2014

MARK TWAIN LAKE

WATER QUALITY

REPORT

U.S. ARMY CORPS OF ENGINEERS, ST. LOUIS DISTRICT
ENVIRONMENTAL QUALITY SECTION – WATER QUALITY

Table of Contents

Water Quality Report-Mark Twain Lake

Section and Page No.

List of Figures & Tables

Appendix

Executive Summary

The purpose of this report is to provide an annual analysis of the water quality in the lake for the past year. Mark Twain Lake is located in northeastern Missouri in the Salt River Basin on the Salt River. Clarence Cannon Dam and the Reregulation Dam are located in Ralls County at Salt River miles 63.0 and 53.5, respectively. The purpose of this project was to provide flood control, hydroelectric power generation, water supply, fish and wildlife conservation, recreation and water quality enhancement. The Mark Twain watershed comprises 2,318 square miles, with an additional 29 square miles draining into the Reregulation Pool. Major tributaries are the North Fork, Middle Fork, Elk Fork, and South Fork. The watershed consists of a gently rolling plain in the upstream portion and more hilly in the downstream reaches. High rock bluffs border the stream and lake at various locations. Hickory and oak forests are scattered among crop and grazing lands.

The water of Mark Twain Lake and the downstream river channel is generally good. The lake is a medium depth reservoir nestled in the Salt River Basin. The lake tends to stratify during the summer months.

All sampling sites met the appropriate state standards during 2014 except the phosphorous levels. Phosphorous levels have exceeded the state standard on a routine basis. Generally the tailwater levels are lower than the incoming tributary flows, which indicates that the lake is sinking the phosphorous. This is also occurring with nitrogen. The project area has little pollution potentials at present time, no major form of degradation to the lake or streams is apparent. Constant water quality monitoring will continue to check future degradation of the watershed.

WATER QUALITY MONITORING PROGRAM

1.0 GENERAL OVERVIEW

This report summarizes water quality activities of the St. Louis District for Fiscal Year 2014 in accordance with ER 1110-2-8154 Water Quality & Environmental management for Corps Civil Works Projects and ETL 1110-2-362 Environmental Engineering Initiatives for Water Management. According to the U.S. Environmental Protection Agency (USEPA) poor lakeshore habitat is the biggest problem in our nation's lakes, followed by nutrients. Shoreline vegetation provides shelter for aquatic wildlife, reduces sediment and nutrient movement. The biology of a lake is characterized by the diversity if it's organisms. The number and kinds of plant and animal species present is a direct measure of a lake's well-being. Water quality at Mark Twain Lake is directly assessed using stream and river data from 10 site locations.

Water quality monitoring remains one of the Sections major responsibilities. The objective is to maintain a reasonable environmental monitoring program for the Mississippi River and the 5 lakes under the St. Louis District's control. The District's reservoirs consist of Mark Twain and Wappapello Lakes in Missouri, and Shelbyville, Carlyle and Rend Lakes in Illinois. Water quality sampling is conducted within the lakes and their tributaries to establish trend analysis and to maintain water quality at or above state and federal regulations.

The main objective is to provide technical expertise of an environmental nature to all Corps elements requesting assistance in accordance with ER 1110-2-8154. This would include updating the water quality management priorities for the district's projects to ensure water quality meets the state and federal regulations, for protection of human health and the environment, and for the safety and economic welfare of those at Corps projects. Ongoing goals include ensuring that downstream water quality meets all state and federal regulations, is suitable for aquatic and human life; and to continue to evaluate trend analysis in relation to baseline conditions at all projects.

Water quality data is provided to the Missouri Department of Natural Resources (MDNR) to be used as a screening mechanism for the Missouri Water Quality Report which is required every two years by the Clean Water Act Sections 303(d) and 305(b). MDNR does not routinely monitor Mark Twain Lake. However, the Lakes of Missouri Volunteer Program (LMVP) in cooperation with the University of Missouri-Columbia has been taking samples at 3 sites since 1989. The LMVP only analyze for Nutrients and Chlorophyll. In 2014, the LMVP took eight samples at 3 locations at the lake. See appendix D for data.

The National Water Quality Inventory Report to Congress (305(b) report) is the primary vehicle for informing Congress and the public about general water quality conditions in the United States. This document characterizes our water quality, identifies widespread water quality problems of national significance, and describes various programs implemented to restore and protect our waters.

Under Section 303(d) of the 1972 Clean Water Act, states, territories and authorized tribes are required to develop a list of water quality limited segments. These waters on the list do not meet water quality standards, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for water on the lists and develop action plans, called as Total Maximum Daily Loads (TMDL), to improve water quality.

The 2014 water quality report compiled by the Missouri Department of Natural Resources has listed the Salt River below the Cannon Dam and Mark Twain Lake as impaired. The Salt River is impaired by low Dissolved Oxygen and Mercury. Mark Twain Lake is impaired by Mercury. Mark Twain Lake is listed as eutrophic. Continued monitoring of the lake and its tributaries is vital in assisting the future assessment of the lake for these and other possible impairments. The water quality monitoring program represents the single metric that encompasses the overall health of the watershed as it is a direct measure of how well the environmental stewardship programs are working.

1.1 INTRODUCTION

Mark Twain Lake is located in northeast Missouri. The land surrounding the lake is used predominately for agriculture. The main agricultural contaminants into the watershed include pesticides and fertilizers. Also a concern is the high sediment loading into the lake and the colloidal characteristic of the sediments as well as low dissolved oxygen levels related to turbine generation. The lake is also susceptible to fish kills due to algal decay in the lake arms.

The operating purposes for Mark Twain Lake are fish/wildlife, hydroelectric power, flood control, recreation, navigation and water supply. The water quality management program for the lake includes monitoring of baseline parameters, ecological trends and investigation of problem areas to keep the lake within state and federal standards.

Water quality monitoring was conducted during 2014 to assure safe conditions for human recreation, wildlife and aquatic life as maintained and managed within the lake system. The 2014 water quality monitoring program was funded to conduct three sampling events. The sampling sites include the following: Site 1 (MTL-1) Spillway, Site 5 (MTL-5) South Fork at Hwy D, Site 8 (MTL-8) Elk Fork at Hwy 15, Site 9 (MTL-9) Middle Fork at Hwy 15, Site 11 (MTL-11) North Fork at Hwy 36, Site 12 (MTL-12) below re-regulation dam, Site 22 (MTL-22) old river channel 1mile up lake from dam, Site 33 (MTL-33) Lick Creek at Hwy J, Site 66 (MTL-66) South Fork at Hwy 107 bridge, and Site 77 (MTL-77) North Fork at Hwy 107 bridge. During the sampling event one site was selected for quality control duplication and denoted as MTL-15. In 2014, it was decided to replace a couple of sites with locations closer to the lake. Sites MTL-5, MTL-8, and MTL-11 were scheduled to be replaced by MTL-88, MTL-41, and MTL-25 respectively. However, the new sites did not meet all tributary requirements. Therefore, we reverted back to the old sample sites. In June MTL-8 was replaced by MTL-13. MTL-13 provides a safer and easier access point. The locations of the ten sampling sites are depicted on the lake map in Figure 1.

As mentioned above, LMVP collects samples at Mark Twain Lake. This year they conducted 8 sampling events at 3 sites. Their data is in Appendix D. We have also included data from the United Water Services Clarence Cannon WTP in Appendix E.

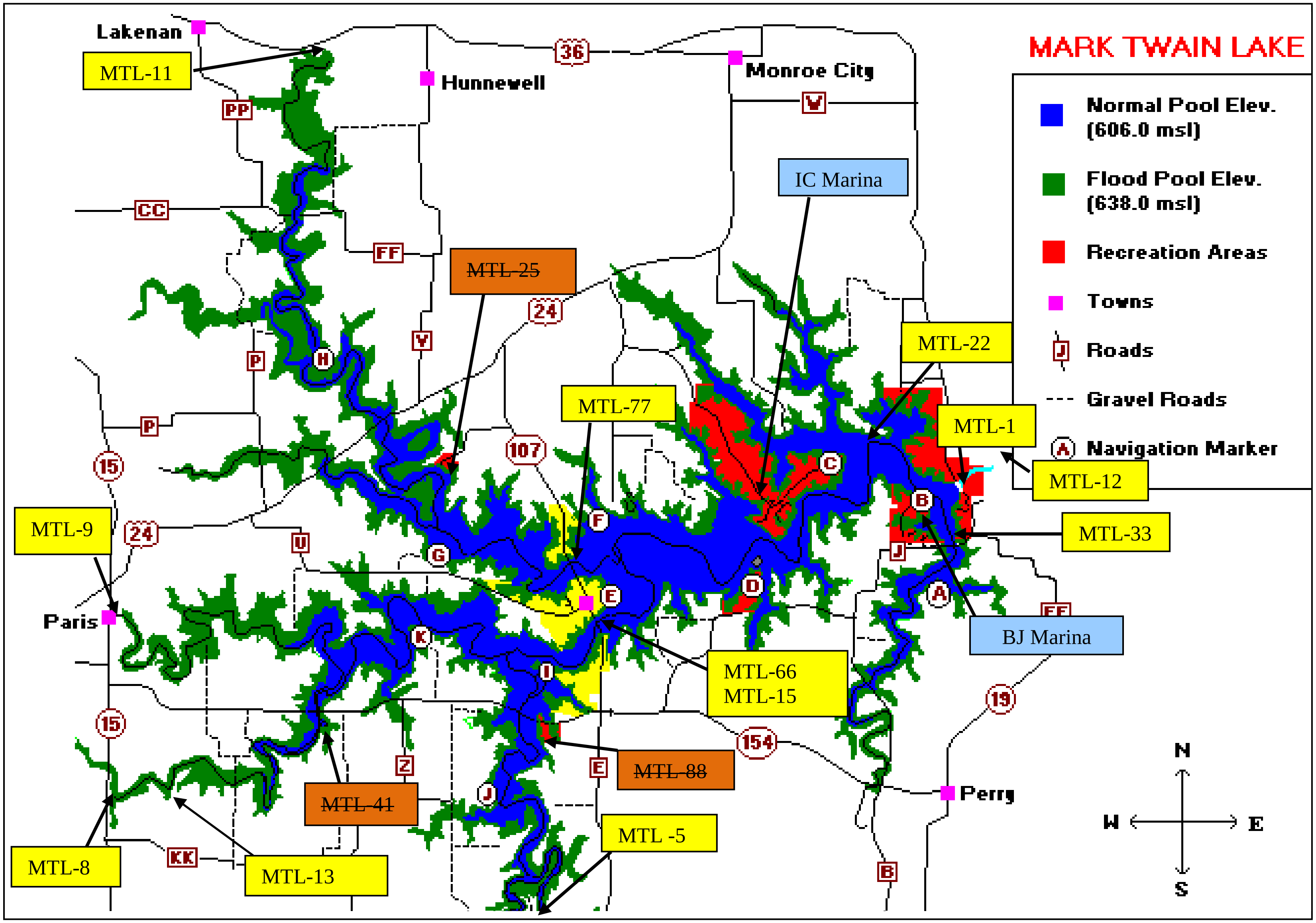


Figure 1
Location of sample sites (Site 13 replaced Site 8)

2.0 WATER QUALITY ASSESSMENT CRITERIA

2.1 Water Quality

The water quality assessment criteria, which have been generally accepted criteria for sustaining adequate aquatic plant and animal growth were based upon the State of Missouri regulatory limits for certain contaminants. The samplings and analysis which were conducted at the Mark Twain Lake sites reflect the minimal set of parameters needed to analyze the current status of water quality for the Mark Twain Lake system.

The following parameters were analyzed in the Fiscal Year 2014 sampling at Mark Twain Lake: Total Organic Carbon (TOC), iron, manganese, ammonia-nitrogen, nitrate-nitrogen, orthophosphate, total phosphate, Total Suspended Solids (TSS), Total Volatile Suspended Solids (TVSS), escherichia coliform (E. coli), pH, temperature, dissolved oxygen, specific conductance, oxidation-reduction potential (ORP), chlorophyll, pheophytin-a, atrazine and alachlor,

The Missouri Department of Natural Resources, Code of State Regulations, Division 20, Chapter 7 classifies water quality criteria based on designated usage. These standards are used to determine the aquatic water quality of the lake. Table 2.1 provides a listing of the regulatory limits where a limit has been established for the parameters analyzed.

TABLE 2.1
State of Missouri
Water Quality Standards

PARAMETER	LIMIT
Temperature	20.5°C - 33°C (68°F - 90°F)
Ammonia Nitrogen	< 15 mg/L
Nitrate Nitrogen	10 mg/L
Iron	1.0 mg/L (Aquatic Life)
Manganese	0.05 mg/L (Drinking Water & GW)
Phosphorous as Phosphate	0.05 mg/L
E. Coli	Missouri standard is 235 E. coli per 100ml for single sample or 126 for geometric mean
pH	Range: 6.5 to 9.0
DO	> 5.0 mg/L
Atrazine	3ug/L[1], 82ug/L[2], 9ug/L[3]
Alachlor	2ug/L[1]
Conductivity	1,700 *u*S/cm≈TDS of 1,000 mg/L
Total Suspended Solids (TSS)	116mg/L (streams); ≥12mg/L Lakes
Chlorpyrifos	10ug/L[1]
Cyanazine	370ug/L[2]; 30ug/L[3]
Metolachlor	1.7mg/L[2]
Metribuzin	200ug/L[1] 91ug/L HRL
Pendmethalin (PROWL)	70ug/L HBSL, 20ug/L[1]
Simazine	4.0ug/L[1]

Trifluralin	26ug/L[2]; 1.1ug/L[3]

[1] Drinking Water
[2] Acute
[3] Chronic
Health Based Sreening Level (HBSL)
Health Reference Level (HRL)

Nitrogen is an essential component of proteins, genetic material, chlorophyll, and other key organic molecules. All organisms require nitrogen in order to survive. Nitrogen exists in several forms. These forms include gaseous nitrogen (N_2), nitrites (NO_2), nitrate (NO_3), ammonia nitrogen (NH_3-N), and ammonium (NH_4). Ammonia can be toxic to fish and other aquatic organisms at certain levels. Unlike ammonia, ammonium (NH4) is not toxic to aquatic organisms and is readily available for uptake by plankton and macrophytes. Nitrogen levels have increased as human activities have accelerated the rate of fixed nitrogen being put into circulation. High nitrogen levels can cause eutrophication. Eutrophication increases biomass of phytoplankton, decreases water transparency, and causes oxygen depletion. Ammonia nitrogen is monitored so that the effects on fish spawning, hatching, growth rate and pathologic changes in gills, liver and kidney tissue can be related to the detected levels of ammonia nitrogen. Nitrate-nitrogen degrades to nitrite or produces ammonia which has a detrimental effect on aquatic life and, therefore, has been monitored to assure levels are below the regulatory "safe" limit.

Phosphate has been analyzed as phosphorus and has been monitored due to the potential for uptake by nuisance algae. Levels of phosphate can indicate the potential for rapid growth of algae (algae bloom), which can cause serious oxygen depletion during the algae decay process. Phosphorous is typically the limiting nutrient in a water body. Therefore, addition of phosphorous to the ecosystem stimulates the growth of plants and algae. Phosphorous is delivered to lakes and streams by way of storm water runoff from agricultural fields, residential property, and construction sites. Other sources of phosphorous are anaerobic decomposition of organic matter, leaking sewer systems, waterfowl, and point source pollution. The general standard for phosphorous in lake water is 0.05mg/L. Dissolved phosphorous also called ortho-phosphorous is generally found in much smaller concentrations than total phosphorous and is readily available for uptake. For this reason dissolved phosphorous concentrations are variable and difficult to use as an indicator of nutrient availability.

The metals manganese and iron are nutrients for both plants and animals. Living organisms require trace amounts of metals. However, excessive amounts can be harmful to the organism. Heavy metals exist in surface waters in three forms, colloidal, particulate, and dissolved. Water chemistry determines the rate of adsorption and desorption of metals to and from sediment. Metals are desorbed from the sediment if the water experiences increases in salinity, decreases in redox potential, or decreases in pH. Metals in surface waters can be from natural or human sources. Currently human sources contribute more metals than natural sources. Metals levels in surface water may pose a health risk to humans and the environment.

Photosynthetic activity can be hindered by the levels of total suspended solids. Total suspended solids concentrations, which cause the photosynthetic activity to be reduced by more than 10% from the seasonably established norm, can have a detrimental effect on aquatic life. Soil particles, organic material, and other debris comprise suspended solids in the water column. Secchi disk measurements are inverse to suspended solid measurements. As total suspended solids (TSS) increases, the secchi disk depth or water transparency decreases. Total suspended solids can be an important indicator of the type and degree of turbidity. TSS measurements represent a combination volatile suspended solids (VSS), that consist of organic material and nonvolatile suspended solids (NVSS) which is comprised of inorganic mineral particles in the water. In order to more accurately determine the types and amounts of suspended solids, volatile suspended solids (VSS) are analyzed. VSS concentration represents the organic portion of the total suspended solids. Organic material often includes plankton and additional plant and animal debris that are present in water. Total volatile solids indicate the presence of organics in suspension; and therefore, show additional demand levels of oxygen. Missouri does not currently have a standard for TSS or TVSS. However, literature suggests that NVSS above 15mg/L could highly impair recreational lake use. A NVSS of 3 to 7mg/L might cause slight impairment.

Chlorophyll and pheophytin *a* are monitored to provide indicators of algae growth and, therefore, potential oxygen depletion activity. Chlorophyll is measured in lakes to estimate the type and amount of algal productivity in the water column. Chlorophyll a is present in green algae, blue-green algae, and in diatoms. Chlorophyll a is often used to indicate the degree of eutrophication. Chlorophyll b and c are used to estimate the extent of algal diversity and productivity. Chlorophyll b is common in green algae and is used as an auxiliary pigment for photosynthesis. Chlorophyll c is most common in diatom species and serves as an auxiliary pigment. Algal productivity and diversity can be determined by the concentrations of the individual pigments. For example high concentrations of chlorophyll a and b would indicate that green algae is abundant. High concentrations of chlorophyll a would indicate abundance of blue-green algae and concentrations of chlorophyll a and c would indicate diatoms are the dominant species. Chlorophyll production is currently being connected with hypoxia.

Fecal coliform bacteria is monitored for the protection of human health as it relates to full body contact of recreational waters. People can be exposed to disease-causing organisms, such as bacteria, viruses and protozoa in beach and recreational waters mainly through accidental ingestion of contaminated water or through skin contact. These organisms, called pathogens, usually come from the feces of humans and other warm-blooded animals. If taken into the body, pathogens can cause various illnesses and on rare occasions, even death. Waterborne illnesses include diseases resulting from bacteria infection such as cholera, salmonellosis, and gastroenteritis, viral infections such as hepatitis, gastroenteritis, and intestinal diseases, and protozoan infections such as ameobic dysentery and giardiasis. The most commonly monitored recreational water indicator organisms are fecal coliform, Escherichia coli, (E. coli) and enterococci. Fecal coliform are bacteria that live in the intestinal tracts of warm-blooded animals. The Missouri standard for fecal coliform is less than 200 colonies per 100ml of sample water calculated as a geometric mean. Fecal coliform was originally recommended in 1968 by the Federal Water Pollution Control Administration (predecessor to EPA) as an effective water quality indicator organism for recreational waters. Recent studies indicate that fecal coliform show less correlation to illness than other indicator organisms such as E. coli and enterococci. The Environmental Protection Agency (EPA) currently recommends E. coli or enterococci as an indicator organism for fresh waters. Since 2009 the St. Louis District has been using E. coli as the standard indicator.

Atrazine and Alachlor herbicides are commonly used agricultural chemicals which can be readily transported by rainfall runoff. Both compounds are suspected of causing cancer; and therefore, were monitored for the protection of human and aquatic health. Organic compounds include many pesticides. A pesticide can be any substance that is intended to prevent, destroy, repel, or mitigate any pest. This includes insecticides, herbicides, fungicides, fumigants, algaecides and other substances. Herbicides which are pesticides used to kill vegetation are the most widely used and sampled. Ten of the most frequently used herbicides detected in water are Atrazine, Metolachlor, Alachlor, 2,4-D, Trifluralin, Glyphosate, Dicamba, Cyanazine, Simazine, and 2,4,5-T. Two of the most widely used pesticides are Atrazine and Alachlor. Atrazine is a preemergence or postemergence herbicide use to control broadleaf weeds and annual grasses. Atrazine is most commonly detected in ground and surface water due to its wide use, and its ability to persist in soil and move in water. Alachlor is a Restricted Use Pesticide (RUP) due to the potential to contaminate groundwater. The drinking water standard for Atrazine is 0.003mg/L and 0.002 mg/L for Alachlor.

Temperature, dissolved oxygen and pH are monitored for the protection of aquatic life. Temperature is important because it controls several aspects of water quality. Colder water hold more dissolved oxygen which is required by aquatic organisms. Plants grow more rapidly and use more oxygen in warmer water. Decomposition of organic matter which uses oxygen is accelerated in warmer water. Temperature can also determine the availability of toxic compounds such as ammonia. Since aquatic organisms are cold blooded, water temperature regulates their metabolism and ability to survive. The number and kinds of organisms that are found in streams or lakes is directly related to temperature. Certain organisms require a specific temperature range, such as trout, which require water temperatures below 20^oC. Most aquatic organisms require a minimum concentration of dissolved oxygen to survive. In spring, surface waters of the lake mix with the water below through wind and thermal action. This mixing diminishes as the upper layer of water becomes warmer and less dense. Solar insulation during the summer months stratifies the lake into three zones. The upper warmer water zone is called the epilimnion and the lower cooler water zone is called the hypolimnion. The epilimnion and the hypolimnion zones are divided by a transition zone known as the metalimnion. The thermocline located within the metalimnion exhibits a rapid change in water temperature. During the summer months the hypolimnion may become anaerobic. In this anaerobic zone, chemical reduction of iron and manganese, or the production of methane and sulfides can occur. Iron rapidly oxidizes in aerobic environments, but manganese oxidizes slowly and can remain in the reduced state for long distances down stream even in aerobic environments. The degree of acidity of water is measured by a logarithmetic scale ranging from 0 to 14 and is known as the pH scale. A reading of 7 indicates neutrality and readings below seven are acidic and above are alkaline. Most Missouri lakes range from 6 to 9 on the pH scale. The buffering capacity of water is the ability to neutralize acid better known as alkalinity. A high alkalinity concentration indicates an increased ability to neutralize pH and resist changes; whereas a low alkalinity concentration indicates that a water body is vulnerable to changes in pH.

Conductivity is a measure of water's ability to conduct an electrical current. The ability to carry a current is often driven by the dissolved materials present in a water column. These materials can include dissolved ions and other materials in the water and thus are directly proportional to the concentration of total dissolved solids (TDS) present in the water column. Typically TDS concentrations represent 50-60% of the conductivity measurements. Conductivity is also affected by water temperature. The warmer the water, the higher the conductivity. Conductivity in streams and rivers is affected by the geology of the area. Streams running through granite areas tend to have lower conductivity due to granite being composed of inert material, materials that do not ionize or dissolve into ionic compounds in water. On the other hand streams that run through areas of limestone or clay soils tend to have higher conductivity readings because of the presence of materials that ionize. Conductivity is useful as a general measure of water quality. A stream tends to have a relatively constant range of conductivity that once establish can be used as a baseline. Significant changes, either high or low, might indicate a source of pollution has been introduced into the water. The pollution source could be a treatment plant, which raises the conductivity; or an oil spill, which would lower the conductivity.

Redox or Oxidation-Reduction Potential (ORP) is a measure of a water system's capacity to either release or gain electrons. Oxidation involves an exchange of electrons between 2 atoms. The atom that loses an electron is oxidized and the one that gains an electron is reduced. ORP sensors measure the electrochemical potential between the solution and a reference electrode. Readings are expressed in millivolts. Positive readings indicate increased oxidizing potential and negative readings increased reduction. The ORP probe is essentially a millivolt meter, measuring the voltage across 2 electrodes with the water in between. ORP values are used much like pH values to determine water quality. While pH readings characterize the state of a system relative to the receiving or donating hydrogen ions (base or acid), ORP readings characterize the relative state of losing or gaining electrons. The conversion of ammonia (NH_3) requires an oxidating environment to convert it into nitrites (NO_2) and nitrates (NO_3). Ammonia levels as low as 0.002mg/L can be harmful to fish. Generally ORP readings above 400mV are harmful to aquatic life. However, ORP is a non-specific measurement, which is a reflection of a combination of effects of all the dissolved materials in the water. Therefore, the measurement of ORP in relatively clean water has only limited utility unless a predominant redox-active material is known to be present.

Water clarity is intuitively used by the public to judge water quality. Secchi depth has been used for many years as a limnological characterization tool for characterizing water clarity. Secchi depth is a measure of light penetration into a waterbody and is a function of the absorption and scattering of light in the water. There are three characteristics of water which affect the penetration of light: (1) color of water, (2) amount of phytoplankton in the water column, and (3) amount of inorganic material in the water column. Secchi depth integrates the combined impacts of all three of these factors. Water transparency was measured using a Secchi disk. Secchi disk readings were taken at all lake sites.

2.2 Sediment

In accordance with EM-1110-2-1201, sediment samples should be taken to monitor and assess potential impacts to aquatic and human health. To assess ecological risk, sample values were compared against toxicity information published in the National Oceanic Atmospheric

Administrations (NOAA) Screening Quick Reference Tables (SQRT) or similar references for ecological receptors in freshwater sediment. Without standards or other widely applicable numerical tools, NOAA scientists found it difficult to estimate the possible toxicological significance of chemical concentrations in sediment. Therefore, numerical sediment quality guidelines (SQG's) were developed as informal, interpretive tools. The SQGs were not promulgated as regulatory standards, but rather as informal, non-regulatory guidelines for interpreting chemical data from analyses of sediments. For potential ecological risk from inorganic contaminants, seven metals are typically of "most concern" with regards to fish and wildlife: Arsenic, Copper, Cadmium, Selenium, Mercury, Lead, and Zinc. Avian species are thought to be particularly sensitive to arsenic, and is also considered a carcinogenic, mutagenic, and teratogenic contaminant in a variety of species in elevated doses over time. Avian species are also known to be particularly sensitive to lead in the environment with effects ranging from mortality, reduced growth and reproductive output, behavior changes, blood chemistry alterations, and lesions of major organs. Finally, the embryo stages in fish and avian species are known to be the most sensitive to selenium affecting reproductive success.

For potential human health risk, there are no known values in Missouri for sediments. While not a direct correlation, sample results are compared against Missouri Risk Based Corrective Action (MRBCA) lowest default target levels for all soil types and exposure pathways for soils.

3.0 SUMMARY OF MONITORING RESULTS

3.1 Water Quality Summary

The monitoring program for Mark Twain Lake during Fiscal Year 2014 revealed good water quality when compared to limits established by the MDNR for general use, secondary contact, and indigenous aquatic life. Agricultural nutrient runoffs were primary concerns for the lake's water quality. Better land management practices, erosion control and buffering zones are methods used to reduce such contaminants from entering the lake. The St. Louis District personnel are available to work with lake personnel, area communities, and other agencies in the implementation of educational programs and planning to bring about the use of better management techniques to improve the lake's water quality.

E. coli were sampled at the marinas to ensure that the marina areas are not being contaminated by boats with restroom facilities. Bacteria levels for both marinas were well below the Missouri standard of 235. We currently do not take enough samples in a month to calculate a geometric mean, so we mainly look at a high reading of 235/100ml of sample to trigger additional investigations. E. coli beach sample results for the Corps beaches were received from the project office, and data for the state beach was received from MDNR were incorporated into this report. Beach samples were taken weekly during the recreation season. No Corps beach samples were above the Missouri standard for beaches. The state park beach did exceed the 235 limit on August 18.

Total iron and total manganese are sampled above the dam near the bottom of the channel (MTL-22-15), below the re-regulation dam (MTL-12), and in the spillway area (MTL-1). As was previously stated living organisms require trace amounts of metals, however excessive amounts can be harmful to the organism. Iron cycling is a function of oxidation-reduction processes. Iron oxidizes relatively rapidly (minutes to hours); therefore any iron released through the spillway will normally be oxidized in a short period of time. Iron did not exceed the state standard. Manganese oxidizes slower and can persist in the reduced state long distances downstream even in aerobic environments. Missouri's standard for manganese is for drinking water and groundwater. Missouri does not have a manganese standard for aquatic life.

Nitrogen and phosphates are sampled at all sites. All lake sites exceeded the total phosphorous 0.05 mg/l standard at least once during the sampling period. Phosphorous levels were higher in the upper reaches of the lake (MTL-66 & 77, 15 is a duplicate of 66). Levels were higher in April than in June or August. Precipitation did occur prior to sampling in April, which may be the cause of the elevated levels. Phosphorous levels are lowest near and below the dam. Phosphorous levels at site 5 in June were much higher than the other tributary sites during that time frame. This may have been the result of fertilizer applications in the watershed along with precipitation events prior to and on June 12. Total Phosphates are used or locked up as water travels down the lake. Because phosphorous in water is not considered directly toxic to humans and animals no drinking water standards have been established for phosphorous. However, phosphorous can cause health threats through the stimulation of toxic algal blooms and the resulting oxygen depletion. Nitrates can pose a threat to human and animal health. Nitrate in water is toxic at high levels and has been linked to toxic effects of livestock and to blue baby disease (methemoglobinemia) in infants. The Maximum Contaminant Level (MCL) for nitrate-N in drinking water is 10mg/L to protect babies 3 to 6 months of age. The Missouri Water Quality Standard for ammonia nitrogen (NH_3-N) is 15mg/L. Nitrate-Nitrogen did not exceed the 10mg/L standard at any site. The highest value recorded was 1.3mg/L at site 77 (North Fork Arm). Ammonia-Nitrogen tends to be constant throughout the lake. The increased levels of phosphate in combination with nitrogen and other lake conditions, such as temperature, pH and stagnant lake conditions, can lead to increased algae growth. Eutrophication is currently the most widespread water quality problem in the U.S. and many other countries. Restoration of eutrophic waters requires the reduction of nonpoint inputs of phosphorous and nitrogen. The resulting detrimental effects of algae toxins and oxygen depletion could result in health problems for fish and other aquatic species as well as land animals utilizing the water supply. There were no signs of any of these effects during the site visits in 2012.

Chlorophyll *a* was sampled at 4 sites, MTL-22, MTL-33, MTL-66 and MTL-77. MTL-15 is a duplicate sample of MTL-66. Chlorophyll *a* is a green pigment found in plants. Missouri does not currently have a standard for chlorophyll. Chlorophyll *a* concentrations are an indicator of phytoplankton abundance and biomass. They can be an effective measure of trophic status, and used as a measure of water quality. High levels often indicate poor water quality and low levels suggest good conditions. However, elevated levels are not necessarily bad. It is the long term persistence of elevated levels that is the problem. It is natural for chlorophyll *a* levels to fluctuate over time. Chlorophyll *a* tends to be higher after storm events and during the summer months when water temperatures and light levels are elevated. Chlorophyll can reduce the clarity of the water and the amount of oxygen available to other organisms. Chlorophyll concentrations and cyanobacteria cell counts serve as proxies for the actual presence of algal toxins. Exposure to cyanobacteria or their toxins may produce allergic reactions such as skin rashes, eye irritations, respiratory symptoms, and in some cases more severe health effects. Microcystin is currently believed to be the most common cyanotoxin in lakes. While EPA does not currently have water quality criteria for algal toxins, the World Health Organization (WHO) has established recreational exposure guidelines for Chlorophyll-a, cyanobacterial cell counts, and microcystin. Mark Twain Lake was in the moderate risk of exposure category for chlorophyll.

Seventy percent of the Mark Twain Lake watershed is used for agriculture and 50% of this is used for cropland. Atrazine and Alachlor are pesticides that were sampled at all sites. These chemicals are herbicides used to control weed growth. On June 12, 2014 MTL-5 and MTL-13 exceeded the state standard of 3.0ug/L for atrazine, and sites MTL-9 and MTL-11 had elevated levels (2.9ug/L). All other sites were below the state standard on this date and were below the state standards for the other sampling events. Stormwater runoff as a result of precipitation on June 9, 10 and 12 may attribute to the higher levels on this date. These substances can enter water bodies as a result of drift during spraying, surface runoff, and leaching through soil. Cyanizine, Metolachlor, Trifluralin and Simazine are also analyzed as part of the pesticide screening. In order to eliminate pesticide contamination of waters it is important for the public to be educated and institute best management practices when using these chemicals.

Total Suspended Solids (TSS) and Total Volatile Suspended Solids (TVSS) samples are collected at all sites. Solids can affect water quality by increasing temperature through the absorption of sunlight by the particles in the water, which also affects the clarity of the water. This can then affect the amount of oxygen in the water. Total Suspended Solids in the tributaries were highest at site MTL-5 (South Fork) on June 12 and in the lake at MTL-66 on April 17. Precipitation prior to these sampling events may have contributed to these higher readings. Missouri does not currently have a standard for TSS or TVSS. However, literature suggests that Nonvolatile Suspended Solids (NVSS) which is a subdivision of TSS above 15mg/L could highly impair recreational lake use and a NVSS of 3 to 7mg/L might cause slight impairment.

Total Organic Carbon (TOC) is collected at all sites. TOC is an indicator of the organic character of water. The larger the carbon or organic content, the more oxygen is consumed. TOC tends to be higher in the summer months which may be a result of plant material, which had grown all summer and begins to decay. TOC was fairly consistent within the lake ranging from 5 to 7mg/L. Missouri does not currently have a standard for TOC.

