WATER SEGMENT ASSESSMENT
TROUT CREEK (WBID 1455)

TAMPA BAY TRIBUTARIES (GROUP 2)
HILLSBOROUGH RIVER PLANNING UNIT
HILLSBOROUGH RIVER WATERSHED
HILLSBOROUGH & PASCO COUNTIES, FLORIDA

TAMPA BAY STAKEHOLDERS

MARCH 21, 2011

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1.0 INTRODUCTION

Several water segments in the Tampa Bay area appeared on Florida's 303(d) list in 1998 as impaired for dissolved oxygen (DO) or DO and nutrients. Since that time, The U.S. Environmental Protection Agency (EPA) and the Florida Department of Environmental Protection (FDEP) have developed total maximum daily loads (TMDLs) for the various water bodies, some of which are still in draft form and some finalized by EPA.

FDEP proposed a TMDL for Trout Creek in June 2009 (Kang & Gilbert, 2009). Because FDEP calculated an annual average chlorophyll *a* (Chl *a*) concentration of 20.87 micrograms per liter (µg/L) for 2007, they verified impairment of the system for nutrients. The assessment identified nitrogen as the causative pollutant because Trout Creek is nitrogen limited, and FDEP recommended that a TMDL be developed to restore the stream to its designated use. However, the TMDL proposed in 2009 included load reductions for both total nitrogen (TN) (1,827 pounds per year for wastewater discharges and a 50 percent load reduction from non-point source and stormwater) and for total phosphorus (TP) (341 pounds per year and a 72 percent non-point/stormwater reduction). These load reductions were based on numerical modeling of the system using a watershed model to simulate loadings based on land use, and a hydrodynamic and water quality model to simulate the impacts of the existing and proposed loadings on the system.

Written comments, and comments presented at a September 3, 2009 administrative hearing by various Stakeholders (FDOT, Pasco County, Hillsborough County), raised significant issues with the technical assumptions used in the modeling (ATM, 2010a and ATM, 2010b). Based upon those comments, FDEP postponed finalization of the TMDLs until February 2010. On September 30, 2009, EPA proposed the FDEP TMDL in compliance with its consent decree order. On November 30, 2009, comments similar to those provided to FDEP were sent to EPA. The EPA TMDL was not finalized in March 2010 but remained in draft form. In February 2010, FDEP proposed its revised TMDL based upon the use of local reference stations to define TN and TP targets. The revised TMDL identified an annual reduction of TN of 800 pounds from point-source and 33.3 percent reduction from non-point source and Municipal Separate Storm Sewer System (MS4) dischargers. For TP, a 411 pound point sources and 1.4 percent reduction non-point and stormwater source

reduction was proposed. The in-stream targets identified for TN and TP through this effort were 0.87 milligrams per liter (mg/L) and 0.181 mg/L, respectively.

1.1 PURPOSE OF REPORT

In February of 2010 local Stakeholders filed a challenge on the Trout Creek TMDL proposed by FDEP. Through negotiations, the challenge was put in abeyance while the local Stakeholders worked with FDEP to identify a resolution pathway. A Memorandum of Agreement (MOA) was developed in cooperation with FDEP and EPA that outlined a path forward for resolution. The MOA was developed through multiple coordination meetings and a site-visit to Trout Creek by representatives of the local Stakeholder group, FDEP, and EPA. The MOA is included as Appendix A.

The first step under the MOA is the development of a Water Body ID (WBID) Assessment Report. The report provides an assessment of the water segment using available water quality, land use, hydrologic, and biological data to examine its impairment status with special emphasis on DO and nutrients. It is intended to provide additional information to assist FDEP and local stakeholders in determining an appropriate path forward relative to future management and/or restoration of this water body. The potential paths forward include the following or some combination of the following:

1. TMDL for nutrients and/or biochemical oxygen demand (BOD) with potential for revised DO target using regional DO criteria
2. Class III Limited re-designation
3. Physical or habitat restoration
4. TMDL not needed (TNN)

For water bodies that have significant historical physical modifications, it may be determined that trying for a Class III Limited designation may be the appropriate path forward. In those cases, where the water body is impaired for the state's DO standard, but the water quality data do not show a strong connection of DO response to nutrients or BOD, the water body may be considered TNN status under Category 4. In those cases where the DO condition can be traced to past significant physical disturbances to the water body and it is expected that restoration activities will make the water body attain its designated use, physical restoration will be recommended. Finally, where data indicate that load reductions will

achieve restoration of the designated use of the water body, then the path to an appropriate final TMDL will be defined.

This document presents the pathway forward for Trout Creek (WBID 1455). The MOA between the FDEP and Stakeholders included specific work tasks to guide the determination. As outlined in the MOA, these analyses include the following:

- Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values.
- Compare low DO values and other key water quality factors within Trout Creek against data from adjacent WBIDs with low DO that are currently not listed as impaired.
- Examine the high Chl *a* measurement to try to determine the potential cause of the apparent anomalous measurement.
- Look at other data that may be available upstream to determine if there are distinct differences in the upstream and downstream conditions to decide if splitting the WBID makes sense.
- Examine biological data, where available, to determine level of biological health.
- Examine more recent data from the Environmental Protection Commission of Hillsborough County (EPCHC) to see conditions in recent years. Specifically, examine if there are 3 consecutive years after 2007 that are below the impairment threshold to support a delisting for nutrients.
- Provide a WBID Assessment Report outlining the path forward with any future timelines.

1.2 CHARACTERIZATION OF WATER SEGMENT

1.2.1 BASIN AND STREAM ENVIRONMENT DESCRIPTION

The Trout Creek water segment (WBID 1455) is located in the Hillsborough River Watershed in Hillsborough and Pasco Counties, Florida. It has been placed in the Hillsborough River Planning Unit, which is part of the Tampa Bay Tributaries Assessment Group. This group is assessed as part of FDEP's Group 2 and is currently in its third cycle (1/1/2006 – 6/30/2013). Figure 1-1 provides the location of the Trout Creek segment within the Hillsborough River Planning Unit.

Trout Creek is defined as a perennially flowing tributary to the Hillsborough River, however, periods of measured no flow are not uncommon. It is classified by FDEP as a Class III Freshwater. In the 2010 TMDL document (Kang & Gilbert, 2009), FDEP reports that the Trout Creek watershed encompasses approximately 14,960 acres (Figure 1-2). The stream is similar to other blackwater streams that are found throughout Florida and the southeastern United States. These types of systems are characterized by mild slopes, high summertime temperatures, large changes in seasonal flow patterns, high allochthonous inputs (such as leaf litter), and extensive floodplain inundation during high rainfall periods. Streams of this type are also often characterized by large variations in DO and observations below state water quality standards (especially in low flow and summertime conditions) (Todd et al., 2009).

The stream is narrow and shallow and gently winds through hardwood swamp. The tree canopy is nearly complete along its course with few areas of open water visible from aerial photography. Figure 1-3, at the SR 581 bridge where the majority of water samples have been collected, is typical of the system, with the stream channel barely visible and only at the bridge, where it has been modified.

1.2.2 LAND USES

2009 land use data were retrieved from the shape file library of Southwest Florida Water Management District (SWFWMD, 2011) and used to prepare Figure 1-2 and Table 1-1. SWFWMD derived the classifications using the Florida Land Use and Cover Classification System (FLUCCS). The features were photointerpreted by SWFWMD at 1:8,000 using 2009 1-foot color infrared (CIR) digital aerial photographs. The FLUCCS and the SWFWMD's photo interpretation methodology are described in their Photo Interpretation Key (SWFWMD, 2010). The predominant land uses (59 percent) are natural (8,758 acres), including nearly 2,700 acres of undeveloped open lands, 1,100 acres of upland forest, and 5,000 acres of wetlands and water. The more disturbed uses are dominated by residential (3,095 acres; 21 percent) and agriculture (917 acres; 6.1 percent), which is primarily in crops and pasture land (804 acres; 5.4 percent). The riparian buffer is typically expansive and appears largely undisturbed. No phosphate mines or concentrated animal feeding operations are indicated in the watershed.

Table 1-1. Classification of Trout Creek Watershed Land Uses in 2009

FLUCCS CODE	FLUCS DESC	Acres	% of Total
1100/1200/1300	RESIDENTIAL	3,095	20.7
1400/1500/1700	COMMERCIAL/INDUSTRIAL/INSTITUTIONAL	837	5.6
1600	MINING	0	0.0
1800	PARKS AND GOLF	519	3.5
1900/2600/3000	UNDEVELOPED AND OPEN LANDS	2,677	17.9
2100	CROPLAND AND PASTURELAND	804	5.4
2200	TREE CROPS	112	0.7
2300	FEEDLOTS	0	0.0
2400/2500	SPECIALTY FARMS	1	0.0
4000	UPLAND FOREST	1,114	7.4
5000	WATER	749	5.0
6000	WETLANDS	4,218	28.2
7000	DISTURBED LAND	28	0.2
8000	TRANSPORTATION AND UTILITIES	804	5.4
	TOTAL	14,959	100.0

Notes: FLUCCS determinations made by SWFWMD using 2009 1-ft color infrared photography. Combinations shown in the table were completed by ATM.

Source: SWFWMD, 2011.

1.2.3 CLIMATE AND SOILS

The Trout Creek watershed has a sub-tropical climate, with an annual rainfall of 45 inches. The average summer temperature is 89.9 degrees Fahrenheit (°F) and the average winter temperature is 72.8°F. The ecoregion is located in the Southwestern Florida Flatwoods and has elevations ranging from 30 to 40 feet above sea level in the downstream portion and 80 to 90 feet above sea level in the upstream areas. Soils are predominantly composed of medium fine sands and silts. There are no major human population centers in the watershed.

1.2.4 HYDROLOGY

The Trout Creek water segment (WBID 1455) is identical to the U.S. Geological Survey (USGS) Trout Creek Watershed (HUC 0310020563), which is contained in the Hillsborough Hydrologic Unit (03100205). The USGS monitors stream flow and stage on Trout Creek at Station 02303350 (Trout Creek near Sulphur Springs) in Hillsborough County, which includes a drainage area of approximately 23 square miles. The gauge is located at the

SR 581 bridge crossing (see Figure 1-4) 4.1 miles upstream of the confluence with the Hillsborough River. The gauge is monitored in cooperation with the SWFWMD and the City of Tampa. The period of record includes miscellaneous high-water discharge measurements in September 1962, discharge measurements and crest-stage partial records from February 1964 to November 1966. From December 1966 to May 1974, the gauge measured discharge only. From June 1974 to the present, the gauge measured both stage and discharge.

Average annual daily flow is approximately 20 cubic feet per second (cfs) over the period of record, but there is considerable variability ranging from 2.1 cfs in 1977 to 85.7 cfs in 1998, with a standard deviation of 17 cfs (Figure 1-5). The median flow value of 16 cfs suggests significantly more low flow years over the period of record than high ones.

Additionally, there is considerable seasonal variation in stream discharge that follows local rainfall patterns with flows being reduced significantly in late spring. Over the period of record, there is no flow in the stream for 14 percent of monthly daily average values with the bulk of these no flow periods occurring in May and early June (Figure 1-6).

1.2.5 ASSESSMENT HISTORY AND STATUS

Trout Creek was delisted from the 1998 303(d) list in Cycle 1 (2001 to 2006), but in Cycle 2 (2007 to 2012), the FDEP verified the stream as impaired for DO citing TN as the causative pollutant.

Because the modeling effort was limited in many respects, including its ability to simulate the hydrodynamics of the system, the Tampa Stakeholders provided comments to FDEP detailing the problems with the model and model approach, and provided recommendations for correcting the simulation to better assess the need for load reductions. Additionally, several factors suggested that the observed DO concentrations in Trout Creek are largely its natural condition, and that this system is typical of other low-flow blackwater streams in the southeastern United States.

In 2010, the FDEP completely revised the TMDL proposal and abandoned the use of numerical simulations to develop nutrient load reductions. The currently proposed TMDL still requires load reductions to both TN (800 pounds per year from wastewater treatment

and a 33.3 percent reduction of non-point source and stormwater loads) and TP (411 pounds per year from wastewater treatment and a 1.4 percent reduction from non-point/stormwater) based on a reference stream approach.

1.2.6 SOURCE ASSESSMENT

The way nutrients and oxygen-demanding substances enter the Trout Creek watershed can be grouped as either point sources or non-point sources. As typically defined, point sources are discharges to surface or ground water that originate from discrete, well-defined areas such as a facility discharge from the end of a pipe, through a ditch or over a weir; but other discrete applications of known constituents like sprayfield applications are also considered point sources. Point sources are usually divided into two types: domestic wastewater (treatment plant discharge that originates from wastewater from homes, businesses, and institutions) and industrial wastewater (process water discharge, runoff, leachate, etc., from industrial processing, handling, or storage facilities). Although stormwater discharge from non-industrial sites can be classified as a point source, it is usually considered with non-point sources because of practical considerations involved in measuring loads and loading points.

Non-point sources all originate from precipitation water. Stormwater runoff contains nutrients and oxygen-demanding substances deriving from atmospheric deposition and the entrainment of nutrients from human activities such as fertilizer application and land disturbance, but also from natural sources from the watershed's soils and organic constituents. While nutrient loads from soils (particularly phosphorus) and organic matter (decaying plant and animal material, leaf litter, etc.) are not entering the watershed from outside its boundary, the nutrients entrained by the stormwater enter and affect the streams nonetheless. After entrainment, nutrients and oxygen-demanding substances enter the stream course either by direct surface runoff or through the groundwater.

An additional source of nutrients and oxygen-demanding substances that can enter the stream are called legacy sources. While properly a subset of non-point or even point-source loading, this category usually focuses on fertilizer or pollutants from past land uses or operations that would not be quantified in an analysis that only examined current point sources by reviewing National Pollutant Discharge Elimination System (NPDES) permits or

current land uses in the watershed. For example, long-term farming operations may have applied fertilizers that remain in the soil profile, but slowly leach to groundwater over time.

1.2.6.1 Point Sources

Permitted point sources to the Trout Creek water segment are described in detail by FDEP in the 2009 Fecal Coliform TMDL document (Laskis & Tyler, 2009) and is summarized here. The only significant discharger of nutrients and BOD is a domestic wastewater treatment facility (WWTF) serving the Pebble Creek Village community. The Pebble Creek Village WWTF maintains an active NPDES permit with monitored discharge (FL 0039896). The facility has a three months average daily flow (3MADF) of 0.4 million gallons per day (mgd) and it is located on 10210 Regents Park Drive, Tampa, Florida.

Part III of Chapter 62-610, Florida Administrative Code (F.A.C.) sets the standards for public access reuse systems. Effluent from the Pebble Creek Village WWTP that meets Part III quality standards is transferred to the Pebble Creek Golf Course for reuse. The plant is also permitted for the disposal of complying effluent to Trout Creek through a 12-inch-diameter pipe with no diffuser. FDEP (Kang & Gilbert, 2009) estimated the maximum permitted loads of nutrients to be approximately 10.01 pounds per day (lb/day) for TN and 3.34 lb/day for TP. Stormwater storage ponds for Part III reclaimed water stored in the Pebble Creek Golf Course's stormwater storage lake system also intermittently discharge to Trout Creek.

Domestic wastewater influent contains phosphorus and nitrogen compounds and other potentially oxygen-demanding substances that must be treated before discharge back to the environment. Much of the nitrogen is removed from domestic wastewater by a process that involves breaking down the nitrogen-containing organic compounds to ammonia and conversion of the ammonia through biological oxidation to nitrate that is then followed by denitrification to nitrogen gas that is released to the atmosphere. As the process is not 100 percent efficient, TN is released to the stream primarily as inorganic nitrogen compounds (primarily nitrate followed by ammonia and organic forms). Phosphorus is typically removed from domestic wastewater either through a biological process of select bacteria that take up large quantities of phosphorus into their cells. Then this biomass is separated from the treated water or through precipitation with iron or aluminum salts or lime. The phosphorus not removed by these processes is discharged under permit primarily as dissolved orthophosphate.

The stormwater collection systems in the Trout Creek water segment are owned and operated by Hillsborough County (#FLS 000006), Pasco County (#FLS 000032), the City of Tampa and the Florida Department of Transportation (FDOT) in conjunction with FDOT and are covered by Phase I MS4 permits. MS4-permitted dischargers of stormwater from roadways, medians and natural areas managed under the MS4 permits generate loads through atmospheric deposition, transport of materials like fertilizer, and more natural sources such as phosphorus from soils and nitrogen from plant material. Stormwater treatment systems remove much of the nutrient influent, but removal efficiencies are incomplete so discharges from treatment ponds can be expected to contain nitrogen in both organic and inorganic forms and dissolved orthophosphate. Most particulate phosphorus is expected to settle and remain in the ponds.

1.2.6.2 Legacy Sources

No significant legacy sources of potential oxygen-demanding substances were found in the Trout Creek basin. Land use change has primarily been the conversion of rangeland and pasture land to urban residential, which have similar loading characteristics in the literature in terms of TN, TP, and BOD. However, nitrogen loads from urban residential sources tend to be more bioavailable forms of nitrogen than pasture land (inorganic versus organic sources), depending on fertilizer practices.

1.2.6.3 Non-Point Sources

Non-point sources are expected to be the largest contributor of anthropogenic nutrients to the Trout Creek water course and its surrounding wetlands. Nutrient enrichment can occur through direct and treated stormwater runoff to the creek from surrounding lands and roadways; the leaching of nutrients from residential, commercial, agricultural, and even natural forested systems to groundwater that will eventually reach the creek; and through atmospheric deposition. Atmospheric deposition is a major contributor of nutrients to the watershed (especially nitrogen). FDEP (2005) estimated the average annual atmospheric load of TN and TP to the surface area of Tampa Bay to be 1,094 tons of TN and 259 tons of TP or over 17 percent of the total nitrogen load to the bay from all sources. Assuming that the Trout Creek watershed experiences similar local depositional characteristics, atmospheric deposition can be expected to account for a load of 75 tons of TN and 18 tons of TP annually to the land and water are of the basin.

The diffuse loading from stormwater runoff is typically estimated by using a watershed model to simulate the loading to the stream from stormwater and groundwater sources as it moves from the point of precipitation to the stream course. The models are typically geographic information system (GIS) based programs that utilize many different factors (called coverages) developed as GIS layers. These include land uses, soils, climate, topography, and hydrology of the watershed. Each of the watershed land uses can be assigned a loading value typical of that land use. These values are often expressed as estimated maximum concentrations (EMCs) that have been developed from measurements taken from past storm events. There is a growing literature of EMC values for various land uses that can be used for screening or estimation purposes as long as the researcher is careful to assess the appropriateness of the chosen literature value and ensure that is comparable to the subject site. The U.S. Army Corps of Engineers (USACE) reviewed the available literature in 2004 (Lin, 2004). However, if the watershed model is intended to accurately assess loads to the stream (for example, to establish a TMDL), then it is important to use regionally or locally derived values through measurement. As Lin (2004) states, "[I]f accurate pollutant estimates are required, researchers should look into obtaining (or generating their own) local coefficients/concentrations for their area of interest."

For the purposes of comparison between land use types and to assess potential sources of excess nutrients or oxygen-demanding substances in the Trout Creek watershed, typical ranges of EMC values derived literature are provided in Table 1-2 (Harper & Baker, 2007 & Harper, 1998).

