Albany Pool Tributary Water Quality Assessment

Albany Pool
Part B Long-Term Control Plan

Prepared for:
Capital District Regional Planning Commission (CDRPC)

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Executive Summary

The Albany Pool Communities have 92 combined sewer overflows (CSOs) that discharge to the Hudson and Mohawk Rivers. To implement a plan for evaluating the impact of these discharges, the City of Troy, City of Albany, City of Cohoes, City of Rensselaer, City of Watervliet and the Village of Green Island (the "Pool" communities) have joined in a comprehensive inter-municipal venture, led by the Capital District Regional Planning Commission (CDRPC).

In 2008, the Albany Pool communities initiated a comprehensive receiving water conditions assessment that was designed to characterize the receiving water quality of the Hudson and Mohawk Rivers where the Albany Pool Communities CSOs discharge. A Receiving Water Quality Report was produced describing the results of the implementation of the Receiving Water Quality Sampling Plan (October 2007 Revised by letter May 23, 2008).

This document describes the sampling that was performed in 2009 to further examine the water quality of the tributaries within the Albany Pool Communities contributory to the Hudson River. This work was done as a follow up to the 2008 sampling which identified that the tributaries were generally at or exceeded the fecal coliform compliance limit during both dry and wet weather conditions.

In 2009, additional locations were sampled on each tributary to better identify potential pollution sources and determine the influences from outside communities. Samples were collected at 18 locations during five dry weather events and three wet weather events. The samples were analyzed for fecal coliform and in-situ field measurements were also collected including dissolved oxygen (DO). The tributaries sampled included the Patroon Creek, Normans Kill, Wynants Kill, Poesten Kill, and Mill Creek. The following summarizes briefly the results of the report.

Dry Weather Bacteria

Geometric mean values for fecal coliform for the five dry weather events were used to determine the compliance of each sample location. The results were generally consistent with 2008 for the locations that were sampled in both years with the exception of the Patroon Creek which showed significant reductions in fecal coliform counts.

The major dry weather findings are:

Patroon Creek

The Patroon Creek was sampled at Tivoli Street near its confluence with the Hudson River in 2008 and 2009. During both years, the resulting fecal coliform counts exceeded the compliance limit during dry weather. However, the geometric mean fecal coliform counts decreased significantly from the values of more than 8,000 colony-forming units (cfu)/100 milliliter (mL) recorded during the sampling of 2008 to 400 cfu/100 mL recorded in 2009. The City of Albany and the Albany County Sewer District (ACSD) identified and mitigated two illicit sanitary sewer connections contributing to the Patroon Creek. The significant reductions in fecal coliform are likely the result of these activities. Despite this significant reduction in coliform, the water quality standard of 200 cfu/100 mL is still exceeded at its confluence with the Hudson River.

Of particular concern were the significant bacteria counts recorded during all sampling events where the Patroon Creek crosses Fuller Road. The geometric mean value for the 30-day period was almost 1,000 cfu/100 mL. The consistent exceedence of the water quality standard prompted additional sampling in the vicinity. The results of the additional sampling suggest that Rensselaer Lake is not a source of fecal coliform but that there is a significant source between Rensselaer Lake and the Fuller Road sampling location. Additional investigations at this location are ongoing.

Samples were also collected in three tributaries to Patroon Creek entering Albany from the Town of Colonie. Two of the sampling locations, Palma Park and Corporate Woods Boulevard, were in compliance during the 2009 dry weather sampling. The third sampling location, Sand Creek, exceeded the compliance limit indicating that the Patroon Creek is being negatively impacted by Sand Creek.

Normans Kill

The Normans Kill was sampled at River Road near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated compliance with the water quality standard for fecal coliform for all dry weather sampling events and some improvement over the 2008 sampling results.

The Normans Kill and the Krum Kill were also sampled upstream of their confluence near Route 85. Both of these locations exceeded the water quality standard for fecal coliform based on the geometric mean of five samples. The upstream Normans Kill sample results showed slightly elevated fecal coliform counts coming from the Town Bethlehem. The Krum Kill location showed larger exceedences but, because it runs along

the border of Albany and Bethlehem and has its source in the Town of Guilderland, source conclusions are difficult.

Wynants Kill

The Wynants Kill was sampled at Burden Avenue near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated compliance with the water quality standard for fecal coliform based on the geometric mean of the five dry weather sampling events and some improvement over the 2008 sampling results.

The Wynants Kill was also sampled at Brookside Avenue and Winter Street. Both these locations met the water quality standard for all dry weather events indicating that no significant dry weather sources are entering Troy from North Greenbush at these locations.

Poesten Kill

The Poesten Kill was sampled at 2nd Street near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated compliance with the water quality standard for fecal coliform based on the geometric mean of the five dry weather sampling events and some improvement over the 2008 sampling results.

The Poesten Kill was also sampled at Pawling Avenue. This location met the water quality standard for all dry weather events indicating that no significant dry weather sources are entering Troy from Brunswick at this location.

Mill Creek

The Mill Creek was sampled at Washington Avenue near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated the exceedence of the water quality standard for fecal coliform for all samples. A similar exceedence at this location was observed in 2008.

The Mill Creek was also sampled at High Street and at a tributary from Hampton Lake Manor at South Street. Both these locations exceeded the water quality standard for fecal coliform indicating that dry weather sources are entering Rensselaer from North Greenbush.

Wet Weather Bacteria

As with the dry-weather events, geometric mean values for fecal coliform were used to determine the compliance of each sample location. The geometric means include 10 samples collected during each 48 hour sampling event period. Three wet weather events

were sampled; Event 1 and Event 3 had a similar amount of cumulative precipitation, 1.12 and 1.19 inches, respectively. The cumulative rainfall measured during Event 2 was 0.34 inches. The results were generally consistent with 2008 for the locations that were sampled in both 2008 and 2009 with the exception of the Patroon Creek which showed significant reductions in fecal coliform counts.

The major wet weather findings are:

Patroon Creek

The Patroon Creek was sampled at Tivoli Street near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated the exceedance of the water quality standard for fecal coliform for all samples. However, the geometric mean fecal coliform counts decreased significantly from the values of more than 10,000 cfu/100 mL recorded during the sampling of 2008 to 4000 cfu/100 mL recorded in 2009. As stated earlier, the City of Albany and the Albany County Sewer District (ACSD) identified and mitigated two illicit sanitary sewer connections contributing to the Patroon Creek. The significant reductions in fecal coliform are likely the result of these activities. Despite this significant reduction in coliform, the water quality standard of 200 cfu/100 mL was still exceeded at its confluence with the Hudson River for all three events.

The Patroon Creek was also sampled at Fuller Road and at three tributaries to Patroon Creek from the Town of Colonie. All four locations exceeded the water quality standard for all of the wet weather events indicating elevated counts entering Albany from the Town of Colonie.

Normans Kill

The Normans Kill was sampled at River Road near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated the exceedance of the water quality standard for fecal coliform for all of the wet weather events. A similar exceedance at this location was observed in 2008.

The Normans Kill and the Krum Kill were also sampled upstream of their confluence near Route 85. The Normans Kill exceeded the water quality standard for two of the three wet weather events while the Krum Kill exceeded the water quality standard for all of the wet weather events. The Krum Kill location showed larger exceedences but, because it runs along the border of Albany and Bethlehem and has its source in the Town of Guilderland, source conclusions are difficult. Although no direct evidence was collected, this is potentially due to the City of Albany's permitted overflow at the Woodville Pump Station which is approximately 7.6 miles upstream of our sampling location.

Wynants Kill

The Wynants Kill was sampled at Burden Avenue near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated the exceedance of the water quality standard for all of the wet weather events. However, the sampling also indicated some improvement over the 2008 sampling results.

The Wynants Kill was also sampled at Brookside Avenue and Winter Street. Both these locations exceeded the water quality standard for all of the wet weather events indicating that wet weather sources are entering Troy from North Greenbush at these locations.

Poesten Kill

The Poesten Kill was sampled at 2nd Street near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated exceedance of the water quality standard for all of the wet weather events at this location. A similar exceedance at this location was observed in 2008.

The Poesten Kill was also sampled at Pawling Avenue. This location exceeded the water quality standard for two of the three wet weather events indicating that wet weather sources are entering Troy from Brunswick.

Mill Creek

The Mill Creek was sampled at Washington Avenue near its confluence with the Hudson River in 2008 and 2009. The 2009 sampling indicated the exceedance of the water quality standard for all of the wet weather events. A similar exceedance at this location was observed in 2008.

The Mill Creek was also sampled at High Street and at a tributary from Hampton Lake Manor at South Street. Both these locations exceeded the water quality standard for fecal coliform indicating that wet weather sources are entering Rensselaer from North Greenbush.

Dissolved Oxygen

Along with fecal coliform samples, field measurements were collected at each tributary location, including DO. All dry weather DO values measured in the tributaries in 2009 were in compliance. During wet weather events the DO measurements along Mill Creek, Wynants Kill and Poesten Kill were in compliance during Event 1 but were out of compliance during the subsequent events with minimum and average values at approximately 4 mg/l. DO measurements along the Normans Kill and Patroon Creek were in compliance for all three wet weather events.

DO measurements were also collected along a transect of the Mohawk and Hudson Rivers at their upstream boundary of the Albany Pool. All dry weather DO values measured at both the Mohawk River and Hudson River transects in 2009 were in compliance (on the order of 8 mg/l). The Mohawk River (RT1) DO measurements were also in compliance for all the wet weather events (on the order of 9 mg/l). The Hudson River (RT3A) DO measurements were lower than the water quality standard (approximately 4 mg/l) during all three wet-weather events. Because of the location of the 2009 Hudson River transect (RT3A), the reduced DO is not likely associated with a CSO discharge within the Albany Pool. Rather, the lowered DO values are likely due to an upstream source sufficiently far away to influence to Hudson River's DO at the measurement location. In addition, the real time DO data recorded by the in-stream Hudson River Environmental Conditions Observing System (HRECOS) gage at Schodack Island show acceptable DO levels throughout the 2009 sampling period including the periods during and following the sampled wet weather events. This data implies that the DO is recovering through the Albany Pool region as similar lower DO values are not present at Schodack Island. These conclusions support the belief of the NYSDEC that there are no violations of the water quality standard for dissolved oxygen in the Hudson River as a result of CSOs (Correspondence dated April 13, 2010).

1. Introduction

1.1 Project Background

The Albany Pool Communities have 92 combined sewer overflows (CSOs) that discharge to the Hudson and Mohawk Rivers. To implement a plan for evaluating the impact of these discharges, the City of Troy, City of Albany, City of Cohoes, City of Rensselaer, City of Watervliet and the Village of Green Island (the "*Pool*" communities) have joined in a comprehensive inter-municipal venture, led by the Capital District Regional Planning Commission (CDRPC).

CSOs are point sources subject to National Pollutant Discharge Elimination System (NPDES) permit requirements including both technology-based and water quality based requirements of the Clean Water Act.

In 2008 the Albany Pool communities initiated a comprehensive receiving water conditions assessment that was designed to characterize the receiving water quality of the Hudson and Mohawk Rivers where the Albany Pool Communities CSOs discharge. A Receiving Water Quality Report was produced describing the results of the implementation of the Receiving Water Quality Sampling Plan (October 2007 Revised by letter May 23, 2008). Tributary samples were collected during dry and wet-weather events in seven tributary locations. Five of the tributaries sampled were generally at or exceeded the fecal coliform compliance limit. Therefore, additional sampling was performed for the five tributaries of concern; Normans Kill, Mill Creek, Wynants Kill, Poesten Kill and Patroon Creek.

Following the 2008 sampling, receiving water modeling was performed to characterize the impacts of pollutants from the Albany Pool Communities' CSO and wastewater treatment plant (WWTP) discharges on the Hudson River. The modeling considered the fate and transport of fecal coliform bacteria down the river and the potential for carbonaceous biochemical oxygen demand (CBOD) in combined sewer overflow to influence dissolved oxygen (DO) levels. This report describes the sampling that was performed in 2009 to further examine the water quality of the identified tributaries and to support the receiving water modeling effort, specifically picking up boundary conditions for the Mohawk and Hudson Rivers for biochemical oxygen demand (BOD), Ammonia Nitrogen, and Total Phosphorus, which were not collected as part of the 2008 effort.

1.2 The Albany Pool Communities

According to the New York State Department of Environmental Conservation (NYSDEC), CSOs from each of the Albany Pool Communities include:

- City of Albany with eleven (11) CSOs under SPDES Permit No. NY-002 5747;
- City of Rensselaer with eight (8) CSOs under SPDES Permit No. NY-002 6026;
- City of Watervliet with five (5) CSOs under SPDES Permit No. NY-002 0899;
- Village of Green Island with three (3) CSOs under SPDES Permit No. NY-003 3031;
- City of Cohoes with seventeen (17) CSOs under SPDES Permit No. NY-003 1046;
- City of Troy with forty-eight (48) CSOs under SPDES Permit No. NY-009 9309.

1.3 Water Quality Standards

The State of New York has promulgated standards for water quality in Part 703 based on the designated class of the receiving water. The 2008 Section 303(d) List of Impaired Water Requiring a TMDL/Other Strategy identifies those waters that do not support appropriate uses and, as the title states, which require development of a Total Maximum Daily Load (TMDL) or other restoration strategy. A review of this list identifies the Hudson River Estuary in Albany County in Part 2b – Multiple Segment/Categorical Impaired Waterbody Segments (fish consumption) for polychlorinated biphenyls (PCBs). The list also identifies Patroon Creek in Part 3a – Waterbodies for which TMDL Development May be Deferred (Requiring Verification of Impairment) for Dissolved Oxygen and Oxygen Demand. No investigation of PCBs was considered as part of this study. PCBs are not considered to be associated with CSO discharges.

The Rivers and tributaries in this study area are generally designated as Class C receiving streams. Both the Hudson River and the Mohawk River have Class A designations in the northern and western portions of the sampling region. The Mohawk changes from Class A to Class C at the School Street Dam approximately two miles southeast of the Route 9 Bridge (River Transect 1, see Section 3) and the Hudson changes from Class A to Class C at the confluence with the Mohawk just south of Waterford. The Hudson remains Class C for approximately 25 miles after which it becomes Class A again just south of Schodack Island. All the tributaries are Class C with the exception of Wynants Kill and Poesten Kill which are Class C(t).

Applicable NYS standards which were considered for this study include:

- The fecal coliform standard for both Class A and C designations states that the geometric mean of no less than 5 examinations (samples) shall be less than 200 colony-forming units (cfu)/100 milliliter (ml). For A-special waters, the rule states that the five samples must be taken over not more than a 30-day period. The

standard does not differentiate between wet and dry-weather sampling. There is no specific single sample maximum criterion applicable to these receiving waters. This Report will compare geometric means to these criteria as is appropriate, but will also indicate the relative difference between individual samples and these geometric mean criteria as a point of reference for several sets of data.

- The applicable dissolved oxygen standard as stated by New York is "For nontrout waters, the minimum daily average shall not be less than 5.0 mg/L, and at no time shall the DO concentration be less than 4.0 mg/L." [Note: mg/L = milligrams per liter, and DO = dissolved oxygen]
- The pH standard for both Class A and C designations states that the pH "shall not be less than 6.5 or more than 8.5."
- In nontrout waters the water temperature at the surface of a stream shall not be raised to more than 90 degrees Fahrenheit at any point.
- Specific conductivity was also measured in the field; however New York State has not produced a standard for this parameter.

During the 2008 sampling effort, testing was performed for E. Coli. However, similar data trends resulted from the E. Coli testing as did from the fecal coliform testing. Therefore, the E. Coli testing was not included in the 2009 study.

1.4 Scope of This Report

This Report briefly describes the locations, equipment, methodologies, and data management protocols that were used by the Albany Pool Joint Venture Team (APJVT) to gather water quality data for the 2009 tributary sampling and summarizes the results of that data collection effort.

Water quality data was collected during dry and wet weather to examine the potential effects of CSOs. Together with the flow monitoring data, project modeling tools, and historical data, the water quality sampling results will assist the Albany Pool Communities with assessing the impacts of CSOs, help prioritize areas of principal concern with regard to tributary water quality, and access the existing conditions relative to the water quality standards.

The discussion in this Report includes:

- The 2009 water quality sampling program;
- The 2009 dry-weather sampling events;
- The 2009 wet-weather sampling events;
- The 2009 water quality field sampling results;
- Comparisons of the 2009 results to previous studies;
- Discussions.

2. Receiving Water Quality Sampling Program

2.1 Water Quality Sampling Locations

For the 2009 tributary sampling, discrete samples of receiving water were collected for laboratory analyses at two river transects, one each along the Mohawk and Hudson Rivers, and sixteen locations along five tributaries to the Hudson River. Each river transect includes a sample collected from the west bank (WB), river center (RC), and east bank (EB). The dry- and wet-weather water quality sampling locations are listed in Table 2-1 and shown on Figure 2-1 (note that all Figures are presented at the end of this Report).

Table 2-1:
Receiving Water Body Sample Locations

Sampling Location Identification Number	Location	Sample Collection Location	Parameters
River Transect Locations			
RT1-WB RT1-RC RT1-EB	Route 9 bridge crossing of Mohawk River upstream of Cohoes and Crescent Dam (2008)	bridge	Temperature, DO, pH, Specific Conductance, BOD, Ammonia Nitrogen, Total Phosphorus
RT3A-WB RT3A-RC RT3A-EB	126th Street Bridge crossing of Hudson River	bridge	Temperature, DO, pH, Specific Conductance, BOD, Ammonia Nitrogen, Total Phosphorus
Tributary Locations			
T11-02	Normans Kill near confluence with Hudson River at **River Road** Bridge north of intersection with Corning Hill Road in Albany (2008)	bridge	Fecal Coliform, Temperature, DO, pH, Specific Conductance, BOD, Ammonia Nitrogen, Total Phosphorus
T11-03	Normans Kill near the confluence with Krum Kill at the foot bridge off **NY State Route 85** north of Blessing Road	bridge	Fecal Coliform, Temperature, DO, Specific Conductance
T11-04	Krum Kill near the confluence with Normans Kill at the **NY State Route 85** Bridge south of Blessing Road	bridge	Fecal Coliform, Temperature, DO, Specific Conductance
T12-05	Mill Creek near confluence with Hudson River at the **Washington Avenue** bridge south of Fourth Avenue in Rensselaer (2008)	bridge	Fecal Coliform, Temperature, DO, pH, Specific Conductance, BOD, Ammonia Nitrogen, Total Phosphorus

T12-06	Mill Creek near the border of Rensselaer and East Greenbush, **High Street** Bridge	bridge	Fecal Coliform, Temperature, DO, Specific Conductance
T12-07	Tributary from Hampton Manor Lake near the confluence with Mill Creek near the border of Rensselaer and East Greenbush, Culvert on **South Street**	bridge	Fecal Coliform, Temperature, DO, Specific Conductance
T13-08	Wynants Kill near confluence with Hudson River, **Burden Avenue** (2008)	bridge	Fecal Coliform, Temperature, DO, pH, Specific Conductance, BOD, Ammonia Nitrogen, Total Phosphorus
T13-09	Wynants Kill near the border of Troy and North Greenbush, **Winter Street** Bridge	bridge	Fecal Coliform, Temperature, DO, Specific Conductance
T13-10	Wynants Kill near the border of Troy and North Greenbush, **Brookside Avenue** Bridge	bridge	Fecal Coliform, Temperature, DO, Specific Conductance
T14-11	Poesten Kill near confluence with Hudson River at the **2nd Street** bridge between Canal Avenue and Ida Street in Troy (2008)	bridge	Fecal Coliform, Temperature, DO, pH, Specific Conductance, BOD, Ammonia Nitrogen, Total Phosphorus
T14-12	Poesten Kill near the border of Troy and Brunswick, **Pawling Avenue** Bridge	bridge	Fecal Coliform, Temperature, DO, Specific Conductance
T16-13	Patroon Creek near confluence with Hudson River near **Tivoli Street** northwest of the intersection of Tivoli Street and North Pearl Street in Albany (2008)	bridge	Fecal Coliform, Temperature, DO, pH, Specific Conductance, BOD, Ammonia Nitrogen, Total Phosphorus
T16-14	Unnamed tributary near the confluence with Patroon Creek near the border of Albany and Colonie (**Corporate Woods Boulevard**)	shore	Fecal Coliform, Temperature, DO, Specific Conductance
T16-15	Sand Creek near the confluence with Patroon Creek near the border of Albany and Colonie, Dead end of **Corning Street**.	shore	Fecal Coliform, Temperature, DO, Specific Conductance
T16-17	Cherry Creek near the confluence with Patroon Creek near the border of Albany, Colonie, and Guilderland (**Palma Park**)	shore	Fecal Coliform, Temperature, DO, Specific Conductance
T16-18	Patroon Creek culvert outlet on the east side of **Fuller Road.**	shore	Fecal Coliform, Temperature, DO, Specific Conductance

In the table above, sample locations that carried over from the 2008 sampling have a bold identification number and "(2008)" at the end of the location description. These locations include T11-02, T12-05, T13-08, T14-11, and T16-13. The first half of the identification number corresponds to the 2008 sample location. The additional 2009 sample locations with the same first half of the identification number correspond to locations contributing to the same tributary.

2.2 Program Organization and Communications During Sampling Events

The sampling period began in July 2009 and was completed in September 2009. Five dry-weather events were sampled at all locations during the sampling effort. Three wet-weather events were sampled at all locations. Table 2-2 lists the dates and times of the actual sampling events as conducted.

Table 2-2:
Start Times of Dry and Wet-Weather Events

Date	Dry/Wet	Event No.	Start Time
7/15/2009	Dry	1	8:00 AM
7/16/2009	Dry	2	8:00 AM
7/16/2009	Wet	1	6:00 PM
7/21/2009	Dry	3	8:00 AM
7/21/2009	Wet	2	12:00 PM
8/5/2009	Dry	4	8:00 PM
8/6/2009	Dry	5	8:00 AM
8/28/2009	Wet	3	8:00 PM

2.3 Sampling Equipment

The water quality sampling program used the following equipment:

- For sampling from bridge access points, laboratory sampling containers were lowered into the sampling medium using an adjustable pole or rope.
- A YSI 556 MPS (Multiprobe System) Water Quality Meter was used to collect field parameters during sample collection at all sampling locations.
- Sampling Event Summary Sheets were filled out for each sampling team to record details of sample collection activities.

2.4 Surface Water Sampling Procedures

Surface water samples were collected using the direct grab sampling technique outlined in Section 9.10.4 and 9.11.4 of the *New York State Department of Environmental*

Conservation (NYSDEC) Standard Operating Procedure: Collection of Ambient Water Quality Samples (SOP) (NYSDEC, 2002) included as Attachment 2 to the sampling plan document. Samples were collected at each location and interval in the following order using the detailed procedures outlined in the sampling plan document:

1. Fecal coliform (where required)
2. BOD, Ammonia Nitrogen, Total Phosphorus, and pH (where required)
3. In-situ field measurements (temperature, pH, conductivity, and dissolved oxygen)

Fecal coliform samples were delivered to St. Peter's Bender Laboratory within approximately five hours of sample collection to meet the six hour holding time for these analyses. BOD, Ammonia Nitrogen, and Total Phosphorus samples were couriered to Environmental Laboratory Services within 24-36 hours of the last sample collection of the 24-hour composite in order to meet the 48 hour holding time for these analyses.

2.5 Sample Collection Methodology

The sampling methodology was similar for all the sampling locations including the list of parameters for which samples will be analyzed. The Receiving Water Sampling Plan (October 2007) detailed the methodology of sampling. No significant deviations from the sampling methodology occurred during the 2009 sampling.

3. Dry-Weather Results

3.1. Dry-Weather Sampling Overview

Five dry-weather sampling events were performed for this study within a 30-day period. A dry-weather sampling event was defined as an event that was preceded by 72-hours of dry weather across the communities. The dry-weather sampling events along with their corresponding river flows and tidal conditions at the time of sampling are shown in Table 3-1.

Table 3-1:
Summary of Dry-Weather Sampling Events

Dry Event No.	Date Time	Hudson River @ Lock 1 Waterford (cfs)	Mohawk River @ Cohoes (cfs)	Hudson River @ Federal Dam (1) (cfs)	Patroon Creek @ Northern Blvd (2) (cfs)	Hudson River Tide @ Albany Port (feet)	Tide Condition
1	7/15/09 8:00	6811	3438	10249	N/A	3.21	High
2	7/16/09 8:00	6847	2291	9138	N/A	2.74	Flow
3	7/21/09 8:00	4065	1631	5696	N/A	0.62	Ebb
4	8/5/09 20:00	6979	4862	11841	N/A	1.90	Ebb
5	8/6/09 8:00	7065	3873	10938	N/A	1.89	Ebb

(1) Estimated based on the sum of Hudson River and Mohawk River Flows

(2) Data collection at the Patroon Creek stream gage has been discontinued.

3.2. Bacteria

The dry-weather sampling included collection of samples at 16 locations tributary to the Albany Pool receiving waters. The tributaries and their sampling designations are:

- T11-02; Normans Kill, River Road (2008)
- T11-03; Normans Kill, NY State Route 85
- T11-04; Krum Kill, NY State Route 85
- T12-05; Mill Creek, Washington Avenue (2008)
- T12-06; Mill Creek, High Street
- T12-07; Mill Creek, South Street
- T13-08; Wynants Kill, Burden Avenue (2008)
- T13-09; Wynants Kill, Winter Street
- T13-10; Wynants Kill, Brookside Avenue
- T14-11; Poesten Kill, 2nd Street (2008)

- T14-12; Poesten Kill, Pawling Avenue
- T16-13; Patroon Creek, Tivoli Street (2008)
- T16-14; Patroon Creek, Corporate Woods Boulevard
- T16-15; Patroon Creek, Sand Creek
- T16-17; Patroon Creek, Cherry Creek at Palma Park
- T16-18; Patroon Creek, Fuller Road.

