Final

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Environmental Assessment and Restoration

Bureau of Watershed Management

NORTHWEST DISTRICT • OCHLOCKONEE–ST. MARKS BASIN

Dissolved Oxygen TMDL for Juniper Creek, WBID 682

Richard Wieckowicz, Ph.D., P.E.
Erin G. Wilcox
Ben Ralys

September, 2008

Acknowledgments

This analysis could not have been accomplished without significant contributions from staff in the Florida Department of Environmental Protection's Watershed Assessment Section. George Jackson and William Weatherspoon provided most of the recent flow and data logger collections. Tricia McClenahan provided the basin delineations and Florida land use aggregations. Editorial assistance was provided by Jan Mandrup-Poulsen and Linda Lord.

Map production assistance was provided by Ben Ralys.

For additional information on the watershed management approach and impaired waters in the Ochlockonee–St. Marks River Basin, contact:

Jan Mandrup-Poulsen
Florida Department of Environmental Protection
Bureau of Watershed Management
Watershed Assessment Section
2600 Blair Stone Road, Mail Station 3555
Tallahassee, FL 32399-2400
jan.mandrup-poulsen@dep.state.fl.us
Phone: (850) 245–8448
Fax: (850) 245–8434

Access to all data used in the development of this report can be obtained by contacting:

Erin G. Wilcox
Florida Department of Environmental Protection
Bureau of Watershed Management
Watershed Assessment Section
2600 Blair Stone Road, Mail Station 3555
Tallahassee, FL 32399-2400
erin.wilcox@dep.state.fl.us
Phone: (850) 245–8442
Fax: (850) 245–8536

Contents

List of Tables

List of Figures

Web sites

Florida Department of Environmental Protection, Bureau of Watershed Management

TMDL Program

http://www.dep.state.fl.us/water/tmdl/index.htm

Identification of Impaired Surface Waters Rule

http://www.dep.state.fl.us/legal/Rules/shared/62-303/62-303.pdf

STORET Program

http://www.dep.state.fl.us/water/storet/index.htm

2006 305(b) Report

http://www.dep.state.fl.us/water/tmdl/docs/2006_Integrated_Report.pdf

Criteria for Surface Water Quality Classifications

http://www.dep.state.fl.us/water/wqssp/classes.htm

Basin Status Report

http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

Water Quality Assessment Report

http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

U.S. Environmental Protection Agency

Region 4: Total Maximum Daily Loads in Florida

http://www.epa.gov/region4/water/tmdl/florida/

National STORET Program

http://www.epa.gov/storet/

Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for dissolved oxygen (DO) for Juniper Creek, located in the Ochlockonee–St. Marks Basin. The waterbody was verified as impaired for DO and fecal coliform, and was included on the Verified List of impaired waters adopted by Secretarial Order on June 3, 2008.

The TMDL establishes the allowable loadings to Juniper Creek that would restore the waterbody so that it meets its applicable water quality impairment threshold for DO. A separate TMDL document addresses the fecal coliform impairment (Wieckowicz, 2008).

1.2 Identification of Waterbody

The Juniper Creek Watershed, located in Gadsden County, Florida, has an 8.84-square-mile (mi^2) drainage area (**Figure 1.1**). There are no major centers of population in the watershed. However, the small community of Sawdust lies at the creek's headwaters. The city of Quincy is located several miles to the northeast.

Juniper Creek is about 4.6 miles long and reaches from State Road (SR) 65 going west to SR 65A and Telogia Creek. It is a second-order stream fed by the Floridan aquifer and industrial runoff. Additional information about the creek's hydrology and geology are available in the Basin Assessment Report for the Ochlockonee–St. Marks Basin (Florida Department of Environmental Protection [Department], 2003). The Telogia Creek wasteload allocation report (Wieckowicz, 1981) provides additional historical information about Telogia Creek and Juniper Creek.

For assessment purposes, the Department has divided the Ochlockonee–St. Marks Basin into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach. The basin is divided into numerous segments (**Figure 1.2**), and this TMDL report primarily addresses the Juniper Creek Watershed, including WBIDs 682, 691, 714, 726, 732, and 737.

Figure 1.1. Juniper Creek Watershed in Florida, and Major Geopolitical Features

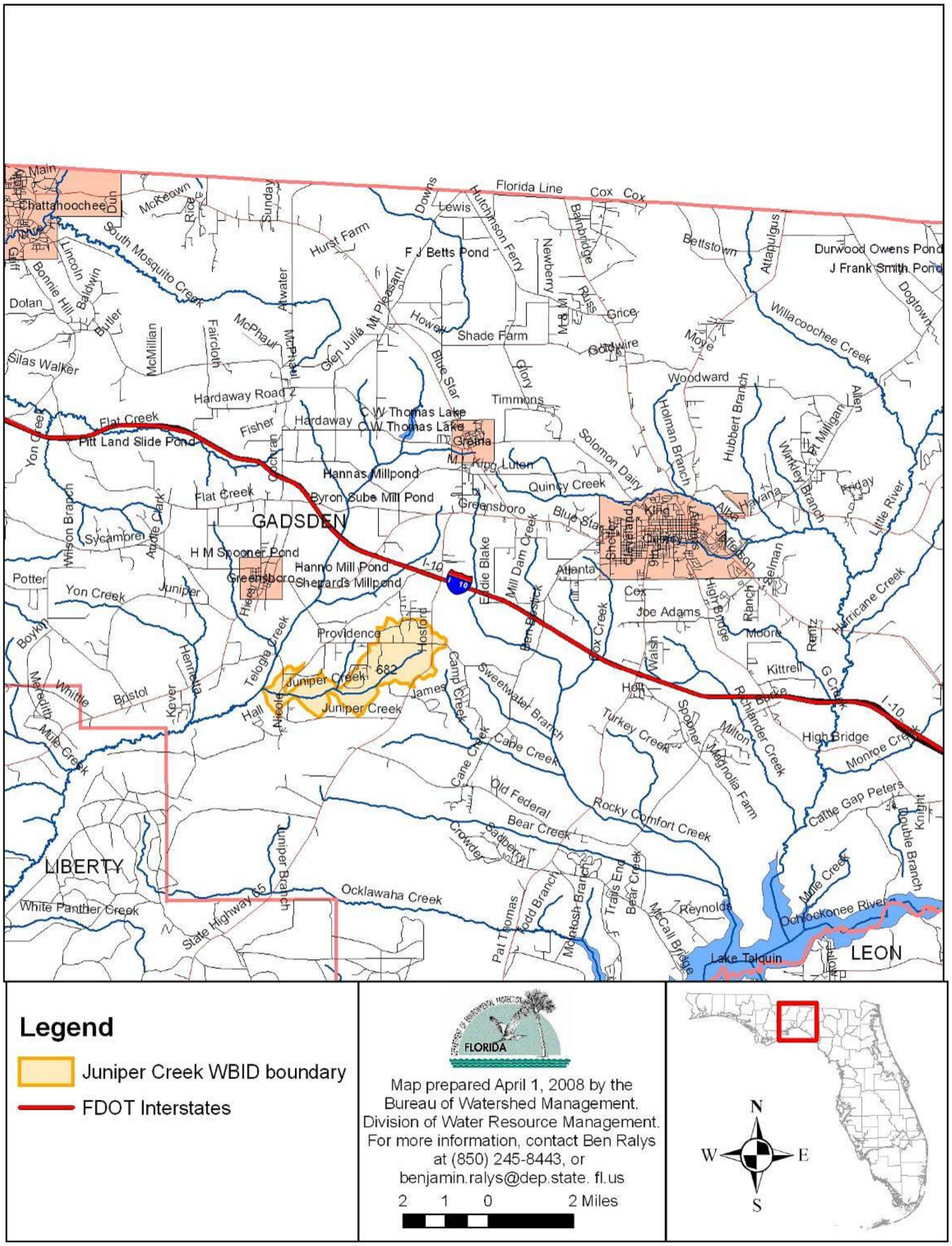
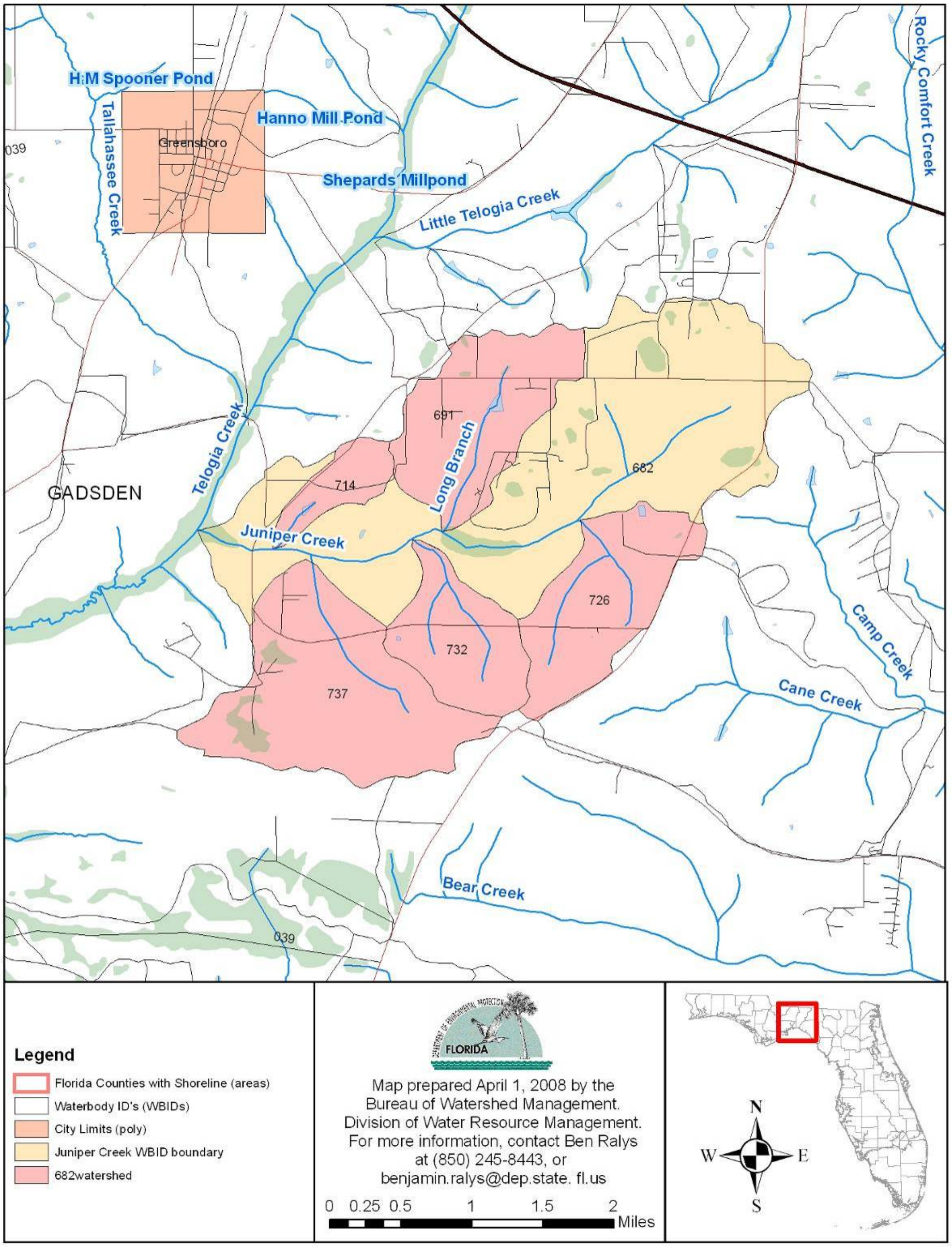


Figure 1.2. WBIDs in the Juniper Creek Watershed, Including WBIDs 682, 691, 714, 726, 732, and 737



1.3 Background

This report was developed as part of the Department's watershed management approach for restoring and protecting state waters and addressing TMDL Program requirements. The watershed approach, which is implemented using a cyclical management process that rotates through the state's 52 river basins over a 5-year cycle, provides a framework for implementing the TMDL Program–related requirements of the 1972 federal Clean Water Act and the 1999 Florida Watershed Restoration Act (FWRA) (Chapter 99-223, Laws of Florida).

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards. They provide important water quality restoration goals that will guide restoration activities.

This TMDL report will be followed by the development and implementation of a Basin Management Action Plan, or BMAP, to reduce the amount of nutrients and five-day biochemical oxygen demand (BOD_5) that contributed to the verified DO impairments in Juniper Creek. These activities will depend heavily on the active participation of the Northwest Florida Water Management District (NWFWMD), local governments, businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act requires states to submit to the U.S. Environmental Protection Agency (EPA) a list 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. The Department has developed such lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4], Florida Statutes [F.S.]), and the state's 303(d) list is amended annually to include basin updates.

Florida's 1998 303(d) list included 24 waterbodies in the Ochlockonee–St. Marks Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rulemaking process, the Environmental Regulation Commission adopted the new methodology as Rule 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001. The IWR was modified in 2007.

2.2 Information on Verified Impairments

The Department used the IWR to assess water quality impairments in the Ochlockonee–St. Marks Basin and has verified the impairments listed in **Table 2.1**. **Table 2.2** summarizes the number of DO exceedances in Juniper Creek, WBID 682. Data were collected in 1979, 1992, 1993, 2006, and 2007.

Table 2.1. Verified Impaired Segments in the Ochlockonee–St. Marks Basin

WBID	Waterbody Segment	Parameters Assessed using the IWR	Priority for TMDL Development	Projected Year of TMDL Development
427	Swamp Creek	Fecal Coliform	Low	2008
563	Unnamed Drain	Fecal Coliform, Turbidity	Low	2018
582	Lake Jackson Outlet	Unionized Ammonia	Low	2014
628	Black Creek	Fecal Coliform	Low	2018
647	Alford Arm	DO	Medium	2008
682	**Juniper Creek**	**DO, Fecal Coliform**	**Medium**	**2008**
684	Mule Creek	Fecal Coliform	Low	2018
689	Lake Overstreet Drain	Fecal Coliform	Low	2018
716	Caney Branch	Fecal Coliform	Low	2018
756	Lake Lafayette Drain	DO	Medium	2008
757	Bear Creek	Fecal Coliform	Low	2018
807	Munson Slough (below Lake Munson)	DO, Unionized Ammonia	Medium	2013
808	Copeland Sink Drain	DO	Low	2014
809	Megginnis Arm Run	Fecal Coliform	Low	2018
820	Godby Ditch	Fecal Coliform	Low	2018
879	Hammock Creek	DO	Low	2014
896	Polk Creek	Fecal Coliform	Low	2018
913	Big Creek	Fecal Coliform	Low	2018
919	Unnamed Slough	Fecal Coliform	Low	2018
921	Harvey Creek	Fecal Coliform	Low	2018
965	Sweetwater Branch	Fecal Coliform	Low	2018
971	Chicken Branch	Fecal Coliform	Low	2018
977	Moore Branch	Fecal Coliform	Low	2018
1006	Wakulla River	Biology	Medium	2008
1024	Black Creek	Fecal Coliform	Low	2008
1028	McBride Slough	Fecal Coliform	Low	2018
1049	Big Branch	Fecal Coliform	Low	2018
1054	Black Creek	DO	Low	2014
1124	Big Boggy Branch	Fecal Coliform	Low	2018
1300	Telogia Creek	Fecal Coliform, Iron	Medium	2008
1303	Quincy Creek	Fecal Coliform, Iron	Low	2018
8026	Coastapalach Gulf West	Shellfish	Medium	2008
8999	Gulf Coast	Mercury (in Fish Tissue)	Low	2011
1248B	Ochlockonee Bay	Fecal Coliform	Low	2018

WBID	Waterbody Segment	Parameters Assessed using the IWR	Priority for TMDL Development	Projected Year of TMDL Development
1248C	Ochlockonee Bay	Fecal Coliform	Low	2018
1297B	Ochlockonee River	Iron	Medium	2013
1297C	Lake Talquin	DO, TSI	Medium	2013
1297D	Lake Talquin	TSI	Medium	2013
1297E	Ochlockonee River	Iron	Medium	2013
1297F	Ochlockonee River	Iron	Medium	2013
540A	Tallavanna Lake	TSI	Medium	2008
756A	Upper Lake Lafayette	Fecal Coliform, DO	Low	2018
756B	Lake Piney Z	DO, TSI	Medium	2008
756C	Lower Lake Lafayette	DO, TSI	Medium	2008
791N	Lake Miccosukee	TSI	Low	2014
8025B	Mashes Island	Bacteria	High	2008
8026B	Shell Point	Bacteria	Low	2018
807C	Lake Munson	DO, TSI, Turbidity	Medium	2008
807D	Munson Slough (above Lake Munson)	DO, Fecal Coliform, Turbidity	Low	2008
971B	Lake Weeks	DO	Medium	2008

Note: The parameters listed in **Table 2.1** provide a complete picture of the impairment in the Ochlockonee–St. Marks Basin, but this TMDL only addresses DO impairment in the Juniper Creek Watershed.

TSI – Trophic State Index

Table 2.2. Summary of DO Exceedances for Juniper Creek Watershed, WBID 682

WBID	N DO	N DO <5	Minimum	Maximum	Mean
682	26	10	2.4 mg/L	10 mg/L	6.15 mg/L

Mg/L – Milligrams per liter

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criteria Applicable to the TMDL

Florida's surface waters are protected for five designated use classifications, as follows:

Class I	**Potable water supplies**
Class II	**Shellfish propagation or harvesting**
Class III	**Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife**
Class IV	**Agricultural water supplies**
Class V	**Navigation, utility, and industrial use (there are no state waters currently in this class)**

Juniper Creek and its tributaries are Class III fresh waterbodies (with a designated use of recreation, propagation and the maintenance of a healthy, well-balanced population of fish and wildlife). The water quality criterion applicable to the impairment addressed by this TMDL is the Class III criterion for DO. The pollutants contributing to this impairment is TN. **Figure 3.1** shows Juniper Creek at SR 65A.

Figure 3.1. Juniper Creek at SR 65A

3.2 Applicable Water Quality Standards and Numeric Water Quality Targets

The DO criterion (Subsection 62-302.530[30], F.A.C.) requires that DO shall not be less than 5.0 mg/L. Normal daily and seasonal fluctuations above these levels shall be maintained.

3.2.1 Reference Stream and Lake Approach

In determining nutrient and DO TMDLs for several waterbodies in the Leon County area, the EPA (2006) used seven reference streams from this area to set a nutrient targets of 0.72 mg/L for total nitrogen (TN) (**Tables 3.1** and **3.2**), based on the 75th percentile value of the combined data.

Table 3.1. EPA Set of Reference Streams in North Florida

Storet ID	Station Nickname	Station Description	Waterbody Name
22030061	LLOYDDREF	Lloyd Creek S.R. 158a Jefferson Co.	Lloyd Creek
31010140	NMOS REF	North Mosquito Ck	North Mosquito Creek
22020062	OKLREF	Oklawaha Ck	Oklawaha Creek
31010050	CRKREF	Crooked Creek @ Hwy. 20 Gadsden Co.	Crooked Creek
31010142	FLTREF	Flat Creek @ Hwy.12 Gadsden Co.	Flat Creek
22020049	MULEREF	Mule Creek @ SR 12 Liberty Co.	Mule Creek
31010051	SETREF	Sweetwater Creek @ Hwy. 270 Liberty Co.	Sweetwater Creek

Table 3.2. EPA Stream Nutrient Targets

Parameter	No of Stations	No. of Data Points	Units	75th Percentile of All Reference Data	TMDL Target
TN	7	47	mg/L	0.72	0.72

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of nutrients in the 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 failing septic systems; and atmospheric deposition.

However, the 1987 amendments to the Clean Water Act 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, including 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 Clean Water Act definitions, the term "point source" will be 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**). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES stormwater discharges and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

4.2 Potential Sources of Nutrients in the Juniper Creek Watershed

4.2.1 Point Sources

In Gadsden County, there is currently one permitted wastewater treatment facility located in the Juniper Creek Watershed (**Figure 4.1**). Quincy Farms (FLA010088, expiring October 25, 2009; see **Table 4.1** and **Figure 4.2**) grows and processes mushrooms and sells compost to the public. The plant started operation around March 12, 1982. Process water is obtained from on-site wells. The water not consumed in the mushroom growing process, along with contact stormwater, is disposed of through an on-site sewage treatment and disposal system (OSTDS). Treated effluent is disposed of through spray irrigation to a man-made wetland. The system was designed for no discharge to surface waters.

The 0.179-million-gallons-per-day (mgd) Long Term Average industrial wastewater treatment system consists of a 0.5-million-gallon recycle basin, 2 lagoons (stabilization ponds) of 1.5 and 3.6 million gallons, and a 30-acre manmade wetland with a 27-acre spray irrigation area. The recycle basin collects and reuses nutrient-rich runoff from the composting process. The lagoons are lined with high-density polyethylene (HDPE) to prevent discharge to ground water. The lagoons reduce carbonaceous biochemical oxygen demand (BOD_5) through aerobic-anaerobic processes and total suspended solids (TSS) through settling.

The facility is permitted through Florida's Industrial Wastewater program. In the unlikely event of a discharge, the only permit limit is for pH (6.5 to 8.5 standard units [su]). The following parameters are report only: Flow (Q), BOD_5, TSS, NO_{23}-N, and TKN. Additional parameters monitored for the wells are conductivity and water levels in the wells. **Figure 4.2** contains a layout of the wastewater system and the monitoring wells in relation to Juniper Creek on the north.

Appendix C shows effluent data plotted vs. time for the following parameters: Q, TEMP, pH, BOD_5, TKN, and TSS. Flow (Q) was reduced from about 0.4 mgd in early 2000 to a range of 0.05 to 0.3 mgd through 2007. Temperature was fairly consistent through this period (about 18 to 25 ºC). pH rose slightly from about 7.5 to 8.0 su. BOD_5 rose, from about 50 to 100 mg/L to values exceeding 500 to 1,000 mg/L, starting in May 2005. TKN varied from about 20 to 180 mg/L, with no apparent trend. The graphs show a large decrease in TKN starting in about 2006. However, the paper copies of permit files do not reflect this decrease but note that TKN exceeded 400 mg/L in December 2006. TSS increased by an order of magnitude from about 50 to 500 mg/L and parallels BOD_5. **Tables 4.4a** through **4.4d** summarize annual point source loads to Juniper Creek for 1997. **Appendix C** contains annual summaries for 2000-–2006.

Appendix C summarizes monitoring well data. Of the 8 monitoring wells examined, 5 wells had nitrate concentrations greater than 10 mg/L. Monitoring well MWC-3 had 11 of 31 samples exceeding 10 mg/L.

Table 4.1. Potential Sources in the Juniper Creek Watershed-WBID 682

NPDES Permit Number	Facility Name	City Mailling Address	Type of Facility	Facility Status	Design Capacity (mgd)	Watershed	WBID
FLA010088	Quincy Farms	Quincy	Industrial	Active	0.179	Juniper Creek	682

Municipal Separate Storm Sewer System Permittees

Within the Juniper Creek Watershed there are no Phase I or Phase II NPDES municipal separate storm sewer system (MS4) permits.

Figure 4.1. Wastewater Facilities in the Juniper Creek Watershed

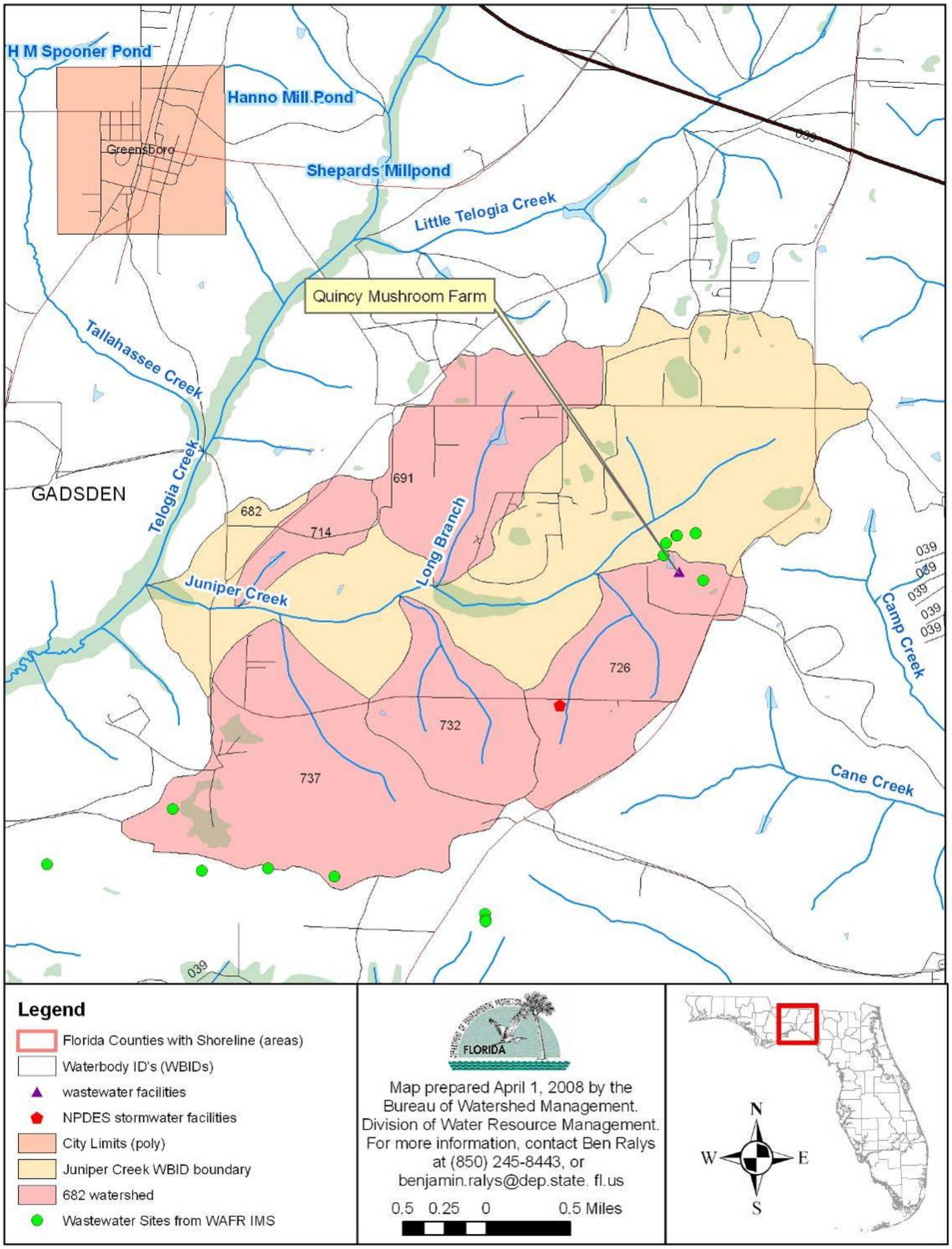
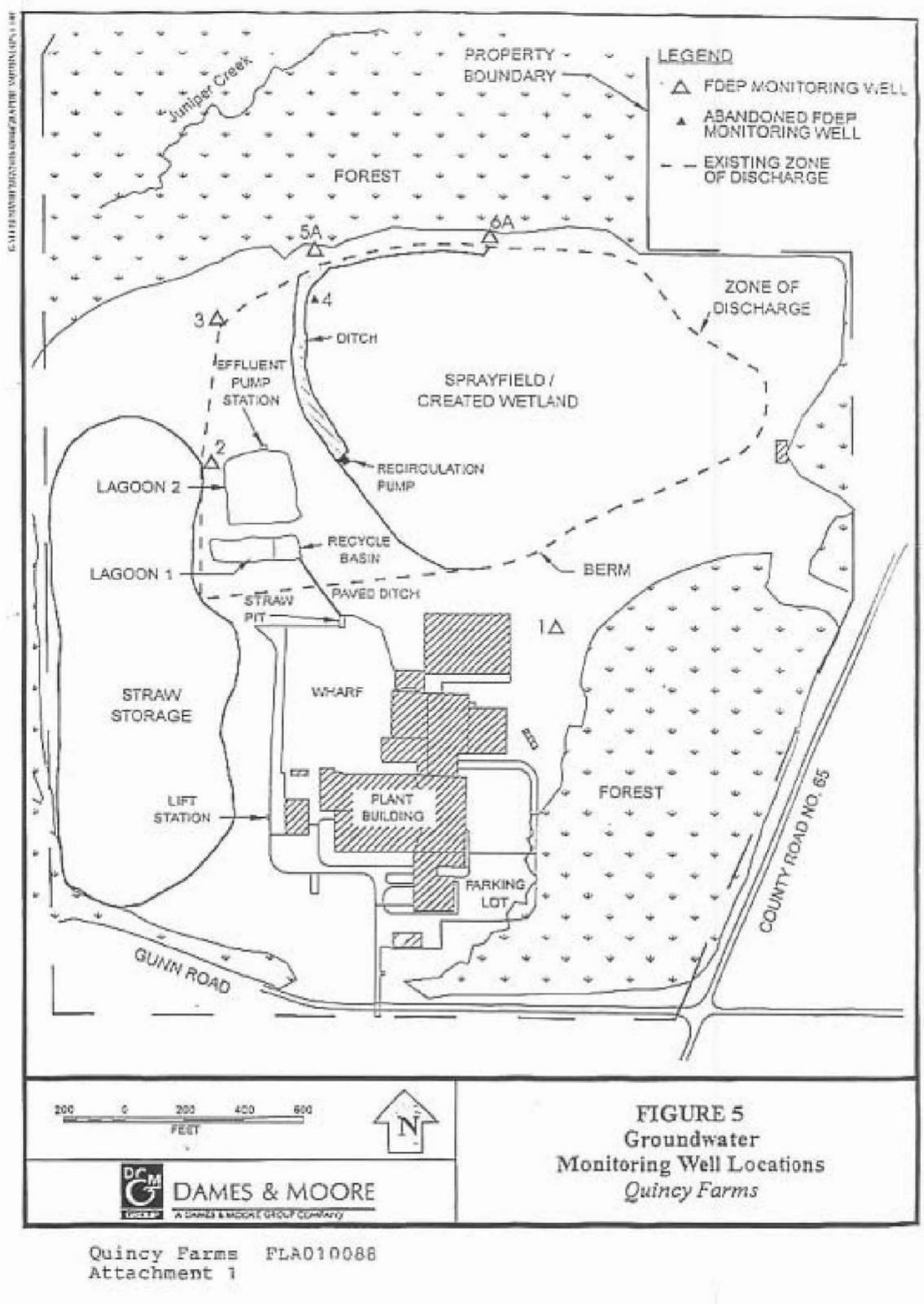


Figure 4.2. Quincy Farms Wastewater System and Monitoring Well Locations in the Juniper Creek Watershed



4.2.2 Land Uses and Nonpoint Sources

Nutrient and BOD_5 loadings to the Juniper Creek Watershed are generated from nonpoint sources in the watershed. Potential nonpoint sources of nutrients are characterized by their pathway or delivery to the river, tributary runoff, ground water, sediment nutrient release, and atmospheric deposition. They can also be described by the type of land use where the sources are generated.

Land Uses

The spatial distribution and acreage of different land use categories in Florida were identified using the 1995 land use coverage (scale 1:40,000) contained in the Department's geographic information system (GIS) library. Land use categories in the watershed (Gadsden County) were aggregated using the simplified Level 1/Level 3 codes tabulated in **Tables 4.2a** and **4.2b**. **Figures 4.3a** and **4.3b** show the acreage of the principal land uses in the watershed. As shown in **Table 4.2a**, land use is heavily dominated by upland forests, which comprise 57.68 percent of the entire watershed. Other measurable land uses include agriculture (28.17 percent), urban and built-up (5.39 percent), and wetlands (5.67 percent). There are several large nurseries located in and around the watershed. For example, Hackney Nursery, located just to the north of Juniper Creek, operates on both sides of Highway 65A (Juniper Creek Rd.).