Table 1-2. Typical EMC Values for Trout Creek Land Uses Derived from the Literature (mg/L)

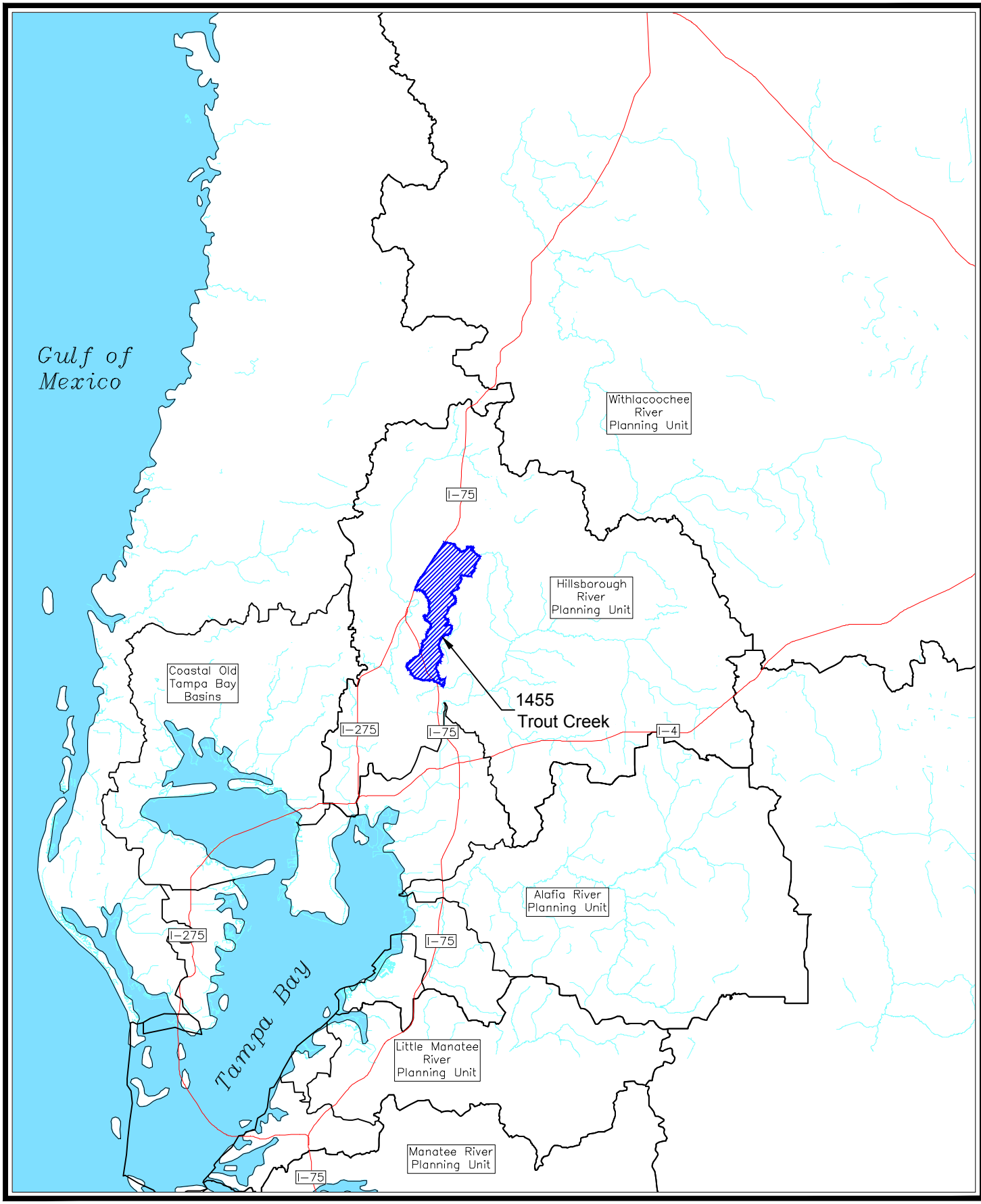
FLUCS DESC	TN	Ortho-P	TP	BOD
RESIDENTIAL	1.61 – 2.32	0.08 – 0.27	0.19 - 0.52	4.7 – 11.3
COMMERCIAL/INDUSTRIAL/INSTITUTIONAL	1.18 – 2.40	0.03 – 0.33	0.18 – 0.35	7.6 – 11.3
MINING	1.18	0.07	0.15	7.6
PARKS AND GOLF	1.25	0.05	0.11	1.6
UNDEVELOPED AND OPEN LANDS	1.15	0.05	0.06	1.4
CROPLAND AND PASTURELAND	2.65 – 3.47	0.09 0.40	0.59 – 0.62	5.1
TREE CROPS (citrus)	2.24	N/A	0.18	2.6
SPECIALTY FARMS	N/A	N/A	N/A	N/A
UPLAND FOREST	1.15	0.05	0.06	1.4
WATER	1.25	0.05	0.11	1.6
WETLANDS	1.60	0.13	0.19	4.63
DISTURBED LAND	N/A	N/A	N/A	N/A
TRANSPORTATION AND UTILITIES	1.64	0.14	0.22	5.2

Notes: Values are stormwater runoff EMCs and are provided in mg/L
Source: Harper & Baker, 2007; Harper, 1998

For the Trout Creek system, where less than 27 percent of the land uses are residential or commercial and agricultural uses are approximately 6 percent, most of the nutrient and BOD loading to this system is expected to come from direct atmospheric deposition to the water surfaces, wetlands exports (high in organic nitrogen and BOD), and runoff from open lands and forest areas.

Nutrients will also enter the Trout Creek watercourse from groundwater sources or baseflow. Both natural and anthropogenic sources of nutrients will leach through or from the soils over time and be carried to the stream with the surficial groundwater. For this watershed, human sources include agricultural fertilizer applications, residential fertilizer applications, and nutrients from septic tanks. While the impact from nutrients from properly functioning septic systems is often overstated, like domestic wastewater treatment plants, these autonomous wastewater treatment systems are not 100 percent efficient treaters of residential waste. Like centralized systems, the most mobile nutrients and nutrient forms will eventually reach the creek with groundwater. Most of the influent phosphorus is retained in the septic system through settling and is eventually pumped and disposed of. Studies have also shown that the vast majority of the soluble phosphorus leaving the septic tank is retained in the soil (depending on soil type). Nitrogen removal by typical septic systems is less efficient. Most of the organic sources and ammonium can be expected to be retained in the soils, but

nitrate can move quickly through soils as leachate and be carried to the stream with the groundwater.



11-2213 Tampa TMDL - Location Maps.dwg Trout 2/25/2011 10:38 AM

Figure 1-1
Location Map - Trout Creek (1455)

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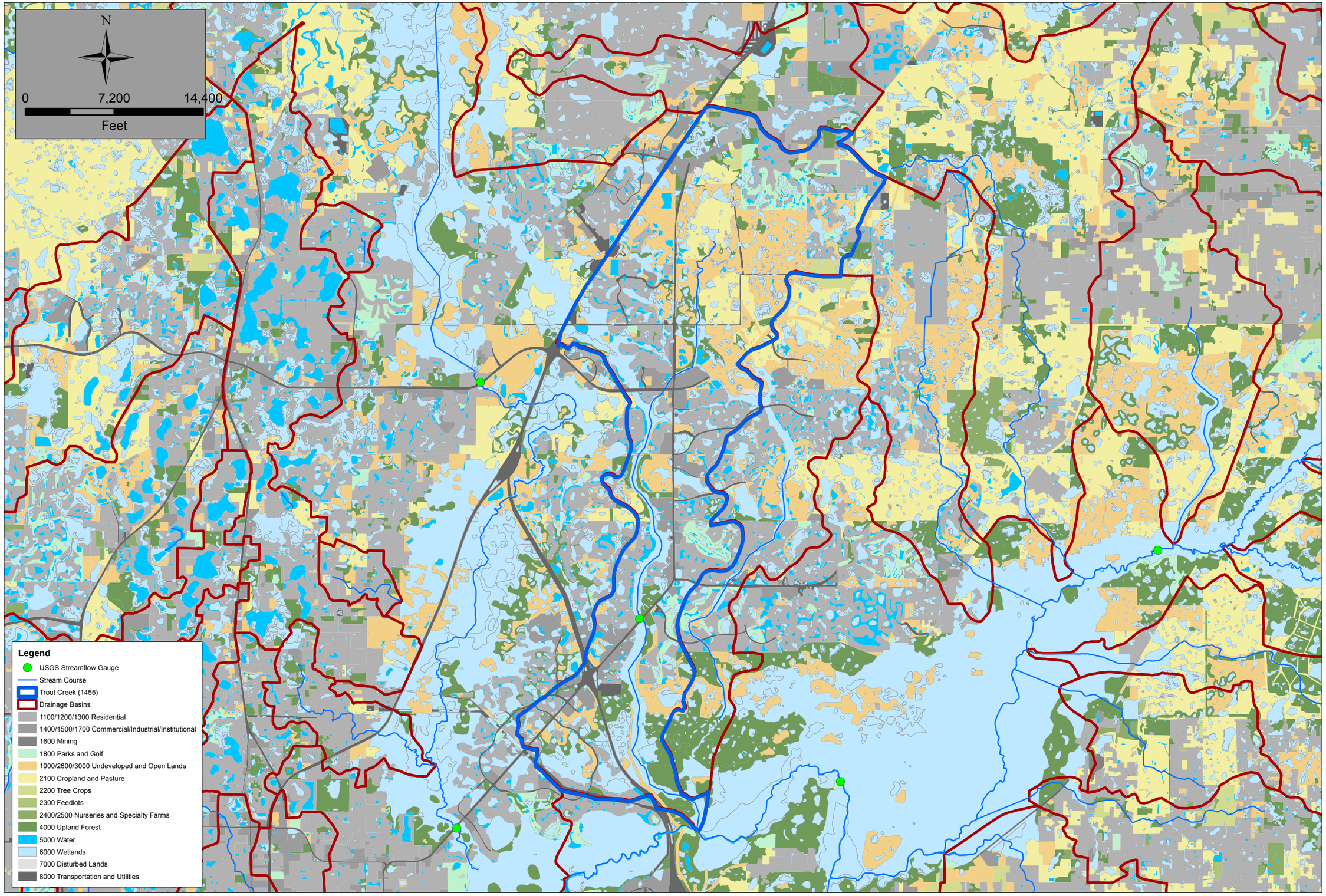

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APPLIED TECHNOLOGY & MANAGEMENT

Figure 1-2
WBID Land Uses - Trout Creek (1455)

Figure 1-3
Trout Creek Tree Canopy

APPLIED TECHNOLOGY & MANAGEMENT

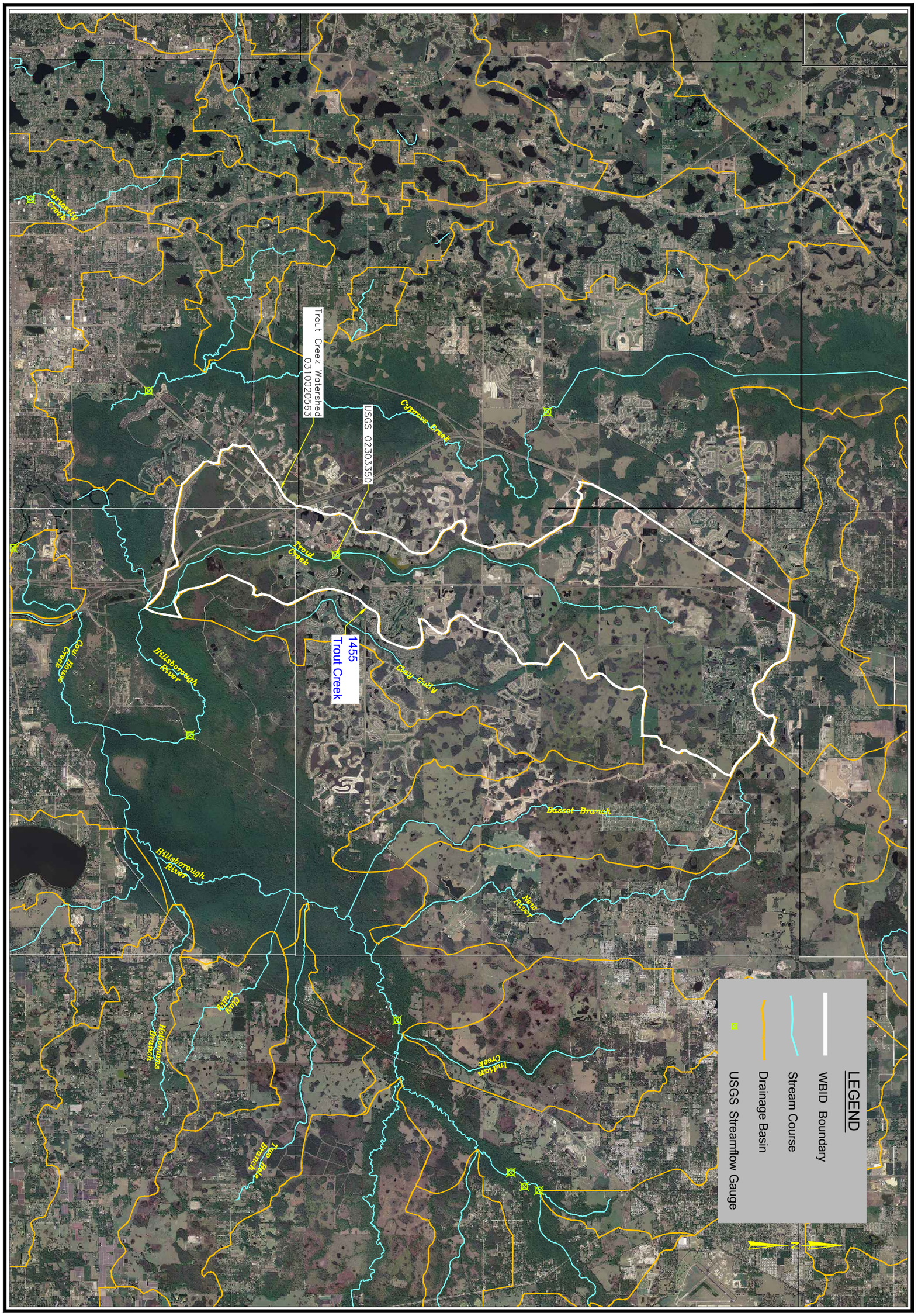

Figure 1-4
Hydrology and Basins - Trout Creek (1455)

APPLIED TECHNOLOGY & MANAGEMENT

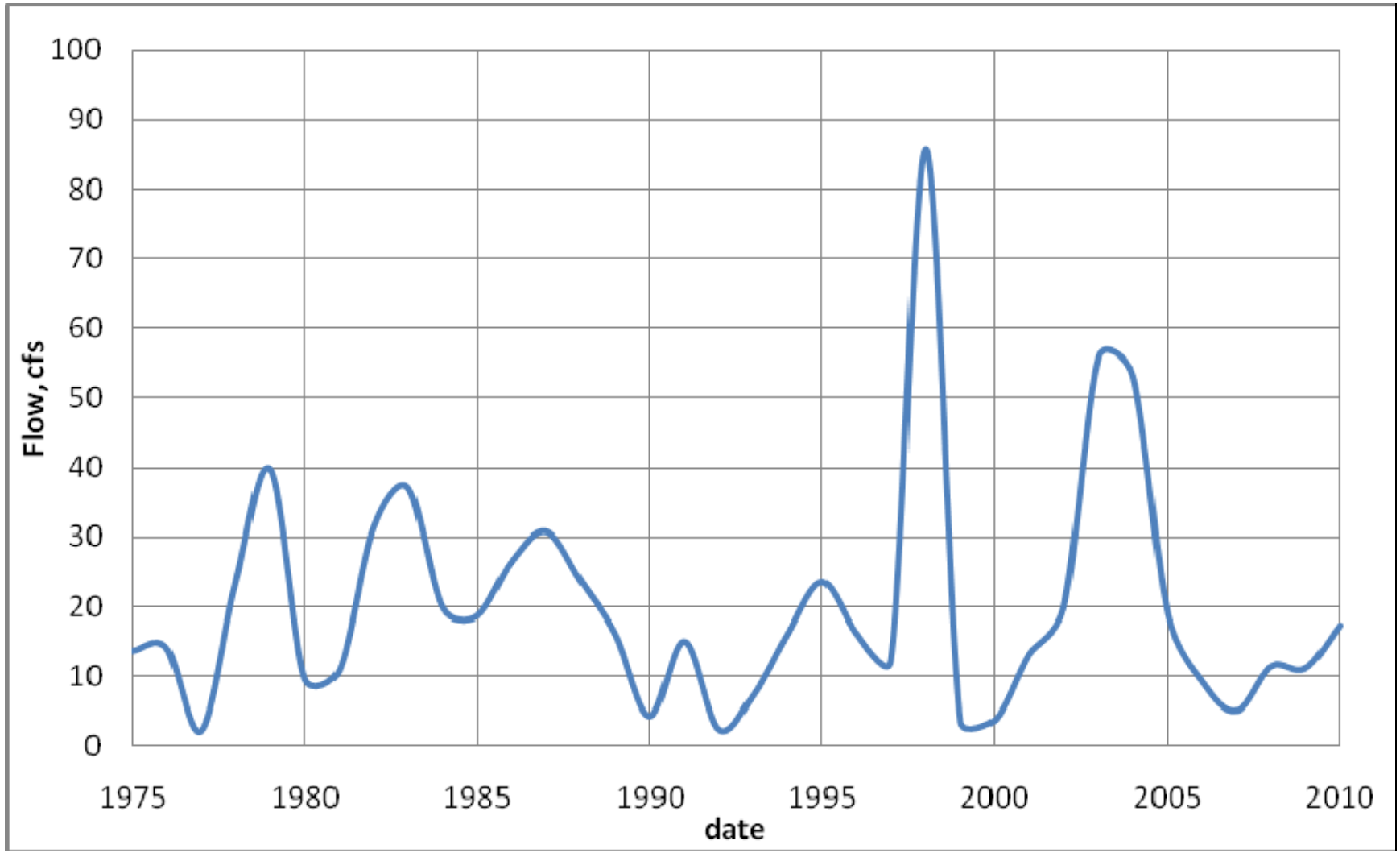

Figure 1-5
Average Annual Daily Flow at Trout Creek

APPLIED TECHNOLOGY & MANAGEMENT

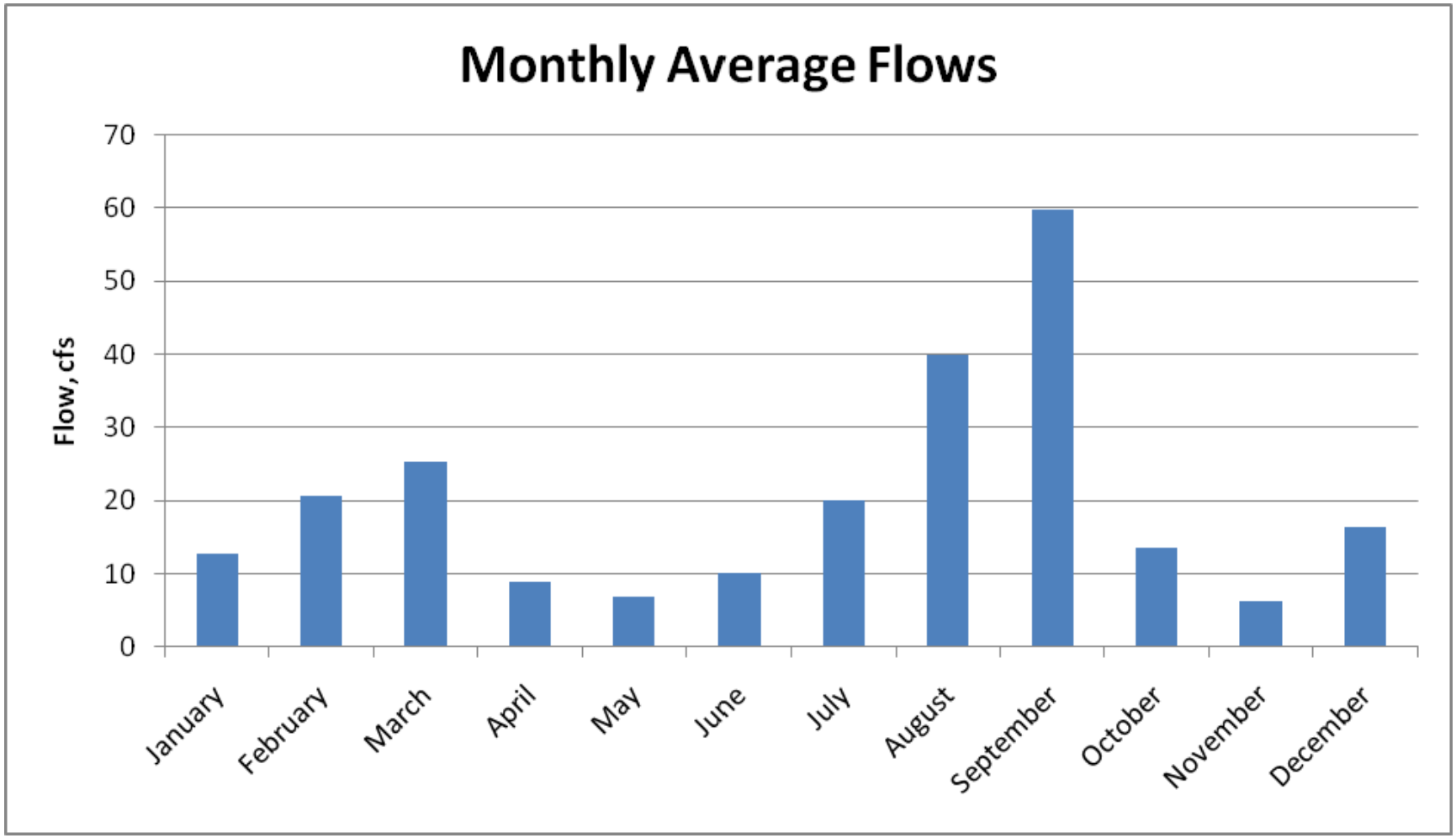

Figure 1-6
Monthly Average Flows

APPLIED TECHNOLOGY & MANAGEMENT

2.0 WATER QUALITY DATA ASSESSMENT

2.1 BACKGROUND & REASON FOR IMPAIRMENT

Run 41 from the Impaired Waters Rule (IWR) database contains DO concentration measurements from five stations from 1969 to 2010. Observations ranged from a minimum of 0.2 mg/L to 11.0 mg/L, with an average of 4.6 mg/L. 2-1 plots the period of record measurements from all available stations. The graph indicates that the condition observed in Cycle 2 that resulted in verifying impairment for DO has been consistent through the measured period. The low DO along with a single period where Chl a values were high, lead to the waterbody being listed for nutrients and DO.