Table 3-2 lists the measurements of fecal coliform bacteria collected in the tributaries.

Table 3-2:
Dry-Weather Fecal Coliform Concentrations (cfu/100ml) in Tributary Samples

Tributary	Sampling Location	ID #	7/15	7/16	7/21	8/5	8/6	Geometric Mean	Direction of Flow
Normans Kill	Krum Kill, NYS Route 85	T11-04	580	153	320	1,098	250	379	↓
	NYS Route 85	T11-03	153	210	180	340	189	206	
	River Rd. (2008)	**T11-02**	27	63	54	108	108	64	
Mill Creek	South St.	T12-07	220	3,000	27	90	210	202	↓
	High St.	T12-06	260	560	440	250	420	368	
	Washington Ave. (2008)	**T12-05**	390	666	530	380	330	444	
Wynants Kill	Brookside Ave.	T13-10	36	45	54	200	45	60	↓
	Winter St.	T13-09	144	126	126	108	90	117	
	Burden Ave. (2008)	**T13-08**	81	99	99	234	90	111	
Poesten Kill	Pawling Ave.	T14-12	117	200	63	144	171	129	↓
	2nd St. (2008)	**T14-11**	99	63	162	270	200	140	
Patroon Creek	Fuller Rd.	T16-18	666	891	1,251	1,521	873	997	↓
	Palma Park	T16-17	54	90	18	400	220	95	
	Sand Creek	T16-15	280	260	108	490	711	307	
	Corporate Park Blvd.	T16-14	63	90	210	280	225	150	
	Tivoli St. (2008)	**T16-13**	X	500	144	470	774	402	

In order to compare the tributaries to the water quality standard, geometric means of the fecal coliform counts were calculated for the five samples from each site. These geometric mean values show eight locations that exceed the water quality standard. The comparisons of upstream to downstream geometric means within the same tributary will be discussed in Section 4, with the wet-weather results.

The geometric mean values can also be compared to dry-weather fecal coliform geometric mean values from 2008. Figure 3-1 shows the comparison with the 2008 dry weather fecal coliform geometric mean values. For this comparison the location identification refers to the 2008 sampling plan. Normans Kill (**T11**-02), Wynants Kill (**T13**-08), Poesten Kill (**T14**-11), and Patroon Creek (**T16**-13) show a consistent

reduction of bacteria at all common locations, but continued exceedances were observed at Mill Creek (T12-05) and Patroon Creek. The 2009 Mill Creek (**T12**-05) geometric mean value is comparable to the values from 2008, but exceeds the standard and is greater than two of the dry weather mean values obtained in 2008. The Patroon Creek (**T16**-13) indicates a significant decrease in dry-weather bacteria, but continues to exceed the geometric mean standard, as in 2008. This reduction is likely due to the activities of both the City of Albany and the Albany County Sewer District. The City of Albany was able to successfully identify two locations where the sanitary sewer service was connected to the storm sewer system. These connections were removed and reconnected to the sanitary sewer. Additional investigations are ongoing.

Figure 3-2 shows the dry weather fecal coliform geometric mean values for the 2009 and 2008 samples. Each plot corresponds to samples taken at locations within or contributing to one tributary. In each plot the sample locations are listed from upstream on the left to downstream on the right, ending with the sample location that corresponds with the 2008 sample location.

The Normans Kill runs along the southern border of Albany shared by Bethlehem. Upstream of this border, the Normans Kill passes through New Scotland and Bethlehem. The Krum Kill runs along the western border of Albany shared by Bethlehem and Guilderland. The confluence of the Krum Kill and Normans Kill is at the southwest corner of Albany. The fecal coliform geometric mean count at the upstream Normans Kill location (T11-03), entering Albany from Bethlehem, is slightly greater than the NYS Standard. However, the fecal coliform count at the Krum Kill location (T11-04) significantly exceeds the NYS Standard. As the Krum Kill runs along the border between Albany, Bethlehem and Guilderland, the source of the fecal coliform could come from any of the three communities.

The Mill Creek (T12-06) and Hampton Manor Lake tributary (T12-07) sample location are upstream of the confluence with the Hudson River near the border of Rensselaer and East Greenbush. The fecal coliform geometric mean count at the sample location on Mill Creek (T12-06) and along the Hampton Manor Lake tributary (T12-07), both entering Rensselaer from East Greenbush, exceed the NYS Standard.

Immediately upstream and east of Troy the Poesten Kill flows through Brunswick and the Wynants Kill flows through North Greenbush. For the dry-weather events, all the geometric mean counts along the Poesten Kill and Wynants Kill meet the NYS Standard.

The Corporate Woods Boulevard (T16-14), Sand Creek (T16-15) and Palma Park (T16-17) sampling locations are within tributaries to Patroon Creek outside of Albany flowing through the Town of Colonie. The geometric mean of the fecal coliform counts from the samples collected from the Corporate Woods Boulevard (T16-14) and Palma Park (T16-17) sample locations do not exceed the NYS Standard. However, the geometric mean at

Sand Creek (T16-15) did exceed the NYS Standard. The Fuller Road (T16-18) sampling location is within Albany and significantly exceeds the NYS Standard. This location will be discussed further in Section 8.

4. Wet-Weather Results

4.1. Wet-Weather Sampling

Three wet-weather sampling events were performed for this study. A wet-weather sampling event was defined as an event that was preceded by 72 hours of dry-weather and resulted in more than 0.25 inches of rain over the Pool Community area. The wet-weather sampling events along with their corresponding river flow rates and measured precipitation are shown in Table 4-1.

Table 4-1.
Summary of Wet-Weather Sampling Events

Wet Event No.	Sample Start Time	Cumulative Precipitation @ Albany Airport (inches)	Hudson River @ Lock 1 Waterford[(1)] (cfs)	Mohawk River @ Cohoes[(1)] (cfs)	Hudson River @ Federal Dam [(1) (2)] (cfs)	Patroon Creek @ Northern Blvd[(1)(3)] (cfs)	Sampling Duration (hours)
1	7/16/09 18:00	1.12	6095	3065	9160	N/A	48
2	7/21/09 12:00	0.34	5951	2282	8233	N/A	48
3	8/28/09 20:00	1.19	6926	7673	14599	N/A	48

(1) Flows are time averaged over duration of the sampling event

(2) Estimated based on the sum of Hudson River and Mohawk River Flows

(3) Data collection at the Patroon Creek stream gage has been discontinued.

The three wet-weather events provided a range of wet-weather conditions to observe changes in bacteria concentration during an event. The first wet-weather sampling event was initiated on July 16 where rainfall was measured to be 1.12 inches at the Albany Airport. The second wet-weather sampling event was initiated on July 21 and had rainfall totals measured 0.34 inches. The third wet-weather sampling event was initiated on September 28 where rainfall was measured to be 1.19 inches at the Albany Airport.

The Hudson River and Mohawk River flows show similar responses to the precipitation as were observed in 2008. The flows of the Hudson and Mohawk Rivers do not noticeably respond to the precipitation events on July 16 and July 21. They show similar flows to those measured during the dry-weather events. However, during a period of large and sustained precipitation, such as the event recorded on August 28, flows in the rivers noticeably increased. As was the case in 2008, the dry-weather flows were similar or greater in magnitude than the wet-weather flows. This phenomenon is likely due to

the influence of the controlled releases from the EJ West hydroelectric plant at the Great Sacandaga Lake.

4.1.1. Bacteria

The bacteria data suggests that the tributaries continue to contribute a significant load of bacteria during wet weather. Though the bacteria concentrations are not typically as high as those from CSOs, these are still responsible for contributing significant loads to the Hudson River. Figure 4-1 shows a summary of the fecal coliform data for all sixteen tributary sites for all three of the events. Most of the samples contain bacteria in concentrations higher than the designated geometric mean concentration standard.

Table 4-2 details the geometric means of the fecal coliform data collected over the events.

Table 4-2.
Wet-Weather Tributary Geometric Means for Fecal Coliform

Tributary	Sampling Location	ID #	Wet Event No.			Direction of Flow
			1	2	3	
Normans Kill	Krum Kill, NYS Route 85	T11-04	10249	955	7649	↓
	NYS Route 85	T11-03	1503	169	870	
	River Rd. (2008)	**T11-02**	1554	249	844	
Mill Creek	South St.	T12-07	1157	333	1641	↓
	High St.	T12-06	2105	717	2422	
	Washington Ave. (2008)	**T12-05**	2983	976	2006	
Wynants Kill	Brookside Ave.	T13-10	680	232	755	↓
	Winter St.	T13-09	654	333	862	
	Burden Ave. (2008)	**T13-08**	1008	214	975	
Poesten Kill	Pawling Ave.	T14-12	363	179	786	↓
	2nd St. (2008)	**T14-11**	495	265	892	
Patroon Creek	Fuller Rd.	T16-18	3205	2699	872	↓
	Palma Park	T16-17	5019	639	3150	
	Sand Creek	T16-15	2237	1179	2656	
	Corporate Park Blvd.	T16-14	1004	350	3129	
	Tivoli St. (2008)	**T16-13**	4166	682	4276	
Cumulative Precipitation @ Albany Airport (IN)			1.12	0.34	1.19	

Figure 4-2 shows the wet-weather fecal coliform geometric mean values. Each plot corresponds to samples taken at locations within or contributing to one tributary. In each plot the sample locations are generally listed from upstream on the left to downstream on the right, ending with the sample location that corresponds with the 2008 sample location. For all but one location (T16-18) the geometric mean concentration for Wet Event 2 is the lowest of the three wet events.

For the Normans Kill, the two upstream sample locations that are on the Normans Kill (T11-03) and Krum Kill (T11-04) just upstream of their confluence exceed the water quality standard. Krum Kill samples show a significantly higher fecal coliform concentration than the upstream Normans Kill and the Normans Kill at the confluence with the Hudson River (T11-02). Although no direct evidence was collected, this is potentially due to the City of Albany's permitted overflow at the Woodville Pump Station which is approximately 7.6 miles upstream of our sampling location. Both sets of samples within the Normans Kill (T11-02 and T11-03) show similar values. This suggests that the fecal coliform values are entering Albany from upstream communities, exceeding the NYS Standard and do not increase between the upstream sampling location and the sampling location near the confluence with the Hudson River. The higher Krum Kill concentrations are apparently diluted by the larger Normans Kill flow. Wet Event 2 sampled at the upstream Normans Kill location and the Dry Event sampled at the downstream Normans Kill location are the only geometric mean concentrations below the NYS standard for fecal coliform. The geometric mean values are also compared to wet-weather fecal coliform geometric mean values from 2008. For the Normans Kill (T11-02) the values are comparable and continue to exceed the NYS Standard.

The geometric mean concentration results for Mill Creek show a slight increase from upstream to downstream. The fecal coliform counts enter Rensselaer from East Greenbush exceeding the NYS Standard and the counts increase further between the upstream sampling location and the sampling location near the confluence with the Hudson River. The values at the downstream Mill Creek location (T12-05) are consistent with the values of 2008. All the geometric mean concentrations throughout Mill Creek continue to exceed the NYS Standard value as they did in 2008.

The geometric mean concentration results for Wynants Kill show consistent values from upstream to downstream. This suggests that the fecal coliform values are entering Troy from North Greenbush exceeding the NYS Standard and do not increase between the upstream sampling location and the sampling location near the confluence with the Hudson River. The values at the downstream Wynants Kill location (T13-08) seem to have slightly decreased from 2008. All the wet event geometric mean concentrations, throughout Wynants Kill, continue to exceed the NYS Standard value, as they did in 2008.

The geometric mean concentration results for Poesten Kill show consistent values for both sample locations. This suggests that the fecal coliform values are entering Troy from Brunswick exceeding the NYS Standard and do not increase between the upstream sampling location and the sampling location near the confluence with the Hudson River. The values at the downstream Poesten Kill location (T14-11) are also consistent with the values from 2008. All but one wet event exceeds the NYS Standard.

The geometric mean concentration results for Patroon Creek show mostly consistent values throughout its length. This suggests that the fecal coliform values are entering Albany from upstream communities, exceeding the NYS Standard and do not increase between the upstream sampling location and the sampling location near the confluence with the Hudson River. The dry-weather values for each location are lower than the wet-weather values, except at the Fuller Road (T16-18) sampling location. All wet-weather events exceed the NYS Standard value with Wet-Weather Event 2 showing the lowest concentration of the three events at each location except at the Fuller Road (T16-18) sampling location. The geometric mean concentrations for the Patroon Creek are less than what was observed in 2008, but continue to exceed the NYS Standard. As stated earlier, the City of Albany was able to successfully identify two locations where the sanitary sewer service was connected to the storm sewer system. These connections were removed. Additional investigations are ongoing in the vicinity of the Fuller Road area.

5. Field Measurements

5.1. General

Field measurements of general water quality variables were made during sample collection for all locations. The water temperature, specific conductance, and dissolved oxygen were measured with field probes at the time each bacteria sample was collected.

5.2. Dry-Weather Results

Temperature measurements at the sites were consistent with the season of the sample, with colder temperatures later in the season. The specific conductivity was relatively similar among most of the tributaries with consistently lower values measured in Poesten Kill (T14-11 and T14-12) and consistently higher values measured in Patroon Creek (T16-13 through T16-18), Krum Kill (T11-04) and Hampton Manor Lake outflow (T12-07). The temperature and conductivity data is presented in Tables 5-1 and 5-2 respectively. Dissolved Oxygen measurements for all the tributary dry-weather samples are listed in Table 5-3. The samples all showed DO readings meeting the water quality standard.

Table 5-1.
Dry-Weather Temperature (°C) at Each Tributary Sample Location

Tributary	Sampling Location	ID #	7/15	7/16	7/21	8/5	8/6	Direction of Flow
Normans Kill	Krum Kill, NYS Route 85	T11-04	17.14	18.21	18.79	19.78	17.77	↓
	NYS Route 85	T11-03	20.43	21.75	21.76	21.28	21.02	
	River Rd. (2008)	T11-02	19.63	20.48	21.55	23.19	20.63	
Mill Creek	South St.	T12-07	16.32	18.32	21.09	19.64	18.47	↓
	High St.	T12-06	18.42	20.22	20.15	20.84	19.81	
	Washington Ave. (2008)	T12-05	17.62	19.37	20.07	20.88	19.21	
Wynants Kill	Brookside Ave.	T13-10	16.46	18.78	19.50	21.57	19.17	↓
	Winter St.	T13-09	17.00	18.94	19.61	21.50	19.02	
	Burden Ave. (2008)	T13-08	16.95	19.01	20.14	21.48	19.42	
Poesten Kill	Pawling Ave.	T14-12	17.80	19.91	20.20	21.62	18.64	↓
	2nd St. (2008)	T14-11	17.46	20.19	20.59	21.72	19.03	
Patroon Creek	Fuller Rd.	T16-18	23.16	21.67	22.87	21.35	21.12	↓
	Palma Park	T16-17	19.02	18.62	19.21	19.43	18.16	
	Sand Creek	T16-15	15.28	16.10	16.38	17.59	15.79	
	Corporate Park Blvd.	T16-14	17.91	18.25	18.55	18.93	17.81	
	Tivoli St. (2008)	T16-13	17.22	18.45	19.09	20.50	18.33	
Mohawk River	Route 9 bridge	RT1	21.47	22.29	23.84	22.95	22.57	
Hudson River	126th St.	RT3A	21.41	21.89	23.14	23.20	22.36	

Table 5-2.
Dry-Weather Specific Conductivity (mS/cm) at Each Tributary Sample Location

Tributary	Sampling Location	ID #	7/15	7/16	7/21	8/5	8/6	Direction of Flow
Normans Kill	Krum Kill, NYS Route 85	**T11-04**	1.75	1.01	1.56	1.64	1.66	↓
	NYS Route 85	**T11-03**	0.52	0.52	0.48	0.45	0.47	
	River Rd. (2008)	**T11-02**	0.58	0.58	0.52	0.49	0.50	
Mill Creek	South St.	**T12-07**	1.15	1.19	0.76	0.99	1.00	↓
	High St.	**T12-06**	0.45	0.46	0.43	0.43	0.43	
	Washington Ave. (2008)	**T12-05**	0.48	0.49	0.46	0.45	0.45	
Wynants Kill	Brookside Ave.	**T13-10**	0.33	0.34	0.29	0.23	0.24	↓
	Winter St.	**T13-09**	0.35	0.36	0.30	0.24	0.25	
	Burden Ave. (2008)	**T13-08**	0.36	0.37	0.31	0.25	0.26	
Poesten Kill	Pawling Ave.	**T14-12**	0.19	0.20	0.18	0.13	0.14	↓
	2nd St. (2008)	**T14-11**	0.20	0.21	0.19	0.13	0.14	
Patroon Creek	Fuller Rd.	**T16-18**	1.01	1.01	0.93	0.91	0.94	↓
	Palma Park	**T16-17**	1.71	1.81	1.54	1.64	1.71	
	Sand Creek	**T16-15**	1.08	1.08	1.07	1.06	1.06	
	Corporate Park Blvd.	**T16-14**	1.12	1.13	0.52	1.12	1.11	
	Tivoli St. (2008)	**T16-13**	1.23	1.26	0.52	1.16	1.17	
Mohawk River	Route 9 bridge	**RT1**	0.31	0.32	0.32	0.26	0.26	
Hudson River	126th St.	**RT3A**	0.17	0.15	0.17	0.15	0.14	

Table 5-3.
Dry-Weather Dissolved Oxygen (mg/L) at Each Tributary

		2009								2008			
Tributary	Sampling Location	ID #	7/15	7/16	7/21	8/5	8/6	Arithmetic Mean	Direction of Flow		1st 30 days DW	2nd 30 days DW	3rd 30 days DW
Normans Kill	Krum Kill, NYS Route 85	T11-04	10.22	9.88	9.28	-	11.05	10.11	↓				
	NYS Route 85	T11-03	8.94	8.47	7.85	-	9.63	8.72					
	River Rd. (2008)	**T11-02**	9.62	8.90	9.32	-	10.54	9.60		**T11**	5.84	10.33	9.85
Mill Creek	South St.	T12-07	9.65	9.03	5.01	-	5.60	7.32	↓				
	High St.	T12-06	9.23	8.44	5.05	-	5.38	7.03					
	Washington Ave. (2008)	**T12-05**	9.70	9.01	5.19	-	5.79	7.42		**T12**	5.04	12.25	11.87
Wynants Kill	Brookside Ave.	T13-10	10.38	9.69	5.98	-	6.31	8.09	↓				
	Winter St.	T13-09	10.31	9.47	5.32	-	6.24	7.84					
	Burden Ave. (2008)	**T13-08**	10.15	9.14	5.99	-	6.16	7.86		**T13**	6.63	12.34	12.72
Poesten Kill	Pawling Ave.	T14-12	10.04	8.57	6.37	-	6.79	7.94	↓				
	2nd St. (2008)	**T14-11**	9.91	8.52	6.20	-	7.26	7.97		**T14**	5.73	8.90	9.27
Patroon Creek	Fuller Rd.	T16-18	6.50	6.96	5.82	-	8.27	6.89	↓				
	Palma Park	T16-17	7.92	8.03	7.70	-	9.62	8.32					
	Sand Creek	T16-15	10.10	9.97	9.95	-	11.50	10.38					
	Corporate Park Blvd.	T16-14	9.18	8.92	9.00	-	10.54	9.41					
	Tivoli St. (2008)	**T16-13**	9.93	9.49	9.64	-	11.25	10.08		**T16**	8.44	10.67	6.66
Mohawk River	**Route 9 bridge**	**RT1**	7.88	8.53	9.12	-	9.20	8.68		**RT1**	9.93	8.59	6.45
Hudson River	126th St.	RT3A	8.80	8.34	8.46	-	7.63	8.31					

*Note: See Section 7 QA/QC for explanation of excluded measurements.

For comparison, the 2008 dry-weather 30-day averages are shown on the right side of the table and the arithmetic mean values of the 2009 dry-weather events are shown in the middle of the table. The comparable locations from 2008 to 2009 are highlighted in grey. The samples from the tributaries in 2008 are average values of five samples within a 30-day period. In the tributaries, the 1st 30-day average is the lowest of the three values, except for Patroon Creek (T16). The 2nd and 3rd 30-day averages are higher. The 2009 average value for each common tributary is within the values shown in 2008. The samples in the Mohawk River (RT1) from 2008 show higher values for the 1st and 2nd 30-day averages and a lower value for the 3rd 30-day average. The 2009 average value for the Mohawk River (RT1) also remains within the range of values shown from 2008. The 2009 average value for the Hudson River (RT3A) is consistent with that of the Mohawk River (RT1) and meets the NYS Standard.

5.3. Wet-Weather Results

During the wet-weather events, the field measurements for Temperature and Specific Conductivity show few readings that are outside of normal ranges (Figures 5-1 to 5-4). Dissolved Oxygen (DO) measurements for the tributaries and transects are shown in Figures 5-5 and 5-6, respectively. Figure 5-7 shows the arithmetic mean values at each location for 2009 wet-weather events (blues) and 2008 wet-weather events (reds). The raw field measurement data is included on the attached disc as Appendix A.

Normans Kill tributaries show the arithmetic means of the measured DO ranging from 8.16 to 11.04 mg/L for wet weather. Also, for each sampling location the DO concentration is highest during Wet Event 3, followed by the mean of the dry-weather events. The measurements taken at the sampling locations along the Patroon Creek show the same trend as Normans Kill. Compared to the 2008 DO arithmetic mean values, the 2009 DO values are higher.

Mill Creek, Wynants Kill and Poesten Kill showed high DO concentration measurements during the dry-weather events compared to the wet events. During Wet Event 1, the measurements started high and ended low resulting in mean values between 6 and 7, as shown in the figures. For the same locations, the DO measurements remained low during Wet Events 2 and 3. The mean values at each location are approximately 4 mg/L. Compared to the 2008 DO arithmetic mean values, the 2009 DO values for the dry-weather events and Wet-Weather Event 1 are of comparable value. However, the 2009 DO values for Wet-Weather Events 2 and 3 are lower.

The Mohawk River (RT1) DO concentration arithmetic mean value during dry-weather is consistent with the last two wet-weather events. The first wet-weather event is slightly

higher. The 2009 Mohawk River DO values are consistent with the first 2008 wet-weather event. However, the last three 2008 wet-weather events have lower values.

The Hudson River (RT3A) DO concentration arithmetic mean values show a high concentration during dry-weather events and lower values during wet-weather events, especially during the last two events. Though these wet weather events show reduced DO levels relative to the dry weather readings, there is no indication these are related to Albany Pool CSO discharges. This conclusion is based on the location of upstream CSOs, timing of the oxygen depleting kinetics, and apparent recovery of DO through the Albany Pool as indicated by the HRECOS gage located at Schodack Island (Figure 5-8).

The 2009 Hudson River transect (RT3A) location was selected in an attempt to measure the upstream boundary for the Albany Pool. This location deviates slightly from the location sampled in 2008 (RT3). Because no comprehensive Hudson River sampling was performed in 2009, no boats were available and the transect was recorded from the 126th Street Bridge rather than from a boat at Troy's municipal boundary. The 126th Street Bridge is the northern most crossing of the Hudson within the Albany Pool. Only one CSO, Troy's CSO 001, is upstream of this location. Based on the CSS modeling performed in 2009, this CSO is one of the three smallest of Troy's 48 overflows (based on predicted annual volume, duration of overflow, and number of events). Because of the predicted small discharge volume, the short travel time from CSO 001 to the RT3A location (approximately 30-90 minutes), and the time required for oxygen depleting substances to impact dissolved oxygen, the reduced DO is not likely associated with a CSO discharge within the Albany Pool. Rather, the lowered DO values are likely due to an upstream source sufficiently far away to influence the Hudson River's DO at the measurement location.

In addition, the real time DO data recorded by the in-stream HRECOS gage at Schodack Island show acceptable DO levels throughout the 2009 sampling period including the periods during and following the sampled wet weather events. This data implies that the DO is actually recovering through the Albany Pool region as similar lower DO values are not present at Schodack Island. These conclusions support the belief of the NYSDEC that there are no violations of the water quality standard for dissolved oxygen in the Hudson River as a result of CSOs (Correspondence dated April 13, 2010).

6. ELS Results

Samples were collected for the measurement of Biological Oxygen Demand (BOD), Ammonia Nitrogen, Total Phosphorus, and pH to support the water quality modeling. BOD, Ammonia Nitrogen and Total Phosphorus were not recorded in 2008, and therefore cannot be compared to previous values.

All dry-weather values represent analytical results from a grab sample while all wet-weather values represent analytical results from 24-hour composite samples collected over the storm event.

6.1. Biological Oxygen Demand

Oxygen demand is a property of wastewater and stormwater that is important to water quality as the amount of oxygen demanding material discharged into a receiving stream will have a lagged effect on downstream water quality as those substances consume dissolved oxygen from the water. Typically natural unpolluted waters have BOD concentrations less than 5 mg/L.

The concentrations of BOD were often controlled by the detection limits of each analysis (Figure 6-1). The concentrations during dry weather and Wet-Weather Events 2 and 3 showed few actual valued concentrations. Most concentrations were reported as less than a value, such as less than 6 or less than 3. In these cases, the numbers plotted are greater than the actual concentrations. However, during Wet-Weather Event 1 several of the actual BOD measurements exceeded 10 mg/L including a 24-hour composite sample from Normans Kill (T11-02) that reached 61 mg/L.

6.2. Ammonia Nitrogen

Ammonia nitrogen water quality is specifically regulated by a water quality standard that is temperature and pH dependent. The applicable criteria for un-ionized ammonia as NH_3 would range between 5.9 µg/l and 35 µg/l measured outside the mixing zone. Un-ionized ammonia is a proportion of ammonia nitrogen which also varies with temperature and pH from less than 1 percent to around 5 percent in the ranges of temperature and pH observed in this study. For purposes of comparison then mg/L ammonia nitrogen is roughly equivalent to µg/l un-ionized ammonia.