Temperature and dissolved oxygen levels were taken at all sites. Measurements were taken at 1 meter intervals at the lake sites. During the summer months the lake stratifies and a boundary is formed between the upper warmer water and the lower cooler water. This transition area is known as the thermocline, the area where the temperature drops significantly. Oxygen levels can also change drastically as a function of depth. This area where the oxygen level significantly drops is called the oxycline. The depth of the thermocline and oxycline can have an effect on the aquatic organisms. Occasionally the thermocline and oxycline are at or near the same depth. The DO graphs for the sondes at the tailwater and re-reg dam is located in appendix C on pages C23 to C24.

pH is taken at all sites and at 1 meter intervals at lake sites. All sites were within the 6 to 9 pH range, except MTL-41 on April 17. Variances in pH can be caused by a rainfall event.

Conductivity and redox are taken at all sites and at 1 meter intervals at lake sites. Recommended standard for conductivity is 1,700*u*S/cm. Missouri does not currently have a standard for redox.

Seechi disk readings at sites 22 (above dam) and 33 (Lick Creek Arm near Hwy J) indicate that these sites tend to have better water clarity than the rest of the lake. This would seem to be reasonable since these sites are located closer to the dam which allows solids time to settle out of the water column as they travel down the lake.

3.2 Sediment Summary

Sediment sampling was not conducted in 2014. Sediment sampling is normally conducted every 5 years if funding is available. Sediment sampling was last conducted in 2007.

It is recommended that the next round of sediment samples focus on organochlorines in freshwater sediment to assess potential chronic aquatic impacts (e.g. aldrin, chlordane, endrin, endosulfan, DDT, methoxychlor).

4.0 PLANNED 2015 STUDIES

The Mark Twain Lake water quality monitoring will continue in Fiscal Year 2014. Because of budgetary constraints the number of sampling events will remain at 3 for 2014. A restored number of sampling events would provide the ability to better evaluate water quality trends, better defend project operations (lake levels, releases, maintenance projects, construction projects, etc.), to better confirm that we meet state water quality standards, and to better confirm that human health and safety are adequately protected. The sampling events are planned to be conducted between April and August in 2015. Mark Twain Lake provides drinking water to many communities and is a high usage recreational lake. The monitoring of water quality is imperative to assure the water quality is within acceptable limits for the designated usage.

The sampling sites include the following: Site 1 (MTL-1) Spillway, Site 5 (MTL-5) South Fork at Hwy D, Site 13 (MTL-13) Elk Fork at 715, Site 9 (MTL-9) Middle Fork at Hwy 15, Site 11 (MTL-11) North Fork at Hwy 36, Site 12 (MTL-12) below re-regulation dam, Site 22 (MTL-22) old river channel 1mile up lake from dam, Site 33 (MTL-33) Lick Creek at Hwy J, Site 66 (MTL-66) South Fork at Hwy 107 bridge, and Site 77 (MTL-77) North Fork at Hwy 107 bridge. This combination of sites effectively represents the incoming contaminants and their effects on the lake.

A remote sensor was installed several years ago in the spillway to allow the project as well as water quality personnel to remotely monitor temperature and oxygen readings to avoid fish kills. During low flow, water is discharged through the after bay. This water is low in oxygen and can create a low oxygen area below the dam. The sensor will allow the project to track oxygen levels below the dam and make appropriate adjustments to avoid a possible fish kill. Normally allowing water to spill through the tainter gates will alleviate low oxygen levels below the dam. In 2009 a remote sensor was installed in the re-reg pool near the re-reg dam to monitor the lower portion of the re-reg pool. Water quality personnel will continue to maintain and monitor these probes.

Sediment sampling will be conducted if funding is available.

APPENDIX A

DATA

LAB DATA

Site #	Collection Date	Reported Result	Flag	Units	Parameter
MTL-1	4/17/14	0.20	<	UG/L	Alachlor
MTL-1	6/12/14	0.22	<	UG/L	Alachlor
MTL-1	8/12/14	0.20	<	UG/L	Alachlor
MTL-11	6/12/14	0.22	<	UG/L	Alachlor
MTL-11	8/12/14	0.20	<	UG/L	Alachlor
MTL-12	4/17/14	0.20	<	UG/L	Alachlor
MTL-12	6/12/14	0.22	<	UG/L	Alachlor
MTL-12	8/12/14	0.20	<	UG/L	Alachlor
MTL-13	6/12/14	0.22	<	UG/L	Alachlor
MTL-13	8/12/14	0.20	<	UG/L	Alachlor
MTL-15	4/17/14	0.20	<	UG/L	Alachlor
MTL-15	6/12/14	0.20	<	UG/L	Alachlor
MTL-15	8/12/14	0.20	<	UG/L	Alachlor
MTL-22	4/17/14	0.20	<	UG/L	Alachlor
MTL-22	6/12/14	0.20	<	UG/L	Alachlor
MTL-22	8/12/14	0.22	<	UG/L	Alachlor
MTL-25	4/17/14	0.22	<	UG/L	Alachlor
MTL-33	4/17/14	0.20	<	UG/L	Alachlor
MTL-33	6/12/14	0.20	<	UG/L	Alachlor
MTL-33	8/12/14	0.20	<	UG/L	Alachlor
MTL-41	4/17/14	0.22	<	UG/L	Alachlor
MTL-5	6/12/14	0.22		UG/L	Alachlor
MTL-5	8/12/14	0.20	<	UG/L	Alachlor
MTL-66	4/17/14	0.20	<	UG/L	Alachlor
MTL-66	6/12/14	0.20	<	UG/L	Alachlor
MTL-66	8/12/14	0.20	<	UG/L	Alachlor
MTL-77	4/17/14	0.20	<	UG/L	Alachlor
MTL-77	6/12/14	0.20	<	UG/L	Alachlor
MTL-77	8/12/14	0.20	<	UG/L	Alachlor
MTL-88	4/17/14	0.22	<	UG/L	Alachlor
MTL-9	4/17/14	0.20	<	UG/L	Alachlor
MTL-9	6/12/14	0.20	<	UG/L	Alachlor
MTL-9	8/12/14	0.22	<	UG/L	Alachlor
MTL-1	4/17/14	0.030	<	MG/L	Ammonia Nitrogen
MTL-1	6/12/14	0.030	<	MG/L	Ammonia Nitrogen
MTL-1	8/12/14	0.030		MG/L	Ammonia Nitrogen
MTL-11	6/12/14	0.082		MG/L	Ammonia Nitrogen
MTL-11	8/12/14	0.076		MG/L	Ammonia Nitrogen
MTL-12	4/17/14	0.051		MG/L	Ammonia Nitrogen
MTL-12	6/12/14	0.038		MG/L	Ammonia Nitrogen
MTL-12	8/12/14	0.085		MG/L	Ammonia Nitrogen
MTL-13	6/12/14	0.082		MG/L	Ammonia Nitrogen
MTL-13	8/12/14	0.032		MG/L	Ammonia Nitrogen
MTL-15	4/17/14	0.26		MG/L	Ammonia Nitrogen
MTL-15	6/12/14	0.030	<	MG/L	Ammonia Nitrogen
MTL-15	8/12/14	0.030	<	MG/L	Ammonia Nitrogen
MTL-22	4/17/14	0.030	<	MG/L	Ammonia Nitrogen
MTL-22	6/12/14	0.030	<	MG/L	Ammonia Nitrogen
MTL-22	8/12/14	0.030		MG/L	Ammonia Nitrogen
MTL-22-15	4/17/14	0.030	<	MG/L	Ammonia Nitrogen

Site #	Collection Date	Reported Result	Flag	Units	Parameter
MTL-22-15	6/12/14	0.030	<	MG/L	Ammonia Nitrogen
MTL-22-15	8/12/14	0.030	<	MG/L	Ammonia Nitrogen
MTL-25	4/17/14	0.32		MG/L	Ammonia Nitrogen
MTL-33	4/17/14	0.030	<	MG/L	Ammonia Nitrogen
MTL-33	6/12/14	0.035		MG/L	Ammonia Nitrogen
MTL-33	8/12/14	0.030	<	MG/L	Ammonia Nitrogen
MTL-41	4/17/14	0.052		MG/L	Ammonia Nitrogen
MTL-5	6/12/14	0.086		MG/L	Ammonia Nitrogen
MTL-5	8/12/14	0.047		MG/L	Ammonia Nitrogen
MTL-66	4/17/14	0.26		MG/L	Ammonia Nitrogen
MTL-66	6/12/14	0.040		MG/L	Ammonia Nitrogen
MTL-66	8/12/14	0.036		MG/L	Ammonia Nitrogen
MTL-77	4/17/14	0.21		MG/L	Ammonia Nitrogen
MTL-77	6/12/14	0.030	<	MG/L	Ammonia Nitrogen
MTL-77	8/12/14	0.030	<	MG/L	Ammonia Nitrogen
MTL-88	4/17/14	0.38		MG/L	Ammonia Nitrogen
MTL-9	4/17/14	0.030	<	MG/L	Ammonia Nitrogen
MTL-9	6/12/14	0.12		MG/L	Ammonia Nitrogen
MTL-9	8/12/14	0.030	<	MG/L	Ammonia Nitrogen
MTL-1	4/17/14	0.33		UG/L	Atrazine
MTL-1	6/12/14	0.83		UG/L	Atrazine
MTL-1	8/12/14	0.29		UG/L	Atrazine
MTL-11	6/12/14	2.9		UG/L	Atrazine
MTL-11	8/12/14	0.21		UG/L	Atrazine
MTL-12	4/17/14	0.38		UG/L	Atrazine
MTL-12	6/12/14	0.52		UG/L	Atrazine
MTL-12	8/12/14	0.20	<	UG/L	Atrazine
MTL-13	6/12/14	7.0		UG/L	Atrazine
MTL-13	8/12/14	0.20	<	UG/L	Atrazine
MTL-15	4/17/14	0.32		UG/L	Atrazine
MTL-15	6/12/14	0.30		UG/L	Atrazine
MTL-15	8/12/14	0.41		UG/L	Atrazine
MTL-22	4/17/14	0.36		UG/L	Atrazine
MTL-22	6/12/14	0.45		UG/L	Atrazine
MTL-22	8/12/14	0.34		UG/L	Atrazine
MTL-25	4/17/14	0.22	<	UG/L	Atrazine
MTL-33	4/17/14	0.43		UG/L	Atrazine
MTL-33	6/12/14	0.43		UG/L	Atrazine
MTL-33	8/12/14	0.30		UG/L	Atrazine
MTL-41	4/17/14	0.22	<	UG/L	Atrazine
MTL-5	6/12/14	6.8		UG/L	Atrazine
MTL-5	8/12/14	0.22		UG/L	Atrazine
MTL-66	4/17/14	0.31		UG/L	Atrazine
MTL-66	6/12/14	0.20	<	UG/L	Atrazine
MTL-66	8/12/14	0.40		UG/L	Atrazine
MTL-77	4/17/14	0.29		UG/L	Atrazine
MTL-77	6/12/14	0.20	<	UG/L	Atrazine
MTL-77	8/12/14	0.41		UG/L	Atrazine
MTL-88	4/17/14	0.39		UG/L	Atrazine
MTL-9	4/17/14	0.20	<	UG/L	Atrazine
MTL-9	6/12/14	2.9		UG/L	Atrazine
MTL-9	8/12/14	0.22	<	UG/L	Atrazine
MTL-15	4/17/14	2.0	<	MG/CU.M.	Chlorophyll a

Site #	Collection Date	Reported Result	Flag	Units	Parameter
MTL-15	6/12/14	2.0	<	MG/CU.M.	Chlorophyll a
MTL-15	8/12/14	2.1		MG/CU.M.	Chlorophyll a
MTL-22	4/17/14	3.7		MG/CU.M.	Chlorophyll a
MTL-22	6/12/14	2.0	<	MG/CU.M.	Chlorophyll a
MTL-22	8/12/14	2.0	<	MG/CU.M.	Chlorophyll a
MTL-33	4/17/14	2.7		MG/CU.M.	Chlorophyll a
MTL-33	6/12/14	2.0	<	MG/CU.M.	Chlorophyll a
MTL-33	8/12/14	2.0	<	MG/CU.M.	Chlorophyll a
MTL-66	4/17/14	2.0	<	MG/CU.M.	Chlorophyll a
MTL-66	6/12/14	2.0	<	MG/CU.M.	Chlorophyll a
MTL-66	8/12/14	2.5		MG/CU.M.	Chlorophyll a
MTL-77	4/17/14	2.0	<	MG/CU.M.	Chlorophyll a
MTL-77	6/12/14	2.0	<	MG/CU.M.	Chlorophyll a
MTL-77	8/12/14	4.5		MG/CU.M.	Chlorophyll a
MTL-1	4/17/14	0.20	<	UG/L	Chlorpyrifos
MTL-1	6/12/14	0.22	<	UG/L	Chlorpyrifos
MTL-1	8/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-11	6/12/14	0.22	<	UG/L	Chlorpyrifos
MTL-11	8/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-12	4/17/14	0.20	<	UG/L	Chlorpyrifos
MTL-12	6/12/14	0.22	<	UG/L	Chlorpyrifos
MTL-12	8/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-13	6/12/14	0.22	<	UG/L	Chlorpyrifos
MTL-13	8/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-15	4/17/14	0.20	<	UG/L	Chlorpyrifos
MTL-15	6/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-15	8/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-22	4/17/14	0.20	<	UG/L	Chlorpyrifos
MTL-22	6/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-22	8/12/14	0.22	<	UG/L	Chlorpyrifos
MTL-25	4/17/14	0.22	<	UG/L	Chlorpyrifos
MTL-33	4/17/14	0.20	<	UG/L	Chlorpyrifos
MTL-33	6/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-33	8/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-41	4/17/14	0.22	<	UG/L	Chlorpyrifos
MTL-5	6/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-5	8/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-66	4/17/14	0.20	<	UG/L	Chlorpyrifos
MTL-66	6/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-66	8/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-77	4/17/14	0.20	<	UG/L	Chlorpyrifos
MTL-77	6/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-77	8/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-88	4/17/14	0.22	<	UG/L	Chlorpyrifos
MTL-9	4/17/14	0.20	<	UG/L	Chlorpyrifos
MTL-9	6/12/14	0.20	<	UG/L	Chlorpyrifos
MTL-9	8/12/14	0.22	<	UG/L	Chlorpyrifos
MTL-1	4/17/14	0.20	<	UG/L	Cyanazine
MTL-1	6/12/14	0.22	<	UG/L	Cyanazine
MTL-1	8/12/14	0.20	<	UG/L	Cyanazine
MTL-11	6/12/14	0.22	<	UG/L	Cyanazine
MTL-11	8/12/14	0.20	<	UG/L	Cyanazine
MTL-12	4/17/14	0.20	<	UG/L	Cyanazine

Site #	Collection Date	Reported Result	Flag	Units	Parameter
MTL-12	6/12/14	0.22	<	UG/L	Cyanazine
MTL-12	8/12/14	0.20	<	UG/L	Cyanazine
MTL-13	6/12/14	0.22	<	UG/L	Cyanazine
MTL-13	8/12/14	0.20	<	UG/L	Cyanazine
MTL-15	4/17/14	0.20	<	UG/L	Cyanazine
MTL-15	6/12/14	0.20	<	UG/L	Cyanazine
MTL-15	8/12/14	0.20	<	UG/L	Cyanazine
MTL-22	4/17/14	0.20	<	UG/L	Cyanazine
MTL-22	6/12/14	0.20	<	UG/L	Cyanazine
MTL-22	8/12/14	0.22	<	UG/L	Cyanazine
MTL-25	4/17/14	0.22	<	UG/L	Cyanazine
MTL-33	4/17/14	0.20	<	UG/L	Cyanazine
MTL-33	6/12/14	0.20	<	UG/L	Cyanazine
MTL-33	8/12/14	0.20	<	UG/L	Cyanazine
MTL-41	4/17/14	0.22	<	UG/L	Cyanazine
MTL-5	6/12/14	0.20	<	UG/L	Cyanazine
MTL-5	8/12/14	0.20	<	UG/L	Cyanazine
MTL-66	4/17/14	0.20	<	UG/L	Cyanazine
MTL-66	6/12/14	0.20	<	UG/L	Cyanazine
MTL-66	8/12/14	0.20	<	UG/L	Cyanazine
MTL-77	4/17/14	0.20	<	UG/L	Cyanazine
MTL-77	6/12/14	0.20	<	UG/L	Cyanazine
MTL-77	8/12/14	0.20	<	UG/L	Cyanazine
MTL-88	4/17/14	0.22	<	UG/L	Cyanazine
MTL-9	4/17/14	0.20	<	UG/L	Cyanazine
MTL-9	6/12/14	0.20	<	UG/L	Cyanazine
MTL-9	8/12/14	0.22	<	UG/L	Cyanazine
BJ MARINA	6/12/14	50.0		COL/100 ML	E. Coliform
BJ MARINA	8/12/14	75.0		COL/100 ML	E. Coliform
IC MARINA	6/12/14	100		COL/100 ML	E. Coliform
IC MARINA	8/12/14	25.0		COL/100 ML	E. Coliform
MTL-1	4/17/14	0.84		MG/L	Iron
MTL-1	6/12/14	1.1		MG/L	Iron
MTL-1	8/12/14	0.22		MG/L	Iron
MTL-12	4/17/14	1.1		MG/L	Iron
MTL-12	6/12/14	1.5		MG/L	Iron
MTL-12	8/12/14	0.83		MG/L	Iron
MTL-22-15	4/17/14	0.85		MG/L	Iron
MTL-22-15	6/12/14	1.5		MG/L	Iron
MTL-22-15	8/12/14	0.23		MG/L	Iron
MTL-1	4/17/14	0.033		MG/L	Manganese
MTL-1	6/12/14	0.020		MG/L	Manganese
MTL-1	8/12/14	0.013		MG/L	Manganese
MTL-12	4/17/14	0.11		MG/L	Manganese
MTL-12	6/12/14	0.080		MG/L	Manganese
MTL-12	8/12/14	0.11		MG/L	Manganese
MTL-22-15	4/17/14	0.030		MG/L	Manganese
MTL-22-15	6/12/14	0.018		MG/L	Manganese
MTL-22-15	8/12/14	0.012		MG/L	Manganese

Site #	Collection Date	Reported Result	Flag	Units	Parameter
MTL-1	4/17/14	0.48		UG/L	Metolachlor
MTL-1	6/12/14	1.3		UG/L	Metolachlor
MTL-1	8/12/14	1.8		UG/L	Metolachlor
MTL-11	6/12/14	5.0		UG/L	Metolachlor
MTL-11	8/12/14	0.48		UG/L	Metolachlor
MTL-12	4/17/14	0.59		UG/L	Metolachlor
MTL-12	6/12/14	0.98		UG/L	Metolachlor
MTL-12	8/12/14	0.96		UG/L	Metolachlor
MTL-13	6/12/14	5.2		UG/L	Metolachlor
MTL-13	8/12/14	0.20	<	UG/L	Metolachlor
MTL-15	4/17/14	0.35		UG/L	Metolachlor
MTL-15	6/12/14	1.6		UG/L	Metolachlor
MTL-15	8/12/14	1.7		UG/L	Metolachlor
MTL-22	4/17/14	0.61		UG/L	Metolachlor
MTL-22	6/12/14	0.90		UG/L	Metolachlor
MTL-22	8/12/14	2.1		UG/L	Metolachlor
MTL-25	4/17/14	0.23		UG/L	Metolachlor
MTL-33	4/17/14	0.57		UG/L	Metolachlor
MTL-33	6/12/14	1.1		UG/L	Metolachlor
MTL-33	8/12/14	1.7		UG/L	Metolachlor
MTL-41	4/17/14	0.22	<	UG/L	Metolachlor
MTL-5	6/12/14	7.5		UG/L	Metolachlor
MTL-5	8/12/14	0.36		UG/L	Metolachlor
MTL-66	4/17/14	0.31		UG/L	Metolachlor
MTL-66	6/12/14	0.99		UG/L	Metolachlor
MTL-66	8/12/14	1.7		UG/L	Metolachlor
MTL-77	4/17/14	0.53		UG/L	Metolachlor
MTL-77	6/12/14	5.2		UG/L	Metolachlor
MTL-77	8/12/14	2.5		UG/L	Metolachlor
MTL-88	4/17/14	0.22	<	UG/L	Metolachlor
MTL-9	4/17/14	0.20	<	UG/L	Metolachlor
MTL-9	6/12/14	2.7		UG/L	Metolachlor
MTL-9	8/12/14	0.22	<	UG/L	Metolachlor
MTL-1	4/17/14	0.20	<	UG/L	Metribuzin
MTL-1	6/12/14	0.22	<	UG/L	Metribuzin
MTL-1	8/12/14	0.20	<	UG/L	Metribuzin
MTL-11	6/12/14	0.22	<	UG/L	Metribuzin
MTL-11	8/12/14	0.20	<	UG/L	Metribuzin
MTL-12	4/17/14	0.20	<	UG/L	Metribuzin
MTL-12	6/12/14	0.22	<	UG/L	Metribuzin
MTL-12	8/12/14	0.20	<	UG/L	Metribuzin
MTL-13	6/12/14	0.31		UG/L	Metribuzin
MTL-13	8/12/14	0.20	<	UG/L	Metribuzin
MTL-15	4/17/14	0.20	<	UG/L	Metribuzin
MTL-15	6/12/14	0.20	<	UG/L	Metribuzin
MTL-15	8/12/14	0.20	<	UG/L	Metribuzin
MTL-22	4/17/14	0.20	<	UG/L	Metribuzin
MTL-22	6/12/14	0.20	<	UG/L	Metribuzin
MTL-22	8/12/14	0.22	<	UG/L	Metribuzin
MTL-25	4/17/14	0.22	<	UG/L	Metribuzin
MTL-33	4/17/14	0.20	<	UG/L	Metribuzin
MTL-33	6/12/14	0.20	<	UG/L	Metribuzin
MTL-33	8/12/14	0.20	<	UG/L	Metribuzin

Site #	Collection Date	Reported Result	Flag	Units	Parameter
MTL-41	4/17/14	0.22	<	UG/L	Metribuzin
MTL-5	6/12/14	0.65		UG/L	Metribuzin
MTL-5	8/12/14	0.35		UG/L	Metribuzin
MTL-66	4/17/14	0.20	<	UG/L	Metribuzin
MTL-66	6/12/14	0.20	<	UG/L	Metribuzin
MTL-66	8/12/14	0.20	<	UG/L	Metribuzin
MTL-77	4/17/14	0.20	<	UG/L	Metribuzin
MTL-77	6/12/14	0.20	<	UG/L	Metribuzin
MTL-77	8/12/14	0.20	<	UG/L	Metribuzin
MTL-88	4/17/14	0.22	<	UG/L	Metribuzin
MTL-9	4/17/14	0.20	<	UG/L	Metribuzin
MTL-9	6/12/14	0.20	<	UG/L	Metribuzin
MTL-9	8/12/14	0.22	<	UG/L	Metribuzin
MTL-1	4/17/14	0.57		MG/L	Nitrate as Nitrogen
MTL-1	6/12/14	0.82		MG/L	Nitrate as Nitrogen
MTL-1	8/12/14	0.44		MG/L	Nitrate as Nitrogen
MTL-11	6/12/14	0.57		MG/L	Nitrate as Nitrogen
MTL-11	8/12/14	0.17		MG/L	Nitrate as Nitrogen
MTL-12	4/17/14	0.64		MG/L	Nitrate as Nitrogen
MTL-12	6/12/14	0.81		MG/L	Nitrate as Nitrogen
MTL-12	8/12/14	0.47		MG/L	Nitrate as Nitrogen
MTL-13	6/12/14	0.91		MG/L	Nitrate as Nitrogen
MTL-13	8/12/14	0.52		MG/L	Nitrate as Nitrogen
MTL-15	4/17/14	1.1		MG/L	Nitrate as Nitrogen
MTL-15	6/12/14	1.0		MG/L	Nitrate as Nitrogen
MTL-15	8/12/14	0.33		MG/L	Nitrate as Nitrogen
MTL-22	4/17/14	0.69		MG/L	Nitrate as Nitrogen
MTL-22	6/12/14	0.82		MG/L	Nitrate as Nitrogen
MTL-22	8/12/14	0.43		MG/L	Nitrate as Nitrogen
MTL-22-15	4/17/14	0.66		MG/L	Nitrate as Nitrogen
MTL-22-15	6/12/14	0.84		MG/L	Nitrate as Nitrogen
MTL-22-15	8/12/14	0.45		MG/L	Nitrate as Nitrogen
MTL-25	4/17/14	1.1		MG/L	Nitrate as Nitrogen
MTL-33	4/17/14	0.72		MG/L	Nitrate as Nitrogen
MTL-33	6/12/14	0.64		MG/L	Nitrate as Nitrogen
MTL-33	8/12/14	0.45		MG/L	Nitrate as Nitrogen
MTL-41	4/17/14	0.13		MG/L	Nitrate as Nitrogen
MTL-5	6/12/14	1.9		MG/L	Nitrate as Nitrogen
MTL-5	8/12/14	1.5		MG/L	Nitrate as Nitrogen
MTL-66	4/17/14	1.1		MG/L	Nitrate as Nitrogen
MTL-66	6/12/14	1.0		MG/L	Nitrate as Nitrogen
MTL-66	8/12/14	0.30		MG/L	Nitrate as Nitrogen
MTL-77	4/17/14	0.83		MG/L	Nitrate as Nitrogen
MTL-77	6/12/14	1.1		MG/L	Nitrate as Nitrogen
MTL-77	8/12/14	0.29		MG/L	Nitrate as Nitrogen
MTL-88	4/17/14	1.4		MG/L	Nitrate as Nitrogen
MTL-9	4/17/14	0.033		MG/L	Nitrate as Nitrogen
MTL-9	6/12/14	1.0		MG/L	Nitrate as Nitrogen
MTL-9	8/12/14	0.020	<	MG/L	Nitrate as Nitrogen
MTL-1	4/17/14	0.20	<	UG/L	Pendimethalin
MTL-1	6/12/14	0.22	<	UG/L	Pendimethalin
MTL-1	8/12/14	0.20	<	UG/L	Pendimethalin
MTL-11	6/12/14	0.22	<	UG/L	Pendimethalin

Site #	Collection Date	Reported Result	Flag	Units	Parameter
MTL-11	8/12/14	0.20	<	UG/L	Pendimethalin
MTL-12	4/17/14	0.20	<	UG/L	Pendimethalin
MTL-12	6/12/14	0.22	<	UG/L	Pendimethalin
MTL-12	8/12/14	0.20	<	UG/L	Pendimethalin
MTL-13	6/12/14	0.22	<	UG/L	Pendimethalin
MTL-13	8/12/14	0.20	<	UG/L	Pendimethalin
MTL-15	4/17/14	0.20	<	UG/L	Pendimethalin
MTL-15	6/12/14	0.20	<	UG/L	Pendimethalin
MTL-15	8/12/14	0.20	<	UG/L	Pendimethalin
MTL-22	4/17/14	0.20	<	UG/L	Pendimethalin
MTL-22	6/12/14	0.20	<	UG/L	Pendimethalin
MTL-22	8/12/14	0.22	<	UG/L	Pendimethalin
MTL-25	4/17/14	0.22	<	UG/L	Pendimethalin
MTL-33	4/17/14	0.20	<	UG/L	Pendimethalin
MTL-33	6/12/14	0.20	<	UG/L	Pendimethalin
MTL-33	8/12/14	0.20	<	UG/L	Pendimethalin
MTL-41	4/17/14	0.22	<	UG/L	Pendimethalin
MTL-5	6/12/14	0.20	<	UG/L	Pendimethalin
MTL-5	8/12/14	0.20	<	UG/L	Pendimethalin
MTL-66	4/17/14	0.20	<	UG/L	Pendimethalin
MTL-66	6/12/14	0.20	<	UG/L	Pendimethalin
MTL-66	8/12/14	0.20	<	UG/L	Pendimethalin
MTL-77	4/17/14	0.20	<	UG/L	Pendimethalin
MTL-77	6/12/14	0.20	<	UG/L	Pendimethalin
MTL-77	8/12/14	0.20	<	UG/L	Pendimethalin
MTL-88	4/17/14	0.22	<	UG/L	Pendimethalin
MTL-9	4/17/14	0.20	<	UG/L	Pendimethalin
MTL-9	6/12/14	0.20	<	UG/L	Pendimethalin
MTL-9	8/12/14	0.22	<	UG/L	Pendimethalin
MTL-15	4/17/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-15	6/12/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-15	8/12/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-22	4/17/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-22	6/12/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-22	8/12/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-33	4/17/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-33	6/12/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-33	8/12/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-66	4/17/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-66	6/12/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-66	8/12/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-77	4/17/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-77	6/12/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-77	8/12/14	2.0	<	MG/CU.M.	Pheophytin a
MTL-1	4/17/14	0.17		MG/L	Phosphorus
MTL-1	6/12/14	0.11		MG/L	Phosphorus
MTL-1	8/12/14	0.034		MG/L	Phosphorus
MTL-11	6/12/14	0.70		MG/L	Phosphorus
MTL-11	8/12/14	0.38		MG/L	Phosphorus
MTL-12	4/17/14	0.15		MG/L	Phosphorus
MTL-12	6/12/14	0.15		MG/L	Phosphorus
MTL-12	8/12/14	0.12		MG/L	Phosphorus
MTL-13	6/12/14	0.33		MG/L	Phosphorus

Site #	Collection Date	Reported Result	Flag	Units	Parameter
MTL-13	8/12/14	0.31		MG/L	Phosphorus
MTL-15	4/17/14	0.40		MG/L	Phosphorus
MTL-15	6/12/14	0.19		MG/L	Phosphorus
MTL-15	8/12/14	0.058		MG/L	Phosphorus
MTL-22	4/17/14	0.13		MG/L	Phosphorus
MTL-22	6/12/14	0.14		MG/L	Phosphorus
MTL-22	8/12/14	0.044		MG/L	Phosphorus
MTL-22-15	4/17/14	0.12		MG/L	Phosphorus
MTL-22-15	6/12/14	0.14		MG/L	Phosphorus
MTL-22-15	8/12/14	0.044		MG/L	Phosphorus
MTL-25	4/17/14	0.50		MG/L	Phosphorus
MTL-33	4/17/14	0.14		MG/L	Phosphorus
MTL-33	6/12/14	0.094		MG/L	Phosphorus
MTL-33	8/12/14	0.044		MG/L	Phosphorus
MTL-41	4/17/14	0.32		MG/L	Phosphorus
MTL-5	6/12/14	1.2		MG/L	Phosphorus
MTL-5	8/12/14	0.49		MG/L	Phosphorus
MTL-66	4/17/14	0.36		MG/L	Phosphorus
MTL-66	6/12/14	0.18		MG/L	Phosphorus
MTL-66	8/12/14	0.053		MG/L	Phosphorus
MTL-77	4/17/14	0.18		MG/L	Phosphorus
MTL-77	6/12/14	0.35		MG/L	Phosphorus
MTL-77	8/12/14	0.063		MG/L	Phosphorus
MTL-88	4/17/14	0.70		MG/L	Phosphorus
MTL-9	4/17/14	0.23		MG/L	Phosphorus
MTL-9	6/12/14	0.62		MG/L	Phosphorus
MTL-9	8/12/14	0.13		MG/L	Phosphorus
MTL-1	4/17/14	0.045		MG/L	Phosphorus, -ortho
MTL-1	6/12/14	0.044		MG/L	Phosphorus, -ortho
MTL-1	8/12/14	0.014		MG/L	Phosphorus, -ortho
MTL-11	6/12/14	0.078		MG/L	Phosphorus, -ortho
MTL-11	8/12/14	0.020		MG/L	Phosphorus, -ortho
MTL-12	4/17/14	0.045		MG/L	Phosphorus, -ortho
MTL-12	6/12/14	0.046		MG/L	Phosphorus, -ortho
MTL-12	8/12/14	0.014		MG/L	Phosphorus, -ortho
MTL-13	6/12/14	0.061		MG/L	Phosphorus, -ortho
MTL-13	8/12/14	0.16		MG/L	Phosphorus, -ortho
MTL-15	4/17/14	0.091		MG/L	Phosphorus, -ortho
MTL-15	6/12/14	0.084		MG/L	Phosphorus, -ortho
MTL-15	8/12/14	0.010	<	MG/L	Phosphorus, -ortho
MTL-22	4/17/14	0.048		MG/L	Phosphorus, -ortho
MTL-22	6/12/14	0.067		MG/L	Phosphorus, -ortho
MTL-22	8/12/14	0.010	<	MG/L	Phosphorus, -ortho
MTL-22-15	4/17/14	0.042		MG/L	Phosphorus, -ortho
MTL-22-15	6/12/14	0.067		MG/L	Phosphorus, -ortho
MTL-22-15	8/12/14	0.010	<	MG/L	Phosphorus, -ortho
MTL-25	4/17/14	0.094		MG/L	Phosphorus, -ortho
MTL-33	4/17/14	0.059		MG/L	Phosphorus, -ortho
MTL-33	6/12/14	0.061		MG/L	Phosphorus, -ortho
MTL-33	8/12/14	0.010	<	MG/L	Phosphorus, -ortho
MTL-41	4/17/14	0.011		MG/L	Phosphorus, -ortho
MTL-5	6/12/14	0.18		MG/L	Phosphorus, -ortho
MTL-5	8/12/14	0.29		MG/L	Phosphorus, -ortho