2.2 SUMMARY OF AVAILABLE WATER QUALITY DATA

For this analysis, multiple parameters and the relationship of those parameters to each other, stream flow, and other variables were studied. A summary of the period of record data for several key parameters are provided in Table 2-1. From these data, a picture of the stream emerges as a relatively dark water nitrogen-limited water body. The typical condition is low flow (20 cfs daily), with frequent stoppages of flow altogether in late spring and periodic pulses of high flow (>50 cfs daily) during extreme storm events. The chronic low DO condition is typical of the system and occurs without any signs of algal imbalance. The average chlorophyll *a* concentration measured over the period of record was 3.0 µg/L, with only 4 of the 102 observations (<4 percent) over 20 µg/L indicating that algal blooms are atypical of the system.

Table 2-1. Selected Water Quality Observations from the IWR Database (Run 41) (period of record)

Parameter	Observations	Minimum	Maximum	Mean
Dissolved Oxygen, mg/L	392	0.2	11.0	4.6
Temperature, °C	451	9	35	21.8
Total Nitrogen, mg/L	286	0.19	3.28	0.93
Total Phosphorus, mg/L	297	0.02	2.6	0.16
BOD, mg/L	206	0.28	7.2	1.30
Chlorophyll *a*, µg/L	102	0.7	195.2	3.0
TKN, mg/L	260	0.17	3.22	0.86
Ammonia-Nitrogen, mg/L	287	<0.01	0.35	0.05
Total Organic Carbon, mg/L	27	6.8	157	17.5
Color, PCU	202	19	320	98

Of the five stations in the period of record, only three have sufficient long-term data to be useful for trends analysis. All available data is located in the lower reach of the system and the vast majority of the data comes from a single area (near the SR 581 bridge), which is the same location where long-term stream flow measurements have been recorded. Of the two remaining stations with quality long-term data, both are in essentially the same location (the SR 581 bridge crossing) but cover different periods. 21FLHILL24030046 was sampled from 1989 to 1998 and 21FLHILL145 has been sampled from 1999 to the present. Pasco County began monitoring a station in the upstream reach of the creek this year [(see Figure 2-2) for location], but there was no flow during the scheduled collection in January so a sample was not taken. The February sample results have not yet been reported.

2.3 PAIRED DATA ANALYSIS

An analysis was conducted to pair appropriate parameters to the 392 DO measurements in order to provide a means to test potential "dose/response" relationships by regression. Table 2-2 provides the number of paired measurements available from all stations to DO (expressed as a concentration).

Table 2-2. Number of Available Paired Measurements to Dissolved Oxygen from the IWR Database (Run 41) (period of record) for All Stations

Temp	TN	TP	BOD	Chl *a*	TKN	NH_4	TOC	Color
325	315	325	241	119	290	324	22	236

The DO measurements at the SR 581 bridge crossing have been consistent over time and compare well to the plot of the data from all stations in the record (above). Figures 2-3 and 2-4 present the measured DO from 1998 through 2008 and 1988 through 1998 respectively.

In Cycle 1, the FDEP found that "[t]here are a sufficient number of DO violations to place DO on the verified list. However, [they were] unable to link low DO to a causative pollutant (BOD or nutrients)." They further suggested that the lower DO observations are "[p]otentially linked to physical alteration or [a] naturally occurring condition." They recommended additional monitoring to identify a causative pollutant. In Cycle 2, the DO observations were linked to nutrients based on a single Chl *a* measurement of 195.2 µg/L in November 2007. In the TMDL report (Kang & Gilbert, 2009), graphs are presented that show that Chl *a*

violated the 20 µg/L threshold in the fourth quarter of 2007 (observation noted above) and for all of 2007 based on the annual average.

However, and as stated earlier, Chl *a* has only been observed to exceed 20 µg/L in four observations in the entire period of record. The anomalous bloom in winter 2007 does not actually trip the threshold when the average is expressed as a geometric mean. The geometric mean of available (as of IWR Run 41) corrected Chl *a* measurements in fourth quarter of 2007 is 11.6 µg/L (4 observations of 6.8 µg/L, 0.7 µg/L, 195.2 µg/L, and 19.6 µg/L, all taken at Station 21FLHILL145) and the annual geometric mean of available observations is 6.7 µg/L. When applying the 20 µg/L threshold for verification of impairment, FDEP has typically expressed the "annual mean chlorophyll *a* concentrations" as arithmetic means, which leads to excessive Type 1 errors when assessing for impairment. Because environmental concentration data are typically log-normally distributed and positively skewed, the geometric mean is a much better representation of central tendency. This is true of nutrient concentrations and is especially true for biological data such as Chl *a.* FDEP expresses this well in a recent technical support document outlining potential approaches for establishing numeric nutrient criteria in marine waters:

> *It should be noted that the geometric mean was used in the St. Joseph Bay example because nutrient data are typically positively skewed…and the geometric mean is considered to be the most robust estimate of the central tendency for positively skewed data. It is the mean of the logarithms, transformed back to the original data. For positively skewed data, the geometric mean is typically very close to the median. In fact, when the logarithms of the data are symmetric, the geometric mean is an unbiased estimate of the true median (Helsel and Hirsch 2002). For distributions that are positively skewed and vary over orders of magnitude (such as nutrients or bacteria counts), the geometric mean is a more accurate indicator of the central tendency than the arithmetic mean (Sanders et al. 2003). (FDEP, 2010a, p.11)*

Nine corrected Chl *a* measurements were made in Trout Creek by EPCHC. All but two were below 7 µg/L and only one exceeded 20 µg/L. Through the inappropriate use of an arithmetic mean, the results trip the Chl *a* threshold (annual average greater than 20 µg/L). Since FDEP impaired the stream for DO, nutrients were identified for verification and TN identified as the causative pollutant (because the stream is nitrogen-limited (TN/TP ratio of 8.8)). However, water column algae (as surrogated by Chl *a*) appears to be well in balance. Furthermore, there is no relationship is apparent between TN, TP and Chl *a* (see

Figure 2-5). In this case, the median value (6.6 µg/L) of the stream for 2007 is much better approximated by the geometric mean (6.7 µg/L) than an arithmetic mean (30.1 µg/L).

Additionally, it appears that FDEP utilized the uncorrected Chl *a* measurements for the 2007 data analysis. The IWR states that (when available) only corrected Chl *a* should be used in the IWR assessments from the effective date of the Rule (November 10, 2006). In Figure 2.4 of the revised FDEP TMDL (Kang & Gilbert, 2010) document (page 14), the caption mentions that "a value of 274.9 µg/L observed on 11/27/07 was not included [on the pictured graph] due to [it being] out of scale." That value is reported in the IWR database (Station 21FLHILL145) as an "uncorrected" concentration. The corrected chlorophyll *a* value for that measurement was actually 195.2 µg/L. Figure 2-6 shows a comparison of the FDEP results using seasonal arithmetic means of uncorrected chlorophyll *a* data and comparable results using geometric means of the available corrected chlorophyll *a* data.

Chl *a* has only been observed to exceed 20 µg/L in four observations in the entire period of record (less than 4 percent of all measurements). Because FDEP identified that the Chl *a* threshold (annual average greater than 20 µg/L) was violated, they impaired the water body for nutrients, and TN was identified as the causative pollutant (because the stream is nitrogen-limited, TN/TP average ratio of 8.8). Single measurements during an algal bloom do not seem sufficient grounds for impairment especially since long-term Chl *a* measurements are systematically low, and there is no statistical relationship between TN and Chl a response (Figure 2-5). Additionally, DO concentrations or deficit (concentration below 100 percent saturation) do not appear to have a statistically significant relationship with observed chlorophyll a concentrations (Figure 2-7).

Looking at speciation in the nitrogen observations, the data overwhelmingly show that the source of the nitrogen is bound up in organic compounds with very little inorganic nitrogen in the typical stream signature (Figure 2-9). In the absence of anthropogenic sources that could be expected to contribute organic nitrogen (e.g., improperly treated sewage or animal manure), the data suggest the vast majority of the nitrogen contribution (typically over 90 percent) is from natural sources such as wetlands and leaf litter from the forest canopy.

When evaluating nitrogen inorganic species against Chl *a*, there is still no observed relationship. These paired data analyses demonstrate no observed relationship that ties

nutrient concentrations of either TN or TP or nitrogen species to changes in observed DO concentrations or changes to Chl *a* (Figure 2-10).

2.4 WATER QUALITY SIMULATION

Another means of testing the potential relationship between in-stream nutrient concentrations and DO is through numerical simulation modeling. When ATM (2010a) prepared suggestions for refinement of the first proposed TMDL for Trout Creek for DO and nutrients (Kang & Gilbert, 2009), an initial and similar paired data assessment was conducted at that time and a relationship between measured in-stream DO concentrations and potential causative compounds of nitrogen, phosphorus or BOD could not be established.

To test the assertion that nutrients are not the causative parameter of Trout Creek's observed DO below 5.0 mg/L, ATM requested the water quality model FDEP developed for Trout Creek and refined it so that it adaquately conserves mass and better represented the flows and depths in the creek (ATM 2010b) and then the model was utilized to test the response of the in-stream DO to reductions in loading. Besides TN, TP, and BOD; ATM held all other parameters within the model constant (including hydrology) and ran the model through the full simulation period.

DO results were compared under various percent load reductions. If TN, TP, and BOD are not causative, one would expect little change in the predicted DO concentration under these various loading scenarios. Table 2-3 (Table 3-1 in ATM, 2010b) presents the results from the model runs. The results show that for all DO percentile values, significant DO changes are not seen due simply to reduction in the loads. This supports the conclusions of the data analyses.

Table 2-3. Predicted DO Changes under Load Reduction Scenarios

Load Reductions	10th Percentile DO (mg/L)	25th Percentile DO (mg/L)	50th Percentile DO (mg/L)	75th Percentile DO (mg/L)	90th Percentile DO (mg/L)	Mean CHL-a (µg/L)
0%	1.07	3.30	5.05	5.88	7.17	2.62
20%	1.09	3.35	5.09	5.92	7.20	2.47
40%	1.10	3.40	5.13	5.96	7.24	2.30
60%	1.11	3.43	5.16	6.00	7.27	2.11
80%	1.12	3.47	5.19	6.04	7.30	1.89

Sensitivity tests indicated that the primary driving factor in the DO conditions is sediment oxygen demand (SOD) (as was speculated in ATM, 2010a). SOD "represents various fixed mechanisms that take up oxygen from water flowing by. This fixed local oxygen demand comes from settling of organic matter within the stream, local attached plant respiration, and other contributions of oxygen demand that are fixed on the stream bed" (ATM, 2010a).

The numerical modeling simulation analysis provides further evidence that water column TN, TP, and BOD are not direct causative factors in the long-term observed DO regime in Trout Creek.

2.5 NON-NUTRIENT FACTORS ASSESSMENT

However, typical natural factors that affect DO are more apparent. When plotting DO and DO deficit against temperature, a relationship emerges (Figure 2-11). Relatedly, the expected seasonal pattern of low DO measurements in the summer months is also apparent beginning in late March through May during the lowest flow period (Figure 2-12).

Additionally, there does appear to be a relationship between flow and observed DO concentrations, with measurements of concentration tending to increase after periods of higher flow and decrease after low flow periods (Figure 2-13). In a blackwater system such as this one, it would be expected that during periods of higher temperatures and lower flows, SOD would heavily influence the oxygen concentration in the overlying water.

As reported earlier (ATM 2010a), considerable research has found that low DO may be a natural condition for summer months in these streams (Bosch et al., 2002; Ice & Sugden,

2003; Vellidis et al., 2003 in Utley et al., 2008). Utley et al. (2008) cite Matlock et al. (2003) in their findings that SOD was responsible for 50 percent of the DO depletion in a typical blackwater stream. Additionally, low dissolved oxygen waters coming in from adjacent swamp areas and from groundwater contributions also play a potential role in the DO conditions in the stream.

2.6 COMPARISON TO SIMILAR REGIONAL WATER SEGMENTS

Trout Creek is just one of several tributary streams to the Hillsborough River that are dominated by in-stream wetlands, shallow water, large hydrologic swings, and highly colored water produced from allochthonous sources. The adjacent Clay Gully (WBID 1460), New River (WBID 1442) and Basset Branch (WBID 1457) lack sufficient long-term data for a proper comparison. The IWR database (Run 42), however, provided DO measurements and paired nutrient species values extending back to 1959 for Blackwater Creek (WBID 1482), which is another tributary to the Hillsborough River upstream of Trout Creek to the northeast. While similar in many ways, Blackwater Creek drains a larger basin and has a larger fall that creates swifter currents along some of its reaches. While the flow regime is temporarily similar, Blackwater Creek is more perennial and experiences fewer no-flow periods (Figure 2-14). Biological assessment work done by the local FDEP offices have identified Black Water Creek as a healthy system (Morgan & Denson, 1995)

Like Trout Creek, Blackwater Creek also appeared on the 1998 303(d) List for Dissolved Oxygen and Nutrients (Chl *a*). FDEP delisted it for nutrients in Cycle 1. In Cycle 1, FDEP assessed the DO impairment and determined that the water segment is "impaired for one or more criteria or designated uses but does not require TMDL development because impairment is not caused by a pollutant." (Assessment Category 4c). This category is "typically applie[d] to impairments tied to low dissolved oxygen (DO)…The impairment is not caused by specific pollutants, but is believed to be natural…" Coincidentally, EPA finalized a TMDL for Blackwater Creek (USEPA, 2005) that determined:

> *Since the low in-stream DO is a result of low DO water flowing from groundwater and wetlands, and not the result of in-stream algae, nutrient, and BOD oxygen consumption, no load reductions are specified in this TMDL report. It is recommended that loads of nutrients and BOD be maintained at current levels. Florida standards state at 62-302.300(15) FAC, "Pollution which causes or contributes to new violations of water quality standards or to continuation of existing violations is harmful to the waters of this State and shall not be allowed. Waters*

having water quality below the criteria established for them shall be protected and enhanced. However, the Department shall not strive to abate natural conditions." The purpose of a TMDL is to allocate pollutant loading such that water quality standards are achieved. The Clean Water Act at Section 303(d)(1)(C) states, "Such load shall established at a level necessary to implement the applicable water quality standards …" In expressing this TMDL, EPA must apply the applicable dissolved oxygen water quality standard while also considering the directive not to abate natural conditions. (P. 41)

EPA further stated that the "the low DO was the result of natural processes in the wetlands and groundwater flowing into these streams…" and "...the DO TMDL requires no reductions…". A water quality analysis analogous to the one conducted for Trout Creek was performed on the Blackwater Creek system that showing the two to be extremely similar. This suggests that the low DO concentrations in Trout Creek could be caused by similar factors as in Blackwater Creek and not from basin-specific pollution.

Figure 2-15 plots the available DO measurements from Trout Creek and Blackwater Creek from 1991 to 2008. While many more measurements were taken in Blackwater Creek, the two systems display a very similar long-term DO pattern. This is especially interesting because the systems are independent in terms of loads and sources. They are similar in stream type and habitat composition and experience similar temperature, runoff, and groundwater inputs because of their relative spatial nearness. Plotting just a recent 4-year period (2002 to 2006) removes some of the "noise" in the plot (Figure 2-16).

During this period, the in-stream DO in both creeks is almost certainly responding to the same stressors under similar environmental conditions. The seasonal sinusoidal signature suggests that stream flow and temperature are likely the greatest factors determining DO in the water column. It is important to note in the comparisons that Blackwater Creek has fewer periods of very low to zero flow and has greater overall energy, suggesting that its DO would tend to be higher under the same conditions.

During the numeric nutrient criteria development process, FDEP extensively studied the phenomena being observed in many of the Hillsborough River tributary streams. In its formal comments to the draft EPA numeric nutrient criteria proposed in January 2010 (FDEP, 2010c), they observed that "[n]atural vegetation, which contributes large quantities of leaf litter and which is subsequently decomposed in wetlands, ultimately provides the source of both the color (humic acid substances) and organic nitrogen…Therefore, the

strong relationship between color and organic nitrogen is truly indicative of natural nitrogen sources" (p. 30). Figure 2-9 demonstrated that the TN in the Trout Creek system is dominated by organic nitrogen. Both Trout Creek and Blackwater Creek display this color/organic nitrogen relationship (Figures 2-17 and 2-18).

Another comparison was also made to one of FDEPs reference sites used in the NNC. Cypress Creek is a higher order tributary system similar to Trout Creek that flows into the Caloosahatchee River. In their overview of the reference station FDEP states:

> *Experienced FDEP scientists conducted a series of observations and measurements (habitat assessment, hydrology, and local land use) at Cypress Branch. Based on our analyses, the Department concluded that the site was influenced only by very low levels of anthropogenic stressors and that it clearly maintained healthy biological assemblages. Thus, not only are the nutrient concentrations reflective of minimally disturbed conditions, they are associated with biota which demonstrate full support of the most sensitive designated use (propagation and maintenance of a healthy, well-balanced population of fish and wildlife).*

Figure 2-19 presents the measured DO at Cypress Branch. As the data show, the levels are similar to those found within Trout Creek. It should be noted here that comparative analyses for DO are only useful to show general similarities. DO conditions at any site are driven by many factors, and temperature and hydrology are the most critical. This analysis along with the Blackwater Creek results shows that low DO measurements, by themselves, are not indicators of anthropogenic impacts, but rather must be evaluated in terms of causative factors and the potential for natural sources.

2.7 EPA NUMERIC NUTRIENT CRITERIA COMPARISON

The following presents a comparison of the present nutrient conditions within Trout Creek to the EPA Numeric Nutrient Criteria for freshwater streams that was promulgated on December 6, 2010 in 40 CFR Part 131 (Water Quality Standards for the State of Florida's Lakes and Flowing Waters). Many of the Stakeholders involved with TMDLs in the Tampa Bay watershed have submitted extensive comments regarding the EPA criteria. The comparison of ambient nutrient data to the EPA criteria is presented herein in recognition of the existence of the criteria at present, and that EPA will play a role in the review of these WBID assessments. The use of the criteria in no way indicates that the Tampa Stakeholders support their validity.

ATM extracted available and qualifying data from the IWR database (Run 42) and performed the calculations necessary to obtain the geometric means for Chl *a*, TN, and TP for qualifying data during the period of interest (Table 2-4). The results of this analysis are provided below together with the associated EPA numeric criteria. Chl *a* is not assessed in the EPA criteria, but these data are provided here for comparison and interest. The results show a consistent record over the past 10 years with no violations of either nutrient criterion. This analysis also shows that the system is consistently nitrogen limited during this entire analysis period. Lastly, the years 2002 and 2007 (higher measured Chl a) have similar nutrient concentrations to average years.