Figure 6-2 illustrates the observed concentrations of ammonia nitrogen during dry and wet-weather. All ammonia nitrogen concentrations, except for one, are shown as less than 1 mg/L in the table as the sensitivity of the test used to measure ammonia nitrogen is limited to a minimum value of 1 mg/L. The only value greater than 1 mg/L was a

concentration of 1.7 mg/L from a sample collected at the center of the Mohawk River (RT1-NB) during a dry-weather event. Historical data does not indicate violations of the New York ammonia standard in the river and these results support that conclusion.

6.3. Total Phosphorus

Total phosphorus (TP) is a measure of both dissolved and particulate bound phosphorus compounds in a water sample and includes both bioavailable forms and forms bound to substrate that are less available to provide nutrients for plant life. Phosphorus is essential to plant and animal life and is often the limiting nutrient in freshwater aquatic systems. As such an overabundance of available phosphorus can lead to an overabundance of algal or other plant growth. Such over-fertilization is called eutrophication meaning too much life. Such overabundance of algal growth can cause dissolved oxygen to be less than applicable standards. In many watersheds the primary loads of phosphorus come from non-point source application of fertilizers.

The data for TP collected in this study is presented on Figure 6-3 for dry and wet-weather events. During the dry-weather events the concentration values ranged from less than 0.05 to 0.12 mg/L. Wet-Weather Event 1 showed the largest range of values from less than 0.05 to 0.35 mg/L. New York State has nonnumeric standard for nutrient limitation and only imposes standards where water quality does not meet the narrative criteria for nutrients which describe concentrations that cause excessive growth.

6.4. pH

pH is a measure of how acidic or basic a water sample is. In more detail, pH describes the balance of hydrogen ions and hydroxide ions in water. Most aquatic plants and animals have adapted to life in water with a specific pH. Extremely high or low pH can be detrimental to these plants and animals. As stated earlier the pH standard for both Class A and C designations states that the pH “shall not be less than 6.5 or more than 8.5.” As all the waterways sampled in this study are either Class A, Class C or Class C(t), a pH less than 6.5 or greater than 8.5 could impact local aquatic life.

Figure 6-4 presents the data for pH collected during this study. The measured pH during the dry-weather events ranged from 6.6 to 8.3, while the wet-weather events ranged from 6.6 to 8.1. Therefore, all samples collected are within the designated limits of 6.5 and 8.5.

7. QA/QC

7.1. Quality Assurance and Quality Control

The Quality Assurance and Quality Control (QA/QC) protocols for this sampling program were defined in the field sampling plan document and in the lab provided QAPP documents from the selected laboratories as required in the sampling plan. Field QA included requirements for record keeping and chain of custody. In addition, training was conducted with the field crews prior to the sampling season and a safety and QA/QC discussion was held with all field teams prior to the start of each dry or wet-weather sampling event.

Lab QA/QC performance was stipulated to meet certification standards as acceptable to NYSDEC and were detailed in the lab proposals. In addition to the internal lab QA/QC each field team collected co-located duplicate samples at one of their sampling sites for each event. Co-located samples were used since true duplicates or split samples were not practical.

7.1.1. Field sampling QA/QC

The field crews provided standardized notations on field sheets for each station for all events that correspond to chain of custody attached to samples submitted to the laboratory for bacterial or chemical analysis. A complete chain of custody is available for all lab samples and each field measurement was recorded on original field sheets and submitted to the project team. The field probes were provided through TRS Environmental with documented certification.

Quality control review of the field data consisted of examination of the values recorded and the documentation provided on the field sheets. The following quality control issues were identified:

1. Measurements recorded by each field probe were plotted versus time as a potential indicator for probe drift or a probe malfunction. For example, Figure 7-1 shows DO values recorded on the east side of the Hudson River on August 5 reached as high as 37 mg/L, exceeding the possible range of values. Also, the measurements seem to follow a trend, decreasing with each measurement. This may be a result of a probe malfunction or user error (not allowing enough time for accurate reading). These measurements were excluded from the analysis. More typical probe behavior is shown in Figure 7-2 which illustrates measurements collected during Wet-Weather Event 3. These measurements show values remaining consistently higher or consistently lower, but within reasonable values, at a single location. Also, the

measurements show frequent increase and decrease of values, not a downward trend. This suggests proper performance and use of the probe.

2. pH was measured both analytically by ELS and in the field using the probes. Field data collected with the multiprobe for pH yielded unreasonably high values. Therefore only the analytical values are included in this report.
3. There were several instances where the field teams did not initial and comment on erasures and changes made in the field so it is not clear what the reason was that values were changed. Generally it appears that those changes were where the field team initially wrote values in the wrong box and did not note that the initial value was erased and a change made. In these cases the values downloaded from the probes were used to confirm the written field values.

7.1.2. Laboratory QA/QC

St. Peter's Bender Laboratory of Albany, New York performed all the bacterial analyses for this study and Environmental Laboratory Services of North Syracuse, New York performed the BOD, NH_3, and TP analytical services. Both laboratories provided internal chain of custody documentation for all samples and other documentation that they met their internal QA/QC checks for all of the data provided. For the bacteria samples the range of dilutions was selected to provide quantification down to 10cfu/100ml and up to approximately 2 million cfu/100ml.

Analysis of the co-located samples shows strong correlation for fecal coliform concentrations. The relationship of the bacteria samples to their duplicates is shown on Figure 7-3. Some deviation between originals and duplicate samples is anticipated due to the variability of bacteria in water samples and the errors inherent in dilution based analysis. Despite these known challenges the differences between measured values and their duplicates were within a range that is clearly acceptable for this type of test.

8. Additional Sampling

8.1. ACSD Sampling

The Albany County Sewer District (ACSD) conducted additional dry-weather sampling along Patroon Creek and tributaries to Patroon Creek. Figure 8-1 shows the locations sampled by the ACSD, as well as those sampled by the APJVT. The ACSD sampling locations are shown by the purple markers with the black diamonds. The APJVT 2009 sampling locations are shown by the red push-pins markers. The green marker closest to the confluence with the Hudson River is the Patroon Creek sampling location used in both 2009 and 2008.

All ACSD samples were collected between 9:00 AM and 10:30 AM following the same procedure outlined in Section 2.4 and 2.5. Fecal coliform testing for the samples collected by the ACSD was performed in the ACSD certified lab.

Figure 8-2 shows the locations where fecal coliform samples were collected along Cherry Creek, a tributary to Patroon Creek, by the APJVT in 2009 and the ACSD and Figure 8-3 shows a plot of the Cherry Creek data. The samples are plotted in approximate sequential order starting upstream (Point 1) and moving downstream toward the Hudson River. Many of the samples collected and analyzed by the ACSD were reported as Too Numerous to Count (TNC). These results have been plotted using a numerical value around 8000 cfu/100 mL in order to show them on the plot. These values are not a reflection of the actual values. The black box identifies these values. The sample values shown are single values each resulting from one sample.

The first four locations sampled by the ACSD show relatively low counts mostly staying below the NYS Standard. A sample collected at the Cemetery Storm Line location shows the first TNC result. Each set of samples collected by the ACSD following the Cemetery Storm Line location along Cherry Creek shows at least one TNC result. The APJVT collected samples at Palma Park (T16-17) which is between the Fuller Road at Cherry Street and the Railroad Track locations sampled by the ACSD. All but one of the wet event samples collected at Palma Park (T16-17) exceed the NYS Standard. Also, two of the three dry event samples collected at Palma Park (T16-17) exceed the NYS Standard. The fecal coliform results from the samples collected at Palma Park (T16-17) and Fuller Road at Cherry Street were consistent, except for the TNC results from Fuller Road at Cherry Street. The APJVT data corroborates the ACSD data and this suggests that there is a fecal coliform source between the Central Avenue at Northway Mall Road sampling location and the Cemetery Storm Line sampling location.

The ACSD encountered two situations during these sampling events upstream of Fuller Road at Cherry Street that may explain the TNC results. First, bypass pumping was being performed by a contractor for Northway Mall as a result of a pipe relining project for the mall's stormwater system. After a storm event this area was flooded causing back-up of storm and potentially sanitary sewer causing an increase in fecal coliform count. Subsequent sampling after the initial TNC results shows a decrease in counts. Second, the ACSD encountered an area believed to be used to dump garbage truck heel in the Village of Colonie. This was reported to the Village of Colonie, but may have contributed to the TNC results of the early collection events.

Figure 8-4 shows a similar plot of the fecal coliform samples collected along Patroon Creek by the APJVT in 2009 and the ACSD. As in Figure 8-3, the samples are plotted in sequential order starting upstream (Point 1) and moving downstream toward the Hudson River with boxed TNC results. The samples collected around Rensselaer Lake meet the NYS Standard. However, less than 0.2 miles downstream at the Fuller Road (T16-18) sampling location, all but one fecal coliform value exceeded the NYS Standard. The next seven ACSD sample locations show at least one TNC value. Four of these sample locations show only TNC values. The final sampling location, Patroon Creek-2008 (T16-13), shows most fecal coliform values exceeding the NYS Standard. This suggests that there is a fecal coliform source between the Rensselaer Lake sampling locations and the Fuller Road (T16-18) sampling location. Also, Figure 8-3 shows either the fecal coliform counts being carried down Patroon Creek or additional sources along the creek keeping the counts above the NYS Standard.

Figure 8-5 shows a plot similar to Figures 8-3 and 8-4. The samples were collected from locations on two tributaries to Patroon Creek: Sand Creek and Corporate Woods Boulevard Samples were collected from the same Sand Creek sampling location by both the ACSD and the APJVT. All but one sample value from both sets of samples exceeds the NYS Standard. The samples collected at the Corporate Woods Boulevard sample location also show most values exceeding the NYS Standard. This suggests that both creeks, flowing through Colonie before contributing to the Patroon Creek, are sources of fecal coliform to the Patroon Creek.

The samples collected by the APJVT and ACSD at Sand Creek (T16-15) and Sand Creek (ACSD) consistently exceed the water quality standard. The July samples collected at Sand Creek (T16-15) are in the 100 to 400 mg/L range. However, the July samples collected at Sand Creek (ACSD) result in higher coliform counts ranging from 700 to TNC. Both sets of sampling data show an exceedance of the water quality standard at this location.

8.2. Rensselaer Lake Additional Sampling

The fecal coliform results from the sample collected at Fuller Road (T16-18) are an order of magnitude larger than the fecal coliform results from Rensselaer Lake location sampled by the ACSD. The Rensselaer Lake sampling location is located at the Rensselaer Lake spillway. Fuller Road (T16-18) is approximately 0.2 miles downstream of the Rensselaer Lake spillway. The counts present in the samples collected at Rensselaer Lake are below the NYS Standard while the counts present in the samples collected at Fuller Road (T16-18) range from 666 to 1,521. This shows compliance with the water quality standard within Rensselaer Lake, but a consistent exceedance of the water quality standard at the Fuller Road (T16-18) location.

Additional sampling was requested by the ACSD of the Rensselaer Lake area and was performed on April 14, 2010. Samples directly upstream, within, and directly downstream of the lake were collected. On Figure 3-3 these samples are shown as Rensselaer Lake. The fecal coliform counts resulting from these samples are in compliance with the NYS Standard. These results suggest that Rensselaer Lake is not a source of fecal coliform to the Patroon Creek.

Also on April 14, 2010, a sample was collected at the T16-18 (Fuller Road) sampling location. This sample has been added as a Fuller Road (T16-18) sample. Although this sample does not exceed the NYS Standard, the fecal coliform count resulting from this sample is much greater than that of the samples considered Rensselaer Lake. This suggests that there is a significant source of fecal coliform downstream of the Rensselaer Lake outlet that contributes to the Patroon Creek. The ACSD is currently investigating this location further. This is in the area of the connection of the Pine Bush Trunk Sewer with the Patroon Creek interceptor sewer.

9. Summary and Conclusions

9.1. Sampling Program Goals and Objectives

Sampling was completed for five dry-weather events and three wet-weather events. Sampling was conducted at two River Transects, and at multiple locations along five Hudson River tributaries in the Albany Pool area. Dry-weather samples were collected to develop an understanding of the specific ambient or background water quality parameters measured. Wet-weather samples were collected to ascertain the water quality impact of the wet-weather events on the Mohawk and Hudson River at their upstream limits of the sampling area and throughout the Albany Pool area.

Samples were collected for fecal coliform analyses in order to assess the data relative to the existing NYSDEC Class A and Class C fecal coliform standard defined in Part 703.4. Field measurements of general water quality variables were also reported for temperature, specific conductance, and DO in order to assess the data relative to the existing NYS standards also defined in Part 703.

The sample results and measurements were used to support the receiving water modeling. The modeling considered the fate and transport of fecal coliform bacteria down the river and the potential for CBOD in combined sewer overflow to influence DO levels.

9.2. Dry-Weather Conditions Observed

Sampling was successfully completed for five dry-weather events at 18 locations described in Section 2. Dry-weather bacteria results were presented in Section 3. Results for field measured parameters were presented in Chapter 5.

Geometric mean values for fecal coliform for the 30-day period were used to determine the compliance of each sample location. Half the locations were at or exceeded the fecal coliform compliance limit. Of particular concern were the significant bacteria counts recorded during all sampling events at the Fuller Road (T16-18) sampling location. The geometric mean value for the 30-day period was almost 1,000 cfu/100 mL. The consistent exceedance of the NYS Standard prompted a request for additional sampling around Rensselaer Lake. The results of the additional sampling suggest that Rensselaer Lake is not a significant source of fecal coliform. However, it also suggests there is a significant source between the Rensselaer Lake and the Fuller Road (T16-18) sampling location possibly attributed to the Pine Bush Trunk Sewer connection with the Patroon Creek interceptor sewer.

Samples were also collected on three tributaries to Patroon Creek entering Albany from Colonie. Two of the sampling locations, Palma Park (T16-17) and Corporate Woods Boulevard (T16-14), were in compliance during the 2009 sampling. The third sampling location, Sand Creek (T16-15), exceeded the compliance limit.

The sampling location closest to the confluence with the Hudson River, Tivoli Street (T16-13), was sampled during 2009 and 2008. During both years, the resulting fecal coliform counts exceeded the compliance limit. However, the value resulting from the samples collected in 2009 decreased significantly from the values of more than 8,000 cfu/100 mL recorded during the sampling of 2008 to 400 cfu/100 mL recorded in 2009.

All three of the sample locations along Mill Creek exceeded the compliance limit. The South Street (T12-07) and High Street (T12-06) sampling locations are near the border of Rensselaer and East Greenbush which suggests the water quality of Mill Creek entering Rensselaer is already above the compliance limit for fecal coliform. However, the highest counts were collected at the Washington Avenue (T12-05) sampling location, which is the most downstream location, closest to the confluence with the Hudson River. This suggests that additional sources of fecal coliform are added within the City of Rensselaer.

The Krum Kill (T11-04) and the upstream Normans Kill (T11-03) sampling locations exceeded the compliance limit. However, the downstream Normans Kill (T11-02) sampling location was in compliance. The upstream Normans Kill (T11-03) sample results show elevated fecal coliform counts in the Normans Kill coming from Bethlehem. However, the Krum Kill and the Normans Kill downstream of T11-03 runs along the border of Albany and Bethlehem making source conclusions difficult.

The sample locations along Wynants Kill and Poesten Kill all had geometric mean values below the compliance limit. The Poesten Kill enters Troy from Brunswick and the Wynants Kill enters Troy from North Greenbush.

The dry weather DO arithmetic mean values are all in compliance and remain within the values resulting from the samples collected in 2008.

9.3. Wet-Weather Conditions Observed

Sampling was successfully completed for three wet-weather events of varying magnitude at 18 locations described in Section 2. Sampling multiple locations along each tributary allowed for a spatial analysis of fecal coliform concentrations. Wet-weather bacteria results were presented in Section 4. Results for field measured parameters were presented in Section 5.

Wet Event 1 and Wet Event 3 had approximately the same amount of cumulative precipitation, 1.12 and 1.19 inches, respectively. The cumulative rainfall measured during Wet Event 2 was only 0.34 inches.

As with the dry-weather events, geometric mean values for fecal coliform for the 48-hour sample time were used to determine the compliance of each sample location. All but two of the sample locations exceeded the compliance limit for all three wet-weather events. The Normans Kill at Route 85 (T11-03) and the Poesten Kill at Pawling Avenue (T14-12) were in compliance during Wet Event 2. The events with higher precipitation resulted in higher fecal coliform counts at every location except at the Patroon Creek at Fuller Road (T16-18) sampling location.

The geometric mean concentration values at the most downstream sample locations on each tributary can be compared to values from 2008. The bacteria concentrations are consistent and significant. The tributaries contribute a significant load of bacteria to the Hudson River during the wet-weather events. The values collected in Patroon Creek (T16-13) are significantly less than those observed in 2008 apparently due to the efforts by the City of Albany and the ACSD. However, the values remain larger than the other tributaries.

For the Normans Kill, the Krum Kill tributary (T11-04) shows a significantly larger concentration than the upstream Normans Kill location (T11-03) and the downstream Normans Kill location (T11-02). Normans Kill, coming from Bethlehem, is larger by volume than Krum Kill and it is expected that the higher fecal coliform concentration of Krum Kill is diluted when it enters Normans Kill. Again, the Krum Kill, along with the Normans Kill downstream of T11-03, runs along the border of Albany and Bethlehem making source conclusions difficult.

For Mill Creek, the geometric mean concentration results show a slight increase from upstream (T12-07) to downstream (T12-05). These results suggest fecal coliform additions along Mill Creek. This is likely due to CSO 011 which contributes to Mill Creek between these two locations. In addition, the high fecal coliform counts at the South Street (T12-07) and High Street (T12-06) sampling locations shows that flows entering Rensselaer from East Greenbush are exceeding the NYS Standard for fecal coliform.

For Wynants Kill and Poesten Kill, the geometric mean concentration results show consistent values from upstream to downstream. These results suggest that a consistent concentration of fecal coliform is contributed to each tributary. The sampling results at the upstream sampling location along the Wynants Kill and Poesten Kill also show fecal coliform counts in exceedance of the NYS Standard entering Troy from North Greenbush and Brunswick, respectively.

For Patroon Creek, the geometric mean concentration results do not show a specific trend. However, many of the sampling locations are on tributaries to Patroon Creek rather than on Patroon Creek itself. The wet-weather events show consistently high fecal coliform counts throughout the tributaries as they enter Albany from Colonie.

Field measurements obtained during wet-weather events for temperature and specific conductance show consistency through the events.

DO measurements along Normans Kill and Patroon Creek are consistently high and show no readings that are out of the normal range. DO measurements along Mill Creek, Wynants Kill and Poesten Kill start in the normal range during Wet Event 1 but show low readings during Wet Events 2 and 3.

The Mohawk River DO measurements are consistent throughout the sampling with the first wet-weather event showing slightly higher values. The Hudson River (RT3A) DO values show a high concentration during dry-weather events and lower values during wet-weather events, especially during the last two events. The 2009 Hudson River transect (RT3A) location was selected in an attempt to measure the upstream boundary for the Albany Pool. Because of the predicted small discharge volume of the only Albany Pool CSO upstream of the sampling location, the short travel time from that CSO to the Hudson River (RT3A) location (approximately 30-90 minutes), and the time required for oxygen depleting substances to impact dissolved oxygen, the reduced DO is not likely associated with a CSO discharge within the Albany Pool. Rather, the lowered DO values are likely due to an upstream source sufficiently far away to influence the Hudson River's DO at the measurement location.

9.4. Recommendations

This 2009 tributary sampling was performed in addition to the 2008 comprehensive receiving water conditions assessment to further examine the water quality of the identified tributaries within the Albany Pool Communities. The additional 2009 sample locations were established at the boundaries of the Albany Pool Communities in order to aid the recommendation of community contribution. The results of this investigation indicate that each of the 18 samples exceeds the NYS Standard for fecal coliform during wet weather events with a cumulative precipitation of approximately 1 inch. This suggests high levels of fecal coliform contribution from outside communities along with the possibility of contributions from the Albany Pool Communities.

The two sampling locations of particular concern that show the possibility of high levels of fecal coliform contribution from an Albany Pool Community are the Krum Kill (T11-04) and Fuller Road (T16-18) sampling locations. The Krum Kill (T11-04) sampling location exceeded the NYS Standard during dry and wet weather events. The Krum Kill runs along the border of Albany and Bethlehem, and although no specific evidence was

found, the high fecal coliform counts could potentially be due to the City of Albany's permitted overflow at the Woodville Pump Station approximately 7.6 miles upstream of the sampling location. To investigate this potential source, it is recommended that block testing be performed on the pump station. The Fuller Road (T16-18) sampling location is located within the boundaries of the City of Albany downstream of Rensselaer Lake. The Albany County Sewer District sampling results from locations within Rensselaer Lake show counts much lower than the NYS Standard and also much lower than the counts from the samples collected at the Fuller Road (T16-18) location. This suggests that there is a fecal coliform source between the Rensselaer Lake outlet and the Fuller Road (T16-18) sampling location. Further investigation of this source is also recommended.

2009 Sampling Locations

RT1) River Transect - Route 9 bridge crossing the Mohawk River upstream of Cohoes and Crescent Dam

RT3A) River Transect - 126th St Bridge crossing of the Hudson River

T11-02) Norman's Kill at Riber Rd bridge north of intersection with Corning Hill Rd in Albany

T11-03) Norman's Kill near the confluence with Krum Kill near the border of Albany and Bethlehem

T11-04) Krum Kill near the confluence with Norman's Kill near the border of Albany and Bethlehem

T12-05) Mill Creek at the Washington St bridge south of Fourth Ave in Rensselaer

T12-06) Mill Creek near the border of Rensselaer and East Greenbush, High St Bridge

T12-07) Tributary from Hampton Manor Lake near the confluence with Mill Creek near the border of Troy and East Greenbush, Culvert on South St

T13-08) Wynants Kill downstream of dam at Burden Environmental Park at intersection of Campbell Ave and Vandenburgh Ave in Troy

T13-09) Wynants Kill near the border of Troy and North Greenbush, Winter St Bridge

T13-10) Wynants Kill near the border of Troy and North Greenbush, Brookside Ave Bridge

T14-11) Poesten Kill at the 2nd St bridge between Canal Ave and Ida St in Troy

T14-12) Poesten Kill near the border of Troy and Brunswick, Pawling Ave Bridge

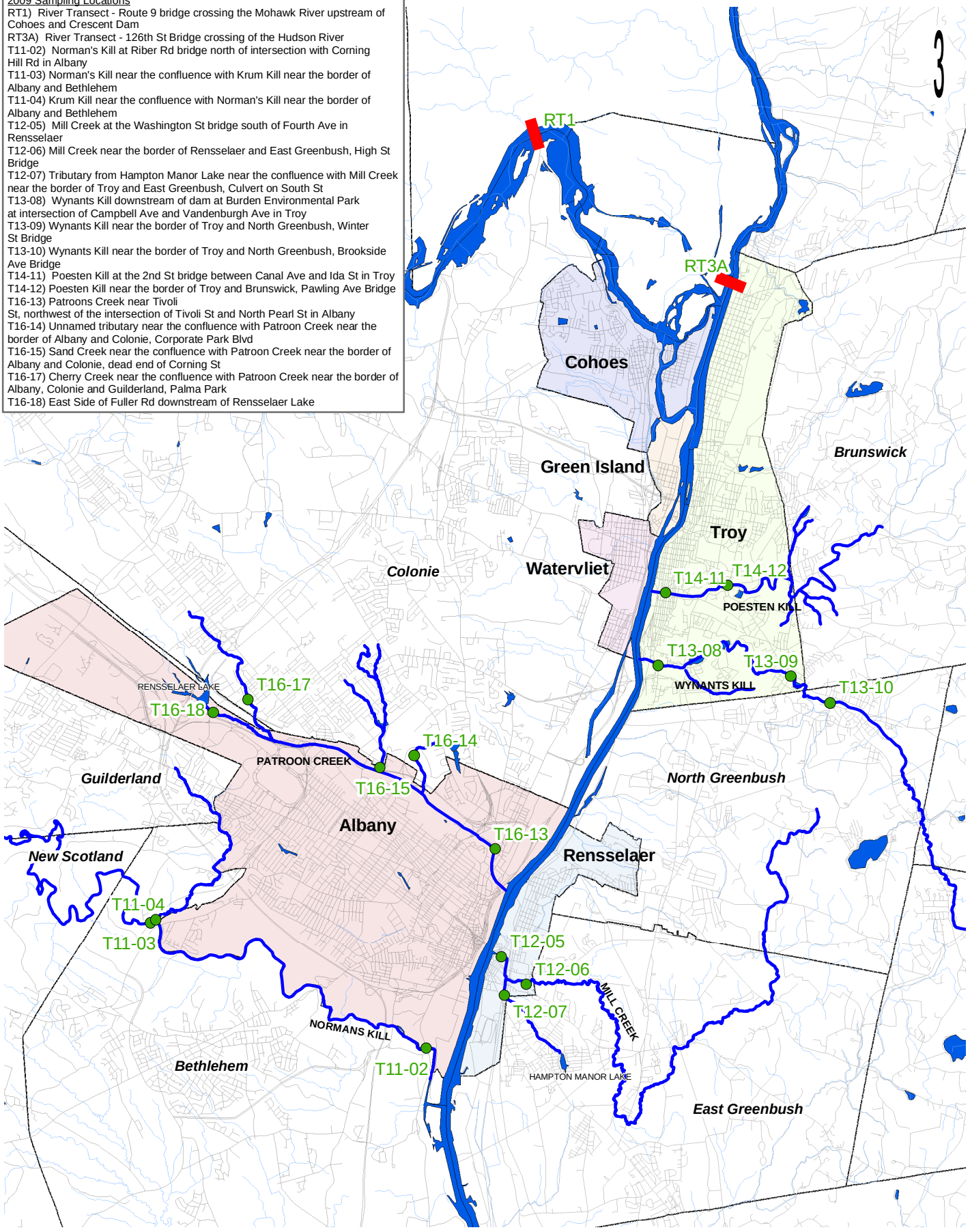
T16-13) Patroons Creek near Tivoli St, northwest of the intersection of Tivoli St and North Pearl St in Albany