Table 4.2a. Classification of Land Use Categories in the Juniper Creek Watershed

Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
WBID 682, Juniper Creek				
1000	Urban and Built-up	128.26	0.20	5.17
2000	Agriculture	913.28	1.43	36.84
3000	Rangeland	78.30	0.12	3.16
4000	Upland Forests	1,104.91	1.73	44.57
5000	Water	8.46	0.01	0.34
6000	Wetlands	245.87	0.38	9.92
7000	Barren Lands	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	0.00	0.00	0.00
	Total	**2,479.07**	**3.87**	**100.00**
Level 1 Code	**Land Use**	**Acreage**	**Mi^2**	**% of WBID Watershed**
WBID 691, Long Branch				
1000	Urban and Built-up	57.17	0.09	7.97
2000	Agriculture	327.78	0.51	45.71
3000	Rangeland	21.15	0.03	2.95
4000	Upland Forests	273.54	0.43	38.15
5000	Water	14.33	0.02	2.00
6000	Wetlands	23.05	0.04	3.22
7000	Barren Lands	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	0.00	0.00	0.00
	Total	**717.03**	**1.12**	**100.00**
Level 1 Code	**Land Use**	**Acreage**	**Mi^2**	**% of WBID Watershed**
WBID 714, Unnamed Run				
1000	Urban and Built-up	40.66	0.06	21.92
2000	Agriculture	47.88	0.07	25.81
3000	Rangeland	0.00	0.00	0.00
4000	Upland Forests	88.43	0.14	47.67
5000	Water	1.13	0.00	0.61
6000	Wetlands	7.40	0.01	3.99
7000	Barren Land	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	0.00	0.00	0.00
	Total	**185.49**	**0.29**	**100.00**

Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
WBID 737, Unnamed Run				
1000	Urban and Built-up	14.56	0.02	1.26
2000	Agriculture	88.90	0.14	7.72
3000	Rangeland	11.01	0.02	0.96
4000	Upland Forests	993.55	1.55	86.32
5000	Water	1.28	0.00	0.11
6000	Wetlands	38.96	0.06	3.39
7000	Barren Land	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	2.70	0.00	0.23
	Total	**1,150.95**	**1.80**	**100.00**

Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
WBID 732, Unnamed Run				
1000	Urban and Built-up	8.75	0.01	1.86
2000	Agriculture	36.22	0.06	7.69
3000	Rangeland	18.27	0.03	3.88
4000	Upland Forests	400.22	0.63	84.92
5000	Water	1.48	0.00	0.32
6000	Wetlands	6.32	0.01	1.34
7000	Barren Land	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	0.00	0.00	0.00
	Total	**471.27**	**0.74**	**100.00**

Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
WBID 726, Unnamed Run				
1000	Urban and Built-up	55.33	0.09	8.41
2000	Agriculture	177.34	0.28	26.96
3000	Rangeland	12.29	0.02	1.87
4000	Upland Forests	398.30	0.62	60.56
5000	Water	3.74	0.01	0.57
6000	Wetlands	10.75	0.02	1.63
7000	Barren Land	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	0.00	0.00	0.00
	Total	**657.75**	**1.03**	**100.00**

Level 1 Code	Land Use	Acreage	Mi^2	% of WBID Watershed
Juniper Creek Watershed				
1000	Urban and Built-up	304.73	0.48	5.39
2000	Agriculture	1,591.40	2.49	28.17
3000	Rangeland	141.02	0.22	2.49
4000	Upland Forests	3,258.95	5.09	57.68
5000	Water	30.42	0.05	0.54
6000	Wetlands	332.34	0.50	5.67
7000	Barren Land	0.00	0.00	0.00
8000	Transportation, Communication, and Utilities	2.70	0.00	0.05
	Total	**5,661.56**	**8.83**	**100.00**

Table 4.2b. Classification of Land Use Categories in Gadsden County

Level 1 Code	Land Use	Acreage	Mi^2	% of County
Gadsden County				
1000	Urban and Built-up	21,691.60	33.89	6.42
2000	Agriculture	43,886.81	68.57	12.98
3000	Rangeland	8,764.68	13.69	2.59
4000	Upland Forests	233,163.80	364.32	68.98
5000	Water	9,152.93	14.30	2.71
6000	Wetlands	18,175.10	28.40	5.38
7000	Barren Land	52.56	0.08	0.02
8000	Transportation, Communication, and Utilities	3,115.13	4.87	0.92
	Total	**338,002.61**	**528.13**	**100.00**

Figure 4.3a. Principal Land Uses in Gadsden County

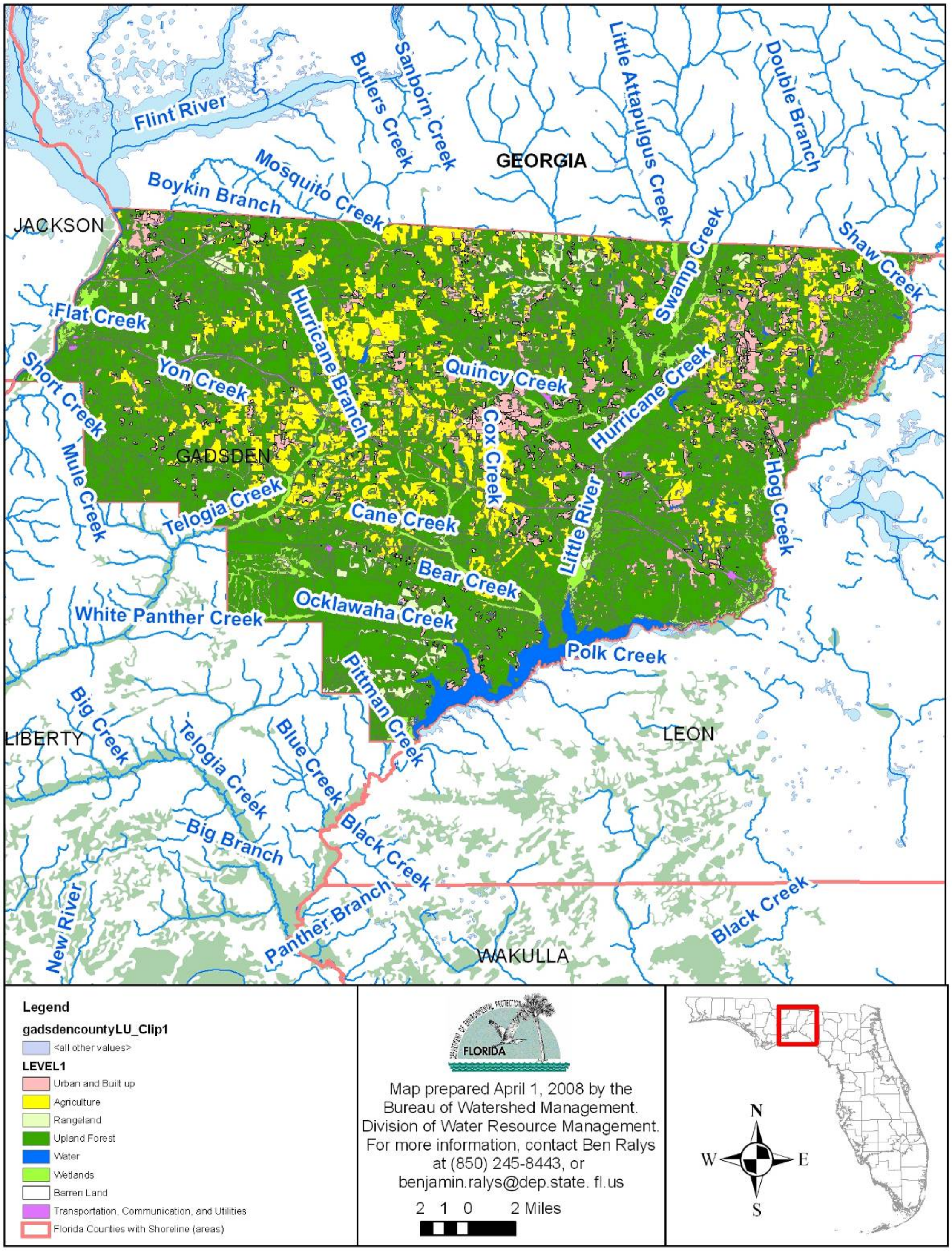
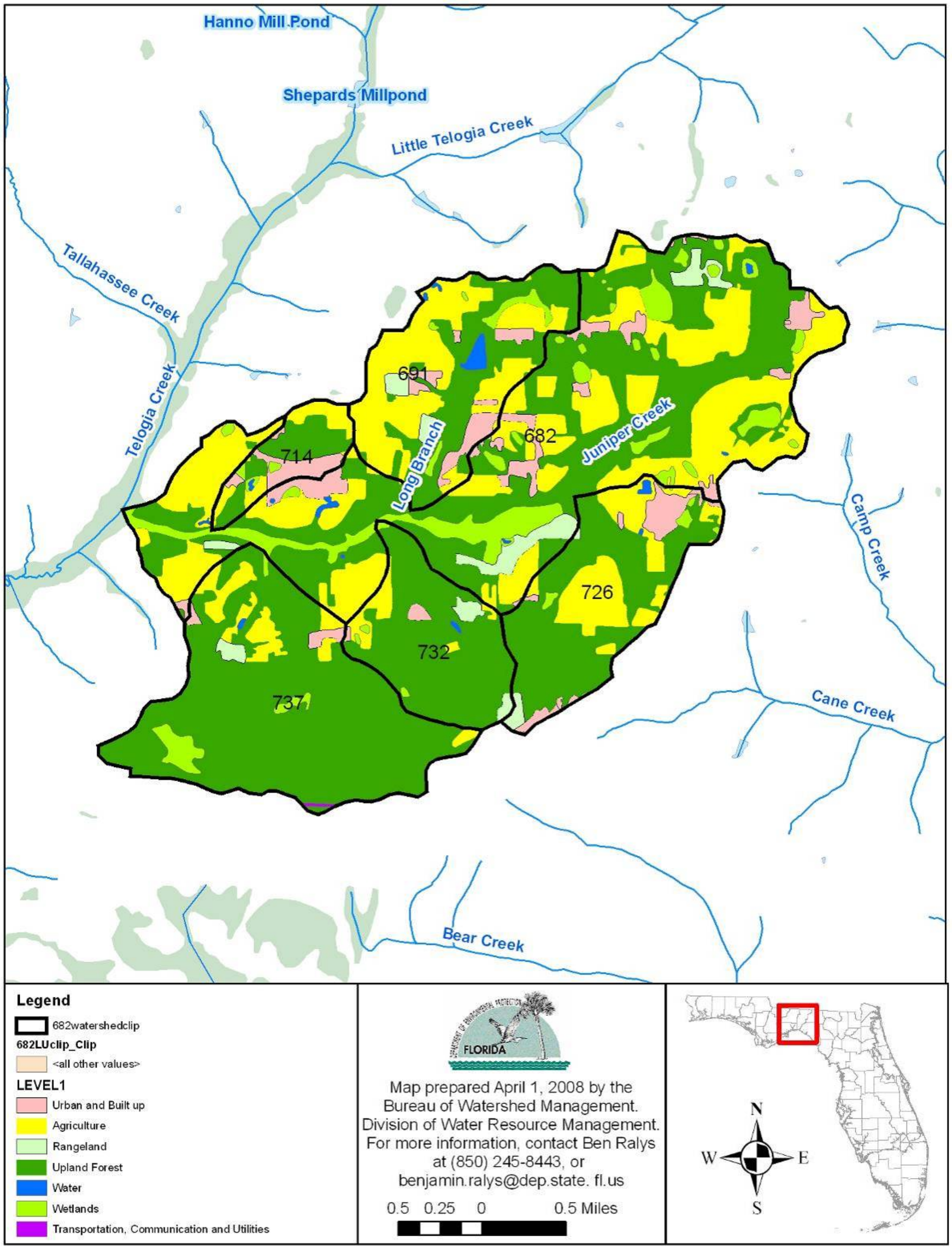


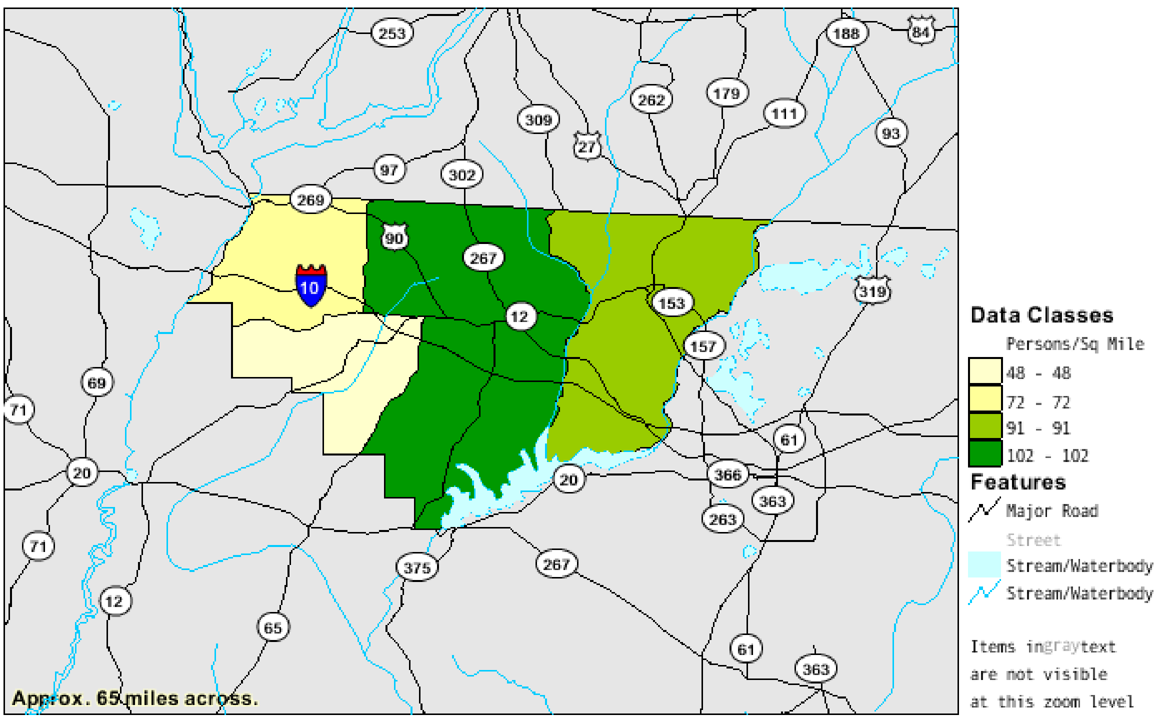
Figure 4.3b. Principal Land Uses in the Juniper Creek Watershed, WBIDs 682, 691, 714, 737, 732 and 726



Population

According to the U.S Census Bureau (2008), the population density in Gadsden County in the year 2000 was at or less than 87.4 people/mi^2 (10 persons/mi^2 is the minimum used by the Census Bureau) (**Figure 4.4**). The Bureau reports that for Gadsden County, which includes WBIDs 682, 691, 714, 737, 732, and 726, the total population for 2000 was 45,087, with 15,867 occupied housing units and 17,703 total housing units. For all of Gadsden County, the Census Bureau reported a housing density of 34.3 housing units/mi^2. This places Gadsden County among the lowest in housing densities in Florida U.S. Census Bureau Website, 2008). This ranking is also supported by land use coverage, which shows that only 5.39 percent of land use in the Juniper Creek watershed is delineated as urban and built-up.

Figure 4.4. Population Density in Gadsden County, Florida



NONPOINT SOURCE RUNOFF LOADING MODELS

Surface Water Runoff. A spreadsheet model developed by the Department's Watershed Assessment Section, using methods comparable to those of the Watershed Management Model (WMM) developed by Camp Dresser & McKee (CDM), is typically used to estimate the watershed surface water runoff loads associated with rainfall. The model is designed to estimate annual or seasonal pollutant loadings from a given watershed (CDM, 1998).

The fundamental assumption of the model is that the amount of stormwater runoff from any given land use is in direct proportion to annual rainfall. The quantity of runoff is controlled by the fraction of the land use category that is characterized as impervious and the runoff coefficients of both pervious and impervious areas. The governing equation is as follows:

(1) $R_L = [C_p + (C_I - C_p) IMP_L] * I$

Where:

R_L = total average annual surface runoff from land use L (inches/year),
IMP_L = fractional imperviousness of land use L,
I = long-term average annual precipitation (inches/year),
C_P = pervious area runoff coefficient, and
C_I = impervious area runoff coefficient.

The model estimates pollutant loadings based on nonpoint pollution loading factors (expressed as pounds/acre/year) that vary by land use and the percent imperviousness associated with each land use. The pollution loading factor, M_L, is computed for each land use L by the following equation:

(2) $M_L = EMC_L * R_L * K$

Where:

M_L = loading factor for land use L (pounds/acre/year),
EMC_L = event mean concentration of runoff from land use L (mg/L); EMC varies by land use and pollutant,
R_L = total average annual surface runoff from land use L computed from Equation (1) (inches/year), and
K = 0.2266, a unit conversion constant.

The data required for applying the spreadsheet model include the following:

- *Area of all the land use categories,*
- *Percent impervious area of each land use category,*
- *EMC for each pollutant type and land use category,*

- *Percent EMC of each pollutant type that is in suspended form, and*
- *Annual precipitation.*

The WMM model was run using annual precipitation data from the Quincy, Florida gage for 1984 through 2006. **Table 4.3** and **Appendix B** summarize the results.

Table 4.3. WMM Model Annual Loads, 1984–2006

Year	TN (lbs/yr)	TP (lbs/yr)	BOD (lbs/yr)	TSS (lbs/yr)
1984	2.6265E+04	2.4297E+03	3.8011E+04	3.7659E+05
1985	3.1899E+04	2.9509E+03	4.6165E+04	4.5737E+05
1986	3.4734E+04	3.2131E+03	5.0267E+04	4.9801E+05
1987	2.6700E+04	2.4699E+03	3.8641E+04	3.8283E+05
1988	2.7896E+04	2.5806E+03	4.0372E+04	3.9998E+05
1989	3.6031E+04	3.3331E+03	5.2144E+04	5.1661E+05
1990	2.1903E+04	2.0262E+03	3.1698E+04	3.1405E+05
1991	4.7512E+04	4.3952E+03	6.8761E+04	6.8124E+05
1992	3.3511E+04	3.2694E+03	5.0216E+04	4.9751E+05
1993	3.3387E+04	3.0885E+03	4.8318E+04	4.7870E+05
1994	4.9473E+04	4.5765E+03	7.1597E+04	7.0934E+05
1995	3.3222E+04	3.0733E+03	4.8080E+04	4.7634E+05
1996	2.9455E+04	2.7247E+03	4.2627E+04	4.2232E+05
1997	3.6750E+04	3.3996E+03	5.3185E+04	5.2693E+05
1998	3.1568E+04	2.9202E+03	4.5685E+04	4.5262E+05
1999	2.4173E+04	2.2362E+03	3.4984E+04	3.4660E+05
2000	2.3887E+04	2.2097E+03	3.4569E+04	3.4249E+05
2001	3.1074E+04	2.8745E+03	4.4971E+04	4.4554E+05
2002	3.2122E+04	2.9715E+03	4.6488E+04	4.6057E+05
2003	3.2155E+04	2.9746E+03	4.6535E+04	4.6104E+05
2004	3.5053E+04	3.2426E+03	5.0729E+04	5.0260E+05
2005	3.5742E+04	3.3063E+03	5.1726E+04	5.1247E+05
2006	2.6192E+04	2.4230E+03	3.7906E+04	3.7555E+05

Lbs/yr – Pounds per year

Baseflow. The baseflow component of stream flow can be estimated using the Baseflow program (Arnold et al., 1995, 1999). One method of estimating baseflow loading is to assign ground water concentrations from well data in the area to the flow generated above. The total annual load (lbs/day or lbs/yr) to a stream is then computed as:

L = L (WMM Storm load) + L (Baseflow load)

As no continuous flow gage data were available for Juniper Creek, this load was not computed.

Septic Tanks

OSTDS's, including septic tanks, are commonly used where providing central sewer is not cost-effective or practical. When properly sited, designed, constructed, maintained, and operated, OSTDS's 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. When not functioning properly, OSTDS's can be a source of coliforms, pathogens, and other pollutants to both ground water and surface water.

As of 2007, Gadsden County had roughly 16,381 septic systems (Florida Department of Health [FDOH] Website, 2008). Data for septic tanks are based on 1970 to 2007 Census results, with year-by-year additions based on new septic tank construction. The data do not reflect septic tanks that have been removed going back to 1970. From fiscal years 1991 to 2007, 1,761 permits for repairs were issued (FDOH Website, 2008). Based on the number of permitted septic tanks and housing units located in the county, approximately 40.7 percent of the housing units are connected to a wastewater treatment facility, about 56.9 percent use septic tank systems, and 2.4 percent use other systems.

To estimate the TN and TP loading per septic system, the EPA methodology was used. The mean household use in Tampa, Florida, is 65.8 gallons/per capita/day (gal/cap/day) (EPA, 2002). The Department used a value of:

Qseptic = 70 gal/cap/day* 2.6 persons /household*0.1337 (cuft/gal)*(1 day/(24*3600 sec).

Thus, Qseptic = 2.8164E-04 cubic feet per second [cfs]/tank. To represent the water quality exiting the septic tank, the mean values of 50.5 mg/L for TN and 9.0 mg/L for TP were used (EPA, 2002). **Appendix B** shows the estimates from 1970 through 2006 for Gadsden County. **Tables 4.4a** through **4.4d** contain the loads for 1997.

Boats

There are no boats contributing to nutrient loading in the watershed.

Agriculture

The U.S. Geological Survey (USGS) (Ruddy et al., 2006) has estimated nutrient inputs to the land surface at the county level from livestock, fertilizer use, and atmospheric deposition. **Appendix D** shows the estimates from 1987 through 2001 for Gadsden County. **Tables 4.4a** through **4.4d** contain the loads for 1997.

Livestock

The USGS (Goolsby et al., 1999) developed methods to estimate the nitrogen (TN) and phosphorus (TP) content of manure generated by various types of livestock. The method accounts for the different life cycles of the animals on an annual basis and whether the animals were in confined or unconfined conditions. Losses of nitrogen due to storage, handling, and volatilization have also been determined. **Appendix D** shows the estimates from 1987 through 2001 for Gadsden County. **Tables 4.4a** through **4.4d** contain the loads for 1997.

Fertilizer

Several methods have been used to allocate state fertilizer data to counties. State fertilizer sales data, in tons, were compiled through the U.S. Department of Agriculture's Census of Agriculture from 1945 through 1985. The USGS (Alexander et al., 1990) used county fertilized-acreage data from the Census to allocate the state-level sales to fertilizer use within individual counties. The USGS also compiled additional data from 1985 through 2001 (Battaglin et al., 1995). It was assumed that fertilizer sold within the county was used in the same year. Fertilizer in tons of product was converted to tons of nitrogen and phosphorus based on the chemical composition data for each product. In addition, fertilizer was divided into farm (agricultural) and nonfarm (urban) land use. **Appendix D** shows the estimates from 1987 through 2001 for Gadsden County. **Tables 4.4a** through **4.4d** contain the loads for 1997.

Atmospheric Deposition

The annual summaries of wet deposition in kilograms per hectare (kg/ha) were obtained by the USGS from the National Atmospheric Deposition Program (NADP) Website (NADP, 2002). Nationwide wet deposition sites were utilized and developed into 1 kilometer (km) resolution grid cells. Annual wet deposition for each county by year was then developed from the grid cells within each county. **Appendix B** contains tables of TN (kilograms/year). No TP data were developed, because concentrations were not considered significant and samples were subject to contamination.

The wet and dry atmospheric deposition rates (kilograms/hectare/year) for Gadsden County were calculated separately from the USGS, as noted in **Tables 4.4a** through **4.4d**. NADP data from 1984 through 2006 for the Quincy, Florida site (FL14) were used and applied to the Gadsden County areas with values converted to lbs/yr. **Appendix B** includes these data. Dry deposition was assumed equal to wet deposition (wet:dry ratio = 1.00) based on studies in the Tampa Bay area (Poor et al., 2001; Pribble et al., 1999). However, there are some monitoring sites (Pollman et al., 2003) where the wet:dry ratio is much lower (Sumatra, Florida wet:dry ratio = 1:0.19). Wet deposition data at the Sumatra, Florida site (SUM156; Clean Air Status and Trends Network [CASTNET] Website, 2007) were comparable to the Quincy site (FL14).

Additional studies from the Department's air pollution files (Rogers, 2006) have compiled information on nitrogen oxide emissions (tons/yr) by county for various source categories, including stationary point, stationary area, on-road mobile, nonroad mobile, and total sources.

TP deposition data from early studies in Florida (Brezonik et al., 1983) show wet+dry TP deposition of 59 milligrams/square meter/year. However, this analysis showed that dry deposition accounted for 80 percent of the total. Concentrations in Florida studies from 1955 to 1975 ranged from 26 to 50 micrograms per liter (μg/L). The USGS (Irwin et al., 1980) monitored TP in bulk precipitation (1977–78) at a site in Leon County near the Ochlockonee River and U.S. Highway 27. Results for 5 samples gave a mean TP of 0.03 mg/L (30 μg/L) and a range of 0.01 to 0.05 mg/L.

Domesticated Animals

Domesticated animals can also provide a source of nutrients to the Juniper Creek Watershed. The number of households (HH) can be used to estimate the numbers of dogs, cats, and horses in each county. Using nationwide figures from the American Veterinary Medical Association (AVMA) Website (2004; available: www.avma.org), the numbers are as follows:

NDOGS = 0.58* HH
NCATS = 0.66* HH
NHORSES = 0.05*HH

The fecal loading rates from a variety of farm and domestic animals are well documented in the literature (EPA, 2001). However, the nutrient loading rates for dogs and cats were much more difficult to find. Bruce Warden of California's Lahontan Regional Water Quality Control Board estimated that an average 45-pound dog produces 13 lbs/yr of TN and 2 lbs/yr of TP (Warden, 2007). Using household Census figures from 1990 and 2000, linear interpolation was used to estimate the number of dogs (NDOGS) for each year from 1970 through 2006 and the corresponding load.

Domestic cats are not considered equivalent to dogs, because many use a litter box. However, the number of feral or wild cats (NFERALCATS) can be quite large. Veterinary research in Canada (Funaba, 2005) tested a variety of cat foods and measured the input and output of TN, TP, and other nutrients based on an average cat with a body weight of 4 kilograms.

The same loading rates are used for domestic horses and ponies, and for agricultural horses (Ruddy et al., 2006). **Appendix B** shows the estimates from 1970 to 2005 for Gadsden County. **Tables 4.4a** through **4.4d** contain the loads for 1997.

Wildlife

Another possible source of nutrients to Juniper Creek could be wild animals. The Florida Department of Agriculture and Consumer Services (FDACS) (Knight, 2004) notes that there are major wildlife areas along much of the Pine Barren Creek watershed in Escambia County. The white-tailed deer population has been estimated at various densities (Knight, 2004); however, this TMDL analysis used a deer density of 1/50 acre or 12.8/mi^2. Assuming similar wildlife densities in this area, **Appendix B** shows the estimated deer population for the Ochlockonee–St. Marks Basin. Using the average TN and TP loading per animal (Ontario, 2007), the annual TN and TP loads to the watershed can be calculated.

Migratory waterfowl and other wild bird populations have been estimated annually from 1998 to 2006 (Birdsource Website, 2007; Knight, 2003), as shown in **Appendix B**. The numbers of waterfowl and other birds are compiled annually through the Christmas bird count. Some birds may frequent wetland areas, while others may congregate near landfills.

Studies of nutrient loading from migratory waterfowl showed that median TN is 3.15 grams/day/bird and TP is 0.45 grams/day/bird (Post et al., 1998). USGS summaries (Ruddy et al., 2006) of livestock nutrient loading show values for chickens and hens, and for tom and hen turkeys, that are similar to these numbers.

The most recent TMDL work (Benham, 2007) quantifying wildlife contributions to fecal coliform divides the load among eight categories of wildlife: deer, raccoons, muskrats, beavers, geese, ducks, wild turkeys, and other. **Appendix B** shows the estimates for Gadsden County. **Tables 4.4a** through **4.4d** contain the loads for 1997.

Spills

The Florida Department of Community Affairs (FDCA, 2007) maintains a Website (available: www.eoconline.org) that lists pollutant spills by date, time, county, reported amount, and description. Pollutants may be wastewater, petroleum, or other types of waste. **Appendix B** lists the summaries (Ziegmont, 2005) for Gadsden County. Using the annual estimate of gallons spilled and typical nutrient values for raw wastewater, TN and TP loads can be estimated. **Tables 4.4a** through **4.4d** contain the loads for 1997.

Sewage Line Leaks–Infiltration/Exfiltration

Estimates of chronic sewage line leaks to ground water or nearby streams and lakes are not readily available for most municipalities. A Department drinking water staff (Hoofnagle, 2008) review of engineering texts suggests that about 15 percent of usage (drinking water line flow) is unaccounted-for water. This includes drinking water line leaks, fire fighting, and line flushing.

Recent EPA Permitting Policy (Mehan, 2003) estimates that leaking sewer lines contribute about 5 percent of the WWTP design flow before reaching the treatment facility. Additional EPA research (Amick, 2000) has documented leakage rates in California, Maryland, and Kentucky that varied from 11.9 to 49.1 percent. The best documented study was for Albuquerque, New Mexico, where the leakage rate was 10 percent of the average daily base wastewater flow.

No information is available on sewer lines in the Juniper Creek watershed, and therefore this analysis assumes that no sewer leaks occur. **Tables 4.4a** through **4.4d** contain the loads for 1997.

Sludge/Residuals

The amount of residuals (dry tons/yr) generated in Gadsden County was tabulated for 1994 through 2005, as shown in **Appendix B** (Department, 2007). The TN nutrient content was assumed to be 5.0 percent of the dry weight and TP was 2.5 percent of the dry weight (Barker, 2007). **Tables 4.4a** through **4.4d** contain the loads for 1997. The limited data available for this county suggest that little of the sludge generated is reported.

4.3 Summary of Nutrient Loadings into Juniper Creek from Various Sources

Table 4.4a summarizes the annual average BOD_5 loadings from point sources (2000) and each of the nonpoint source categories (1997) detailed above generated within Gadsden County and the Juniper Creek Watershed. Missing data are shown as a zero load. **Tables 4.4b** through **4.4d** summarize the annual TKN, TN, and TP loads, respectively, to the Juniper Creek Watershed for the categories noted above. **Appendix B** provides a detailed breakdown for each category for other years.

Table 4.4a. Summary of BOD_5 Loads to the Juniper Creek Watershed, 1997

Estimated Annual Loading	Year(s)	Flow (mgd)	BOD_5 (lbs/yr)	
			Gadsden County	Juniper Creek Watershed
Point Sources				
Quincy Farms FLA010088	2000	0.2300		2.9848E+04
Nonpoint Sources				
Department Atmospheric Deposition Wet+Dry	1997			
USGS Atmospheric Deposition	1997			
USGS Nonfarm Fertilizer Use	1997			
USGS Farm Fertilizer Use	1997			
USGS Unconfined Livestock	1997			
USGS Confined Livestock	1997			
Total USGS Agriculture	1997			
Total Baseflow	1997			
Total Ground Water Seepage Loss	1997			
Total Septic Tanks	1997		1.6839E+06	2.3850E+04
Total Spills Sewage	1997			
Total Leaks Sewage	1997			
Total Sludge/Residuals Loading	1997			
Total Surface Runoff WMM Model	1997			5.3185E+04
Total Wildlife	1997			
Total Domestic Animals	1997			
Total Nonpoint Source Load	**1997**	**2.3000E-01**	**1.6839E+06**	**1.0688E+05**

Table 4.4b. Summary of TKN Loads to the Juniper Creek Watershed, 1997

Estimated Annual Loading	Year(s)	Flow (mgd)	TKN (lbs/yr)	
			Gadsden County	Juniper Creek Watershed
Point Sources				
Quincy Farms FLA010088	2000	0.2300		2.7237E+04
Nonpoint Sources				
Department Atmospheric Deposition Wet+Dry	1997			
USGS Atmospheric Deposition	1997			
USGS Nonfarm Fertilizer Use	1997			
USGS Farm Fertilizer Use	1997			
USGS Unconfined Livestock	1997			
USGS Confined Livestock	1997			
Total USGS Agriculture	1997			
Total Baseflow	1997			
Total Ground Water Seepage Loss	1997			
Total Septic Tanks	1997		3.7803E+05	5.3542E+03
Total Spills Sewage	1997			
Total Leaks Sewage	1997			
Total Sludge/Residuals Loading	1997			
Total Surface Runoff WMM Model	1997			
Total Wildlife	1997			
Total Domestic Animals	1997			
Total Nonpoint Source Load	**1997**	**2.3000E-01**	**3.7803E+05**	**3.2591E+04**

Table 4.4c. Summary of TN Loads to the Juniper Creek Watershed, 1997

Estimated Annual Loading	Year(s)	Flow (mgd)	TN (lbs/yr)	
			Gadsden County	Juniper Creek Watershed
Point Sources				
Quincy Farms FLA010088	2000			
Nonpoint Sources				
Department Atmospheric Deposition Wet+Dry	1997		2.0076E+06	3.3603E+04
USGS Atmospheric Deposition	1997		1.0048E+06	1.6819E+04
USGS Nonfarm Fertilizer Use	1997		1.2206E+05	4.4325E+03
USGS Farm Fertilizer Use	1997		2.5783E+06	9.3626E+04
USGS Unconfined Livestock	1997		4.1129E+05	1.4935E+04
USGS Confined Livestock	1997		1.9455E+05	7.0646E+03
Total USGS Agriculture	1997		3.3062E+06	1.2006E+05
Total Baseflow	1997			
Total Ground Water Seepage Loss	1997			
Total Septic Tanks	1997		3.8567E+05	5.4624E+03
Total Spills Sewage	1997			
Total Leaks Sewage	1997			
Total Sludge/Residuals Loading	1997		0.0000E+00	
Total Surface Runoff WMM Model	1997			3.6750E+04
Total Wildlife	1997		1.6247E+06	2.7195E+04
Total Domestic Animals	1997		1.9137E+05	2.7105E+03
Total Nonpoint Source Load	**1997**	**0.0000E+00**	**1.1826E+07**	**3.6266E+05**

Table 4.4d. Summary of TP Loads to the Juniper Creek Watershed, 1997

Estimated Annual Loading	Year(s)	Flow (mgd)	TP (lbs/yr)	
			Gadsden County	Juniper Creek Watershed
Point Sources				
Quincy Farms FLA010088	2000			
Nonpoint Sources				
Department Atmospheric Deposition Wet+Dry	1997		2.1411E+04	3.5838E+02
USGS Atmospheric Deposition	1997			
USGS Nonfarm Fertilizer Use	1997		1.7844E+04	6.4797E+02
USGS Farm Fertilizer Use	1997		4.6074E+05	1.6731E+04
USGS Unconfined Livestock	1997		1.3372E+05	4.8558E+03
USGS Confined Livestock	1997		6.0794E+04	2.2076E+03
Total USGS Agriculture	1997		6.7310E+05	2.4442E+04
Total Baseflow	1997			
Total Ground Water Seepage Loss	1997			
Total Septic Tanks	1997		6.8733E+04	9.7350E+02
Total Spills Sewage	1997			
Total Leaks Sewage	1997			
Total Sludge/Residuals Loading	1997		0.0000E+00	
Total Surface Runoff WMM Model	1997			3.3996E+03
Total Wildlife	1997		8.9548E+02	1.4989E+01
Total Domestic Animals	1997		3.0940E+04	4.3822E+02
Total Nonpoint Source Load	**1997**	**0.0000E+00**	**1.4682E+06**	**5.4069E+04**

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

One way to assess the target loading and existing loading for a stream or watershed is to use hydrologic and water quality modeling. Many of these models depend on the relationship between flow and surface water drainage area as well as the relationship between land use and soils and pollutant delivery. Juniper Creek's DO levels depend on the loading of BOD_5, TKN, and other nutrients from several of the 6 small tributary systems over its length of 4.6 miles. The only named tributary is Long Branch (WBID 691). The industrial discharger (Quincy Farms) was also shown to be a contributing source in the past (2000) and may still potentially contribute loading to Juniper Creek.