Table 2-4. Comparison of EPA Numeric Nutrient Criteria for Florida Streams (Trout Creek)

Parameter	Criterion	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Chlorophyll *a*, µg/L	**N/A**	2.6	1.4	7.7	2.7	3.0	3.3	3.1	6.7	N/A	N/A
TN, mg/L	**1.65**	1.1	1.4	1.1	1.0	0.94	0.94	1.0	1.0	1.1	1.2
TP, mg/L	**0.49**	0.14	0.18	0.12	0.11	0.10	0.11	0.12	0.15	0.11	0.17

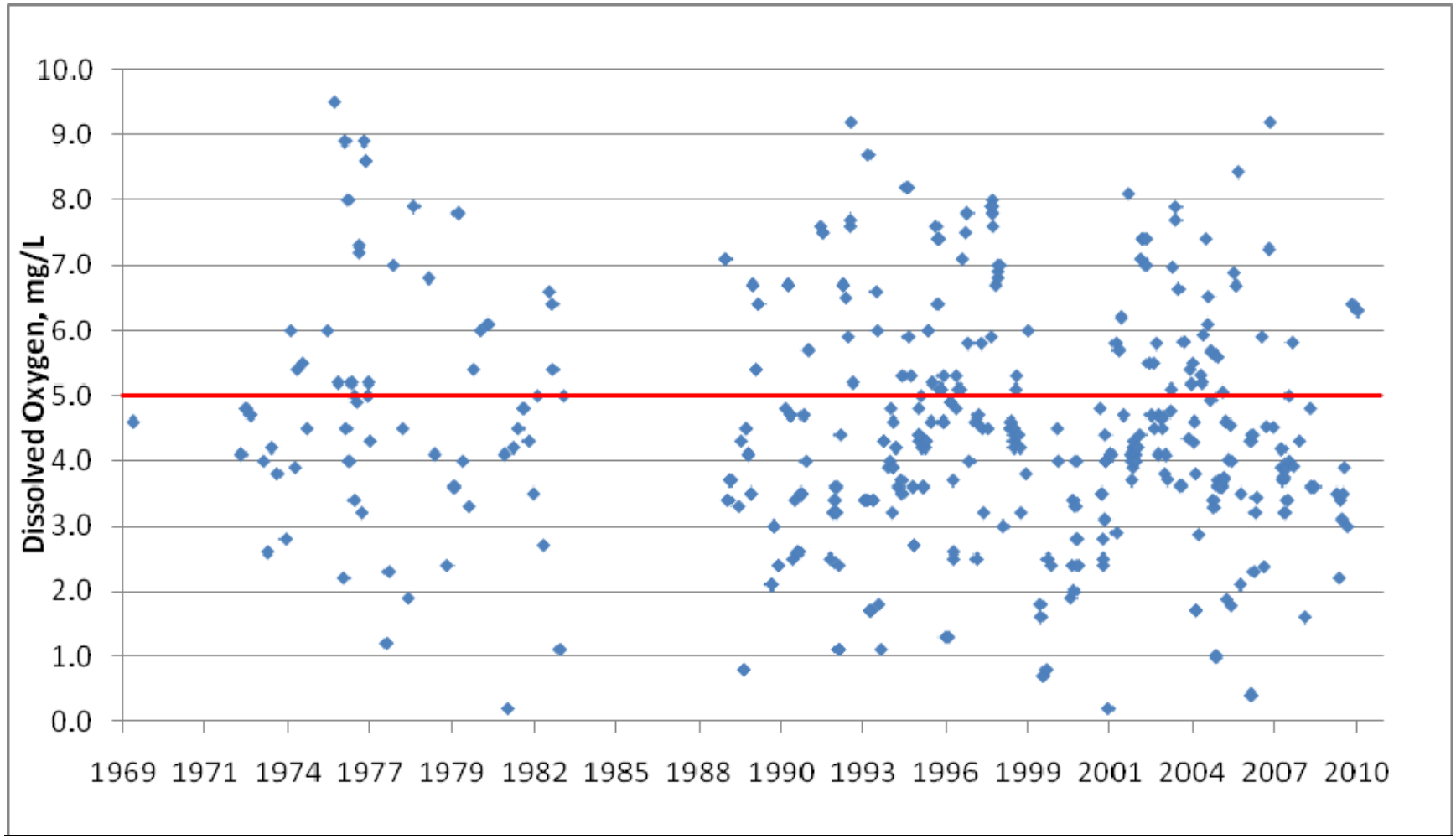

Figure 2-1
Dissolved Oxygen Observations in Trout Creek (All Stations)

APPLIED TECHNOLOGY & MANAGEMENT

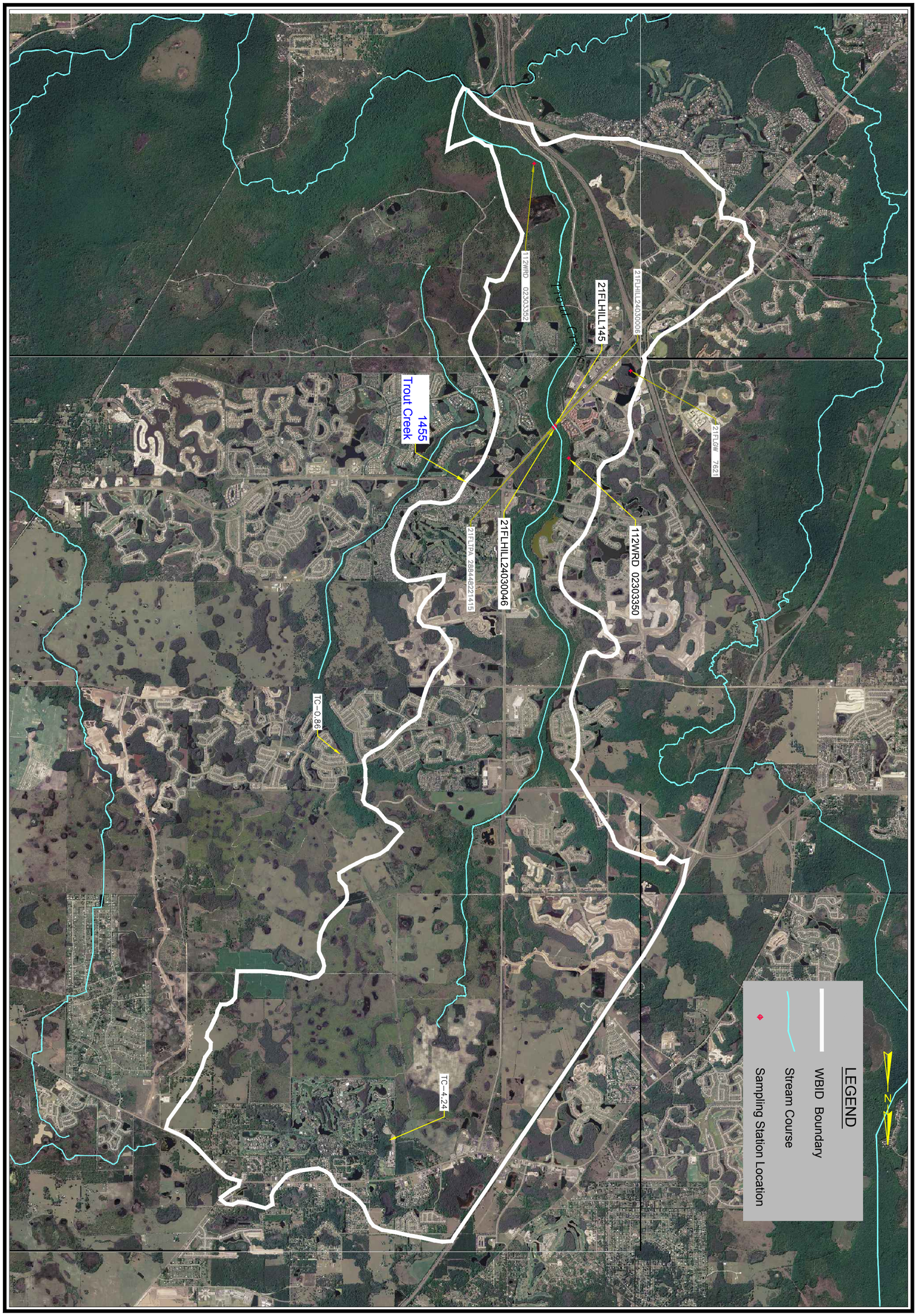

Figure 2-2
WBID Boundaries, Stream Reach, and Water Quality Stations - Trout Creek (1455)

APPLIED TECHNOLOGY & MANAGEMENT

11-2213 Tampa TMDL.dwg Trout 2/25/11

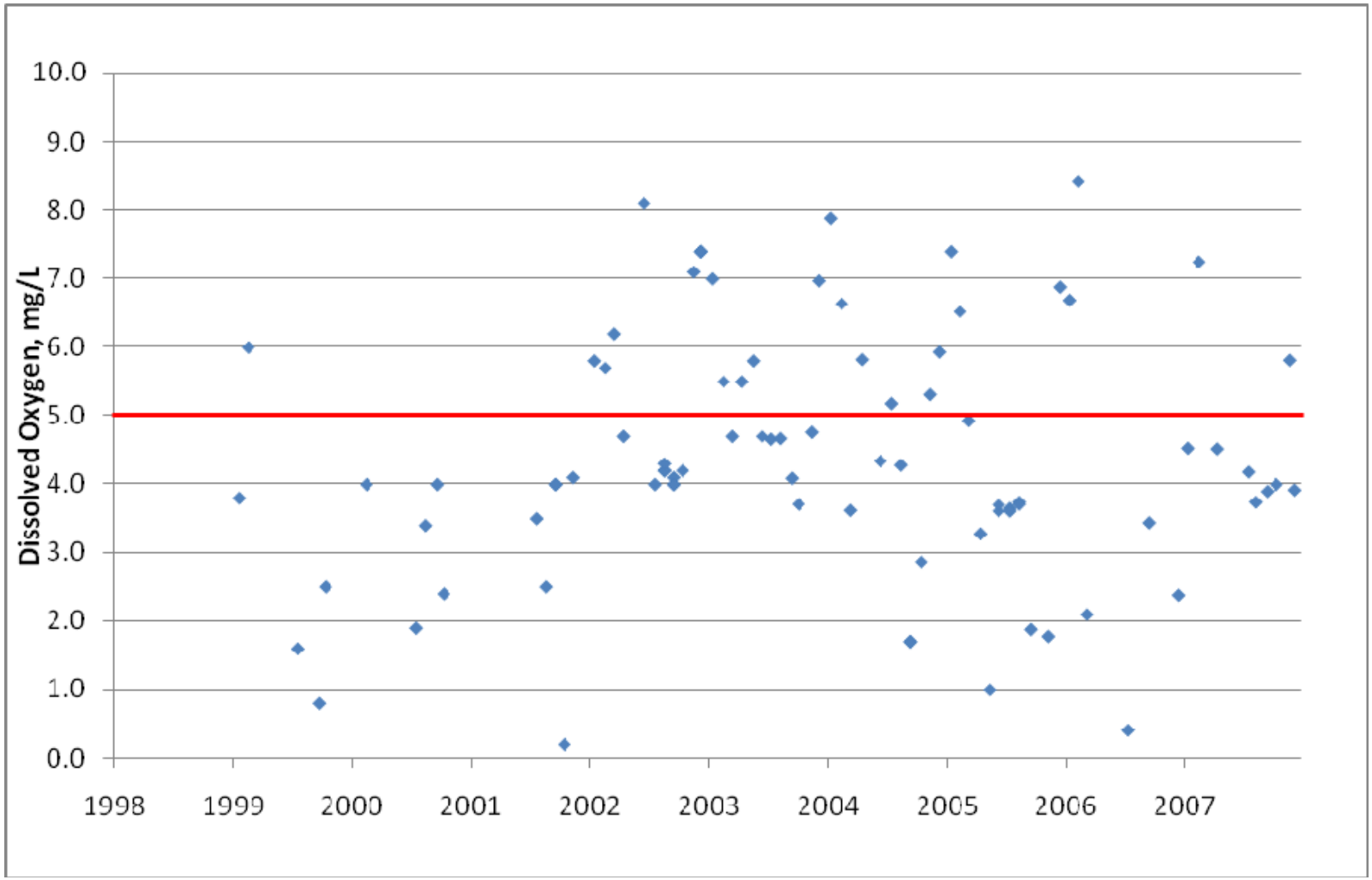

Figure 2-3
Dissolved Oxygen Observations at Station 21FLHILL145

APPLIED TECHNOLOGY & MANAGEMENT

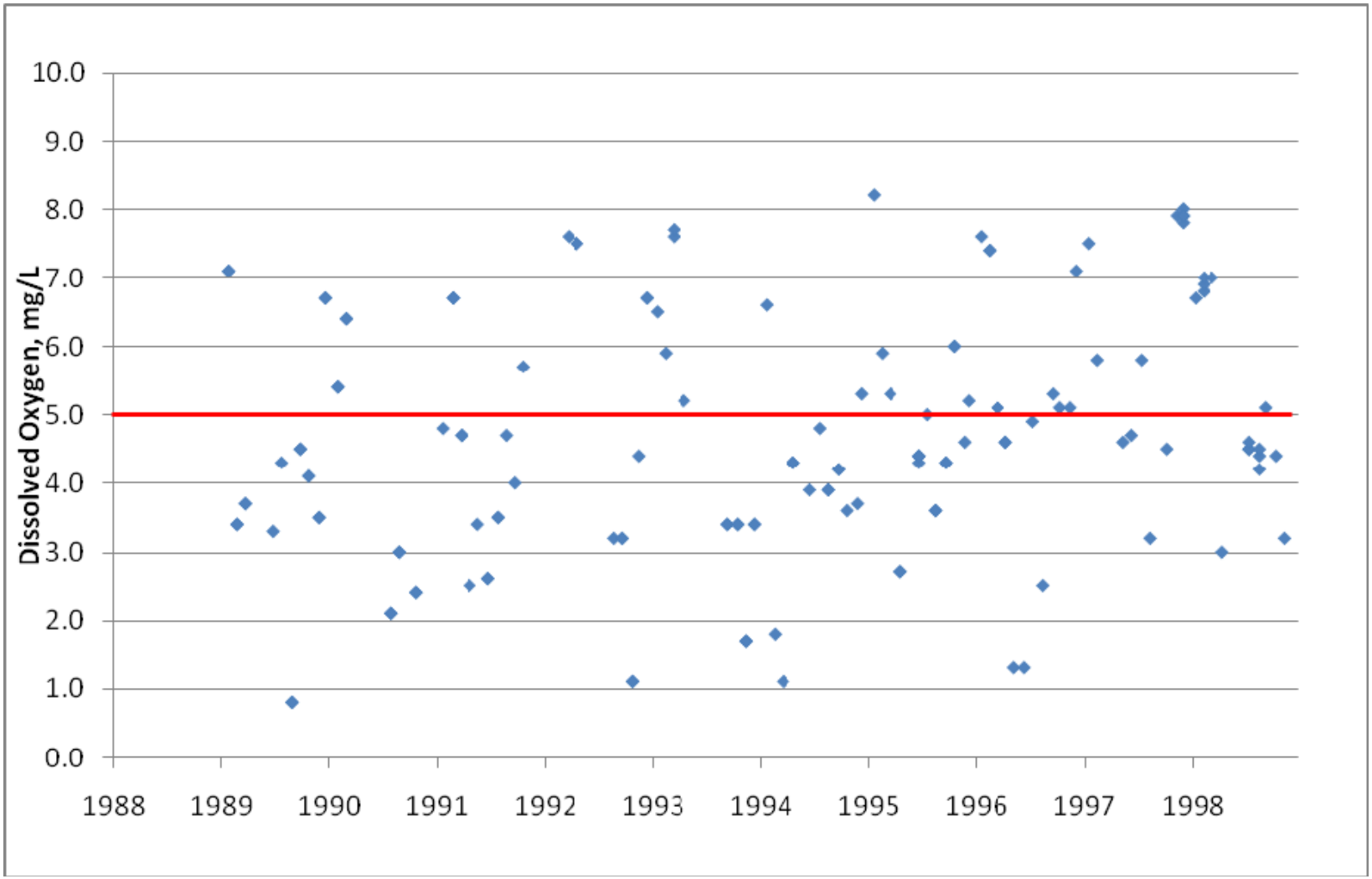

Figure 2-4
Dissolved Oxygen Observations for Station 21FLHILL24030046

APPLIED TECHNOLOGY & MANAGEMENT

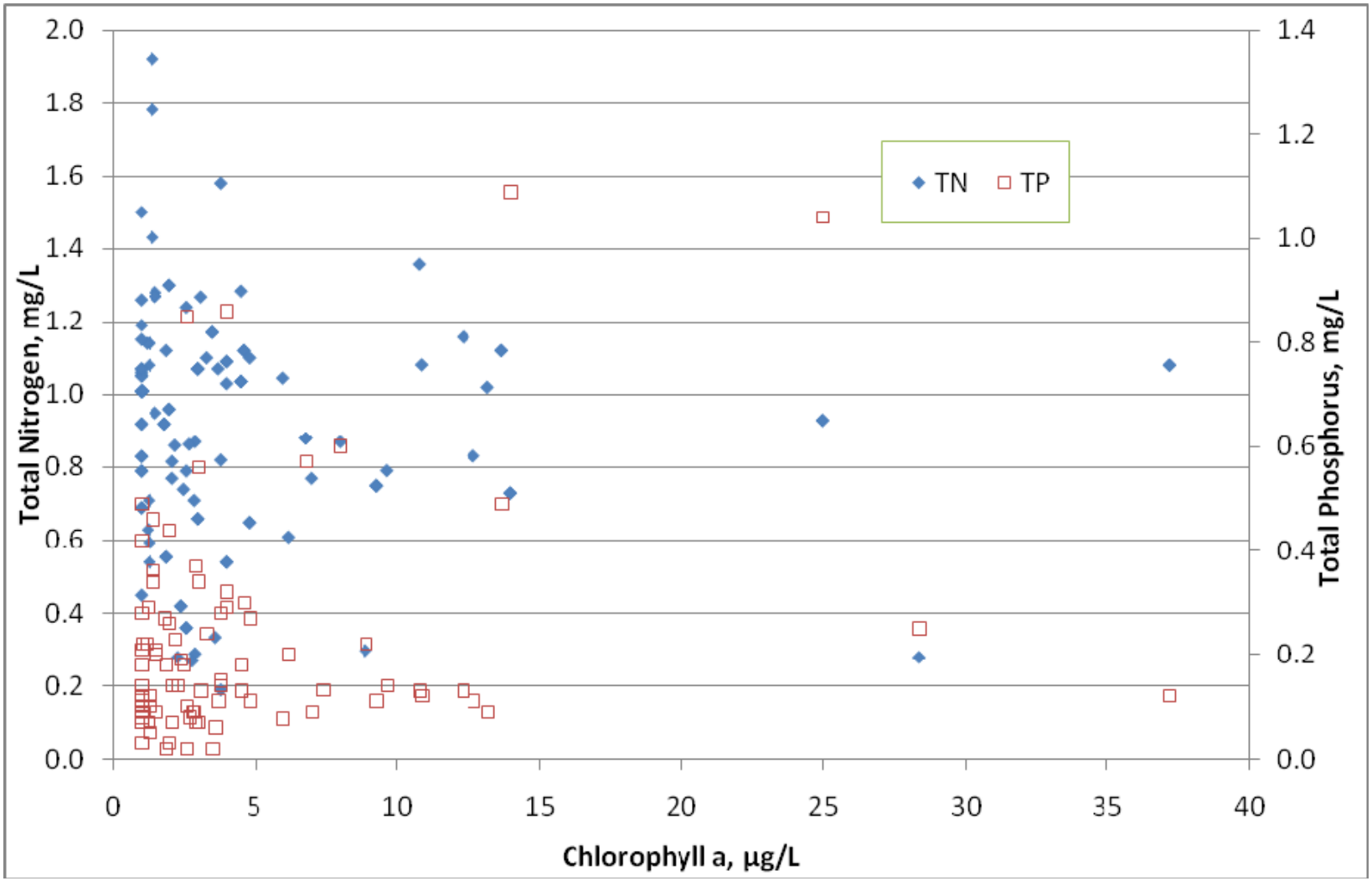

Figure 2-5
Paired Measurements for TN & TP versus Chlorophyll *a* (All Stations)

APPLIED TECHNOLOGY & MANAGEMENT

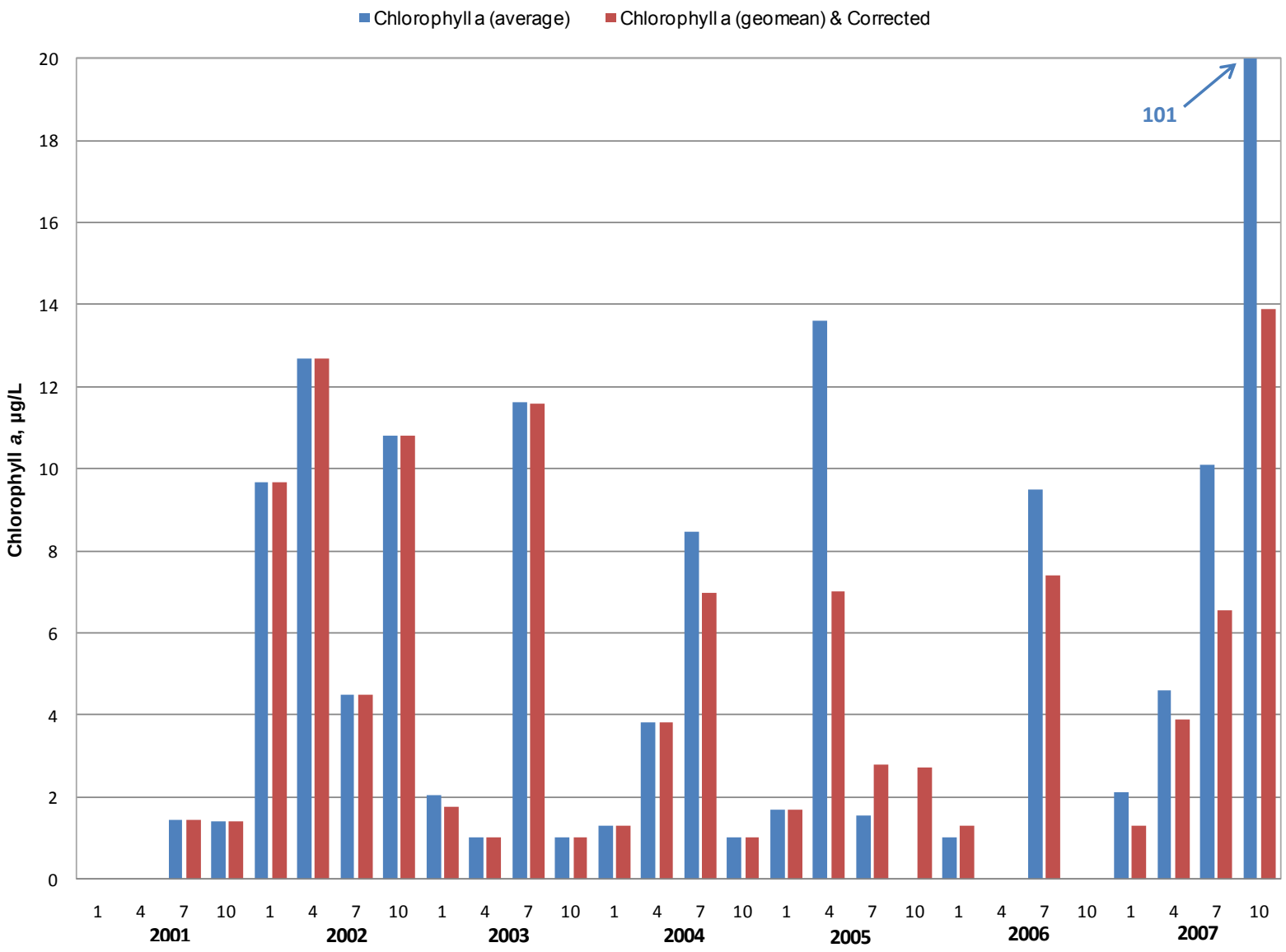

Figure 2-6

Comparison of Chlorophyll Data from Trout Creek using Uncorrected Chlorophyll *a* and Seasonal Arithmetic Means versus Using Corrected Chlorophyll *a* (when available – 2005-2007) and Geometric Means