T16-14) Unnamed tributary near the confluence with Patroon Creek near the border of Albany and Colonie, Corporate Park Blvd

T16-15) Sand Creek near the confluence with Patroon Creek near the border of Albany and Colonie, dead end of Corning St

T16-17) Cherry Creek near the confluence with Patroon Creek near the border of Albany, Colonie and Guilderland, Palma Park

T16-18) East Side of Fuller Rd downstream of Rensselaer Lake



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MALCOLM PIRNIE

ALBANY CSO POOL
LONG TERM CONTROL PLAN
0241003

SAMPLING LOCATIONS 2009

MALCOLM PIRNIE, INC.
AUGUST 2010
FIGURE 2-1

Figure 3-1: Tributaries-Fecal Coliform
2008 & 2009 Dry Weather Comparison of Data

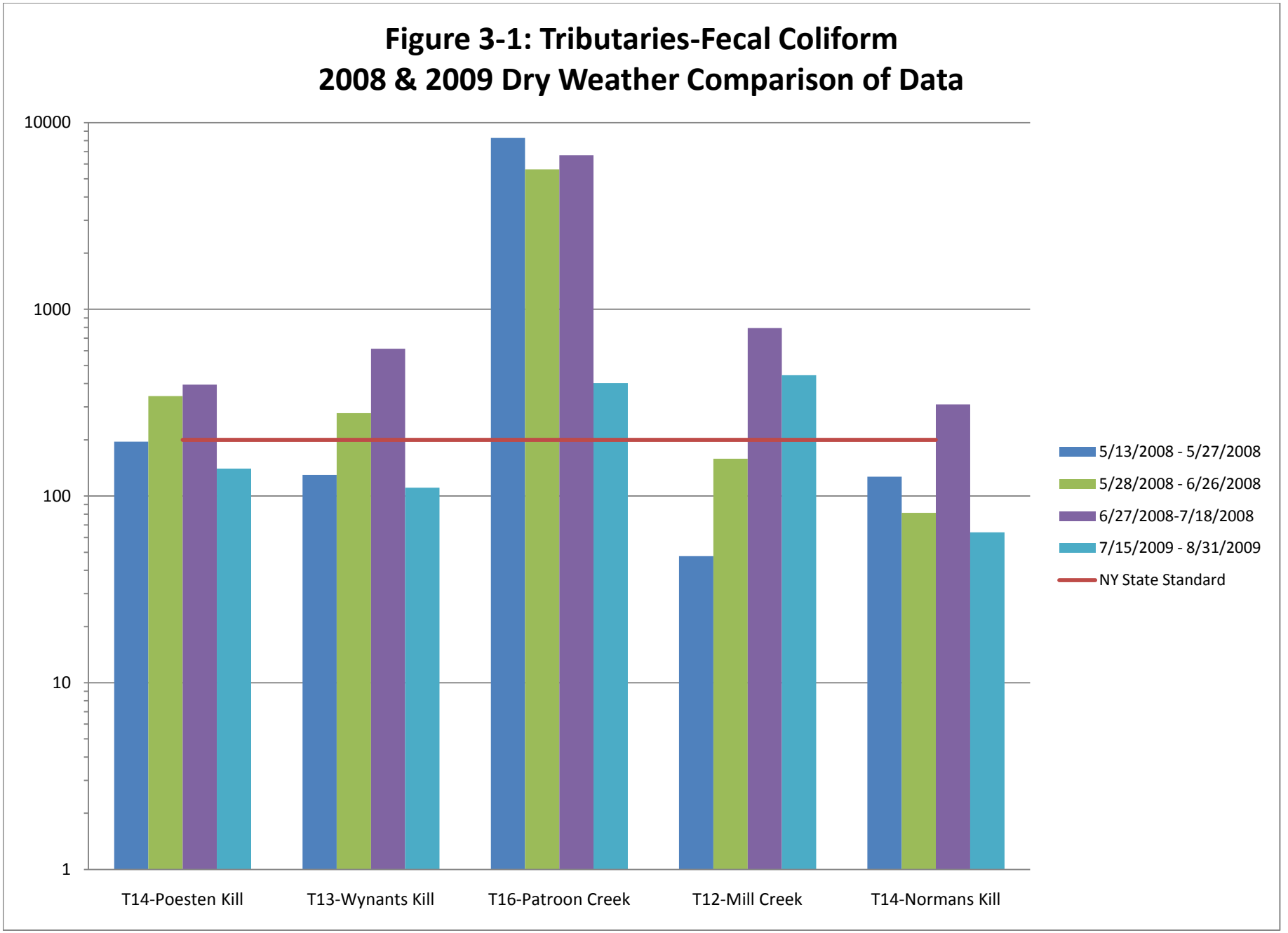
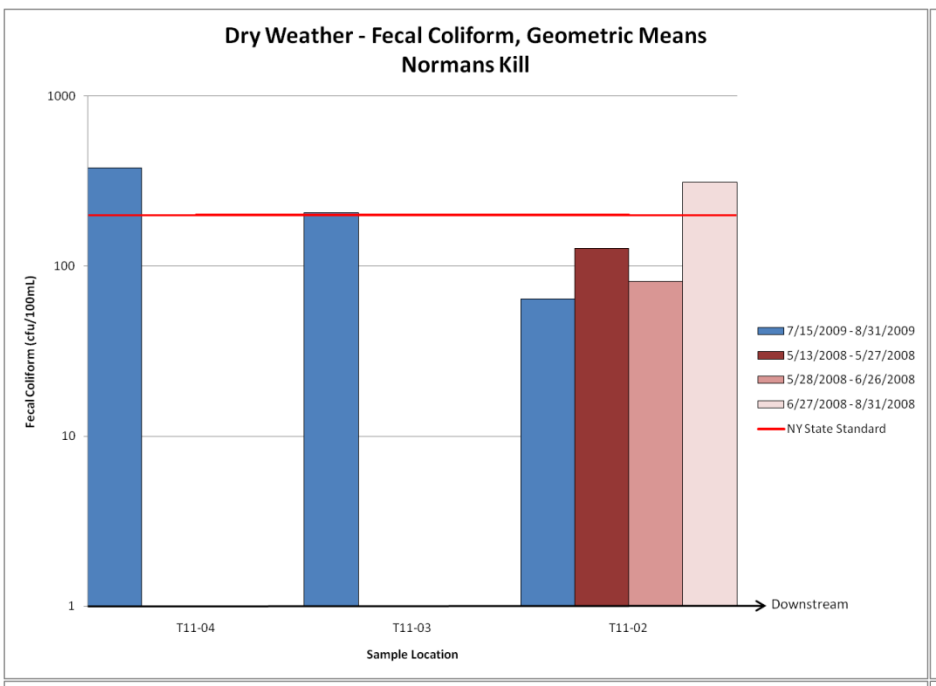
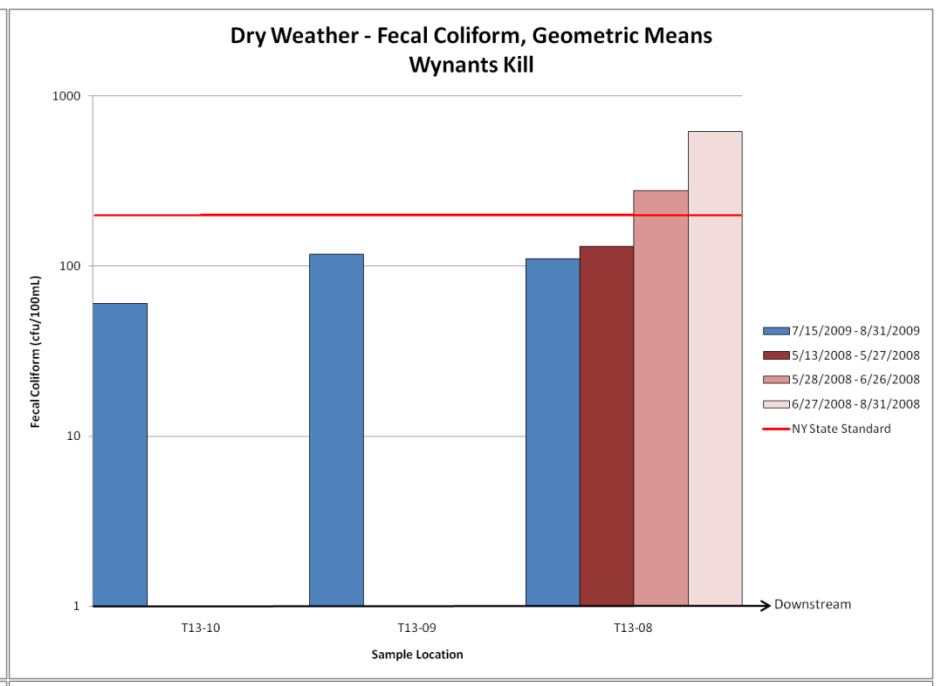
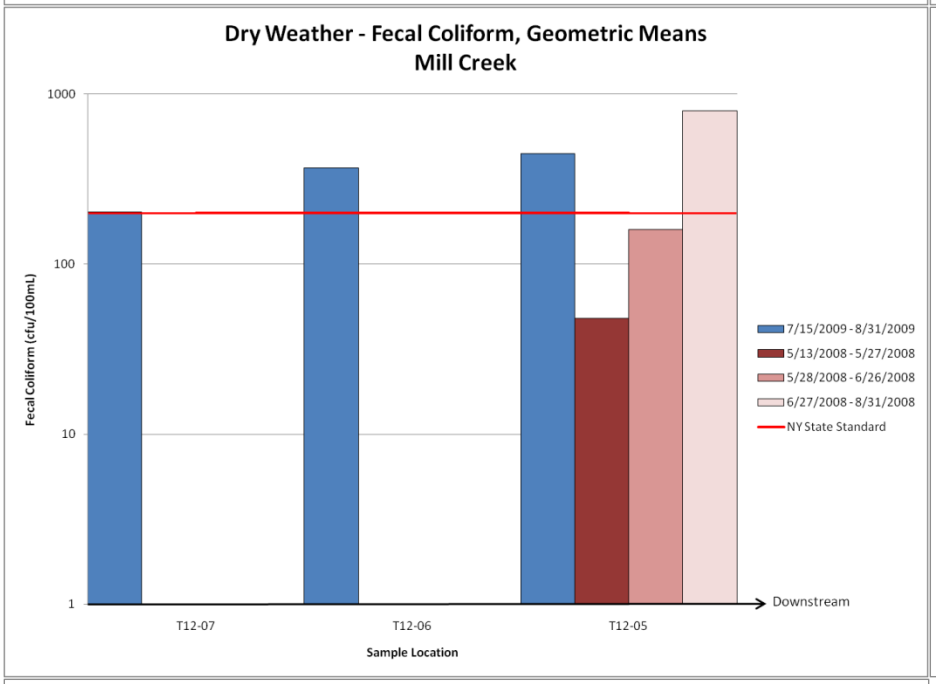
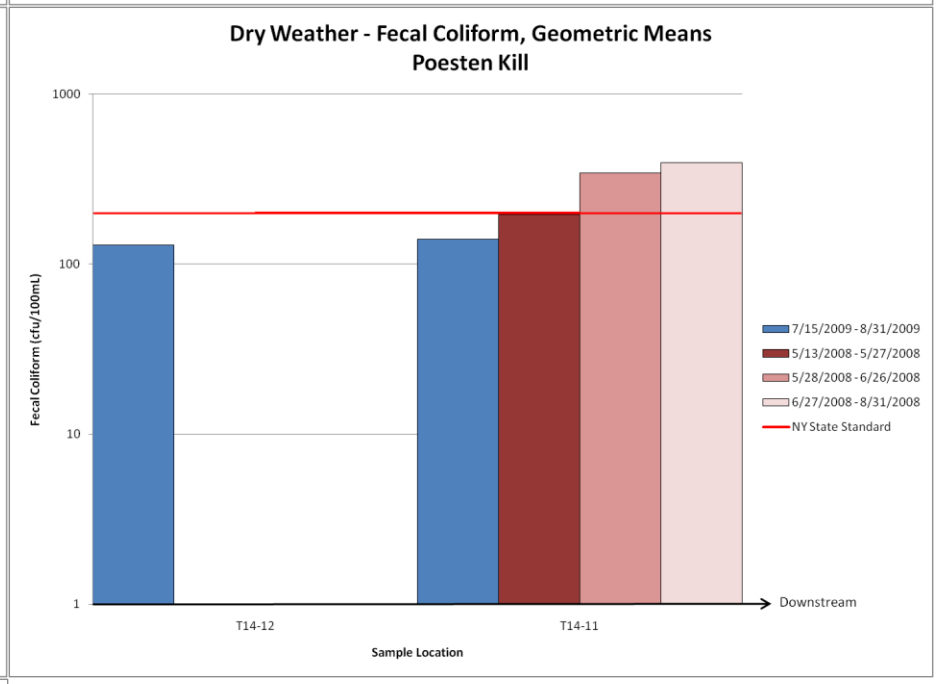


Figure 3-2: Dry Weather Fecal Coliform Geometric Mean Summary 2008 and 2009 Data Comparison









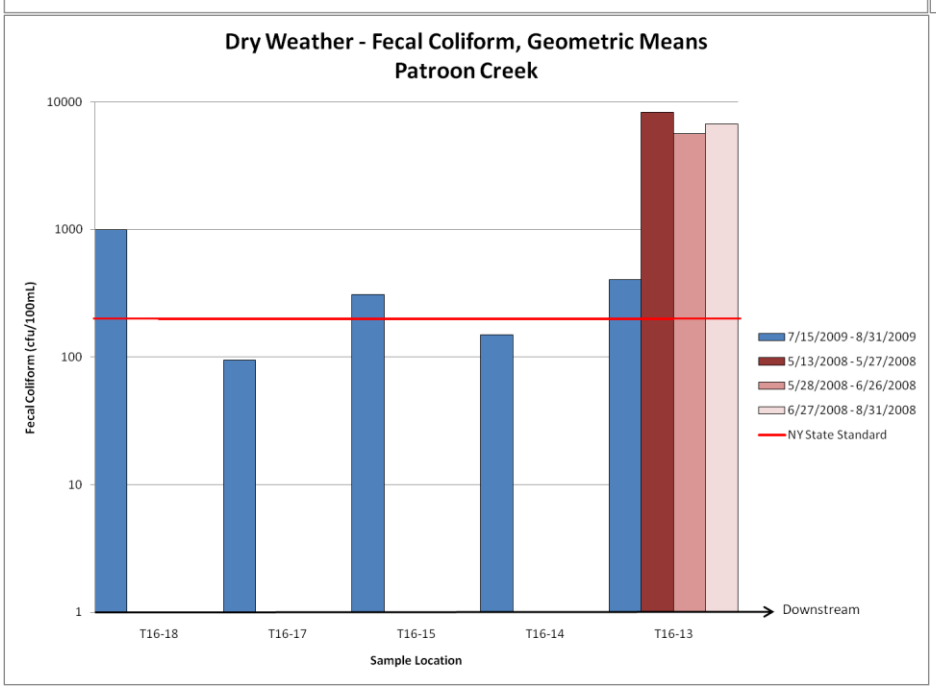
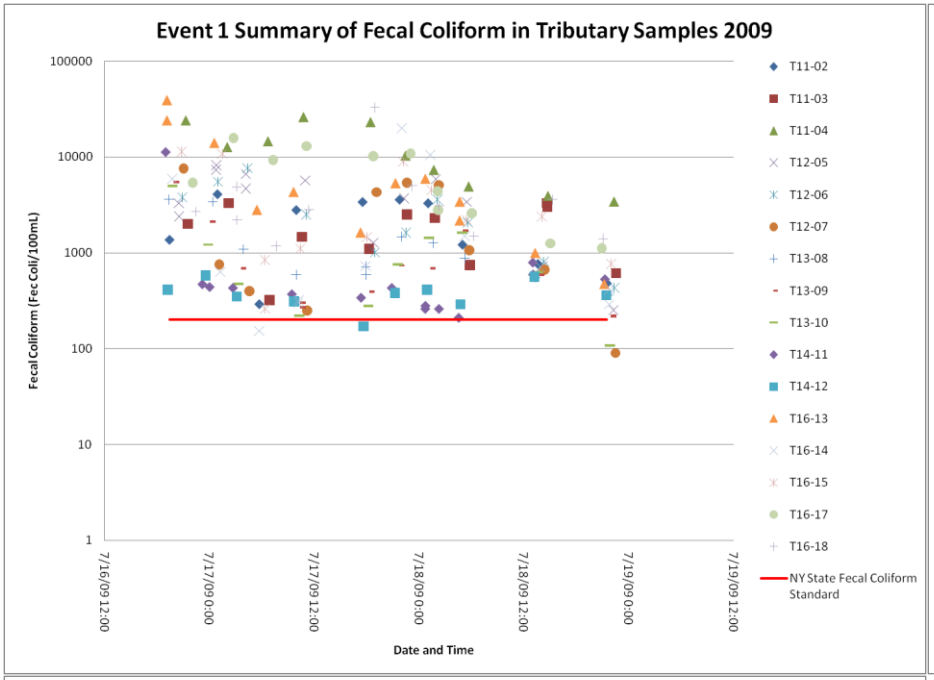
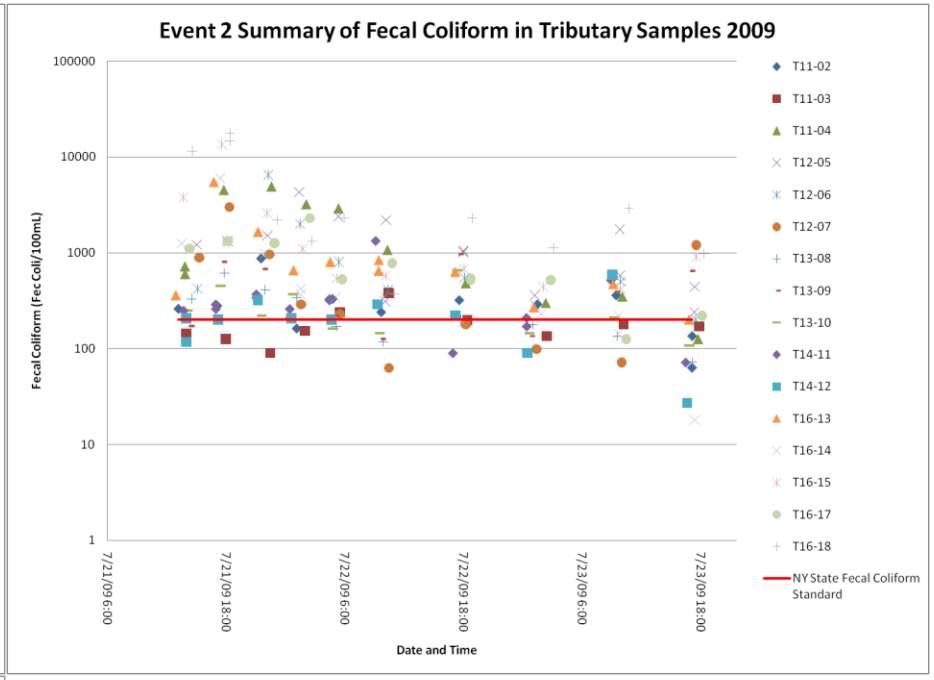


Figure 4-1: Wet-Weather Fecal Coliform Summary





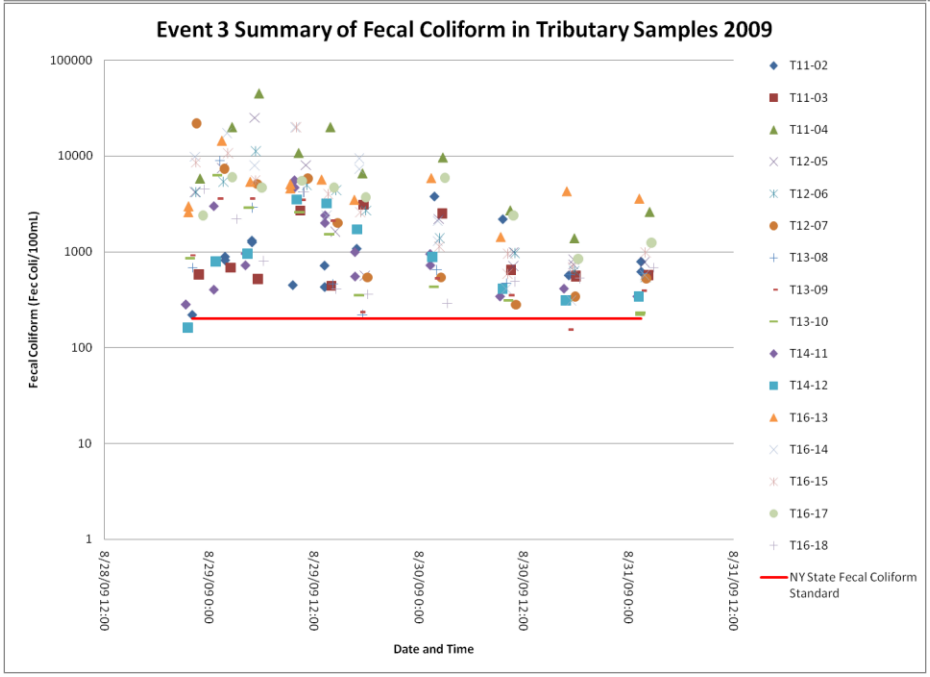
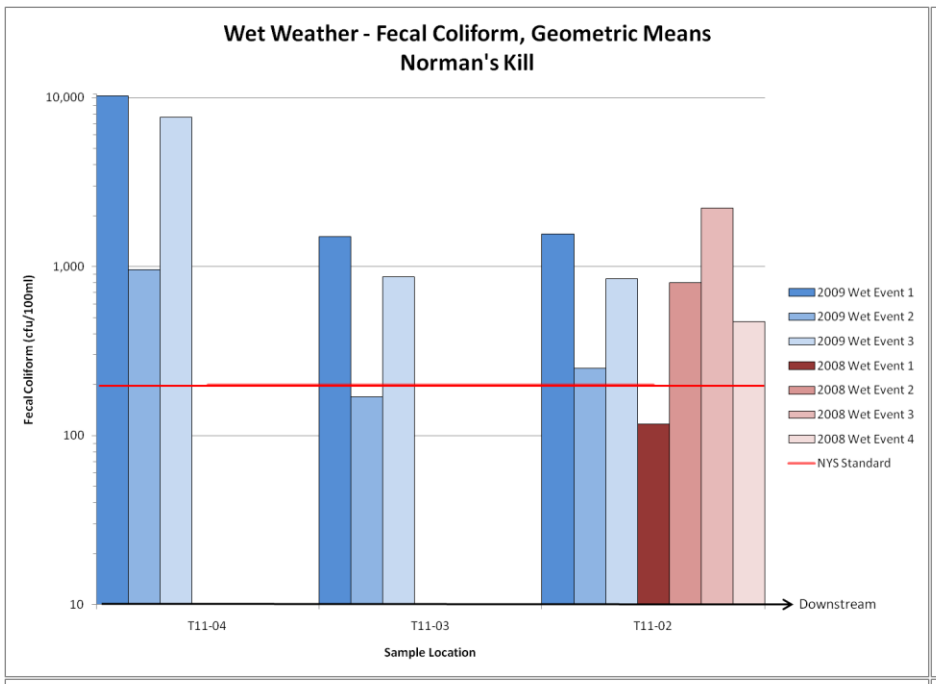
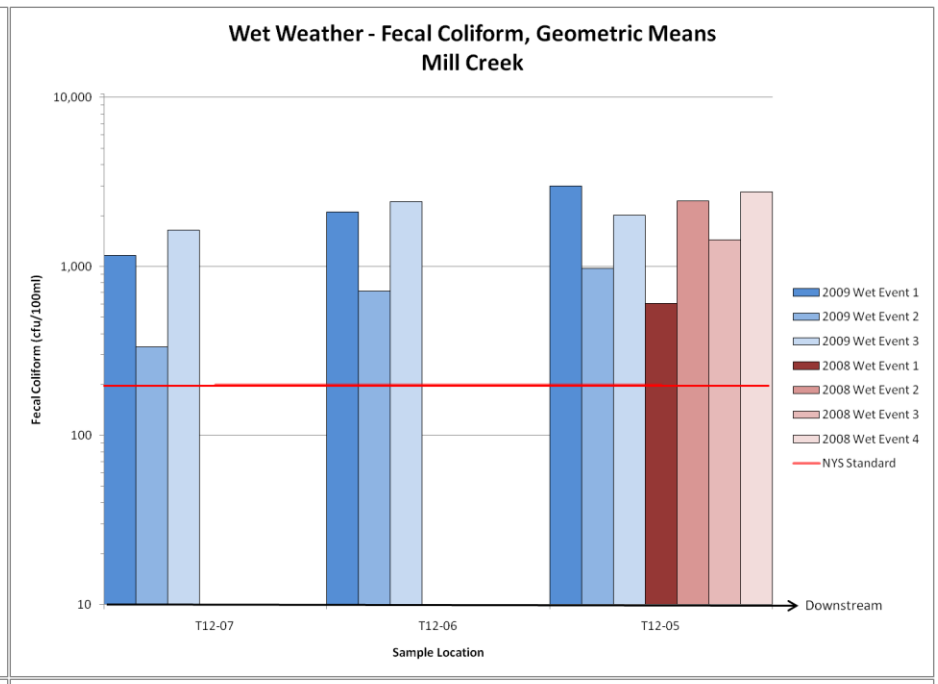
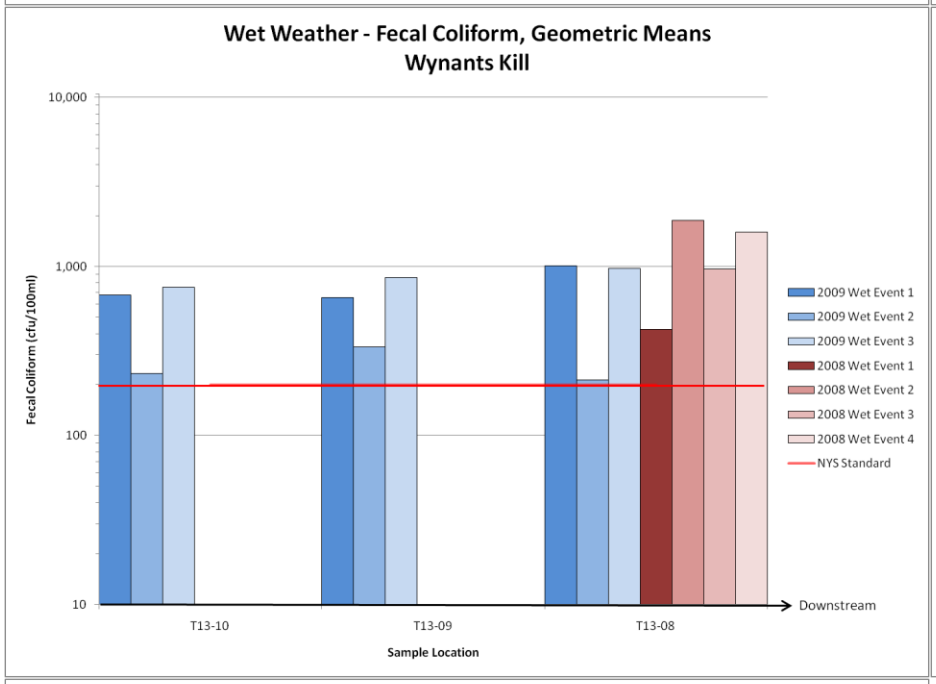
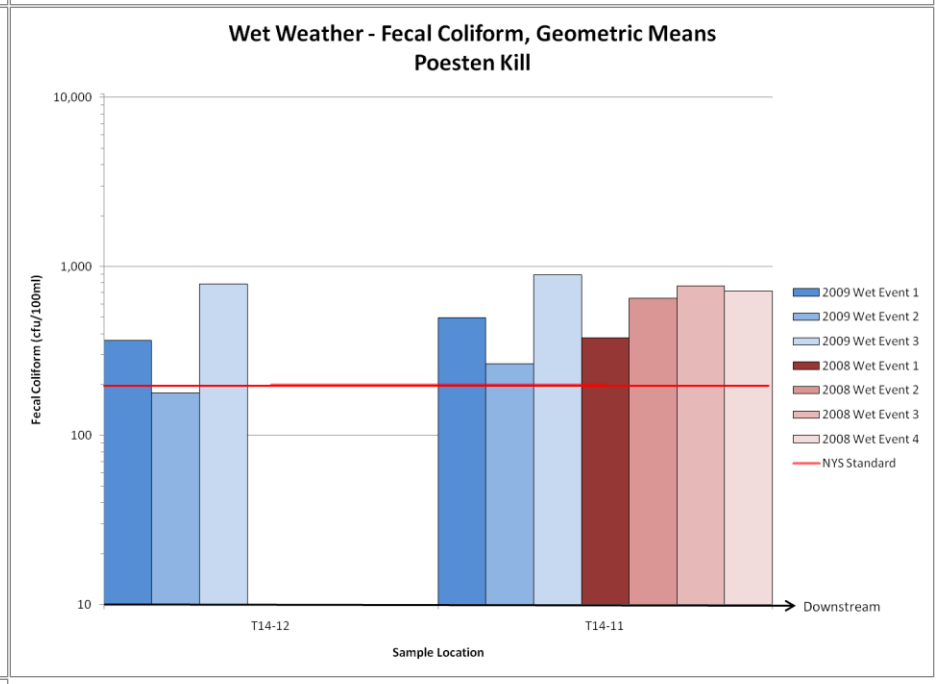