Site #	Collection Date	Reported Result	Flag	Units	Parameter
MTL-66	4/17/14	0.088		MG/L	Phosphorus, -ortho
MTL-66	6/12/14	0.075		MG/L	Phosphorus, -ortho
MTL-66	8/12/14	0.010	<	MG/L	Phosphorus, -ortho
MTL-77	4/17/14	0.076		MG/L	Phosphorus, -ortho
MTL-77	6/12/14	0.069		MG/L	Phosphorus, -ortho
MTL-77	8/12/14	0.010	<	MG/L	Phosphorus, -ortho
MTL-88	4/17/14	0.16		MG/L	Phosphorus, -ortho
MTL-9	4/17/14	0.076		MG/L	Phosphorus, -ortho
MTL-9	6/12/14	0.087		MG/L	Phosphorus, -ortho
MTL-9	8/12/14	0.010	<	MG/L	Phosphorus, -ortho
MTL-1	4/17/14	7.7		MG/L	Solids, Total Suspended
MTL-1	6/12/14	2.8		MG/L	Solids, Total Suspended
MTL-1	8/12/14	3.7		MG/L	Solids, Total Suspended
MTL-11	6/12/14	141		MG/L	Solids, Total Suspended
MTL-11	8/12/14	51.0		MG/L	Solids, Total Suspended
MTL-12	4/17/14	12.8		MG/L	Solids, Total Suspended
MTL-12	6/12/14	20.0		MG/L	Solids, Total Suspended
MTL-12	8/12/14	15.4		MG/L	Solids, Total Suspended
MTL-13	6/12/14	42.0		MG/L	Solids, Total Suspended
MTL-13	8/12/14	14.0		MG/L	Solids, Total Suspended
MTL-15	4/17/14	18.3		MG/L	Solids, Total Suspended
MTL-15	6/12/14	3.7		MG/L	Solids, Total Suspended
MTL-15	8/12/14	5.5		MG/L	Solids, Total Suspended
MTL-22	4/17/14	8.9		MG/L	Solids, Total Suspended
MTL-22	6/12/14	3.5		MG/L	Solids, Total Suspended
MTL-22	8/12/14	4.2		MG/L	Solids, Total Suspended
MTL-22-15	4/17/14	9.4		MG/L	Solids, Total Suspended
MTL-22-15	6/12/14	2.1		MG/L	Solids, Total Suspended
MTL-22-15	8/12/14	3.3		MG/L	Solids, Total Suspended
MTL-25	4/17/14	40.6		MG/L	Solids, Total Suspended
MTL-33	4/17/14	8.6		MG/L	Solids, Total Suspended
MTL-33	6/12/14	2.9		MG/L	Solids, Total Suspended
MTL-33	8/12/14	3.7		MG/L	Solids, Total Suspended
MTL-41	4/17/14	52.0		MG/L	Solids, Total Suspended
MTL-5	6/12/14	188		MG/L	Solids, Total Suspended
MTL-5	8/12/14	13.0		MG/L	Solids, Total Suspended
MTL-66	4/17/14	18.9		MG/L	Solids, Total Suspended
MTL-66	6/12/14	3.5		MG/L	Solids, Total Suspended
MTL-66	8/12/14	4.6		MG/L	Solids, Total Suspended
MTL-77	4/17/14	9.6		MG/L	Solids, Total Suspended
MTL-77	6/12/14	9.1		MG/L	Solids, Total Suspended
MTL-77	8/12/14	8.2		MG/L	Solids, Total Suspended
MTL-88	4/17/14	61.6		MG/L	Solids, Total Suspended
MTL-9	4/17/14	20.0		MG/L	Solids, Total Suspended
MTL-9	6/12/14	70.0		MG/L	Solids, Total Suspended
MTL-9	8/12/14	18.3		MG/L	Solids, Total Suspended
MTL-1	4/17/14	2.0		MG/L	Solids, Volatile Suspended
MTL-1	6/12/14	1.0	<	MG/L	Solids, Volatile Suspended
MTL-1	8/12/14	2.4		MG/L	Solids, Volatile Suspended
MTL-11	6/12/14	13.6		MG/L	Solids, Volatile Suspended
MTL-11	8/12/14	11.5		MG/L	Solids, Volatile Suspended
MTL-12	4/17/14	2.8		MG/L	Solids, Volatile Suspended
MTL-12	6/12/14	2.1		MG/L	Solids, Volatile Suspended

Site #	Collection Date	Reported Result	Flag	Units	Parameter
MTL-12	8/12/14	2.9		MG/L	Solids, Volatile Suspended
MTL-13	6/12/14	5.3		MG/L	Solids, Volatile Suspended
MTL-13	8/12/14	2.9		MG/L	Solids, Volatile Suspended
MTL-15	4/17/14	2.6		MG/L	Solids, Volatile Suspended
MTL-15	6/12/14	1.0	<	MG/L	Solids, Volatile Suspended
MTL-15	8/12/14	2.2		MG/L	Solids, Volatile Suspended
MTL-22	4/17/14	1.8		MG/L	Solids, Volatile Suspended
MTL-22	6/12/14	1.2		MG/L	Solids, Volatile Suspended
MTL-22	8/12/14	2.2		MG/L	Solids, Volatile Suspended
MTL-22-15	4/17/14	1.9		MG/L	Solids, Volatile Suspended
MTL-22-15	6/12/14	1.0	<	MG/L	Solids, Volatile Suspended
MTL-22-15	8/12/14	1.8	<	MG/L	Solids, Volatile Suspended
MTL-25	4/17/14	5.4		MG/L	Solids, Volatile Suspended
MTL-33	4/17/14	1.5		MG/L	Solids, Volatile Suspended
MTL-33	6/12/14	1.9		MG/L	Solids, Volatile Suspended
MTL-33	8/12/14	1.9		MG/L	Solids, Volatile Suspended
MTL-41	4/17/14	12.0		MG/L	Solids, Volatile Suspended
MTL-5	6/12/14	22.2		MG/L	Solids, Volatile Suspended
MTL-5	8/12/14	2.8		MG/L	Solids, Volatile Suspended
MTL-66	4/17/14	2.2		MG/L	Solids, Volatile Suspended
MTL-66	6/12/14	1.0	<	MG/L	Solids, Volatile Suspended
MTL-66	8/12/14	1.9		MG/L	Solids, Volatile Suspended
MTL-77	4/17/14	1.3		MG/L	Solids, Volatile Suspended
MTL-77	6/12/14	1.0		MG/L	Solids, Volatile Suspended
MTL-77	8/12/14	2.8		MG/L	Solids, Volatile Suspended
MTL-88	4/17/14	8.4		MG/L	Solids, Volatile Suspended
MTL-9	4/17/14	5.1		MG/L	Solids, Volatile Suspended
MTL-9	6/12/14	8.7		MG/L	Solids, Volatile Suspended
MTL-9	8/12/14	4.3		MG/L	Solids, Volatile Suspended
MTL-1	4/17/14	5.8		MG/L	Total Organic Carbon
MTL-1	6/12/14	5.8		MG/L	Total Organic Carbon
MTL-1	8/12/14	5.4		MG/L	Total Organic Carbon
MTL-11	6/12/14	8.6		MG/L	Total Organic Carbon
MTL-11	8/12/14	7.2		MG/L	Total Organic Carbon
MTL-12	4/17/14	5.4		MG/L	Total Organic Carbon
MTL-12	6/12/14	5.4		MG/L	Total Organic Carbon
MTL-12	8/12/14	5.7		MG/L	Total Organic Carbon
MTL-13	6/12/14	7.5		MG/L	Total Organic Carbon
MTL-13	8/12/14	8.0		MG/L	Total Organic Carbon
MTL-15	4/17/14	6.8		MG/L	Total Organic Carbon
MTL-15	6/12/14	6.3		MG/L	Total Organic Carbon
MTL-15	8/12/14	5.9		MG/L	Total Organic Carbon
MTL-22	4/17/14	5.4		MG/L	Total Organic Carbon
MTL-22	6/12/14	5.8		MG/L	Total Organic Carbon
MTL-22	8/12/14	5.7		MG/L	Total Organic Carbon
MTL-22-15	4/17/14	5.2		MG/L	Total Organic Carbon
MTL-22-15	6/12/14	7.0		MG/L	Total Organic Carbon
MTL-22-15	8/12/14	5.7		MG/L	Total Organic Carbon
MTL-25	4/17/14	7.0		MG/L	Total Organic Carbon
MTL-33	4/17/14	5.4		MG/L	Total Organic Carbon
MTL-33	6/12/14	5.8		MG/L	Total Organic Carbon
MTL-33	8/12/14	5.7		MG/L	Total Organic Carbon
MTL-41	4/17/14	6.7		MG/L	Total Organic Carbon

Site #	Collection Date	Reported Result	Flag	Units	Parameter
MTL-5	8/12/14	6.7		MG/L	Total Organic Carbon
MTL-66	4/17/14	6.8		MG/L	Total Organic Carbon
MTL-66	6/12/14	6.4		MG/L	Total Organic Carbon
MTL-66	8/12/14	5.9		MG/L	Total Organic Carbon
MTL-77	4/17/14	6.0		MG/L	Total Organic Carbon
MTL-77	6/12/14	6.5		MG/L	Total Organic Carbon
MTL-77	8/12/14	5.7		MG/L	Total Organic Carbon
MTL-88	4/17/14	7.6		MG/L	Total Organic Carbon
MTL-9	4/17/14	7.3		MG/L	Total Organic Carbon
MTL-9	6/12/14	1.0	<	MG/L	Total Organic Carbon
MTL-9	8/12/14	6.0		MG/L	Total Organic Carbon
MTL-1	4/17/14	0.20	<	UG/L	Trifluralin
MTL-1	6/12/14	0.22	<	UG/L	Trifluralin
MTL-1	8/12/14	0.20	<	UG/L	Trifluralin
MTL-11	6/12/14	0.22	<	UG/L	Trifluralin
MTL-11	8/12/14	0.20	<	UG/L	Trifluralin
MTL-12	4/17/14	0.20	<	UG/L	Trifluralin
MTL-12	6/12/14	0.22	<	UG/L	Trifluralin
MTL-12	8/12/14	0.20	<	UG/L	Trifluralin
MTL-13	6/12/14	0.22	<	UG/L	Trifluralin
MTL-13	8/12/14	0.20	<	UG/L	Trifluralin
MTL-15	4/17/14	0.20	<	UG/L	Trifluralin
MTL-15	6/12/14	0.20	<	UG/L	Trifluralin
MTL-15	8/12/14	0.20	<	UG/L	Trifluralin
MTL-22	4/17/14	0.20	<	UG/L	Trifluralin
MTL-22	6/12/14	0.20	<	UG/L	Trifluralin
MTL-22	8/12/14	0.22	<	UG/L	Trifluralin
MTL-25	4/17/14	0.22	<	UG/L	Trifluralin
MTL-33	4/17/14	0.20	<	UG/L	Trifluralin
MTL-33	6/12/14	0.20	<	UG/L	Trifluralin
MTL-33	8/12/14	0.20	<	UG/L	Trifluralin
MTL-41	4/17/14	0.22	<	UG/L	Trifluralin
MTL-5	6/12/14	0.20	<	UG/L	Trifluralin
MTL-5	8/12/14	0.20	<	UG/L	Trifluralin
MTL-66	4/17/14	0.20	<	UG/L	Trifluralin
MTL-66	6/12/14	0.20	<	UG/L	Trifluralin
MTL-66	8/12/14	0.20	<	UG/L	Trifluralin
MTL-77	4/17/14	0.20	<	UG/L	Trifluralin
MTL-77	6/12/14	0.20	<	UG/L	Trifluralin
MTL-77	8/12/14	0.20	<	UG/L	Trifluralin
MTL-88	4/17/14	0.22	<	UG/L	Trifluralin
MTL-9	4/17/14	0.20	<	UG/L	Trifluralin
MTL-9	6/12/14	0.20	<	UG/L	Trifluralin
MTL-9	8/12/14	0.22	<	UG/L	Trifluralin

U Analyte was not detected
J Estimated value between Method Detection Limit (MDL) and Practical Quantitation Limit (PQL)

FIELD DATA

Site	Date	Depth	Water Temp (oC)	Redox (mv)	Cond (uS)	DO %	DO mg/l	pH	Time	Seechi (in)
1	4/17/14	0.7	10.92	486	193	118.3	12.74	8.89	1115	
1	6/12/14	2.1	20.28	383	200	99.7	7.5	6.92	1057	
1	8/12/14	2.3	25.52	352	196.8	118.4	9.75	8.59	1235	
88	4/17/14	0.5	11.73	481	173.5	80.4*	8.95*	8.2	1230	
5	6/12/14	2.1	19.49	369	179.5	98.9	7.6	6.77	1321	
5	8/12/14	0.4	28.52	327	257	122.7	9.91	8.37	1558	
9	4/17/14	0.5	12.26	482	394			8.71	1321	
9	6/12/14	2	20.39	387	233.1	86.2	6.46	6.52	1223	
9	8/12/14	0.4	25.53	312	347	120.9	9.92	8.36	1445	
25	4/17/14	0.7	11.88	492	189			7.7	1400	
11	6/12/14	2.2	20.55	397	233.3	100.5	7.51	6.66	1149	
11	8/12/14	0.5	25.49	235	238.1	112.3	9.28	8.59	1235	
12	4/17/14	0.5	11.3	521	199.3	106.8	11.66	8.67	950	
12	6/12/14	2	21	379	216.2	99.3	7.41	6.71	1027	
12	8/12/14	2.2	25.4	354	201.7	78.6	6.44	7.85	1138	
41	4/17/14	0.7	12.44	471	376	114*	11.8	9.27	1255	
13	6/12/14	2.2	20.97	309	417	88.3	6.48	7.38	1247	
13	8/12/14	0.5	26.95	337	238.1	104.3	8.41	8.12	1525	
MTL-22	4/17/14	0.5	10.11	394	185	101.2	11.78	7.77	1222	24
22	4/17/14	1.5	9.94	396	185	104.9	11.68	7.74		
22	4/17/14	2.5	9.97	401	186	104.9	11.6	7.77		
22	4/17/14	3.5	9.91	402	185	104.7	11.6	7.77		
22	4/17/14	4.5	9.71	403	185	102.3	11.4	7.71		
22	4/17/14	5.5	9.9	404	185	104.3	11.53	7.79		
22	4/17/14	6.5	9.86	404	185	105.1	11.73	7.77		
22	4/17/14	7.5	9.82	405	185	104.3	11.55	7.74		
22	4/17/14	8.5	9.6	408	185	101.1	11.32	7.68		
22	4/17/14	9.5	9.59	408	185	100.4	11.29	7.68		

Site	Date	Depth	Water Temp (oC)	Redox (mv)	Cond (uS)	DO %	DO mg/l	pH	Time	Seechi (in)
MTL-22	6/12/14	0.5	22.14	386	193	89.4	7.75	7.62	1157	33
22	6/12/14	1	22.14	385	193	89	7.72	7.62		
22	6/12/14	2	22.1	385	193	87.7	7.62	7.56		
22	6/12/14	3	22.09	385	193	87.2	7.59	7.56		
22	6/12/14	4	22.07	384	193	86.4	7.51	7.56		
22	6/12/14	5	21.94	385	193	85.1	7.31	7.52		
22	6/12/14	6	20.63	392	193	70.3	6.2	7.28		
22	6/12/14	7	19.54	397	191	54.8	5.06	7.14		
22	6/12/14	8	17.12	399	190	53.3	5.13	7.07		
22	6/12/14	9	16.52	401	189	53.1	5.15	7.04		
22	6/12/14	10	15.28	403	188	49.4	4.93	6.99		
22	6/12/14	11	14.71	404	189	47.7	7.81	6.96		
22	6/12/14	12	13.73	406	187	47.5	4.93	6.9		
22	6/12/14	13	12.59	407	186	46.3	4.87	6.88		
22	6/12/14	14	11.8	408	186	42	4.53	6.85		
22	6/12/14	15	10.93	409	187	39.1	4.2	6.82		
MTL-22	8/12/14	2	25.13	355	194.9	92.6	7.63	8.8	1358	48
22	8/12/14	3	25.04	355	193.9	91.6	7.55	8.76	1359	
22	8/12/14	4	24.87	357	194.6	88.6	7.36	8.71	1400	
22	8/12/14	5	24.63	362	193.8	81.2	6.75	8.55	1401	
22	8/12/14	6	24.59	364	193.1	79.5	6.59	8.5	1402	
22	8/12/14	7	24.55	366	193.2	76.8	6.39	8.46	1403	
22	8/12/14	8	24.53	367	192.8	75.8	6.31	8.43	1404	
22	8/12/14	9	24.37	369	193.3	73.4	6.1	8.4	1405	
22	8/12/14	10	20.4	380	182.6	0	0	8.14	1406	
22	8/12/14	11	16.35	388	197.9	0	0	8.26	1407	
22	8/12/14	12	14.01	388	197.7	0	0	8.43	1408	
MTL-33	4/17/14	0.6	9.89	372	185	101.8	11.3	7.67	1150	18
33	4/17/14	1.6	9.71	382	185	100.6	11.28	7.62		
33	4/17/14	2.6	9.61	387	185	99	11.12	7.66		

Site	Date	Depth	Water Temp (oC)	Redox (mv)	Cond (uS)	DO %	DO mg/l	pH	Time	Seechi (in)
33	4/17/14	3.6	9.58	389	185	98	11.01	7.65		
33	4/17/14	4.6	9.55	395	185	97.3	10.95	7.62		
33	4/17/14	5.6	9.54	397	185	97.2	10.96	7.61		
33	4/17/14	6.6	9.43	399	185	96.7	10.91	7.61		
33	4/17/14	7.6	9.41	402	185.6	96.1	10.88	7.59		
33	4/17/14	8.6	9.36	403	184.8	96.1	10.87	7.59		
33	4/17/14	9.6	9.11	405	185.4	93.3	10.59	7.54		
MTL-33	6/12/14	0.5	22.55	350	193	91.9	7.9	7.69	1135	34
33	6/12/14	1	22.56	350	193	91.6	7.91	7.71		
33	6/12/14	2	22.57	351	193	91.7	7.89	7.7		
33	6/12/14	3	22.35	356	193	85.7	7.42	7.57		
33	6/12/14	4	22.3	358	192	84.2	7.3	7.55		
33	6/12/14	5	22.27	358	192	85.2	7.39	7.57		
33	6/12/14	6	22.16	358	192	85.5	7.43	7.57		
33	6/12/14	7	19.96	371	190	51.7	4.65	7.18		
33	6/12/14	8	17.69	377	190	45.7	4.3	7.06		
33	6/12/14	9	16.44	379	189	46.6	4.5	7.03		
33	6/12/14	10	15.53	381	189	45.5	4.49	7		
33	6/12/14	11	14.82	383	190	43.7	4.35	6.96		
33	6/12/14	12	13.78	384	190	42.7	4.42	6.95		
33	6/12/14	13	12.65	386	191	42	4.4	6.92		
33	6/12/14	14	11.54	388	189	42	4.54	6.87		
33	6/12/14	15	10.78	390	190	35.6	3.9	6.83		
MTL-33	8/12/14	2.6	25.03	351	194.1	89.1	7.35	8.21	1314	48
33	8/12/14	3.6	25.01	354	194.3	88.2	7.26	8.21	1316	
33	8/12/14	4.6	24.93	355	194.7	87.2	7.21	8.68	1317	
33	8/12/14	5.6	24.92	357	195	87.2	7.2	8.7	1318	
33	8/12/14	6.6	24.89	359	194.6	86.6	7.16	8.67	1319	
33	8/12/14	7.6	24.77	361	194.5	83.5	6.93	8.6	1320	
33	8/12/14	8.6	24.73	363	193.3	82.5	6.86	8.58	1321	

Site	Date	Depth	Water Temp (oC)	Redox (mv)	Cond (uS)	DO %	DO mg/l	pH	Time	Seechi (in)
33	8/12/14	9.6	24.63	369	192.2	70.9	5.86	8.32	1322	
33	8/12/14	10.6	24.45	379	184.7	12.2	0.77	7.93	1323	
33	8/12/14	11.6	11.6	393	193.1	0	0	8.34	1324	
33	8/12/14	12.6	12.8	384	201.4	0	0	8.73	1325	
MTL-66	4/17/14	0.7	10.32	403	180	81.1	8.88	7.23	1327	7
66	4/17/14	1.7	10.2	406	180	81	8.9	7.23		
66	4/17/14	2.7	10.17	407	180	80.8	8.92	7.23		
66	4/17/14	3.7	10.14	408	180	81.2	9.02	7.23		
66	4/17/14	4.7	10.11	409	180	81.2	9	7.22		
66	4/17/14	5.7	10.13	409	180	80.9	8.96	7.25		
66	4/17/14	6.7	10.1	410	179	80.6	8.94	7.23		
66	4/17/14	7.7	10.08	411	180	80.2	8.9	7.23		
66	4/17/14	8.7	10.05	412	181	80.4	8.97	7.24		
66	4/17/14	9.7	9.95	413	185	81.4	9.3	7.26		
MTL-66	6/12/14	0.3	22.55	455	200	82.5	7	7.44	1306	16
66	6/12/14	1	22.52	452	201	78.5	6.74	7.43		
66	6/12/14	2	22.5	449	201	78.4	6.76	7.41		
66	6/12/14	3	22.49	445	201	78.2	6.75	7.41		
66	6/12/14	4	22.41	444	201	77.2	6.67	7.39		
66	6/12/14	5	22.3	443	199	76.4	6.61	7.37		
66	6/12/14	6	22.23	442	198	75.5	6.5	7.35		
66	6/12/14	7	22	444	198	72.5	6.09	7.29		
66	6/12/14	8	17.3	453	200	5.5	0.75	6.93		
66	6/12/14	9	16.63	456	200	12.6	1.29	6.87		
66	6/12/14	10	14.82	458	198	0	0	6.84		
66	6/12/14	11	14.25	459	198	0	0	6.81		
66	6/12/14	12	12.68	460	195	0	0	6.75		
66	6/12/14	13	11.83	385	195	0	0	6.77		
MTL-66	8/12/14	2.2	26.23	345	195.1	96.7	7.85	8.63	1511	35
66	8/12/14	3.2	25.29	353	195.5	76.6	6.17	8.28	1512	

Site	Date	Depth	Water Temp (oC)	Redox (mv)	Cond (uS)	DO %	DO mg/l	pH	Time	Seechi (in)
66	8/12/14	4.2	25.18	358	195.6	73.4	5.99	8.22	1513	
66	8/12/14	5.2	25.14	361	195.6	68.5	5.59	8.14	1514	
66	8/12/14	6.2	25.11	365	195.7	69.2	5.33	8.09	1515	
66	8/12/14	7.2	25.03	368	195.1	61.1	5.01	8.04	1516	
66	8/12/14	8.2	25.01	370	194.38	55.5	4.47	7.98	1517	
66	8/12/14	9.2	21.26	372	204.2	0	0	7.84	1518	
66	8/12/14	10.2	17.22	351	215.6	0	0	8.13	1519	
MTL-77	4/17/14	0.6	10.28	375	180	94.1	10.4	7.25	1311	15
77	4/17/14	1.6	9.91	381	181	92.3	10.31	7.33		
77	4/17/14	2.6	9.6	984	181	91.3	10.24	7.35		
77	4/17/14	3.6	9.6	387	181	90.7	10.23	7.37		
77	4/17/14	4.6	9.57	389	180	90.9	10.21	7.39		
77	4/17/14	5.6	9.59	390	181	91	10.23	7.38		
77	4/17/14	6.6	9.58	390	181	90.8	10.21	7.39		
77	4/17/14	7.6	9.58	391	181.2	90.8	10.21	7.4		
77	4/17/14	8.6	9.57	392	181.3	90.7	10.21	7.38		
77	4/17/14	9.6	9.33	393	182	89.9	10.09	7.35		
MTL-77	6/12/14	0.6	22.31	433	175	65.9	5.54	7.28	1238	4
77	6/12/14	1	22.32	435	175	59.9	5.18	7.17		
77	6/12/14	2	22.32	435	175	59.9	5.18	7.12		
77	6/12/14	3	22.31	433	175	59.8	8.17	7.11		
77	6/12/14	4	21.95	434	178	57.4	4.93	7.08		
77	6/12/14	5	21.34	434	185	53.3	4.64	7.06		
77	6/12/14	6	20.29	435	192	43.5	4.87	6.99		
77	6/12/14	7	18.98	437	191	10.6	1.01	6.89		
77	6/12/14	8	17.01	437	195	27.8	3.29	6.89		
77	6/12/14	9	16.14	437	195	15.1	0.87	6.86		
77	6/12/14	10	15.53	439	195	9.1	1.09	6.81		
77	6/12/14	11	14.41	440	194	0	0	6.78		
77	6/12/14	12	13.55	440	194	0	0	6.77		

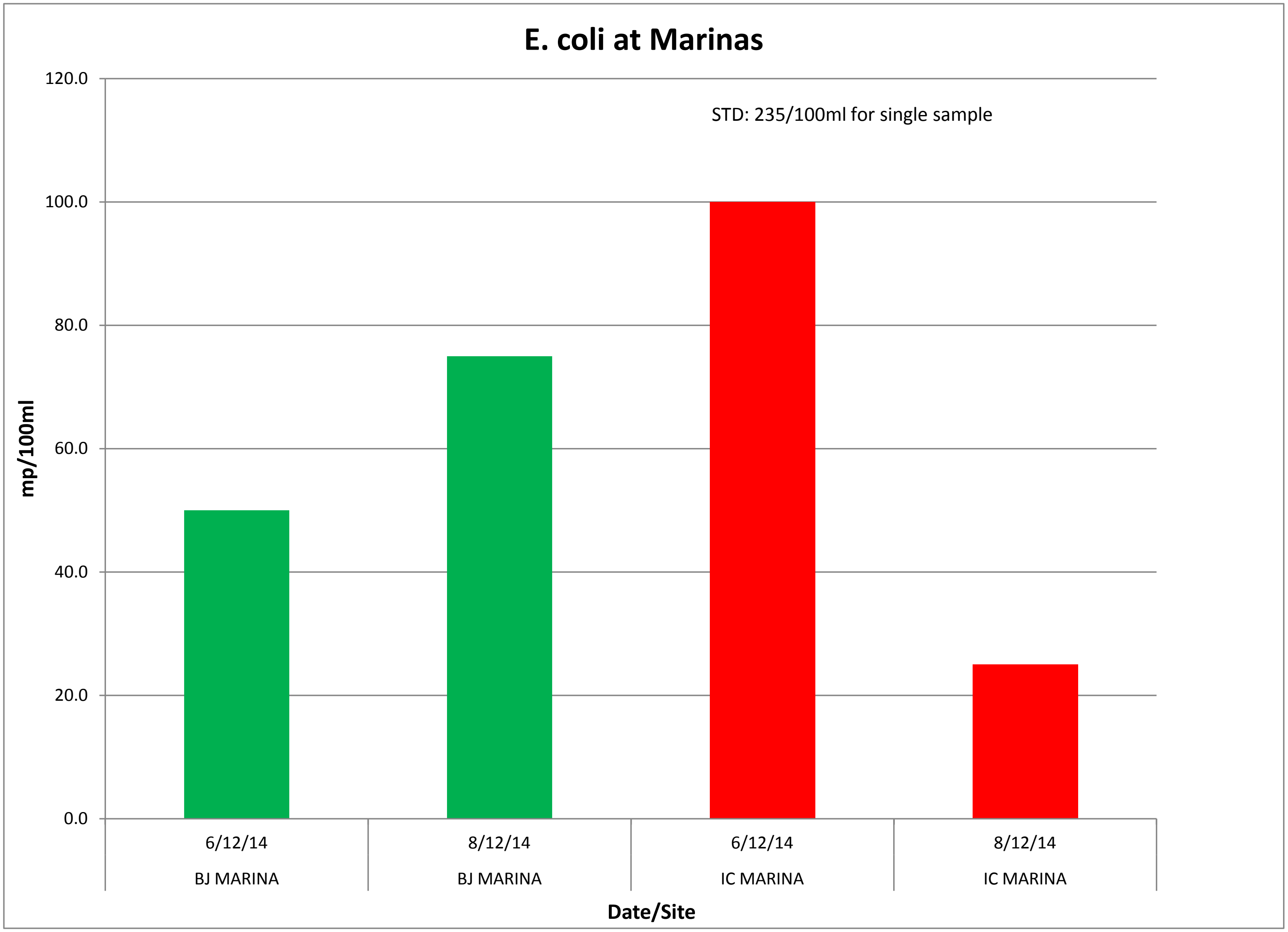
Site	Date	Depth	Water Temp (oC)	Redox (mv)	Cond (uS)	DO %	DO mg/l	pH	Time	Seechi (in)
77	6/12/14	13	12.74	441	194	0	0	6.75		
MTL-77	8/12/14	2.4	25.93	366	195.1	107.3	8.75	8.91	1455	24
77	8/12/14	3.4	25.83	364	195.5	107.3	8.72	8.91	1456	
77	8/12/14	4.4	25.58	373	196.2	86.4	7.11	8.47	1457	
77	8/12/14	5.4	25.02	378	196.7	78.9	6.31	8.32	1458	
77	8/12/14	6.4	24.79	384	196.4	66	5.48	8.14	1459	
77	8/12/14	7.4	24.45	389	196.7	47.5	3.96	8.01	1500	
77	8/12/14	8.4	22.09	401	200.3	0	0	7.8	1501	
77	8/12/14	9.4	19.07	394	206.4	0	0	7.91	1502	
77	8/12/14	10.4	16.59	381	205.2	0	0	8.06	1503	