APPLIED TECHNOLOGY & MANAGEMENT

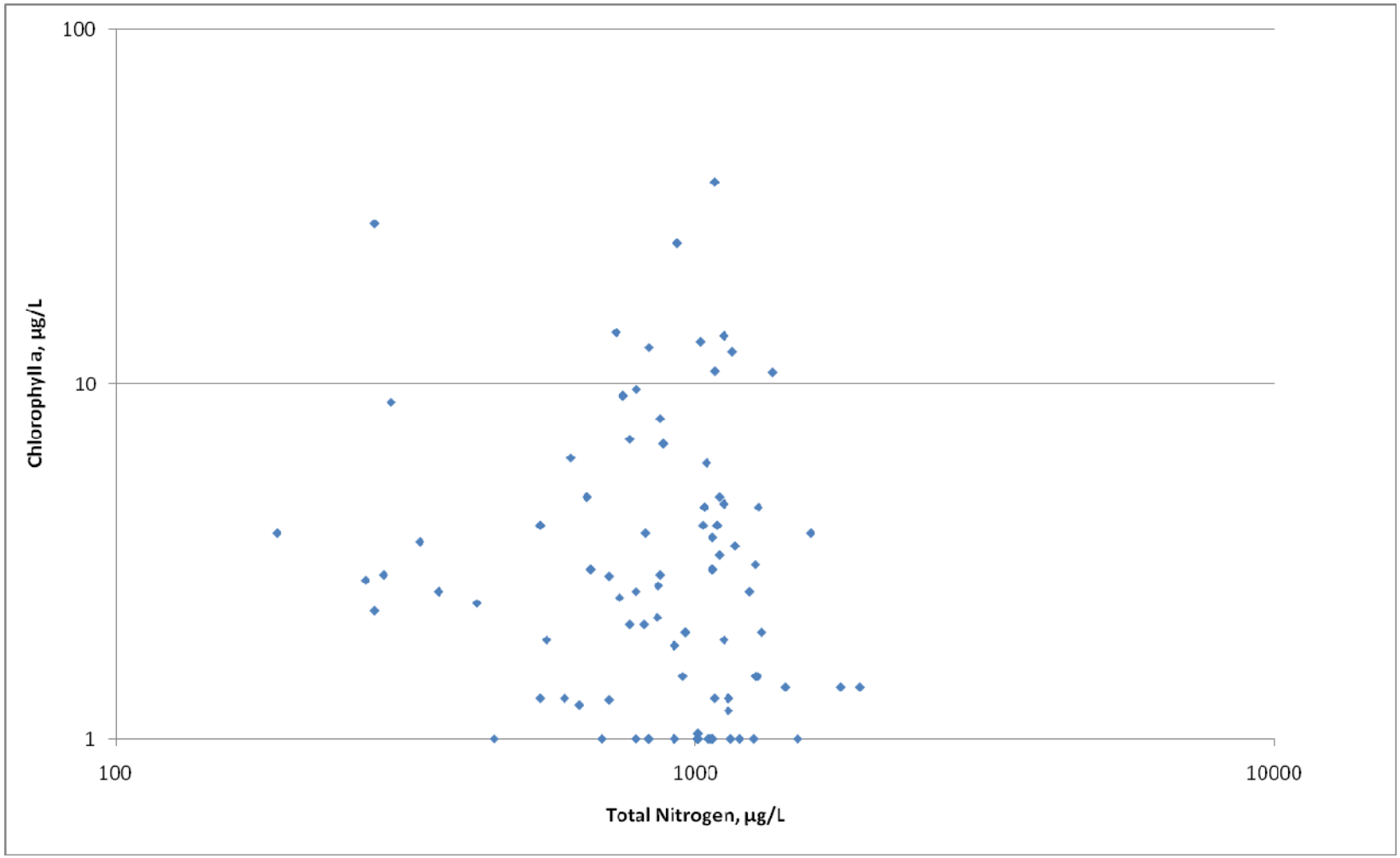

Figure 2-7
Paired Total Nitrogen and Chlorophyll *a* Measurements (All Stations)

APPLIED TECHNOLOGY & MANAGEMENT

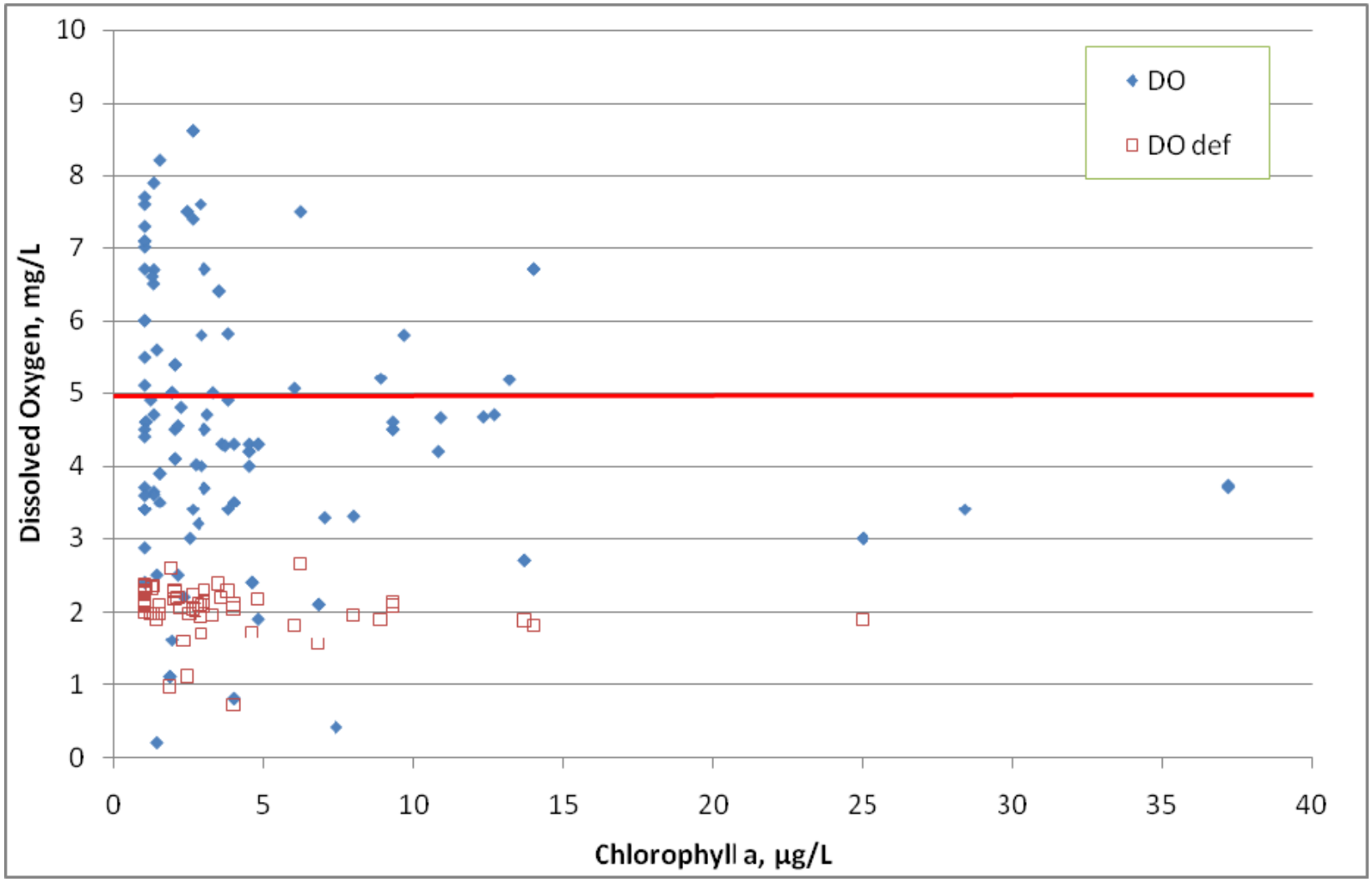

Figure 2-8
Paired Measurements for Dissolved Oxygen versus Chlorophyll *a* (All Stations)

APPLIED TECHNOLOGY & MANAGEMENT

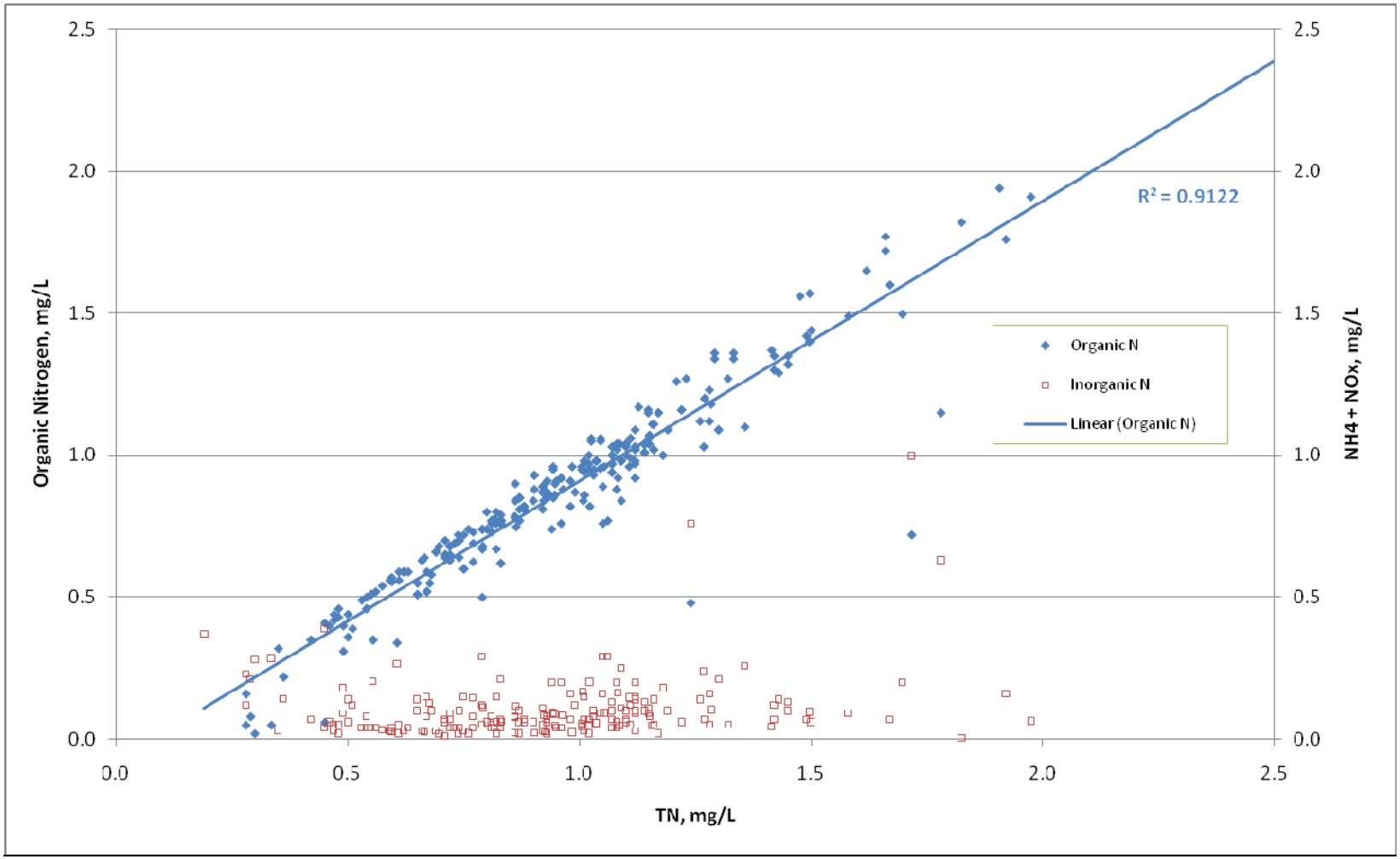

Figure 2-9
Paired Measurements for Organic & Inorganic Nitrogen versus Total Nitrogen (All Stations)

APPLIED TECHNOLOGY & MANAGEMENT

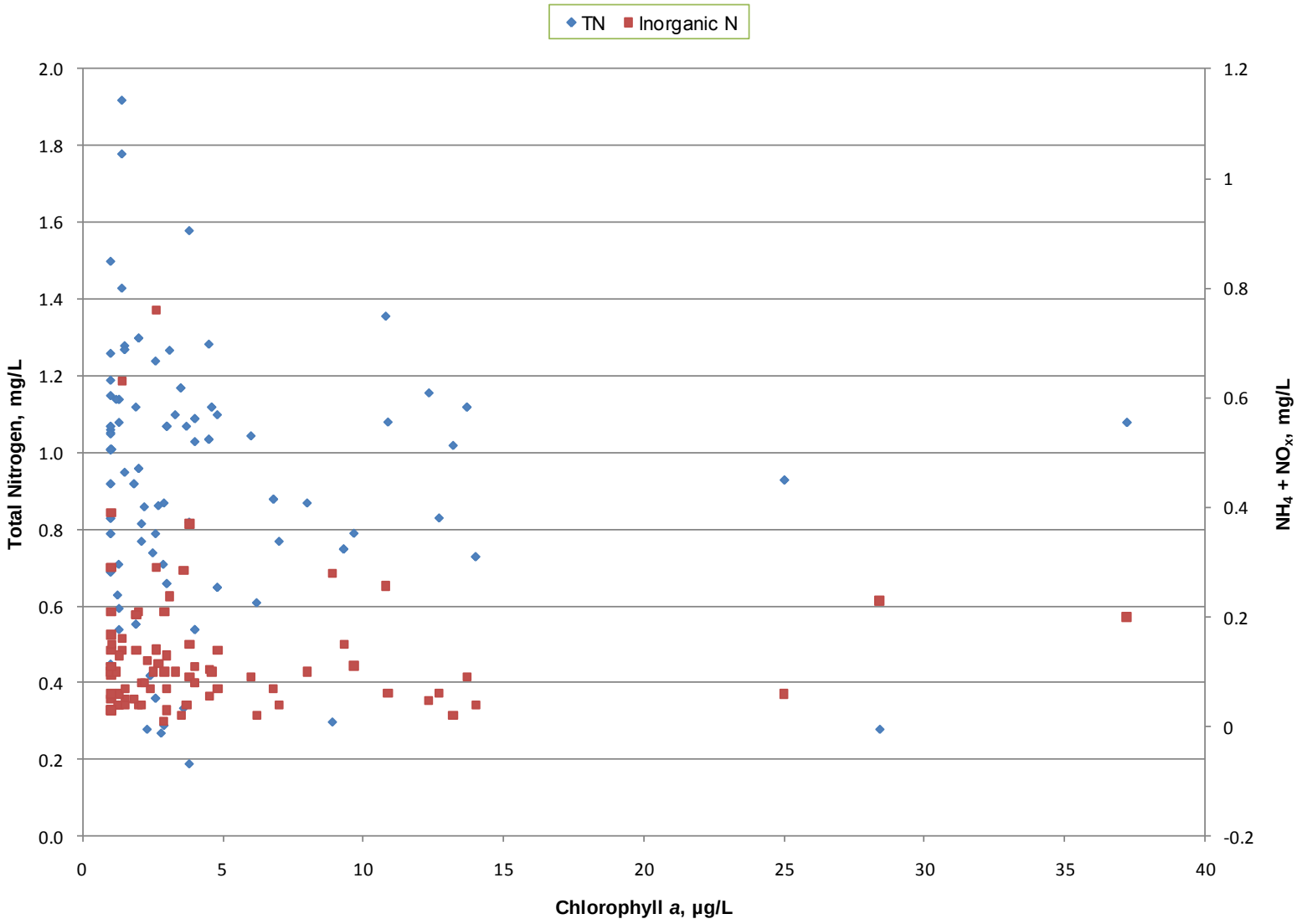

Figure 2-10
Paired Measurements for TN & Inorganic Nitrogen versus Chlorophyll *a* (All Stations)

APPLIED TECHNOLOGY & MANAGEMENT

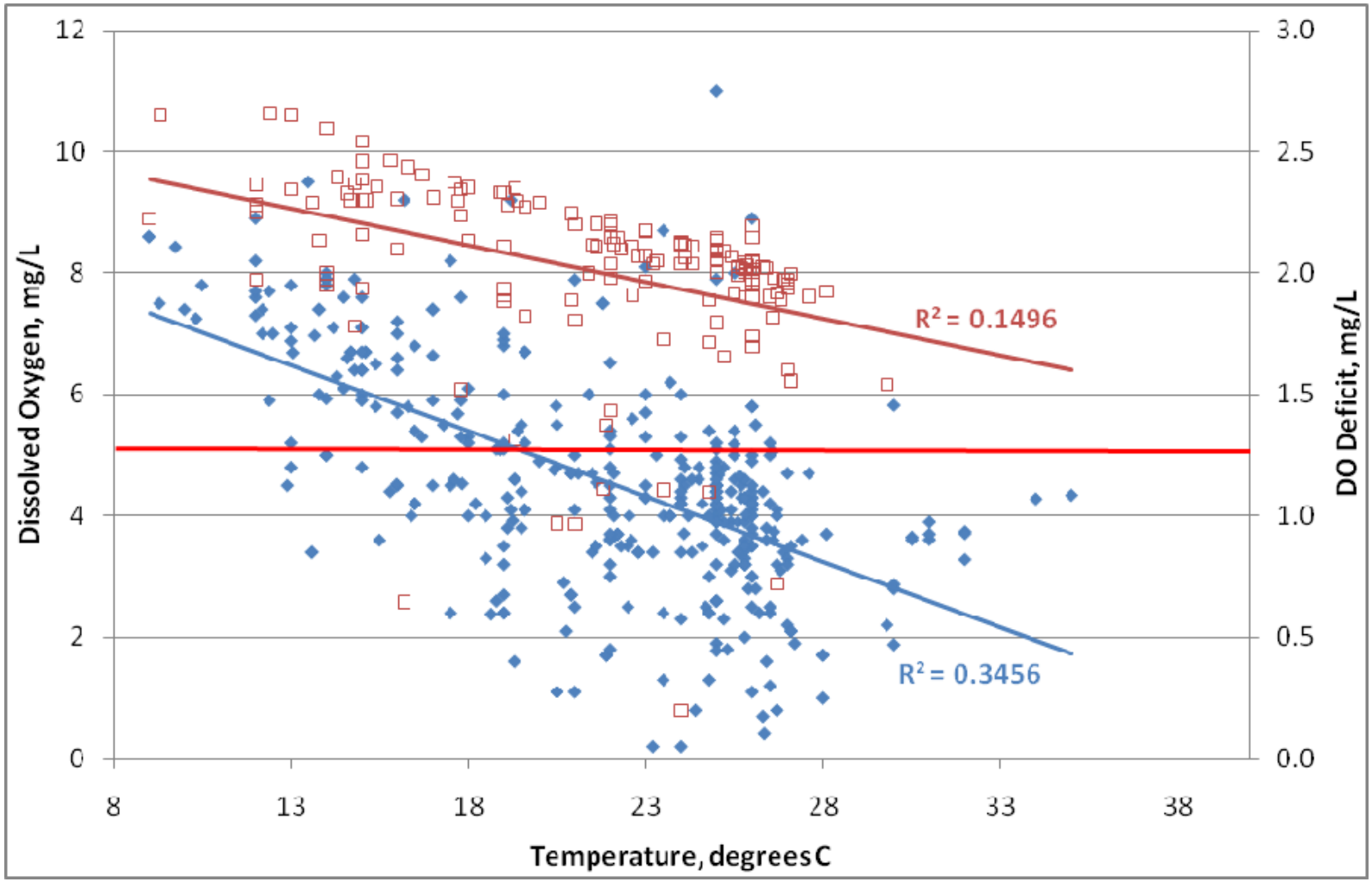

Figure 2-11
Paired Measurements of Dissolved Oxygen and Temperature Measurements (All Stations)