Figure 4-2: Wet Weather Fecal Coliform Geometric Mean Summary 2008 and 2009 Data Comparison









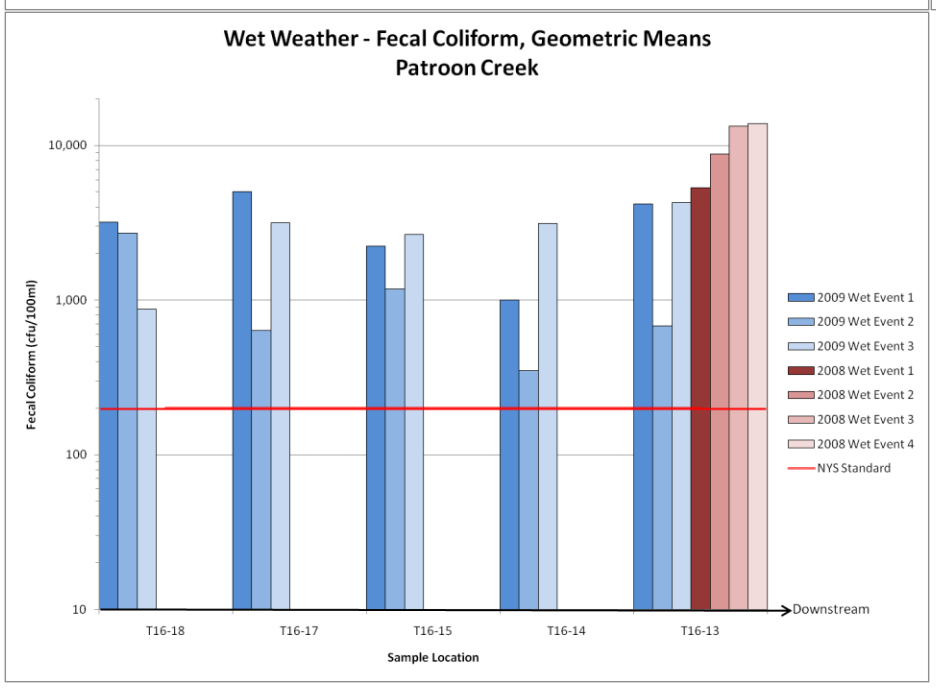
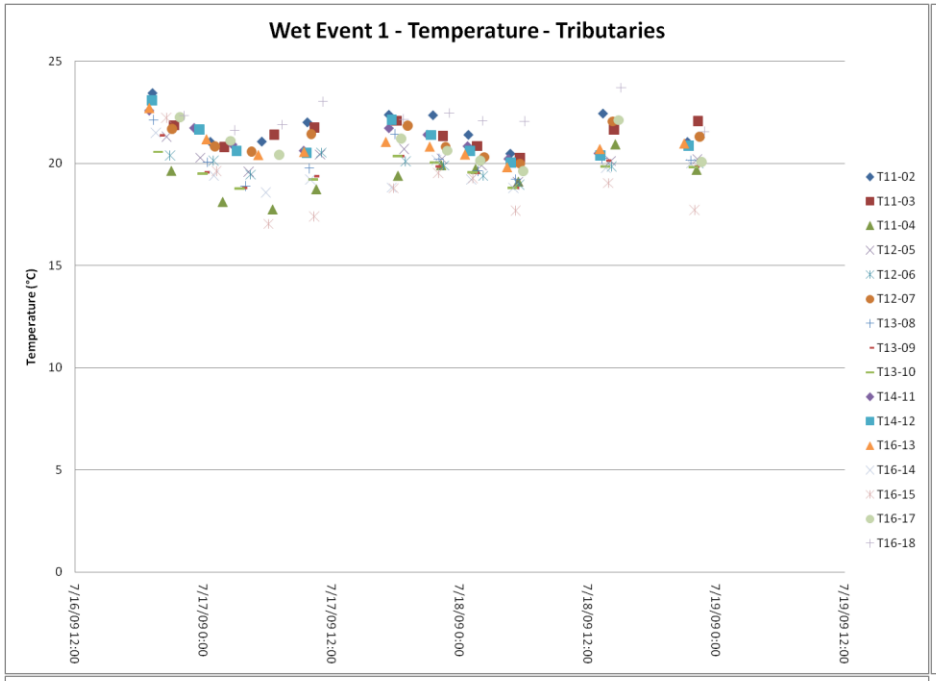
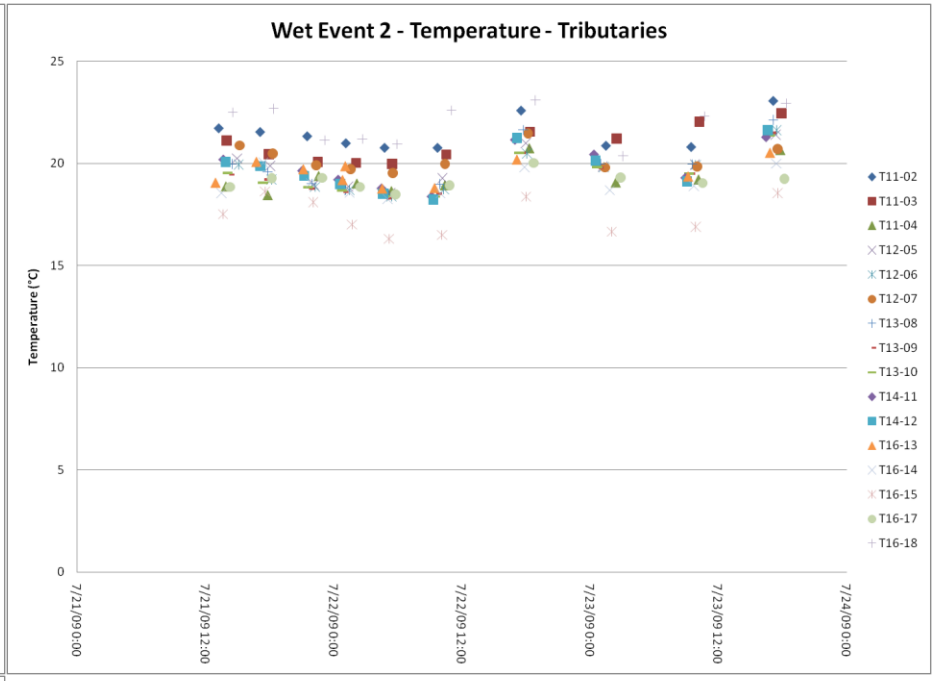


Figure 5-1: Temperature – Wet-Weather Summary - Tributaries





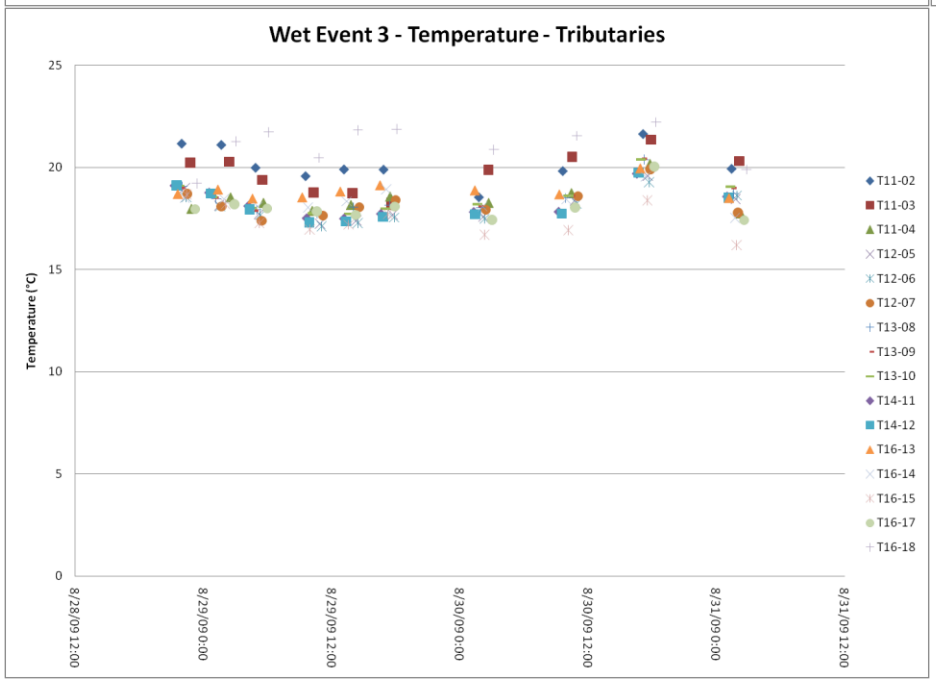
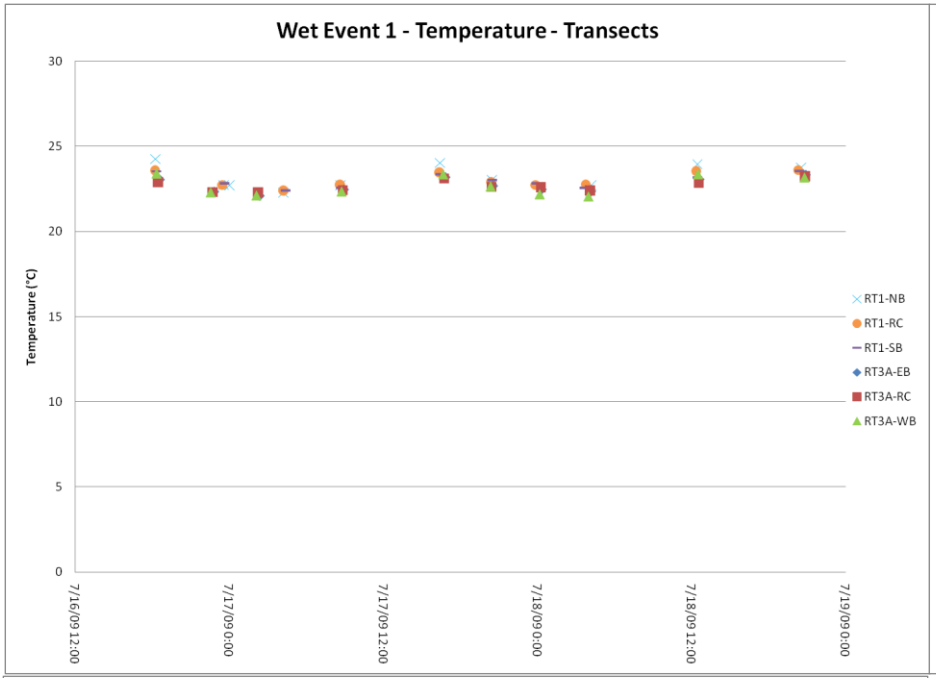
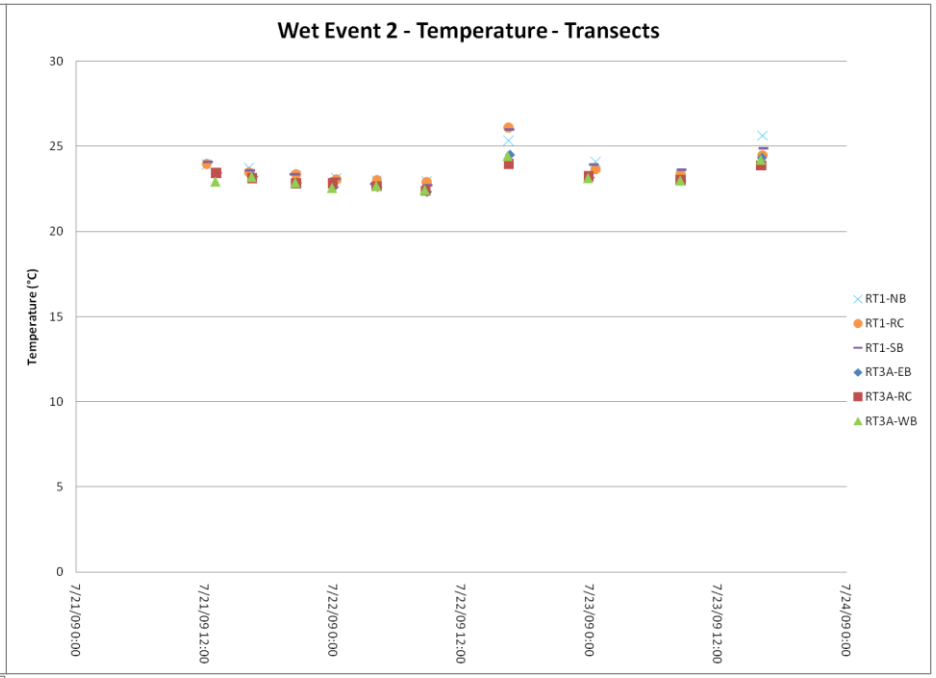


Figure 5-2: Temperature – Wet-Weather Summary - Transects





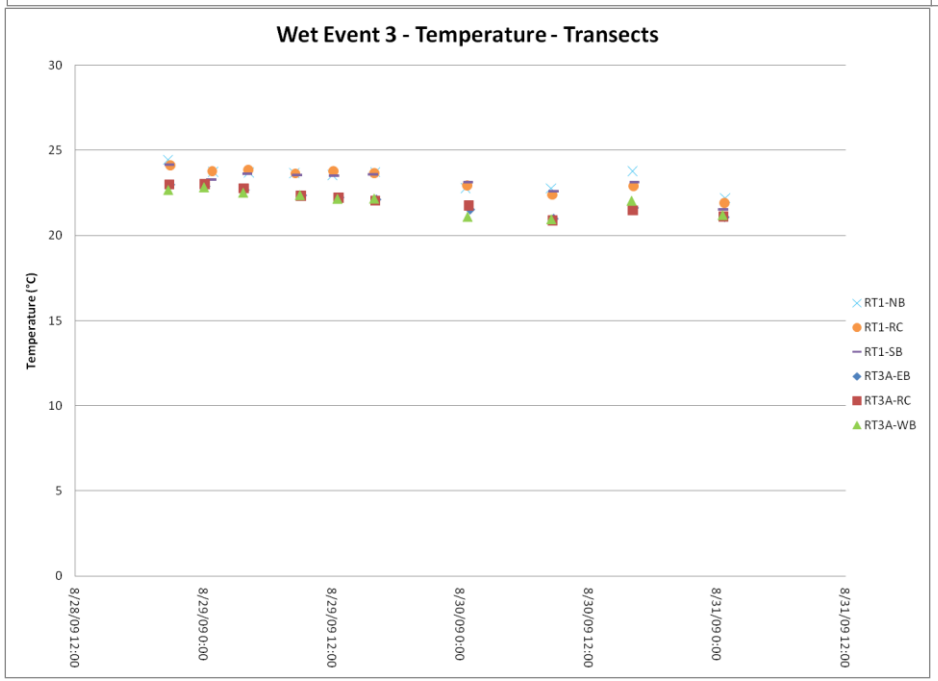
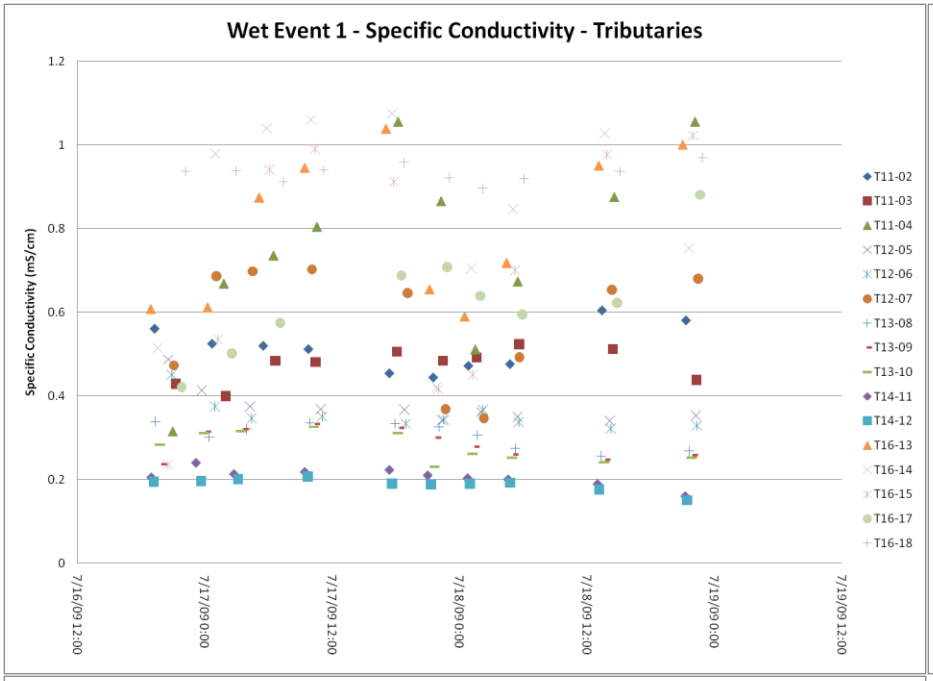
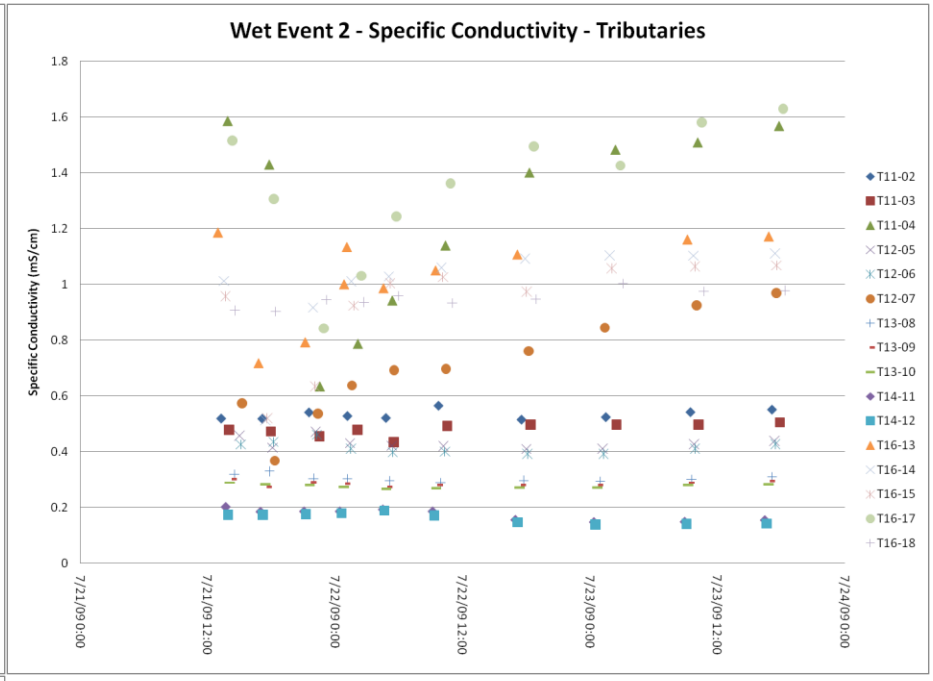