5.1.1 ADEM Model

Because of the possible influence of a discharger in Juniper Creek, the Department explored the use of the Alabama Department of Environmental Management's (ADEM) Spreadsheet Water Quality Model (2001). This model requires inputs of the flow and hydrology of the creek, inputs of headwaters and tributary water quality, and estimates for some of the model decay coefficients. The following briefly summarizes the inputs:

1. *Minimal flow data were available for Juniper Creek itself. The Department made several miscellaneous flow measurements at SR 65A in 1979 (Wieckowicz, 1981), 2006, and 2008. These flow data were compiled along with daily USGS gaged flows made on Telogia Creek (02330100) near Bristol (**Appendix H**). This gage is located on SR 20 downstream of Juniper Creek. In general, the Department used the daily flow/drainage area ratios (Q/DA) from the USGS site and the drainage areas of individual Juniper Creek tributaries to calculate flows within Juniper Creek. In addition, the 7-day, 10-year low flow Q7/10/DA (37 cfs/126 mi^2) ratio from Telogia Creek was also used for Juniper Creek (Rumenik et al., 1996).*
2. *The drainage areas for the individual tributaries were based on the WBID areas for five of six tributaries. One tributary was manually planimetered to obtain the drainage area.*
3. *The ADEM model provides default values for many of the standard model coefficients and some of the concentrations (BOD_5, ORGN, and NH3N). The model also provides a regression formula to calculate stream velocity as a function of stream flow (Q).*
4. *The model was segmented with 8 sections based on the headwaters, 6 tributaries, and 1 discharger over a distance of 4.6 miles.*
5. *As few data were available describing the prospective effluent flow path from the Quincy Farms discharge to Juniper Creek, the Department assumed that the effluent enters between Tributary 1 (Trib 1) and Tributary 2 (Trib 2). The effluent can enter as either surface or ground water. A DO value of 2.0 mg/L was assumed to represent the effluent, as no permit data were available. Quincy Farms effluent data*

were also summarized from paper files, obtained from the Northwest District Tallahassee Branch Office and computerized Wastewater Facilities Regulation Database (WAFR) files. ***Appendix C*** *includes these data.*

6. *To match data availability in Juniper Creek with effluent data, the summer period of 2006 was used for modeling.* ***Appendix C*** *briefly summarizes effluent data for June, July, and August 2006. In general, 2 effluent water quality samples were available for each month. The Department decided to use the July 19–20, 2006 period to calibrate the ADEM model. During this time, Telogia Creek flow was about 60 cfs at USGS Gage 02330100. Using the Q/DA method outlined above, this translates to about 0.4762 cfs/mi*^{2}*. Three effluent scenarios were assumed: A (0 percent pollutant removal), B (90 percent removal), C (99 percent removal) with effluent DO of 2.0 mg/L and an additional 3 scenarios (D, E, and F) with effluent DO of 6.0 mg/L and lower* BOD_5 *levels.* ***Appendix J*** *shows the model results.*

5.1.2 Data Used in the Determination of the TMDL

Figure 5.1 shows the sampling locations in the Juniper Creek Watershed. **Table 5.1** lists the organizations that sample in the watershed. **Table 5.2** contains an annual statistical summary for the watershed. **Figures 5.2a** through **5.2d** show annual average plots, and **Table 5.3** provides a statistical summary of observed data from 1979 through 2007.

Figure 5.1. Monitoring Sites in the Juniper Creek Watershed

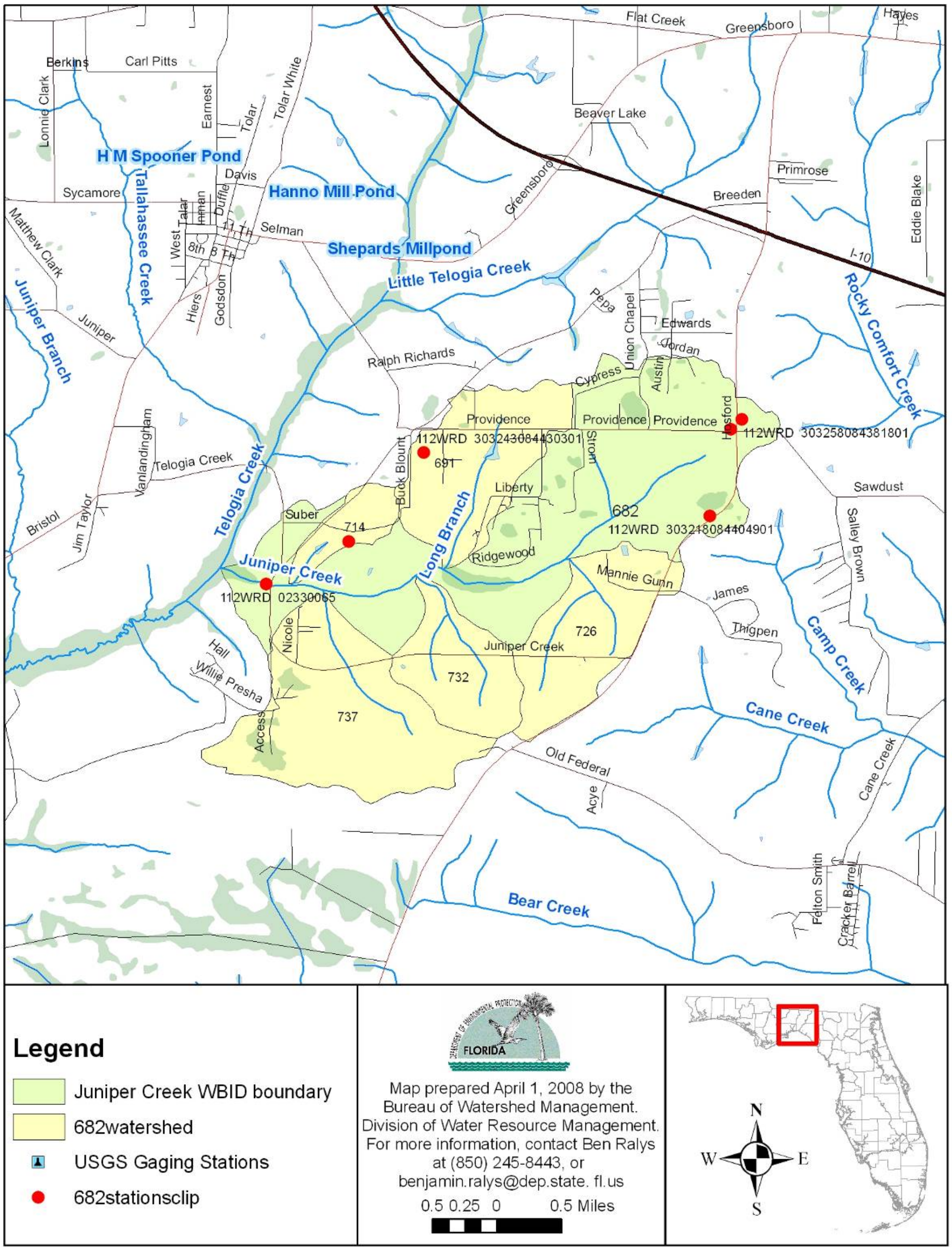


Table 5.1. Organizations That Are Sampling in the Juniper Creek Watershed

Organization
USGS
Florida Department of Environmental Protection, Watershed Assessment Section
Northwest Water Management District
Florida Department of Environmental Protection, Northwest District

Table 5.2. Statistical Annual Summary for Juniper Creek, WBID 682

WBID	Year	DO	BOD	TKN	TN
682	1979	7.40	N/A	N/A	N/A
682	1992	8.60	N/A	0.41	0.96
682	1993	6.67	N/A	0.65	1.20
682	2006	6.08	1.05	0.66	0.94
682	2007	4.10	2.35	1.01	1.74

N/A – Not available

Figure 5.2a. Chart of DO Observations for Juniper Creek, WBID 682

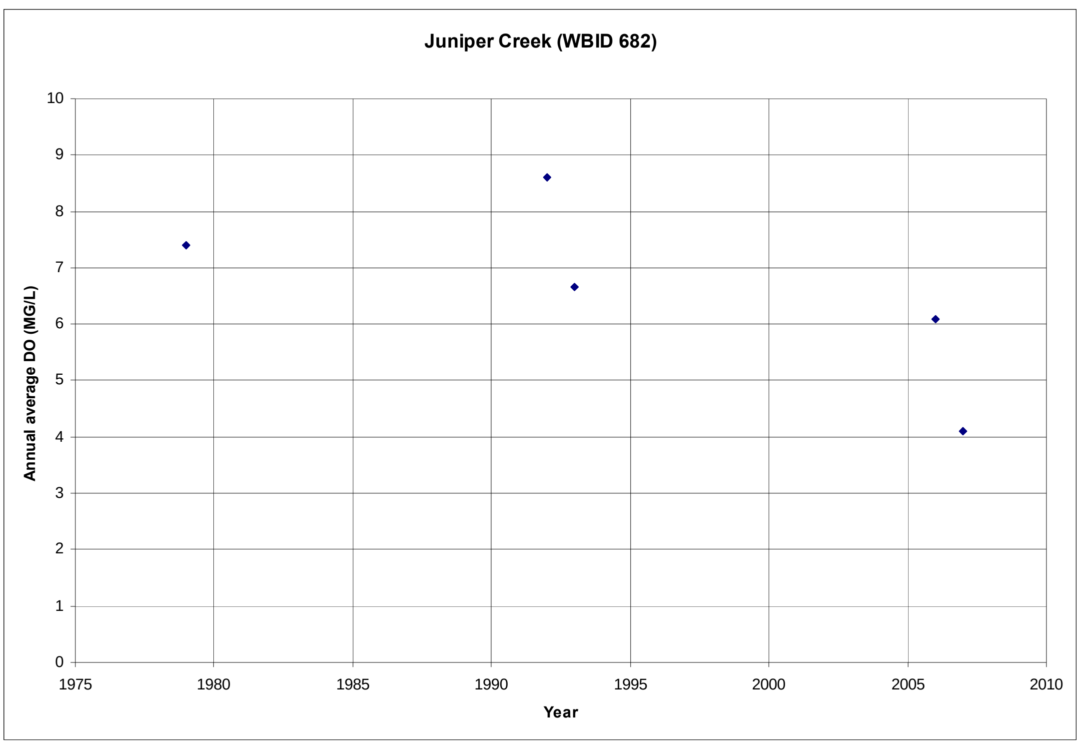


Figure 5.2b. Chart of BOD_5 Observations for Juniper Creek, WBID 682

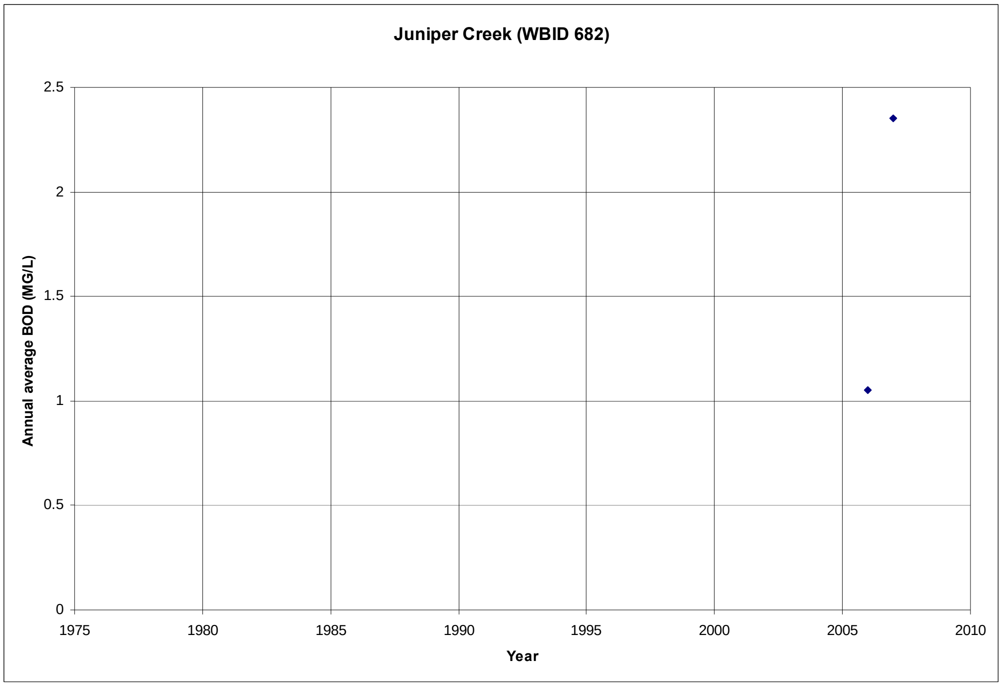


Figure 5.2c. Chart of TKN Observations for Juniper Creek, WBID 682

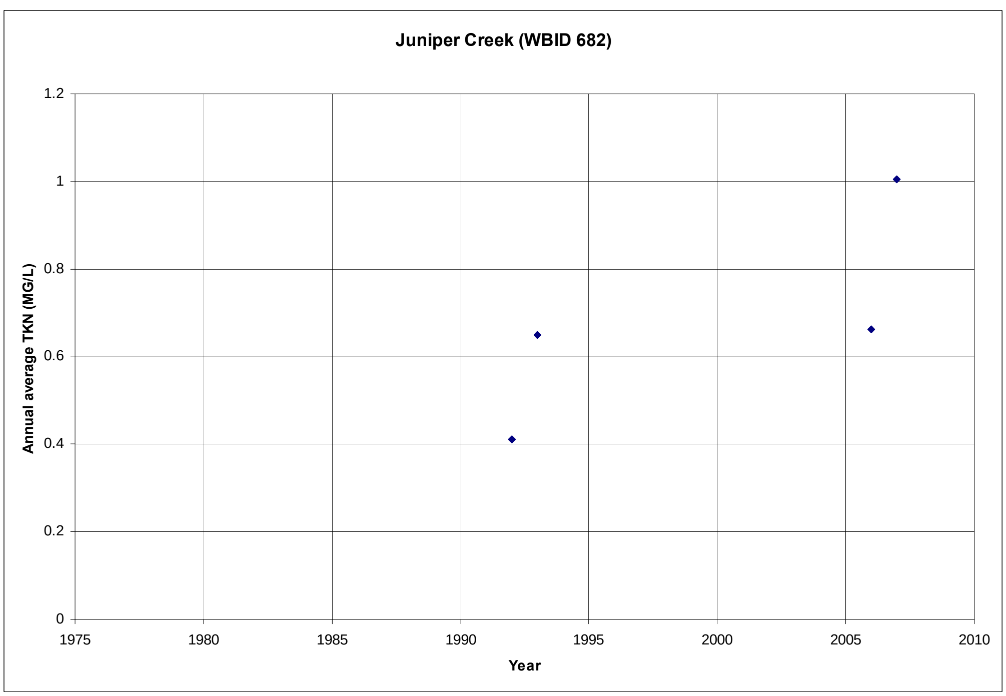


Figure 5.2d.Chart of TN Observations for Juniper Creek, WBID 682

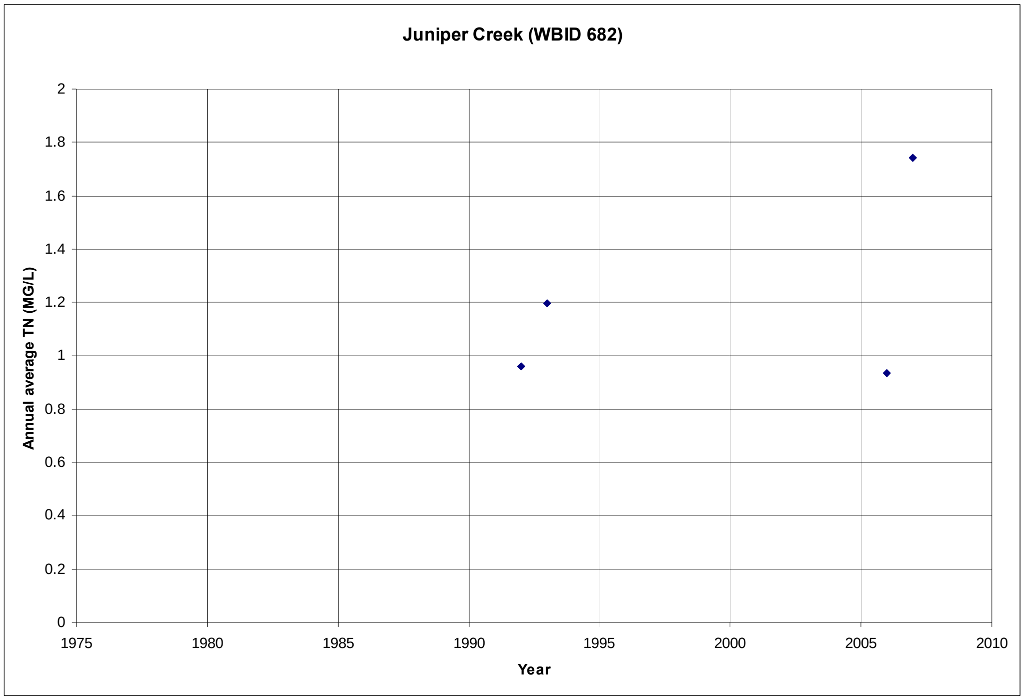


Table 5.3. Statistical Summary of Observed Data from Juniper Creek, WBID 682, 1979–2007

WBID	Parameter	Code	Units	N	Min	Max	Mean	Median	70th Percentile	75th Percentile
682	TEMP	10	DEGC	30	7.7000E+00	2.6260E+01	1.8659E+01	1.9500E+01	2.4112E+01	2.4410E+01
682	TURB	76	NTU	4	3.6000E+00	6.6000E+00	5.3500E+00	5.6000E+00	6.3300E+00	6.3750E+00
682	SECCHI	77	INCHES	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
682	COLOR	80	PTCO	29	8.7000E+00	1.5000E+02	1.0097E+02	1.0000E+02	1.2600E+02	1.3000E+02
682	FCOND	94	US/CM	7	8.0000E+00	1.1200E+02	6.1857E+01	4.8000E+01	1.0100E+02	1.0100E+02
682	LCOND	95	US/CM	25	2.9000E+01	2.0000E+02	8.5400E+01	7.7000E+01	8.7600E+01	9.3000E+01
682	DO	299	MG/L	29	2.4000E+00	1.0200E+01	6.0228E+00	6.2000E+00	7.4000E+00	7.5000E+00
682	DO	300	MG/L	3	6.8000E+00	8.4000E+00	7.4000E+00	7.0000E+00	7.5600E+00	7.7000E+00
682	DO	301	%	4	6.1176E+01	8.1132E+01	7.3100E+01	7.5045E+01	7.9785E+01	8.0010E+01
682	BOD5	310	MG/L	23	5.1000E-01	3.0000E+00	1.2757E+00	1.2000E+00	1.2800E+00	1.4500E+00
682	COD	340	MG/L	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
682	PH	400	SU	28	4.6000E+00	8.1000E+00	6.1329E+00	6.0000E+00	6.4000E+00	6.5200E+00
682	ALK CACO3	410	MG/L	27	6.5000E-01	8.0000E+01	1.4909E+01	1.1000E+01	1.2200E+01	1.4000E+01
682	TS	500	MG/L	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
682	TSS	530	MG/L	25	2.0000E+00	1.5000E+02	1.1880E+01	4.0000E+00	4.0000E+00	5.0000E+00
682	TN	600	MG/L	27	5.6000E-01	2.6000E+00	1.0847E+00	8.8000E-01	1.2840E+00	1.3650E+00
682	ORGN	605	MG/L	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
682	NH3NDISS	608	MG/L	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
682	NH3N	610	MG/L	24	1.7304E-02	2.7000E-01	9.5944E-02	7.0000E-02	1.3100E-01	1.4250E-01
682	NO2N	615	MG/L	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
682	TKNDISS	623	MG/L	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
682	TKN	625	MG/L	28	3.6000E-01	1.3000E+00	7.0036E-01	6.3000E-01	8.2800E-01	8.9500E-01
682	NO23N	630	MG/L	28	4.0000E-02	1.5000E+00	3.6739E-01	2.3000E-01	3.8000E-01	4.3750E-01
682	TP	665	MG/L	28	5.2000E-02	6.8000E+00	6.5979E-01	2.1000E-01	3.1000E-01	3.6750E-01
682	OP04P	671	MG/L	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
682	TOC	680	MG/L	26	1.5000E-01	2.2000E+01	1.1033E+01	9.9000E+00	1.2000E+01	1.2750E+01
682	TOTCOLI	31501	N/100ML	20	6.0000E+01	2.5000E+04	2.9721E+03	2.1000E+03	2.4000E+03	2.4500E+03
682	FCOLI	31625	N/100ML	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
682	CHLA	32211	UG/L	0	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
682	PHAEOP	32218	UG/L	24	1.3000E+00	6.7000E+00	2.3292E+00	1.7000E+00	2.1400E+00	2.5000E+00

5.1.3 TMDL Development Process

There are several possible approaches to developing a BOD_5 and nutrient-based TMDL for Juniper Creek. Two such approaches are described in detail below.

Method 1—Develop Reference Stream Nutrient Target Concentrations from Similar Streams

EPA developed nutrient TMDLs (EPA, 2005) for several tributary streams to Munson Slough in Leon County based on nutrient concentrations for reference streams in north Florida. **Tables 3.1** and **3.2** list the 7 reference streams, used along with the nutrient concentrations based on the 75th percentile values (TN_{sref}) for TN.

If the median values for TN at Juniper Creek at SR 65A are compared with the EPA reference streams, the following calculation provides the needed percent reductions (**Table 5.4**):

TN% Reduction= 100% * (TN median- TN_{sref})/ TN median

This methodology assumes that limiting these nutrients will remove the anthropogenic portion of the load contributing to the lowering of DO in Juniper Creek.

The Florida Department of Environmental Regulation and USGS collected intensive water quality and flow data in the Telogia Creek Watershed in 1979, prior to the Quincy Farms startup in 1982. Plots of water quality vs. River Mile on Telogia Creek (**Appendix E**) did not show any visible impact from Juniper Creek at that time. No comparable intensive survey data are available for the present conditions.

Table 5.4. Summary of the TN Reduction Needed for Juniper Creek, WBID 682, Using EPA Reference Streams

Parameter	Median (mg/L)	EPA TMDL 75%	Difference	% Reduction
TN	0.88	0.72	0.16	18.18

Method 2—Develop Stream Nutrient Target Concentrations from ADEM DO Modeling

This method relies on the ADEM DO model results presented earlier. The 6 effluent modeling scenarios A, B, C, D, E, and F showed that even with treatment levels of 90, 95, and 99 percent, DO does not meet the 5.0 mg/L criterion in Juniper Creek. Increasing the effluent DO and decreasing other parameters further does elevate DO in the creek above 4.0 mg/L. This approach assumes that all the effluent flow reaches Juniper Creek.

If the median values for BOD_5 and TKN at Juniper Creek at SR 65A are compared with the ADEM model, this provides the projected percent reductions (**Table 5.5**). The value of using this added modeling approach is that it supports the supposition that there are natural conditions impacting Juniper Creek such that DO levels would not meet the DO freshwater criterion.

Table 5.5. Summary of BOD_5 and Nutrient Reductions for Juniper Creek, WBID 682

Parameter	Median (mg/L)	ADEM Model (mg/L)	Difference	% Reduction
Quincy Farms				
BOD_5*	587	5	582	99.148211
TKN*	9.663	0.7	8.963	92.755873
Juniper Creek				
BOD_5	1.2	1	0.2	16.666667
TKN	0.63	0.33	0.3	47.619048

*Data are annual averages from 2006 permit data. See **Appendix C.**

Several intensive surveys conducted by the Department's Watershed Assessment Section in 2008 involved the deployment of YSI loggers at three locations in the Juniper Creek Watershed: Juniper Creek at SR 65A, Long Branch at SR 274, and an Unnamed Tributary at SR 65A east of Nicole Rd. **Appendix F** includes plots of these data.

The Juniper Creek site showed a slight diurnal pattern, with TEMP varying between about 16º and 22ºC. DO varied slightly, from 6.1 to 7.1 mg/L. Long Branch had a similar TEMP variation, but DO was generally below 3.0 mg/L. The Unnamed Tributary had the most unusual daily variations for TEMP and DO and will need further investigation. The Department's 1998 *Ecosummary* (**Appendix G**) suggests that pumping from Juniper Creek to an agricultural irrigation pond may affect stream flows in the watershed.

Summary

Based on the various methods discussed above, **Table 6.1** provides the suggested values for TMDL limits for Juniper Creek, WBID 682.

5.1.4 Critical Conditions for DO/Seasonality

The critical condition for DO in a given watershed depends on many factors, including the presence of point sources and the land use pattern in the watershed. Typically, the critical condition for nonpoint sources is an extended dry period followed by a rainfall runoff event. During the wet weather period, rainfall washes off nutrients that have built up on the land surface under dry conditions. However, significant nonpoint source contributions can also appear under dry conditions without any major surface runoff event. This may happen when nonpoint sources contaminate the surficial aquifer and nutrients are brought into the receiving waters through baseflow. In addition, sediments that have accumulated for months may provide a flux of nutrients to the water column under certain weather or DO conditions. The critical condition for point source loading typically occurs during periods of low stream flow, when dilution is minimized.

The Department examined both DO and flow for Juniper Creek as well as variable effluent conditions. The data show that DO was reduced to about 2.0 mg/L during the summer of 2006 (**Appendix F**). During this same period, Telogia Creek was near or below its historical $_7Q_{10}$ low flow of 37 cfs (**Appendix H**), and Juniper Creek would also be expected to have been at its lowest flows. From May 2005 to the present, Quincy Farms effluent levels were at their highest (**Appendix C**).

Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating acceptable loads among all of 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 takes into account any uncertainty concerning 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 (a) 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 (b) 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).

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 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 TMDL for the Juniper Creek Watershed is expressed in terms of concentration of nutrients (TN) and represents the maximum daily load the creek can assimilate and maintain the DO criterion (**Table 6.1**).

Table 6.1. TMDL Components for Juniper Creek, WBID 682

WBID	Parameter	TMDL mg/L	WLA		LA (% reduction)	MOS
			Wastewater (% reduction)	NPDES Stormwater (% reduction)		
682	TN	0.72	Meet any permit limits	18.18	18.18	Implicit

6.2 Load Allocation

Based on existing medians for Juniper Creek, WBID 682 (TN = 0.88 mg/L; see **Table 5.3**), a TN reduction of 18.18 percent is needed from nonpoint sources.

6.3 Wasteload Allocation

Not applicable; there are no permitted point source discharges in the Juniper Creek watershed.

6.3.1 NPDES Wastewater Discharges

The facility is required to meet all state criteria as a condition of its permit, including the criteria for BOD_5 and TKN.

As part of this TMDL, these facilities, and any future discharge permits issued in the Juniper Creek Watershed, are required to meet the state Class III criterion for DO. Any future allocations will require a reduction in nonpoint sources such that these values are not exceeded.

6.3.2 NPDES Stormwater Discharges

There are no MS4 permit facilities in the Juniper Creek watershed.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, 2001), an implicit MOS was used in the development of this TMDL. An implicit MOS was provided by the conservative decisions associated with a number of modeling assumptions and the development of assimilative capacity.

Chapter 7: NEXT STEPS: IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND

7.1 Basin Management Action Plan

Following the adoption of this TMDL by rule, the next step in the TMDL process is to develop an implementation plan for the TMDL, which will be a component of the BMAP for the Ochlockonee–St. Marks Basin. This document will be developed over the next year in cooperation with local stakeholders and will attempt to reach consensus on more detailed allocations and on how load reductions will be accomplished. The BMAP will include the following:

- *Appropriate allocations among the affected parties;*
- *A description of the load reduction activities to be undertaken;*
- *Timetables for project implementation and completion;*
- *Funding mechanisms that may be utilized;*
- *Any applicable signed agreement;*
- *Local ordinances defining actions to be taken or prohibited;*
- *Local water quality standards, permits, or load limitation agreements; and*
- *Monitoring and follow-up measures.*

References

Alabama Department of Environmental Management. September 2001. *Spreadsheet Water Quality Model.* Water Quality Branch.

Alexander, R.B., and R.A. Smith. 1990. *County level estimates of nitrogen and phosphorus fertilizer use in the United States, 1945 to 1985.* U.S. Geological Survey Open-File Report 90-130.

Alexander, R.B., R.A. Smith, and G.E. Schwarz. 2000. Effect of stream channel size on the delivery of nitrogen to the Gulf of Mexico. *Nature, Vol. 403, Feb. 17, 2000.* Available: www.nature.com.

Ambrose, R.B., T.A. Wool, J.P. Connolly, and R.W. Schanz. 1988. *WASP4, A Hydrodynamic and Water Quality Model—Model theory, user's manual, and programmer's guide.* EPA/600/3-87/039.

American Veterinary Medical Association Website. 2004. Available: http://www.avma.org.

Arnold, J.G., and P.M. Allen. 1999. Automated methods for estimating baseflow and ground water recharge from streamflow records. *Journal of the American Water Resources Association 35(2): 411-424.*

Arnold, J.G., P.M. Allen, R. Muttiah, and G. Bernhardt. 1995. Automated base flow separation and recession analysis techniques. *Ground Water 33(6): 1010-1018.*

Battaglin, W.A., and D.A. Goolsby. 1995. *Spatial data in geographic information system format on agricultural chemical use, land use, and cropping practices in the United States.* U.S. Geological Survey Water Resources Investigations Report 95-4176. Available: http://water.usgs.gov/pubs/wri/wri944176.

Birdsource Website. 2007. Available: http://www.birdsource.org/.

Blackburn, R.D., L.W. Weldon, R.R. Yeo, and T.M. Taylor. 1969. Identification and distribution of certain similar-appearing submersed aquatic weeds in Florida. *JAPM 8: 17-21.*

Brezonik, P.L., C.D. Hendry, Jr., E.S. Edgerton, R.L. Schulze, and T.L. Crisman. 1983. *Acidity, nutrients, and minerals in atmospheric precipitation over Florida: Deposition patterns, mechanisms, and ecological effects.* EPA-600/3-83-004.

Brown, M., K.C. Reiss, M.J. Cohen, J.M. Evans, K.R. Reddy, P.W. Inglett, K.S. Inglett, T.K. Frazer, C.A. Jacoby, E.J. Phlips, R.L. Knight, S.K. Notestein, and K.A. McKee. April 28, 2008. *Summary and synthesis of the available literature on the effects of nutrients on spring organisms and systems.* Gainesville, Florida: University of Florida Water Institute. Available: http://www.dep.state.fl.us/springs/reports/files/UF_SpringsNutrients_Report.pdf.

Camp Dresser & McKee Inc. September 1998. Rouge River National Wet Weather Demonstration Project, Wayne County, Michigan. *Technical memorandum. User's manual: Watershed Management Model Version 4.0.* RPO-NPS-TM27.01.

———. 1998. Rouge River National Wet Weather Demonstration Project, Wayne County, Michigan. *User's manual: Watershed Management Model, Version 4.1.* PRO-NPS-TM27.02.

Chapra, S. 1997. *Surface water-quality modeling.* McGraw Hill Science/Engineering/Math.

Clean Air Status and Trends Network Website. 2007. Available: http://www.epa.gov/castnet/.

Colt, J. 1984. *Computation of dissolved gas concentrations in water as functions of temperature, salinity, and pressure.* American Fisheries Society Special Publication 14.