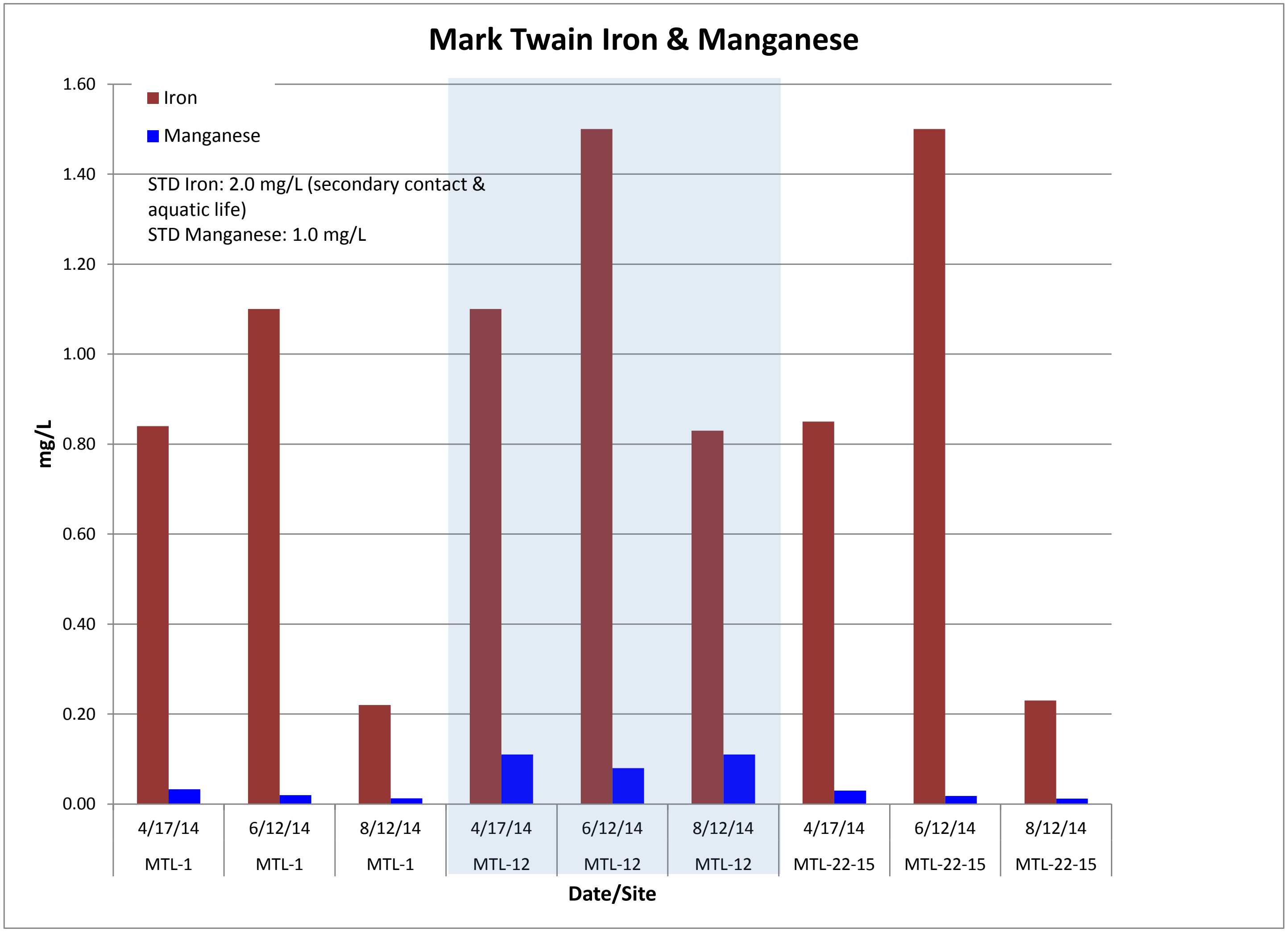
Marina Data

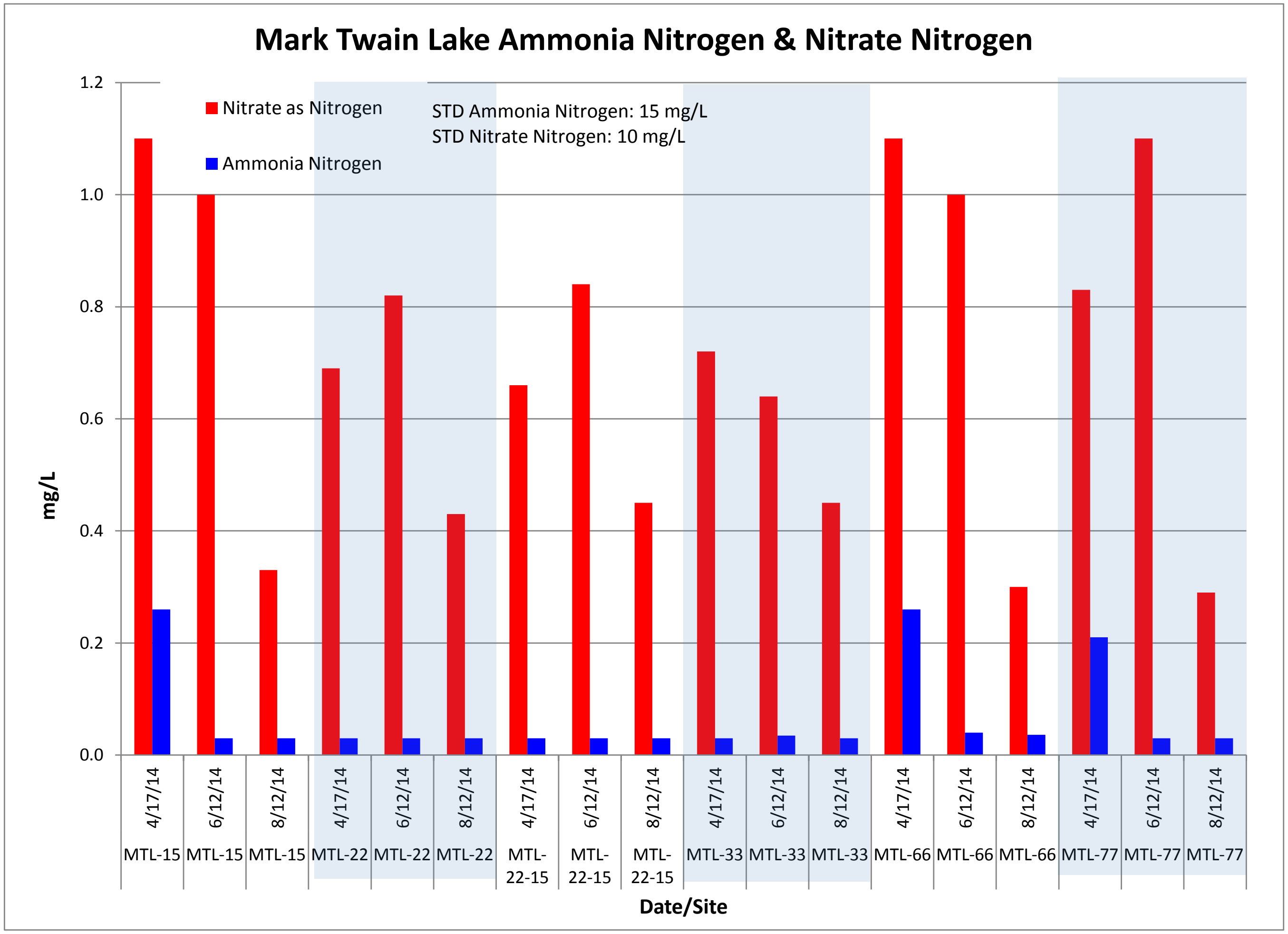
Marina	Date	Result	Qualifier	Units	Parameter
BJ MARINA	6/6/13	25.0		COL/100 ML	E. Coliform
BJ-MARINA	9/5/13	25.0	<	COL/100 ML	E. Coliform
IC MARINA	6/6/13	25.0		COL/100 ML	E. Coliform
IC-MARINA	9/5/13	25.0	<	COL/100 ML	E. Coliform

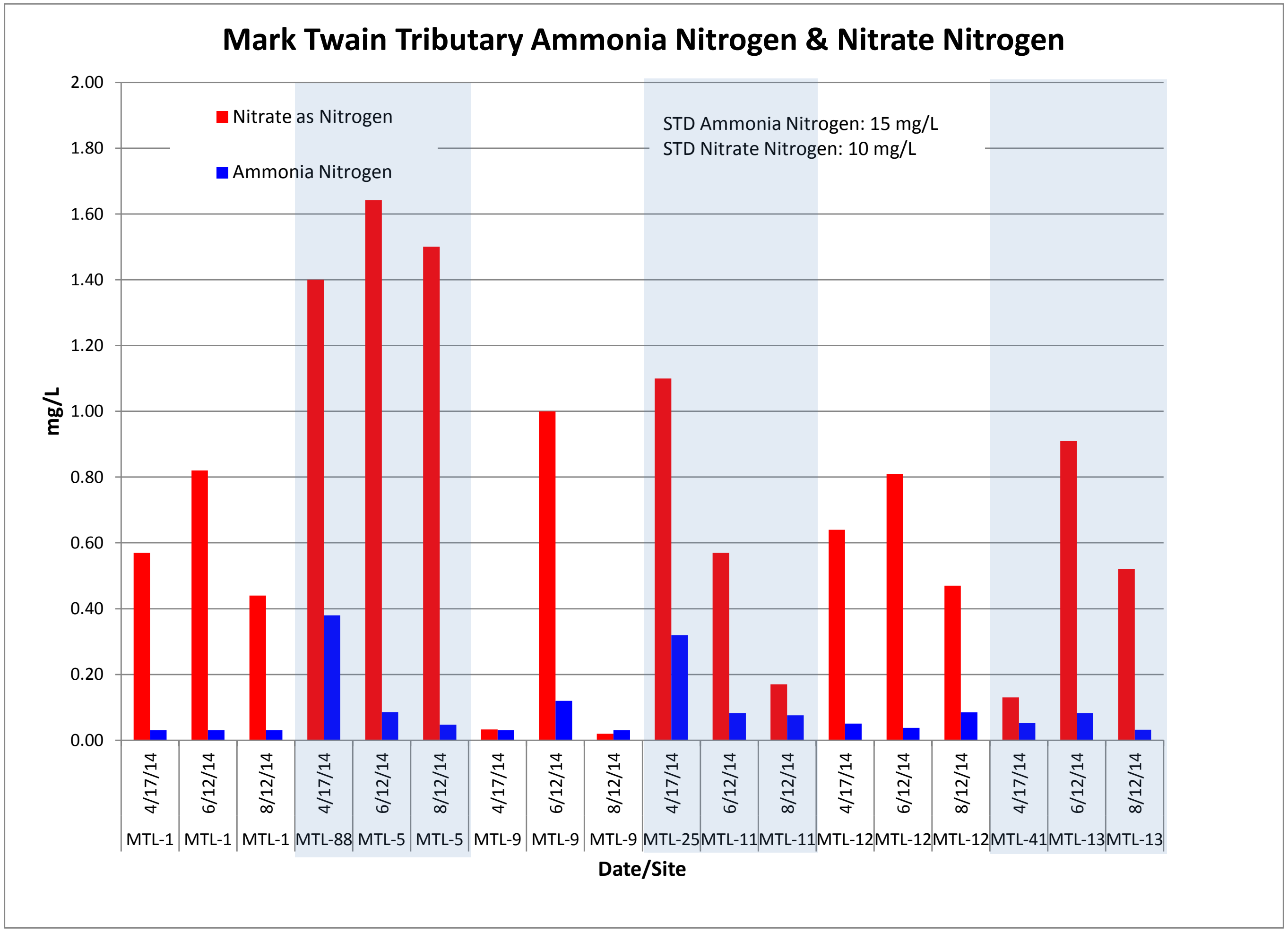
APPENDIX B

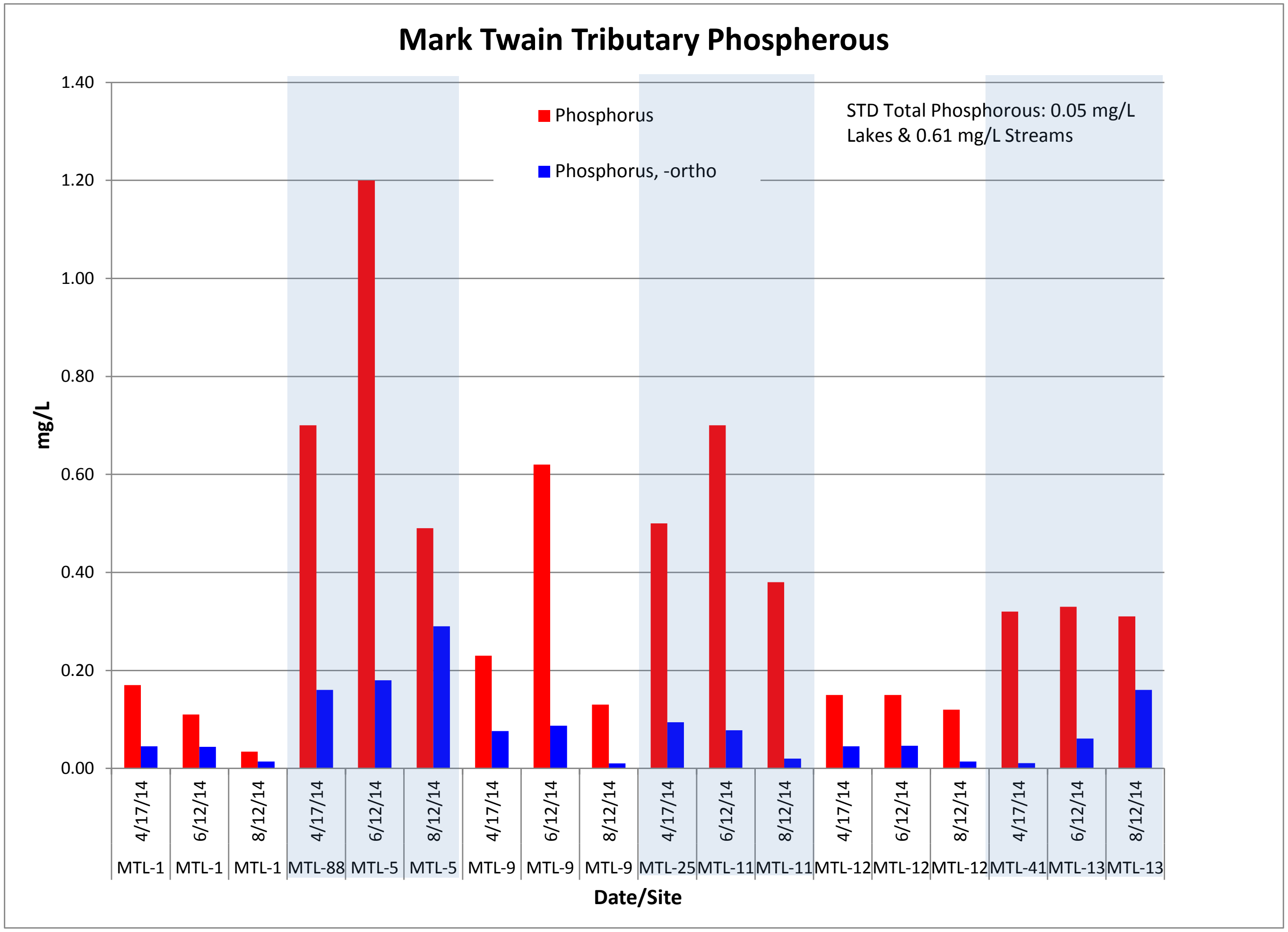
LAB DATA
GRAPHS


E. coli at Marinas
STD: 235/100ml for single sample
mp/100ml
120.0
100.0
80.0
60.0
40.0
20.0
0.0
6/12/14
BJ MARINA
8/12/14
BJ MARINA
6/12/14
IC MARINA
8/12/14
IC MARINA
Date/Site

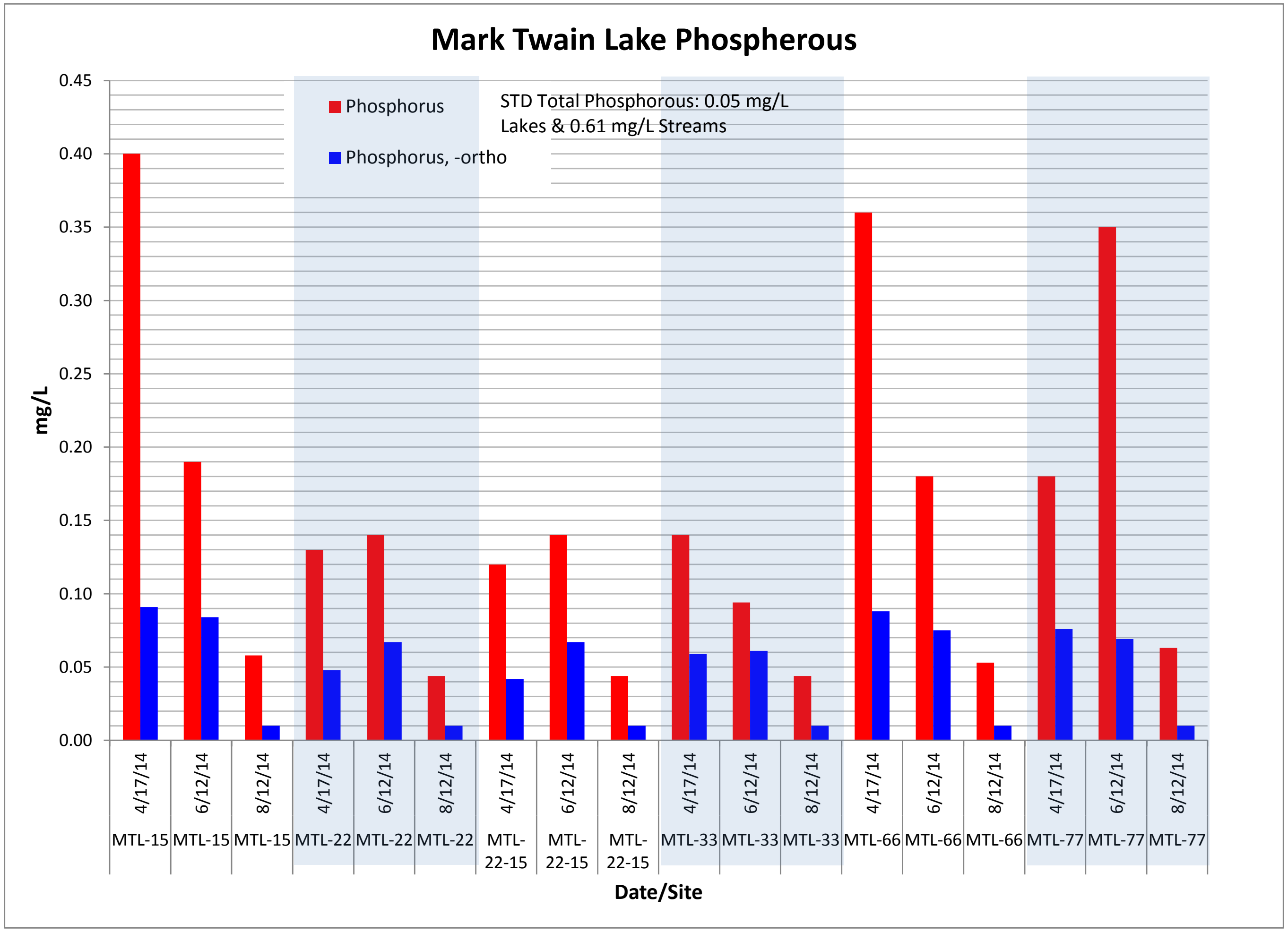

Mark Twain Iron & Manganese
Iron
Manganese
STD Iron: 2.0 mg/L (secondary contact & aquatic life)
STD Manganese: 1.0 mg/L
mg/L
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
4/17/14 MTL-1
6/12/14 MTL-1
8/12/14 MTL-1
4/17/14 MTL-12
6/12/14 MTL-12
8/12/14 MTL-12
4/17/14 MTL-22-15
6/12/14 MTL-22-15
8/12/14 MTL-22-15
Date/Site


Mark Twain Lake Ammonia Nitrogen & Nitrate Nitrogen
Nitrate as Nitrogen
Ammonia Nitrogen
STD Ammonia Nitrogen: 15 mg/L
STD Nitrate Nitrogen: 10 mg/L
mg/L
1.2
1.0
0.8
0.6
0.4
0.2
0.0
4/17/14 MTL-15
6/12/14 MTL-15
8/12/14 MTL-15
4/17/14 MTL-22
6/12/14 MTL-22
8/12/14 MTL-22
4/17/14 MTL-22-15
6/12/14 MTL-22-15
8/12/14 MTL-22-15
4/17/14 MTL-33
6/12/14 MTL-33
8/12/14 MTL-33
4/17/14 MTL-66
6/12/14 MTL-66
8/12/14 MTL-66
4/17/14 MTL-77
6/12/14 MTL-77
8/12/14 MTL-77
Date/Site

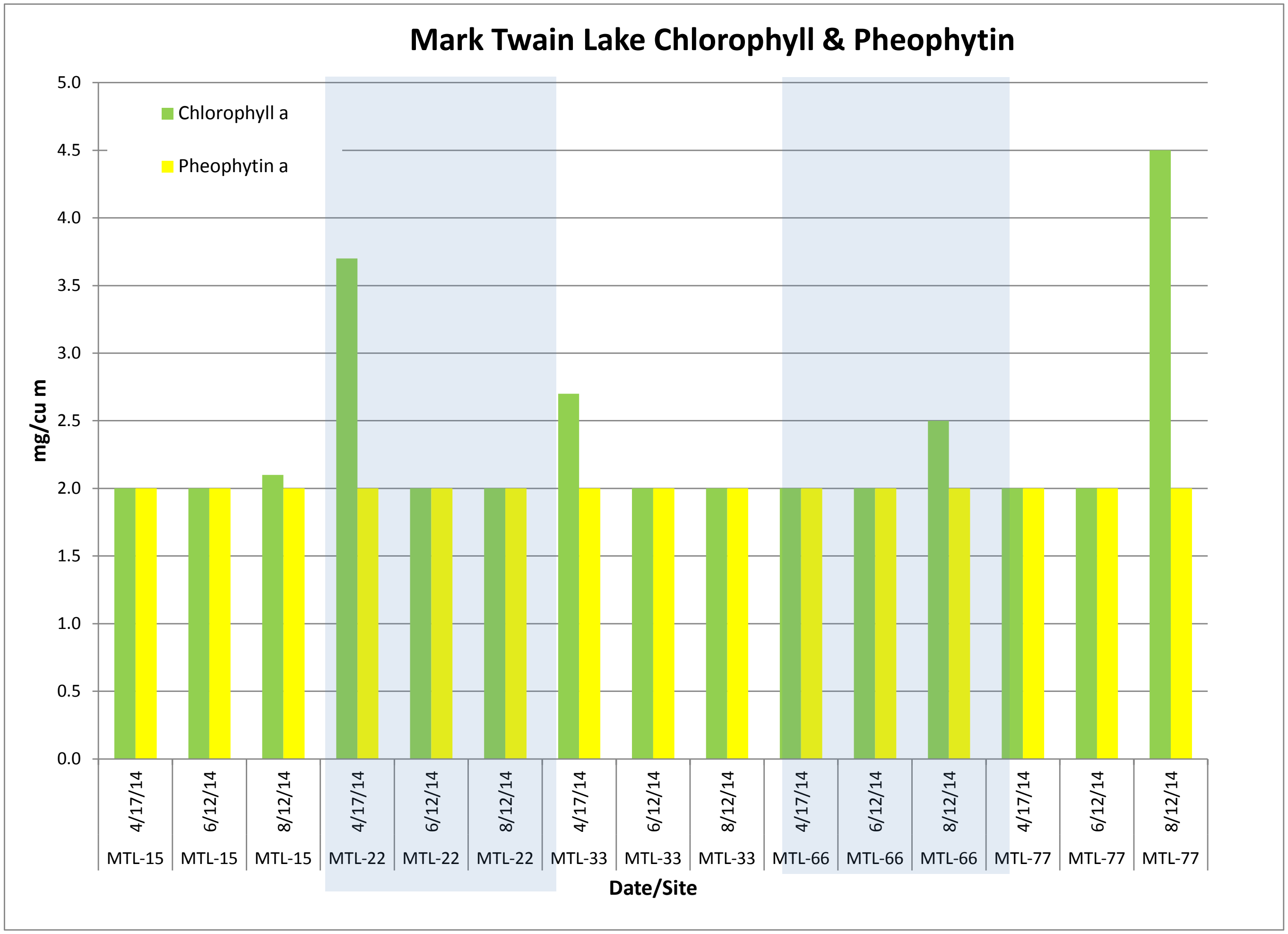

Mark Twain Tributary Ammonia Nitrogen & Nitrate Nitrogen
Nitrate as Nitrogen
Ammonia Nitrogen
STD Ammonia Nitrogen: 15 mg/L
STD Nitrate Nitrogen: 10 mg/L
mg/L
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
4/17/14 MTL-1
6/12/14 MTL-1
8/12/14 MTL-1
4/17/14 MTL-88
6/12/14 MTL-5
8/12/14 MTL-5
4/17/14 MTL-9
6/12/14 MTL-9
8/12/14 MTL-9
4/17/14 MTL-25
6/12/14 MTL-11
8/12/14 MTL-11
4/17/14 MTL-12
6/12/14 MTL-12
8/12/14 MTL-12
4/17/14 MTL-41
6/12/14 MTL-13
8/12/14 MTL-13
Date/Site



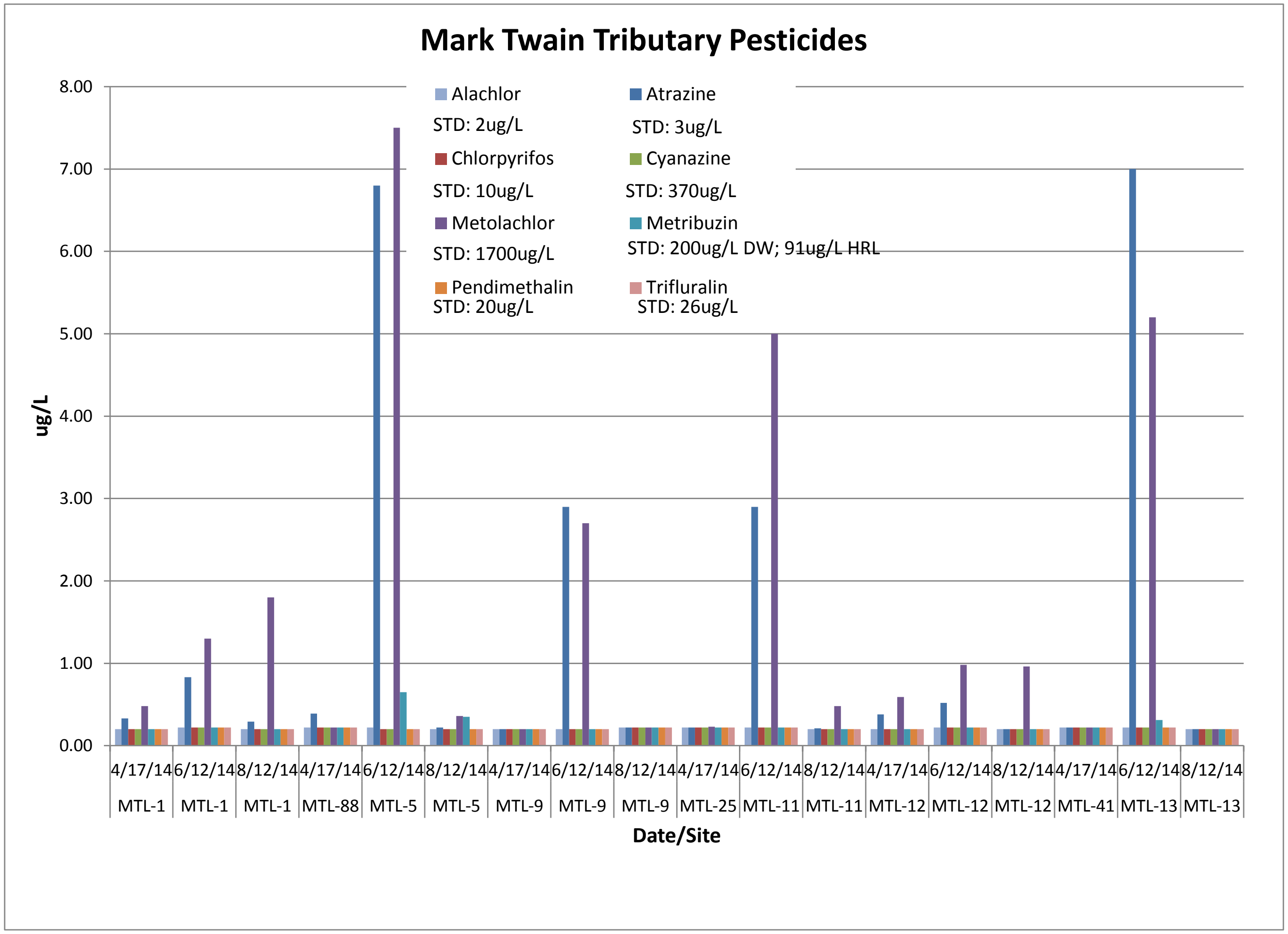
Mark Twain Tributary Phospherous
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
mg/L
Phosphorus
Phosphorus, -ortho
STD Total Phosphorous: 0.05 mg/L Lakes & 0.61 mg/L Streams
4/17/14 MTL-1
6/12/14 MTL-1
8/12/14 MTL-1
4/17/14 MTL-88
6/12/14 MTL-5
8/12/14 MTL-5
4/17/14 MTL-9
6/12/14 MTL-9
8/12/14 MTL-9
4/17/14 MTL-25
6/12/14 MTL-11
8/12/14 MTL-11
4/17/14 MTL-12
6/12/14 MTL-12
8/12/14 MTL-12
4/17/14 MTL-41
6/12/14 MTL-13
8/12/14 MTL-13
Date/Site

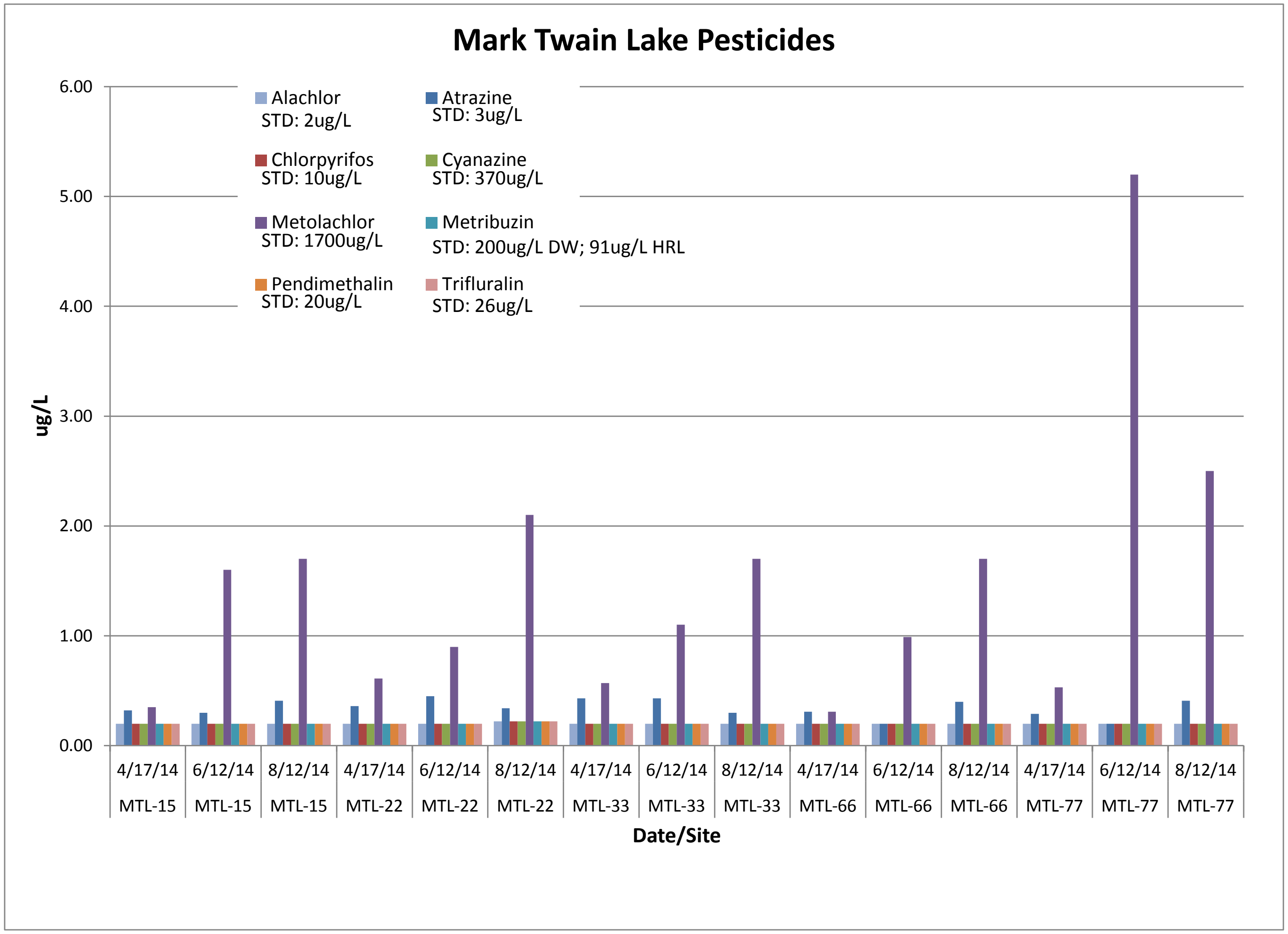


Mark Twain Lake Phospherous
Phosphorus
Phosphorus, -ortho
STD Total Phosphorous: 0.05 mg/L
Lakes & 0.61 mg/L Streams
mg/L
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
4/17/14
6/12/14
8/12/14
MTL-15
MTL-22
MTL-22-15
MTL-33
MTL-66
MTL-77
Date/Site