Figure 5-3: Specific Conductivity – Wet-Weather Summary - Tributaries





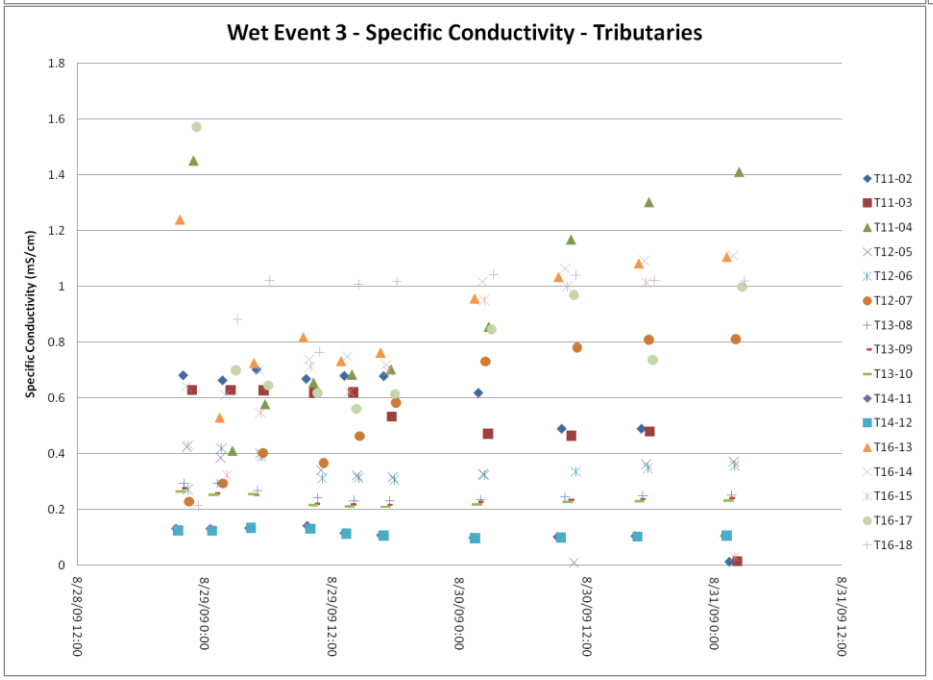
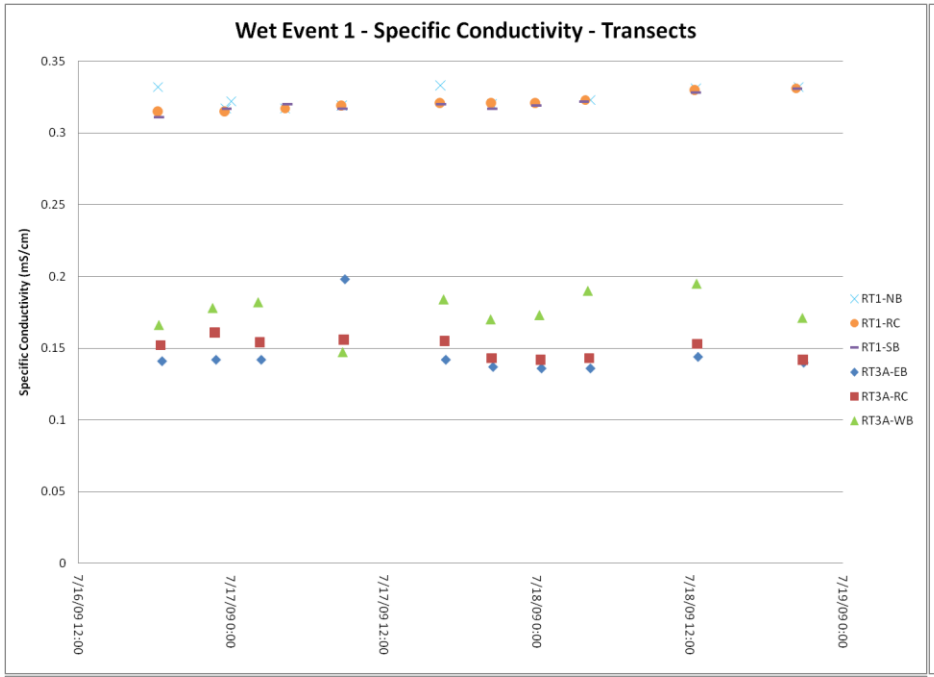
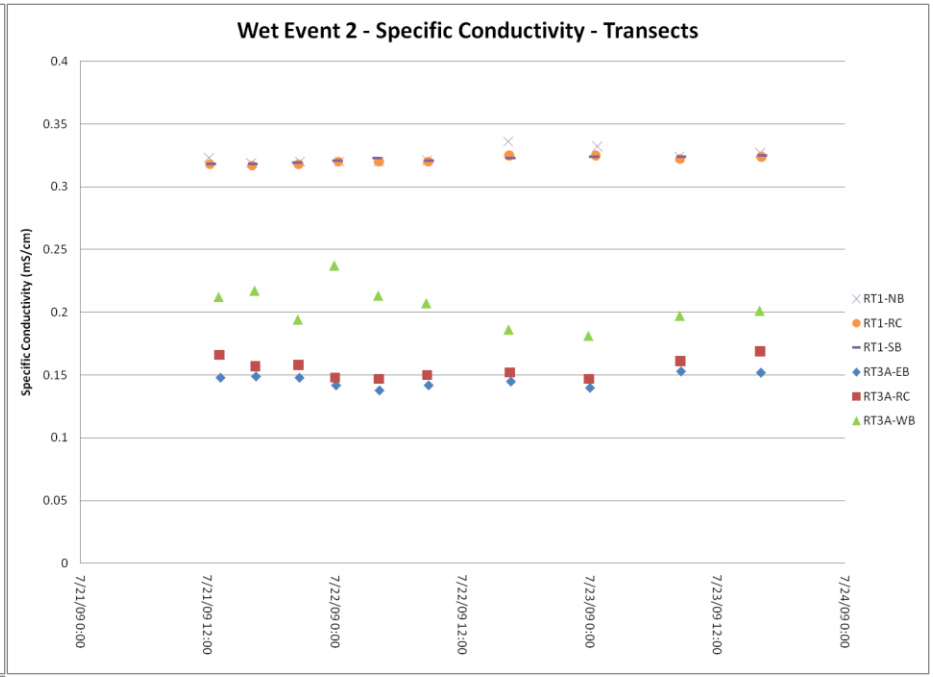


Figure 5-4: Specific Conductivity – Wet-Weather Summary - Transects





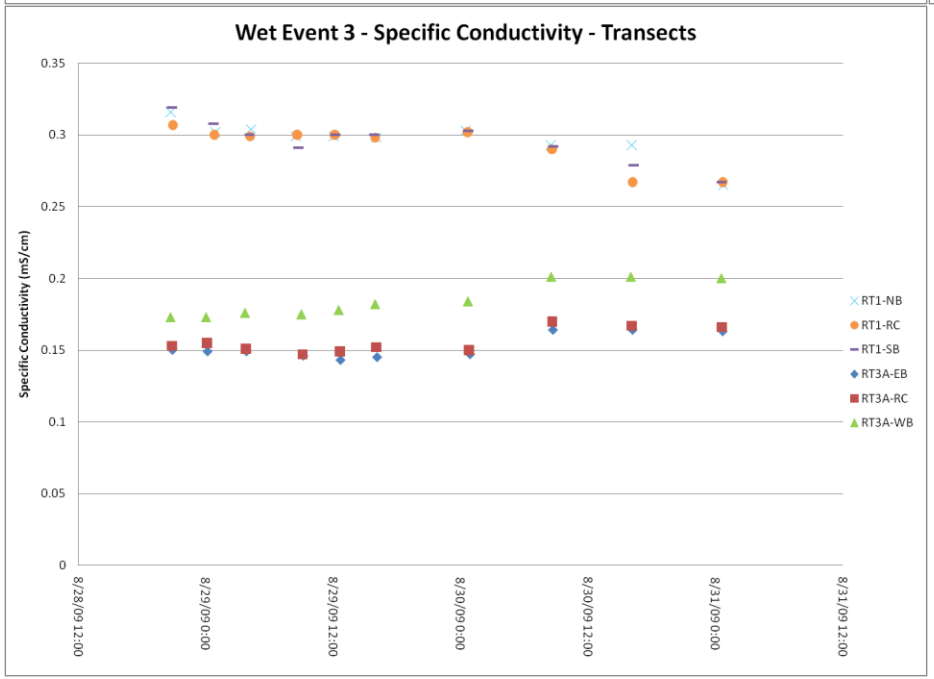


Figure 5-5: Dissolved Oxygen – Wet-Weather Summary - Tributaries

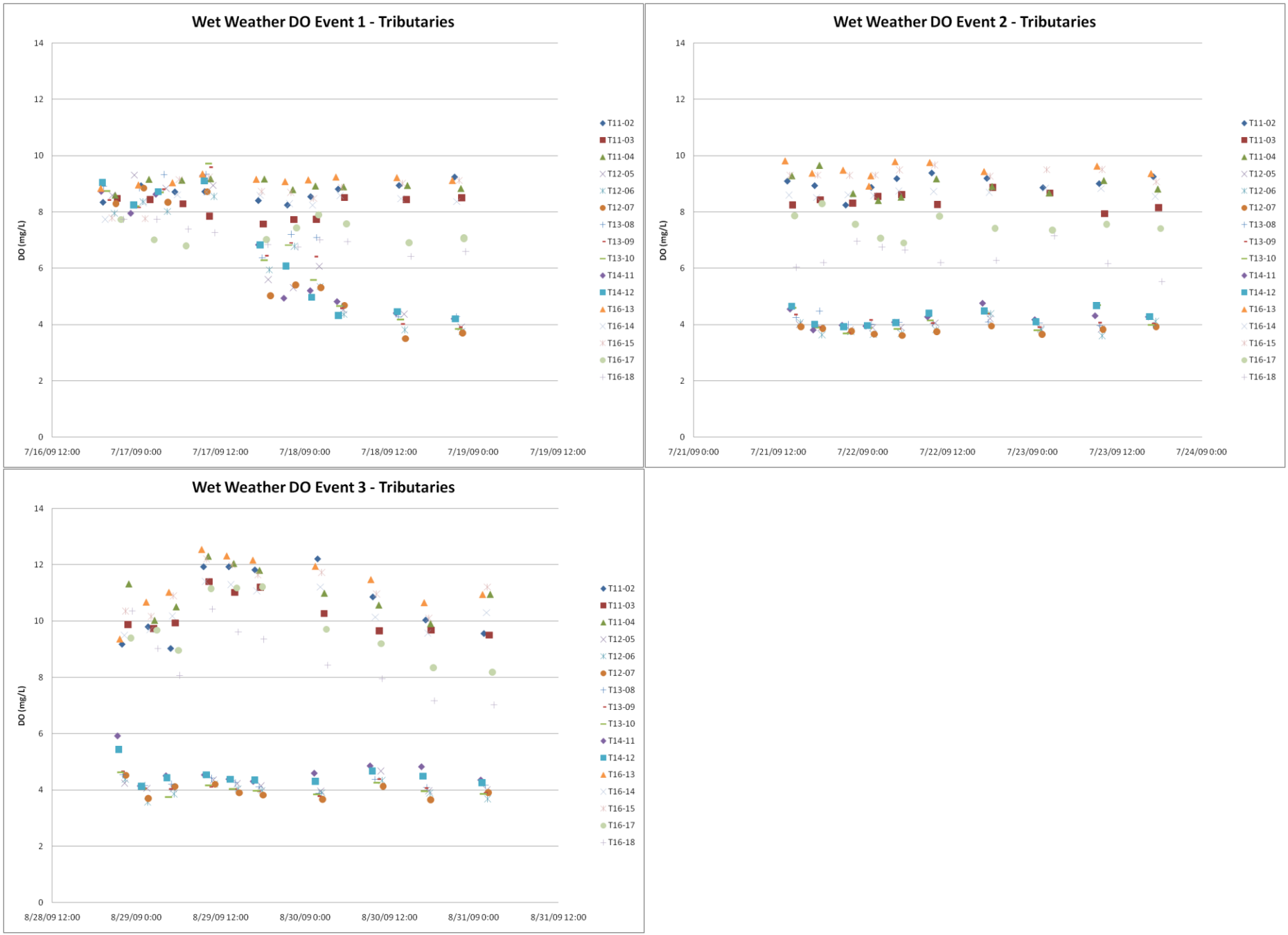
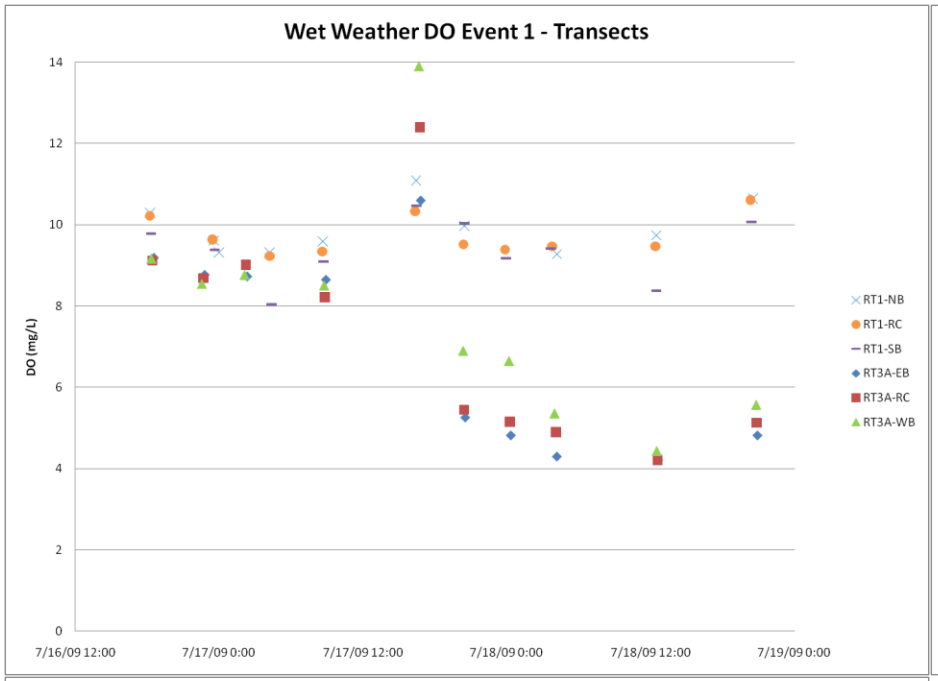
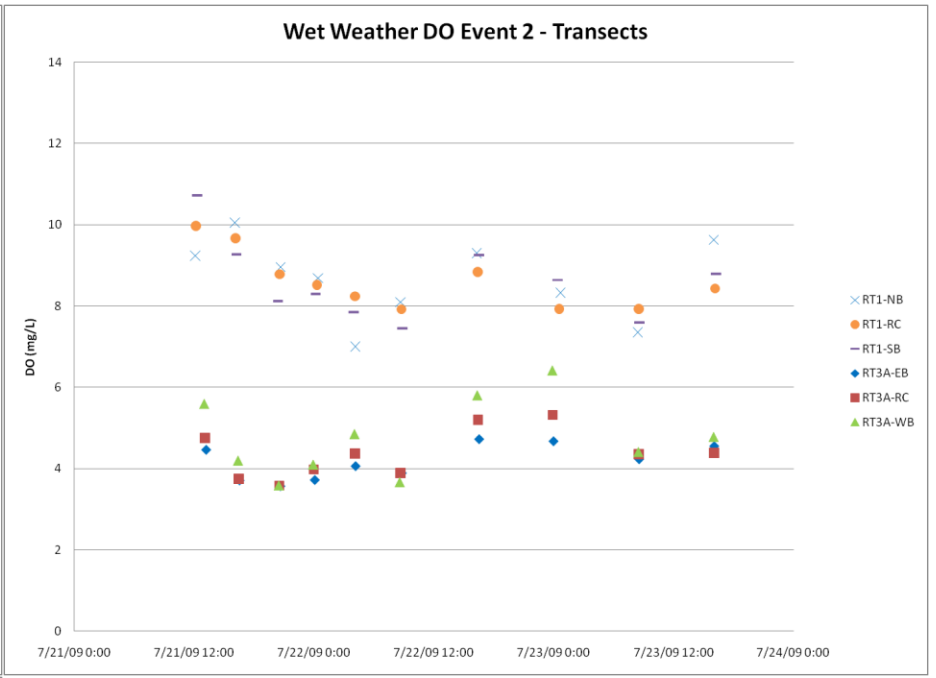


Figure 5-6: Dissolved Oxygen – Wet-Weather Summary – Transects





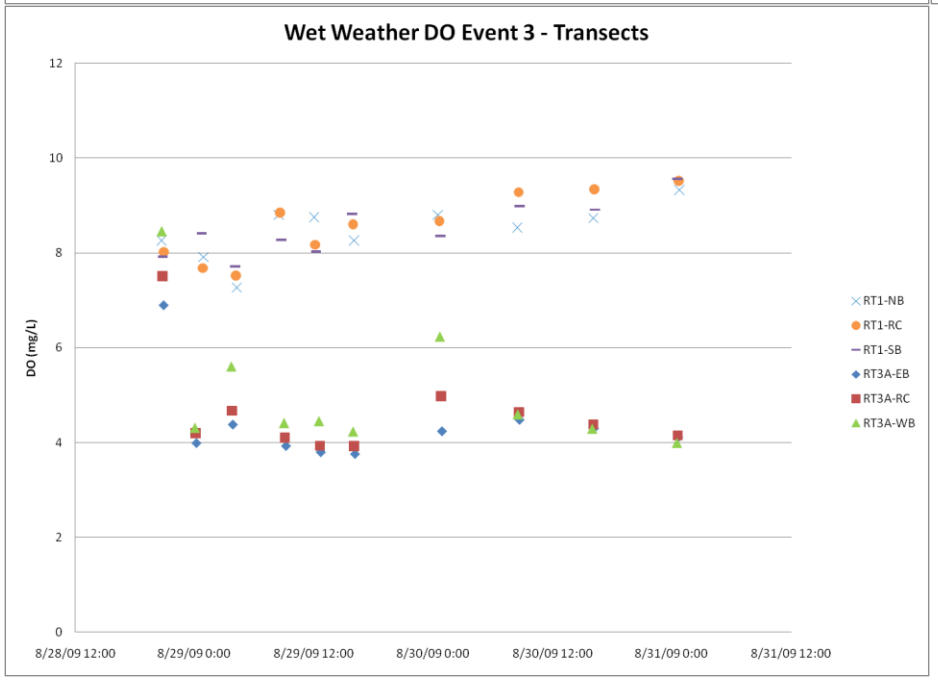
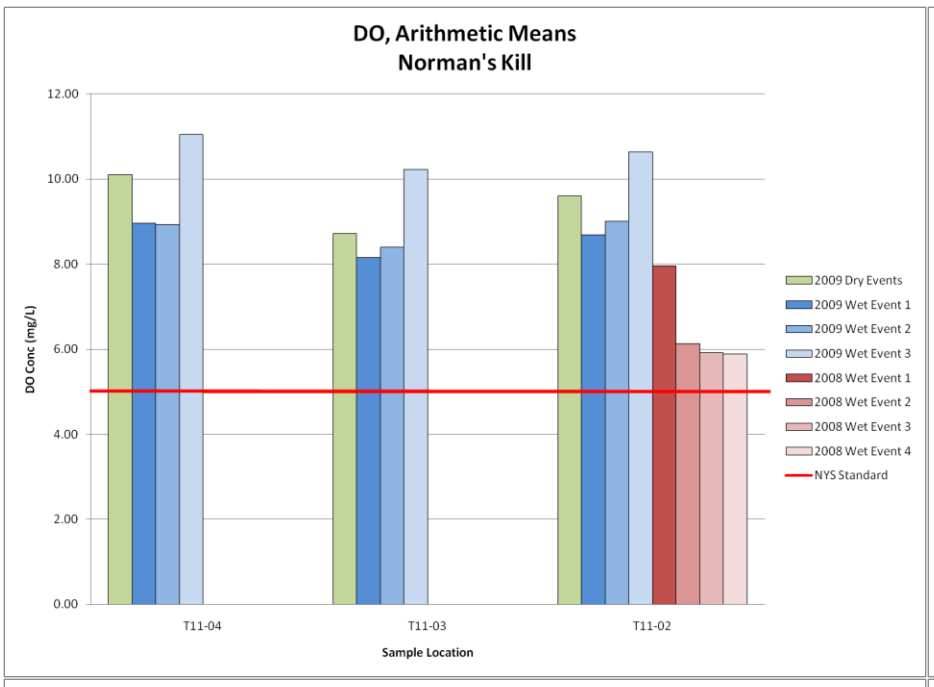
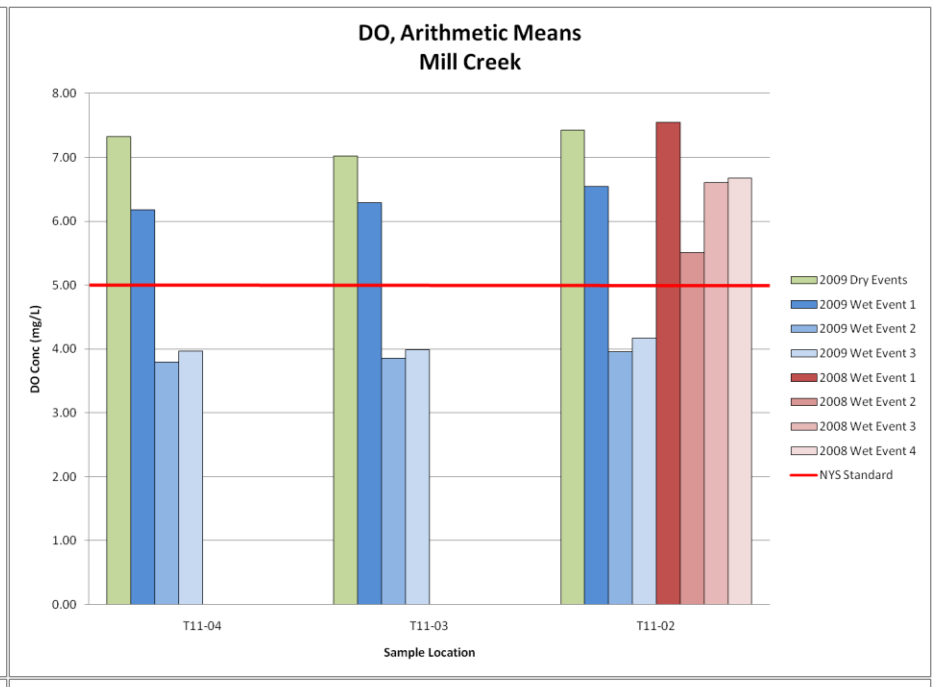
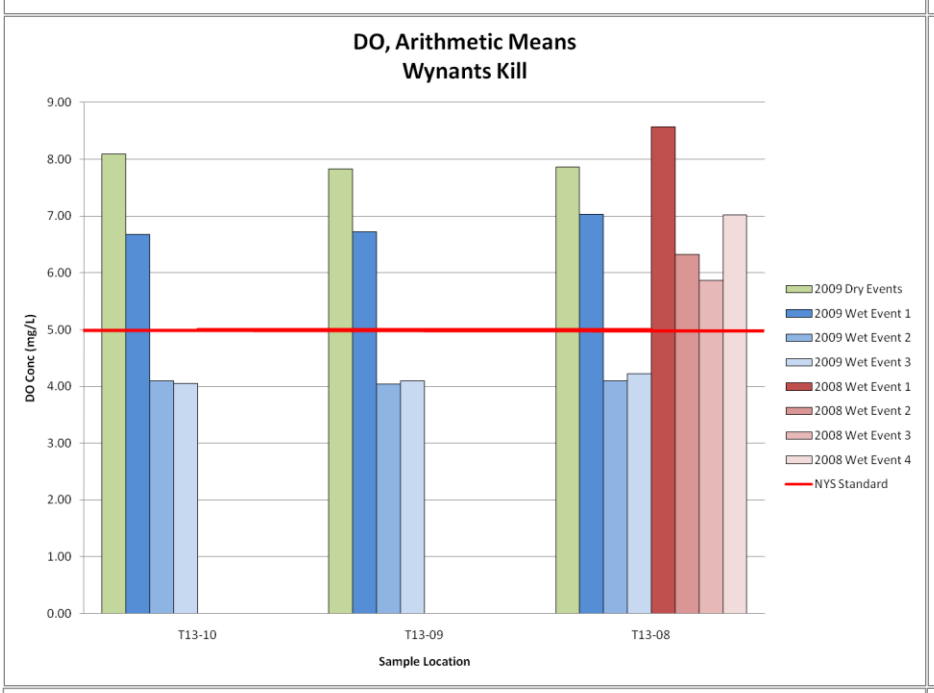
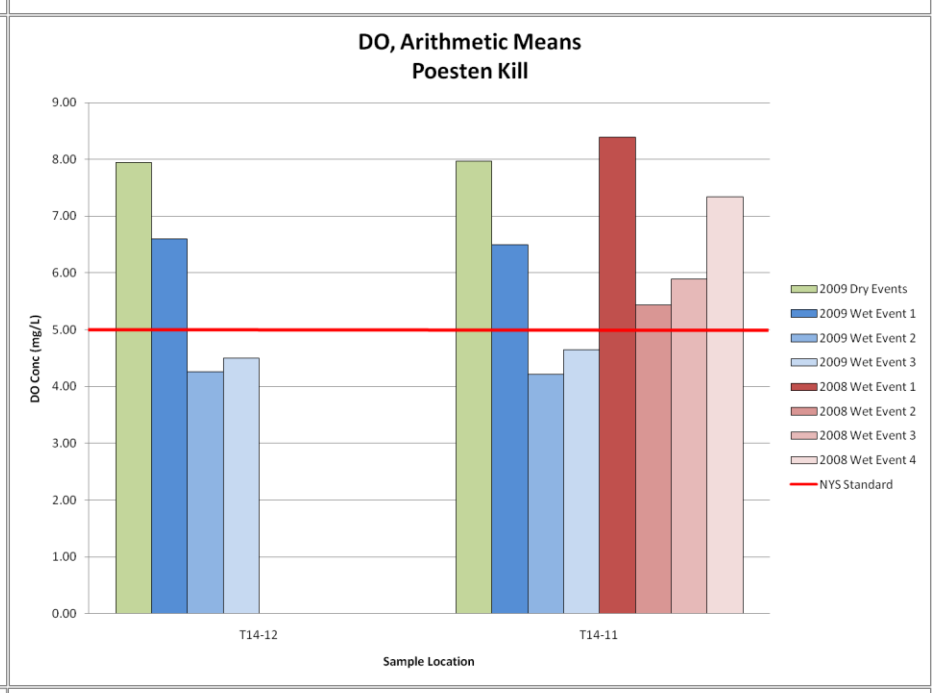


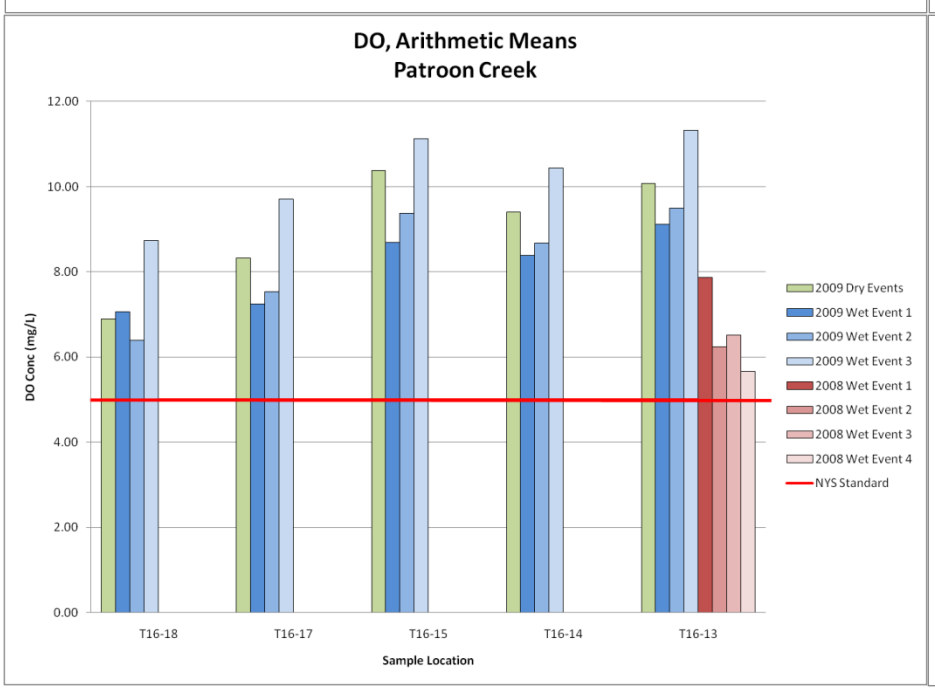
Figure 5-7: Dry and Wet Weather Dissolved Oxygen Arithmetic Mean Summary and Comparison to 2008 Data