Florida Administrative Code. *Rule 62-302, Surface water quality standards.*

———. *Rule 62-303, Identification of impaired surface waters.*

Florida Department of Agriculture and Consumer Services. September 2001. *Florida aquaculture*. Issue No. 11.

———. 2003. *Florida agricultural fast facts.*

Florida Department of Agriculture and Consumer Services Website. 2001. Available: http://www.floridaaquaculture.com/SEAS/SEAS_intro.htm.

Florida Department of Community Affairs Website. 2007. Available: www.eoconline.org.

Florida Department of Environmental Protection. September 2003. *Basin assessment report: Ochlockonee and St. Marks.* Available: http://www.dep.state.fl.us/water/basin411/stmarks/assessment.htm

Florida Department of Health Website. 2008. Available: http://www.doh.state.fl.us/.

Goolsby, D.A., W.A. Battaglin, G.B. Lawrence, R.S. Artz, B.T. Aulenbach, R.P. Hooper, D.R. Keeney, and G.J. Stensland. 1999. *Flux and sources of nutrients in the Mississippi-Atchafalaya River Basin—Topic 3 report for the integrated assessment on hypoxia in the Gulf of Mexico.* Silver Spring, Maryland: National Oceanic and Atmospheric Administration (NOAA) Coastal Ocean Office. NOAA Coastal Ocean Program Decision Analysis Series No. 17.

Irwin, G.A., and R.T. Kirkland. 1980. *Chemical and physical characteristics of precipitation at selected sites in Florida.* U.S. Geological Survey Water Resources Investigations Report 80-81.

Jozwiak, S. 2005. Florida Department of Environmental Protection NPDES Program, NPDES MS4 permitted facilities in Northwest District, personal communication.

Kumar, N. 1984. U.S. Environmental Protection Agency Region 4, personal communication.

National Atmospheric Deposition Program Website. 2002. Available: http://nadp.sws.uiuc.edu/.

Nicol, J.P., and S. McClelland. February 1984. *Automated water quality analysis report development (AWQARD).* Florida Department of Environmental Regulation Water Quality Technical Series, Vol. 3, No. 13.

Northwest Florida Water Management District Website. 2008. Available: http://www.nwfwmd.state.fl.us/.

Pollman, C.D., and S. Roy. August 20, 2003. *Examination of atmospheric deposition chemistry and its potential effects on the lower St. Johns Estuary, Tasks 1 through 4.* Tetra Tech final report, submitted to the St. Johns River Water Management District.

Poor, N., R. Pribble, and H. Greening. 2001. Direct wet and dry deposition of ammonia, nitric acid, ammonium, and nitrate to Tampa Bay Estuary, FL, USA. *Atmos. Environ. 35:3947-3955.*

Post, D.M., J.P.Taylor, J.F.Kitchell, M.H.Olson, D.E. Schindler, and B.R. Herwig. 1998. The role of migratory waterfowl as nutrient vectors in a managed wetland. *Conservation Biology, Vol. 12, 910-920.*

Pribble, R., and A. Janicki. 1999. *Atmospheric deposition contributions to nitrogen and phosphorus loadings in Tampa Bay: Intensive wet and dry deposition data collection and analysis, August 1996–July 1998.* Interim data report. Tampa Bay Estuary Program Technical Publication #05-99.

Reckhow, K., and M.H. Henning. September 5, 1990. *Using EUTROMOD Version 3.0 Watershed and Lake Modeling Software.* North American Lake Management Society, TechTransfer, Duke University School of Forestry and Environmental Studies.

Rogers, T. 2006. Nitrogen oxide emissions for Florida counties 2002, personal communication.

Ruddy, B.C., D.L. Lorenz, and D.K. Mueller. 2006. *County-level estimates of nutrient inputs to the land surface of the conterminous United States, 1982–2001.* U.S. Geological Survey Scientific Investigations Report 2006-5012.

Rumenik, R.P., and J.W. Grubbs. 1996. *Low-flow characteristics of Florida streams.* U.S. Geological Survey, Water Resources Investigations Report 93-4165.

Runkel, R.L., C.G. Crawford, and T.A. Cohn. 2004. *Load Estimator (LOADEST): A FORTRAN program for estimating constituent loads in streams and rivers.* U.S. Geological Survey Techniques and Methods. Book 4, Chapter A5.

Smith, R.A., R.B. Alexander, and G.E. Schwarz. 2003. Natural background concentrations of nutrients in streams and rivers of the conterminous United States. *Environmental Science & Technology Vol. 37, No. 14.*

Smith, R.A., G.E. Schwarz, and R.B. Alexander. December 1997. Regional interpretation of water-quality monitoring data. *Water Resources Research, Vol. 33, No. 12, 2781-2798.*

U.S. Census Bureau Website. 2003. *Census data.* Available:

———. 2007. Available: http://www.census.gov/.

———. 2008. Available: http://www.census.gov/.

U.S. Department of Agriculture. 2002. *National Agricultural Statistics Service.* Available: http://www.nass.usda.gov/index.asp.

U.S. Environmental Protection Agency. 1999. *Protocol for developing nutrient TMDLs.* First edition. EPA 841-B-99-007.

———. November 2005. *TMDL for Ochlockonee and St. Marks River Basins, Florida: Nutrients and coliform.*

———. 2008. *WASP7.2 manual. Ecosystems Research Division, Water Quality Analysis Simulation Program.* Available: www.epa.gov/athens/wwqtsc/html/wasp.html.

U. S. Geological Survey Website. 2005. Available: http://www.usgs.gov/.

Wieckowicz, R. 1981. *Telogia Creek Basin intensive survey documentation and wasteload allocation documentation.* Florida Department of Environmental Regulation Water Quality Technical Series, Vol. 2, No. 28.

Ziegmont, C. 2007. Florida Department of Environmental Protection permitting, data sources for spills, personal communication. Referred to Website at http://www.eoconline.org.

Appendices

Appendix A: Background Information on Federal and State Stormwater Programs—NPDES MS4 Data

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 that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Rule 62-40, F.A.C. In 1994, the Department's stormwater treatment requirements were integrated with the stormwater flood control requirements of the state's water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations.

Rule 62-40, F.A.C., also requires the water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a Surface Water Improvement and Management (SWIM) plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka. No PLRG had been developed for Newnans Lake when this report was published.

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act 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. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and master drainage systems of local governments with a population above 100,000, which are better known as municipal separate storm sewer systems (MS4s). However, because the master drainage systems of most local governments in Florida are interconnected, the EPA implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 urban water control districts, and the Florida Department of Transportation throughout the 15 counties meeting the population criteria. The Department received authorization to implement the NPDES Program in 2000.

An important difference between the federal NPDES and the state's stormwater/environmental resource permitting programs is that the NPDES Program covers both new and existing discharges, while the state's program focuses on new discharges only. Additionally, Phase II of the NPDES Program, implemented in 2003, expands the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 1,000 people. While these urban stormwater discharges are now 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 all MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.

Appendix B: Summary of Land Use Loads and Trends by Category

WMM 1997 for TN and TP
(See CD for more WMM data)

Step 1: Runoff						
	Area (acre)	% impervious	Impervious runoff coef.	Pervious runoff coef.	Effective precipitat. (in/year)	Runoff (acre-feet)
Forest/Rural Open	3,259	0.5%	0.95	0.31	61.56	5,182.6
Urban Open	103	0.5%	0.95	0.04	61.56	24.4
Agricultural	1,591	0.0%	0.95	0.30	61.56	2,481.8
Low-density Residential	199	14.7%	0.95	0.15	61.56	273.7
Medium-density Residential	2	28.1%	0.95	0.15	61.56	4.6
High-density Residential	0	67.0%	0.95	0.12	61.56	0.0
Highways	3	36.2%	0.95	0.69	61.56	10.8
Water	141	100.0%	0.95	0.00	61.56	687.3
Rangeland	30	0.0%	0.95	0.30	61.56	47.4
Wetlands	332	0.0%	0.95	0.23	61.56	383.6
Other 1 (Barren Land)	0	0.2%	0.95	0.30	61.56	0.0
Other 2	0.00	0.0%	0.95	0.00	61.56	0.0
Total	**5,661.56**					**9,096.22**

Step 2: Nutrient Loads						
	Original EMCs		Suspended form		Concentrations of particulate form	
	Ctn (mg/L)	Ctp (mg/L)	% Stn	% Stp	CPtn (mg/L)	CPtp (mg/L)
Forest/Rural Open	1.09	0.046	0%	0%	0.00	0.00
Urban Open	1.12	0.18	0%	0%	0.00	0.00
Agricultural	2.32	0.344	0%	0%	0.00	0.00
Low-density Residential	1.64	0.191	0%	0%	0.00	0.00
Medium-density Residential	2.18	0.335	0%	0%	0.00	0.00
High-density Residential	2.42	0.49	0%	0%	0.00	0.00
Highways	2.23	0.27	0%	0%	0.00	0.00
Water	1.6	0.067	0%	0%	0.00	0.00
Rangeland	2.32	0.344	0%	0%	0.00	0.00
Wetlands	1.01	0.09	0%	0%	0.00	0.00
Other 1 (Barren Land)	1.91	0.245	0%	0%	0.00	0.00
Other 2	0	0	0%	0%		
Total						

Concentrations of dissolved form						
CDtn (mg/L)	CDtp (mg/L)	Delivery Ratio	TN load (lbs)	TP load (lbs)	% of total TN	% of total TP
1.09	0.05	1	15,361.9	648.3	42	19
1.12	0.18	1	74.2	11.9	0	0
2.32	0.34	1	15,657.4	2,321.6	43	68
1.64	0.19	1	1,220.7	142.2	3	4
2.18	0.34	1	27.2	4.2	0	0
2.42	0.49	1	0.0	0.0	0	0
2.23	0.27	1	65.7	8.0	0	0
1.60	0.07	1	2,990.2	125.2	8	4
2.32	0.34	1	299.3	44.4	1	1
1.01	0.09	1	1,053.6	93.9	3	3
1.91	0.25	1	0.0	0.0	0	0
		1	0.0	0.0	0	0
			36,750.2	3,399.6		

WMM 1997 for TSS and BOD
(See CD for more WMM data)

Step 1: Runoff						
	Area (acre)	**% impervious**	**Impervious runoff coef.**	**Pervious runoff coef.**	**Effective precipitat. (in/month)**	**Runoff (acre-feet)**
Forest/Rural Open	3,259	0.5%	0.95	0.31	61.5591	5,182.6
Urban Open	103	0.5%	0.95	0.04	61.56	24.4
Agricultural	1,591	0.0%	0.95	0.30	61.56	2,481.8
Low-density Residential	199	14.7%	0.95	0.15	61.56	273.7
Medium-density Residential	2	28.1%	0.95	0.15	61.56	4.6
High-density Residential	0	67.0%	0.95	0.12	61.56	0.0
Highways	3	36.2%	0.95	0.69	61.56	10.8
Water	141	100.0%	0.95	0.00	61.56	687.3
Rangeland	30	0.0%	0.95	0.30	61.56	47.4
Wetlands	332	0.0%	0.95	0.23	61.56	383.6
Other 1 (Barren Land)	0	0.2%	0.95	0.30	61.56	0.0
Other 2	0.00	0.0%	0.95	0.00	61.56	0.0
Total	**5,661.56**					**9,096.22**

Step 2: Nutrient Loads						
	Original EMCs		Suspended form		Concentrations of particulate form	
	Cbod (mg/L)	Ctss (mg/L)	% Sbod	% Stss	Cpbod (mg/L)	CPtss (mg/L)
Forest/Rural Open	1.23	7.8	0%	0%	0.00	0.00
Urban Open	7.4	72.8	0%	0%	0.00	0.00
Agricultural	3.8	55.3	0%	0%	0.00	0.00
Low-density Residential	4.3	16.9	0%	0%	0.00	0.00
Medium-density Residential	7.4	26	0%	0%	0.00	0.00
High-density Residential	11	71.7	0%	0%	0.00	0.00
Highways	6.7	49.1	0%	0%	0.00	0.00
Water	1.6	3.1	0%	0%	0.00	0.00
Rangeland	3.8	55.3	0%	0%	0.00	0.00
Wetlands	2.63	11.2	0%	0%	0.00	0.00
Other 1 (Barren Land)	0	0	0%	0%	0.00	0.00
Other 2	0	0	0%	0%		
Total						

Concentrations of dissolved form						
Cdbod (mg/L)	CDtss (mg/L)	Delivery Ratio	BOD Load (lbs)	TSS Load (lbs)	% of Total BOD	% of Total TSS
1.23	7.80	1	17,334.9	109,928.9	33	21
7.40	72.80	1	490.3	4,823.6	1	1
3.80	55.30	1	25,645.7	373,211.7	48	71
4.30	16.90	1	3,200.7	12,579.6	6	2
7.40	26.00	1	92.2	323.9	0	0
11.00	71.70	1	0.0	0.0	0	0
6.70	49.10	1	197.5	1,447.1	0	0
1.60	3.10	1	2,990.2	5,793.6	6	1
3.80	55.30	1	490.3	7,134.8	1	1
2.63	11.20	1	2,743.5	11,683.3	5	2
0.00	0.00	1	0.0	0.0	0	0
		1	0.0	0.0	0	0

Septic Tanks
(See CD for entire table)

Date	Year	Gadsden County No. of Tanks New	County Tanks Cum	No. of Tanks	Gal/cap/ day*	Q (cfs/tank**)	80% Q (cfs)	DA= BOD5 (mg/L)	528.13 BOD5 (lbs/day)	SQMI BOD5 (lbs/yr)
1/1/1970	1970	3,085	3,085	3.0850E+03	70	2.82E-04	8.6886E-01	2.2050E+02	1.0326E+03	3.7691E+05
1/1/1971	1971	277	3,362	3.3620E+03	70	2.82E-04	9.4687E-01	2.2050E+02	1.1254E+03	4.1075E+05
1/1/1972	1972	342	3,704	3.7040E+03	70	2.82E-04	1.0432E+00	2.2050E+02	1.2398E+03	4.5254E+05
1/1/1973	1973	498	4,202	4.2020E+03	70	2.82E-04	1.1835E+00	2.2050E+02	1.4065E+03	5.1338E+05
1/1/1974	1974	521	4,723	4.7230E+03	70	2.82E-04	1.3302E+00	2.2050E+02	1.5809E+03	5.7704E+05
1/1/1975	1975	368	5,091	5.0910E+03	70	2.82E-04	1.4338E+00	2.2050E+02	1.7041E+03	6.2200E+05
1/1/1977	1976	408	5,499	5.4990E+03	70	2.82E-04	1.5487E+00	2.2050E+02	1.8407E+03	6.7184E+05
1/1/1978	1977	363	5,862	5.8620E+03	70	2.82E-04	1.6510E+00	2.2050E+02	1.9622E+03	7.1619E+05
1/1/1979	1978	354	6,216	6.2160E+03	70	2.82E-04	1.7507E+00	2.2050E+02	2.0807E+03	7.5944E+05
1/1/1980	1979	176	6,392	6.3920E+03	70	2.82E-04	1.8002E+00	2.2050E+02	2.1396E+03	7.8095E+05
1/1/1981	1980	275	6,667	6.6670E+03	70	2.82E-04	1.8777E+00	2.2050E+02	2.2316E+03	8.1454E+05
1/1/1982	1981	281	6,948	6.9480E+03	70	2.82E-04	1.9568E+00	2.2050E+02	2.3257E+03	8.4888E+05
1/1/1984	1982	340	7,288	7.2880E+03	70	2.82E-04	2.0526E+00	2.2050E+02	2.4395E+03	8.9042E+05
1/1/1983	1983	350	7,638	7.6380E+03	70	2.82E-04	2.1512E+00	2.2050E+02	2.5567E+03	9.3318E+05
1/1/1984	1984	375	8,013	8.0130E+03	70	2.82E-04	2.2568E+00	2.2050E+02	2.6822E+03	9.7899E+05
1/1/1985	1985	300	8,313	8.3130E+03	70	2.82E-04	2.3413E+00	2.2050E+02	2.7826E+03	1.0156E+06
1/1/1986	1986	446	8,759	8.7590E+03	70	2.82E-04	2.4669E+00	2.2050E+02	2.9319E+03	1.0701E+06
1/1/1987	1987	423	9,182	9.1820E+03	70	2.82E-04	2.5860E+00	2.2050E+02	3.0735E+03	1.1218E+06
1/1/1988	1988	433	9,615	9.6150E+03	70	2.82E-04	2.7080E+00	2.2050E+02	3.2184E+03	1.1747E+06
1/1/1989	1989	311	9,926	9.9260E+03	70	2.82E-04	2.7956E+00	2.2050E+02	3.3225E+03	1.2127E+06
1/1/1990	1990	509	10,435	1.0435E+04	70	2.82E-04	2.9389E+00	2.2050E+02	3.4929E+03	1.2749E+06
1/1/1991	1991	450	10,885	1.0885E+04	70	2.82E-04	3.0657E+00	2.2050E+02	3.6435E+03	1.3299E+06

Date	Year	Gadsden County No. of Tanks New	County Tanks Cum	No. of Tanks	Gal/cap/ day*	Q (cfs/tank**)	80% Q (cfs)	DA= BOD5 (mg/L)	528.13 BOD5 (lbs/day)	SQMI BOD5 (lbs/yr)
1/1/1992	1992	550	11,435	1.1435E+04	70	2.82E-04	3.2206E+00	2.2050E+02	3.8276E+03	1.3971E+06
1/1/1993	1993	450	11,885	1.1885E+04	70	2.82E-04	3.3473E+00	2.2050E+02	3.9782E+03	1.4521E+06
1/1/1994	1994	450	12,335	1.2335E+04	70	2.82E-04	3.4740E+00	2.2050E+02	4.1289E+03	1.5070E+06
1/1/1995	1995	627	12,962	1.2962E+04	70	2.82E-04	3.6506E+00	2.2050E+02	4.3387E+03	1.5836E+06
1/1/1996	1996	370	13,332	1.3332E+04	70	2.82E-04	3.7548E+00	2.2050E+02	4.4626E+03	1.6288E+06
1/1/1997	1997	451	13,783	1.3783E+04	70	2.82E-04	3.8818E+00	2.2050E+02	4.6136E+03	1.6839E+06
1/1/1998	1998	457	14,240	1.4240E+04	70	2.82E-04	4.0106E+00	2.2050E+02	4.7665E+03	1.7398E+06
1/1/1999	1999	260	14,500	1.4500E+04	70	2.82E-04	4.0838E+00	2.2050E+02	4.8536E+03	1.7715E+06
1/1/2000	2000	242	14,742	1.4742E+04	70	2.82E-04	4.1519E+00	2.2050E+02	4.9346E+03	1.8011E+06
1/1/2001	2001	204	14,946	1.4946E+04	70	2.82E-04	4.2094E+00	2.2050E+02	5.0028E+03	1.8260E+06
1/1/2002	2002	206	15,152	1.5152E+04	70	2.82E-04	4.2674E+00	2.2050E+02	5.0718E+03	1.8512E+06
1/1/2003	2003	242	15,394	1.5394E+04	70	2.82E-04	4.3356E+00	2.2050E+02	5.1528E+03	1.8808E+06
1/1/2004	2004	270	15,664	1.5664E+04	70	2.82E-04	4.4116E+00	2.2050E+02	5.2432E+03	1.9138E+06
1/1/2005	2005	303	15,967	1.5967E+04	70	2.82E-04	4.4969E+00	2.2050E+02	5.3446E+03	1.9508E+06
1/1/2006	2006	414	16,381	1.6381E+04	70	2.82E-04	4.6135E+00	2.2050E+02	5.4832E+03	2.0014E+06

Atmospheric Deposition
(See CD for entire table)

Date	Year	NADP14 Quincy Annual Rain (cm)	NADP14 Quincy Annual Rain (in)	NWS Tallahassee Annual Rain (in)	NADP14 Precip-Wt Conc NH4 (mg/L)	NO3 (mg/L)	TN (mg/L)	NADP14 Wet Deposition Rate NH4 (kg/ha/yr)	NO3 (kg/ha/yr)	TN (kg/ha/yr)
1/1/1983	1983.00									
1/1/1984	1984.00	111.7500	43.9961	56.2000	0.1200	0.6220	0.2338	1.3400	6.9500	2.6116
1/1/1985	1985.00	135.7200	53.4331	62.9300	0.0730	0.4100	0.1494	0.9900	5.5600	2.0255
1/1/1986	1986.00	147.7800	58.1811	71.7800	0.0440	0.5150	0.1505	0.6500	7.6100	2.2239
1/1/1987	1987.00	113.6000	44.7244	67.8200	0.0770	0.5490	0.1839	0.8700	6.2400	2.0857
1/1/1988	1988.00	118.6900	46.7283	48.4600	0.0640	0.7470	0.2185	0.7600	8.8700	2.5940
1/1/1989	1989.00	153.3000	60.3543	63.5900	0.1440	0.6360	0.2556	2.2100	9.7500	3.9205
1/1/1990	1990.00	93.1900	36.6890	45.7300	0.1530	0.7300	0.2838	1.4300	6.8000	2.6477
1/1/1991	1991.00	202.1500	79.5866	72.2500	0.0680	0.5380	0.1744	1.3700	10.8800	3.5223
1/1/1992	1992.00	147.6300	58.1220	62.7800	0.0740	0.5440	0.1804	1.0900	8.0300	2.6610
1/1/1993	1993.00	142.0500	55.9252	51.9300	0.1140	0.7110	0.2492	1.6200	10.1000	3.5406
1/1/1994	1994.00	210.4900	82.8701	89.8900	0.0620	0.4570	0.1514	1.3100	9.6200	3.1911
1/1/1995	1995.00	141.3500	55.6496	52.4000	0.1660	0.6140	0.2678	2.3500	8.6800	3.7878
1/1/1996	1996.00	125.3200	49.3386	56.7200	0.1090	0.5650	0.2124	1.3700	7.0800	2.6643
1/1/1997	1997.00	156.3600	61.5591	64.2500	0.0910	0.6300	0.2130	1.4200	9.8500	3.3286
1/1/1998	1998.00	134.3100	52.8780	58.8300	0.0960	0.5990	0.2099	1.2900	8.0500	2.8211
1/1/1999	1999.00	102.8500	40.4921	50.0700	0.0950	0.6900	0.2297	0.9800	7.1000	2.3654
1/1/2000	2000.00	101.6300	40.0118	44.5100	0.1230	0.7680	0.2691	1.2500	7.8000	2.7335
1/1/2001	2001.00	132.2100	52.0512	63.4500	0.1010	0.6110	0.2165	1.3400	8.0800	2.8667
1/1/2002	2002.00	136.6700	53.8071	56.4000	0.0850	0.5390	0.1878	1.1600	7.3700	2.5664
1/1/2003	2003.00	136.8100	53.8622	65.3000	0.1130	0.6280	0.2297	1.5500	8.5900	3.1452
1/1/2004	2004.00	149.1400	58.7165	56.8300	0.0820	0.5640	0.1911	1.2200	8.4100	2.8479
1/1/2005	2005.00	152.0700	59.8701	68.2800	0.1100	0.5510	0.2100	1.6700	8.3800	3.1911
1/1/2006	2006.00	111.4400	43.8740	49.3400	0.1510	0.6810	0.2712	1.6800	7.5900	3.0205

Spills

Date	Year	No. of Spills (yr)	Q (mg/yr)	Q (mgd)	Q (cfs)	TN (mg/L)	TN (lbs/day)	TN (lbs/yr)	TP (mg/L)	TP (lbs/day)	TP (lbs/yr)
1/1/1983	1983					4.0000E+01			1.0000E+01		
1/1/1984	1984					4.0000E+01			1.0000E+01		
1/1/1985	1985					4.0000E+01			1.0000E+01		
1/1/1986	1986					4.0000E+01			1.0000E+01		
1/1/1987	1987					4.0000E+01			1.0000E+01		
1/1/1988	1988					4.0000E+01			1.0000E+01		
1/1/1989	1989					4.0000E+01			1.0000E+01		
1/1/1990	1990					4.0000E+01			1.0000E+01		
1/1/1991	1991					4.0000E+01			1.0000E+01		
1/1/1992	1992					4.0000E+01			1.0000E+01		
1/1/1993	1993					4.0000E+01			1.0000E+01		
1/1/1994	1994					4.0000E+01			1.0000E+01		
1/1/1995	1995					4.0000E+01			1.0000E+01		
1/1/1996	1996					4.0000E+01			1.0000E+01		
1/1/1997	1997					4.0000E+01			1.0000E+01		
1/1/1998	1998					4.0000E+01			1.0000E+01		
1/1/1999	1999					4.0000E+01			1.0000E+01		
1/1/2000	2000					4.0000E+01			1.0000E+01		
1/1/2001	2001	10	5.7100E-01	1.5644E-03	2.4205E-03	4.0000E+01	5.2185E-01	1.9048E+02	1.0000E+01	1.3046E-01	4.7619E+01
1/1/2002	2002	7	2.1500E-02	5.8904E-05	9.1138E-05	4.0000E+01	1.9649E-02	7.1720E+00	1.0000E+01	4.9123E-03	1.7930E+00
1/1/2003	2003	3	1.6400E-01	4.4932E-04	6.9519E-04	4.0000E+01	1.4988E-01	5.4708E+01	1.0000E+01	3.7471E-02	1.3677E+01
1/1/2004	2004					4.0000E+01			1.0000E+01		
1/1/2005	2005					4.0000E+01			1.0000E+01		
1/1/2006	2006	18	8.9605E-02	2.4549E-04	3.7983E-04	4.0000E+01	8.1892E-02	2.9891E+01	1.0000E+01	2.0473E-02	7.4727E+00

Sludge/Residuals

Acres		Gadsden County			
Date	Year	Dry Tons (tons/yr)	TN (lbs/ac/yr)	TN** (lbs/yr)	TP** (lbs/yr)
1/1/1983	1983				
1/1/1984	1984				
1/1/1985	1985				
1/1/1986	1986				
1/1/1987	1987				
1/1/1988	1988				
1/1/1989	1989				
1/1/1990	1990				
1/1/1991	1991				
1/1/1992	1992				
1/1/1993	1993				
1/1/1994	1994				
1/1/1995	1995	0.53		5.3000E+01	2.6500E+01
1/1/1996	1996				
1/1/1997	1997				
1/1/1998	1998				
1/1/1999	1999				
1/1/2000	2000				
1/1/2001	2001				
1/1/2002	2002				
1/1/2003	2003				
1/1/2004	2004				
1/1/2005	2005				
1/1/2006	2006				

Juniper Creek Wildlife Table
(See CD for entire table)

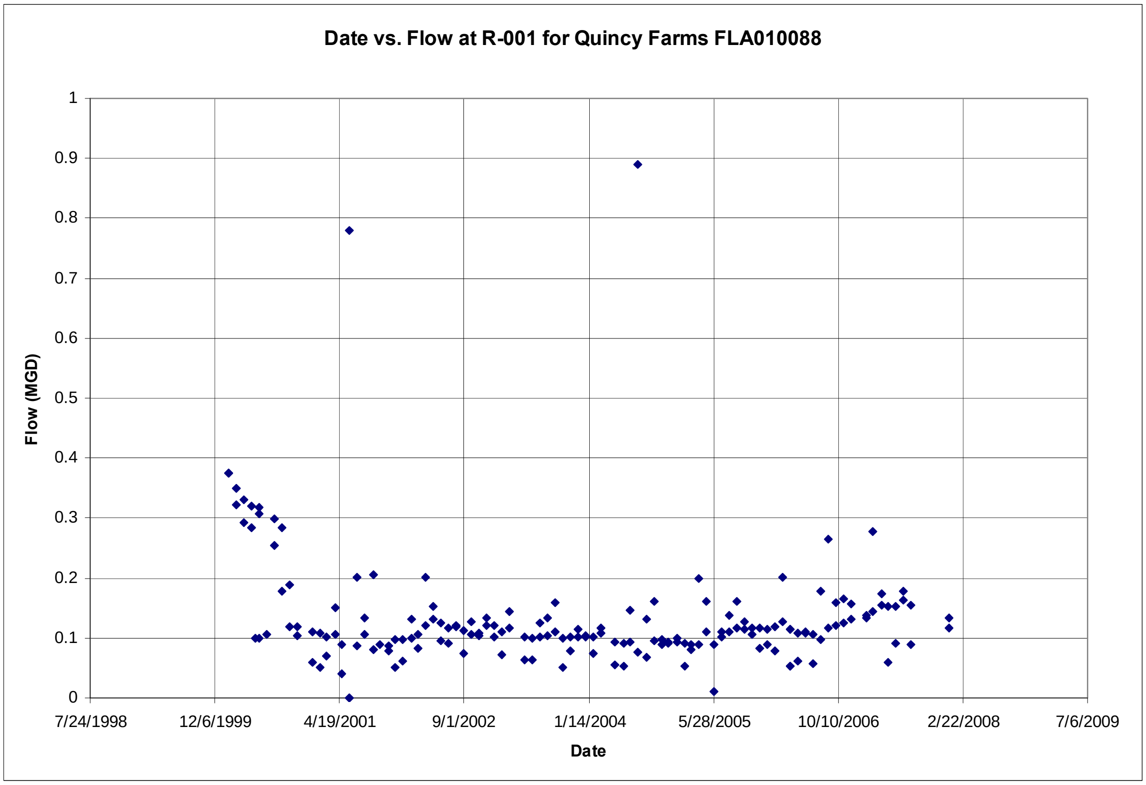
Gadsden County Wildlife								
					FRACTION OF	NWATERFOWL	NDEER	NOTHER
STATE	COUNTY	YEAR	POPULATION	LAND AREA	COUNTY IN	7.98	12.8	
				SQMI	BASIN			
FLORIDA	GADSDEN	1990	41105	5.2813E+02	1.0000E+00	4.214E+03	6.760E+03	
TOTAL				5.2813E+02		4.214E+03	6.760E+03	0.000E+00
STATE	COUNTY		POPULATION					
FLORIDA	GADSDEN	2000	45087					
TOTAL								
*	AVS WEB PAGE		NDOGS=0.58*HH					
**	WWW.NRICD.ORG/LANDWATERCONNECTION/SCOOPONPOOP.HTM							
	AVE DOG=45LB		TN=	1.3000E+01				
			TP=	2.0000E+00				
***								
****	RUDDY, 2006	USGS SIR, 2006-5012						
	HORSES AND PONIES		TN=0.127 (KG/DAY/HORSE)*(2.2046 LB/KG)*(365 DAY/YR)=					
	HORSES AND PONIES		TP= 0.022 (KG/DAY/HORSE)*(2.2046 LB/KG)*(365 DAY/YR)=					
	ONTARIO AGRICULTURE. WWW.OMAFRA.GOV.ON.CA/ENGLISH/NM/REGS/NMPRO/APPTCJ05.HTM							
	WHITE TAIL DEER		TN=(25.4/10.8)*HORSES=					
	WHITE TAIL DEER		TP=(7.9/2.9)*HORSES=					
	KNIGHT, 2003							
	WATERFOWL DENSITY ESCAMBIA AVERAGE BASED ON BIRDSOURCE= 7.98/SQMI							
	DEER DENSITY ESCAMBIA =1/ 50 AC.= 12.8/SQMI							

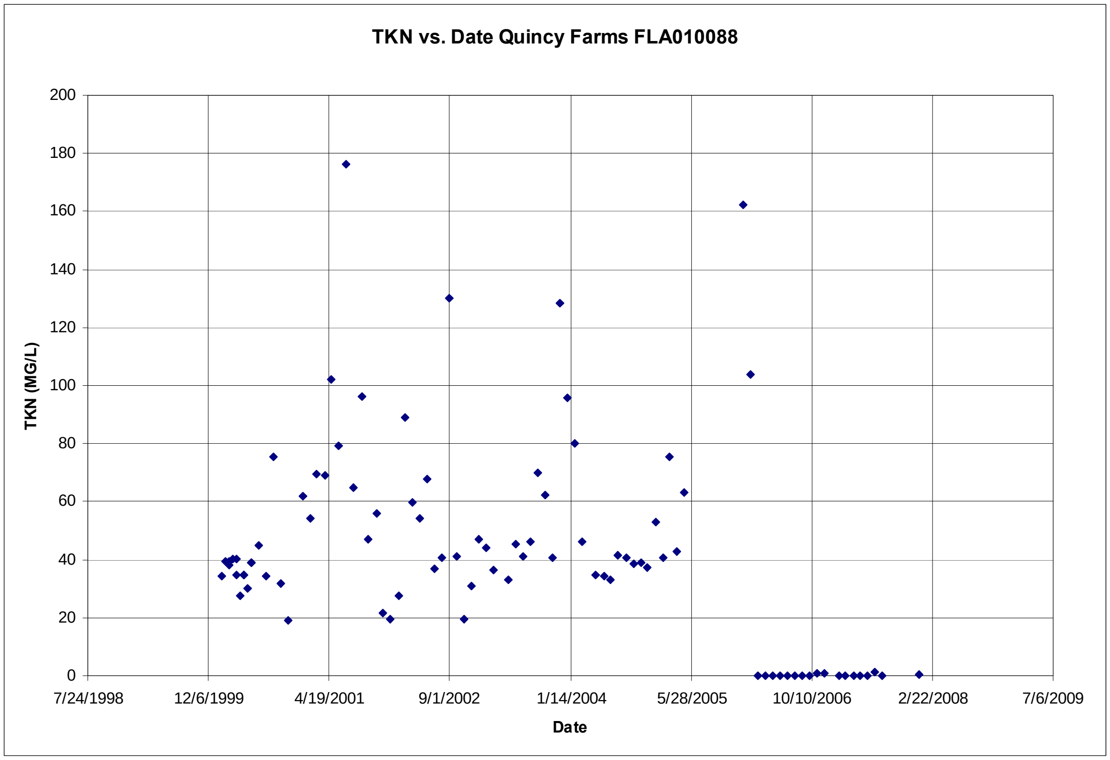
Domesticated Animals
(See CD for entire table)