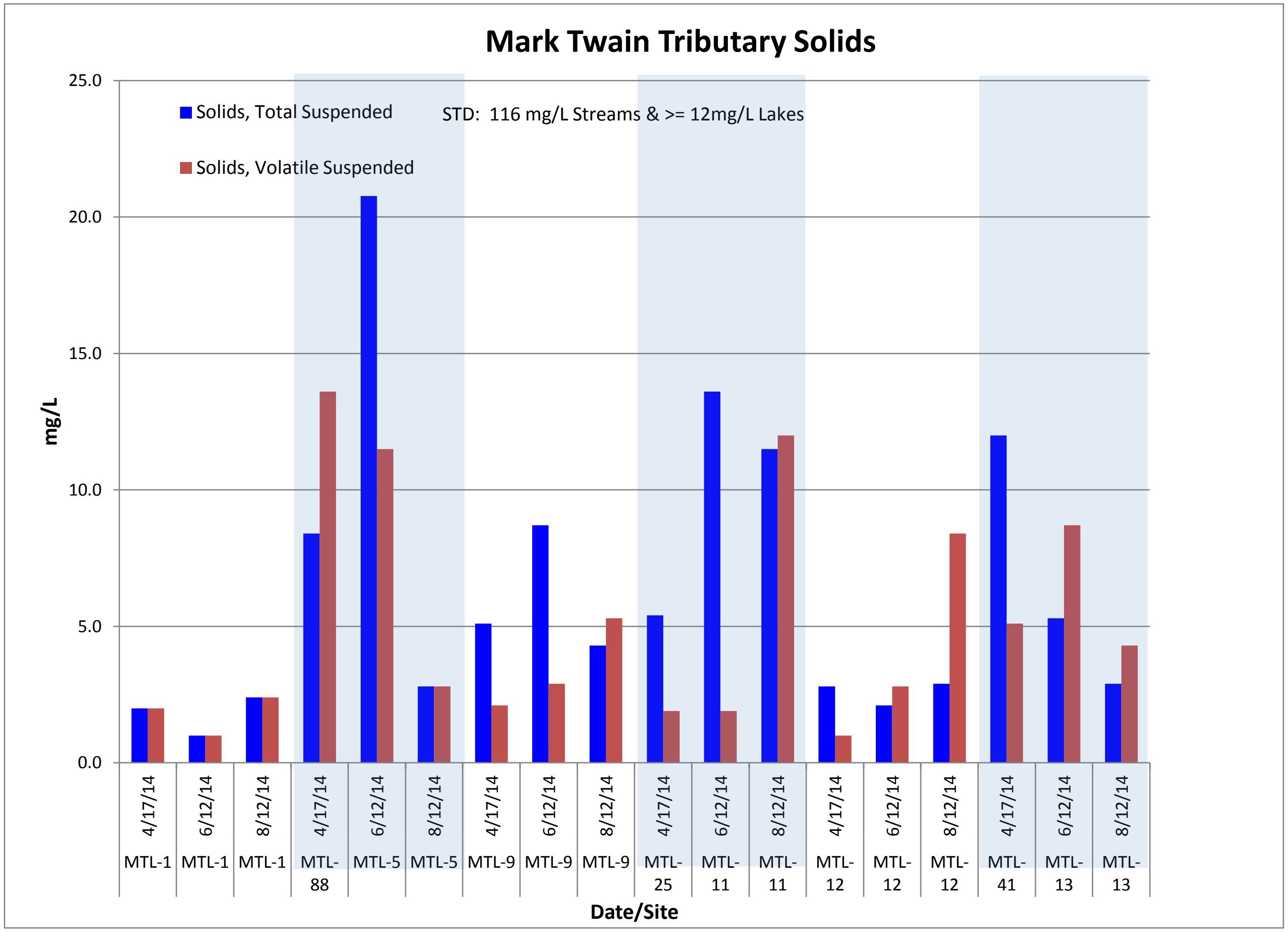


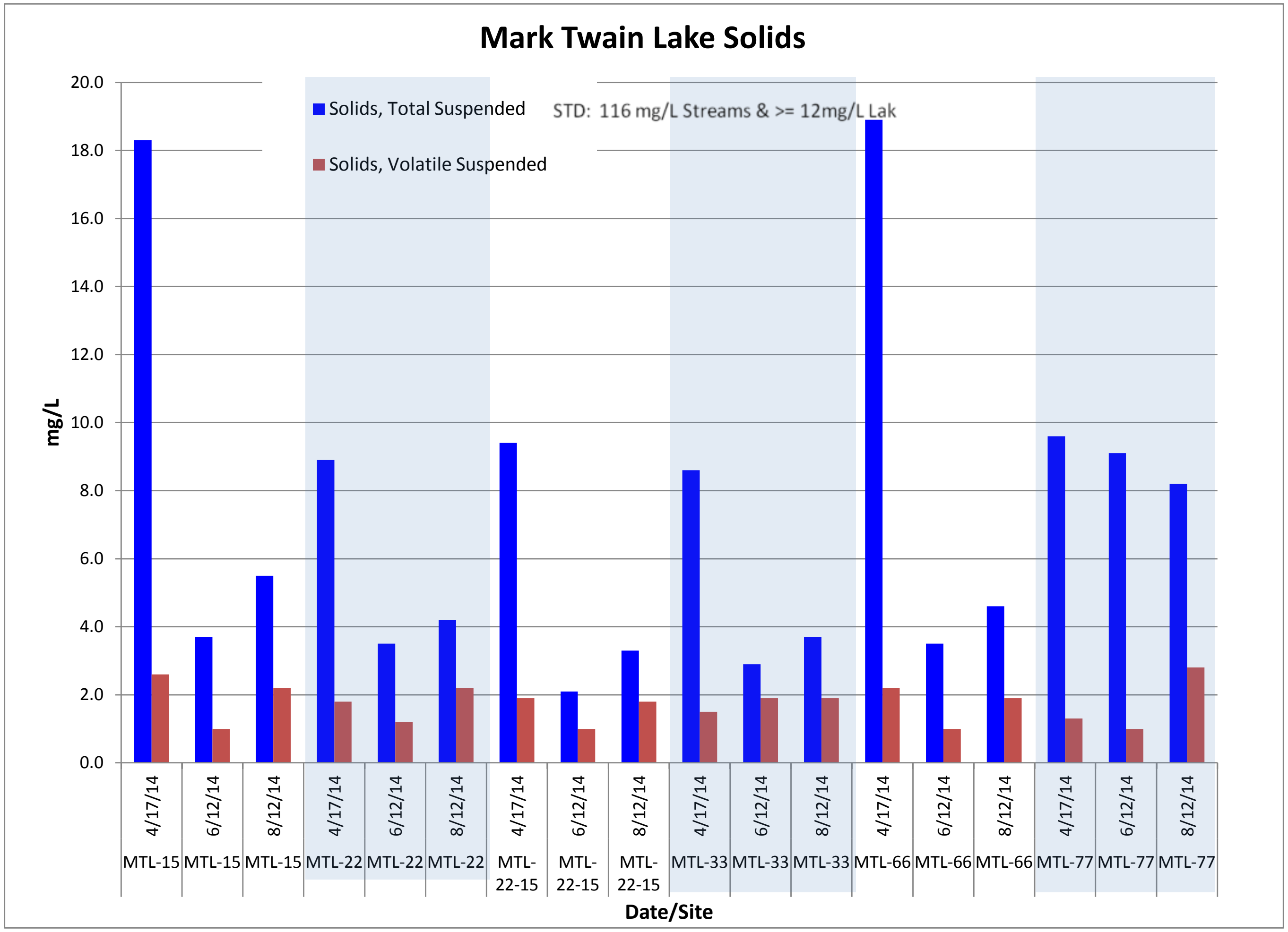
Mark Twain Lake Chlorophyll & Pheophytin
Chlorophyll a
Pheophytin a
mg/cu m
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
4/17/14
6/12/14
8/12/14
MTL-15
MTL-22
MTL-33
MTL-66
MTL-77
Date/Site

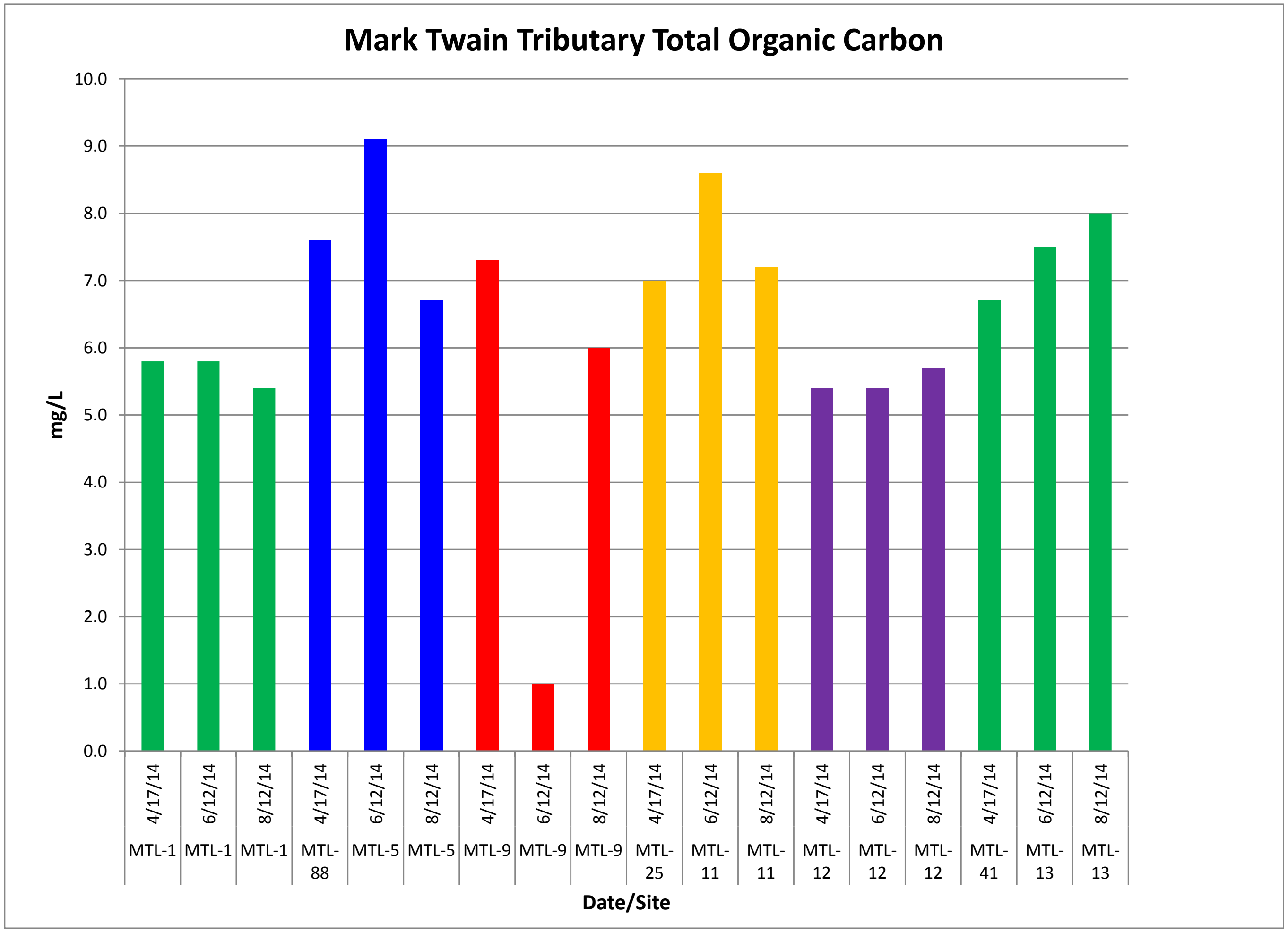

Mark Twain Tributary Pesticides
Alachlor
STD: 2ug/L
Atrazine
STD: 3ug/L
Chlorpyrifos
STD: 10ug/L
Cyanazine
STD: 370ug/L
Metolachlor
STD: 1700ug/L
Metribuzin
STD: 200ug/L DW; 91ug/L HRL
Pendimethalin
STD: 20ug/L
Trifluralin
STD: 26ug/L
ug/L
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
4/17/14 MTL-1
6/12/14 MTL-1
8/12/14 MTL-1
4/17/14 MTL-88
6/12/14 MTL-5
8/12/14 MTL-5
4/17/14 MTL-9
6/12/14 MTL-9
8/12/14 MTL-9
4/17/14 MTL-25
6/12/14 MTL-11
8/12/14 MTL-11
4/17/14 MTL-12
6/12/14 MTL-12
8/12/14 MTL-12
4/17/14 MTL-41
6/12/14 MTL-13
8/12/14 MTL-13
Date/Site

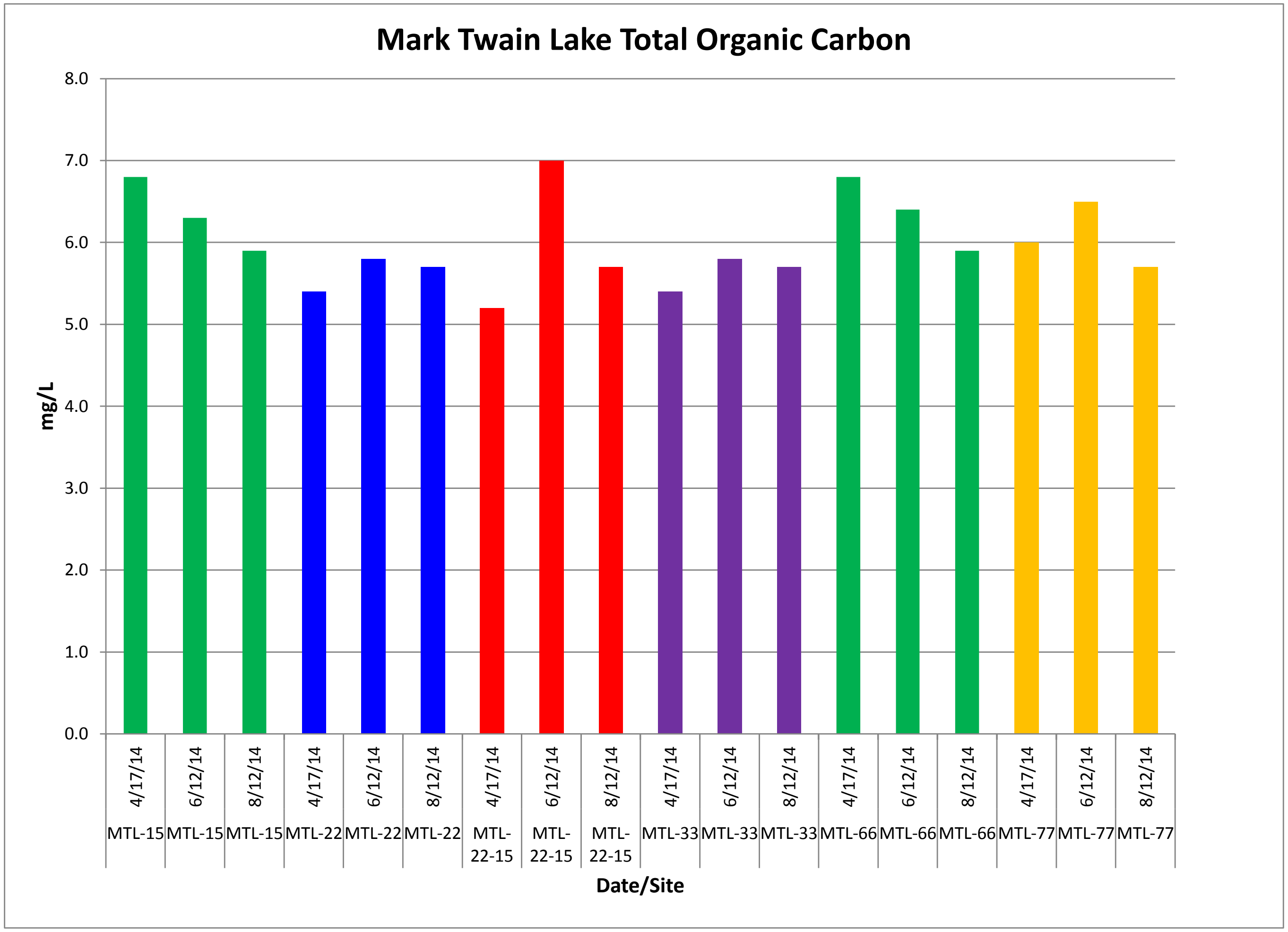


Mark Twain Lake Pesticides
Alachlor STD: 2ug/L
Atrazine STD: 3ug/L
Chlorpyrifos STD: 10ug/L
Cyanazine STD: 370ug/L
Metolachlor STD: 1700ug/L
Metribuzin STD: 200ug/L DW; 91ug/L HRL
Pendimethalin STD: 20ug/L
Trifluralin STD: 26ug/L
ug/L
6.00
5.00
4.00
3.00
2.00
1.00
0.00
4/17/14 MTL-15
6/12/14 MTL-15
8/12/14 MTL-15
4/17/14 MTL-22
6/12/14 MTL-22
8/12/14 MTL-22
4/17/14 MTL-33
6/12/14 MTL-33
8/12/14 MTL-33
4/17/14 MTL-66
6/12/14 MTL-66
8/12/14 MTL-66
4/17/14 MTL-77
6/12/14 MTL-77
8/12/14 MTL-77
Date/Site


Mark Twain Tributary Solids
Solids, Total Suspended
Solids, Volatile Suspended
STD: 116 mg/L Streams & >= 12mg/L Lakes
mg/L
25.0
20.0
15.0
10.0
5.0
0.0
4/17/14 MTL-1
6/12/14 MTL-1
8/12/14 MTL-1
4/17/14 MTL-88
6/12/14 MTL-5
8/12/14 MTL-5
4/17/14 MTL-9
6/12/14 MTL-9
8/12/14 MTL-9
4/17/14 MTL-25
6/12/14 MTL-11
8/12/14 MTL-11
4/17/14 MTL-12
6/12/14 MTL-12
8/12/14 MTL-12
4/17/14 MTL-41
6/12/14 MTL-13
8/12/14 MTL-13
Date/Site

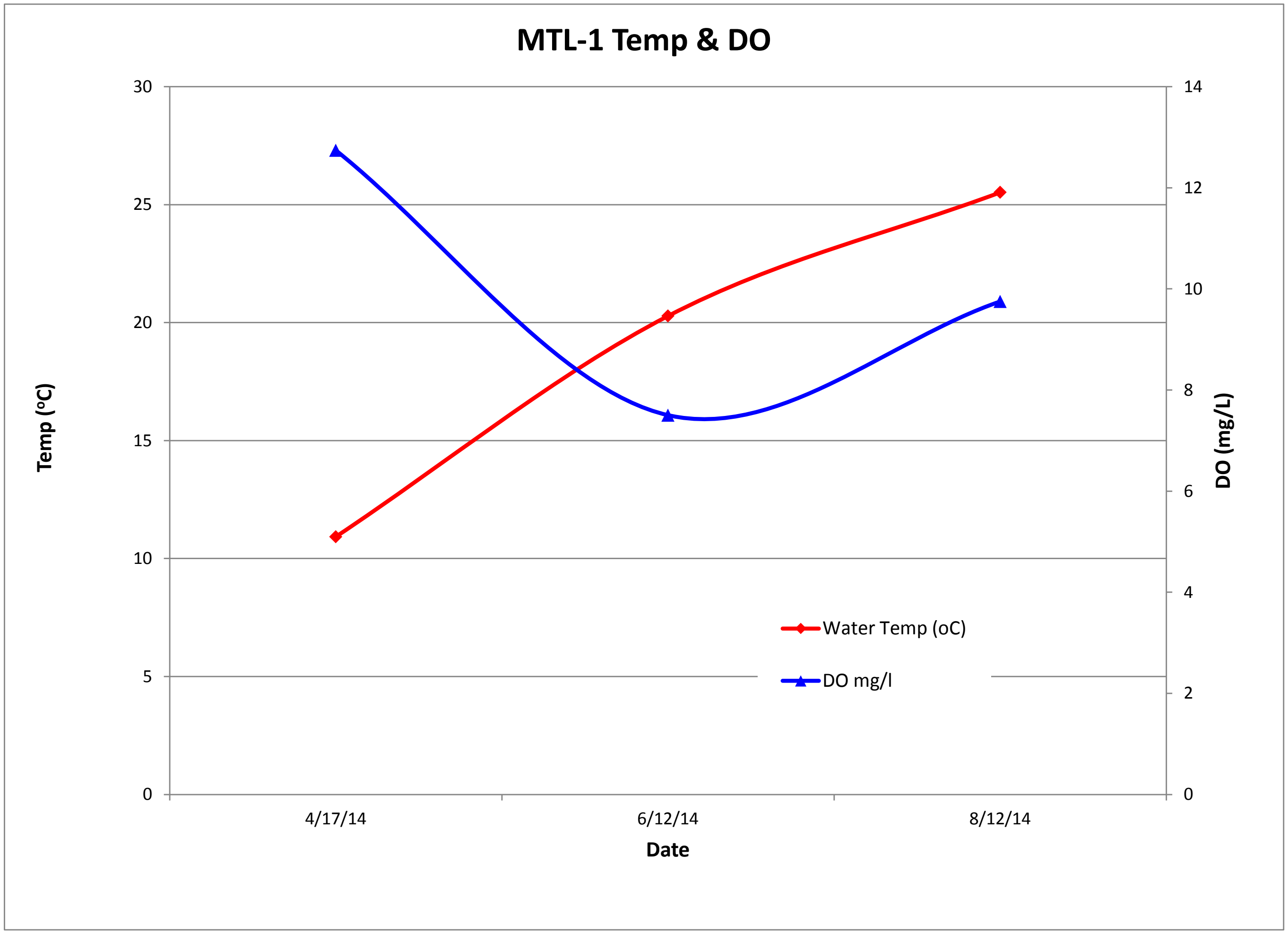

Mark Twain Lake Solids
Solids, Total Suspended
Solids, Volatile Suspended
STD: 116 mg/L Streams & >= 12mg/L Lak
mg/L
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
4/17/14 MTL-15
6/12/14 MTL-15
8/12/14 MTL-15
4/17/14 MTL-22
6/12/14 MTL-22
8/12/14 MTL-22
4/17/14 MTL-22-15
6/12/14 MTL-22-15
8/12/14 MTL-22-15
4/17/14 MTL-33
6/12/14 MTL-33
8/12/14 MTL-33
4/17/14 MTL-66
6/12/14 MTL-66
8/12/14 MTL-66
4/17/14 MTL-77
6/12/14 MTL-77
8/12/14 MTL-77
Date/Site

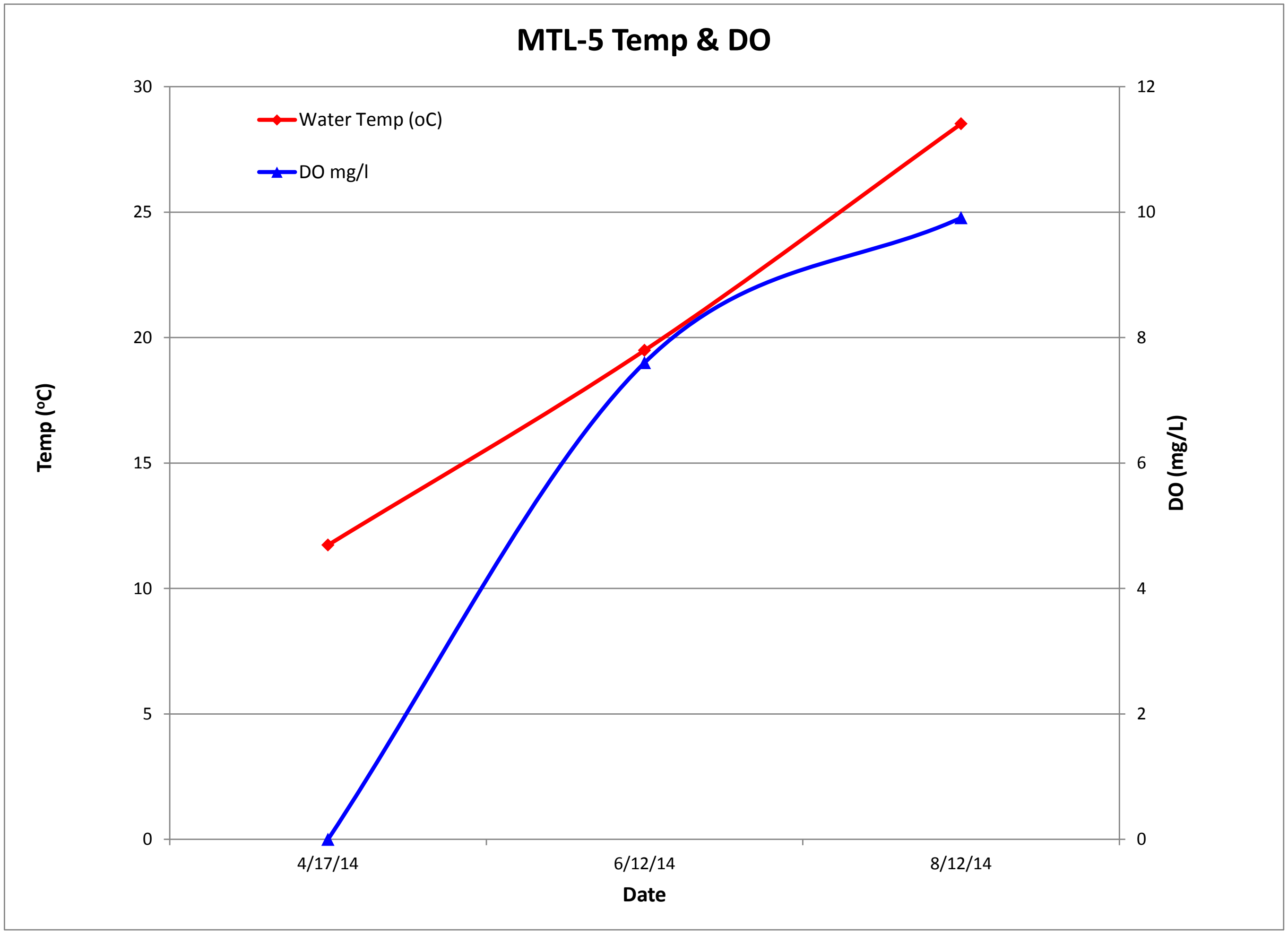

Mark Twain Tributary Total Organic Carbon
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
mg/L
4/17/14
MTL-1
6/12/14
MTL-1
8/12/14
MTL-1
4/17/14
MTL-88
6/12/14
MTL-5
8/12/14
MTL-5
4/17/14
MTL-9
6/12/14
MTL-9
8/12/14
MTL-9
4/17/14
MTL-25
6/12/14
MTL-11
8/12/14
MTL-11
4/17/14
MTL-12
6/12/14
MTL-12
8/12/14
MTL-12
4/17/14
MTL-41
6/12/14
MTL-13
8/12/14
MTL-13
Date/Site

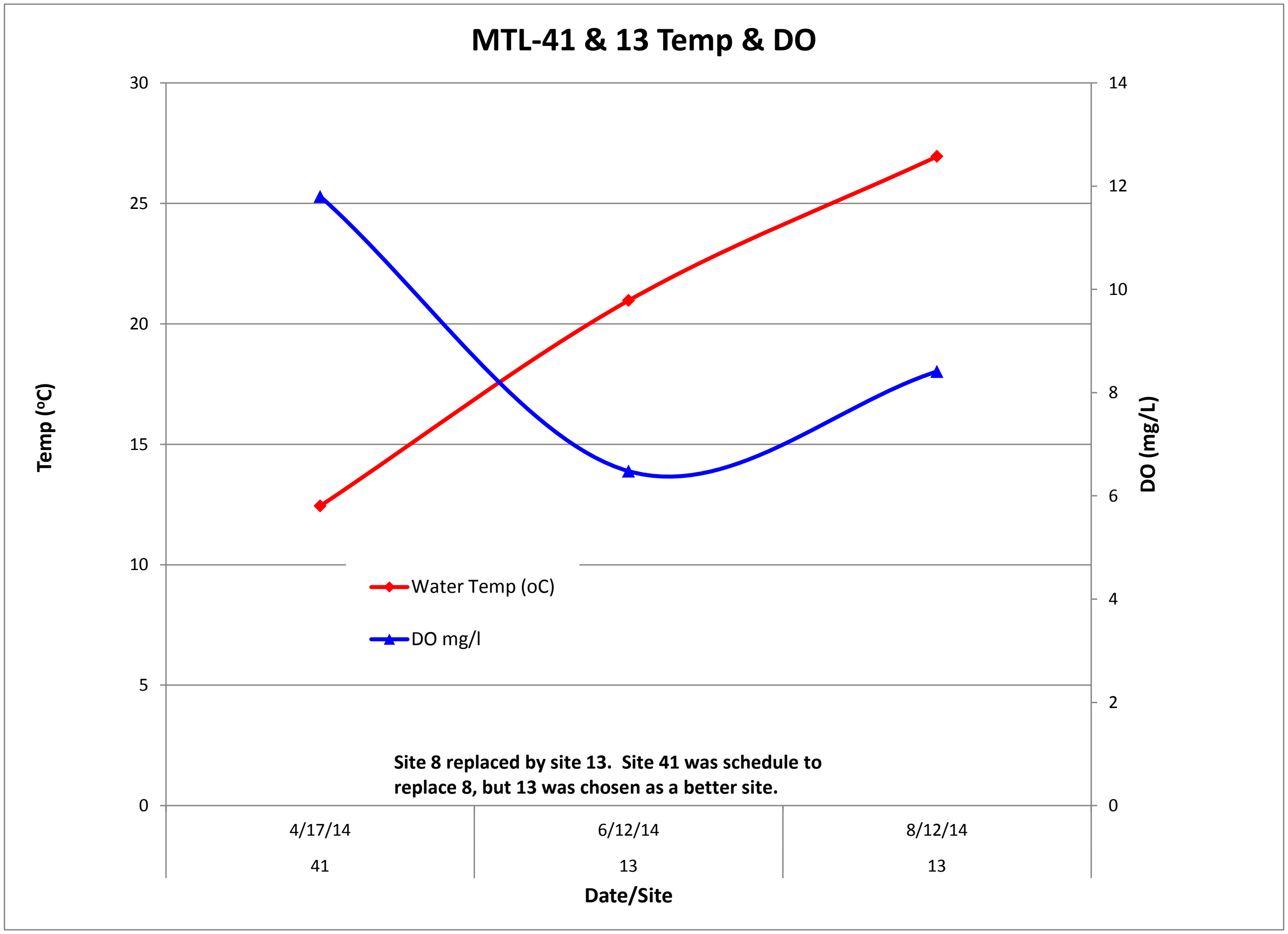

Mark Twain Lake Total Organic Carbon
mg/L
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
4/17/14 MTL-15
6/12/14 MTL-15
8/12/14 MTL-15
4/17/14 MTL-22
6/12/14 MTL-22
8/12/14 MTL-22
4/17/14 MTL-22-15
6/12/14 MTL-22-15
8/12/14 MTL-22-15
4/17/14 MTL-33
6/12/14 MTL-33
8/12/14 MTL-33
4/17/14 MTL-66
6/12/14 MTL-66
8/12/14 MTL-66
4/17/14 MTL-77
6/12/14 MTL-77
8/12/14 MTL-77
Date/Site