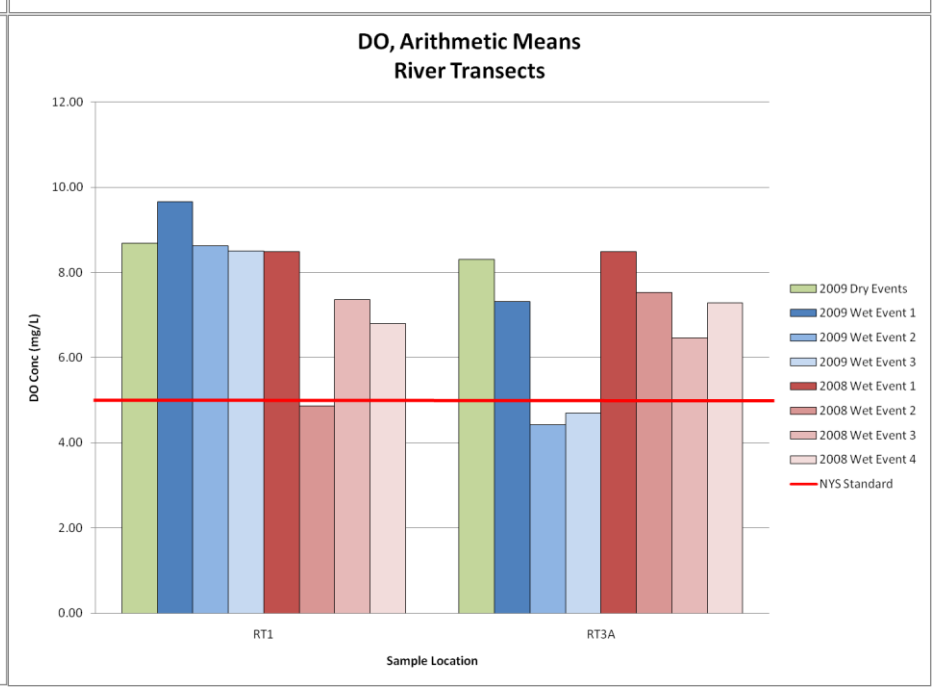


Figure 5-8: Schodack Island HRECOS Data Output - 2009

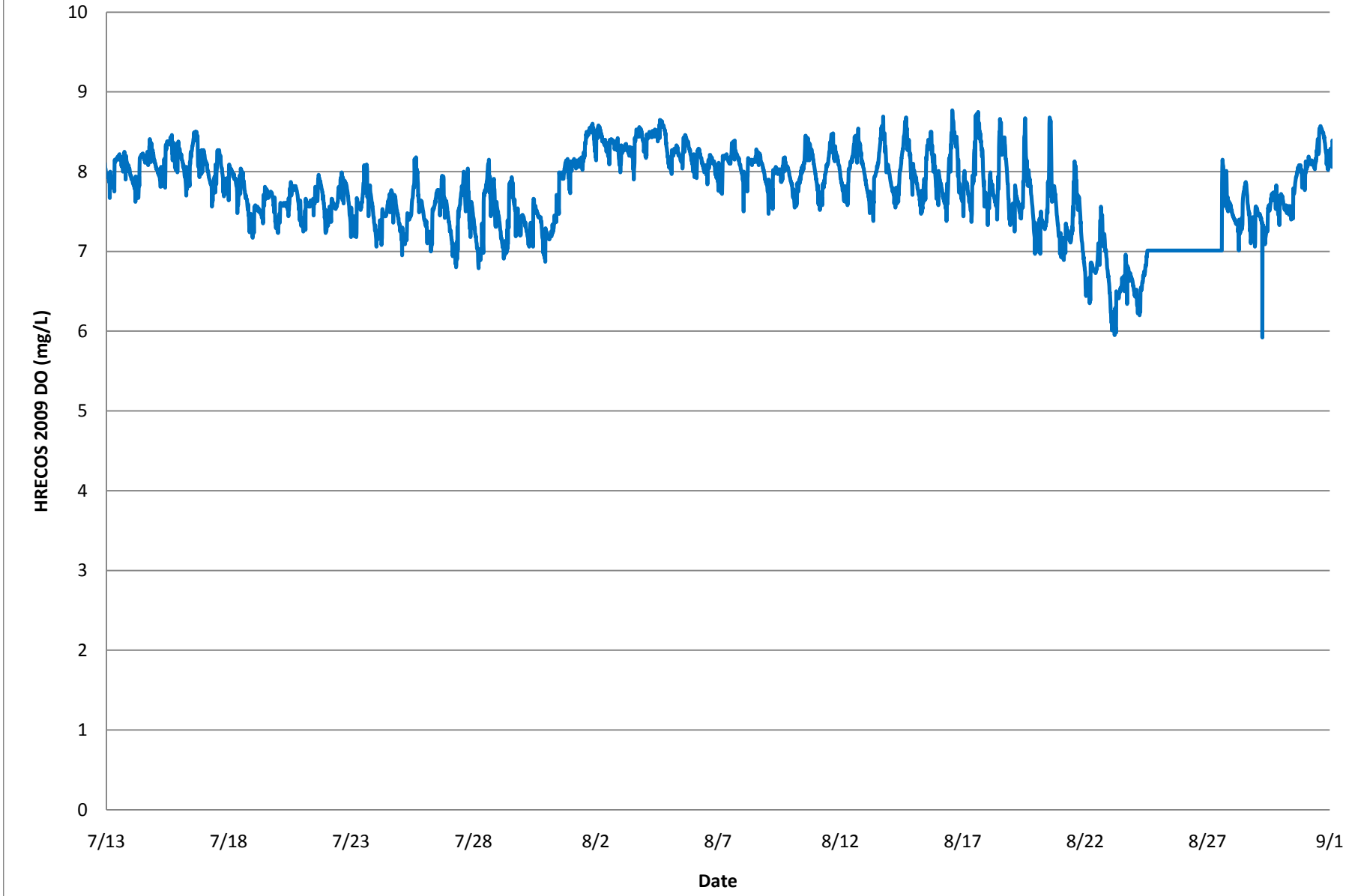


Figure 6-1: Dry and Wet-Weather BOD Summary

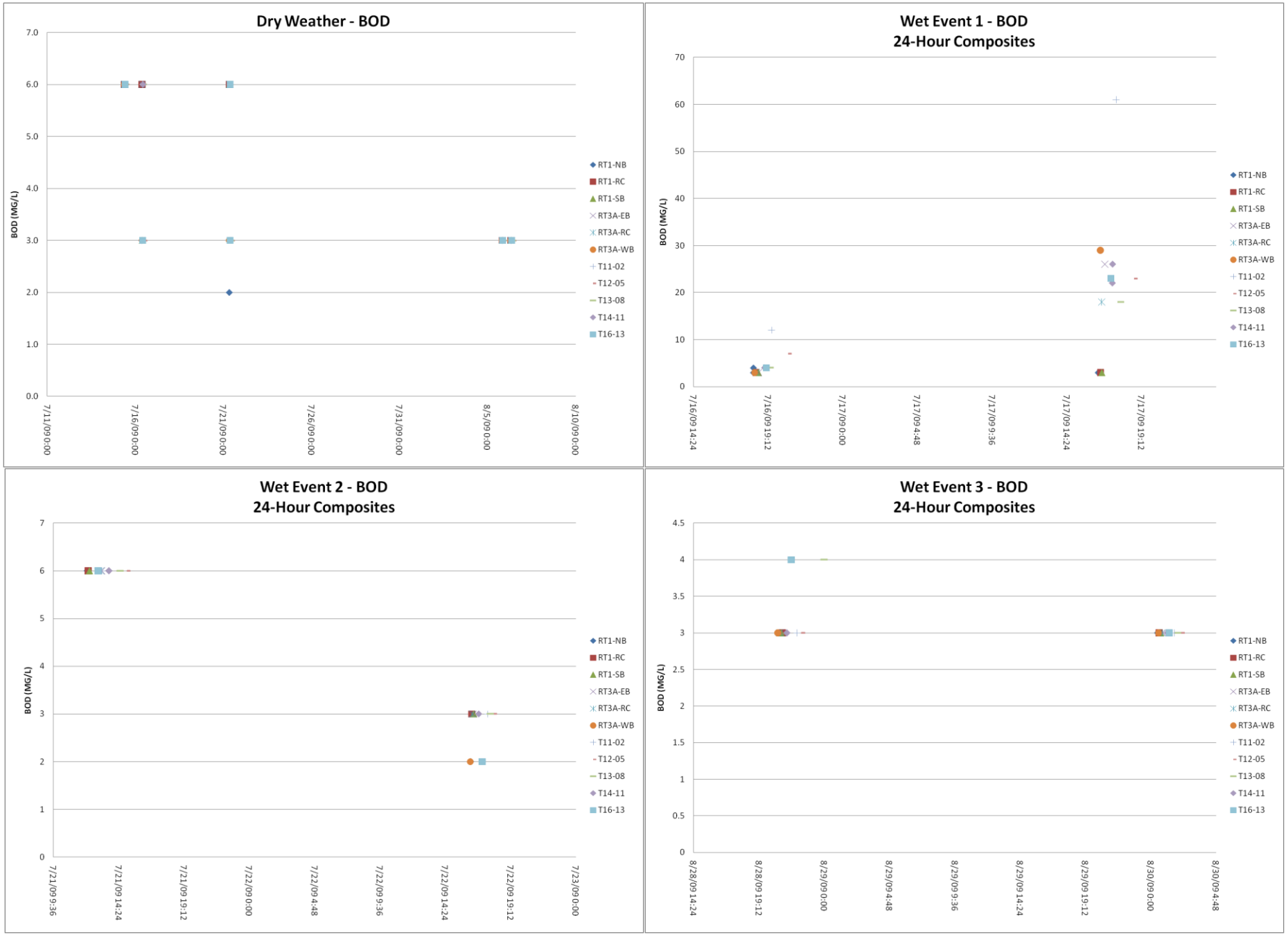
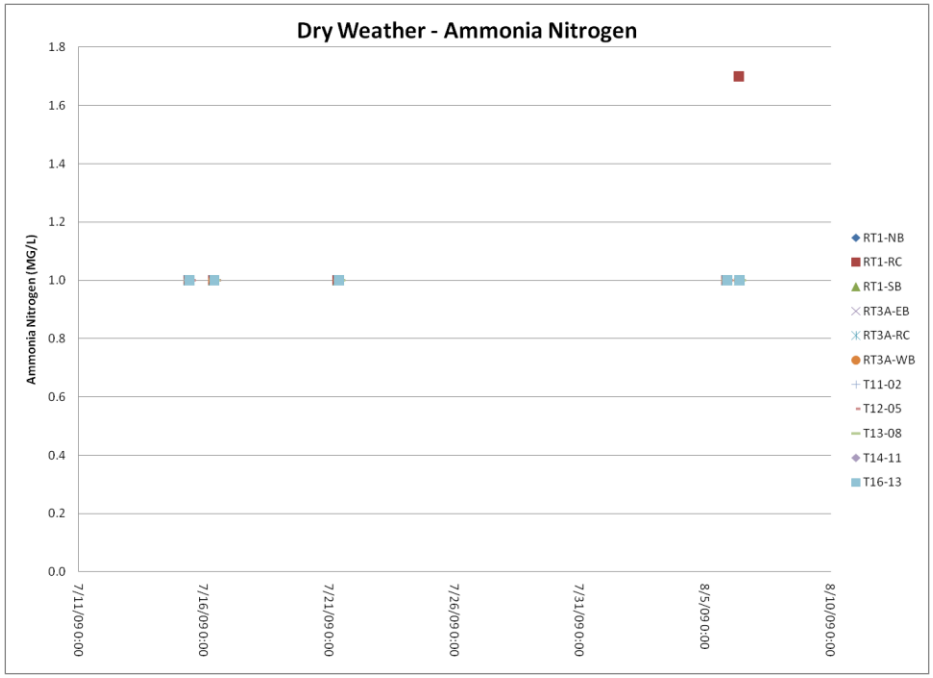


Figure 6-2: Dry and Wet-Weather Ammonia Nitrogen Summary



WW Event 1 - Ammonia Nitrogen		
Sample ID	Sample Date Time	Value (mg/L)
RT1-NB	7/16/09 18:15	<1.0
RT1-NB Dup	7/16/09 18:15	<1.0
RT1-RC	7/16/09 18:25	<1.0
RT1-SB	7/16/09 18:35	<1.0
T16-13	7/16/09 19:05	<1.0
T11-02	7/16/09 19:25	<1.0
RT3A-WB	7/16/09 18:20	<1.0
RT3A-RC	7/16/09 18:27	<1.0
RT3A-EB	7/16/09 18:34	<1.0
T14-11	7/16/09 18:58	<1.0
T13-08	7/16/09 19:20	<1.0
T12-05	7/16/09 20:30	<1.0
RT1-NB	7/17/09 16:25	<1.0
RT1-RC	7/17/09 16:35	<1.0
RT1-SB	7/17/09 16:40	<1.0
T16-13	7/17/09 17:15	<1.0
T11-02	7/17/09 17:35	<1.0
RT3A-WB	7/17/09 16:34	<1.0
RT3A-RC	7/17/09 16:39	<1.0
RT3A-EB	7/17/09 16:51	<1.0
T14-11	7/17/09 17:20	<1.0
T14-11 Dup	7/17/09 17:21	<1.0
T13-08	7/17/09 17:53	<1.0
T12-05	7/17/09 18:45	<1.0

WW Event 2 - Ammonia Nitrogen		
Sample ID	Sample Date Time	Value (mg/L)
RT1-NB	7/21/09 12:05	<1.0
RT1-RC	7/21/09 12:10	<1.0
RT1-SB	7/21/09 12:15	<1.0
T16-13	7/21/09 12:53	<1.0
T11-02	7/21/09 13:10	<1.0
RT3A-WB	7/21/09 12:55	<1.0
RT3A-RC	7/21/09 13:05	<1.0
RT3A-EB	7/21/09 13:10	<1.0
T14-11	7/21/09 13:41	<1.0
T14-11 Dup	7/21/09 13:40	<1.0
T13-08	7/21/09 14:30	<1.0
T12-05	7/21/09 15:00	<1.0
RT1-NB	7/22/09 16:16	<1.0
RT1-RC	7/22/09 16:22	<1.0
RT1-SB	7/22/09 16:30	<1.0
T16-13	7/22/09 17:08	<1.0
T11-02	7/22/09 17:32	<1.0
T11-02 Dup	7/22/09 17:33	<1.0
RT3A-WB	7/22/09 16:15	<1.0
RT3A-RC	7/22/09 16:23	<1.0
RT3A-EB	7/22/09 16:28	<1.0
T14-11	7/22/09 16:53	<1.0
T13-08	7/22/09 17:43	<1.0
T12-05	7/22/09 17:57	<1.0

WW Event 3 - Ammonia Nitrogen		
Sample ID	Sample Date Time	Value (mg/L)
RT1-NB	8/28/09 20:45	<1.0
RT1-RC	8/28/09 20:55	<1.0
RT1-SB	8/28/09 20:50	<1.0
T16-13	8/28/09 21:35	<1.0
T11-02	8/28/09 22:00	<1.0
RT3A-WB	8/28/09 20:35	<1.0
RT3A-RC	8/28/09 20:44	<1.0
RT3A-EB	8/28/09 20:50	<1.0
T14-11	8/28/09 21:15	<1.0
T14-11 Dup	8/28/09 21:16	<1.0
T13-08	8/29/09 0:00	<1.0
T12-05	8/28/09 22:20	<1.0
RT1-NB	8/30/09 0:31	<1.0
RT1-RC	8/30/09 0:38	<1.0
RT1-SB	8/30/09 0:44	<1.0
T16-13	8/30/09 1:23	<1.0
T11-02	8/30/09 1:44	<1.0
T11-02 Dup	8/30/09 1:45	<1.0
RT3A-WB	8/30/09 0:35	<1.0
RT3A-RC	8/30/09 0:50	<1.0
RT3A-EB	8/30/09 0:55	<1.0
T14-11	8/30/09 1:15	<1.0
T13-08	8/30/09 2:00	<1.0
T12-05	8/30/09 2:15	<1.0

