake Anderson Watershed are responsible for a 22 % reduction in TN and a 52 % reduction in TP from the current anthropogenic loading.

It should be noted that any MS4 permittee is only responsible for reducing the anthropogenic loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

5.4 Margin of Safety

The MOS can either be implicitly accounted for by choosing conservative assumptions about loading or water quality response, or explicitly accounted for during the allocation of loadings. Consistent with the recommendations of the Allocation Technical Advisory Committee (DEP 2001), an implicit MOS was used in the development of these TMDLs. The MOS is a required component of a TMDL and accounts for the uncertainty about the relationship between pollutant loads and the quality of the receiving waterbody, CWA, Section 303(d)(1)(c). Considerable uncertainty is usually inherent in estimating nutrient loading from nonpoint sources, as well as in predicting water quality response. The effectiveness of management activities (e.g., stormwater management plans) in reducing loading is also subject to uncertainty.

Consistent with the recommendations of the Allocation Technical Advisory Committee (DEP 2001), an implicit MOS was used in the development of the TMDLs because of the conservative assumptions that were applied. One conservative element is that the highest TN and TP AGM values were used to calculate the percent reductions. The second conservative element is that the low end of the TN and TP criteria ranges were used to establish TMDL targets designed to be met in every year rather than allowing a once in three consecutive year exceedance. However these conservatice measures are only components of the MOS and are not intended to change the frequency or duration of the applicable NNC.

Chapter 6: Implementation Plan Development and Beyond

6.1 Implementation Mechanisms

Following the adoption of a TMDL, implementation takes place through various measures. The implementation of TMDLs may occur through specific requirements in NPDES wastewater and MS4 permits, and, as appropriate, through local or regional water quality initiatives or basin management action plans (BMAPs).

Facilities with NPDES permits that discharge to the TMDL waterbody must respond to the permit conditions that reflect target concentrations, reductions, or WLAs identified in the TMDL. NPDES permits are required for Phase I and Phase II MS4s as well as domestic and industrial wastewater facilities. MS4 Phase I permits require a permit holder to prioritize and act to address a TMDL unless management actions to achieve that particular TMDL are already defined in a BMAP. MS4 Phase II permit holders must also implement the responsibilities defined in a BMAP or other form of restoration plan (e.g., a reasonable assurance plan).

6.2 BMAPs

Information on the development and implementation of BMAPs is contained in Section 403.067, F.S. (the FWRA). DEP or a local entity may initiate and develop a BMAP that addresses some or all of the contributing areas to the TMDL waterbody. BMAPs are adopted by the DEP Secretary and are legally enforceable.

BMAPs describe the fair and equitable allocations of pollution reduction responsibilities to the sources in the watershed, as well as the management strategies that will be implemented to meet those responsibilities, funding strategies, mechanisms to track progress, and water quality monitoring. Local entities, such as wastewater facilities, industrial sources, agricultural producers, county and city stormwater systems, military bases, water control districts, state agencies, and individual property owners usually implement these strategies. BMAPs can also identify mechanisms to address potential pollutant loading from future growth and development.

Additional information about BMAPs is available online.

6.3 Implementation Considerations for the Waterbodies

While the low-end TN and TP applicable NNC were used to establish percent reduction targets for the in-lake TN and TP, the NNC remain the relevant water quality standards. If the chlorophyll *a* NNC threshold of 20 ug/L is achieved, the NNC set the applicable TN and TP criteria as the measured concentration subject to the stated maximum and minimum concentrations. Therefore, restoration efforts should focus on the most efficacious projects that will decrease nutrient concentrations sufficient to reduce chlorophyll *a* concentrations below the applicable NNC.

The goal of this TMDL is to achieve the generally applicable NNC. Stakeholders should focus on nutrient concentration targets that help reduce nutrient and chlorophyll levels. Once the lake consistently meets the NNC over the assessment period, it can be assumed that the TMDL is being met.

Existing nutrient reduction and management infrastructure and plans, such as the stormwater alum treatment system that recently became operational in the inflow to Lake Anderson, should be included in any future pollutant mitigation strategies. In addition to addressing reductions in watershed pollutant contributions to impaired waters during the implementation phase, it may also be necessary to consider the impacts of internal sources (e.g., sediment nutrient fluxes or the presence of nitrogen-fixing cyanobacteria) and the results of any additional associated remediation projects on surface water quality. Approaches for addressing these other factors should be included in comprehensive management plans for the waterbodies.

Additionally, the current water quality monitoring of the lakes should continue and be expanded, as necessary, during the implementation phase to ensure that adequate information is available for tracking restoration progress. According to the Orange County Environmental Protection Division, the control of aquatic vegetation has not been an historical problem in Lakes Condel and Anderson. There is no record of chemical herbicide applications in the lakes, and no current or historical permits exist for the introduction of grass carp into the lakes for vegetation control. A whole-lake alum treatment was previously performed in Lake Anderson, and a recently completed alum treatment system installed in the stormwater pond inflow to Lake Anderson has begun operation. The impacts of projects such as these should be monitored to track progress.

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, F.A.C. In 1994, DEP stormwater treatment requirements were integrated with the stormwater flood control requirements of the water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations, as authorized under Part IV of Chapter 373, F.S.

Chapter 62-40, F.A.C., also requires the state's water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a Surface Water Improvement and Management (SWIM) Program plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, they have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka.

In 1987, the U.S. Congress established Section 402(p) as part of the federal CWA Reauthorization. This section of the law amended the scope of the federal NPDES permitting program to designate certain stormwater discharges as "point sources" of pollution. The EPA promulgated regulations and began implementing the Phase I NPDES stormwater program in 1990 to address stormwater discharges associated with industrial activity, including 11 categories of industrial activity, construction activities disturbing 5 or more acres of land, and large and medium MS4s located in incorporated places and counties with populations of 100,000 or more.

However, because the master drainage systems of most local governments in Florida are physically interconnected, the EPA implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 special districts; community development districts, water control districts, and the Florida Department of Transportation (FDOT) throughout the 15 counties meeting the population criteria. DEP received authorization to implement the NPDES stormwater program in 2000. The authority to administer the program is set forth in Section 403.0885, F.S.

The Phase II NPDES stormwater program, promulgated in 1999, addresses additional sources, including small MS4s and small construction activities disturbing between 1 and 5 acres, and urbanized areas serving a minimum resident population of at least 1,000 individuals. While these urban stormwater discharges are technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution such as domestic and industrial wastewater discharges. It should be noted that Phase I MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.