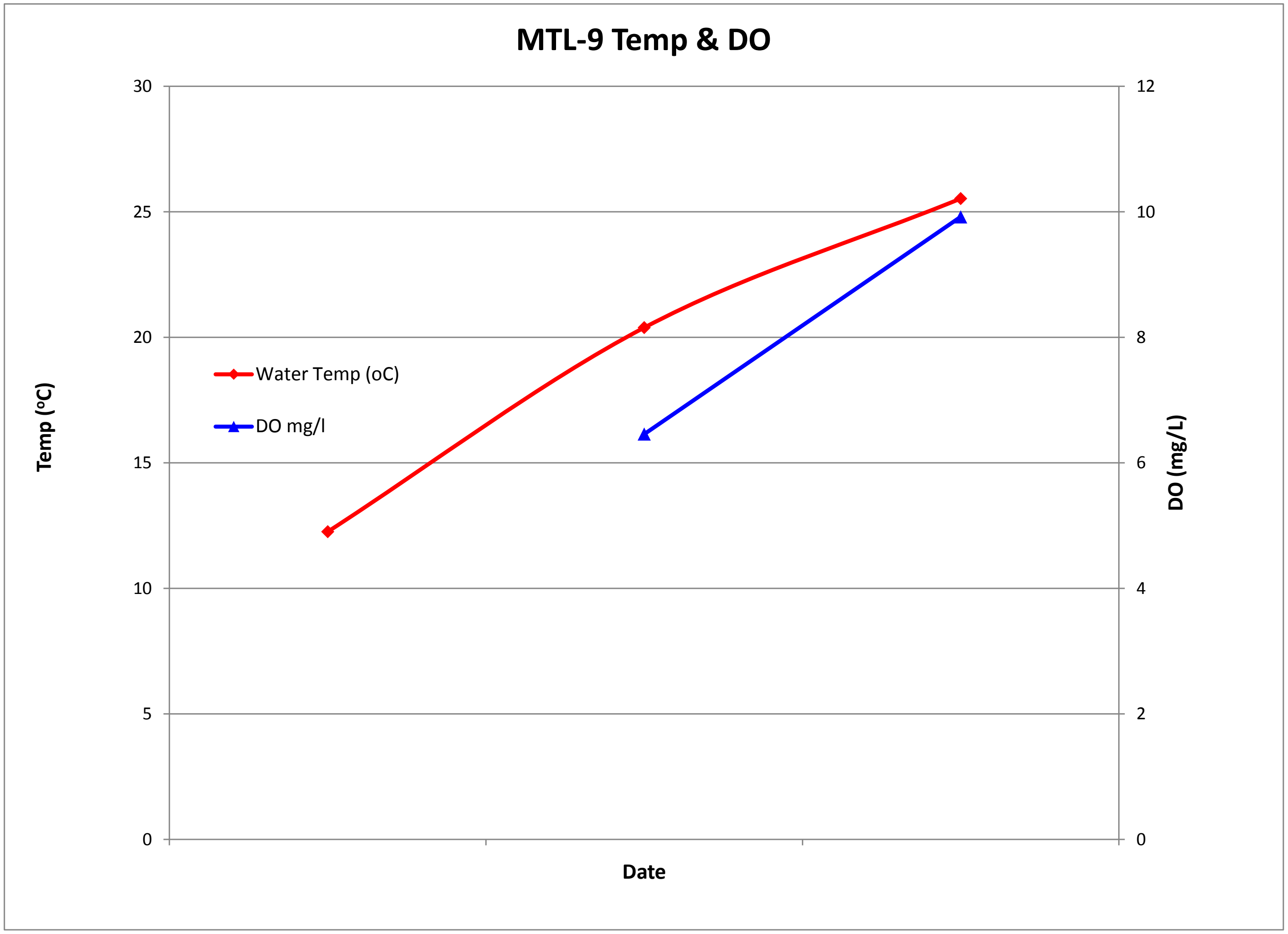
APPENDIX C

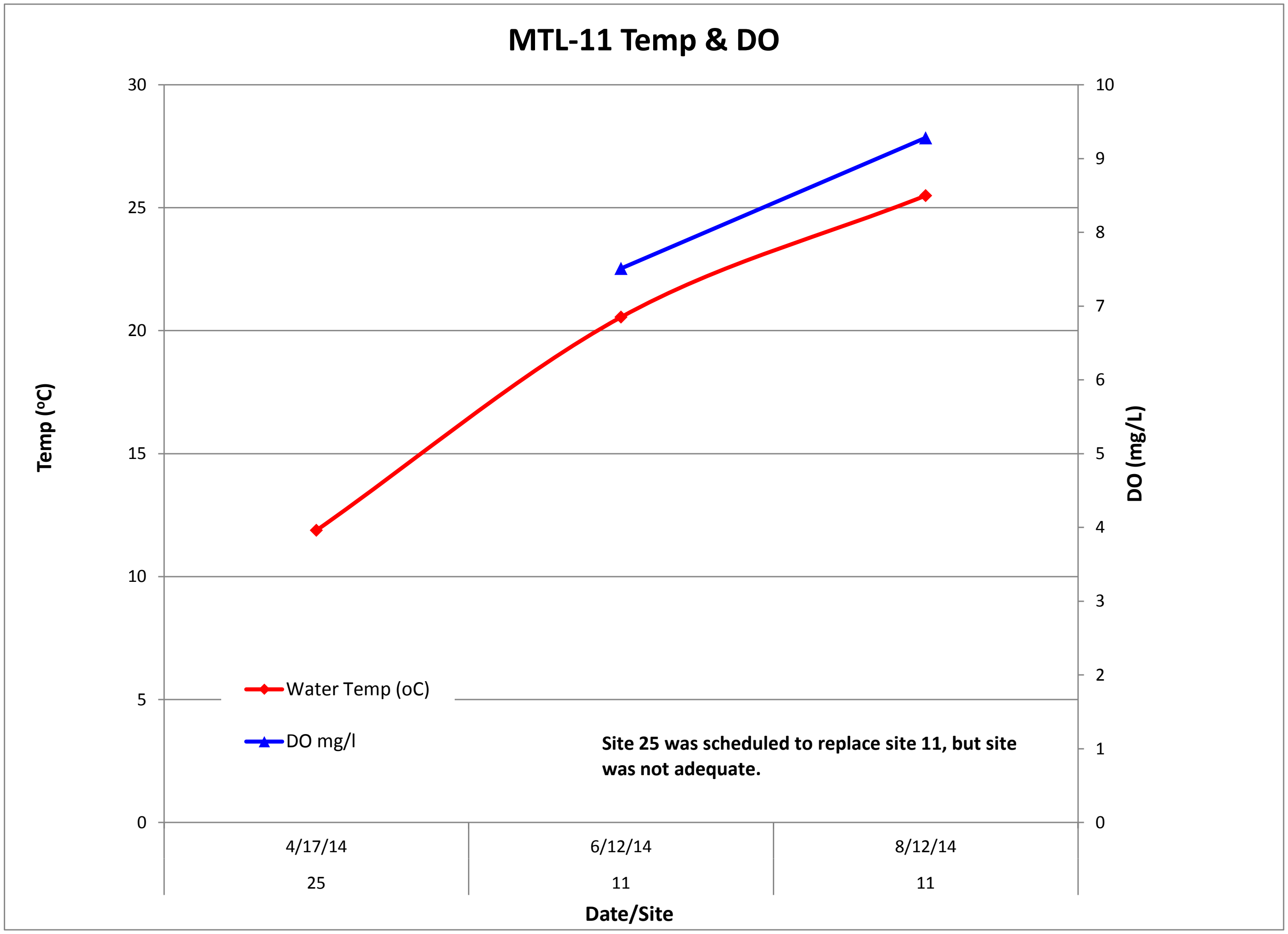
FIELD DATA GRAPHS

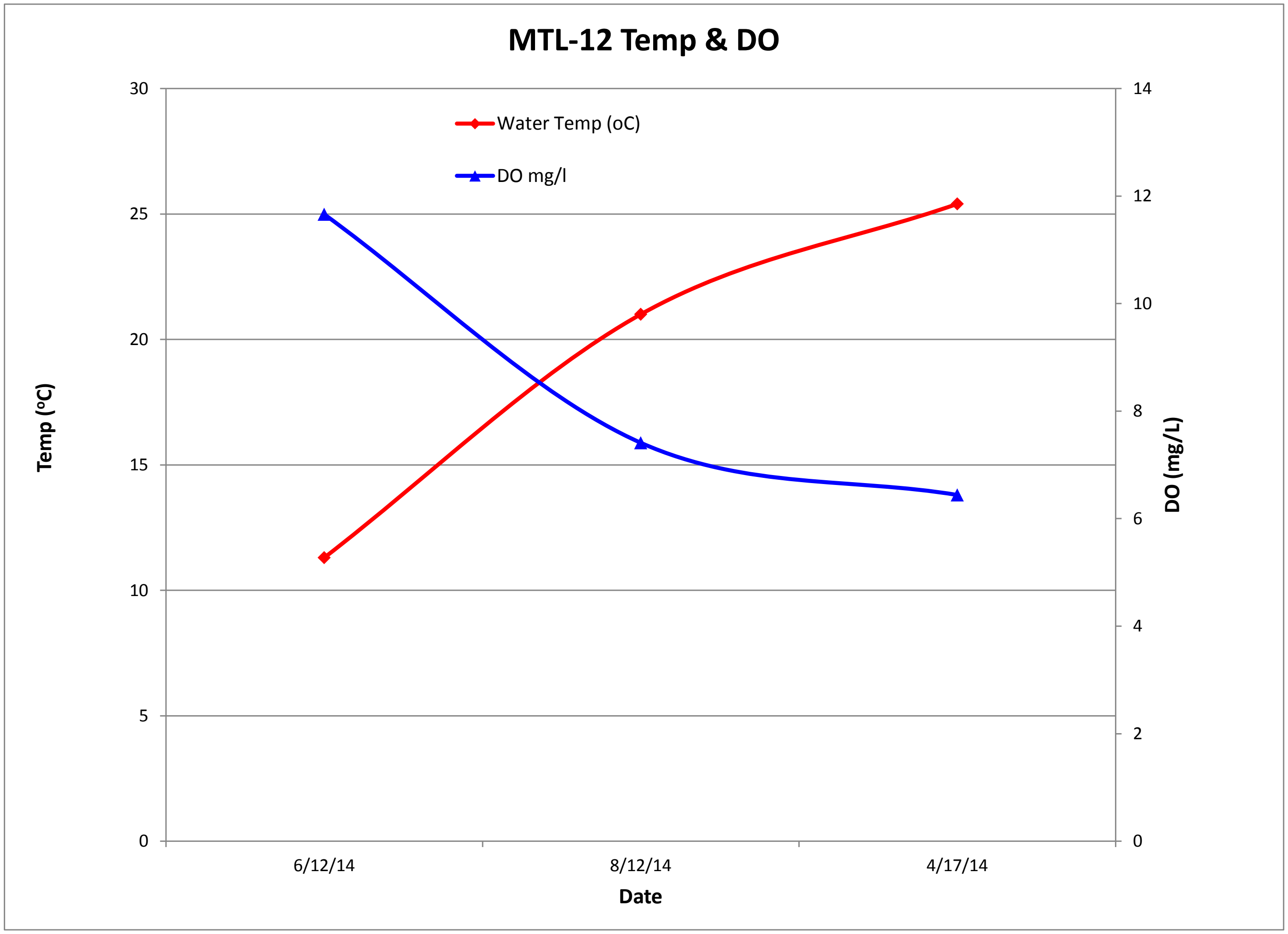

MTL-1 Temp & DO
30
25
20
15
10
5
0
14
12
10
8
6
4
2
0
Temp (ºC)
DO (mg/L)
Water Temp (oC)
DO mg/l
4/17/14
6/12/14
8/12/14
Date

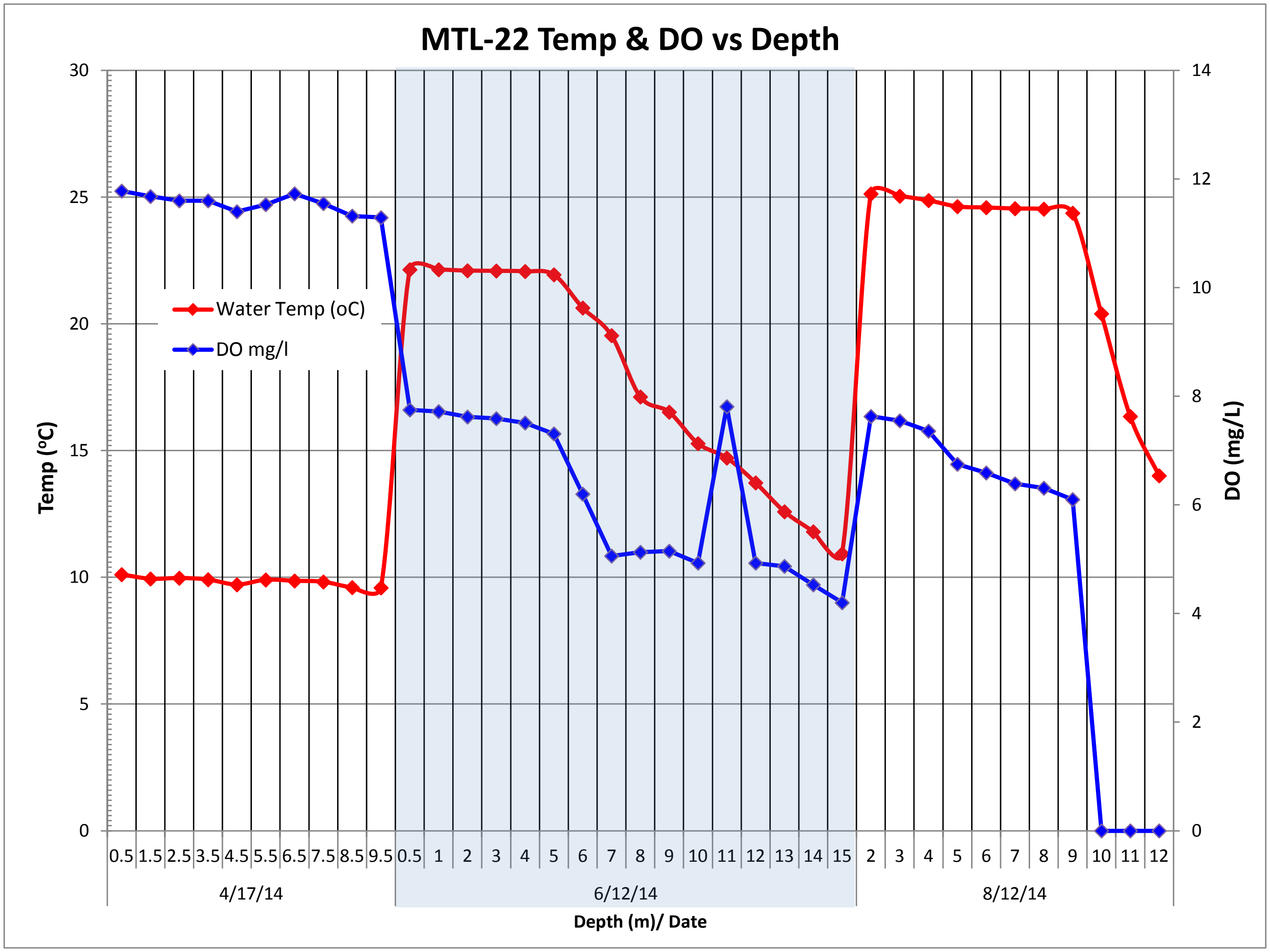

MTL-5 Temp & DO
Water Temp (oC)
DO mg/l
Temp (ºC)
DO (mg/L)
30
25
20
15
10
5
0
12
10
8
6
4
2
0
4/17/14
6/12/14
8/12/14
Date

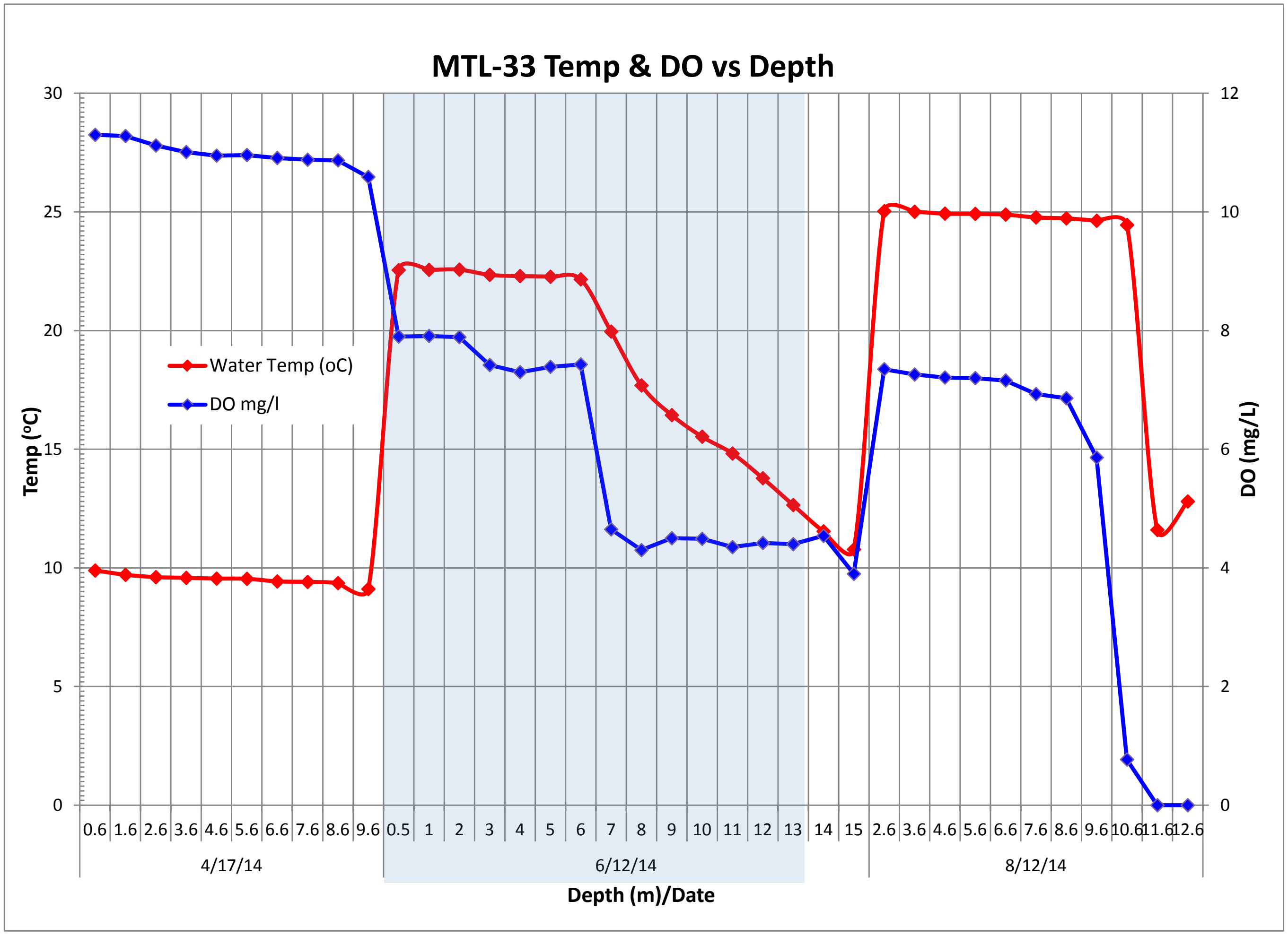

MTL-41 & 13 Temp & DO
Temp (ºC)
DO (mg/L)
30
25
20
15
10
5
0
14
12
10
8
6
4
2
0
Water Temp (oC)
DO mg/l
Site 8 replaced by site 13. Site 41 was schedule to replace 8, but 13 was chosen as a better site.
4/17/14
41
6/12/14
13
8/12/14
13
Date/Site

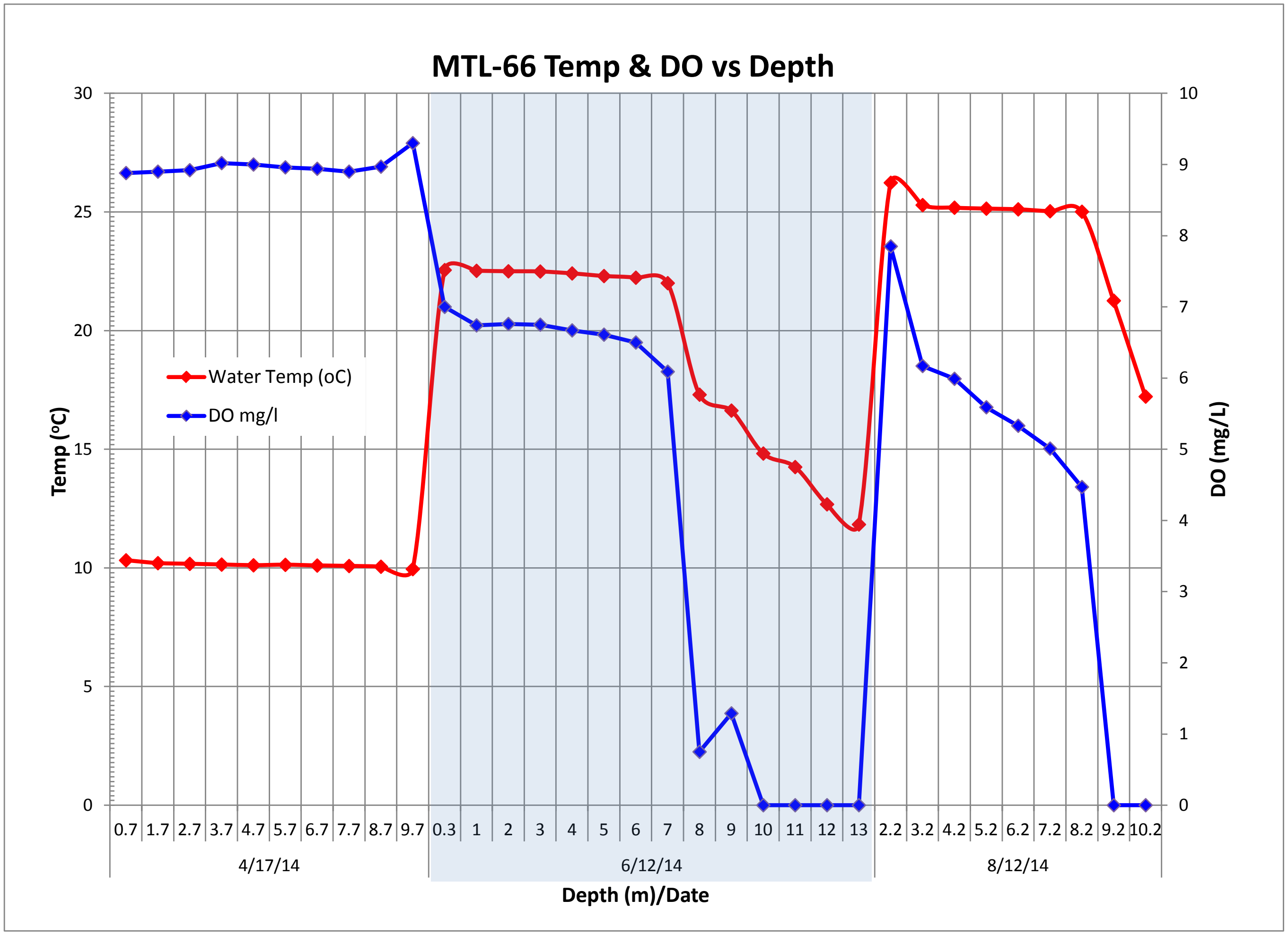

MTL-9 Temp & DO
30
25
20
15
10
5
0
12
10
8
6
4
2
0
Temp (ºC)
DO (mg/L)
Water Temp (oC)
DO mg/l
Date

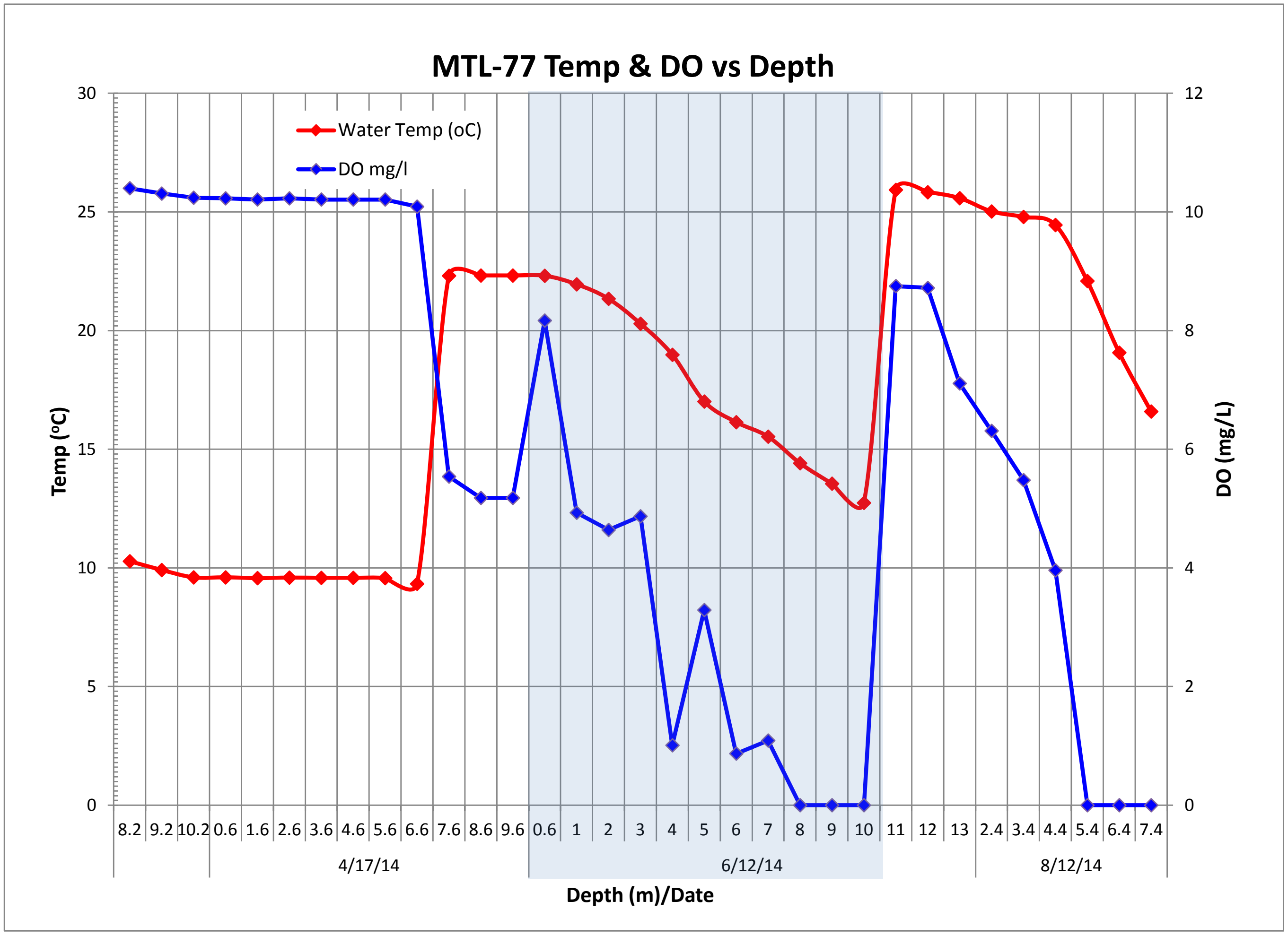

MTL-11 Temp & DO
30
25
20
15
10
5
0
Temp (ºC)
10
9
8
7
6
5
4
3
2
1
0
DO (mg/L)
Water Temp (oC)
DO mg/l
Site 25 was scheduled to replace site 11, but site was not adequate.
4/17/14
25
6/12/14
11
8/12/14
11
Date/Site

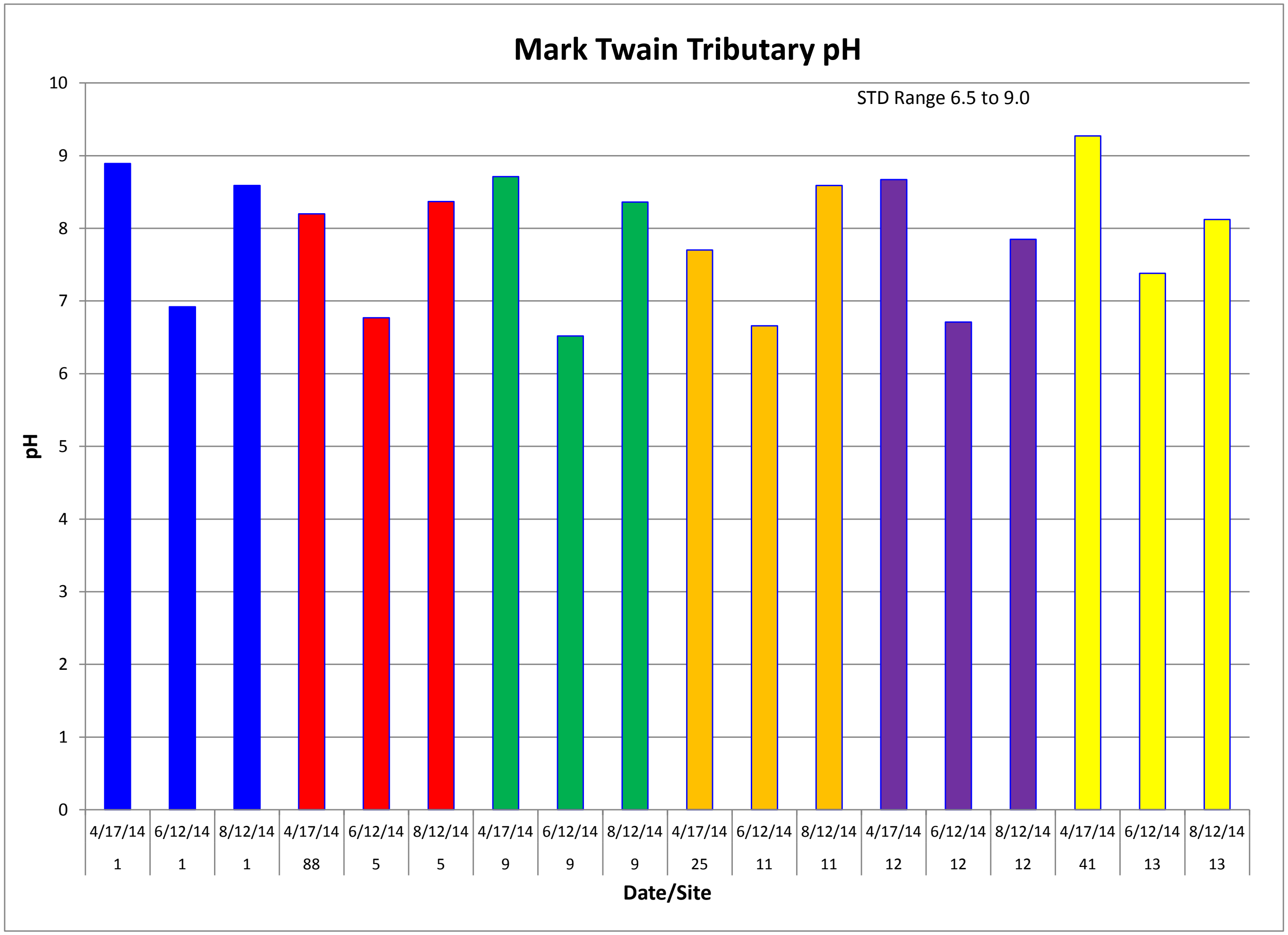

MTL-12 Temp & DO
Water Temp (oC)
DO mg/l
Temp (ºC)
DO (mg/L)
30
25
20
15
10
5
0
14
12
10
8
6
4
2
0
6/12/14
8/12/14
4/17/14
Date

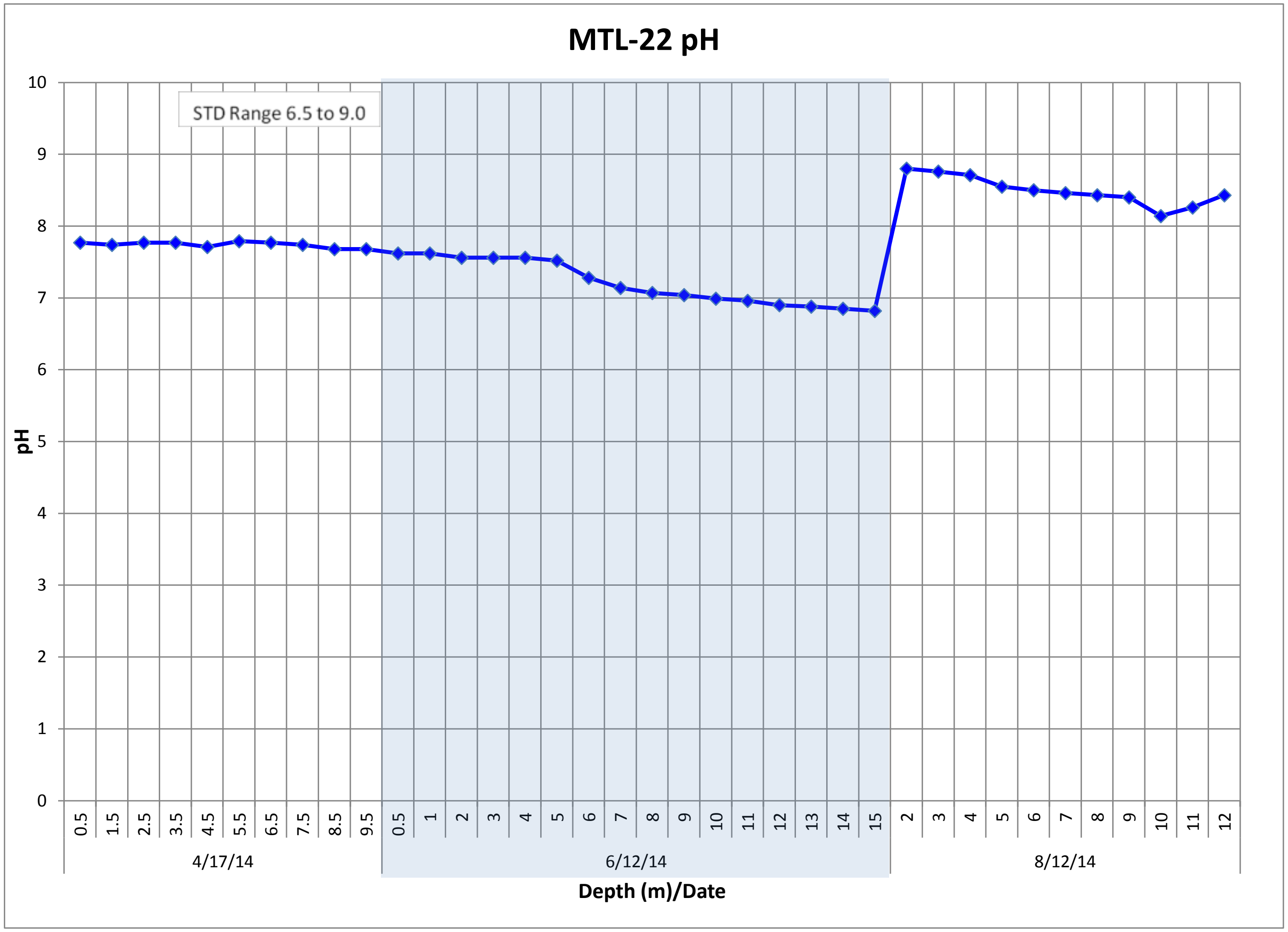

MTL-22 Temp & DO vs Depth
Water Temp (oC)
DO mg/l
Temp (ºC)
DO (mg/L)
30
25
20
15
10
5
0
14
12
10
8
6
4
2
0
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 0.5 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 2 3 4 5 6 7 8 9 10 11 12
4/17/14
6/12/14
8/12/14
Depth (m)/ Date

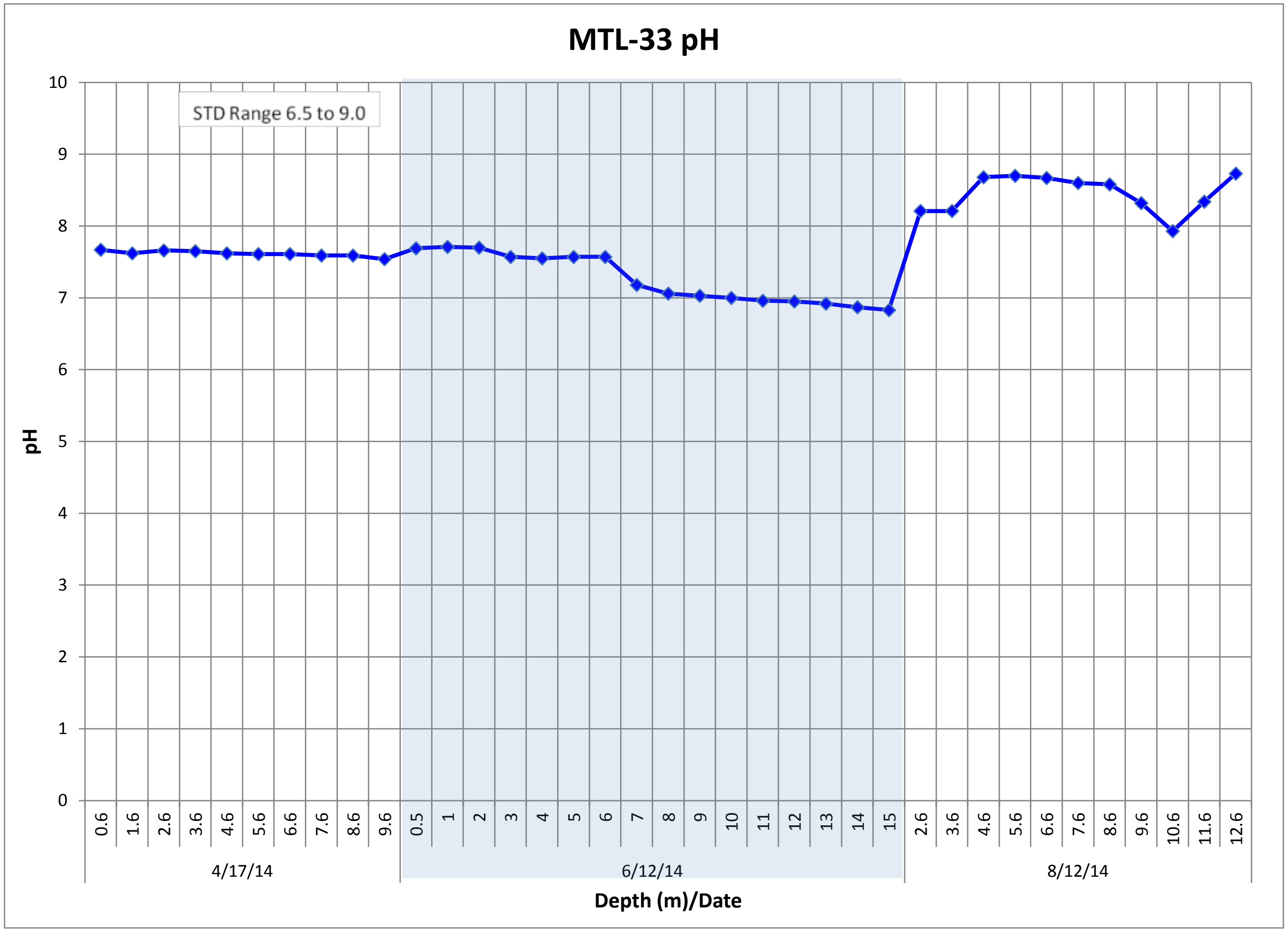

MTL-33 Temp & DO vs Depth
Water Temp (oC)
DO mg/l
Temp (ºC)
DO (mg/L)
30
25
20
15
10
5
0
12
10
8
6
4
2
0
0.6 1.6 2.6 3.6 4.6 5.6 6.6 7.6 8.6 9.6 0.5 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 2.6 3.6 4.6 5.6 6.6 7.6 8.6 9.6 10.6 11.6 12.6
4/17/14
6/12/14
8/12/14
Depth (m)/Date