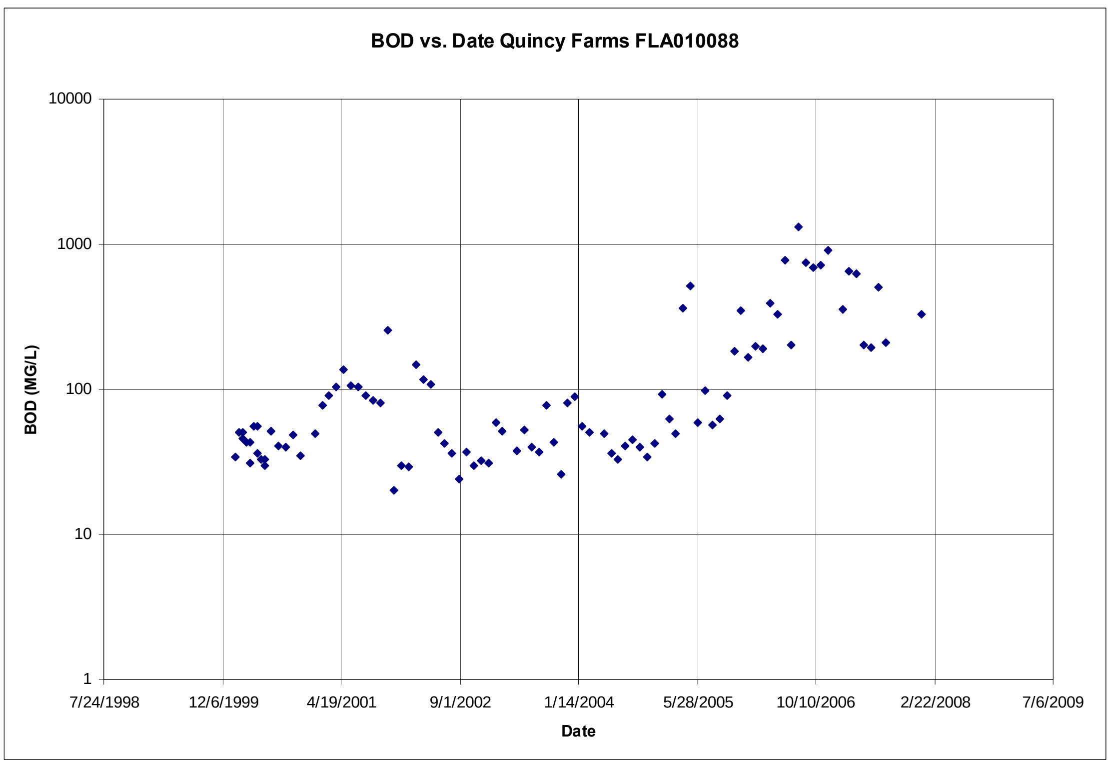
Gadsden Census of Pets								
								HOUSING
								UNITS
STATE	COUNTY	YEAR	POPULATION	HOUSEHOLDS	SEWER	SEPTIC	OTHER	SUM
FLORIDA	GADSDEN	1990	41105	13405	6046	8455	358	14859
TOTAL								
								HOUSING
								UNITS
STATE	COUNTY		POPULATION	HOUSEHOLDS	SEWER	SEPTIC	OTHER	SUM
FLORIDA	GADSDEN	2000	45087	15867				18488
TOTAL								
*	AVS WEB PAGE		NDOGS=0.58*HH		NCATS=0.66*HH		NHORSES=0.05*HH	
**	WWW.NRICD.ORG/LANDWATERCONNECTION/SCOOPONPOOP.HTM							
	AVE DOG=45LB		TN=	1.3000E+01	(LB/YR/DOG)			
			TP=	2.0000E+00	(LB/YR/DOG)			

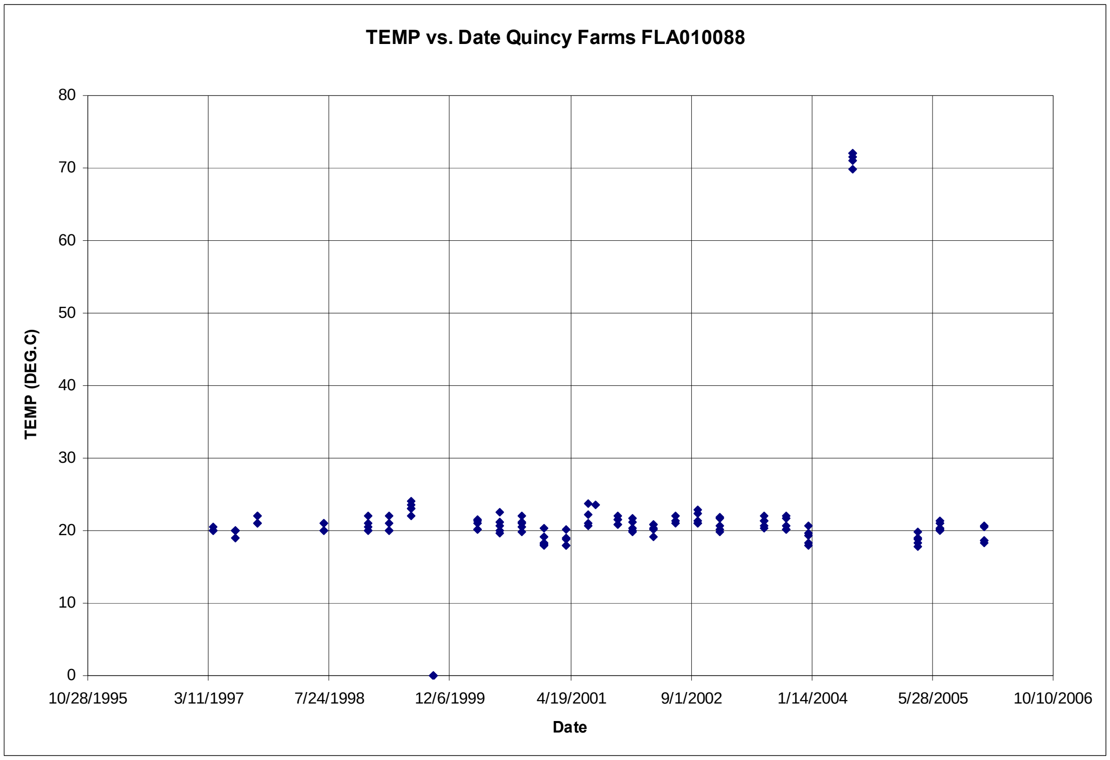
Appendix C: Summary of Permitted Point Source Loads

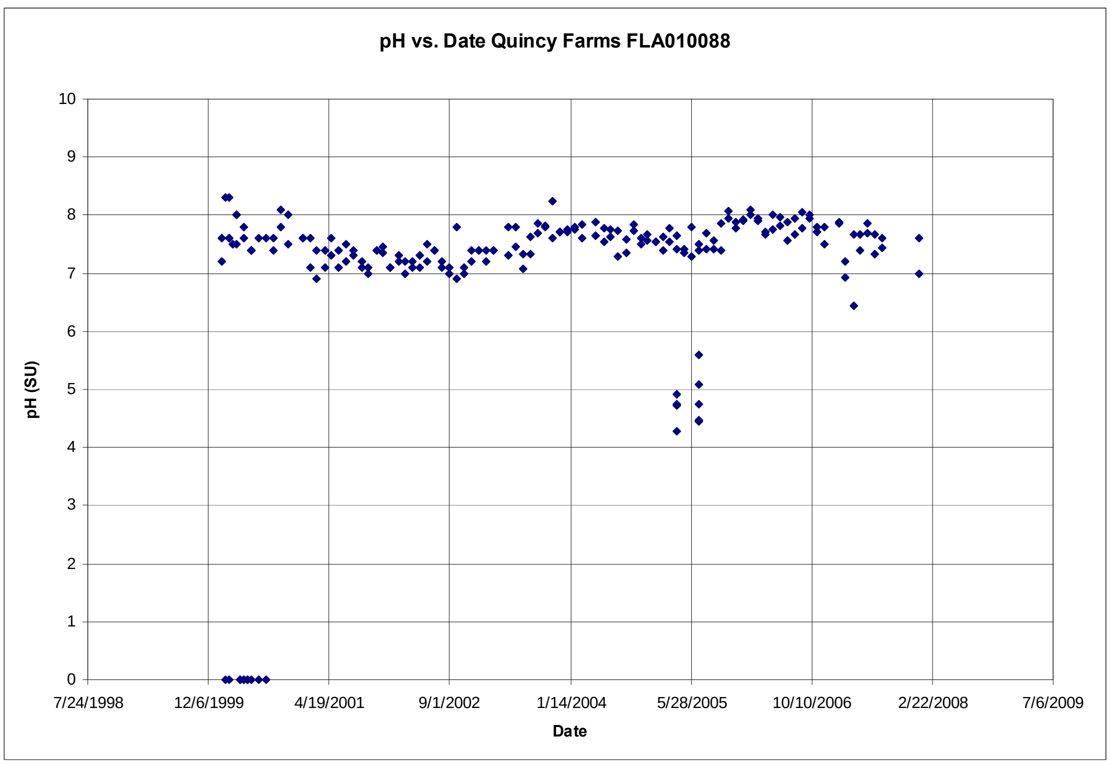
NPDES Permit Number	Facility Name	Units	Max/Min	Annual Average	Monthly Average	Weekly Average	Single Sample	Monitoring Frequency	Sample Type	Monitoring Location Site Number	Discharges to the Juniper Creek Watershed
FLA010088	Quincy Farms			See Permit							Yes

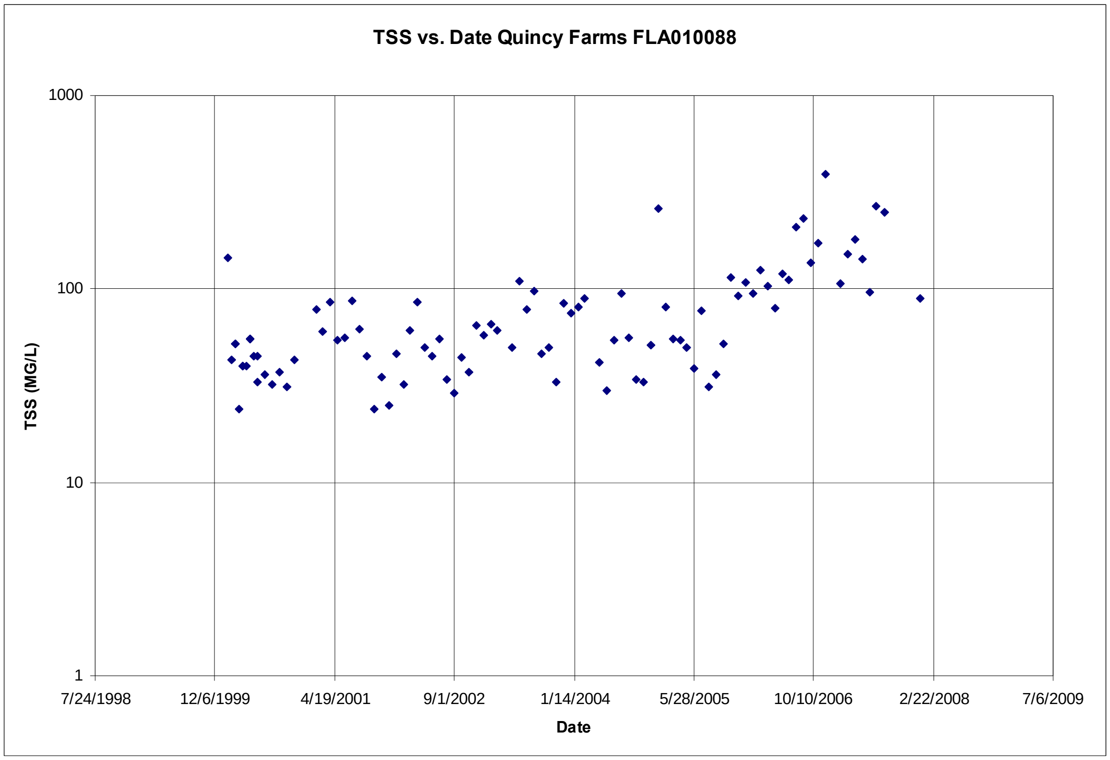



TKN vs. Date Quincy Farms FLA010088
TKN (MG/L)
200
180
160
140
120
100
80
60
40
20
0
7/24/1998
12/6/1999
4/19/2001
9/1/2002
1/14/2004
5/28/2005
10/10/2006
2/22/2008
7/6/2009
Date


BOD vs. Date Quincy Farms FLA010088
BOD (MG/L)
10000
1000
100
10
1
7/24/1998
12/6/1999
4/19/2001
9/1/2002
1/14/2004
5/28/2005
10/10/2006
2/22/2008
7/6/2009
Date


TEMP vs. Date Quincy Farms FLA010088
TEMP (DEG.C)
80
70
60
50
40
30
20
10
0
10/28/1995
3/11/1997
7/24/1998
12/6/1999
4/19/2001
9/1/2002
1/14/2004
5/28/2005
10/10/2006
Date


pH vs. Date Quincy Farms FLA010088
pH (SU)
10
9
8
7
6
5
4
3
2
1
0
7/24/1998
12/6/1999
4/19/2001
9/1/2002
1/14/2004
5/28/2005
10/10/2006
2/22/2008
7/6/2009
Date



Quincy Farms Monitoring Wells (FLA010088)		
Monitoring Well	**NO23N Samples >10mg/L**	**Total No. of Samples**
MW-5	0	0
MWB-1	1	32
MWC-3	11	31
MWC-5	0	2
MWC-5A	1	29
MWC-6	0	2
MWC-6A	1	29
MWI-2	1	30
TOTAL	**15**	**155**

Year	Flow Annual Average (mgd)	BOD Annual Average (mg/L)	BOD Annual Load (lbs/day)	BOD Annual Load (lbs/yr)	TKN Annual Average (mg/L)	TKN Annual Load (lbs/day)	TKN Annual Load (lbs/yr)	TSS Annual Average (mg/L)	TSS Annual Load (lbs/day)	TSS Annual Load (lbs/yr)
2000	0.230	4.2632E+01	8.1776E+01	2.9848E+04	3.8903E+01	7.4623E+01	2.7237E+04	1.3247E+02	2.5411E+02	9.2751E+04
2001	0.120	9.8250E+01	9.7953E+01	3.5753E+04	7.1346E+01	7.1130E+01	2.5963E+04	5.4833E+01	5.4668E+01	1.9954E+04
2002	0.117	5.7083E+01	5.5502E+01	2.0258E+04	5.3714E+01	5.2227E+01	1.9063E+04	4.9667E+01	4.8291E+01	1.7626E+04
2003	0.103	5.4000E+01	4.6162E+01	1.6849E+04	5.8433E+01	4.9951E+01	1.8232E+04	6.8091E+01	5.8208E+01	2.1246E+04
2004	0.133	4.7364E+01	5.2447E+01	1.9143E+04	4.3485E+01	4.8153E+01	1.7576E+04	7.5182E+01	8.3251E+01	3.0386E+04
2005	0.108	1.7167E+02	1.5396E+02	5.6194E+04	7.6818E+01	6.8893E+01	2.5146E+04	6.5750E+01	5.8966E+01	2.1523E+04
2006	0.122	5.8709E+02	5.9590E+02	2.1751E+05	9.6627E+00	9.8078E+00	3.5798E+03	1.6136E+02	1.6379E+02	5.9782E+04
2007	0.145	3.8550E+02	4.6458E+02	1.6957E+05	3.0375E-01	3.6606E-01	1.3361E+02	1.6050E+02	1.9342E+02	7.0600E+04

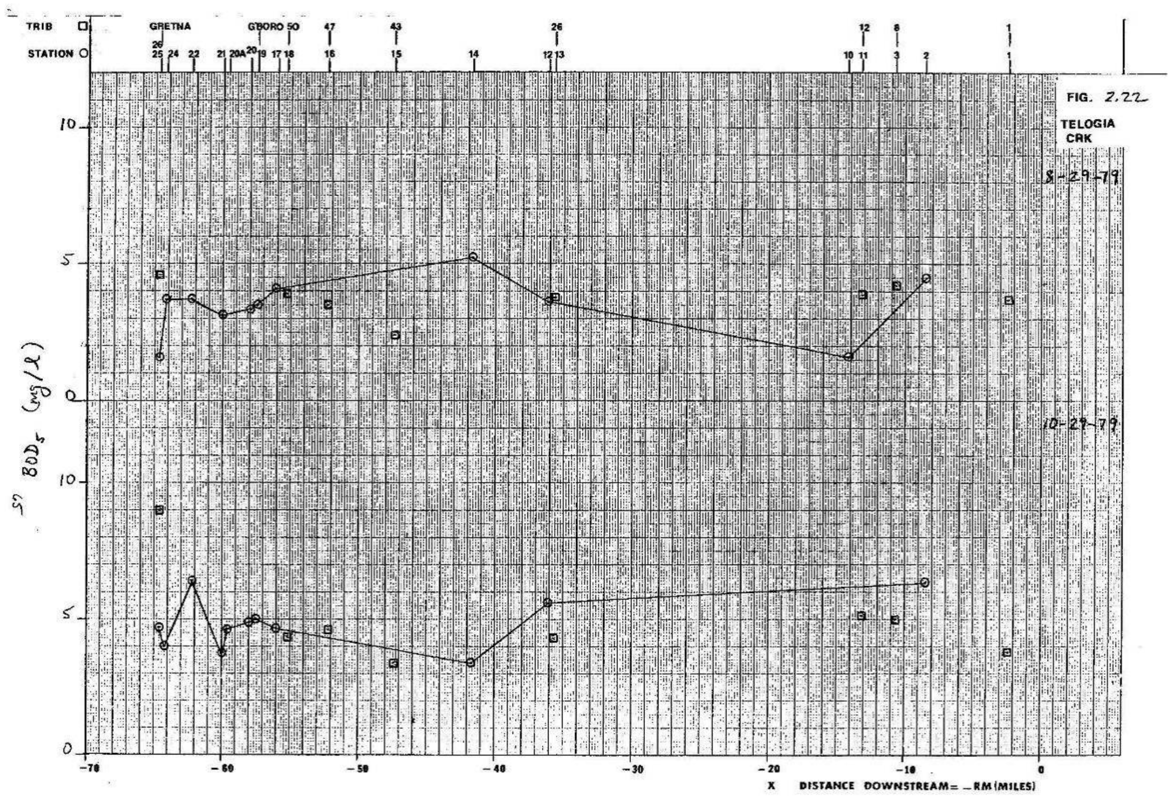
Appendix D: Summary of Measured USGS Loads

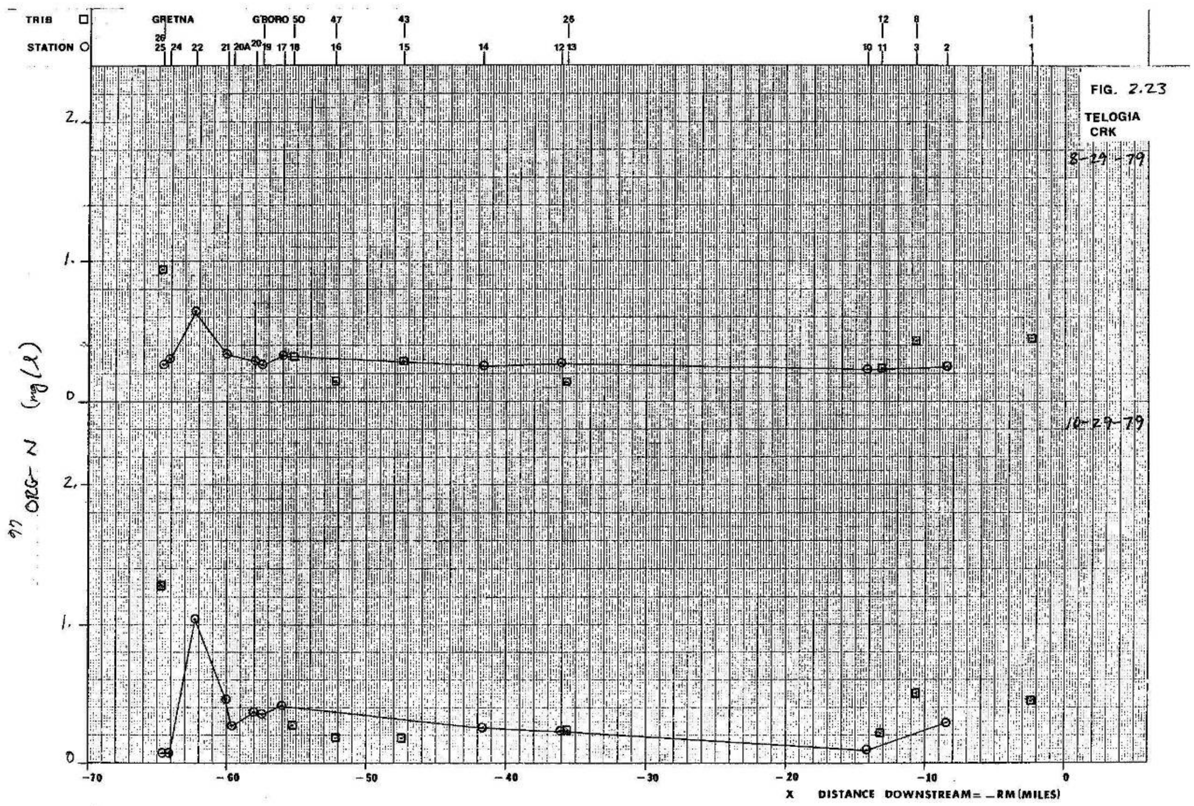
See CD for table.

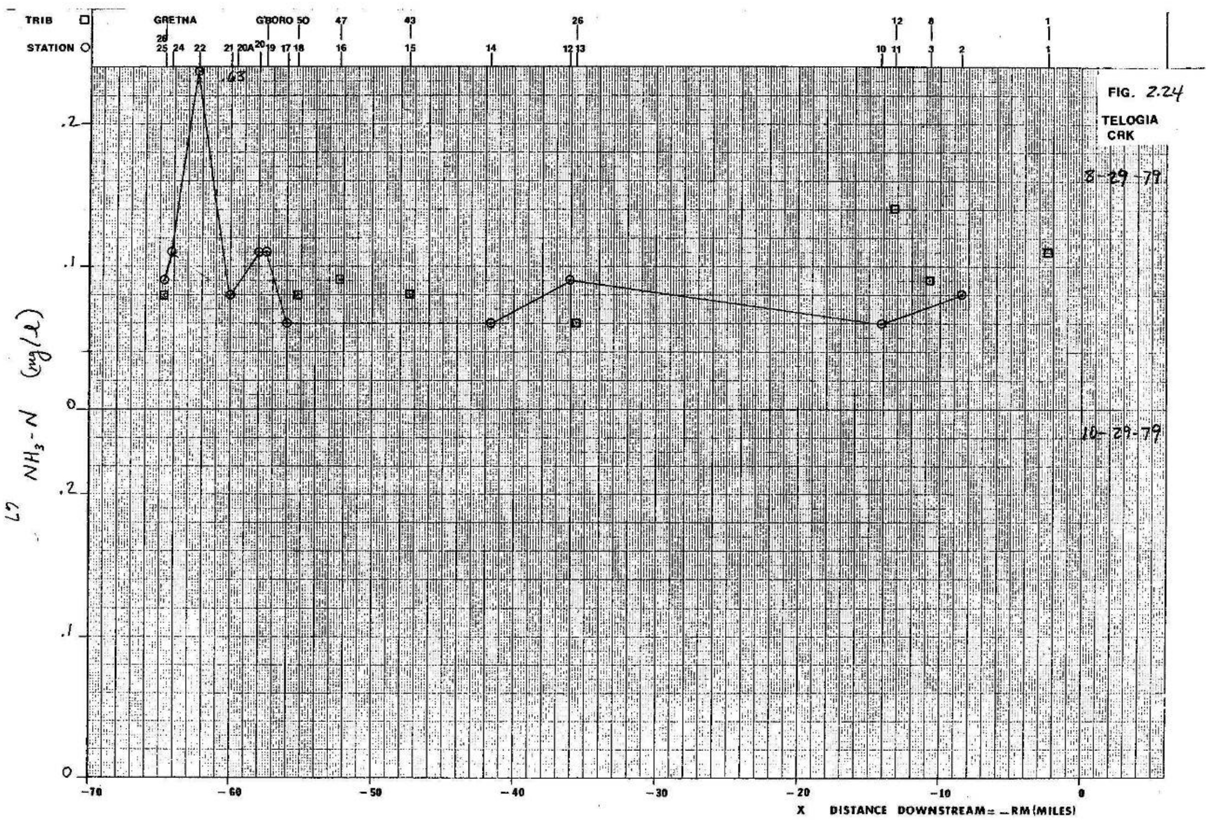
Appendix E: Summary of Juniper Creek Water Quality Spatial Trend Data

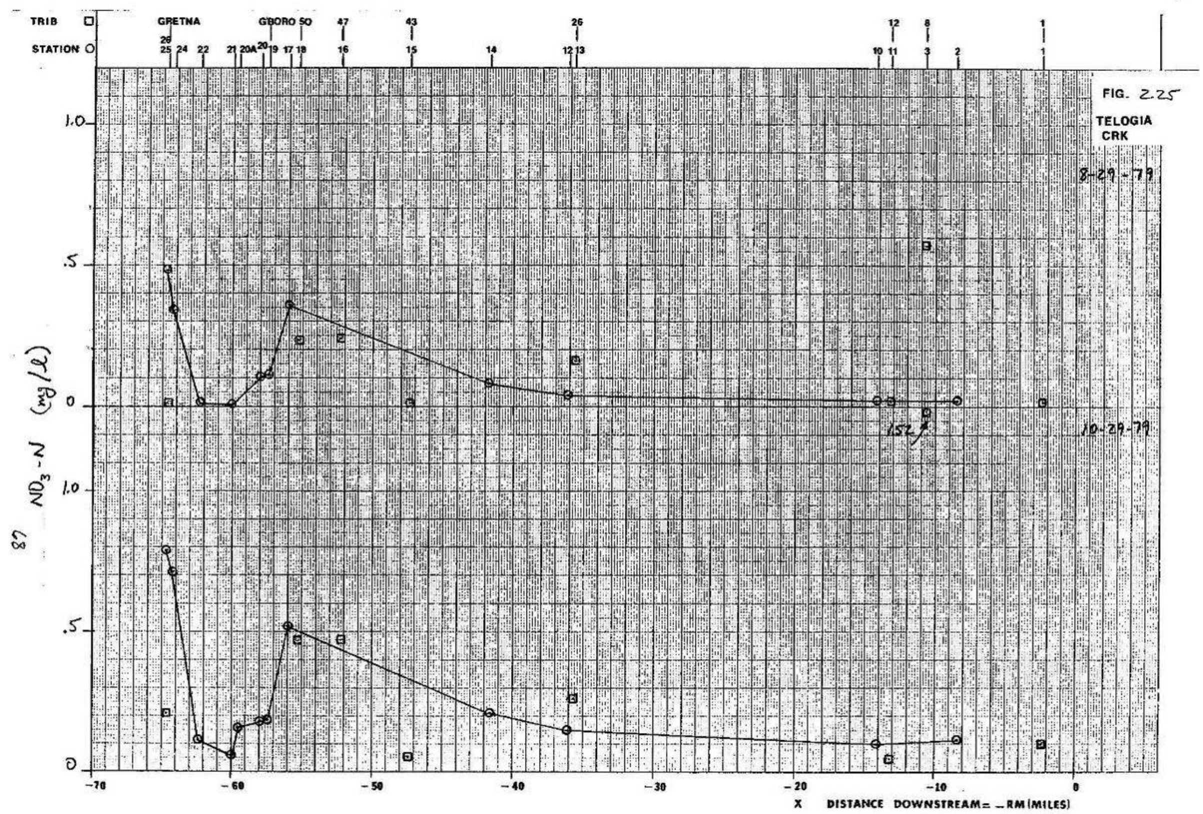
There are currently no spatial trend data available for Juniper Creek.