APPLIED TECHNOLOGY & MANAGEMENT

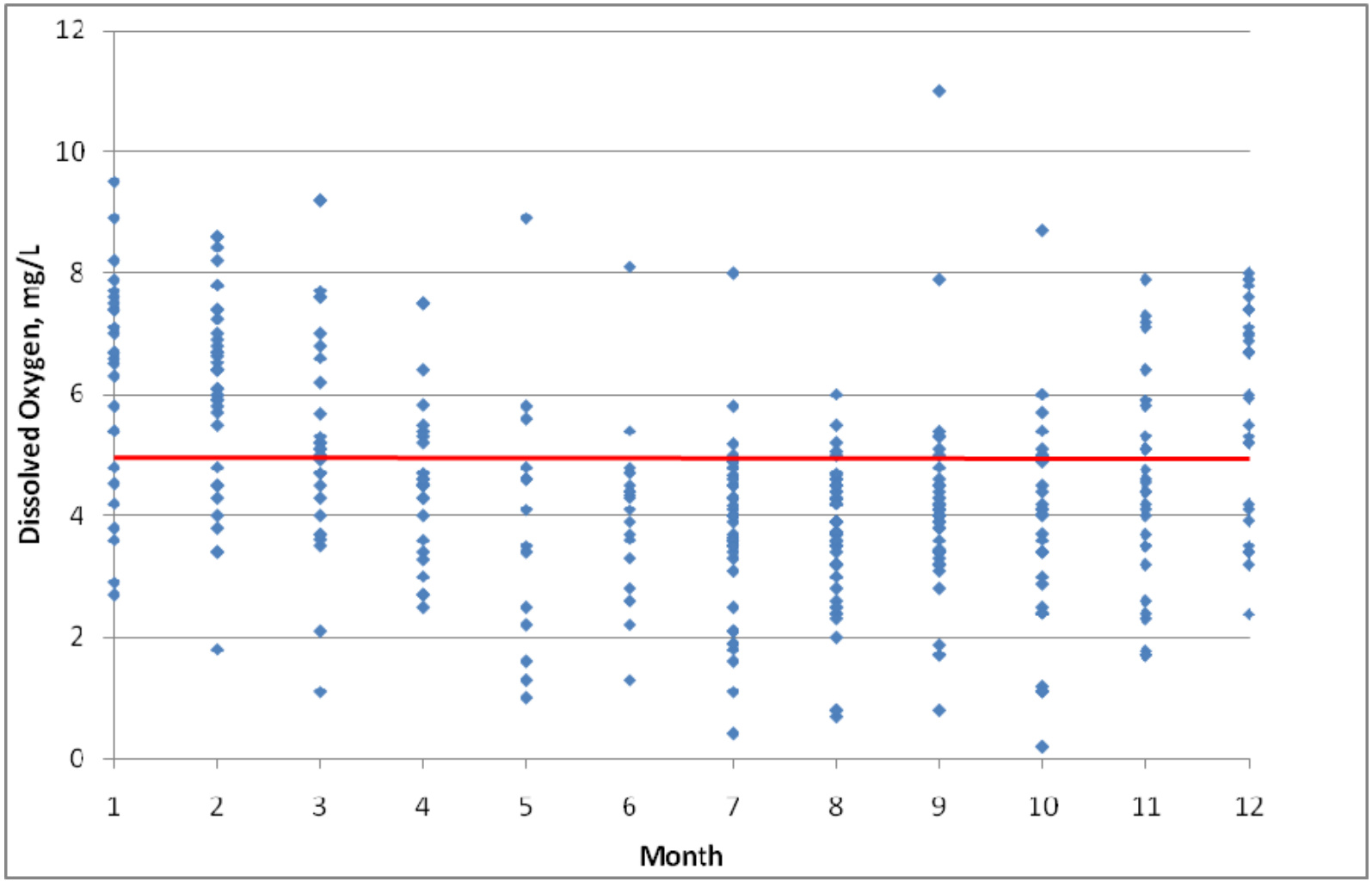

Figure 2-12
Dissolved Oxygen Observations Plotted by Month Taken (All Stations)

APPLIED TECHNOLOGY & MANAGEMENT

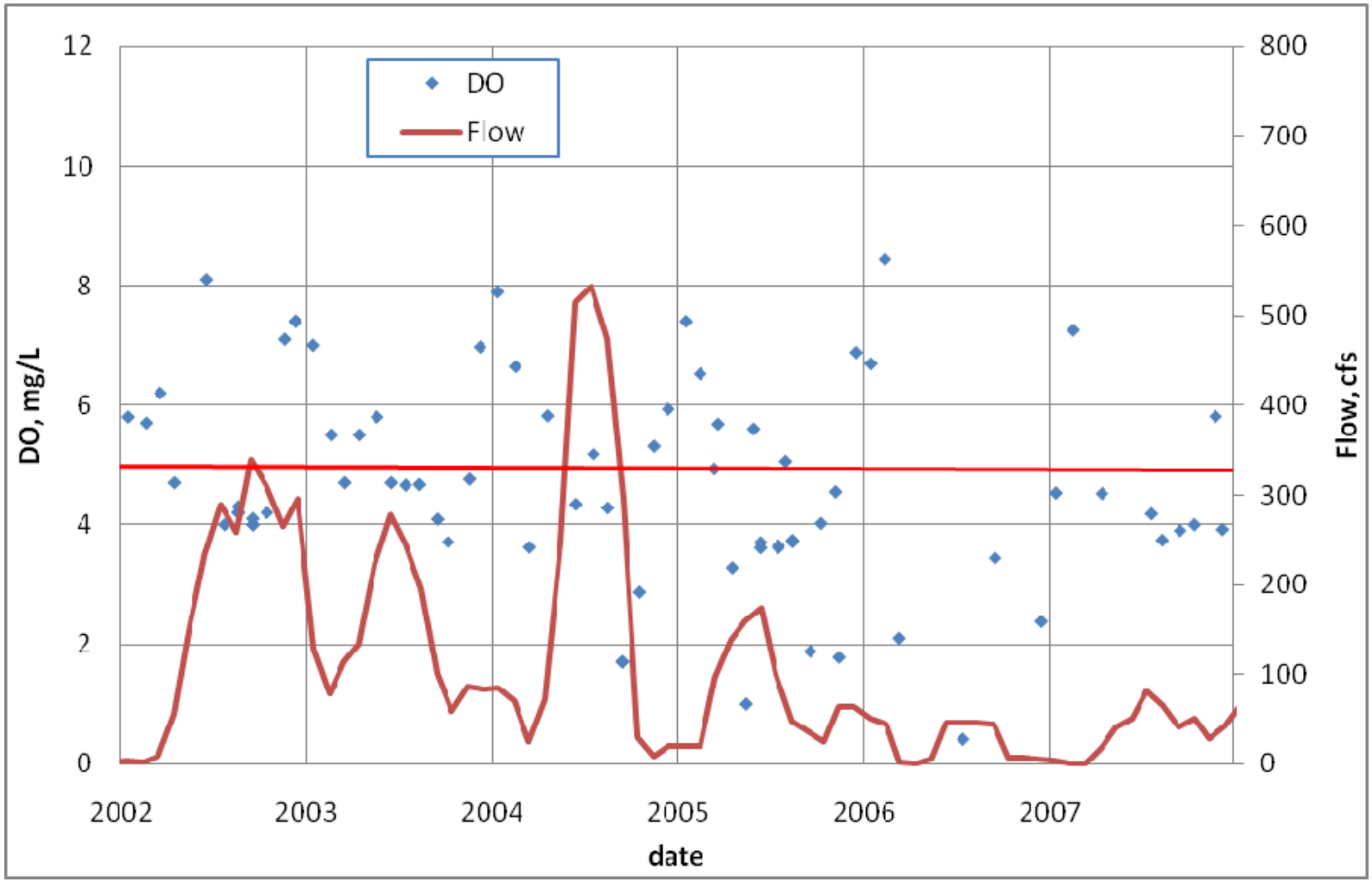

Figure 2-13
Four-Month Cumulative Average Daily Flow versus Dissolved Oxygen

APPLIED TECHNOLOGY & MANAGEMENT

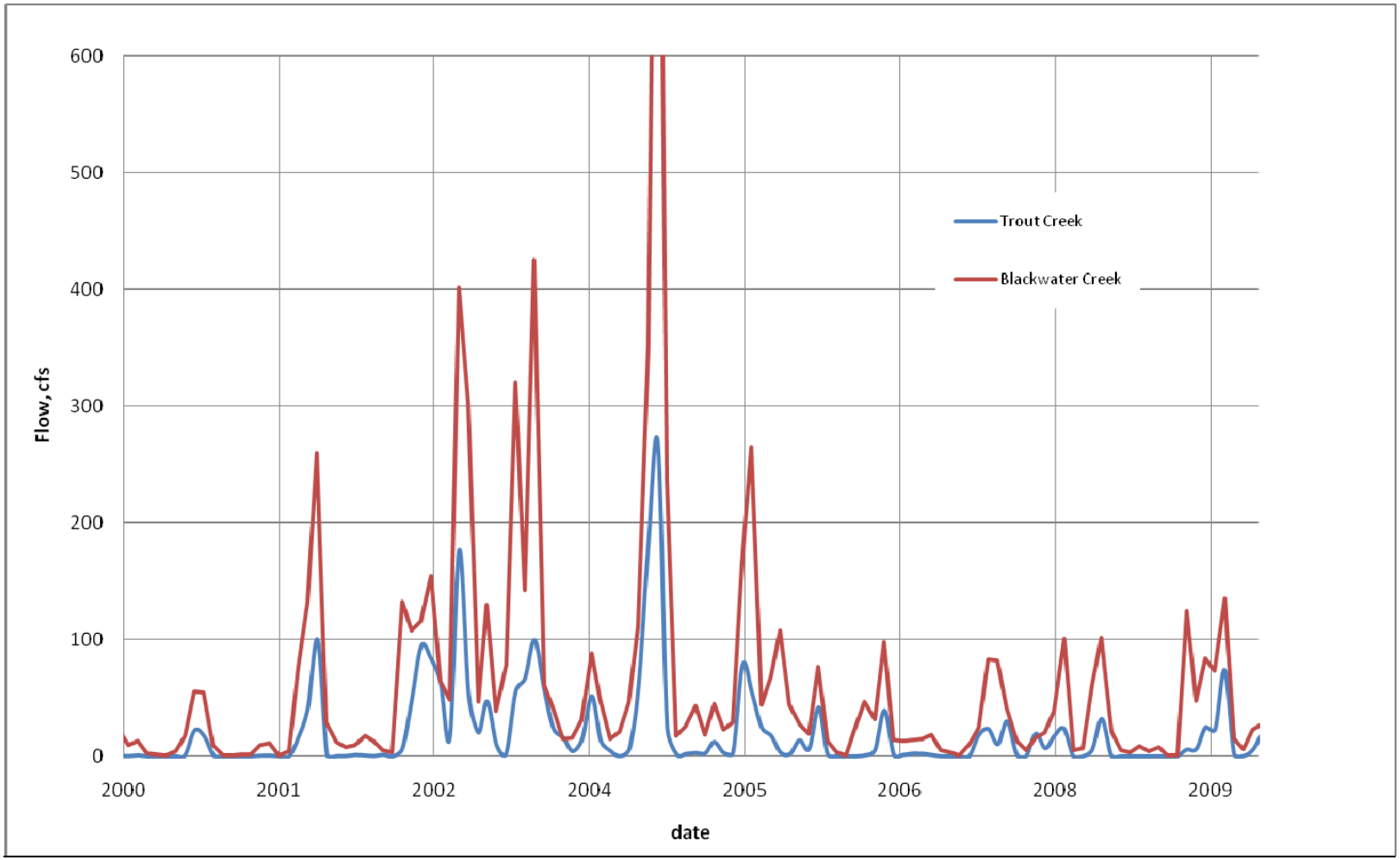

Figure 2-14
Average Monthly Averages of Daily Flows at Trout Creek & Blackwater Creek

APPLIED TECHNOLOGY & MANAGEMENT

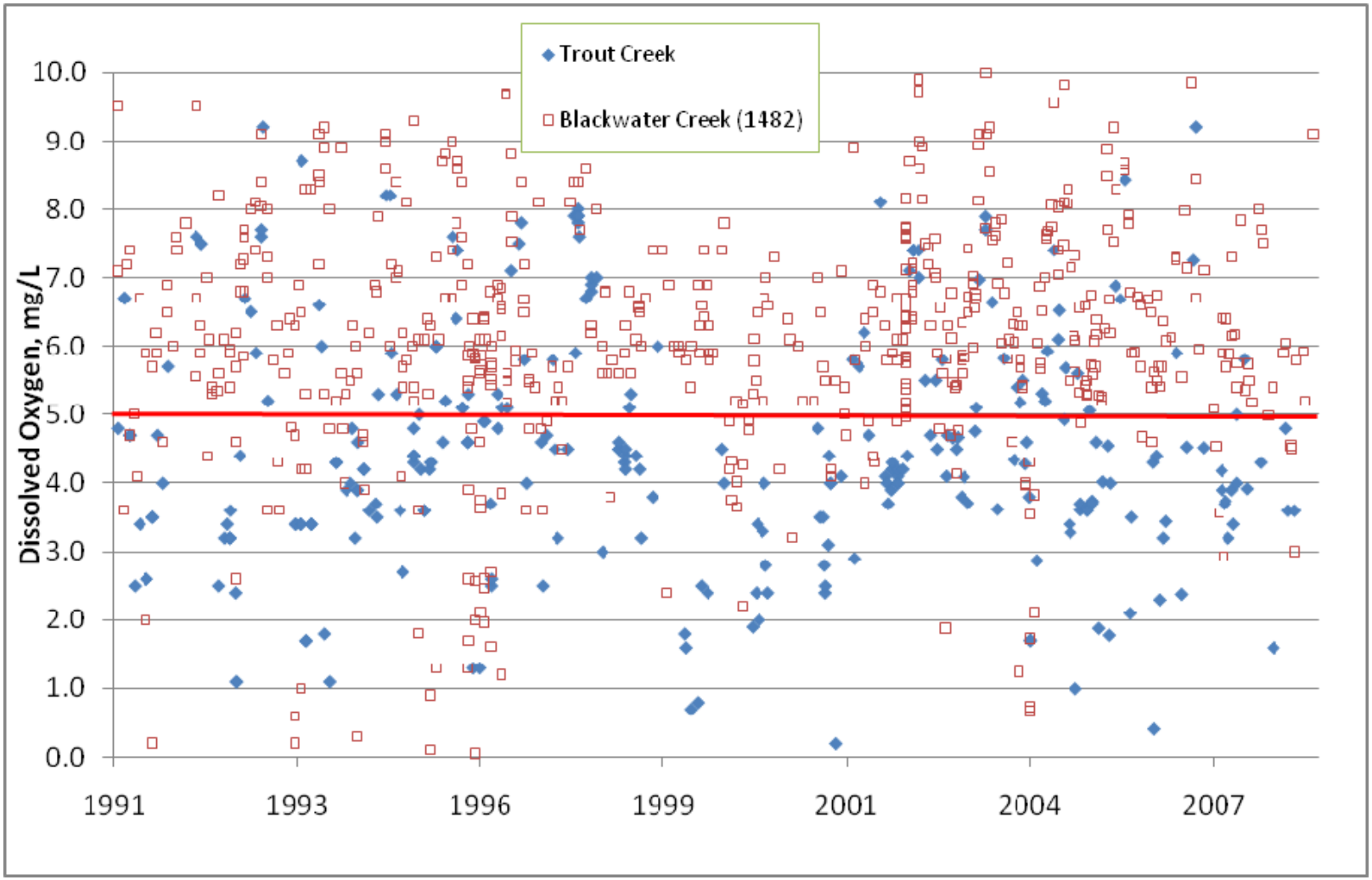

Figure 2-15

Comparison of Dissolved Oxygen Measurements from 1991 to 2008 at Blackwater Creek and Trout Creek

APPLIED TECHNOLOGY & MANAGEMENT

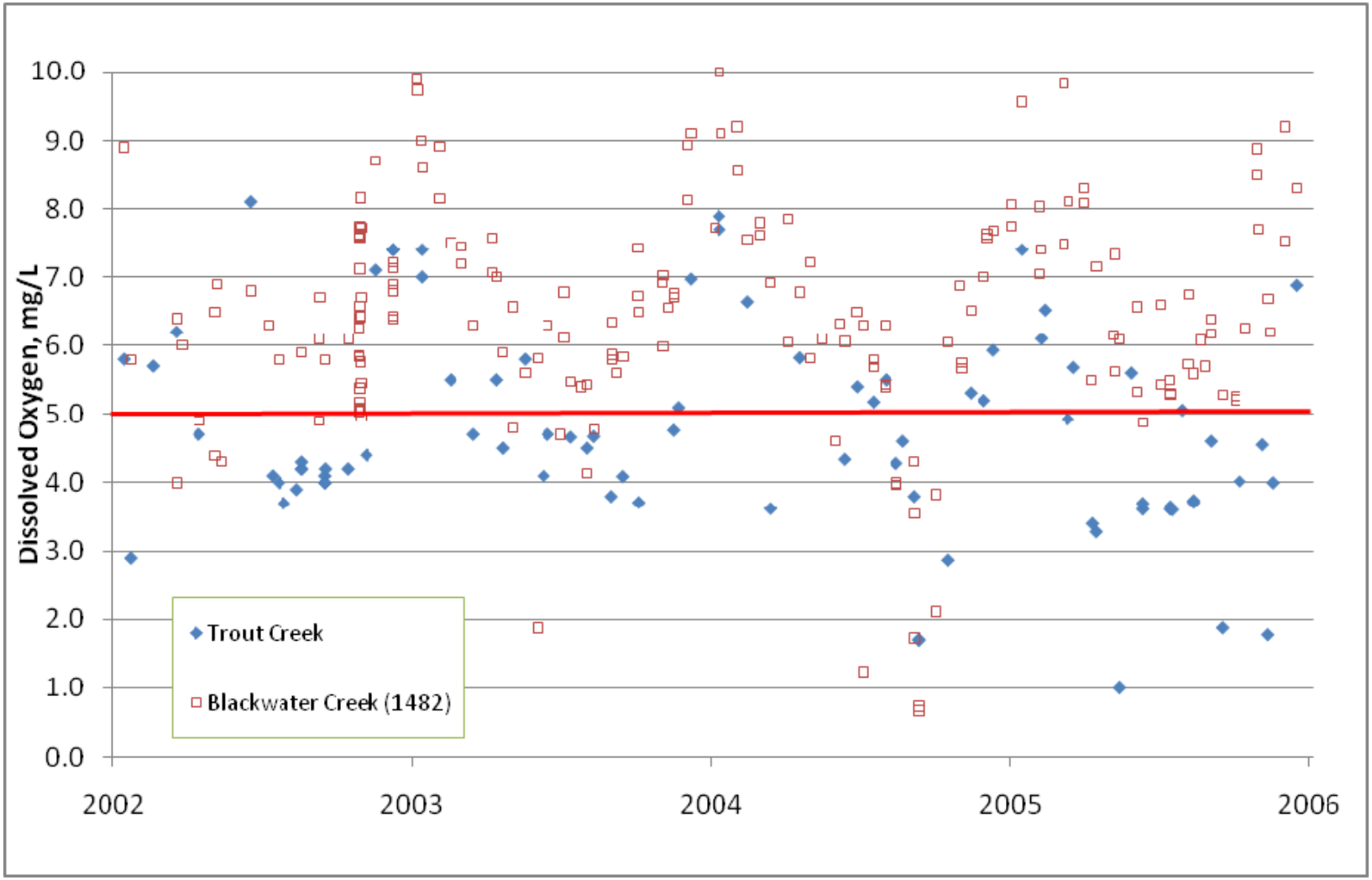

Figure 2-16

Comparison of Dissolved Oxygen Measurements from 2002 to 2006 at Blackwater Creek and Trout Creek