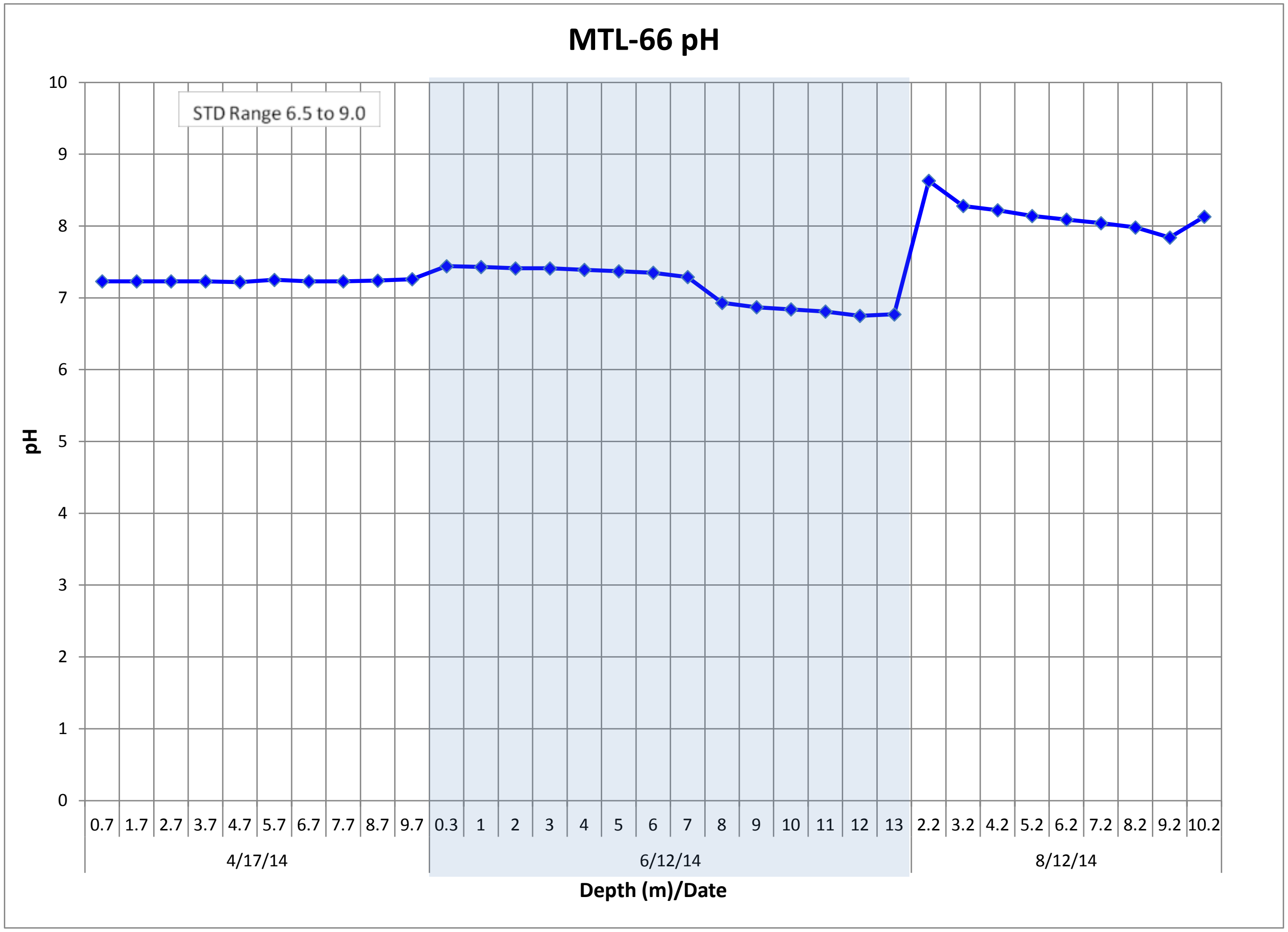

MTL-66 Temp & DO vs Depth
Water Temp (oC)
DO mg/l
Temp (ºC)
DO (mg/L)
30
25
20
15
10
5
0
10
9
8
7
6
5
4
3
2
1
0
0.7 1.7 2.7 3.7 4.7 5.7 6.7 7.7 8.7 9.7
0.3 1 2 3 4 5 6 7 8 9 10 11 12 13
2.2 3.2 4.2 5.2 6.2 7.2 8.2 9.2 10.2
4/17/14
6/12/14
8/12/14
Depth (m)/Date

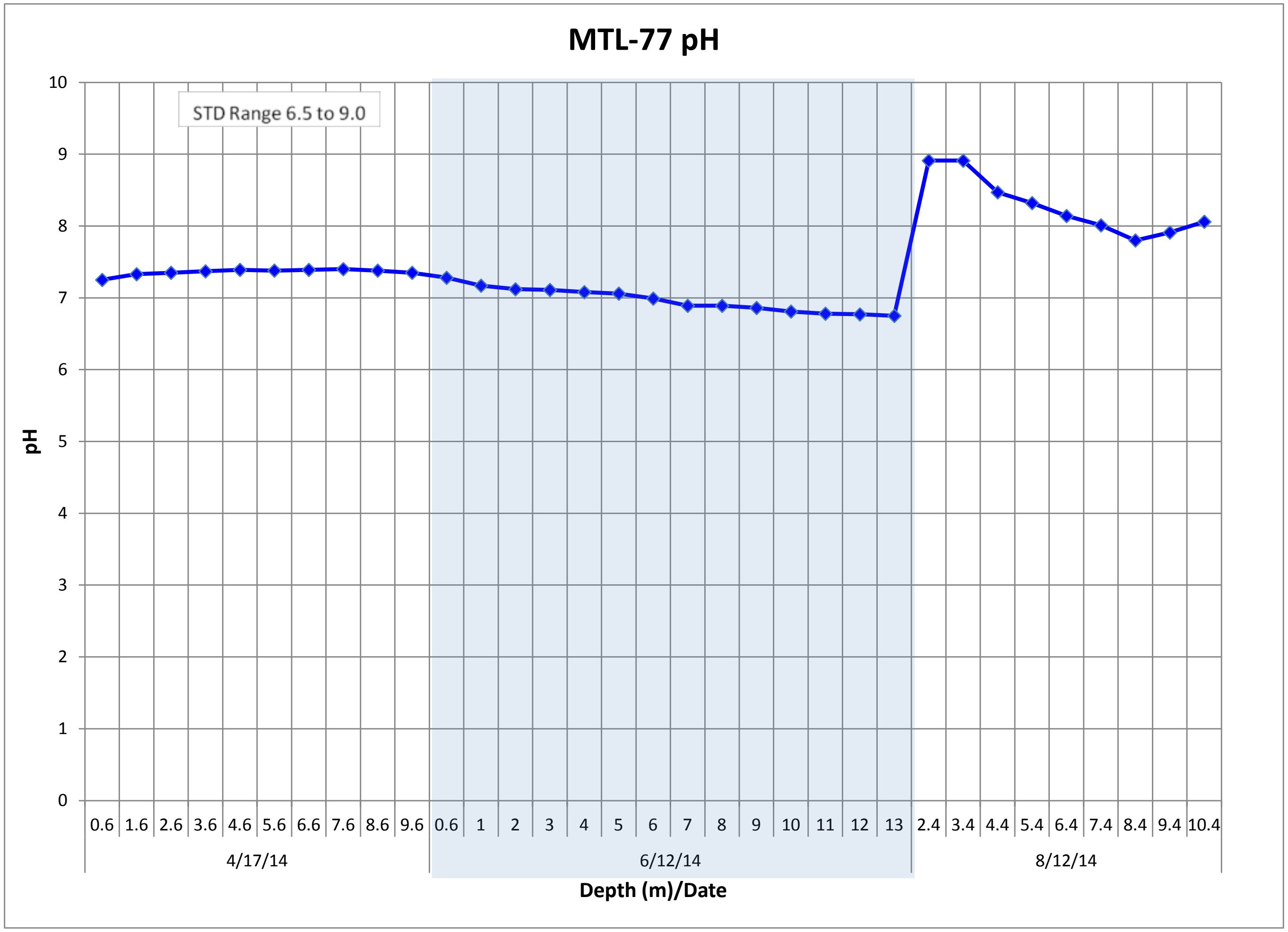

MTL-77 Temp & DO vs Depth
Water Temp (oC)
DO mg/l
Temp (ºC)
DO (mg/L)
30
25
20
15
10
5
0
12
10
8
6
4
2
0
8.2 9.2 10.2 0.6 1.6 2.6 3.6 4.6 5.6 6.6 7.6 8.6 9.6 0.6 1 2 3 4 5 6 7 8 9 10 11 12 13 2.4 3.4 4.4 5.4 6.4 7.4
4/17/14
6/12/14
8/12/14
Depth (m)/Date

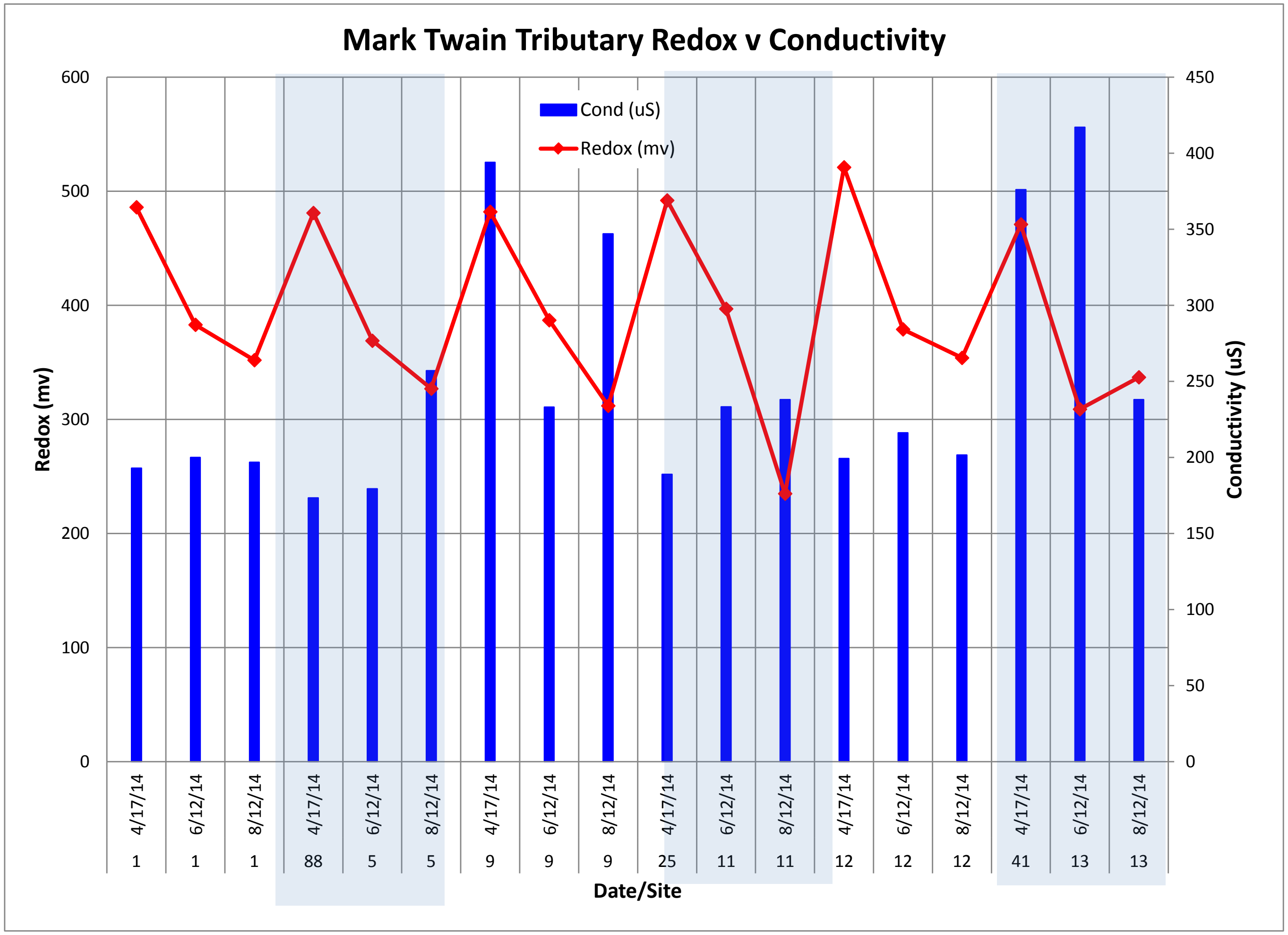

Mark Twain Tributary pH
STD Range 6.5 to 9.0
pH
0
1
2
3
4
5
6
7
8
9
10
4/17/14 1
6/12/14 1
8/12/14 1
4/17/14 88
6/12/14 5
8/12/14 5
4/17/14 9
6/12/14 9
8/12/14 9
4/17/14 25
6/12/14 11
8/12/14 11
4/17/14 12
6/12/14 12
8/12/14 12
4/17/14 41
6/12/14 13
8/12/14 13
Date/Site

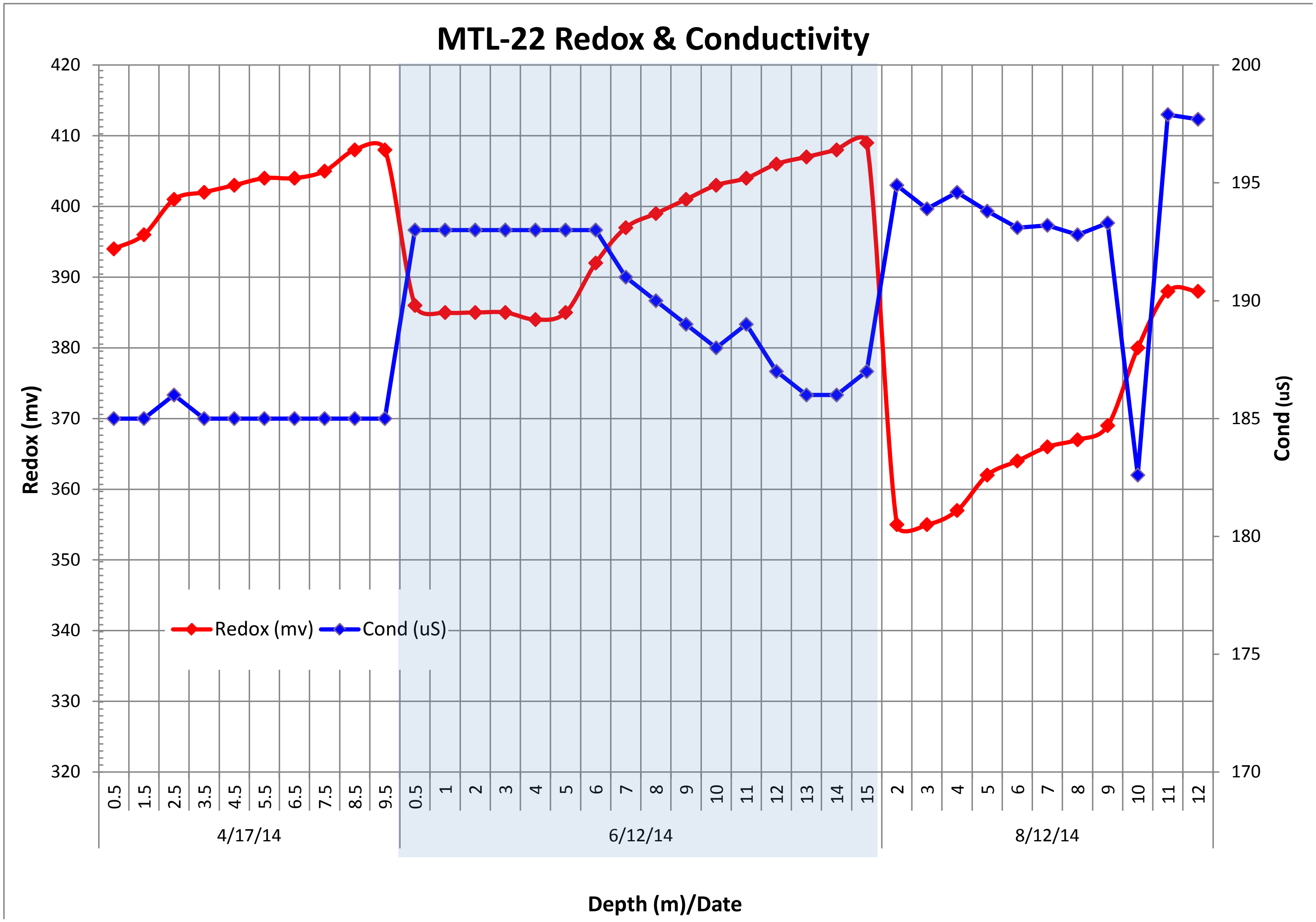

MTL-22 pH
STD Range 6.5 to 9.0
pH
Depth (m)/Date
4/17/14
6/12/14
8/12/14
0.5
1.5
2.5
3.5
4.5
5.5
6.5
7.5
8.5
9.5
0.5
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
2
3
4
5
6
7
8
9
10
11
12
0
1
2
3
4
5
6
7
8
9
10

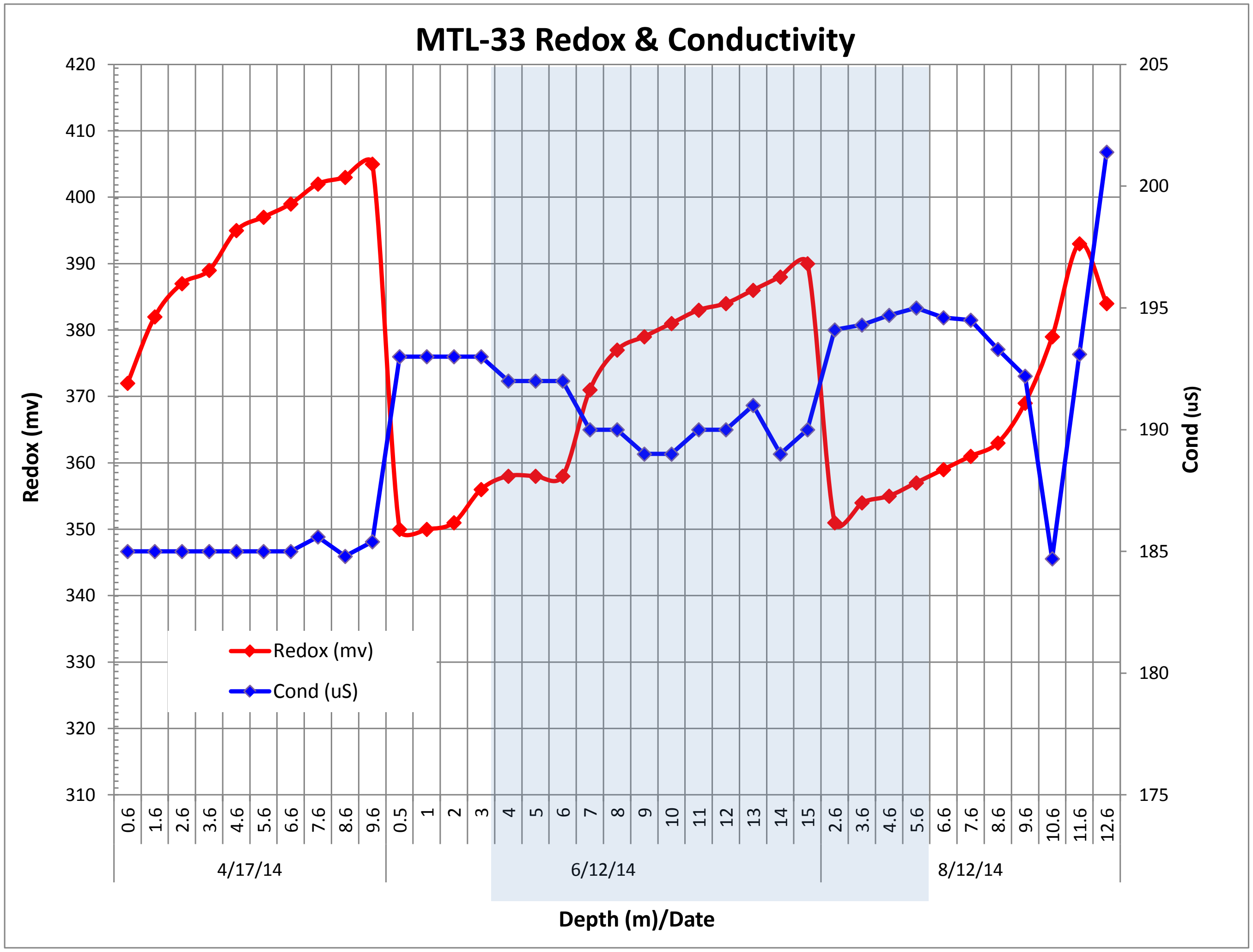

MTL-33 pH
STD Range 6.5 to 9.0
pH
10
9
8
7
6
5
4
3
2
1
0
0.6
1.6
2.6
3.6
4.6
5.6
6.6
7.6
8.6
9.6
0.5
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
2.6
3.6
4.6
5.6
6.6
7.6
8.6
9.6
10.6
11.6
12.6
4/17/14
6/12/14
8/12/14
Depth (m)/Date

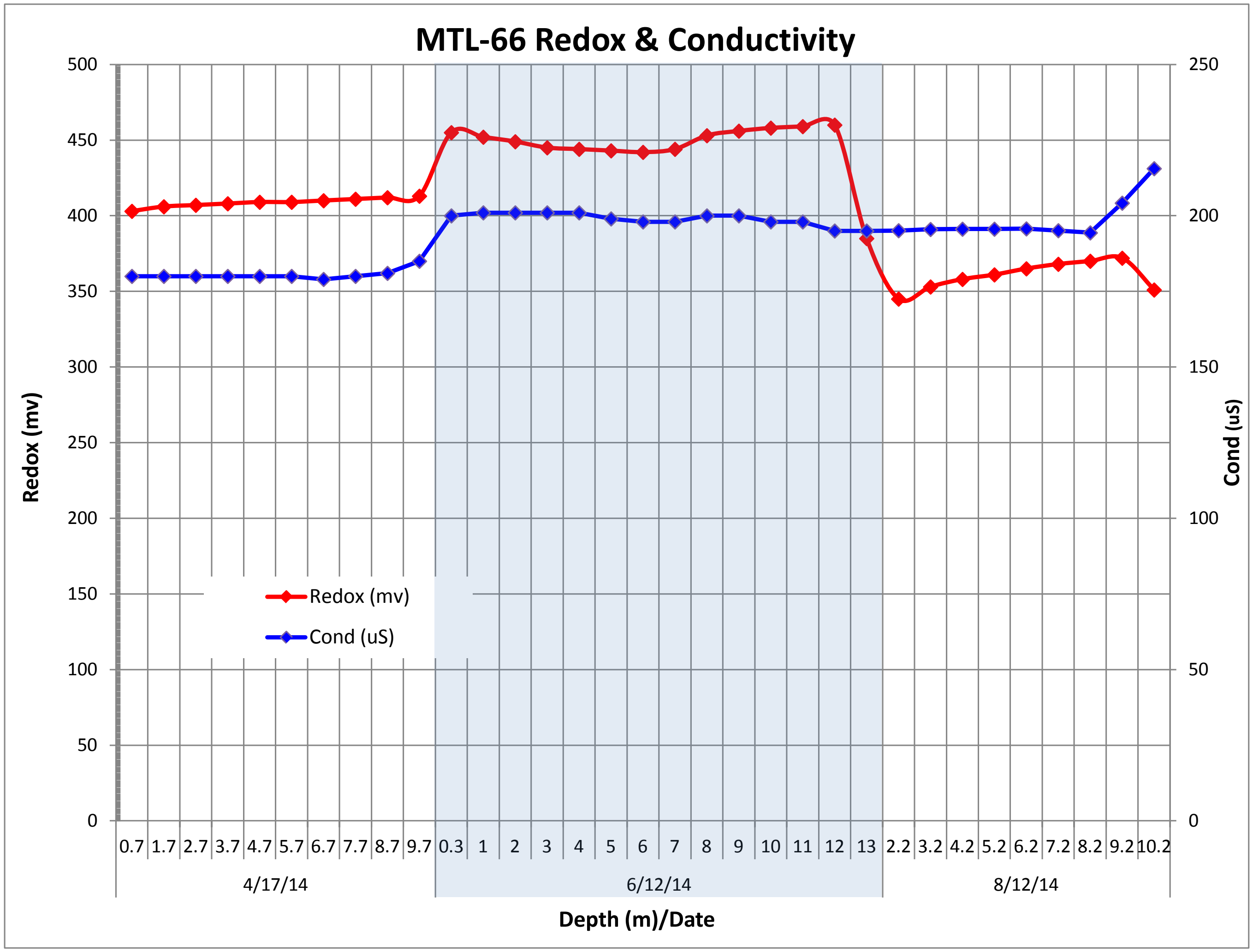

MTL-66 pH
STD Range 6.5 to 9.0
pH
10
9
8
7
6
5
4
3
2
1
0
0.7 1.7 2.7 3.7 4.7 5.7 6.7 7.7 8.7 9.7 0.3 1 2 3 4 5 6 7 8 9 10 11 12 13 2.2 3.2 4.2 5.2 6.2 7.2 8.2 9.2 10.2
4/17/14
6/12/14
8/12/14
Depth (m)/Date


MTL-77 pH
STD Range 6.5 to 9.0
pH
10
9
8
7
6
5
4
3
2
1
0
0.6
1.6
2.6
3.6
4.6
5.6
6.6
7.6
8.6
9.6
0.6
1
2
3
4
5
6
7
8
9
10
11
12
13
2.4
3.4
4.4
5.4
6.4
7.4
8.4
9.4
10.4
4/17/14
6/12/14
8/12/14
Depth (m)/Date

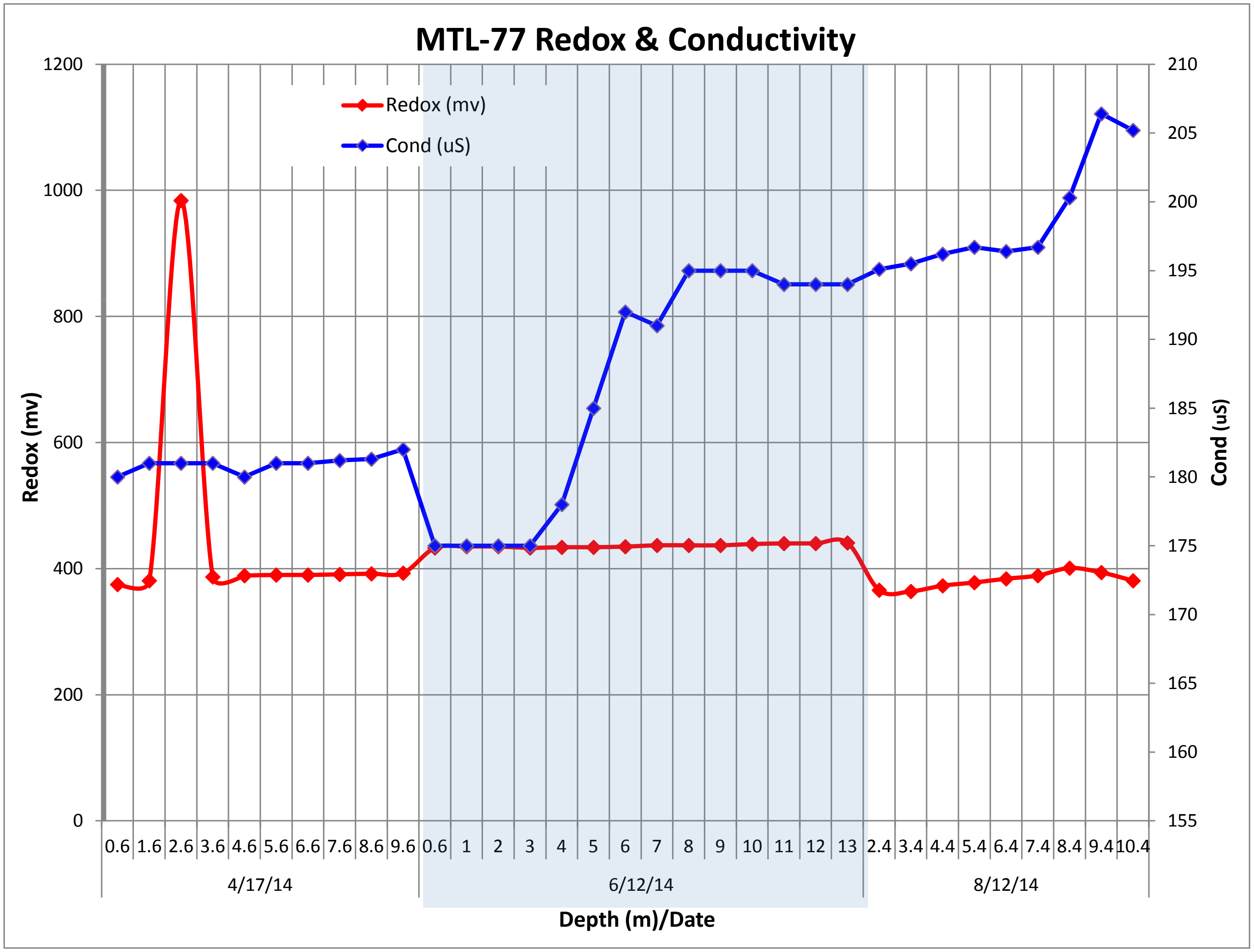

Mark Twain Tributary Redox v Conductivity
Cond (uS)
Redox (mv)
Redox (mv)
Conductivity (uS)
0
100
200
300
400
500
600
0
50
100
150
200
250
300
350
400
450
4/17/14
6/12/14
8/12/14
1
88
5
9
25
11
12
41
13
Date/Site