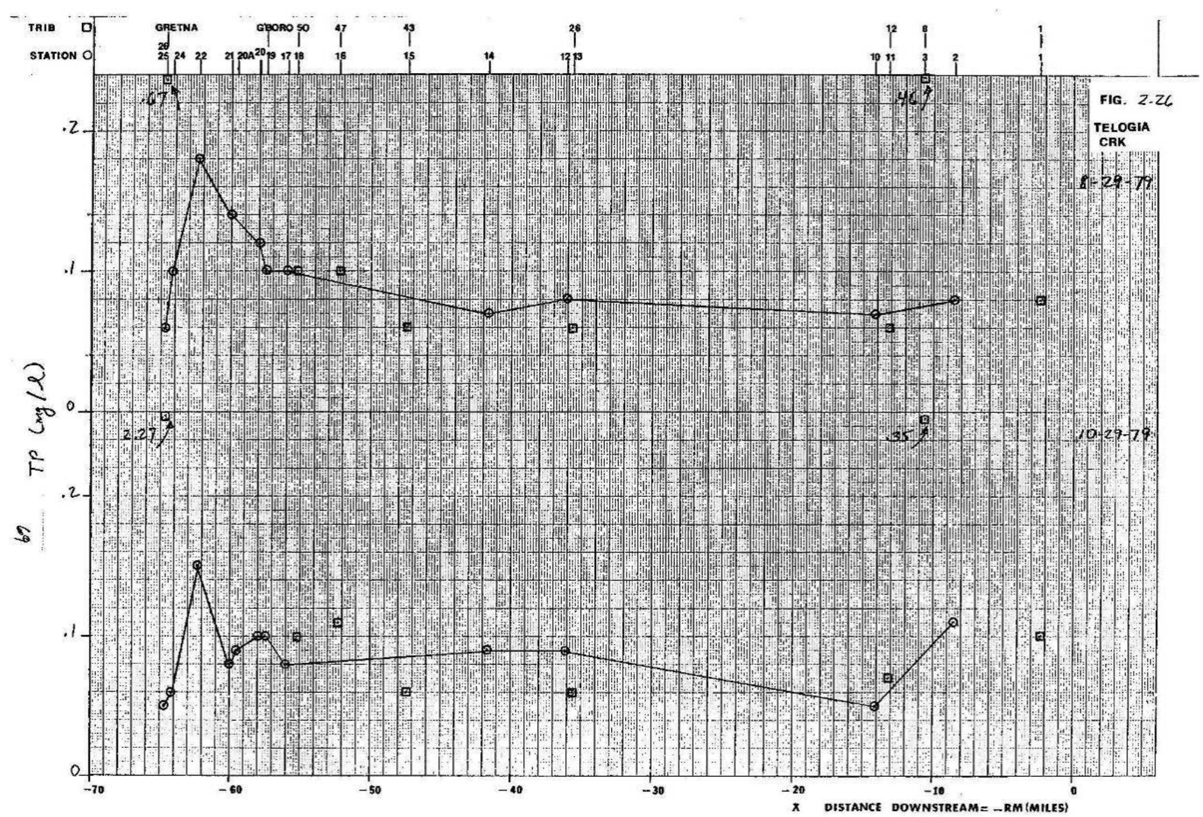
Telogia Creek survey from 1979



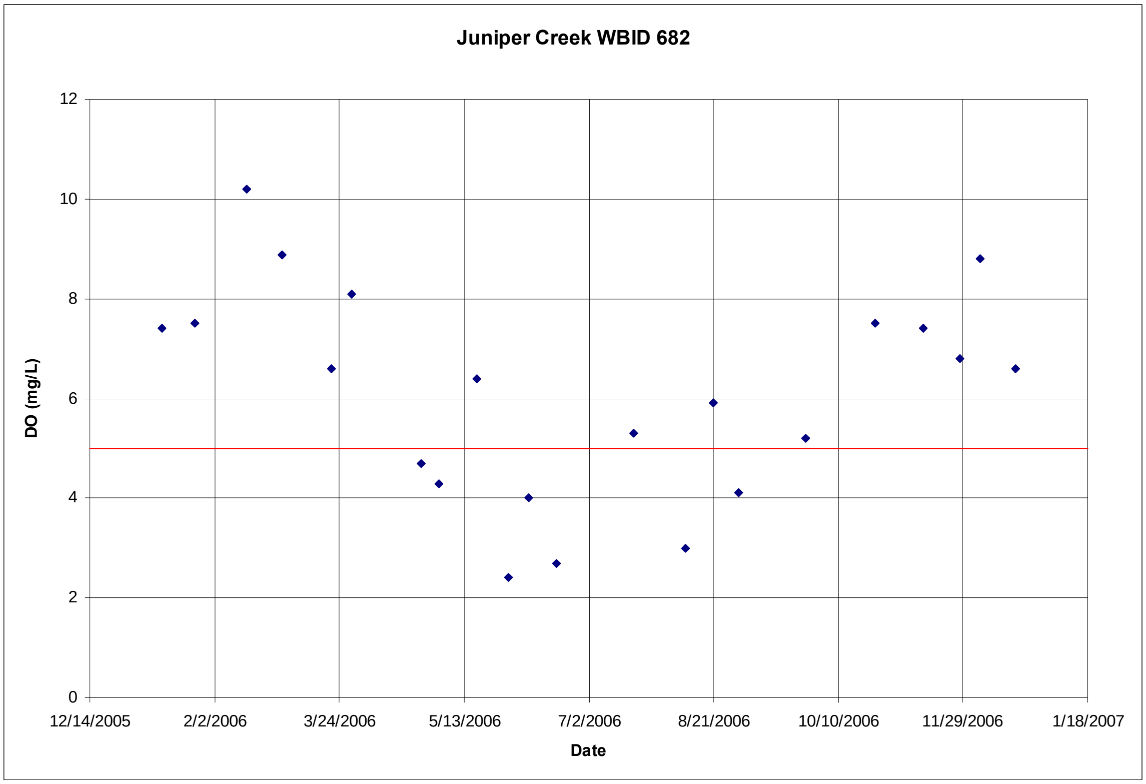

TRIB
STATION
GRETNA
G'BORO
FIG. 2.23
TELOGIA CRK
8-29-79
10-29-79
ORG-N (mg/l)
X DISTANCE DOWNSTREAM= –RM (MILES)

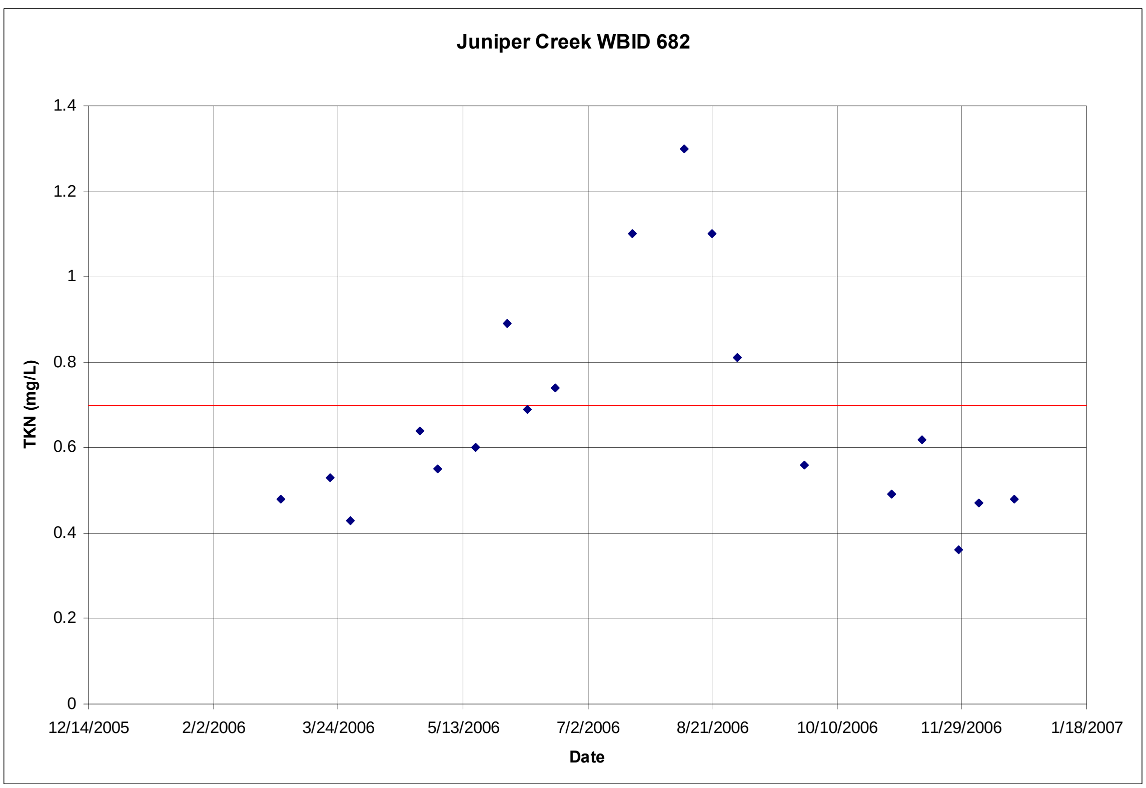

TRIB
STATION
GRETNA
G'BORO
FIG. 2.24
TELOGIA CRK
8-29-79
10-29-79
NH3-N (mg/l)
X DISTANCE DOWNSTREAM= –RM (MILES)


TRIB
STATION
GRETNA
G'BORO
FIG. 2.25
TELOGIA CRK
8-29-79
10-29-79
NO_3-N (mg/l)
.152
DISTANCE DOWNSTREAM = -RM (MILES)


TRIB
STATION
GRETNA
G'BORO
FIG. 2.26
TELOGIA CRK
8-29-79
10-29-79
TP (mg/l)
.67
.46
2.27
.35
DISTANCE DOWNSTREAM = -RM (MILES)

Appendix F: Summary of Juniper Creek Water Quality Time Trend Data



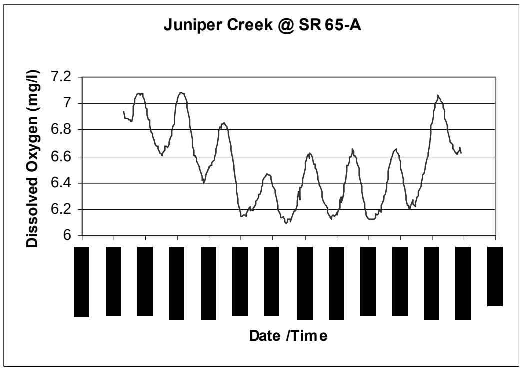


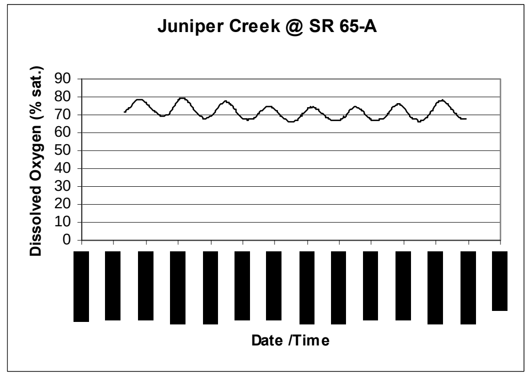
Discrete Sampling
(See CD for entire table)

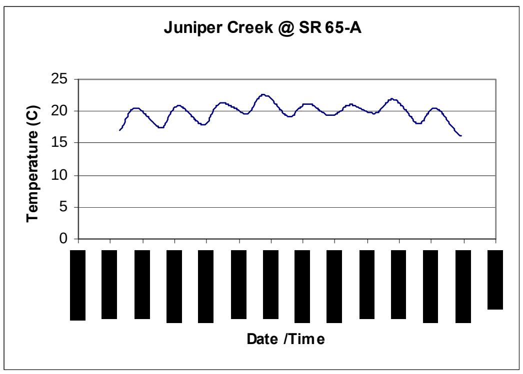
Station	Station Description	HUC	Date MMDDYYYY 73672	Time WQ HHMM	TOTDEPTH FT 81903	SAMDEPTH FT3	TEMP OC 10	DO mg/L 299	PSAT % 301	COND µS/CM 94	SAL PPT 480	pH SU 406	FIELD TURB NTU 82078
7520	Juniper Crk @ SR 65A	03120003	6/15/2006	1243	0.6	0.5	23.33	4.9	57.1	121	0.06	6.23	1.9
7520	Juniper Crk @ SR 65A	03120003	2/16/2006	1327	0.75	0.5	11.78	9.78	90.3	53	0.02	6.38	4.3
7519	Juniper Crk 200 Yds ups SR 65A Bridge	03120003	11/9/2005	1411	0.5	0.5	17.65	6.76	70.8	68	0.03	6.03	7.4
7520	Juniper Crk @ SR 65A	03120003	11/19/2005	1422	0.6	0.5	17.07	6.53	67.6	68	0.03	5.8	1.5
7519	Juniper Crk 200 Yds ups SR 65A Bridge	03120003	11/16/2005	1200	1.13	0.5	18.6	5.92	63	62	0.03	6.05	14.3
7520	Juniper Crk @ SR 65A	03120003	11/16/2005	1210	0.54	0.54	18.29	5.86	62.1	63	0.03	5.89	1.5
7450	Long Branch at SR 274	03120003	4/22/2008	1006	2.92	0.5	18.78	1.37	14.8	43	0.02	5.57	5.3
7520	Juniper Creek at SR 65A	03120003	4/22/2008	1100	0.72	0.5	16.86	6.86	70.8	52	0.02	5.45	3
7430	Trib 1 to East of Nicole Rd	03120003	4/22/2008	1150	0.5	0.5	16.31	9.51	97	45	0.02	3.93	1.1
7420	Trib 2 East of Nicole Rd	03120003	4/22/2008	1200	1.5	0.5	16.25	3.47	35.2	31	0.01	4.19	0.1
7410	Trib 3 East of Nicole Rd	03120003	4/22/2008	1210	1.2	0.5	20.31	5.54	61.2	40	0.02	4.93	3
7400	Trib 4 East of Nicole Rd	03120003	4/22/2008	1230	1	0.5	16.99	4.81	49.8	40	0.02	4.43	0
7450	Long Branch at SR 274	03120003	4/30/2008	1005	2	0.5	18.4	0.88	9.3	45	0.02	5.41	33.1
7520	Juniper Crk @ SR 65A	03120003	4/30/2008	1045	0.9	0.5	16.26	6.59	66.9	61	0.03	5.67	6.2
7440	Trib 0 East of Nicole Rd	03120003	4/30/2008	1125	0.5	0.5	20.53	5	55.6	34	0.01	4.39	1.8
7430	Trib 1 to East of Nicole Rd	03120003	4/30/2008	1135	0.8	0.5	14.23	10.18	100.3	40	0.02	4.23	2.3
7420	Trib 2 East of Nicole Rd	03120003	4/30/2008	1146	1.8	0.56	16.03	3.82	38.6	30	0.01	4.26	0
7410	Trib 3 East of Nicole Rd	03120003	4/30/2008	1200	1.1	0.5	20.37	5.55	61.5	38	0.02	4.9	1.2
7400	Trib 4 East of Nicole Rd	03120003	4/30/2008	1225	1	0.5	16.54	6.18	63.4	39	0.02	4.59	0

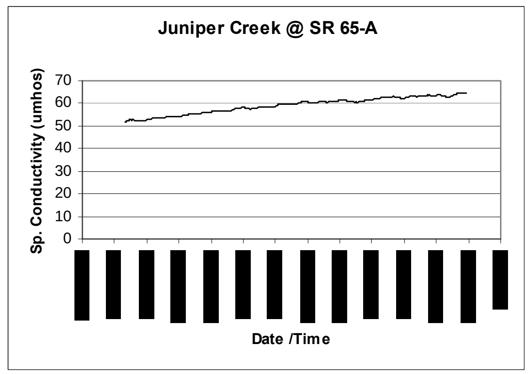
Logger Data

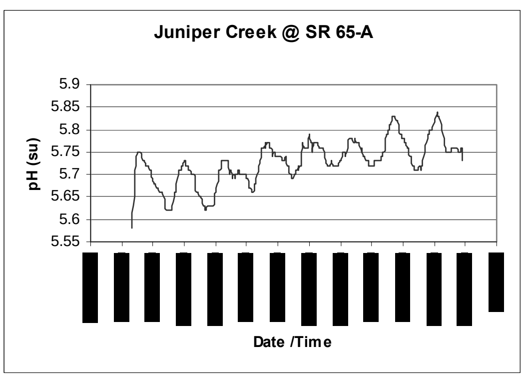
Juniper @ SR 65A

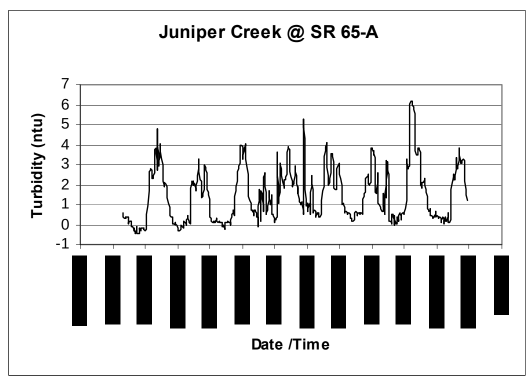


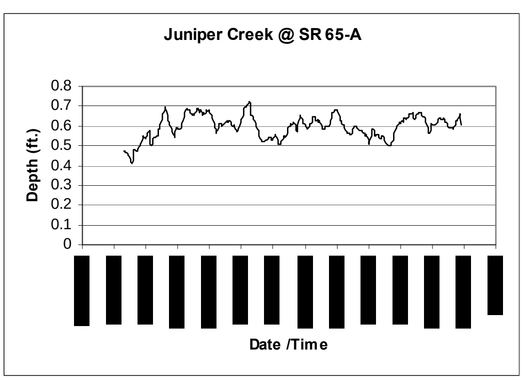


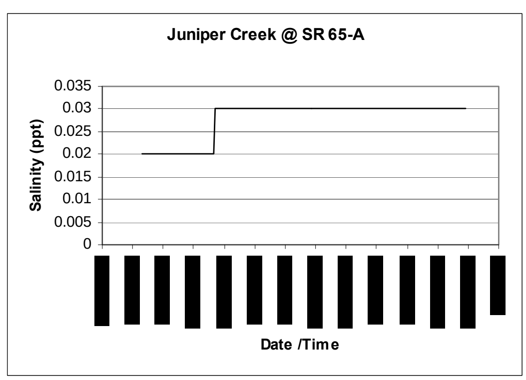




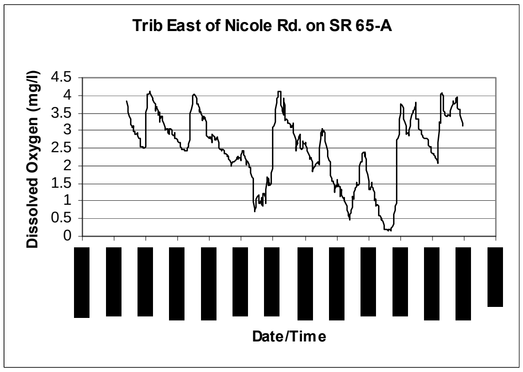


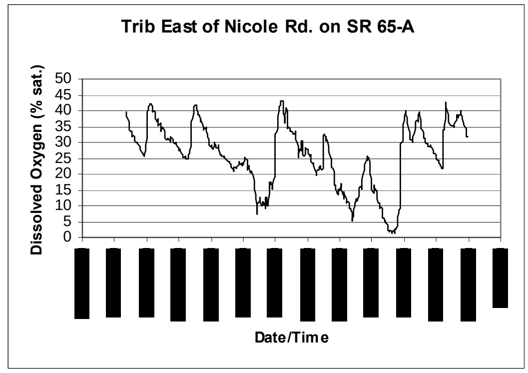


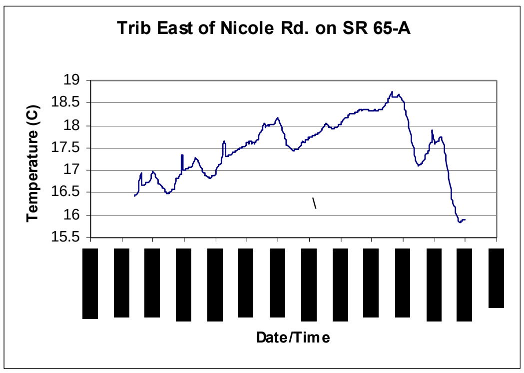


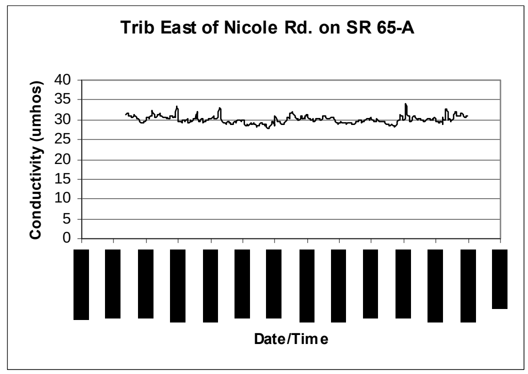


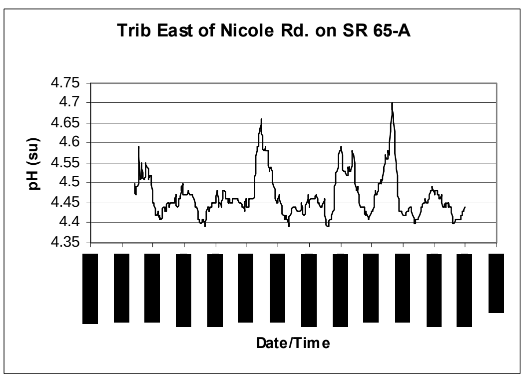
Trib. East of Nicole Rd.

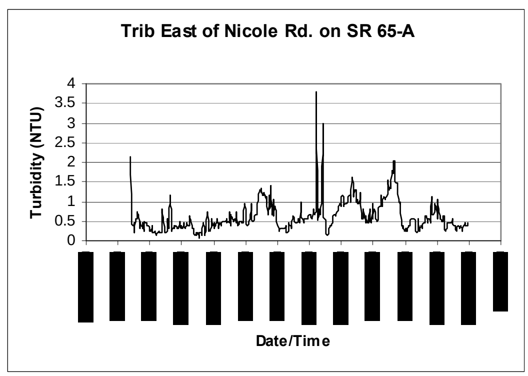


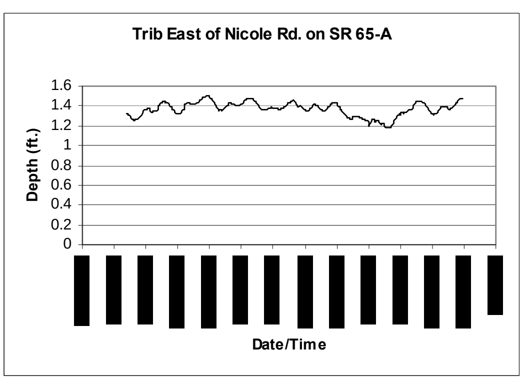


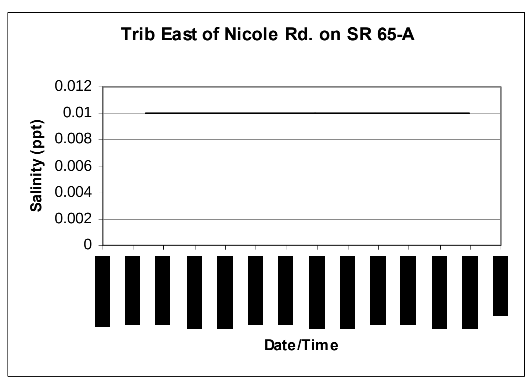




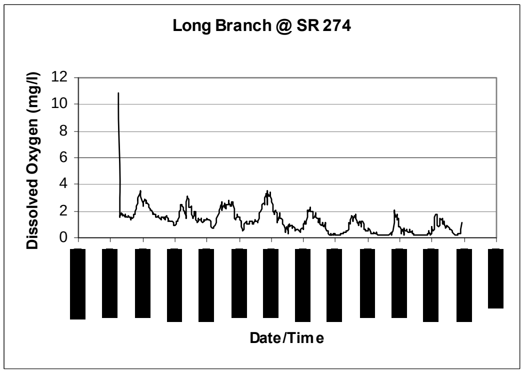


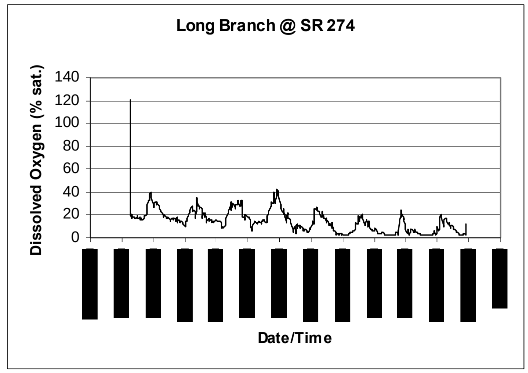


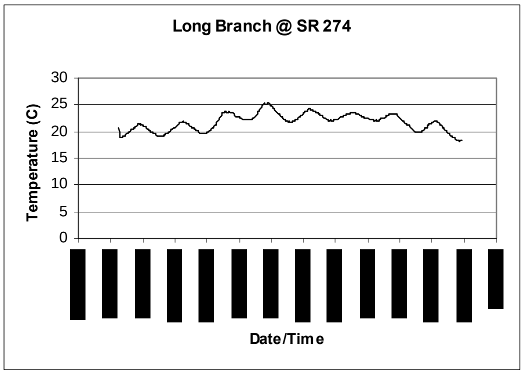


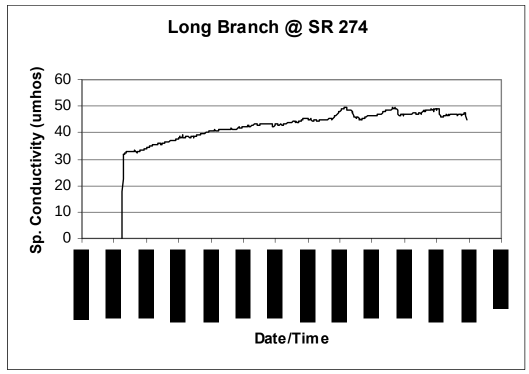


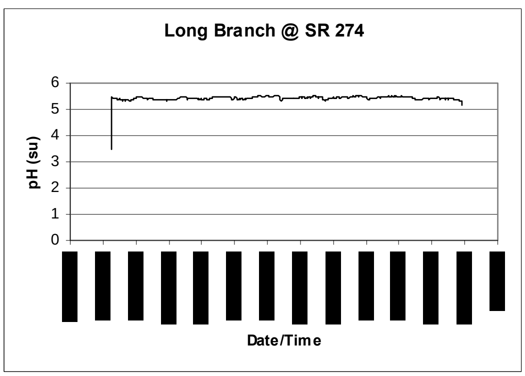
Long Branch at SR 274

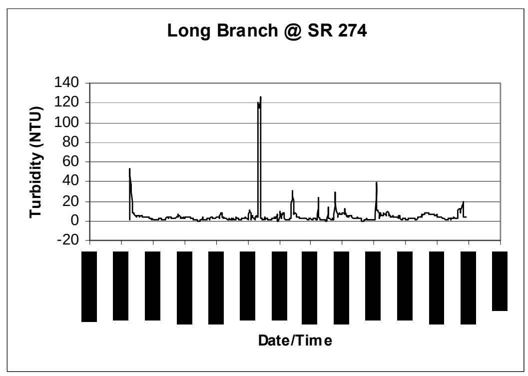


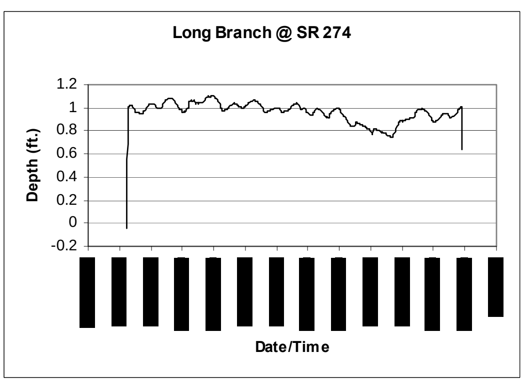


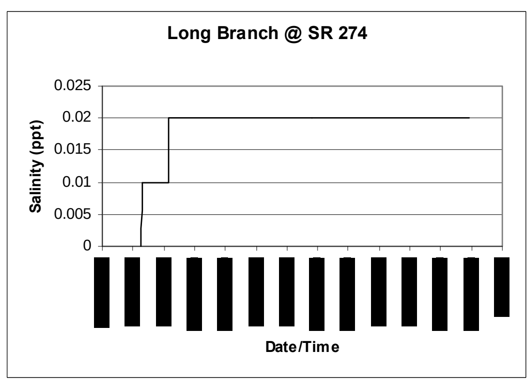












Appendix G: Summary of Juniper Creek Biology Data

EcoSummary

BioRecon Report

Juniper Creek, Gadsden County
7/21/98

BioReconnaissance (BioRecon): A rapid, cost effective screening mechanism for identification of biological impairment.

Introduction

Juniper Creek, a tributary of Telogia Creek, is located in Gadsden County. Land use in the drainage basin consists predominantly of agriculture, silviculture and pasture. Less than 20% of the area remains natural or forested.

Juniper Creek was placed on the 303(d) list for violations of turbidity and coliforms, as well as having elevated nutrient levels. Waterbodies on the 303(d) list are required by EPA to have a Total Maximum Daily Load (TMDL) study performed on them. The purpose of the TMDL is to determine the amount of pollution reduction needed to restore the system to a condition suitable for its designated use. In this case, the designated use is for recreation and maintenance of a healthy, well-balanced aquatic community.

DEP's Environmental Assessment Section was requested to assess the status of selected waterbodies on the TMDL list that were placed on the list with "limited data". "Limited data" waterbodies were those with less than 10 observations in the STORET database, with the most recent observations occurring prior to 1990, or those with qualitative, non-point source survey data only.

Results and Discussion

Macroinvertebrate communities were sampled from in-stream habitats (using 4 discrete dip-net sweeps), field picked, and lab identified (the Biorecon procedure). Three metrics, consisting of total taxa richness, the Florida Index and total EPT taxa (Ephemeroptera, Plecoptera and Trichoptera), are calculated and compared to existing thresholds to determine the community's health. Juniper Creek failed to meet all three of the thresholds, indicating suspected impairment. It is thought that the stream had been dry (during extended drought conditions) prior to sampling, contributing to suppressed macroinvertebrate communities. Although there had been rain prior to sampling, water velocity was very low (0.02 m/sec) with most habitats exposed. The organisms collected were all first or second instars, suggesting only recent inundation or some other recent disturbance.

Total coliform bacteria (3,000 colonies/100 mL), exceeded the Class III water quality standard of 2,400 colonies/100 mL. Fecal coliform counts of 108 colonies/100 mL complied with the Class III standard (800 colonies/100 mL). Dissolved oxygen was 5.4 mg/L, meeting the Class III standard of 5.0 mg/L. Nitrite-nitrate concentrations (0.19 mg/L) in Juniper Creek were elevated to levels higher than those found in 70% of other Florida streams. The specific conductance at Juniper Creek (27 umhos/cm) suggested that non-point source surface runoff, rather than Floridan Aquifer spring inputs, was responsible for the nitrate-nitrite loading. Both total Kjeldahl nitrogen and total phosphorus concentrations (0.47 and 0.088 mg/L, respectively) ranked in the lower 40th percentile of streams in Florida. Juniper Creek had no turbidity problems at the time of sampling (2.3 NTU).

It was also observed that water from this stream was being pumped to an adjacent holding pond for agricultural irrigation purposes. It was not known if this activity was authorized by a consumptive use permit.

Conclusions

Juniper Creek failed all three of the Biorecon metrics. Recent drought conditions and pumping from the stream for irrigation purposes may have contributed to the system going dry prior to sampling. Total coliform samples from Juniper Creek violated Class III water quality criteria, and nitrate-nitrite concentrations were elevated, potentially due to non-point source runoff. It is recommended that Juniper Creek remain on the 303(d) list.

For more information, contact Tom Frick, FDEP Environmental Assessment Section, 2600 Blair Stone Rd., Tallahassee, FL 32399 (850)413-0247

Figure 1: Overview map of Juniper Creek

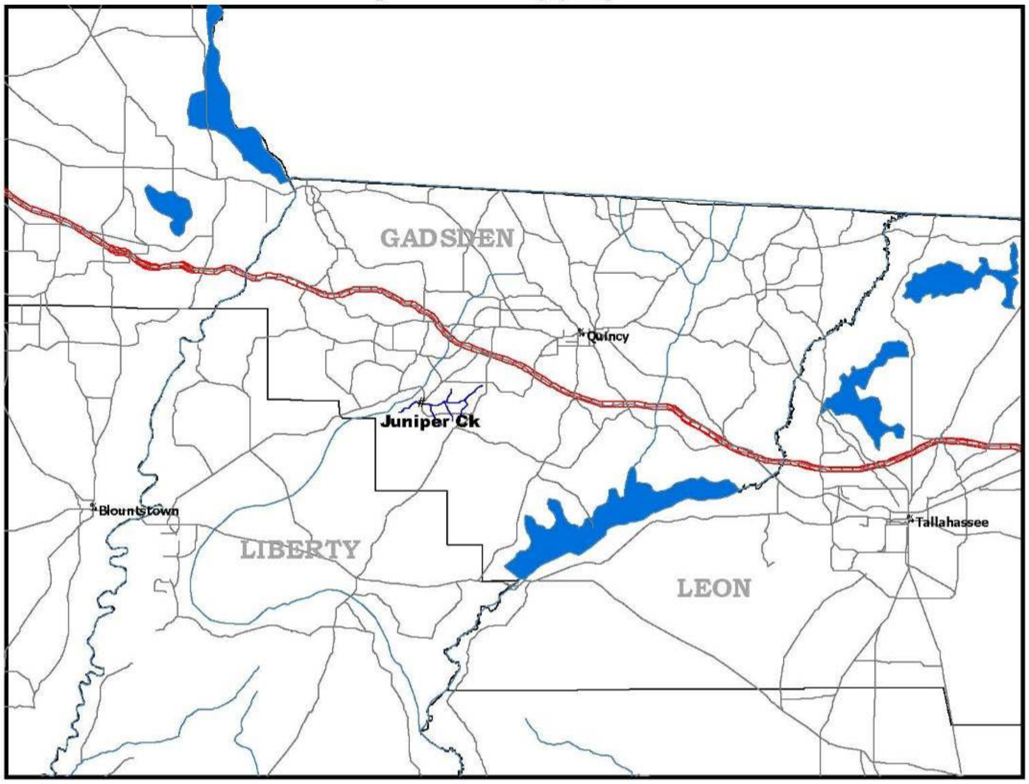
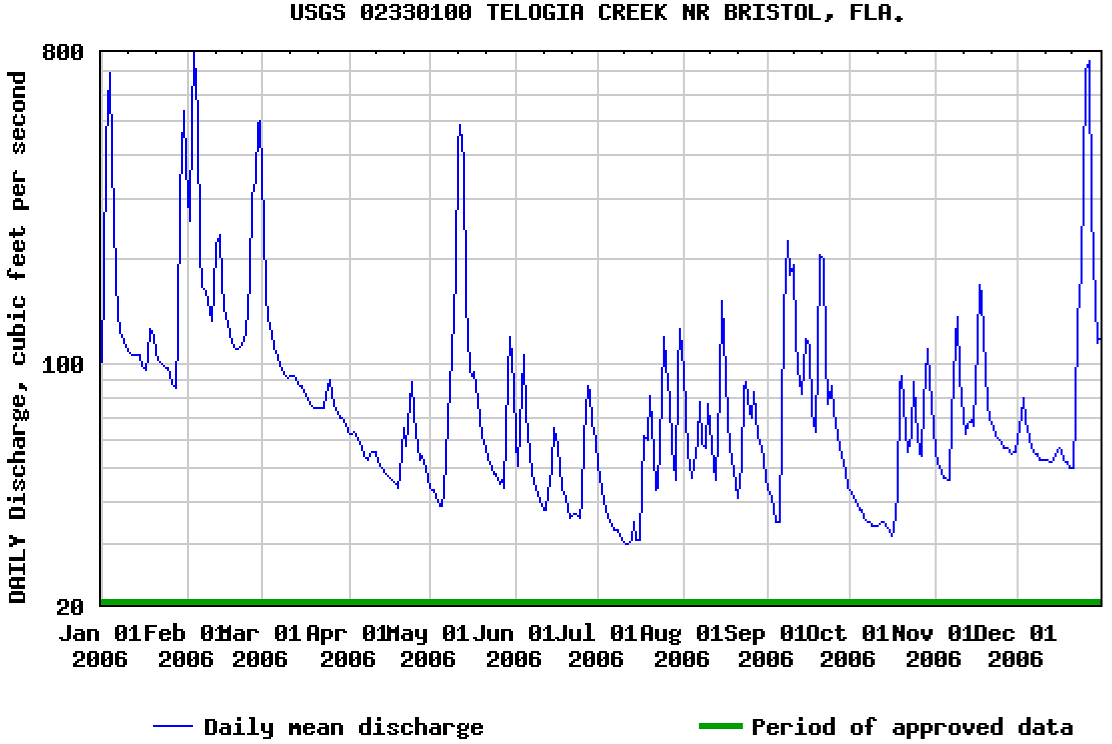


Table 1: Data for selected parameters

Date	# Taxa	Florida index	EPT	Cond-uctivity (uhms/cm^2)	DO (mg/L)	pH (Std Units)	Temp (C)	NOx (mg/L)	TKN (mg/L)	TP (mg/L)	Fecal coliforms (col/100 ml)	Total coliforms (col/100 ml)
7/21/98	16	2	2	27	5.4	5.7	23.9	0.19	0.47	0.088	108	3000

Published by The Department of Environmental Protection; Tallahassee, FL 1999.