Figure 6-3: Dry and Wet-Weather Total Phosphorus Summary

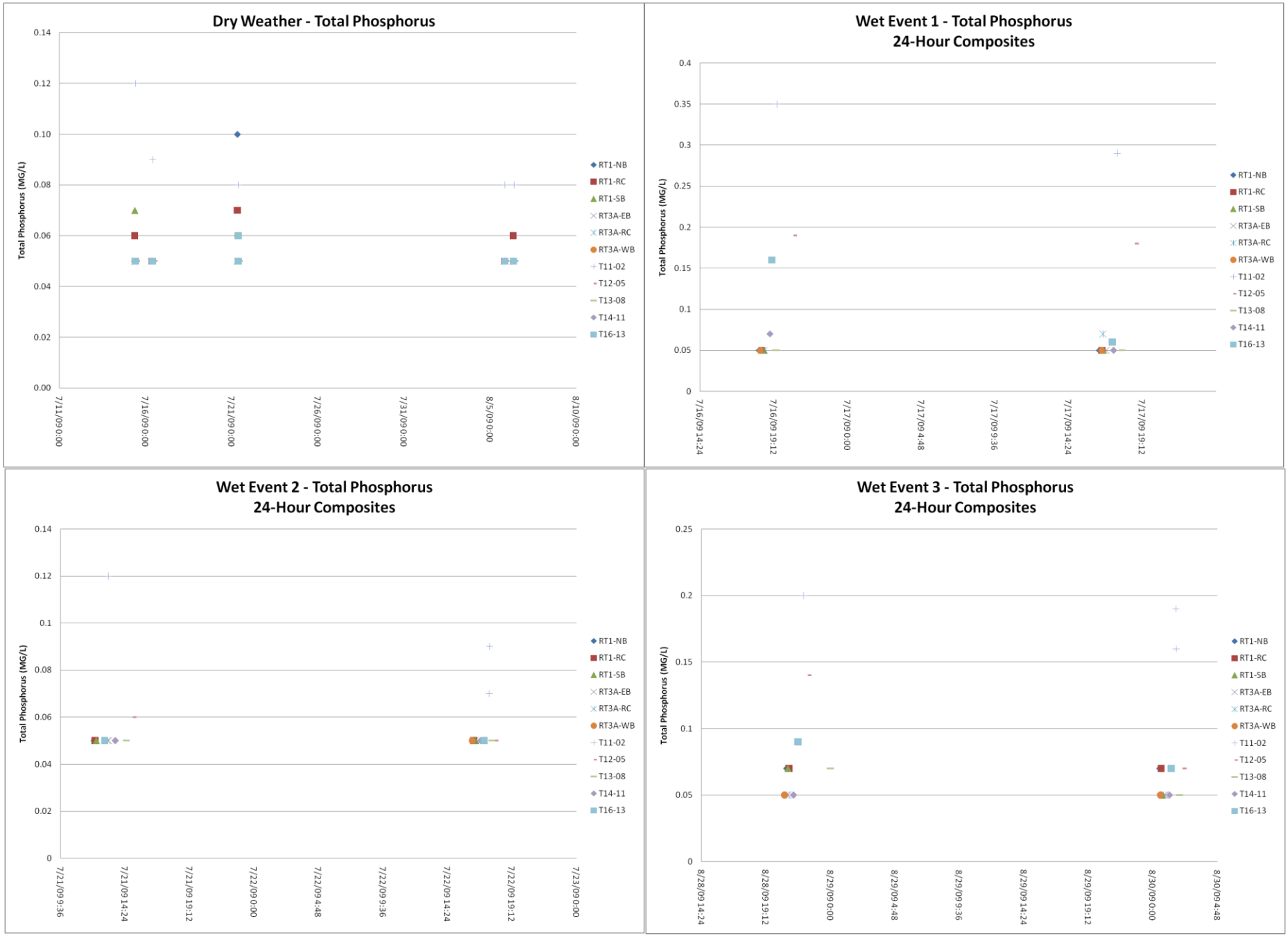


Figure 6-4: Dry and Wet-Weather pH Summary

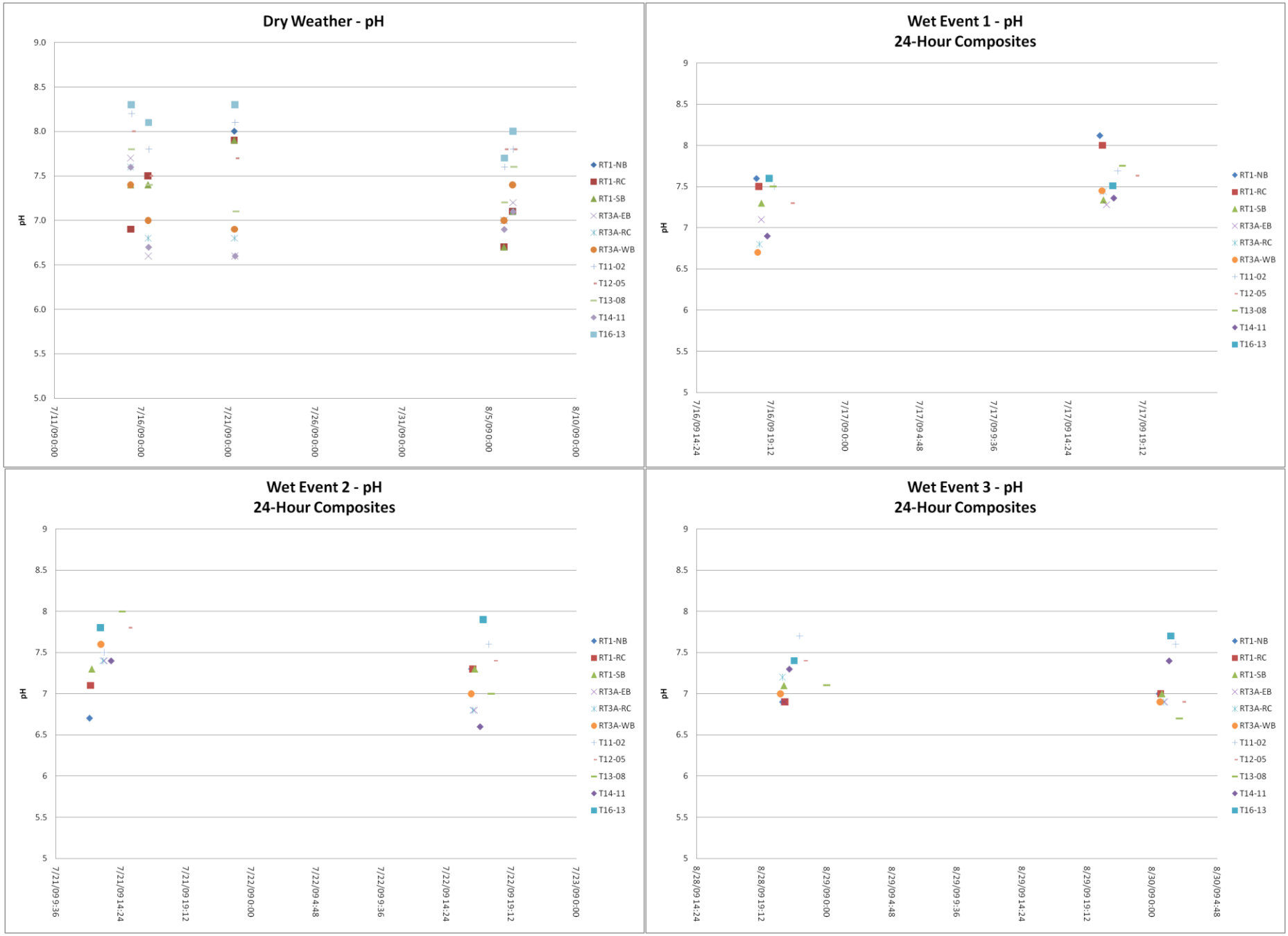


Figure 7-1: Probe QA/QC
Dry-Weather Event 4 - DO

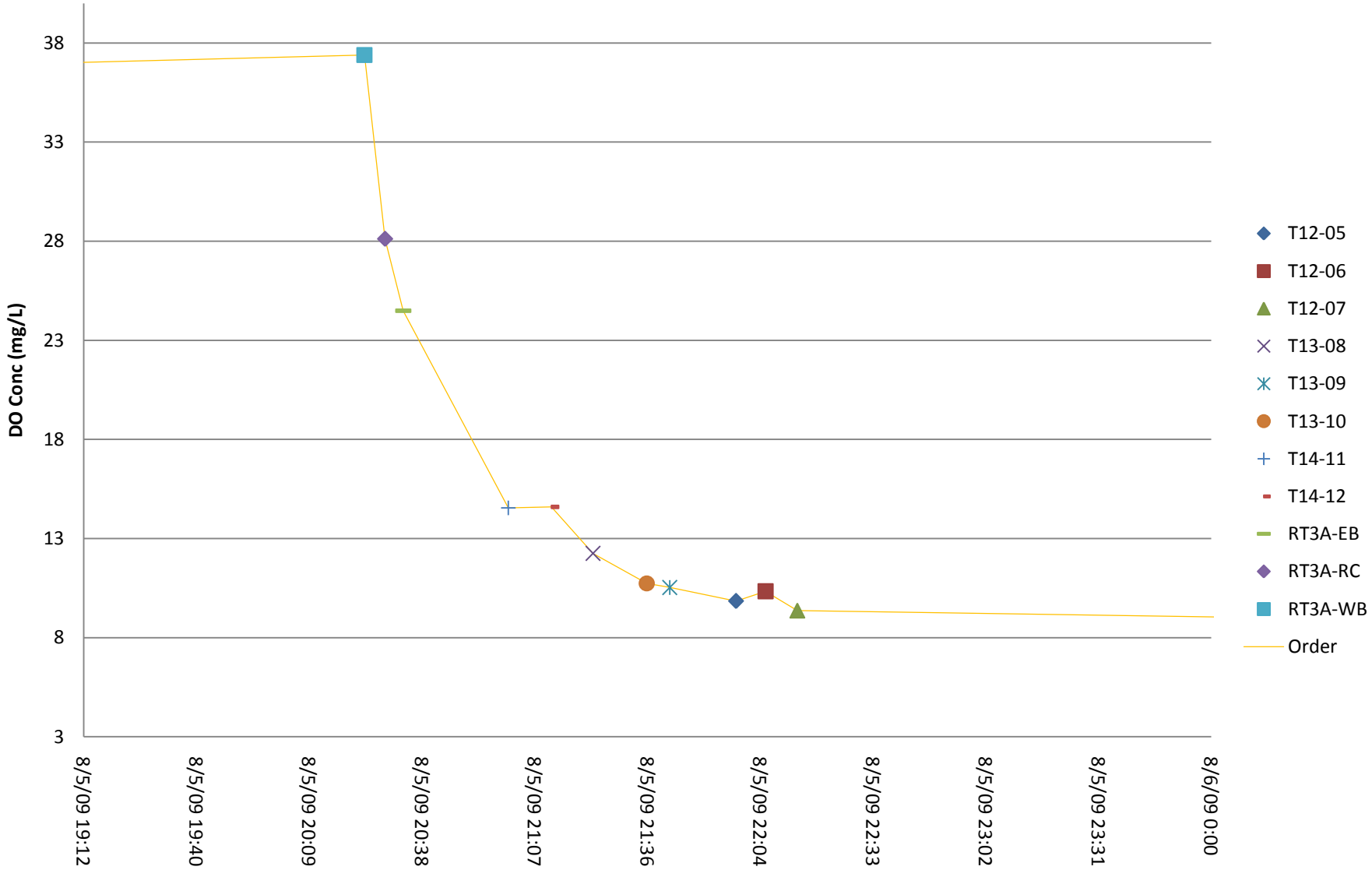


Figure 7-2: Probe QA/QC
Wet-Weather Event 3 - DO

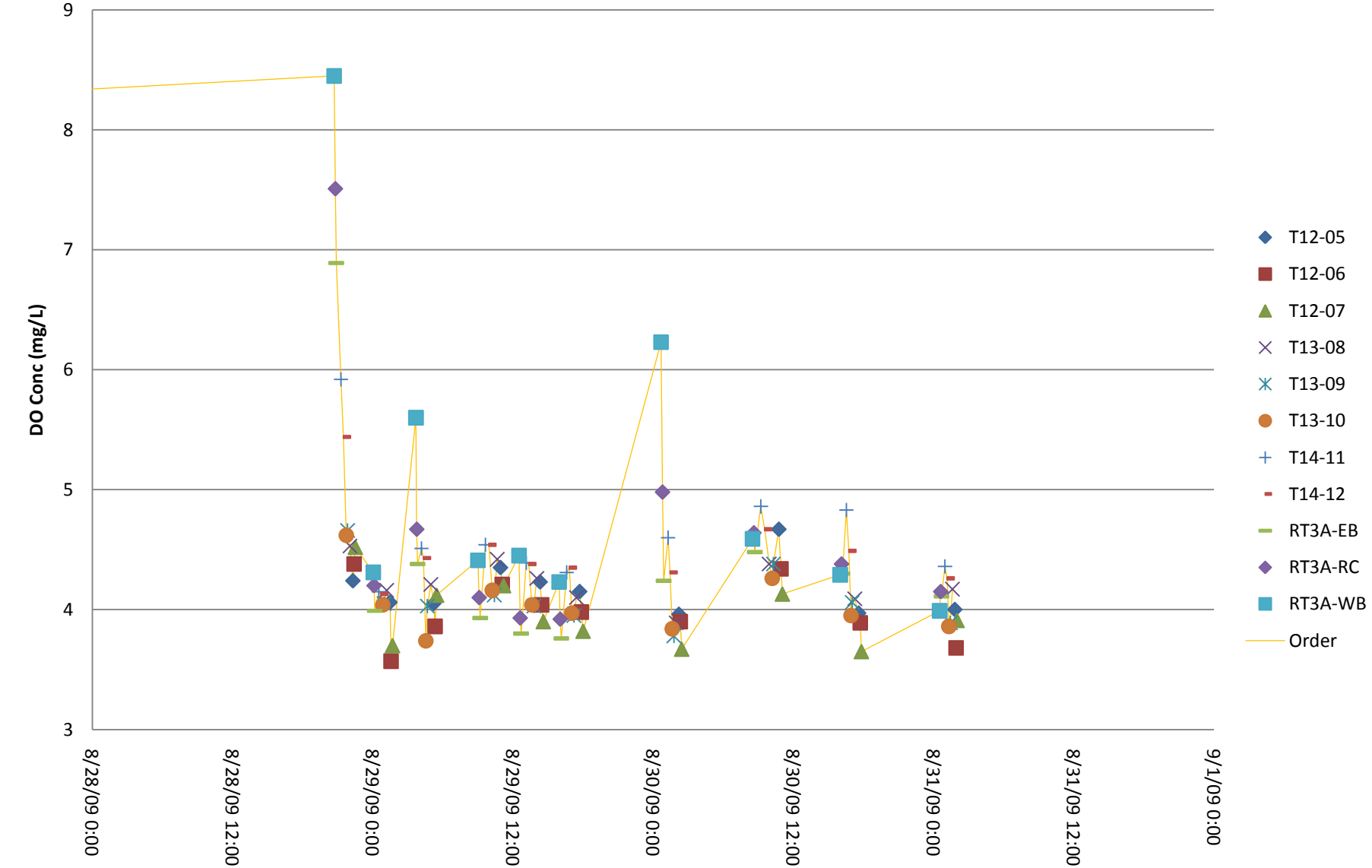


Figure 7-3: Fecal Coliform Duplicate Comparison 2009

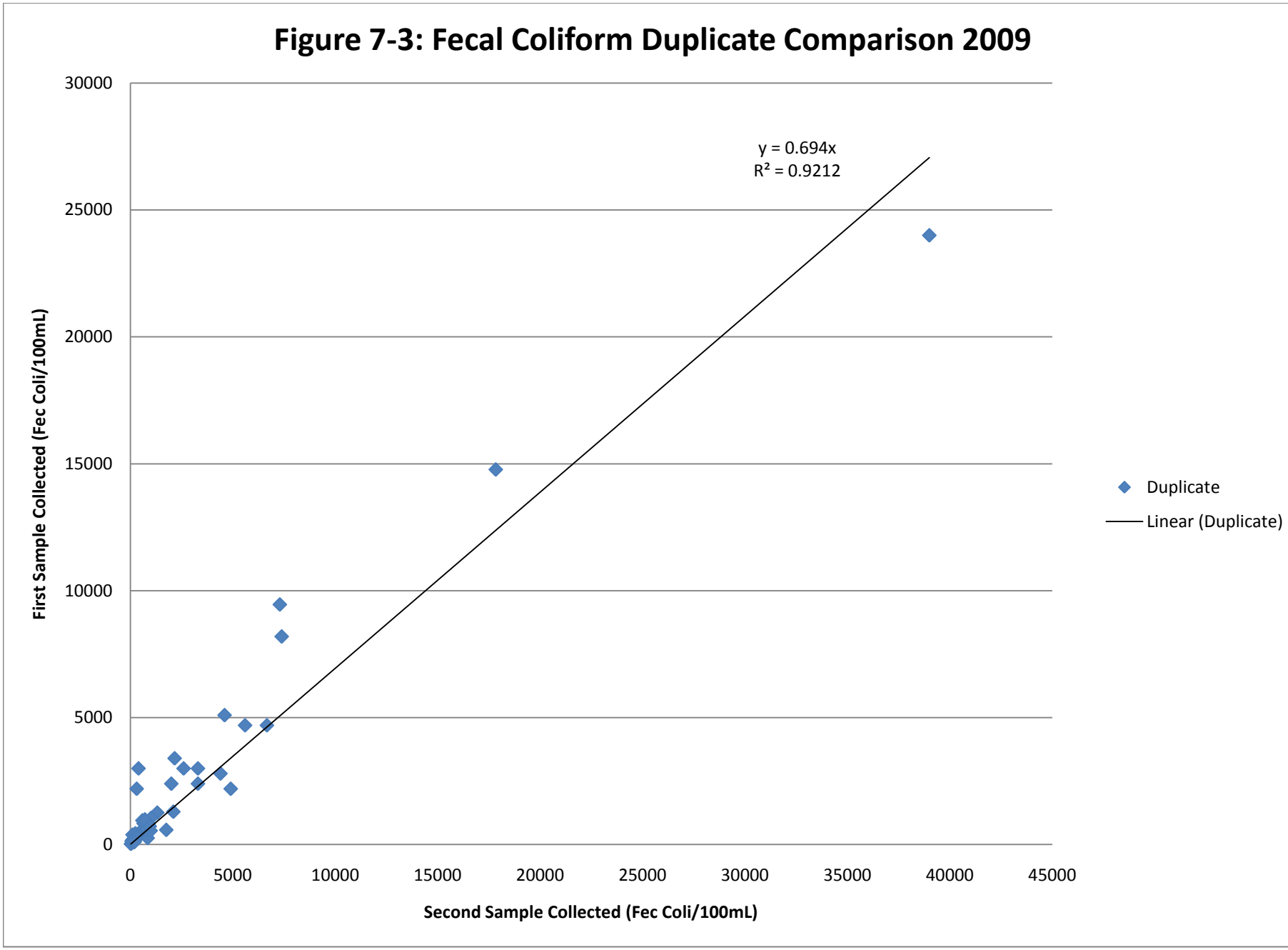


Figure 8-1: Patroon Creek Sampling Locations 2009 – APJVT & ACSD

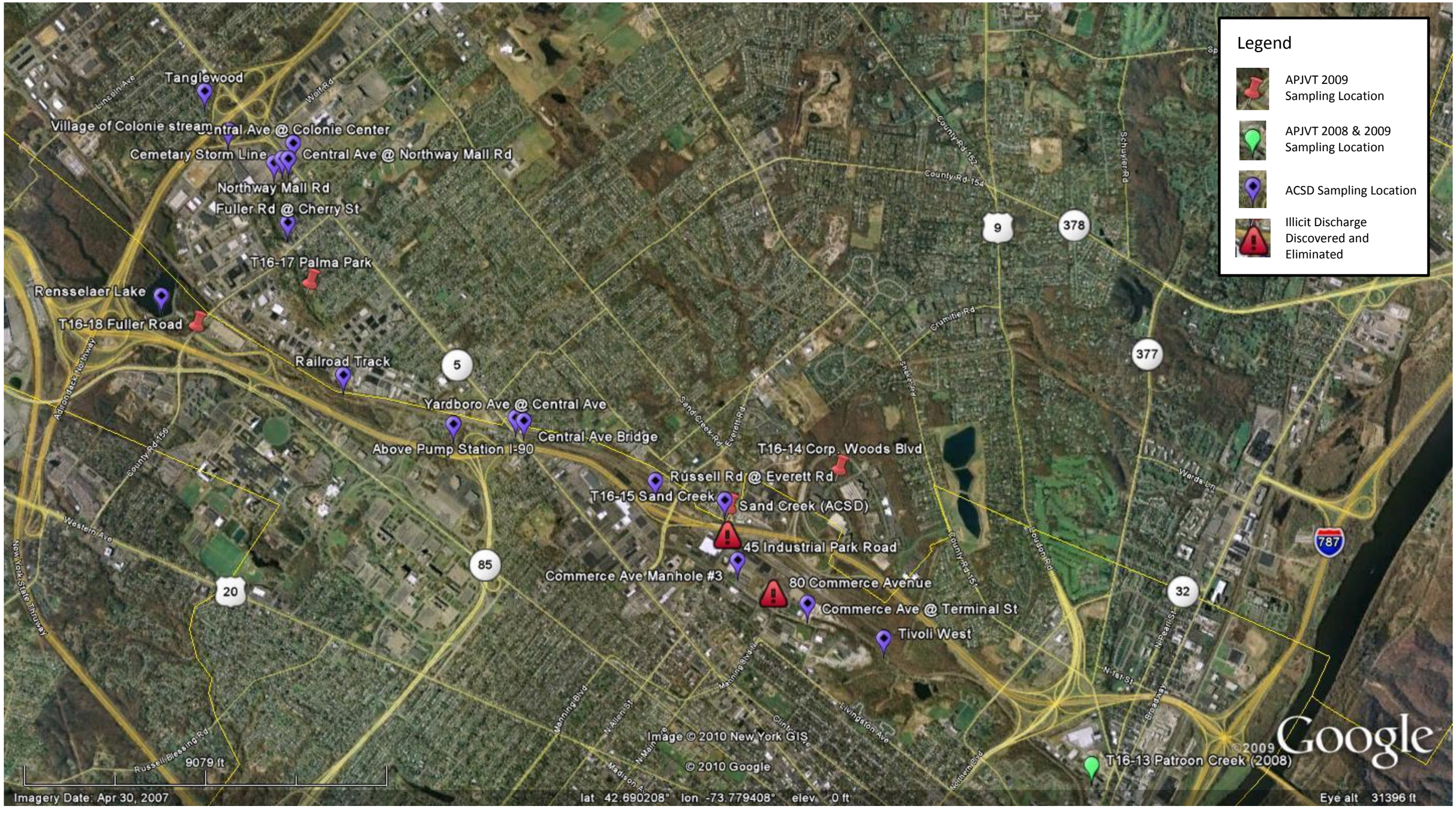
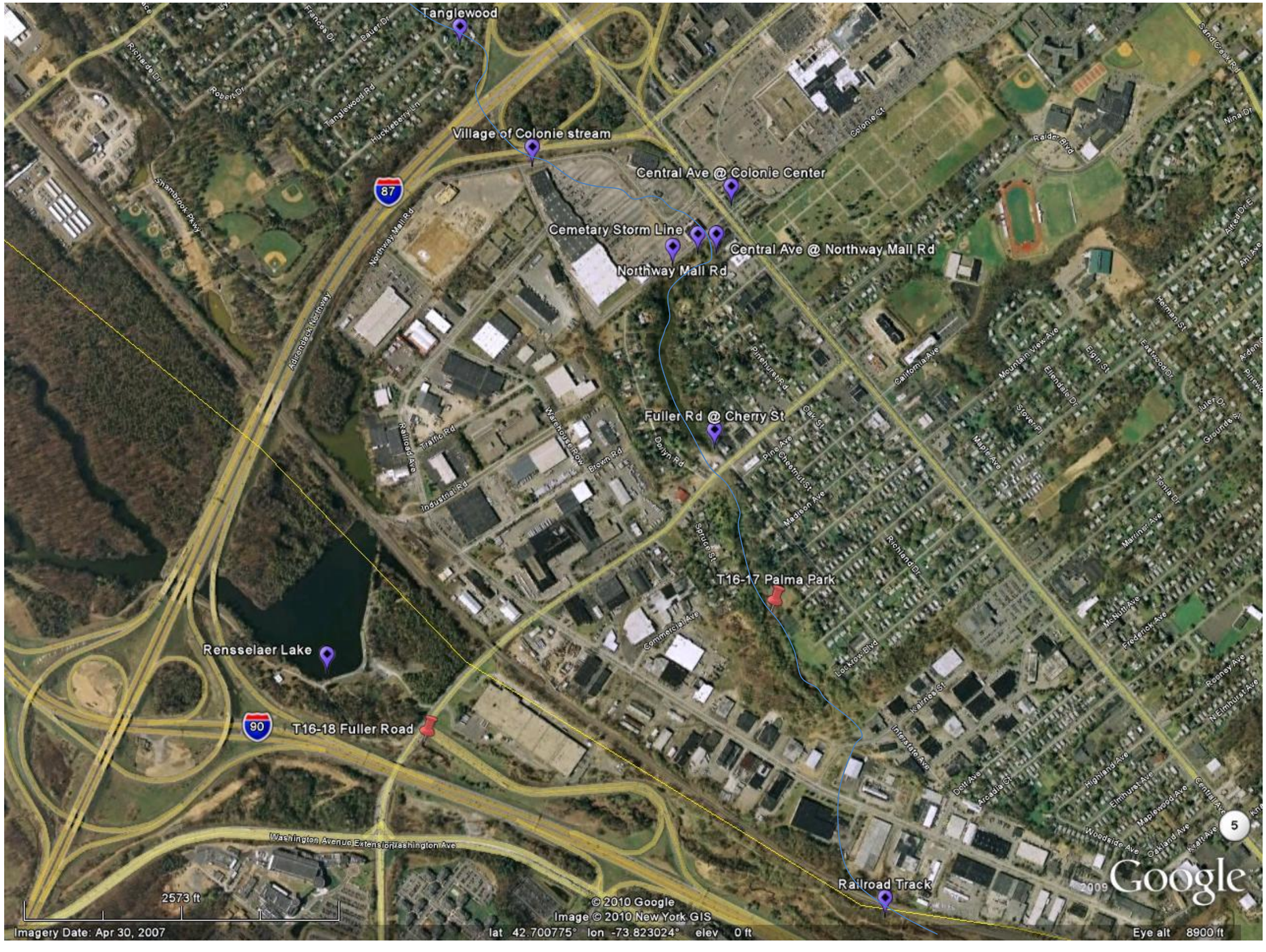


Figure 8-2: Cherry Creek Sampling Locations 2009 – APJVT & ACSD



Legend

- APJVT 2009 Sampling Location
- APJVT 2008 & 2009 Sampling Location
- ACSD Sampling Location
- Illicit Discharge Discovered and Eliminated

Figure 8-3: Cherry Creek - Fecal Coliform
APJVT 2009 and ACSD Sampling

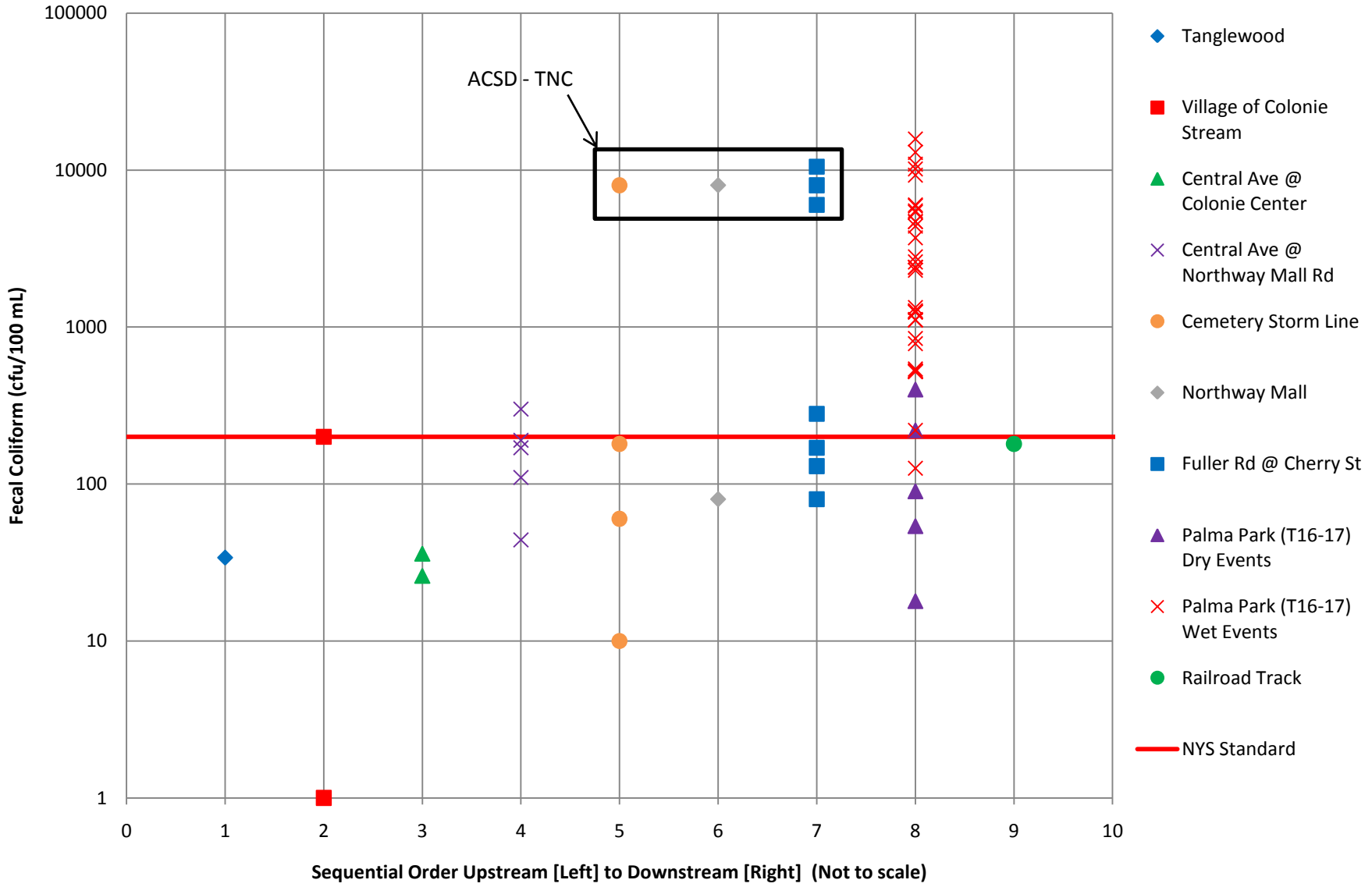


Figure 8-4: Patroon Creek - Fecal Coliform
APJVT 2009 and ACSD Sampling

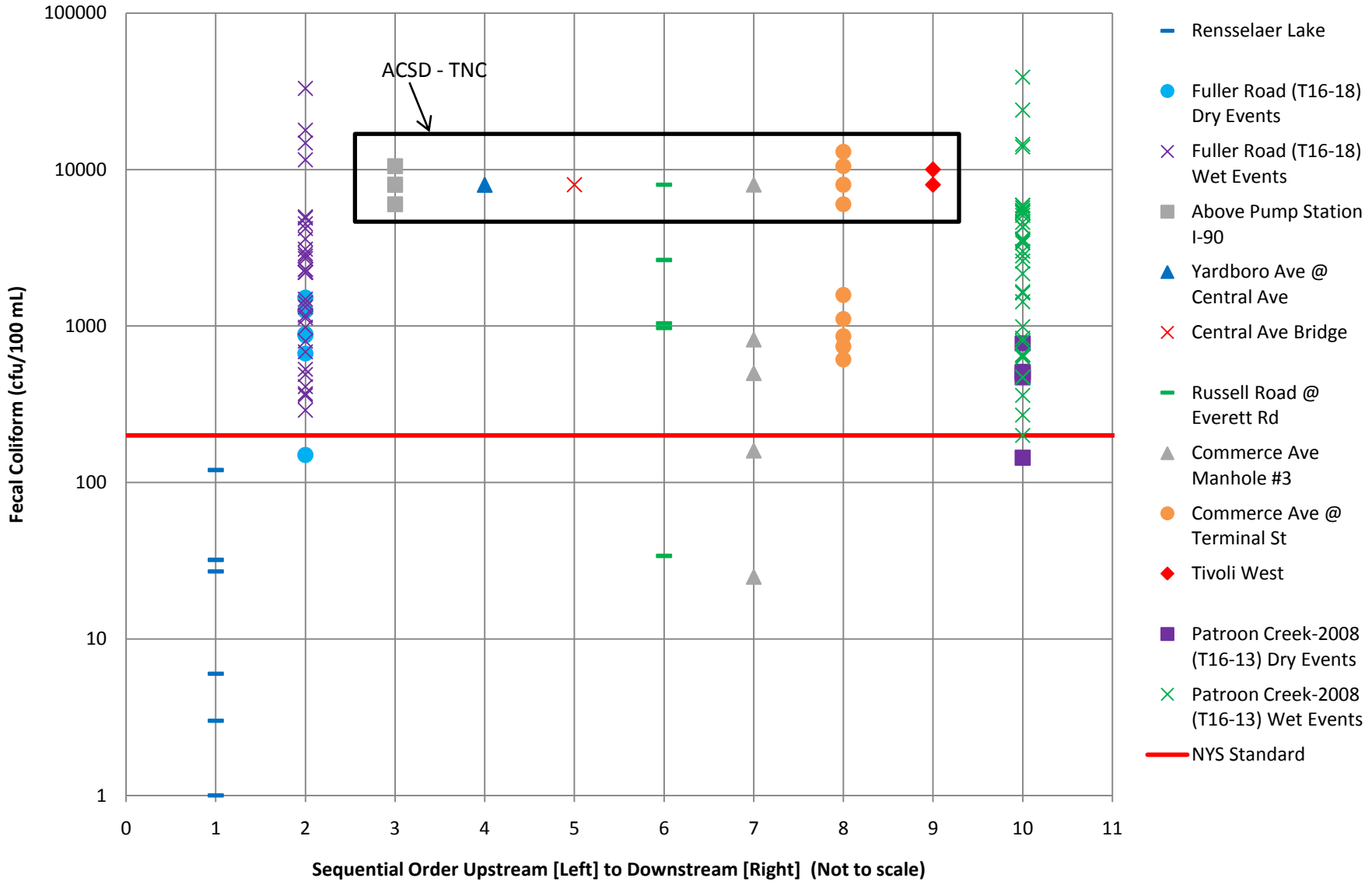


Figure 8-5: Downstream Patroon Creek Tributaries - Fecal Coliform APJVT 2009 and ACSD Sampling