APPLIED TECHNOLOGY & MANAGEMENT

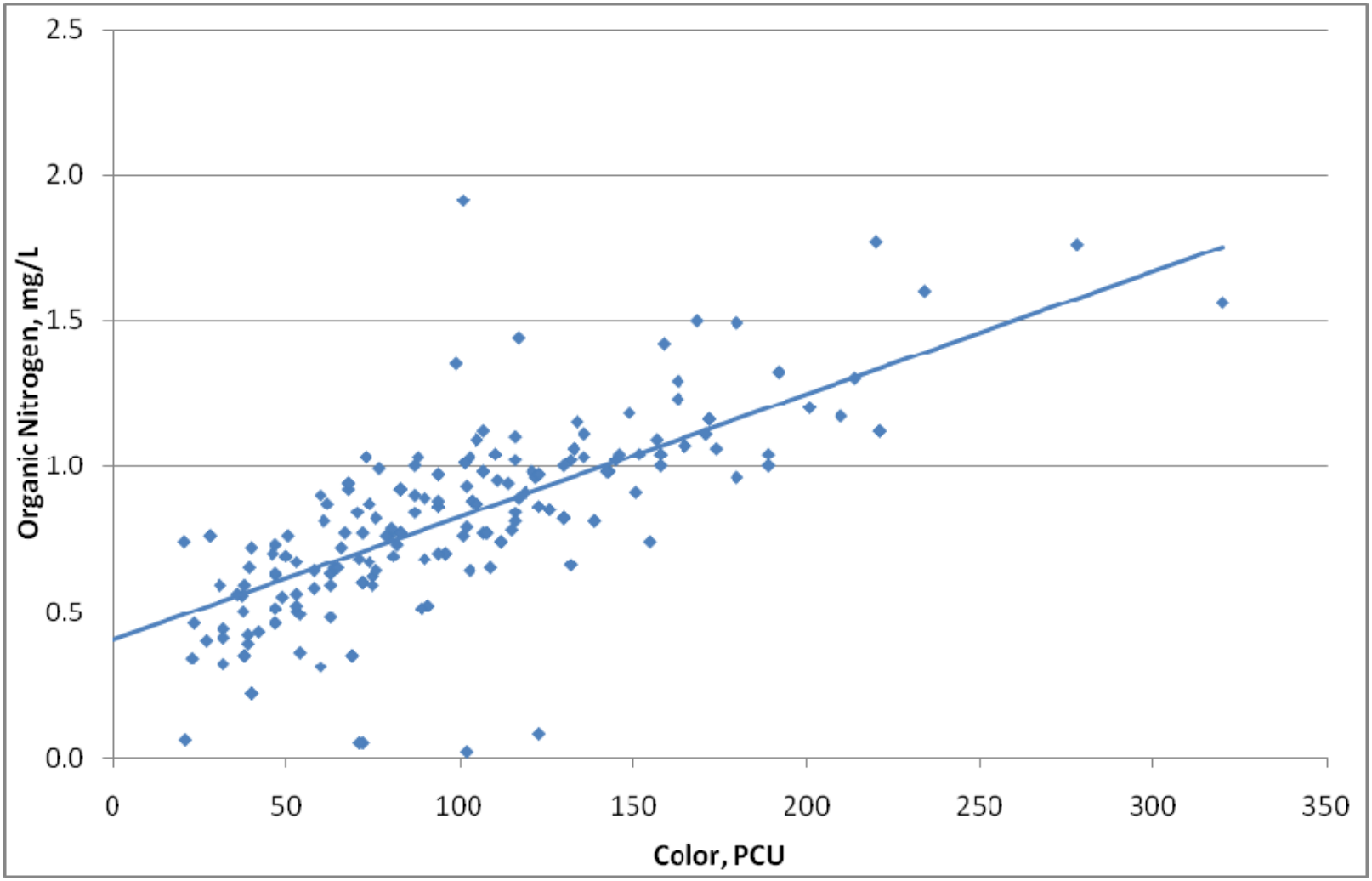

Figure 2-17
Paired Measurements for Organic Nitrogen and Color in Trout Creek

APPLIED TECHNOLOGY & MANAGEMENT

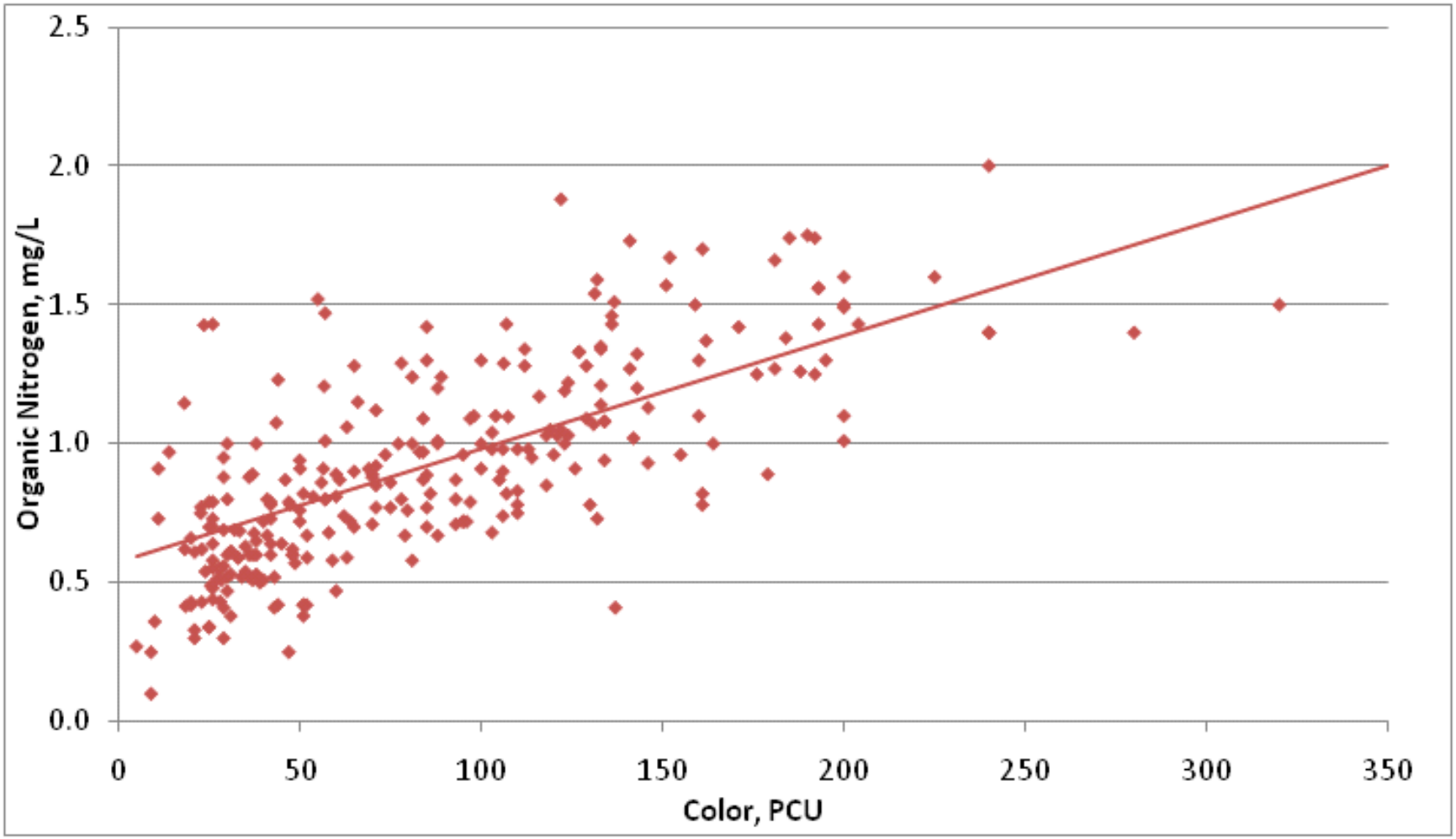

Figure 2-18
Paired Measurements for Organic Nitrogen and Color in Blackwater Creek

APPLIED TECHNOLOGY & MANAGEMENT

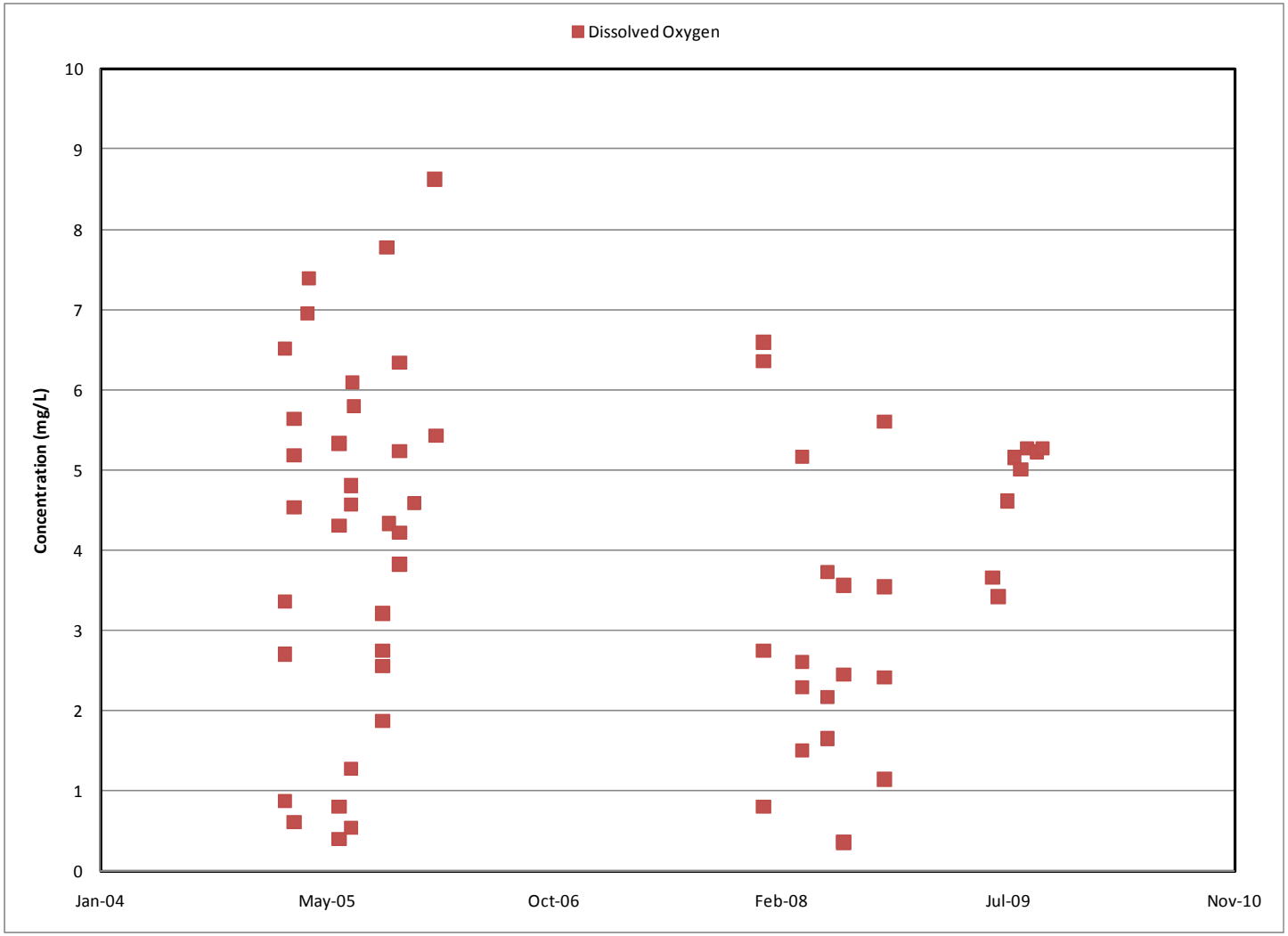

Figure 2-19
Plot of Dissolved Oxygen at FDEP Reference Station (Cypress Branch)

APPLIED TECHNOLOGY & MANAGEMENT

3.0 BIOLOGICAL DATA ASSESSMENT

The FDEP utilizes two standard approaches for assessing streams for biological health. These include the Stream Condition Index (SCI), a composite macroinvertebrate index, and a screening tool or rapid assessment called BioRecon.

3.1 THE STREAM CONDITION INDEX (SCI)

To develop the SCI score, 20 dipnet sweeps are conducted from the most productive habitats in a 100-meter reach of the stream. Organisms collected in these sweeps are preserved and placed in containers according to standard procedures and transported to the laboratory for processing and analysis. The species identified, the counts and the abundance of these organisms is then used to calculate 10 biological metrics that have been shown to respond predictably to human disturbance. The metrics are:

- Number of total taxa
- Number of long lived taxa, those that require more than one year to complete their lifecycle,
- Number of Ephemeroptera (mayflies) taxa,
- Number of Tricoptera (caddisflies) taxa,
- Number of Florida sensitive taxa
- Number of clinger taxa
- Percent dominant taxon
- Percent Tanytarsini
- Percent very tolerant taxa,
- Percent filterers.

3.2 BIORECON

BioRecon is the screening tool version of the SCI that is intended to rapidly assess a site to prioritize it for more intensive sampling. For BioRecon, only four dipnet sweeps are performed of the most productive habitats. BioRecon also differs from an SCI sampling effort in that the organisms are sorted in the field and relative species abundance is recorded on the BioRecon Field Sheet. While the protocol is intended to bypass the laboratory procedure, samples are typically taken of each taxa found and are verified in the laboratory.

FDEP has established thresholds specific to this method for each region for each of six calculated metrics (a subset of the 10 metrics used in the SCI). These include:

- Number of total macroinvertebrate species (taxa)
- Number of long lived taxa, those that require more than one year to complete their life cycle
- Number of sensitive taxa
- Number of clinger taxa
- Number of Ephemeroptera (mayflies) taxa
- Number of Trichoptera (caddisflies) taxa.

3.3 BIOLOGICAL EVALUATIONS OF TROUT CREEK

Only BioRecon measurements have been taken in Trout Creek and not since 1996. However, the water quality data show that the DO concentration pattern has remained similar throughout the period of record so the biological condition as affected by DO can be expected to be similar. A BioRecon was conducted in August 1995 and again in March 1996. The stream was experiencing better-than-average flow during both of these events. The results of the 1995 sampling are reported in a brief FDEP report (Morgan & Denson, 1995) and both events are reported in Appendix G of the Cycle 1 Water Quality Assessment Report (FDEP, 2005). There are some slight discrepancies in the results presented in these reports. ATM obtained the raw taxa counts and lists from FDEP, and the BioRecon results presented in Table 3-1 are based on those data. The macroinvertebrate taxa list from these sampling events show a good diversity of organisms especially considering the intermittent flow regime of the creek. The complete taxa list for both samples is provided in Appendix B.

Table 3-1. Analysis of BioRecon Data from Samples Taken in Trout Creek (WBID 1455)

STORET Station	Date	# of Taxa Score (healthy >12)		FL Index Score (healthy >8)		# of EPT Taxa Score (healthy >4)		Overall Evaluation
24030068	17-Aug-95	22	passed	7	failed	5	passed	Suspect
24030068	14-Mar-96	32	passed	8	passed	8	passed	Passed

Notes: Tabular data summarizes raw data obtained from FDEP

Source: FDEP, 2005; Morgan & Denson, 1995; and raw data obtained from FDEP, 2011

The results of the summer 1995 effort were also reported in (Morgan & Denson, 1995). In that document, the analysis presented in Table 3-1 is explained as follows:

The evaluation of whether a stream is considered healthy or impacted according to BioRecon methods is based on three measurements: the total number of different species present, the number of good water quality ("Florida index") indicator species present, and the total number of mayfly, stonefly, and caddisfly species present (EPT). A stream scoring above a designated value for two or more of these measurements is considered healthy. If less than two values are reached, an impacted condition is suspected.

The thresholds for a “healthy” or passing score are 12 species for total taxa, 8 species for the Florida Index, and 4 species for the ephemeral species or EPT. (Morgan & Denson, 1995) report slightly different results than the Water Quality Assessment Report values provided in Table 3-1. For the August, 1995 event, Morgan & Denson (1995) report that Trout Creek scored a 9 on the Florida Index and a 6 on the EPT, in which case it would have passed all three categories of stream health instead of the value on the threshold reported in the Water Quality Assessment Report for the Florida Index. Perhaps the laboratory data were later reevaluated and the species recounted. In any case, (Morgan & Denson, 1995) report:

This site is located in Flatwoods Park, a Southwest Florida Water Management District land management area. Trout Creek flows toward the Hillsborough from the northwest, passing south of Hunter's Green golf course community, and receiving indirect discharge from Pebble Creek Waste Water Treatment Plant. The creek is bordered by upland forest for most of its length. The BioRecon indicated a fairly healthy system. The Florida Index score was 9, and the EPT was 6.

3.4 CONCLUSIONS FROM THE BIOLOGY

These data, while limited, appear to confirm that the DO regime being measured in the Trout Creek system is a natural long-term condition and that it is supporting a healthy and balanced ecosystem with a large diversity of invertebrate taxa. Three DO measurements were taken in the creek in August 1995 and two in March 1996 (when the biological evaluations were conducted). All five measurements are below 5.0 mg/L. The August 1995 measurements average was 3.9 mg/L and the March 1996 measurements averaged 1.3 mg/L.

4.0 RECOMMENDED PATH FORWARD

The purpose of the analyses presented in the previous sections was to provide the necessary additional information for identification of an appropriate path forward for Trout Creek. As stated in Section 1, The MOA between the FDEP and the Tampa Stakeholders included specific work tasks to guide determination of the category for the path forward. This section will outline the recommended path forward and summarize the findings from the analyses.

Based on the findings, the recommended path forward path forward is that a TMDL is not needed (TNN) for Trout Creek at this time. Based upon our analyses, it is our opinion that the observed DO found in Trout Creek is likely the result of a naturally occurring condition or, at the very least, not the result of an identifiable pollutant and should be reclassified by FDEP in as an appropriate Category 4 type. Following assessment reclassification, further effort in Cycle 3/Cycle 4 should focus on ensuring that a pollutant is not causing the observations, and provide additional biological assessment to more comprehensively define the systems biological health. Additionally, a more appropriate DO criteria needs to be defined for this waterbody.

A summary of the key points from this assessment to support the findings above.

- The water quality analysis conducted in Section 2 found no causative relationship between nutrients, individual nutrient species, or BOD to either observed DO concentrations, DO as expressed as a deficit from 100 percent saturation or measured Chl *a*.
- Calculation of annual mean Chl *a* values using geometric means provides a better predictor of the true median condition (stream central tendency in terms of water column algal mass). Geometric means of the seasonal data and annual averages are all below the IWR listing threshold of 20 µg/L and therefore the system should not have been listed for nutrients.
- A strong relationship was observed between TN and organic nitrogen (i.e., the vast majority of nitrogen source appears to be from allochthonous material such as leaf litter). This is also supported by the strong relationship between color and organic nitrogen in this system, which are typical of wetland-dominated stream systems. In a

nitrogen-limited waterbody where no large sources of anthrogenic nitrogen can be identified or even suggested and the TN is dominated by organic nitrogen (typically over 90 percent), it is not reasonable to list the stream for nutrients unless FDEP's goal is to "abate natural conditions."

- Even though FDEP recognized that the stream is nitrogen limited and consequently identified nitrogen as the causative pollutant, the proposed TMDLs include reductions in phosphorus as well without developing any connection of the observed dissolved oxygen concentrations or in-stream algae.
- Long-term DO measurements also appear to be related to stream flow and temperature primarily.
- Further evidence that the major variables explaining the observed DO measurements are seasonal changes in hydrology and temperature was included by comparing Trout Creek to Blackwater Creek (WBID 1482), a nearby tributary to the Hillsborough similar in many respects Trout Creek. The data analysis show that the two comparable systems have a similar long-term DO regime and appear to respond to the same environment variables at the same time in terms of DO response. Blackwater Creek is currently not verified as impaired for DO and the EPA completed a TMDL for DO and nutrients on the waterbody in 2005 (USEPA, 2005) that called for no reductions in nutrients because the observed "DO is a result of low DO water flowing from groundwater and wetlands, and not the result of in-stream algae, nutrient, and BOD oxygen consumption…" Shallow, slow-moving warm waters are subject to in-stream wetland plant respiration and SOD for the whole of the length of their water courses.
- Two screening level biological reconnaissance sampling events were made in summer 1995 and spring 1996. These samples were taken under higher than average flow conditions but during a time when water quality measurements all reported DO concentrations well below 5.0 mg/L. In both cases, the stream had a large variety of invertebrate taxa and sufficient ephemeral species to receive healthy scores. One of the Florida Index values was at the threshold, so the stream is listed as "suspect" in the IWR. This rating does not mean that it is impaired for biology; it is apparently healthy but further, more rigorous testing (using the SCI) may be warranted to confirm. A large variety of taxa were observed in both sampling periods. The biological data, while limited, appear to confirm that the DO regime being measured in the Trout Creek system may be that natural long-term condition

and that it is supporting a healthy and balanced ecosystem with a large diversity of invertebrate taxa even though stream flow is intermittent.