Appendix H: USGS, Department Flow Data



Juniper Creek miscellaneous flows

Station	Station Description	HUC	Date MMDDYYYY 73672	Time WQ HHMM	TOTDEPTH FT 81903	SAMDEPTH FT3	W FT 4	D FT 64	A FTSQ 51	V FT/S 55	Q CFS 61	WE FT	DE FT	AE FTSQ	VE FT/S	QE CFS
7520	Juniper Crk @ SR 65A	03120003	6/15/2006	1243	0.6	0.5										
7520	Juniper Crk @ SR 65A	03120003	2/16/2006	1327	0.75	0.5	11	0.403	4.435	1.3696	6.074					
7519	Juniper Crk 200 Yds ups SR 65A bridge	03120003	11/9/2005	1411	0.5	0.5						20	0.5		0.1	1
7520	Juniper Crk @ SR 65A	03120003	11/19/2005	1422	0.6	0.5										
7519	Juniper Crk 200 Yds ups SR 65A bridge	03120003	11/16/2005	1200	1.13	0.5						15	2	30	0.1	3
7520	Juniper Crk @ SR 65A	03120003	11/16/2005	1210	0.54	0.54	7.5	0.307	2.304	0.8703	2.005					
7450	Long Branch at SR 274	03120003	4/22/2008	1006	2.92	0.5						20	1.5		0	0
7520	Juniper Creek at SR 65A	03120003	4/22/2008	1100	0.72	0.5	7.3	0.853	6.2245	0.4451	2.771					
7430	Trib 1 to East of Nicole Rd	03120003	4/22/2008	1150	0.5	0.5						25	0.45		0.3	3.375
7420	Trib 2 East of Nicole Rd	03120003	4/22/2008	1200	1.5	0.5						15	0.9		0.2	0.27
7410	Trib 3 East of Nicole Rd	03120003	4/22/2008	1210	1.2	0.5						25	0.9		0.02	0.45
7400	Trib 4 East of Nicole Rd	03120003	4/22/2008	1230	1	0.5						10	0.5		0.1	0.05
7450	Long Branch at SR 274	03120003	4/30/2008	1005	2	0.5										
7520	Juniper Crk @ SR 65A	03120003	4/30/2008	1045	0.9	0.5	7.2	0.757	5.448	0.4105	2.237					
7440	Trib 0 East of Nicole Rd	03120003	4/30/2008	1125	0.5	0.5									0	0
7430	Trib 1 to East of Nicole Rd	03120003	4/30/2008	1135	0.8	0.5						15	0.4		0.05	0.3
7420	Trib 2 East of Nicole Rd	03120003	4/30/2008	1146	1.8	0.56						12	0.9		0	0
7410	Trib 3 East of Nicole Rd	03120003	4/30/2008	1200	1.1	0.5						15	0.8		0	0
7400	Trib 4 East of Nicole Rd	03120003	4/30/2008	1225	1	0.5										

Appendix I: Ground Water Data in the Ochlockonee–St. Marks Basin

GENERATING STATISTICS						
ANALYTE GROUP:	SPRING INITIATIVE					
NETWORK:	ALL					
WATER RESOURCE:	CONFINED UNCONFINED					
TMDL BASIN:	OCHLOCKONEE –ST. MARKS					
COLLECTION DATE:	FROM: 1-JAN-1980 TO: 8-MAY-2008					
RESULTS:	MAX PER WELL					
Parameter Name	Coliform, Total (MF)	Coliform, Fecal (MF)	Enterococci, Membrane Filter	Water Temperature	Turbidity	Color
Parameter Code	31501	31616	31649	10	76	81
Units	#/100ml	#/100ml	#/100ml	degrees C	ntu	Pt-Co
Total Wells	118	153	61	241	199	136
Number BDLs	84	132	44	0	24	42
Number MCL/GCL Exceedances	33	NA	NA	NA	NA	38
Percent MCL/GCL Exceedances	28%	NA	NA	NA	NA	27.90%
Minimum	0	0	0	11.9	0.025	2.5
1st Quartile	0	0	0	20.97	0.5	2.5
Median	0	0	0	21.4	1.6	5
3rd Quartile	10	0	2	22.1	12	22.5
Maximum	2000	900	1300	28.78	3900	4000
Interquartile Range	10	0	2	1.13	11.5	20
Mean	50.085	10.699	35.213	21.527	46.177	75.478
Standard Deviation	226.136	77.34	170.311	1.37	289.428	355.464
Relative Standard Deviation	451.50%	722.87%	483.66%	6.36%	626.78%	470.95%
Standard Error	20.818	6.253	21.806	0.088	20.517	30.481
Variance	51137.531	5981.422	29005.77	1.877	83768.754	126354.307
Coefficient of Skewness	664.445	415.012	620.271	31518.978	473.109	622.944

Number Risk Indicators	**NA**	**13**	**17**	**NA**	**64**	**NA**
Percent Risk Indicators	**NA**	**8.50%**	**27.90%**	**NA**	**32.20%**	**NA**
Number SRA Indicators	**2**	**1**	**6**	**NA**	**33**	**38**
Percent SRA Indicators	**1.70%**	**0.70%**	**9.80%**	**NA**	**16.60%**	**27.90%**
GENERATING STATISTICS						
ANALYTE GROUP:	**SPRING INITIATIVE**					
NETWORK:	**ALL**					
WATER RESOURCE:	**CONFINED UNCONFINED**					
TMDL BASIN:	**OCHLOCKONEE - ST. MARKS**					
COLLECTION DATE:	**FROM: 1-JAN-1980 TO: 8-MAY-2008**					
RESULTS:	**MAX PER WELL**					
Parameter Name	**Specific Conductance, Field**	**Specific Conductance**	**Oxygen, Dissolved, Field**	**pH, Field**	**Alkalinity, Total (as CaCO3)**	**Total Suspended Solids (TSS)**
Parameter Code	**94**	**95**	**299**	**406**	**410**	**530**
Units	**uS/cm**	**uS/cm**	**mg/L**	**s.u.**	**mg/L**	**mg/L**
Total Wells	241	140	231	236	134	61
Number BDLs	0	0	0	0	1	38
Number MCL/GCL Exceedances	NA	NA	NA	43	NA	NA
Percent MCL/GCL Exceedances	NA	NA	NA	18.20%	NA	NA
Minimum	12	14	0.03	3.42	0.325	2
1st Quartile	190	160	0.83	7.1075	106	2
Median	266	250	2.49	7.535	131	2
3rd Quartile	336	310	6.205	7.86	166.75	9
Maximum	12200	1100	10	11.09	451.104	1778
Interquartile Range	146	150	5.375	0.7525	60.75	7
Mean	332.842	254.857	3.484	7.277	138.953	52.754
Standard Deviation	789.524	174.656	2.92	1.034	71.236	231.475
Relative Standard Deviation	237.21%	68.53%	83.81%	14.21%	51.27%	438.78%
Standard Error	50.858	14.761	0.192	0.067	6.154	29.637
Variance	623347.767	30504.771	8.529	1.069	5074.597	53580.522
Coefficient of Skewness	927.807	2946.197	2726.712	13825.919	4012.845	675.071

Number Risk Indicators	NA	NA	NA	NA	NA	NA
Percent Risk Indicators	NA	NA	NA	NA	NA	NA
Number SRA Indicators	2	0	139	208	127	NA
Percent SRA Indicators	0.80%	0%	60.20%	88.10%	94.80%	NA
GENERATING STATISTICS						
ANALYTE GROUP:	**SPRING INITIATIVE**					
NETWORK:	**ALL**					
WATER RESOURCE:	**CONFINED UNCONFINED**					
TMDL BASIN:	**OCHLOCKONEE - ST. MARKS**					
COLLECTION DATE:	**FROM: 1-JAN-1980 TO: 8-MAY-2008**					
RESULTS:	**MAX PER WELL**					
Parameter Name	**Ammonia, Dissolved (as N)**	**Ammonia, Total (as N)**	**Ammonia+Organic Nitrogen, Dissolved**	**Ammonia+ Organic Nitrogen, Total (as N)**	**Nitrate+ Nitrite, Total (as N)**	**Nitrate+ Nitrite, Dissolved (as N)**
Parameter Code	**608**	**610**	**623**	**625**	**630**	**631**
Units	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Total Wells	146	103	141	103	103	148
Number BDLs	47	69	79	74	15	47
Number MCL/GCL Exceedances	NA	NA	NA	NA	0	NA
Percent MCL/GCL Exceedances	NA	NA	NA	NA	0%	NA
Minimum	0.005	0.005	0.03	0.03	0.002	0.002
1st Quartile	0.01	0.005	0.03	0.03	0.009	0.01
Median	0.015	0.005	0.1	0.04	0.13	0.1125
3rd Quartile	0.06775	0.0205	0.16	0.081	0.455	0.52
Maximum	1.3	1.2	1.8	1.4	2.6	19
Interquartile Range	0.05775	0.0155	0.13	0.051	0.446	0.51
Mean	0.061	0.053	0.145	0.124	0.286	0.568
Standard Deviation	0.13	0.143	0.191	0.224	0.417	1.733
Relative Standard Deviation	213.12%	269.81%	131.72%	180.65%	145.80%	305.11%
Standard Error	0.011	0.014	0.016	0.022	0.041	0.142
Variance	0.017	0.02	0.036	0.05	0.174	3.004
Coefficient of Skewness	1292.308	1076.923	1753.927	1482.143	1745.803	918.35

Number Risk Indicators	**NA**	**NA**	**NA**	**NA**	**NA**	**1**
Percent Risk Indicators	**NA**	**NA**	**NA**	**NA**	**NA**	**0.70%**
Number SRA Indicators	**NA**	**NA**	**NA**	**NA**	**26**	**39**
Percent SRA Indicators	**NA**	**NA**	**NA**	**NA**	**25.20%**	**26.40%**
GENERATING STATISTICS						
ANALYTE GROUP:	SPRING INITIATIVE					
NETWORK:	ALL					
WATER RESOURCE:	CONFINED UNCONFINED					
TMDL BASIN:	OCHLOCKONEE - ST. MARKS					
COLLECTION DATE:	FROM: 1-JAN-1980 TO: 8-MAY-2008					
RESULTS:	MAX PER WELL					
Parameter Name	**Phosphorus, Total (as P)**	**Phosphorus, Dissolved (as P)**	**Orthophosphate, Dissolved (as P)**	**Organic Carbon, Total**	**Calcium, Dissolved**	**Calcium, Total**
Parameter Code	**665**	**666**	**671**	**680**	**915**	**916**
Units	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Total Wells	113	142	180	215	148	143
Number BDLs	11	16	37	104	0	0
Number MCL/GCL Exceedances	NA	NA	NA	NA	NA	NA
Percent MCL/GCL Exceedances	NA	NA	NA	NA	NA	NA
Minimum	0.002	0.002	0.002	0.48	0.21	0.15
1st Quartile	0.015	0.01	0.014	0.5	25.625	29.6
Median	0.029	0.03	0.026	1.1	38	39.8
3rd Quartile	0.05	0.06	0.0445	4.16	52.2	53.45
Maximum	1.8	1.9	1.8	170	170	174
Interquartile Range	0.035	0.05	0.0305	3.66	26.575	23.85
Mean	0.093	0.084	0.073	4.432	38.995	43.878
Standard Deviation	0.268	0.211	0.19	13.084	26.605	26.666
Relative Standard Deviation	288.17%	251.19%	260.27%	295.22%	68.23%	60.77%
Standard Error	0.025	0.018	0.014	0.892	2.187	2.23
Variance	0.072	0.045	0.036	171.199	707.82	711.063
Coefficient of Skewness	932.836	1052.133	1015.789	932.131	2968.803	3443.861

Number Risk Indicators	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Percent Risk Indicators	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Number SRA Indicators	**61**	**81**	**91**	**NA**	**NA**	**NA**
Percent SRA Indicators	**54%**	**57%**	**50.60%**	**NA**	**NA**	**NA**
GENERATING STATISTICS						
ANALYTE GROUP:	**SPRING INITIATIVE**					
NETWORK:	**ALL**					
WATER RESOURCE:	**CONFINED UNCONFINED**					
TMDL BASIN:	**OCHLOCKONEE - ST. MARKS**					
COLLECTION DATE:	**FROM: 1-JAN-1980 TO: 8-MAY-2008**					
RESULTS:	**MAX PER WELL**					
Parameter Name	**Magnesium, Dissolved**	**Magnesium, Total**	**Sodium, Total**	**Sodium, Dissolved**	**Potassium, Dissolved**	**Potassium, Total**
Parameter Code	**925**	**927**	**929**	**930**	**935**	**937**
Units	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Total Wells	148	143	143	148	148	88
Number BDLs	0	0	1	0	9	0
Number MCL/GCL Exceedances	NA	NA	1	NA	NA	NA
Percent MCL/GCL Exceedances	NA	NA	0.70%	NA	NA	NA
Minimum	0.2	0.29	0.93	0.71	0.025	0.2
1st Quartile	1.375	3.8	2.595	2.675	0.4	0.4875
Median	5.1	7.7	3.4	3.405	0.5255	0.63
3rd Quartile	10.325	11.9	4.56	4.8025	1.1	1.225
Maximum	57	52	167	130	13.2	40
Interquartile Range	8.95	8.1	1.965	2.1275	0.7	0.7375
Mean	6.835	9.168	7.634	7.258	0.945	1.701
Standard Deviation	7.261	8.225	17.728	14.686	1.348	4.612
Relative Standard Deviation	106.23%	89.71%	232.22%	202.34%	142.65%	271.14%
Standard Error	0.597	0.688	1.482	1.207	0.111	0.492
Variance	52.724	67.659	314.269	215.689	1.817	21.268
Coefficient of Skewness	2121.609	2407.781	1100.068	1250.783	1713.279	969.861

Number Risk Indicators	**NA**	**NA**	**NA**	**0**	**NA**	**NA**
Percent Risk Indicators	**NA**	**NA**	**NA**	**0%**	**NA**	**NA**
Number SRA Indicators	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Percent SRA Indicators	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
GENERATING STATISTICS						
ANALYTE GROUP:	**SPRING INITIATIVE**					
NETWORK:	**ALL**					
WATER RESOURCE:	**CONFINED UNCONFINED**					
TMDL BASIN:	**OCHLOCKONEE - ST. MARKS**					
COLLECTION DATE:	**FROM: 1-JAN-1980 TO: 8-MAY-2008**					
RESULTS:	**MAX PER WELL**					
Parameter Name	**Chloride, Total**	**Chloride, Dissolved**	**Sulfate, Total**	**Sulfate, Dissolved**	**Fluoride, Dissolved**	**Fluoride, Total**
Parameter Code	**940**	**941**	**945**	**946**	**950**	**951**
Units	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
Total Wells	138	153	200	148	148	154
Number BDLs	0	1	64	26	50	20
Number MCL/GCL Exceedances	0	NA	0	NA	NA	0
Percent MCL/GCL Exceedances	0%	NA	0%	NA	NA	0%
Minimum	1.6	0.5	0.1	0.1	0.05	0.025
1st Quartile	3.225	3.6	0.5	1.4175	0.0575	0.092
Median	4.6	4.5	2.525	3.2	0.145	0.17
3rd Quartile	6	6.1	6.925	6.85	0.31425	0.2475
Maximum	250	260	250	260	5	0.91
Interquartile Range	2.775	2.5	6.425	5.4325	0.25675	0.1555
Mean	12.862	11.041	7.283	7.304	0.329	0.205
Standard Deviation	33.308	28.49	22.312	21.917	0.624	0.16
Relative Standard Deviation	258.96%	258.04%	306.36%	300.07%	189.67%	78.05%
Standard Error	2.835	2.303	1.578	1.802	0.051	0.013
Variance	1109.442	811.662	497.819	480.351	0.389	0.026
Coefficient of Skewness	1020.355	1004.668	866.081	853.766	1349.359	2781.25

Number Risk Indicators	**NA**	**1**	**NA**	**1**	**3**	**NA**
Percent Risk Indicators	**NA**	**0.70%**	**NA**	**0.70%**	**2%**	**NA**
Number SRA Indicators	**0**	**NA**	**NA**	**NA**	**NA**	**0**
Percent SRA Indicators	**0%**	**NA**	**NA**	**NA**	**NA**	**0%**

GENERATING STATISTICS		
ANALYTE GROUP:	**SPRING INITIATIVE**	
NETWORK:	**ALL**	
WATER RESOURCE:	**CONFINED UNCONFINED**	
TMDL BASIN:	**OCHLOCKONEE - ST. MARKS**	
COLLECTION DATE:	**FROM: 1-JAN-1980 TO: 8-MAY-2008**	
RESULTS:	**MAX PER WELL**	
Parameter Name	**Alkalinity, Dissolved (as CaCO3)**	**Total Dissolved Solids (TDS measured)**
Parameter Code	**29801**	**70300**
Units	**mg/L**	**mg/L**
Total Wells	143	217
Number BDLs	11	5
Number MCL/GCL Exceedances	NA	5
Percent MCL/GCL Exceedances	NA	2.30%
Minimum	0.5	7.5
1st Quartile	67.8	109
Median	124	151
3rd Quartile	153	193
Maximum	425	790
Interquartile Range	85.2	84
Mean	114.437	160.431
Standard Deviation	74.19	107.061
Relative Standard Deviation	64.83%	66.73%
Standard Error	6.204	7.268

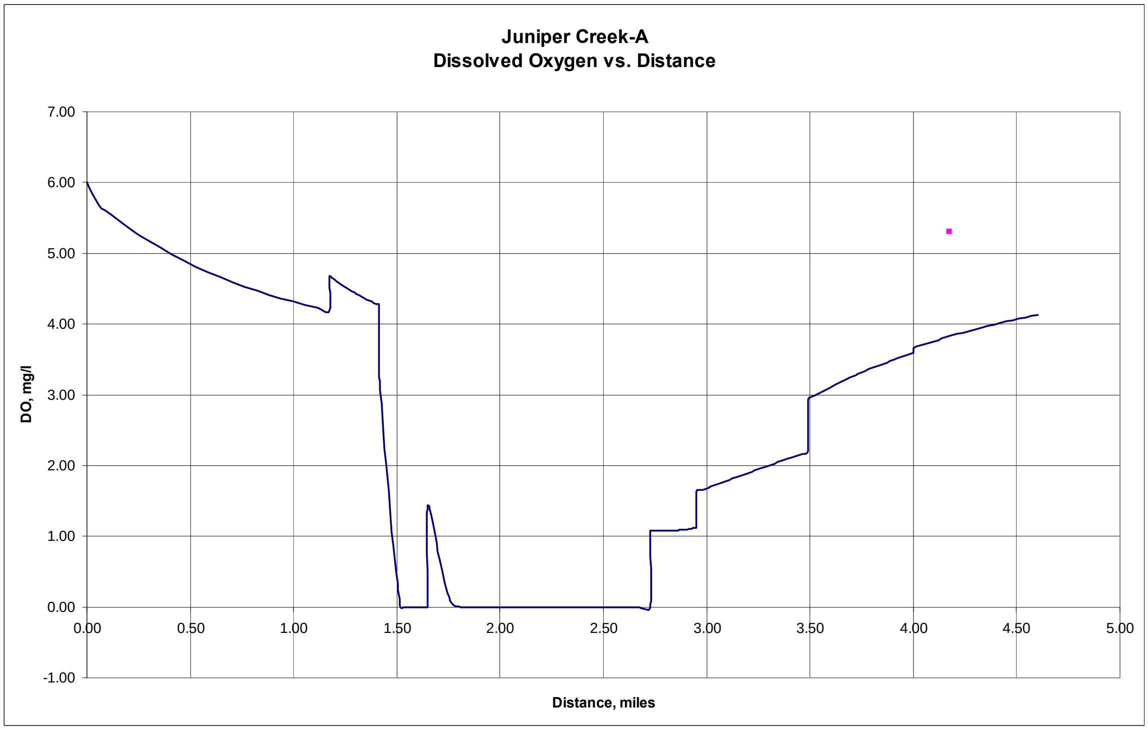
Variance	5504.143	11462.153
Coefficient of Skewness	2956.072	3085.092
Number Risk Indicators	**NA**	**NA**
Percent Risk Indicators	**NA**	**NA**
Number SRA Indicators	**120**	**0**
Percent SRA Indicators	**83.90%**	**0%**

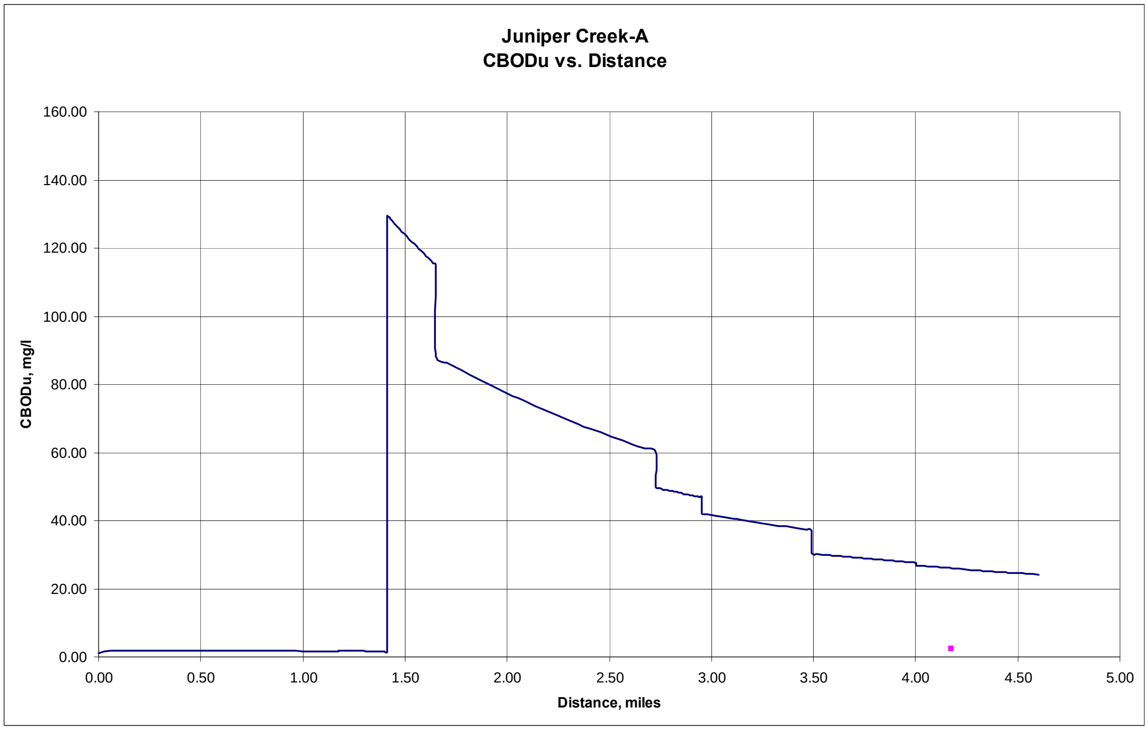
Appendix J: Juniper Creek Modeling Study Using the ADEM Model

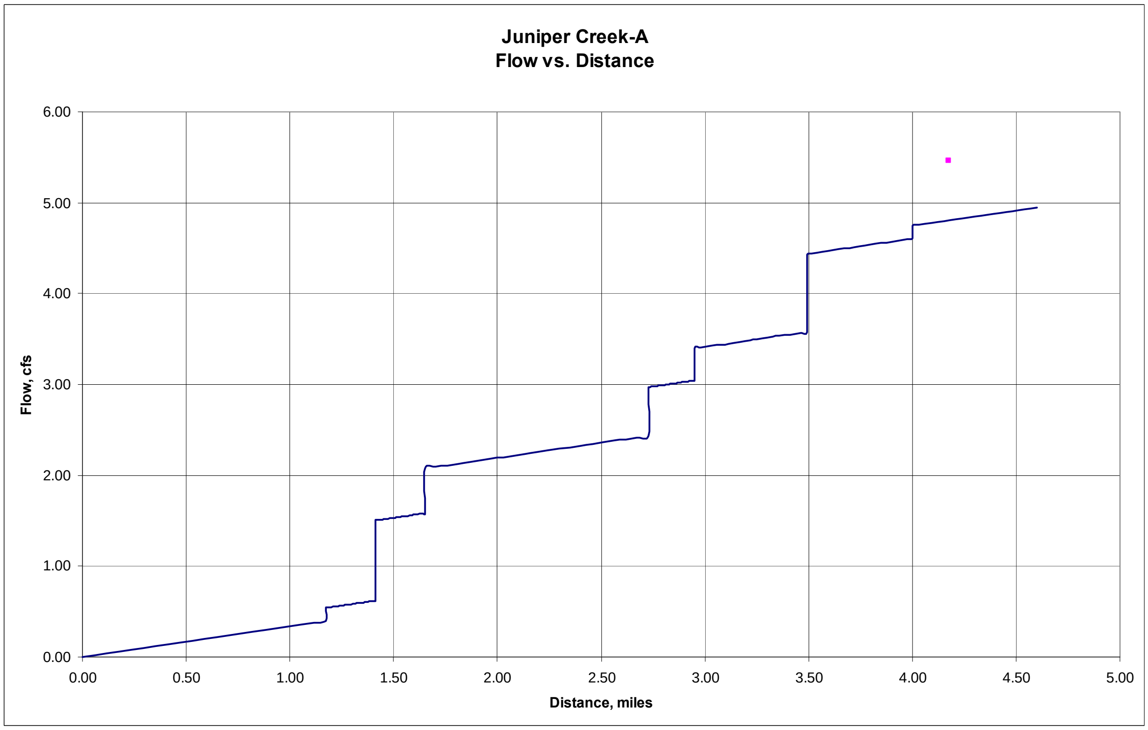
ADEM Model Scenarios, Juniper Creek, WBID 682
Quincy Farms Effluent

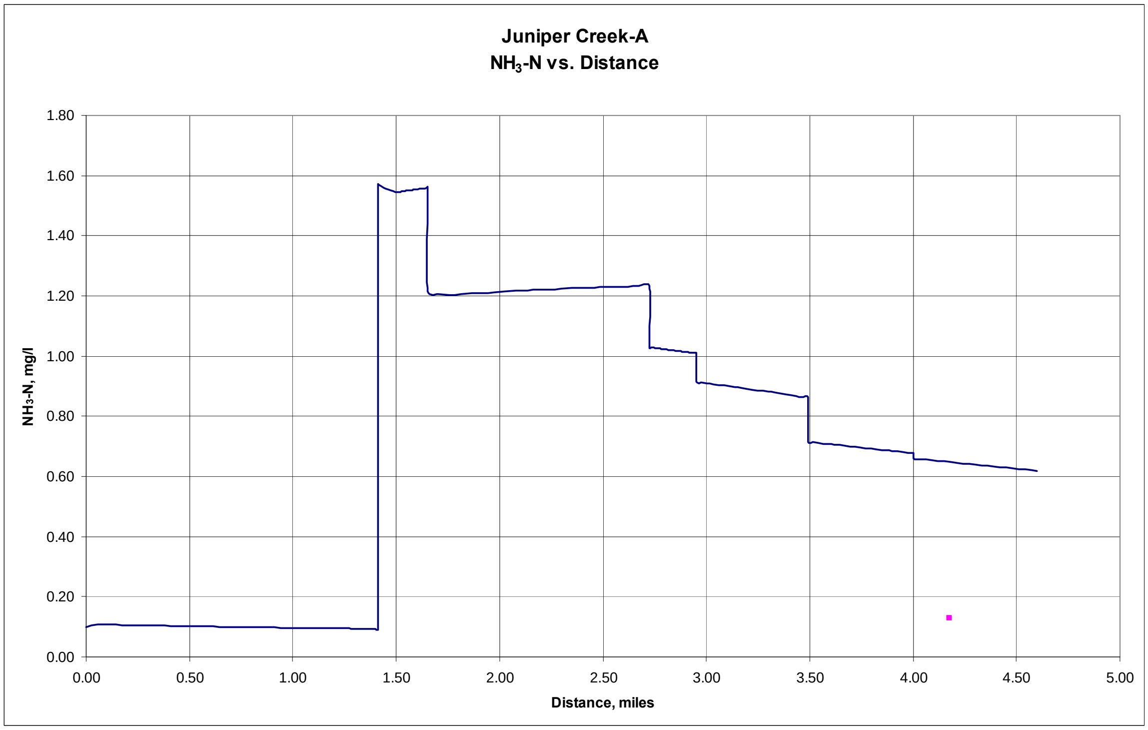
Scenario	Q (mgd)	BOD5 (removal %)	BOD_5 (mg/L)	CBODU (mg/L)	NH3N (mg/L)	ORGN (mg/L)	TKN (mg/L)	DO (mg/L)
A	0.4766	90	131	262	3.1	19	22.1	2
B	0.4766	95	65	130	1.55	9.52	11.07	2
C	0.4766	99	13	26	0.31	1.904	2.214	2
D	0.4766	99	13	26	0.31	1.904	2.214	6
E	0.4766	99.6	5	10	0.3	0.4	0.7	6
F	0.4766	99.9	2	4	0.3	0.4	0.7	6
Q710	0.4766	99	13	26	0.31	1.904	2.214	2

Run A
(See CD for other Run A graphs)



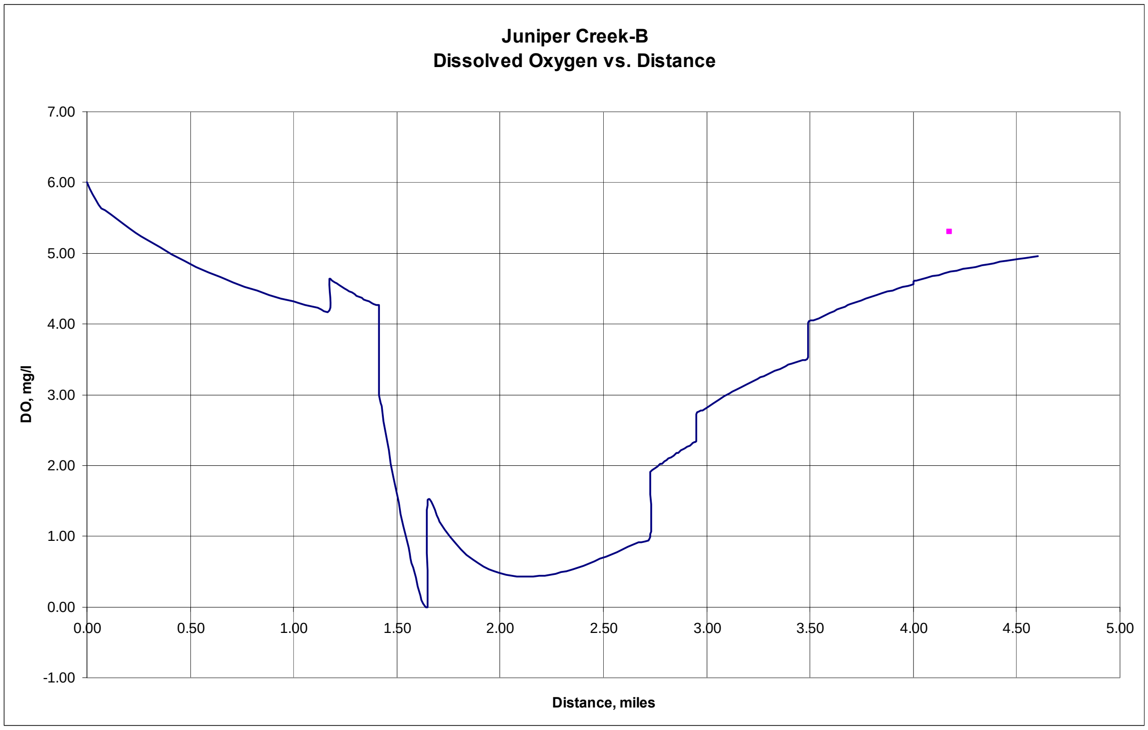

Juniper Creek-A
CBODu vs. Distance
CBODu, mg/l
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Distance, miles