Based on the findings, the recommended path forward path forward is that a TMDL is not needed (TNN) for Trout Creek at this time. Instead, we recommend that the path forward include the development of a more appropriate DO standard for Trout Creek and other similar blackwater systems.

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APPENDIX A

Memorandum of Agreement

EXHIBIT A

MEMORANDUM OF AGREEMENT

The purpose of this memorandum is to outline agreements made between the Florida Department of Environmental Protection (FDEP) and the Parties working on the Tampa Bay Tributary Total Maximum Daily Load (TMDL) challenge. This memo outlines agreements made on a waterbody identification (WBID) basis on the pathways forward to resolution of the TMDLs under challenge and currently in abeyance.

For each WBID, the following outlines the determination made between the Parties and FDEP in relation to the path forward. Additionally, the timelines for completion of deliverables (where applicable) and the specific work tasks to complete the deliverables are provided. The potential outcomes for each WBID include the following:

I. TMDL for nutrients and/or biochemical oxygen demand (BOD) with potential for revised dissolved oxygen (DO) target using regional DO criteria
II. Class III Limited re-designation
III. Physical or habitat restoration
IV. TMDL not needed (TNN)

Specific work tasks outlined below will lead to the determination of the category for the path forward. For waterbodies that have significant historical physical modifications, it may be determined that trying for a Class III Limited designation may be the appropriate path forward. Additionally, where it is determined that the WBID is showing low DO values, but no direct impact from nutrient enrichment can be found either through assessment of primary productivity or other mechanisms, then the waterbody may be considered for TNN status. Finally, where data indicate that load reductions will achieve restoration of the designated use of the WBID, then the path to a final TMDL will be defined.

The deliverables outlined below will either define the final outcome, or will outline steps to reach the final outcome. If the determination is Option II, III, or IV, the report will outline and support the finding. The timeline for completion of the Class III Limited re-designation or the habitat restoration cannot be identified under this process and will be identified at a later time. If it is determined that Option I is the pathway (a revised TMDL needs to be developed), the report will outline the work to be done to complete the TMDL. The timeline for the development of the TMDLs will be at latest December 31, 2011 for all waterbodies where a determination is made to move forward with a revised TMDL.

Trout Creek (1455)

Determination:

- This WBIDs will undergo a full evaluation to determine the path forward (see path forward options listed above). Following completion of the evaluation, a report will be provided that outlines the findings for the WBID.

Timeline/Deliverable:

- WBID Assessment Report – 02/28/11

Work Tasks:

- Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values.
- Compare low DO values and other key water quality factors within Trout Creek against data from adjacent WBIDs with low DO that are currently not listed as impaired.
- Examine the high chlorophyll *a* (Chl *a*) measurement to try to determine the potential cause of the apparent anomalous measurement.
- Look at other data that may be available upstream to determine if there are distinct differences in the upstream and downstream conditions to decide if splitting the WBID makes sense.
- Examine Stream Condition Index (SCI) data to determine level of biological health.
- Examine more recent data from the Environmental Protection Commission of Hillsborough County (EPCHC) to see conditions in recent years. Specifically, examine if there are three consecutive years after 2007 that are below the impairment threshold to support a delisting for nutrients.
- Provide WBID Assessment Report outlining path forward with any future timelines.

Baker Creek (1522C), Mill Creek (1542A), and Spartman Branch (1561)

Determination:

- These WBIDs will undergo a full evaluation to determine the path forward (see path forward options listed above). Following completion of the evaluation, a report will be provided that outlines the findings for each WBID.

Timeline/Deliverable:

- WBID Assessment Report – 02/28/11

Work Tasks

- Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values.
- Compare low DO values and other key water quality factors within Baker Creek, Mill Creek, and Spartman Branch against data from adjacent WBIDs with low DO that are currently not listed as impaired.
- Examine how representative the Baker Creek station is of the inflowing waters versus being representative of conditions in Lake Thonotosassa.
- Examine Pemberton Creek DO values in relation to measurements in Baker Creek.
- Examine the local issues within Mill Creek to determine potential local and downstream impacts due to the discharge from the National Pollutant Discharge Elimination System (NPDES) permittee Crystals International.
- Examine potential for determining the downstream protective value (DPV) approach for Lake Thonotosassa as possible solution.
- Examine SCI data (if available) to determine level of biological health.
- Examine more recent data from EPCHC to see conditions in recent years.
- Review Mill Creek and Spartman Branch separate from Baker Creek.
- Provide WBID Assessment Report outlining path forward with any future timelines.

Two-Hole Branch (1489)

Determination:

- This WBID will undergo a full evaluation to determine the path forward (see path forward options listed above). Following completion of the evaluation, a report will be provided that outlines the findings for each WBID.

Timeline/Deliverable:

- WBID Assessment Report – 02/28/11

Work Tasks

- Examine more closely the available data on DO relative to hydrology and other potential factors causing the low DO values.
- Compare low DO values and other key water quality factors within Two-Hole Branch against data from adjacent WBIDs with low DO that are currently not listed as impaired.
- Examine SCI data if available to assess biological health.
- Provide WBID Assessment Report outlining path forward with any future timelines.

Channelized Stream (1483)

Determination:

- As no Parties participating within the group have specific interests within this WBID, it will be removed from the challenge
- FDEP will deal with other Parties on the TMDL.
- FDEP will examine the TMDL report to remove the reference to Hillsborough County and Florida Department of Transportation (FDOT) from the list of municipal separate storm water sewer system (MS4) permittees because there are no MS4 responsibilities within this WBID.
- Hillsborough County with withdrawal the challenge for Channelized Stream by February 28, 2011.

Tampa Bypass Canal Tributary (1536C)

Determination:

- This WBID will undergo a localized evaluation of conditions at the site to determine potential for Class III Limited designation. Also, a more detailed assessment of potential sources will be evaluated to define if a TMDL is needed to address specific known sources. This more localized work will be completed in conjunction with an evaluation of potential causes of low DO. Following completion of the evaluation, a report will be provided that outlines the findings for the WBID.

Timeline/Deliverable:

- WBID Assessment Report – 02/28/11

Work Tasks:

- Examine more closely the available data on DO relative to hydrology and other potential factors causing the low DO values.

- Compare low DO values and other key water quality factors against data from adjacent WBIDs with low DO that are currently not listed as impaired.
- Examine SCI data if available to assess biological health.
- Review sampling field sheets to determine hydrologic conditions during sampling.
- Conduct assessment of sources within the WBID and examine sources against local data to assess nutrient species.
- Meet with Hillsborough County to do a detailed infield assessment.
- Examine need for additional monitoring.
- Provide WBID Assessment Report outlining path forward with any future timelines.

Sweetwater Creek (1516) and Brushy Creek (1498)

Determination:

- FDEP discussed the potential for withdrawing these TMDLs with EPA at their regularly scheduled conference call on October 12, 2010. EPA responded that at this time they will not withdrawal the TMDLs for Sweetwater Creek and Brushy Creek.
- This WBID will undergo a full evaluation to determine the path forward (see path forward options listed above). Following completion of the evaluation, a report will be provided that outlines the findings for the WBID.

Timeline/Deliverable:

- WBID Assessment Report – 02/28/11

Work Tasks: (if TMDLs not withdrawn)

- Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values.
- Compare low DO values and other key water quality factors against data from adjacent WBIDs with low DO that are currently not listed as impaired.
- Examine SCI data to determine level of biological health.
- Examine more recent data to see conditions in recent years.
- Provide WBID Assessment Report outlining path forward with any future timelines.

Lake Tarpon Canal (Freshwater) (1541B)

Determinations:

- Pinellas County will identify if it is interested in pursuing a Class III Limited designation.
- If Pinellas County decides not to pursue reclassification, then this WBID will undergo a full evaluation to determine the path forward (see path forward options listed above). Following completion of the evaluation, a report will be provided that outlines the findings for the WBID.

Timeline/Deliverable:

- Pinellas County Recommendation (based upon completion of Class III Limited feasibility assessment) – 02/15/11
- WBID Assessment Report (optional)– 02/28/11

Work Tasks:

- Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values.
- Compare low DO values and other key water quality factors against data from adjacent WBIDs with low DO that are currently not listed as impaired.
- Examine SCI data to determine level of biological health.
- Examine more recent data to see conditions in recent years.
- Review Lake Tarpon pollutant load reduction goals (PLRG) for use in TMDL development
- Examine data on DO within Brooker Creek, which was recently identified as TNN, to determine if similar condition exists for Lake Tarpon Canal.

Alligator Lake (1574A) and Alligator Creek (1574B)

Determinations:

- Alligator Lake
    - Complete data analyses.
    - FDEP and Pinellas County will make determination on desired path forward for Alligator Lake designation following analysis of data.
- Alligator Creek
    - WBID will undergo a full evaluation to determine the path forward (see path forward options listed above). Following completion of the evaluation, a report will be provided that outlines the findings for the WBID.

Timeline/Deliverable:

- Alligator Lake Determination – 02/15/11
- Alligator Creek WBID Assessment Report – 02/28/11

Work Tasks:

- Alligator Lake
    - Complete analysis of recent data collected in August and September.
    - Determine appropriateness of weir data to represent the lake as a whole.
    - Examine recent data in relation to total nitrogen (TN) target to determine if TNN designation appropriate based upon recent data.
    - Meet with FDEP and make determination on path forward.
- Alligator Creek
    - Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values.
    - Compare low DO values and other key water quality factors, against data from adjacent WBIDs with low DO that are currently not listed as impaired.
    - Examine SCI data to determine level of biological health.
    - Examine more recent data to see conditions in recent years.
    - Provide WBID Assessment Report outlining path forward with any future timelines.

Bellows Lake (1579A) and Bellows Lake Outlet (1579)

Determinations:

- Bellows Lake
    - DEP will provide Scope of Work for Paleolimnologic Study to Hillsborough County for review.
    - Following completion of the Paleolimnologic Study, a path forward will be developed by FDEP and Hillsborough County based upon analysis of new data. An approach document will be developed with schedule and detailed approach to complete the TMDL once paleolimnologic data is received.
- Bellows Lake Outlet
    - Bellows Lake Outlet will be determined to be in compliance upon completion of the Bellows Lake TMDL.

Timeline/Deliverable:

- Paleolimnologic Study Report – 6/30/11
- Bellows Lake TMDL – 9/30/11

Work Tasks:

- Work tasks to be developed between FDEP and Hillsborough County

Allen Creek Tidal (1604)

Determinations:

- This WBID will undergo a full evaluation to determine the path forward (see path forward options listed above). Following completion of the evaluation, a report will be provided that outlines findings for the WBID.

Timeline/Deliverable:

- WBID Assessment Report – 02/28/11

Work Tasks:

- Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values.
- Examine available biological data/information to identify biological health of system
- Examine more recent data to see conditions in recent years.
- Look at nitrogen species compared to salinity levels to help isolate potential sources.
- Document timeframes for septic tank removal and restoration projects to see if they align with recent water quality improvements
- Examine the measured DO values against other tidal tributaries that are within more pristine areas. Look at TN concentration comparisons.

Bishop Creek Tidal (1569)

Determination:

- This WBID will undergo an evaluation of the data to determine if the high nutrient levels measured are a local condition, i.e., not coming from upstream sources. The evaluation

will lead to the determination of the path forward (see path forward options listed above). Following completion of the evaluation, a report will be provided that outlines the findings for the WBID.

Timeline/Deliverable:

- WBID Assessment Report – 02/28/11

Work Tasks:

- Initial Assessment
    - Examine data to determine if the higher nutrient levels are local and not coming from upstream sources.
    - Potentially do some coordinated sampling in the upstream (freshwater) and downstream (estuarine) areas to see if the upstream watershed is the source or is it a more local issue, i.e., associated with mangroves in old sampling location.
- Further Assessment (if Initial Assessment does not identify path forward).
    - Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values.
    - Examine available biological data/information to identify biological health of system
    - Examine more recent data to see conditions in recent years.
    - Examine the measured DO values against other tidal tributaries that are within more pristine areas. Look at TN concentration comparisons.

Mullet Creek Tidal (1575)

Determinations:

- This WBID will undergo a full evaluation to determine the path forward (see path forward options listed above). Following completion of the evaluation, a report will be provided that outlines the findings for the WBID.

Timeline/Deliverable:

- WBID Assessment Report – 02/28/11

Work Tasks:

- Examine the one year (2002) where Chl *a* values were high to determine any issues with data.
- Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values.
- Examine available biological data/information to identify biological health of system
- Examine more recent data to see conditions in recent years.
- Evaluate the upstream freshwater area measurements against historical downstream estuarine measurements by Pinellas County.
- Examine the measured DO values against other tidal tributaries that are within more pristine areas. Look at TN concentration comparisons.

Lake Tarpon Canal (marine) (1541A)

Determinations:

- This WBID will undergo a full evaluation to determine the path forward (see path forward options listed above). Following completion of the evaluation, a report will be provided that outlines the findings for the WBID.

Timeline/Deliverable:

- WBID Assessment Report – 02/28/11

Work Tasks:

- Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values.
- Examine available biological data/information to identify biological health of system
- Examine more recent data to see conditions in recent years.
- Evaluate the potential upstream freshwater sources to determine potential for impacts on marine section (i.e., Lake Tarpon freshwater resolution solving issue).
- Examine the measured DO and Chl *a* values against other tidal tributaries that are within more pristine areas. Look at TN concentration comparisons.

Double Branch Tidal (1513)

Determination:

- This WBID will undergo a full evaluation to determine the path forward (see path forward options listed above). Following completion of the evaluation, a report will be provided that outlines the findings for the WBID.

Timeline/Deliverable:

- WBID Assessment Report – 02/28/11

Work Tasks:

- Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values. Examine potential local wetland contributions.
- Examine potential contributions from local point sources in watershed.
- Examine available biological data/information to identify biological health of system
- Examine more recent data to see conditions in recent years.
- Evaluate the upstream freshwater area measurements against downstream measurements if available.
- Examine the measured DO values against other tidal tributaries that are within more pristine areas. Look at TN concentration comparisons.

Moccasin Creek Tidal (1530),

Determination:

- This WBID will undergo a full evaluation to determine the path forward (see path forward options listed above). Following completion of the evaluation, a report will be provided that outlines the findings for the WBID.

Timeline/Deliverable:

- WBID Assessment Report – 02/28/11

Work Tasks:

- Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values. Examine potential local wetland contributions.
- Examine potential contributions from local point sources in watershed.
- Examine available biological data/information to identify biological health of system
- Examine more recent data to see conditions in recent years.
- Evaluate the upstream freshwater area measurements against downstream measurements if available.
- Examine the measured DO values against other tidal tributaries that are within more pristine areas. Look at TN concentration comparisons.
- Examine possible link between when the ponds are discharging and the data results. Also need to parse data for times of fresh versus marine conditions.

Cross Canal (1625)

Determination:

- This WBID will be examined to determine if it will be utilized as a pilot study for the Class III Limited designation.
- Pinellas County will make determination on working for Class III Limited status.
- Possibly utilize data coming from Watershed Study.

Timeline/Deliverable:

- Pinellas County Recommendation (based upon completion of Class III Limited feasibility assessment) – 02/15/11

Work Tasks:

- None at this time

Bullfrog Creek (1666A)

Determination:

- FDEP will utilize new data and examine the relationships previously developed to see if relationships hold. FDEP will also provide explanation for the lack of relationship using data from the entire period of record.
- If the relationships hold, then investigations will be done for the development of alternative Chl *a* target for the tidal creek segment.

- If relationships do not hold, this WBID will undergo a full evaluation to determine the path forward (see path forward options listed above). Following completion of the evaluation, a report will be provided that outlines the findings for the WBIDs.

Timeline/Deliverable:

- Revised analysis completed by FDEP - 12/15/10
- Evaluation of FDEP Methodology – 2/15/11
- Chl *a* Target Determination Report (if relationships hold) – To be determined
- WBID Assessment Report (if relationships do not hold) – 02/28/11

Work Tasks:

- Chl a Target Determination
    - Examine tidal creek data to identify potential Chl *a* targets as they relate to the biotic health of these systems
- WBID Assessment Report
    - Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values.
    - Compare low DO values and other key water quality factors against data from adjacent WBIDs with low DO that are currently not listed as impaired.
    - Examine available biological data to assess biological health.
    - Examine more recent data to see conditions in recent years.
    - Given the appropriateness of the empirical relationships derived by FDEP and the proposed Chl *a* targets, estimate critical loads to meet the Chl *a* targets.

Cockroach Bay (1778)

Determination:

- FDEP will utilize new data and examine the relationships previously developed to see if relationships hold. FDEP will also provide explanation for the lack of relationship using data from the entire period of record.
- If the relationships hold, then investigations will be done for the development of alternative Chl *a* target for the tidal creek segment.
- If relationships do not hold, this WBID will undergo a full evaluation to determine the path forward (see path forward options listed above). Following completion of the evaluation, a report outlining the findings for the WBIDs will be provided.

Timeline/Deliverable:

- Revised analysis completed by FDEP - 12/15/10
- Evaluation of FDEP Methodology – 2/15/11
- Chl *a* Target Determination Report (if relationships hold) – To be determined
- WBID Assessment Report (if relationships do not hold) – 02/28/11

Work Tasks:

- Chl a Target Determination
    - Examine tidal creek data to identify potential Chl *a* targets as they relate to the biotic health of these systems

- WBID Assessment Report
    - Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values.
    - Compare low DO values and other key water quality factors against data from adjacent WBIDs with low DO that are currently not listed as impaired.
    - Examine available biological data to assess biological health.
    - Examine more recent data to see conditions in recent years.
    - Given the appropriateness of the empirical relationships derived by FDEP and the proposed Chl *a* targets, estimate critical loads to meet the Chl *a* targets.

Lower Rocky Creek (1563)

Determination:

- FDEP will utilize new data and examine the relationships previously developed to see if relationships hold. FDEP will also provide explanation for the lack of relationship using data from the entire period of record.
- If the relationships hold, then investigations will be done for the development of alternative Chl *a* target for the tidal creek segment.
- If relationships do not hold, this WBID will undergo a full evaluation to determine the path forward (see path forward options listed above). Following completion of the evaluation, a report outlining the findings for the WBIDs will be provided.

Timeline/Deliverable:

- Revised analysis completed by FDEP - 12/15/10
- Evaluation of FDEP Methodology – 2/15/11
- Chl *a* Target Determination Report (if relationships hold) – To be determined
- WBID Assessment Report (if relationships do not hold) – 02/28/11

Work Tasks:

- Chl *a* Target Determination
    - Examine tidal creek data to identify potential Chl *a* targets as they relate to the biotic health of these systems
- WBID Assessment Report
    - Examine more closely all available data on DO relative to hydrology and other potential factors causing the low DO values.
    - Compare low DO values and other key water quality factors against data from adjacent WBIDs with low DO that are currently not listed as impaired.
    - Examine available biological data to assess biological health.
    - Examine more recent data to see conditions in recent years.
    - Given the appropriateness of the empirical relationships derived by FDEP and the proposed Chl *a* targets, estimate critical loads to meet the Chl *a* targets.

Coffee Pot Bayou (1700), Smacks Bayou (1683)

Determination:

- Will examine the potential for these two WBIDs to be taken off the list (i.e., TNN) based upon recent TN and DO data and trends, historic restoration activities within these two WBIDs, and the use of inappropriate canal data (Smacks Bayou) to identify impairment.

Timeline/Deliverable:

- Smacks Bayou and Coffee Pot Bayou Determination - 2/28/11

Work Tasks:

- Smacks Bayou and Coffee Pot Bayou
    - Examination of data within Smacks Bayou and Coffee Pot Bayou to determine if those waterbodies should be taken off the impaired list for DO based on use of canal data and due to watershed restoration activities that have taken place previously.
    - A determination report will be developed that will outline the findings for these two WBIDs.

APPENDIX B

Trout Creek BioRecon Data

APPENDIX B – TAXA LIST FROM 1995/1996 BIORECON SAMPLING

Acentrella alachua
Acerpenna pygmaea
Amnicola dalli johnsoni
Belostoma
Caenis diminuta
Chauliodes
Cheumatopsyche
Chironomidae
Clathrosperchon
Corbicula fluminea
Dineutus
Dubiraphia
Dubiraphia vittata
Enallagma
Epicordulia regina
Ferrissia
Ferrissia hendersoni
Gomphus minutus
Libellula incesta
Limnodrilus hoffmeisteri
Maccaffertium exiguumMacromia taeniolata
Microcylloepus pusillus
Micromenetus dilatatus avus
Naididae
Nasiaeschna pentacantha
Notogillia wetherbyi
Oecetis cinerascens
Optioservus
Palaemonetes paludosus
Pelonomus obscurus gracilipes
Physa
Procloeon viridocularis
Pseudocloeon
Rheotanytarsus
Scirtes
Simulium
Stenacron interpunctatum
Stenelmis fuscata
Turbellaria