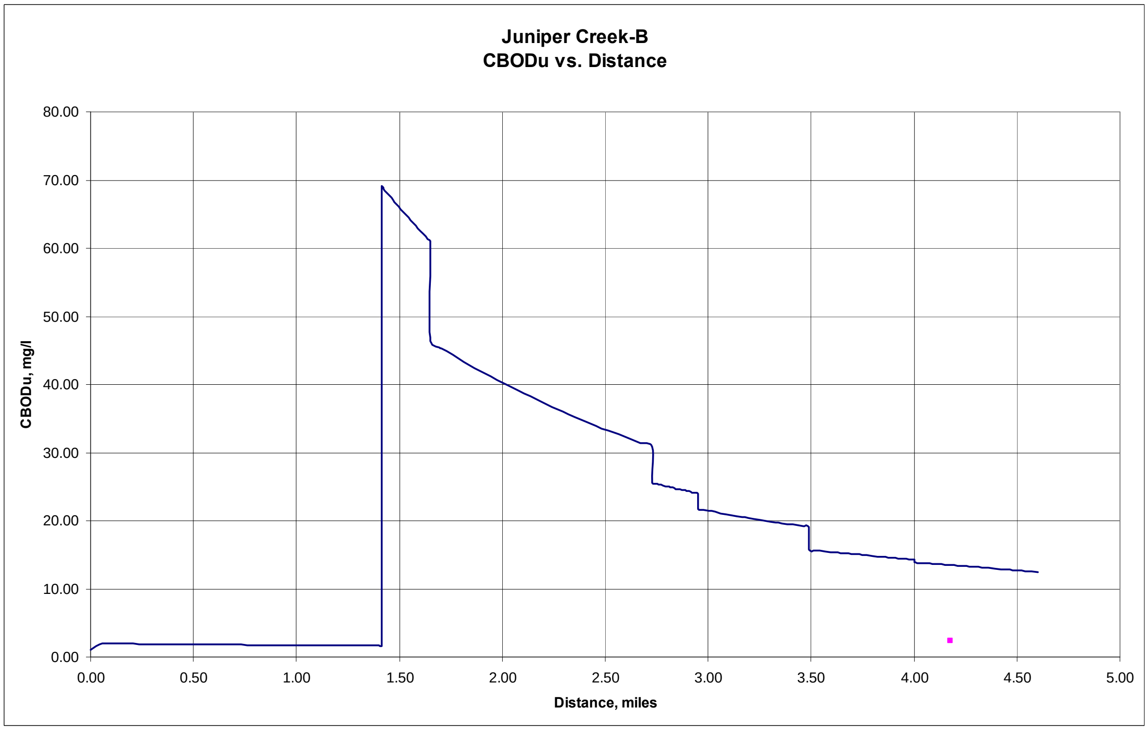

Juniper Creek-A
Flow vs. Distance
Flow, cfs
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Distance, miles

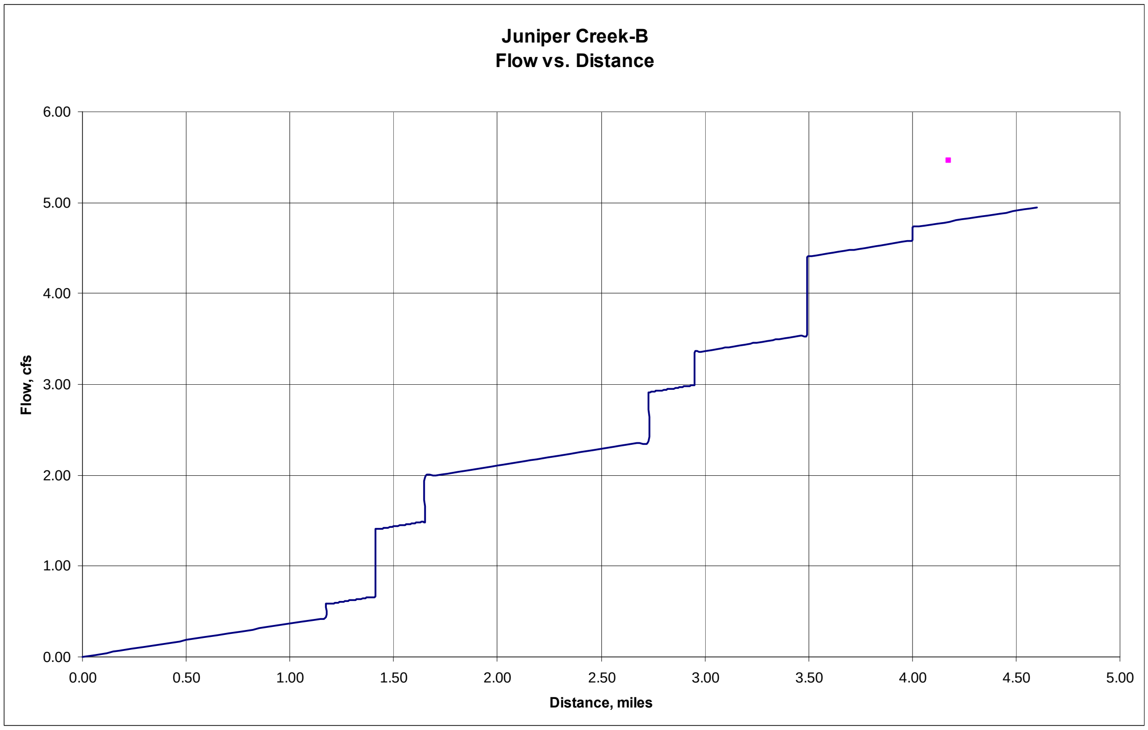

Juniper Creek-A
NH3-N vs. Distance
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
NH3-N, mg/l
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Distance, miles

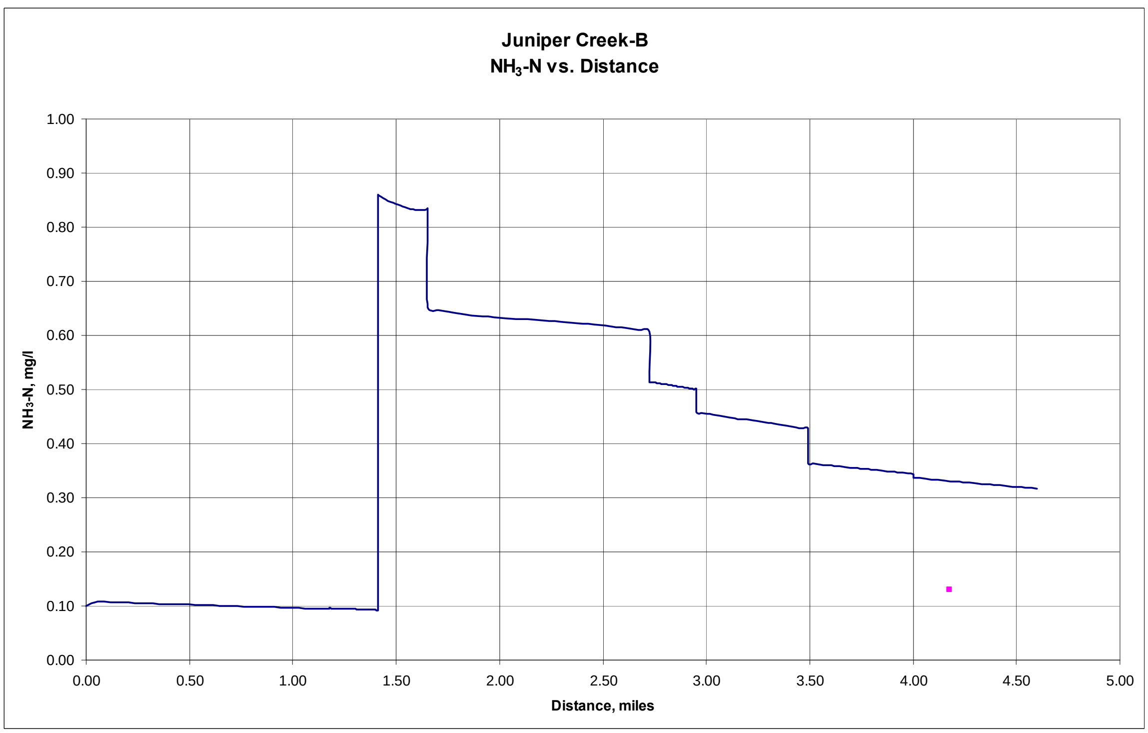
Run B

(See CD for other Run B graphs)

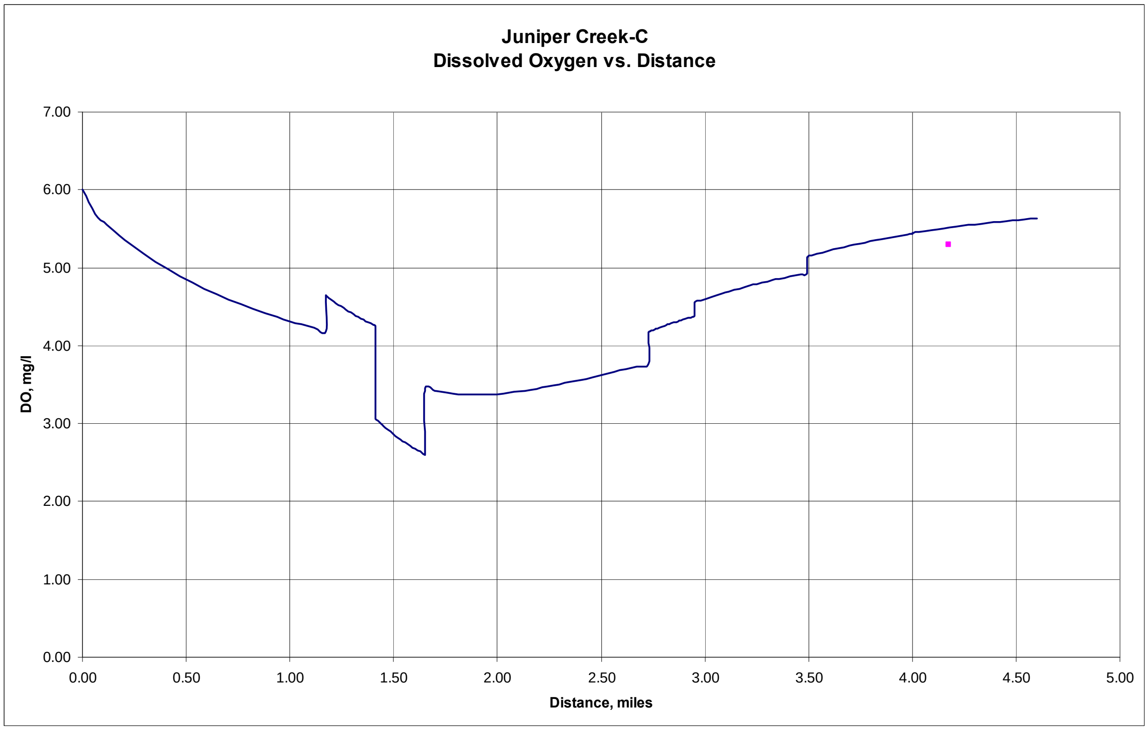


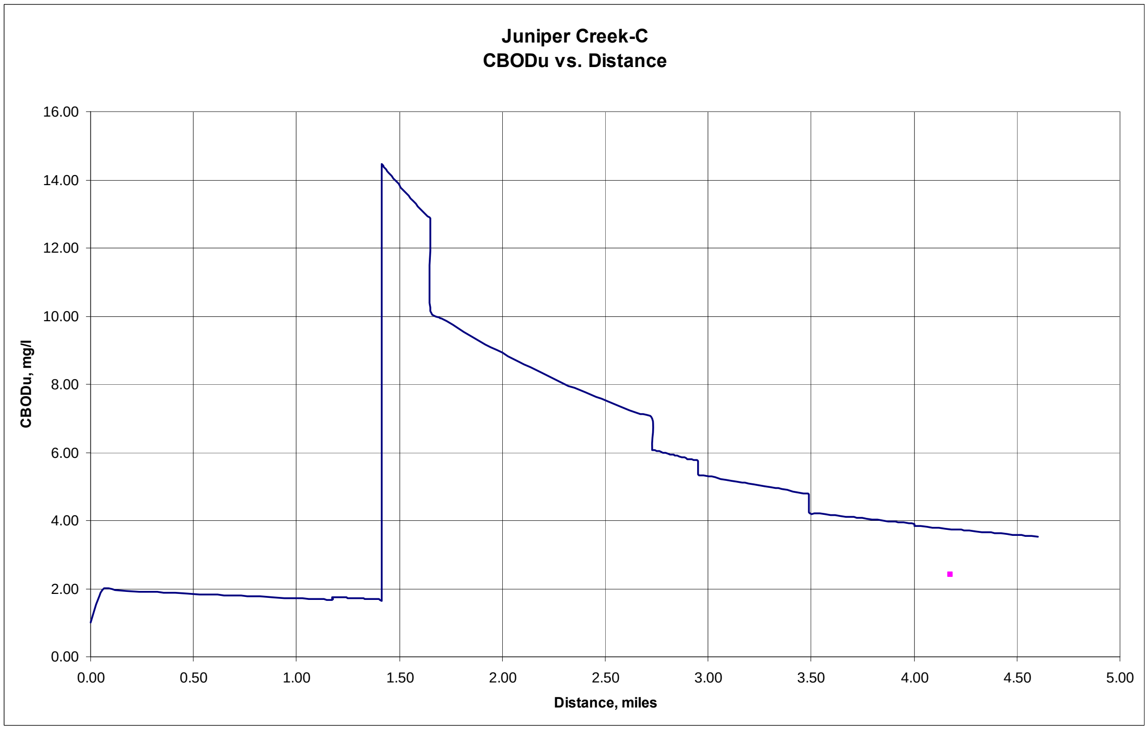


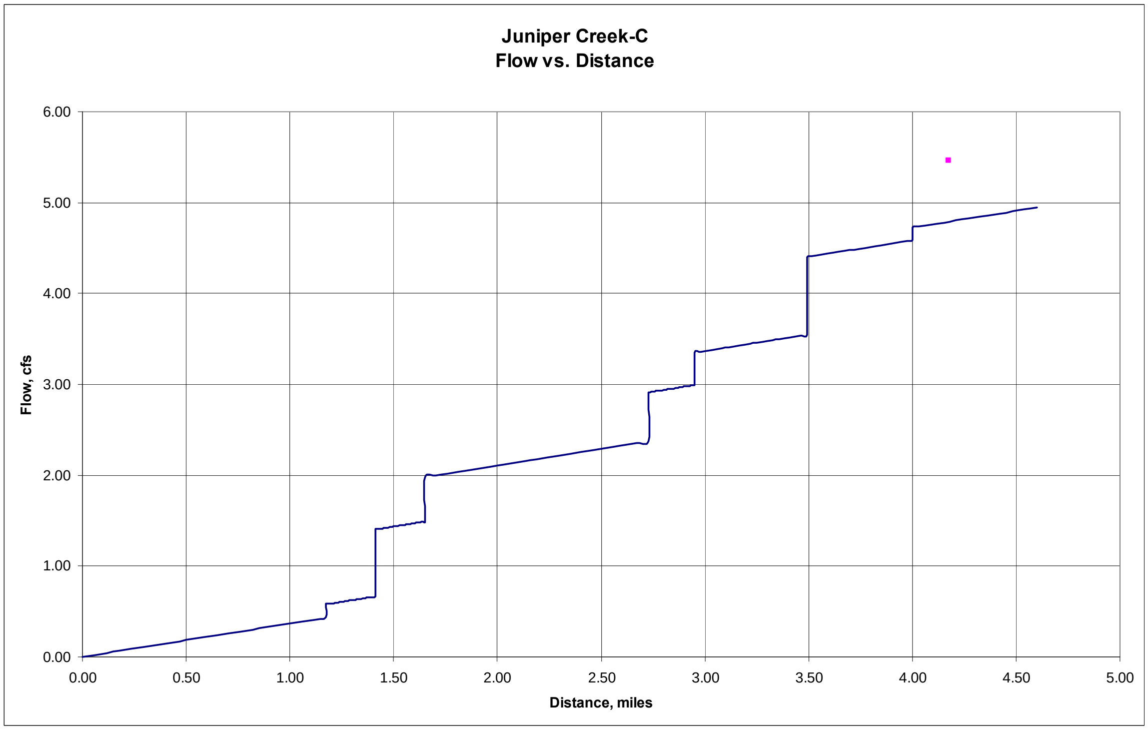

Juniper Creek-B
Flow vs. Distance
Flow, cfs
Distance, miles
0.00
1.00
2.00
3.00
4.00
5.00
6.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00

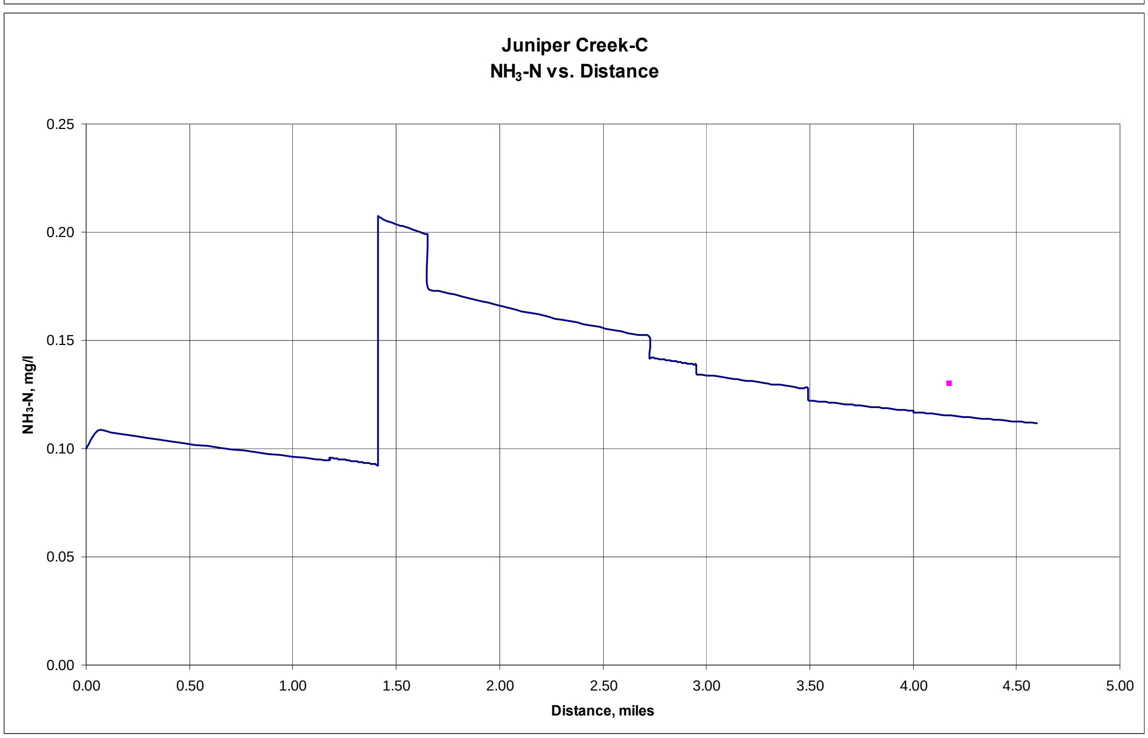

Juniper Creek-B
NH_3-N vs. Distance
NH_3-N, mg/l
Distance, miles
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00

Run C
(See CD for other Run C graphs)

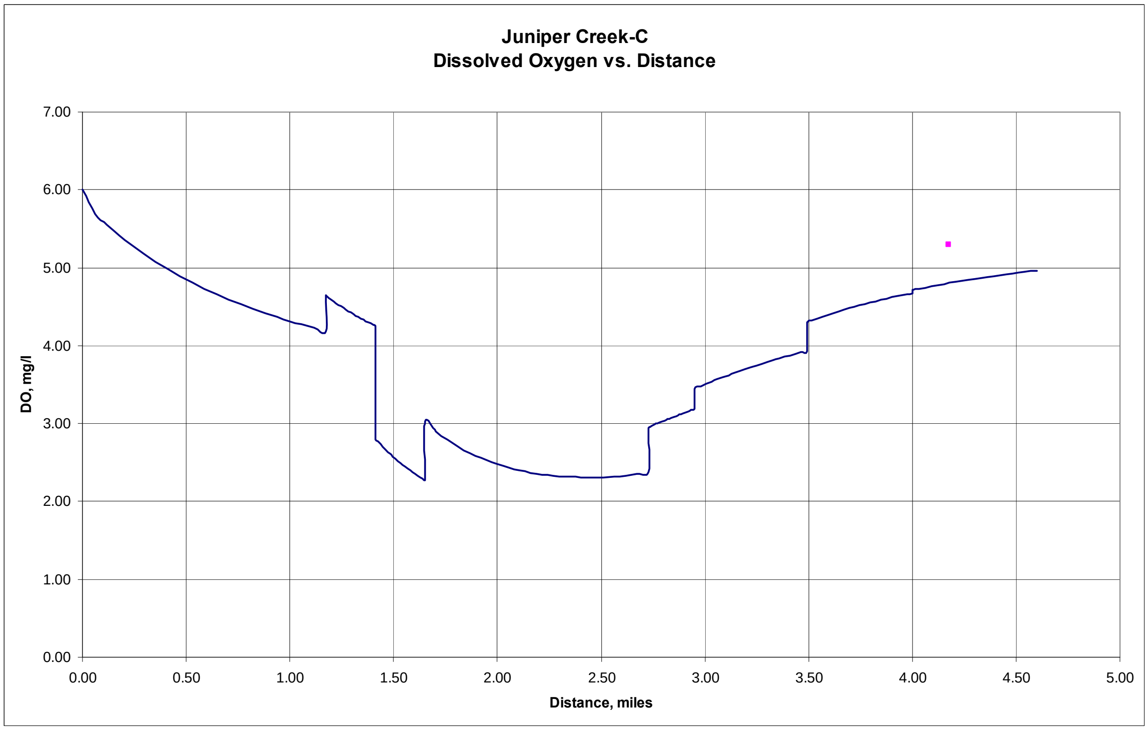


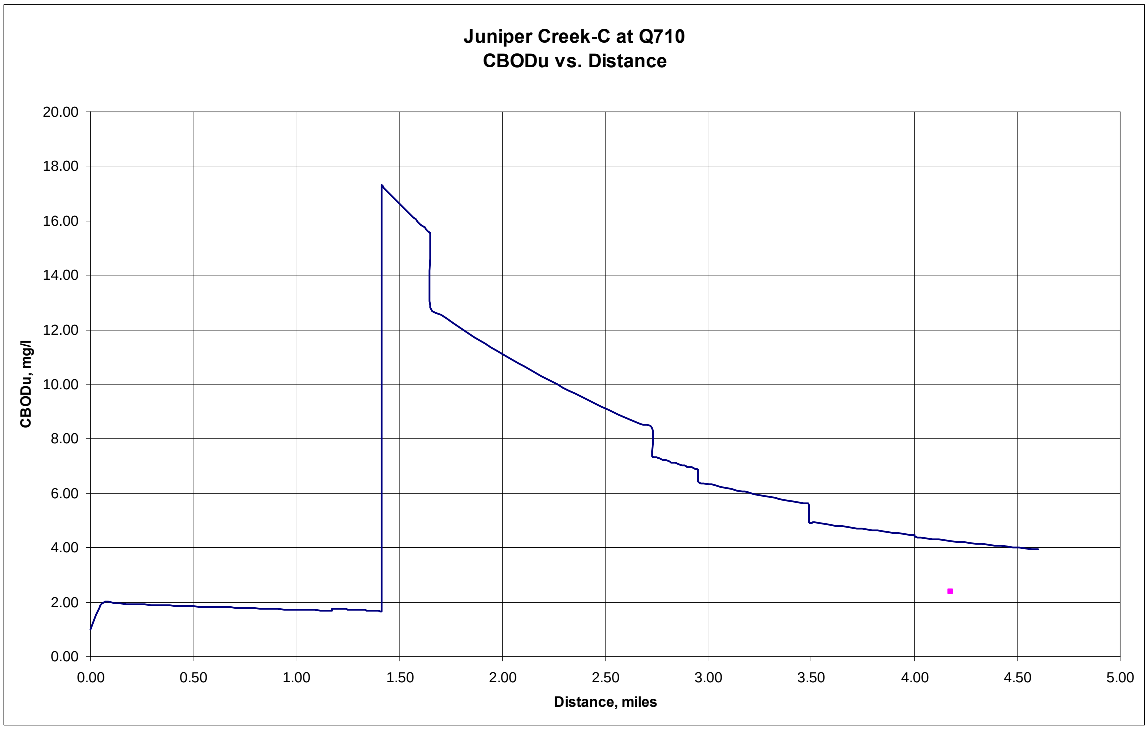


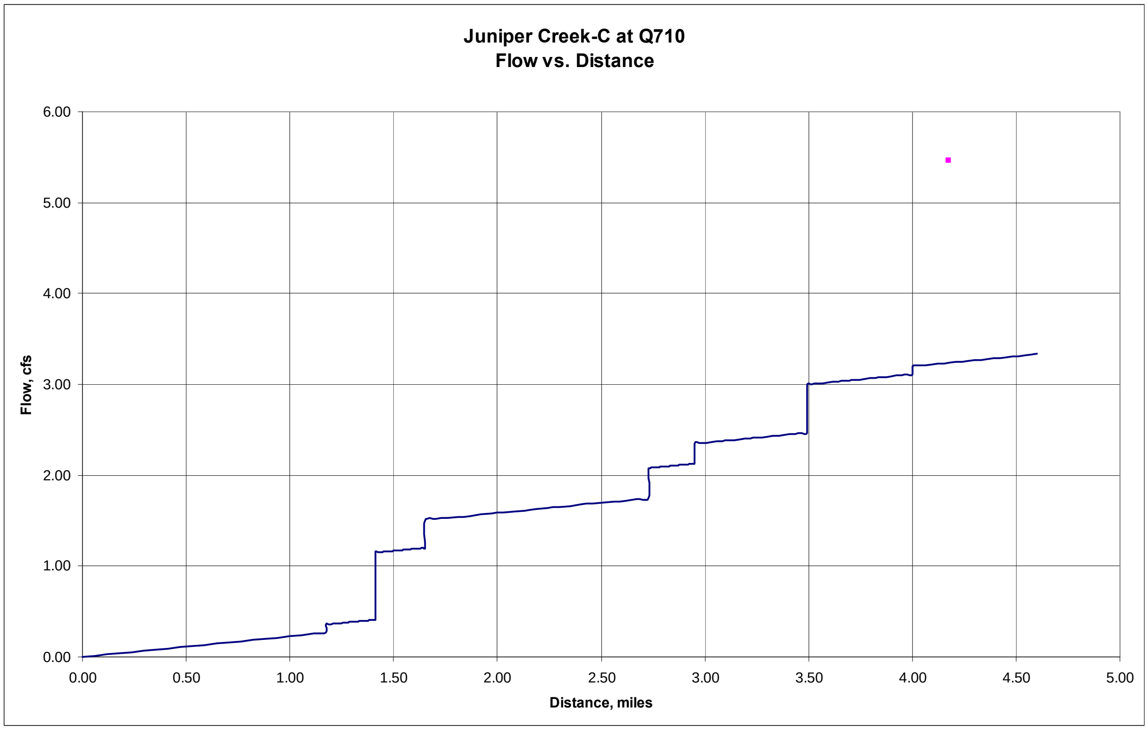

Juniper Creek-C
Flow vs. Distance
Flow, cfs
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Distance, miles


Juniper Creek-C
NH3-N vs. Distance
NH3-N, mg/l
0.25
0.20
0.15
0.10
0.05
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Distance, miles

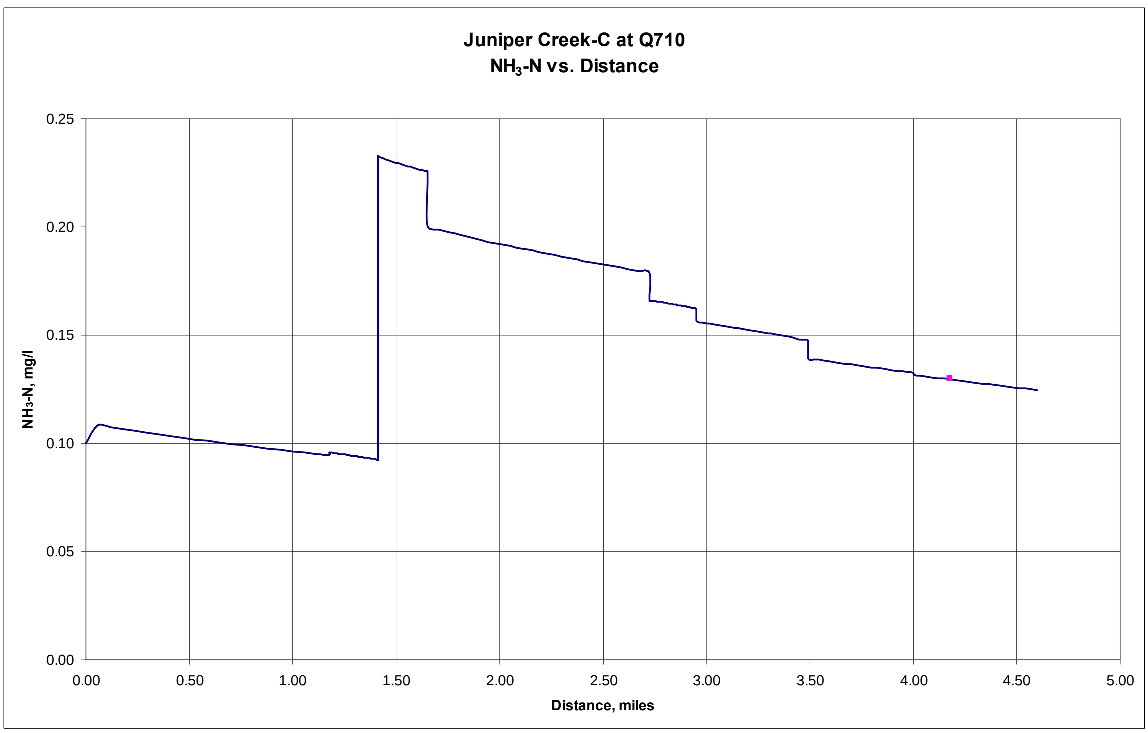
Run C with Q710
(See CD for other Run C with Q710 graphs)







Juniper Creek-C at Q710
Flow vs. Distance
Flow, cfs
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Distance, miles



Juniper Creek-C at Q710
NH_3-N vs. Distance
NH_3-N, mg/l
0.25
0.20
0.15
0.10
0.05
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Distance, miles

Appendix K: Photos of Various Waterbodies in the Juniper Creek Watershed

STA.# 7450 - Long Branch @ SR 274

STA. # 7450 - Long Branch @ SR 274

STA. # 7520 - Juniper Creek @ SR 65A

STA.# 7520 - Juniper Creek @ SR 65A

Trib.25 Yards East of Nicole Rd. - Puddle

Trib. East of Nicole Rd.

STA # 7430 - Trib. 1 East of Nicole Rd.

STA.# 7430 - Trib. 1 East of Nicole Rd.

STA. # 7410 - Trib. 3 East of Nicole Rd.

STA. # 7410 - Trib. 3 East of Nicole Rd.

STA.# 7400 - Trib. 4 East of Nicole Rd.

STA.# 7400 - Trib. 4 East of Nicole Rd.

Trib. 5 just West of SR 65 on SR 65A - Dry

Trib. 5 just West of SR 65 on SR 65A - Dry

Appendix L: Public Comments

-----Original Message-----
From: Mandrup-Poulsen, Jan
Sent: Monday, September 08, 2008 7:53 AM
To: 'junipercreek@pineapp.hcsmail.com'
Cc: Wilcox, Erin G.; Gorham, Bonita
Subject: RE: Draft D.O. TMDL for Juniper Creek WBID 682

Dear Mr. Potts,

Thank you for your e-mail regarding the Department's Total Maximum Daily Load (TMDL) report prepared to address the low dissolved oxygen levels in Juniper Creek (WBID 682), located in Gadsden County. We appreciate getting your information regarding the nursery operations located it the adjoining watershed. Based on your comments, we have added additional language in the report, which will be re-posted on the TMDL web site shortly. In addition, we have successfully completed the rule development process for this TMDL, which is a necessary precursor to initiating the implementation phase, wherein stakeholders will help the Department in developing the list of projects and actions needed to restore Juniper Creek.

We look forward to your continued interest and involvement in restoring Juniper Creek and hope you will help us to protect all of Florida's water resources.

Sincerely,

Jan Mandrup-Poulsen, Administrator
Watershed Assessment Section

-----Original Message-----
From: junipercreek@pineapp.hcsmail.com
[mailto:junipercreek@pineapp.hcsmail.com]
Sent: Monday, July 21, 2008 2:33 PM
To: Mandrup-Poulsen, Jan
Subject: Draft D.O. TMDL for Juniper Creek WBID 682

Dear Mr. Poulsen:

We are sending this e-mail to make a comment in response to the recent draft Dissolved Oxygen TMDL for Juniper Creek WBID 682. We were pleased to see this study is being undertaken on Juniper Creek, which runs along our property in Gadsden County. It looks like a good effort has been put forth to characterize the situation regarding nutrient pollutant loading in the basin. However, we note you did not reference any potential contribution from nurseries in the area which are several hundred acres in size. For instance, a large outdoor plant nursery operates along the north side of Juniper Creek, on either side of Highway 65-A (Juniper Creek Road). This type of operation uses large amounts of fertilizers that may be contributing nutrients (nitrogen and phosphorous) into the creek. We did not see this mentioned in the draft report. We feel this should be considered when developing the final report and the implementation plan. Thank you for considering our comment, and thank you for your efforts on

TMDLs. Please add us to your e-mail distribution list for future developments, including any meetings, regarding this TMDL for Juniper Creek.

Sincerely, Ronald R. Potts
Juniper Creek Road

Florida Department of Environmental Protection
Division of Water Resource Management
Bureau of Watershed Management
2600 Blair Stone Road, Mail Station 3565
Tallahassee, Florida 32399-2400
www.dep.state.fl.us/water/