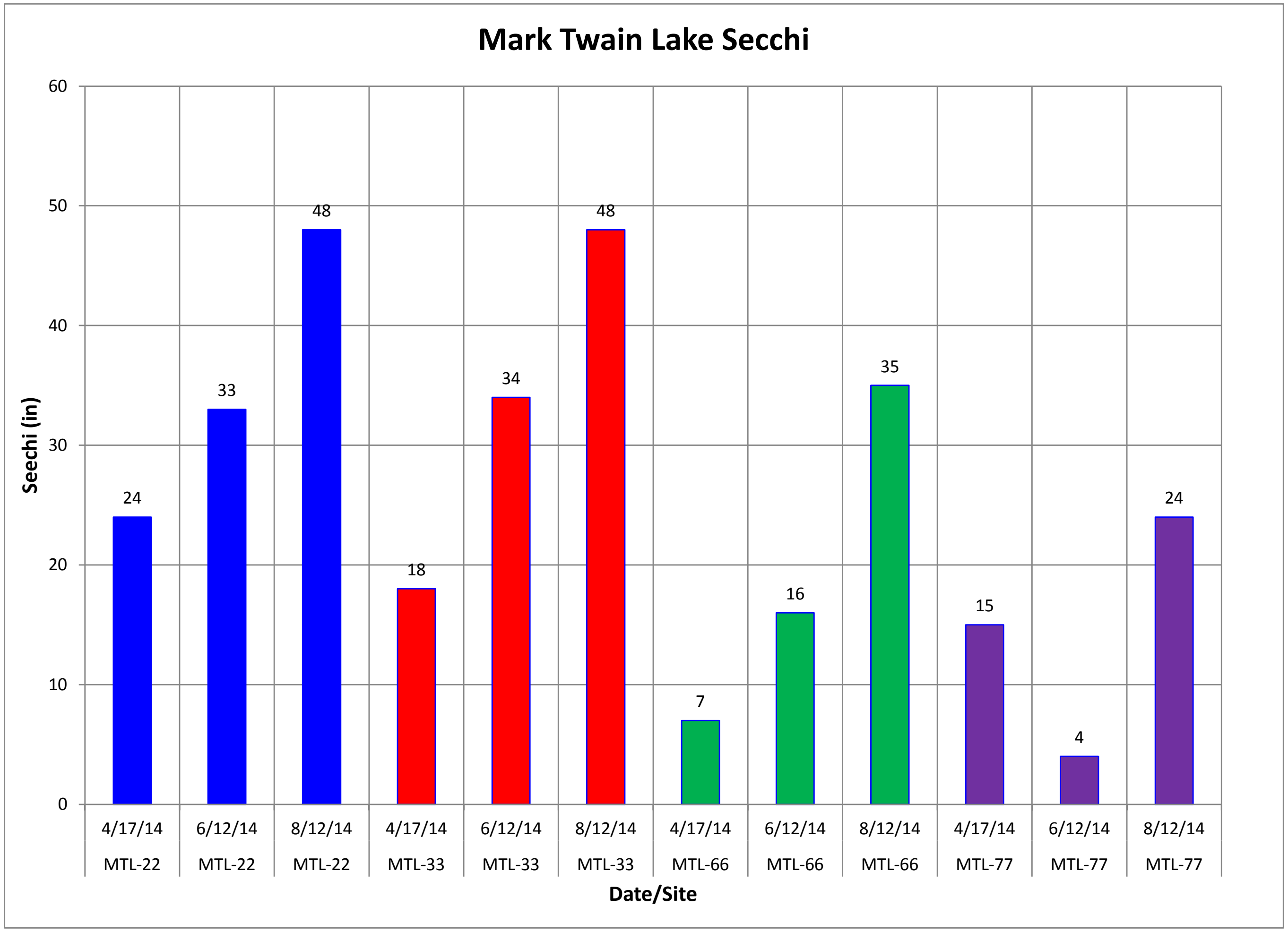

MTL-22 Redox & Conductivity
Redox (mv)
Cond (uS)
Depth (m)/Date
4/17/14
6/12/14
8/12/14
420
410
400
390
380
370
360
350
340
330
320
200
195
190
185
180
175
170
0.5
1.5
2.5
3.5
4.5
5.5
6.5
7.5
8.5
9.5
0.5
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
2
3
4
5
6
7
8
9
10
11
12

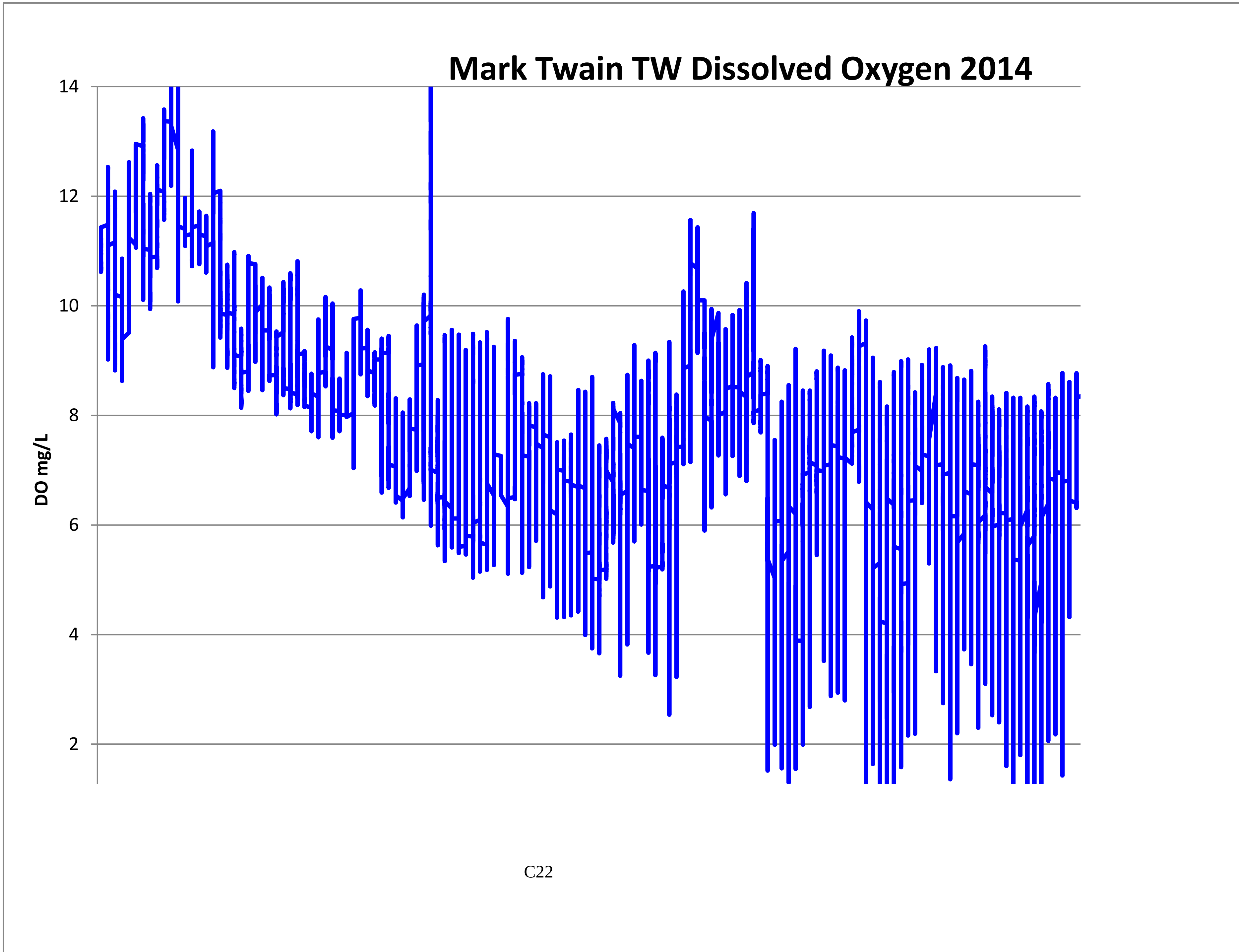

MTL-33 Redox & Conductivity
Redox (mv)
Cond (uS)
420
410
400
390
380
370
360
350
340
330
320
310
205
200
195
190
185
180
175
0.6
1.6
2.6
3.6
4.6
5.6
6.6
7.6
8.6
9.6
0.5
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
2.6
3.6
4.6
5.6
6.6
7.6
8.6
9.6
10.6
11.6
12.6
4/17/14
6/12/14
8/12/14
Depth (m)/Date

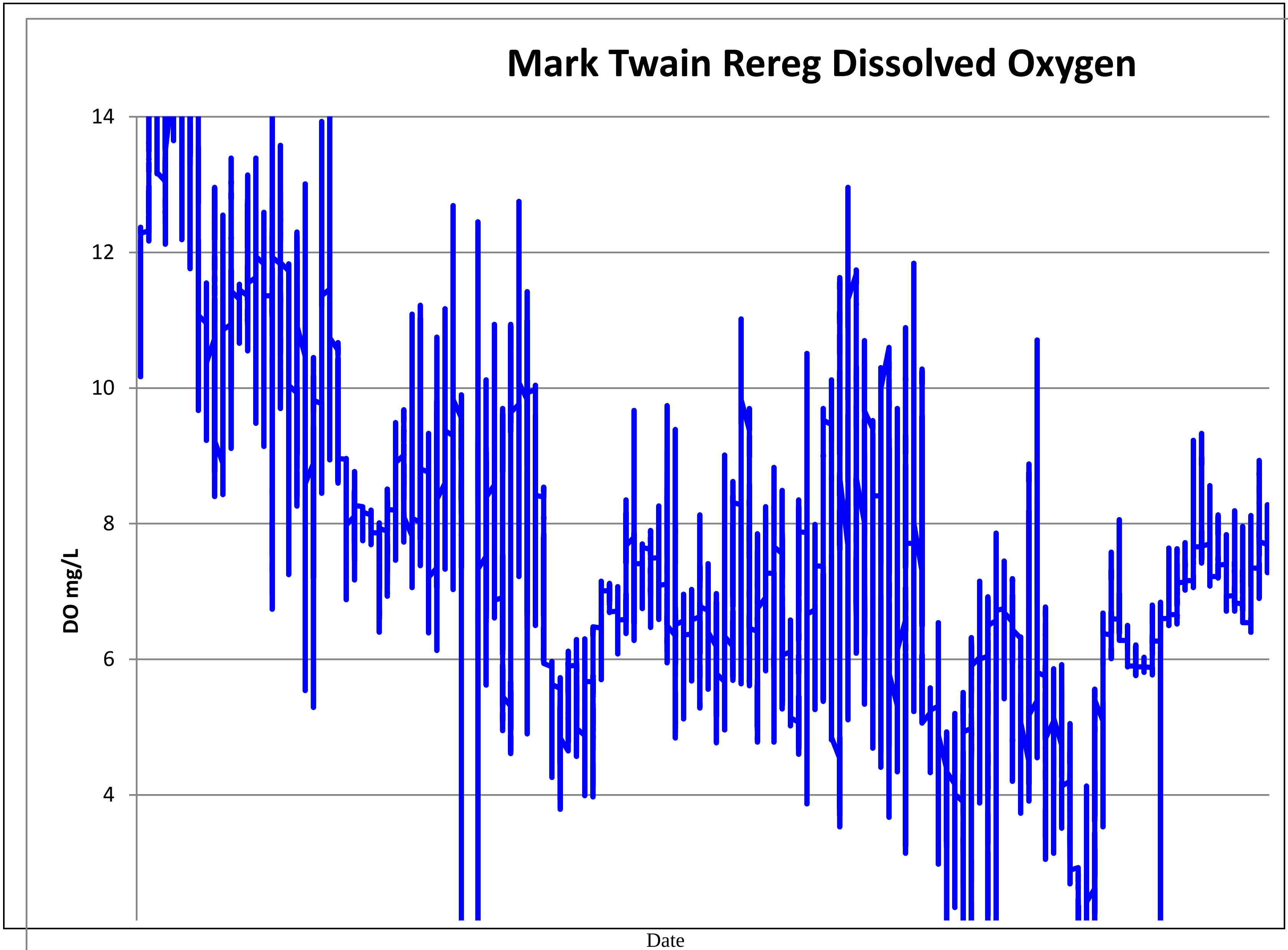


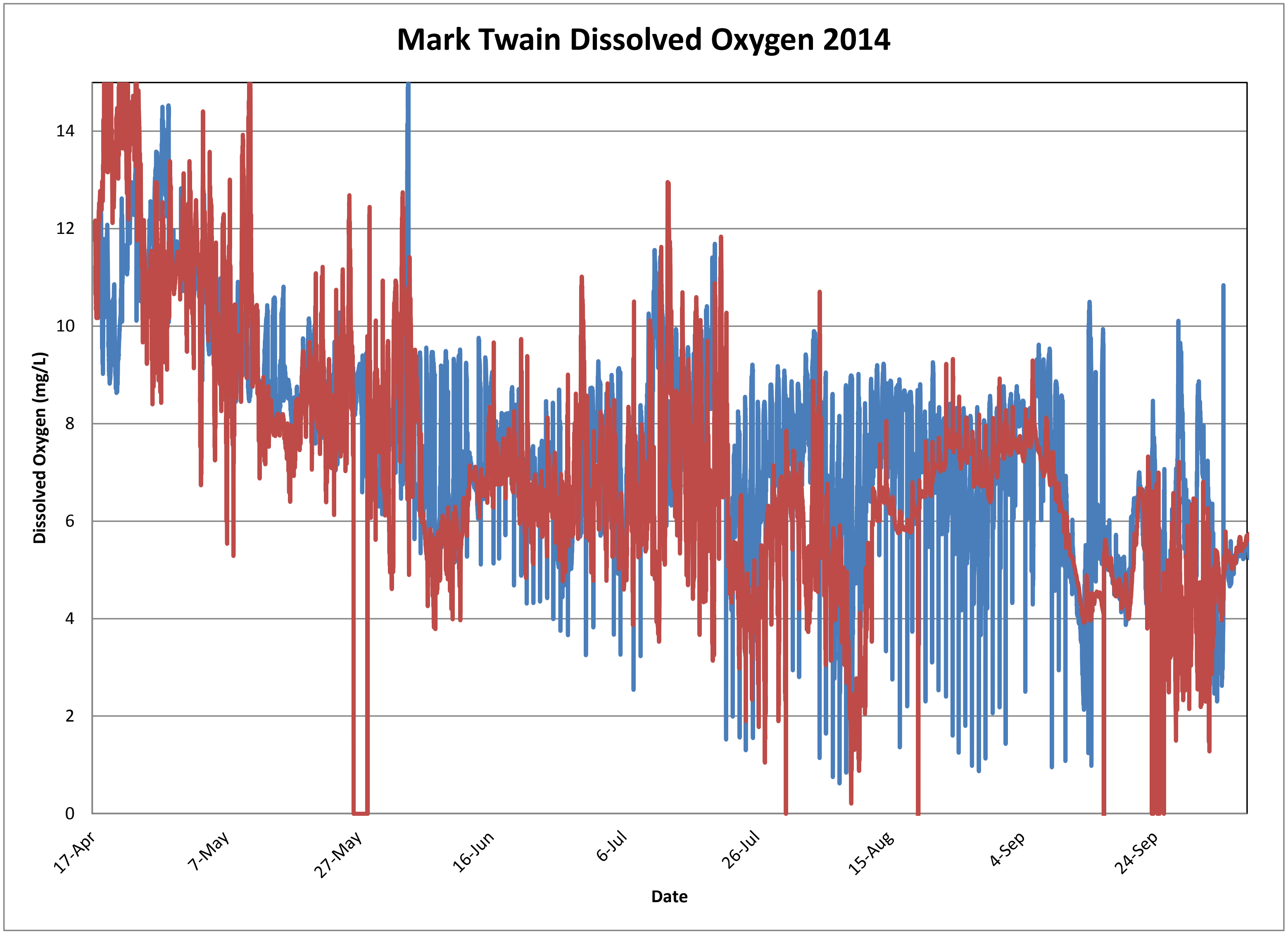
MTL-66 Redox & Conductivity
Redox (mv)
Cond (uS)
500
450
400
350
300
250
200
150
100
50
0
250
200
150
100
50
0
Redox (mv)
Cond (uS)
0.7 1.7 2.7 3.7 4.7 5.7 6.7 7.7 8.7 9.7 0.3 1 2 3 4 5 6 7 8 9 10 11 12 13 2.2 3.2 4.2 5.2 6.2 7.2 8.2 9.2 10.2
4/17/14
6/12/14
8/12/14
Depth (m)/Date


MTL-77 Redox & Conductivity
Redox (mv)
Cond (uS)
Redox (mv)
Cond (us)
0
200
400
600
800
1000
1200
155
160
165
170
175
180
185
190
195
200
205
210
0.6 1.6 2.6 3.6 4.6 5.6 6.6 7.6 8.6 9.6
0.6 1 2 3 4 5 6 7 8 9 10 11 12 13
2.4 3.4 4.4 5.4 6.4 7.4 8.4 9.4 10.4
4/17/14
6/12/14
8/12/14
Depth (m)/Date


Mark Twain Lake Secchi
Seechi (in)
60
50
40
30
20
10
0
24
33
48
18
34
48
7
16
35
15
4
24
4/17/14
MTL-22
6/12/14
MTL-22
8/12/14
MTL-22
4/17/14
MTL-33
6/12/14
MTL-33
8/12/14
MTL-33
4/17/14
MTL-66
6/12/14
MTL-66
8/12/14
MTL-66
4/17/14
MTL-77
6/12/14
MTL-77
8/12/14
MTL-77
Date/Site


Mark Twain TW Dissolved Oxygen 2014
DO mg/L
14
12
10
8
6
4
2


Mark Twain Rereg Dissolved Oxygen
14
12
10
8
6
4
DO mg/L
Date



Combined TW and Re-reg Sonde Dissolved Oxygen

APPENDIX D

Lakes of Missouri Volunteer Program (LMVP) Data

2014 Lakes of Missouri Volunteer Program (LMVP) Data

Site	Date	Temp (F)	Secchi (inches)	TP (ug/L)	TN (ug/L)	TCHLa (ug/L)	ISS (mg/L)	Latitude	Longitude
1	5/3/2014	56	34	61	1410	14.9	4.1	39.5240	-91.6478
1	5/17/2014	65	28	69	1610	1.4	1.3	39.5240	-91.6478
1	6/8/2014	75	45	67	1600	5.6	1.5	39.5240	-91.6478
1	6/28/2014	79	28	59	1620	19.7	3.4	39.5240	-91.6478
1	7/19/2014	80	53	35	1450	12.3	1.4	39.5240	-91.6478
1	8/9/2014	75	55	31	1370	12.0	1.8	39.5240	-91.6478
1	8/31/2014	82	53	24	1990	10.6	0.7	39.5240	-91.6478
1	9/20/2014	70	32	40	980	14.2	5.0	39.5240	-91.6478
2	5/3/2014	55	28	71	1430	31.5	7.7	39.5395	-91.6972
2	5/17/2014	63	27	75	1830	1.4	2.3	39.5395	-91.6972
2	6/8/2014	75	41	69	1640	4.2	2.5	39.5395	-91.6972
2	6/28/2014	81	28	54	1580	25.6	5.9	39.5395	-91.6972
2	7/19/2014	81	46	30	1460	10.2	2.0	39.5395	-91.6972
2	8/9/2014	76	53	23	1440	10.4	2.5	39.5395	-91.6972
2	8/31/2014	84	37	25	1740	12.6	2.5	39.5395	-91.6972
2	9/20/2014	70	37	41	980	17.7	5.3	39.5395	-91.6972
5	5/3/2014	54	20	104	1760	9.4	6.6	39.5066	-91.7679
5	5/17/2014	62	16	122	1880	2.0	4.9	39.5066	-91.7679
5	6/8/2014	74	31	99	1790	9.4	4.6	39.5066	-91.7679
5	6/28/2014	80	18	78	1790	22.6	6.2	39.5066	-91.7679
5	7/19/2014	79	48	24	1450	8.0	1.9	39.5066	-91.7679
5	8/9/2014	75	50	31	1410	21.6	2.8	39.5066	-91.7679
5	8/31/2014	82	52	23	920	11.9	0.9	39.5066	-91.7679
5	9/20/2014	69	24	54	1130	10.5	7.0	39.5066	-91.7679

Site 1 - near dam

Site 2 - Indian Creek

Site 5 - Confluence of North Fork & South Fork

Parameter	Abreviation	Unit of Measure
Water Clarity (using Secchi disk)	Secchi	Inches (")
Total Phosphorus	TP	Micrograms per liter (ug/L) or parts per billion (ppb)
Total Nitrogen	TN	Micrograms per liter (ug/L) or parts per billion (ppb)
Chlorophyll A	TCHLA	Micrograms per liter (ug/L) or parts per billion (ppb) (uncorrected for pheophytin)
Chlorophyll A	CHLA	ug/L (pheophytin corrected)
Pheophytin	Pheo	ug/L
Inorganic Suspended Sediments	ISS	Milligrams per liter (mg/L), or parts per million (ppm)
Organic Suspended Solids	OSS	mg/L
Total Suspended Sediments	TSS	Milligrams per liter (mg/L), or parts per million (ppm)

Full report for all lakes in the LMVP can be found at http://www.lmvp.org/lakes.htm.

APPENDIX E

United Water Services
Clarence Cannon WTP Data

HIGH SERVICE
January 2014 Water Quality Report

	PLANT EFFLUENT														
DATE	**Flow (mgd)**	**pH -**	**Alkalinity (mg/l)**	**Turbidity (NTU)**	**Free Cl2 (mg/l)**	**Total Cl2 (mg/l)**	**Hardness (mg/l)**	**Iron (mg/l)**	**Mn (mg/l)**	**NH_3 (mg/l)**	**NO_2 (mg/l)**	**TDS (mg/l)**	**Color (u)**	**Temp (°C)**	**Total Coliforms**
1	4.92	7.83	101	0.07	0.07	3.51	150	0.005	0.020	0.11	0.003	180	0.0	5	
2	3.94	7.91	101	0.07	0.10	3.69	161	0.002		0.10		181	0.0	4	
3	4.77	7.87	101	0.06	0.08	3.33	152	0.006		0.07		182	0.0	5	
4	4.56	7.77	102	0.05	0.07	3.04	156	0.005		0.04		181	0.0	5	
5	4.52	7.82	101	0.05	0.08	3.33	154	0.004		0.09		183	0.0	5	
6	4.40	7.88	100	0.06	0.08	3.41	150	0.003		0.10		185	0.0	4	
7	5.15	7.89	101	0.06	0.07	3.50	152	0.010		0.08		185	0.0	4	
8	5.45	7.81	103	0.06	0.07	3.54	161	0.005	0.015	0.03	0.003	183	0.0	5	
9	5.18	7.75	102	0.04	0.08	3.45	157	0.003		0.06		203	0.0	4	
10	4.85	7.74	101	0.05	0.08	3.47	158	0.005		0.06		198	0.0	5	
11	5.29	7.77	103	0.06	0.08	3.54	156	0.004		0.11		186	0.0	4	
12	4.70	7.90	105	0.06	0.07	3.54	150	0.005		0.10		184	0.0	4	
13	5.26	7.90	105	0.05	0.06	3.50	157	0.009		0.06		208	0.0	5	
14	4.83	7.83	102	0.05	0.09	3.54	161	0.003		0.06		206	0.0	5	
15	4.82	7.80	101	0.06	0.07	3.67	158	0.004	0.011	0.07	0.004	180	0.0	5	
16	4.83	7.80	100	0.07	0.08	3.55	150	0.033		0.08		180	0.0	4	
17	4.52	7.87	100	0.06	0.07	3.45	155	0.003		0.06		184	0.0	5	
18	4.40	7.91	103	0.05	0.08	3.32	156	0.003		0.04		172	0.0	5	
19	4.89	7.85	102	0.05	0.09	3.30	157	0.001		0.09		172	0.0	5	
20	4.64	7.85	101	0.07	0.07	3.38	152	0.005		0.09		178	0.0	5	
21	4.72	7.89	101	0.06	0.07	3.46	151	0.007		0.15		173	0.0	5	
22	4.65	7.92	102	0.05	0.07	3.62	159	0.004	0.013	0.07	0.010	172	0.0	5	
23	4.41	7.93	103	0.05	0.08	3.42	155	0.009		0.12		172	0.0	4	
24	4.57	7.80	102	0.05	0.08	3.54	159	0.005		0.05		172	0.0	4	
25	4.76	7.71	98	0.05	0.08	3.63	153	0.008		0.20		168	3.0	5	
26	4.77	7.71	99	0.06	0.06	3.50	159	0.010		0.11		180	7.0	4	
27	4.93	7.72	103	0.06	0.06	3.39	155	0.005		0.04		178	0.0	5	
28	4.96	7.74	103	0.05	0.07	3.54	157	0.004		0.05		178	1.0	4	
29	5.17	7.79	103	0.06	0.06	3.44	157	0.007	0.004	0.08	0.002	179	0.5	4	
30	4.88	7.77	101	0.06	0.06	3.54	158	0.007		0.09		180	0.0	4	
31	4.82	7.80	102	0.06	0.06	3.33	157	0.011		0.10		184	0.0	5	
AVG	**4.79**	**7.82**	**102**	**0.06**	**0.07**	**3.47**	**156**	**0.006**	**0.013**	**0.08**	**0.004**	**182**	**0.4**	**4**	
TOTAL	**148.56**														

HIGH SERVICE
February 2014 Water Quality Report

	PLANT EFFLUENT														
DATE	Flow (mgd)	pH -	Alkalinity (mg/l)	Turbidity (NTU)	Free Cl2 (mg/l)	Total Cl2 (mg/l)	Hardness (mg/l)	Iron (mg/l)	Mn (mg/l)	NH_3 (mg/l)	NO_2 (mg/l)	TDS (mg/l)	Color (u)	Temp (°C)	Total Coliforms
1	4.34	7.87	107	0.05	0.08	3.31	159	0.006		0.20		179	0.0	6	A
2	4.83	7.87	107	0.05	0.08	3.40	157	0.005		0.10		180	0.0	6	
3	4.62	7.88	104	0.07	0.07	3.60	154	0.008		0.11		184	0.0	5	
4	4.81	7.92	105	0.06	0.07	3.47	156	0.049		0.11		180	0.0	5	A
5	4.65	7.91	103	0.05	0.08	3.43	160	0.003	0.013	0.08	0.007	179	0.5	5	
6	4.65	7.88	105	0.06	0.09	3.60	163	0.005		0.04		178	0.0	5	A
7	4.28	7.85	105	0.05	0.08	3.40	168	0.001		0.09		176	0.0	4	
8	4.65	7.84	103	0.06	0.08	3.29	165	0.004		0.09		176	0.0	4	A
9	4.50	7.81	103	0.07	0.07	3.26	156	0.004		0.08		178	0.0	4	
10	4.79	7.83	105	0.06	0.07	3.46	161	0.005		0.09		178	0.5	6	
11	4.83	7.93	105	0.05	0.06	3.29	158	0.004		0.07		179	4.0	5	A
12	4.73	7.78	102	0.06	0.06	3.37	154	0.005		0.08		182	0.0	4	
13	4.61	7.75	103	0.06	0.06	3.40	160	0.006	0.009	0.09	0.004	176	0.0	4	A
14	4.58	7.78	103	0.06	0.06	3.32	159	0.003		0.05		176	0.0	5	
15	4.50	7.70	104	0.05	0.08	3.32	161	0.006		0.07		178	0.0	5	A
16	4.72	7.70	103	0.05	0.07	3.31	160	0.002		0.05		178	0.0	5	
17	4.34	7.77	103	0.06	0.05	3.44	155	0.003		0.08		178	0.0	5	
18	4.70	7.80	102	0.07	0.05	3.54	152	0.004		0.08		174	0.0	5	A
19	5.64	7.83	101	0.06	0.07	3.59	159	0.003	0.009	0.04	0.005	176	0.0	6	
20	4.82	7.86	106	0.05	0.08	3.44	162	0.009		0.10		177	0.0	5	A
21	4.84	7.83	103	0.05	0.06	3.39	158	0.001		0.05		174	0.0	5	
22	5.12	7.90	101	0.08	0.06	3.24	158	0.005		0.12		178	0.0	5	A
23	4.92	7.71	86	0.07	0.07	3.26	169	0.006		0.12		180	0.0	5	
24	5.34	7.84	89	0.07	0.06	3.64	161	0.005		0.01		192	0.0	4	
25	4.49	7.97	89	0.07	0.08	3.76	160	0.006		0.06		195	3.5	5	A
26	4.40	7.70	87	0.07	0.09	3.76	160	0.008	0.019	0.05		191	2.5	5	
27	4.87	7.82	86	0.07	0.07	3.21	156	0.005		0.08		194	0.0	5	A
28	4.39	7.92	87	0.08	0.09	3.62	155	0.005		0.08		187	0.0	5	
AVG	**4.71**	**7.83**	**100**	**0.06**	**0.07**	**3.43**	**159**	**0.006**	**0.013**	**0.08**	**0.005**	**180**	**0.4**	**5**	
TOTAL	**131.96**														

HIGH SERVICE
March 2014 Water Quality Report

DATE	Flow (mgd)	pH -	Alkalinity (mg/l)	Turbidity (NTU)	Free Cl2 (mg/l)	Total Cl2 (mg/l)	Hardness (mg/l)	Iron (mg/l)	Mn (mg/l)	NH_3 (mg/l)	NO_2 (mg/l)	TDS (mg/l)	Color (u)	Temp (°C)	Total Coliforms
	PLANT EFFLUENT														
1	4.65	7.97	92	0.07	0.08	3.55	154	0.007		0.05		188	0.5	5	
2	4.67	7.98	91	0.06	0.06	3.66	161	0.004		0.06		185	0.0	5	
3	4.65	7.93	91	0.07	0.06	3.51	156	0.005		0.08		188	0.0	5	A
4	4.73	7.98	89	0.08	0.09	3.47	151	0.005		0.09		182	0.0	5	
5	3.99	7.99	92	0.06	0.08	3.48	157	0.004	0.021	0.18	0.011	191	1.5	6	A
6	4.71	8.01	94	0.06	0.07	3.48	155	0.011		0.08		198	1.0	5	
7	4.69	7.99	91	0.06	0.08	3.63	157	0.003		0.07		196	1.0	5	A
8	4.46	7.95	92	0.07	0.06	3.48	156	0.004		0.07		192	0.0	5	
9	4.52	7.93	94	0.06	0.06	3.54	152	0.005		0.08		186	0.0	5	
10	4.70	7.88	96	0.06	0.06	3.46	158	0.009		0.09		196	0.0	5	A
11	4.60	7.79	94	0.05	0.10	3.51	165	0.010		0.07		200	2.0	6	
12	4.45	7.93	97	0.06	0.06	3.45	156	0.003	0.020	0.05		195	0.0	5	A
13	4.30	7.99	95	0.07	0.06	3.50	150	0.006		0.07		190	0.0	5	
14	4.46	7.83	92	0.07	0.05	3.39	150	0.003		0.10		197	0.0	6	A
15	4.33	7.81	93	0.05	0.07	3.37	152	0.005		0.10		191	1.0	7	
16	4.49	7.86	92	0.05	0.06	3.40	150	0.004		0.07		190	0.5	7	
17	4.54	7.84	89	0.06	0.05	3.38	147	0.005		0.08		195	0.0	6	A
18	4.61	7.94	89	0.07	0.07	3.39	146	0.007		0.06		193	0.0	7	
19	3.99	7.83	85	0.05	0.08	3.18	153	0.004	0.009	0.04	0.011	191	0.0	6	A
20	4.63	7.69	88	0.05	0.08	3.76	150	0.004		0.00		188	0.0	6	
21	4.71	7.82	91	0.05	0.08	3.78	151	0.002		0.09		189	0.0	7	A
22	4.55	7.80	88	0.07	0.06	3.50	148	0.004		0.08		188	0.0	7	
23	3.90	7.76	90	0.06	0.05	3.37	145	0.004		0.09		190	0.0	7	
24	4.97	7.91	93	0.06	0.08	3.48	153	0.005		0.09		190	0.0	7	A
25	4.38	7.84	87	0.06	0.06	3.63	154	0.006		0.04		190	0.0	7	
26	3.87	7.81	88	0.06	0.06	3.70	144	0.010	0.009	0.04	0.004	188	0.0	8	A
27	4.68	7.83	91	0.06	0.07	3.65	146	0.004		0.09		186	0.0	7	
28	4.54	7.83	88	0.06	0.05	3.54	144	0.004		0.06		194	0.0	8	A
29	4.00	7.79	91	0.06	0.06	3.59	150	0.005		0.08		190	0.0	8	
30	4.79	7.89	92	0.06	0.05	3.54	150	0.005		0.05		189	0.0	9	
31	4.22	7.75	87	0.06	0.05	3.50	150	0.005		0.02		196	0.0	8	A
AVG	**4.48**	**7.87**	**91**	**0.06**	**0.07**	**3.51**	**152**	**0.005**	**0.015**	**0.07**	**0.009**	**191**	**0.2**	**6**	
TOTAL	**138.78**														

HIGH SERVICE
April 2014 Water Quality Report

	PLANT EFFLUENT														
DATE	Flow (mgd)	pH -	Alkalinity (mg/l)	Turbidity (NTU)	Free Cl2 (mg/l)	Total Cl2 (mg/l)	Hardness (mg/l)	Iron (mg/l)	Mn (mg/l)	NH_3 (mg/l)	NO_2 (mg/l)	TDS (mg/l)	Color (u)	Temp (°C)	Total Coliforms
1	4.56	7.67	88	0.06	0.07	3.53	143	0.009		0.05		188	0.0	9	
2	4.06	7.70	90	0.06	0.05	3.60	151	0.006	0.020	0.08	0.011	188	0.0	9	A
3	4.37	7.79	92	0.05	0.06	3.65	150	0.003		0.02		191	0.0	10	
4	4.14	7.89	89	0.05	0.05	3.74	155	0.001		0.08		182	0.0	9	A
5	4.48	7.95	89	0.06	0.05	3.61	150	0.004		0.06		190	0.0	9	
6	4.24	7.85	92	0.07	0.06	3.59	150	0.004		0.08		190	0.0	8	
7	4.33	7.82	93	0.06	0.05	3.52	156	0.005		0.06		199	0.0	11	A
8	4.24	7.83	89	0.07	0.06	3.42	161	0.002		0.06		224	0.0	11	
9	4.58	7.98	92	0.07	0.06	3.42	159	0.005	0.008	0.05	0.011	206	0.0	12	A
10	3.90	7.86	95	0.07	0.06	3.42	156	0.005		0.05		210	0.0	12	
11	4.64	7.74	92	0.07	0.06	3.46	154	0.007		0.10		204	0.0	13	A
12	4.54	7.74	94	0.06	0.06	3.43	161	0.004		0.13		194	0.0	13	
13	4.41	7.82	95	0.06	0.06	3.52	162	0.003		0.09		202	0.0	13	
14	4.35	7.89	96	0.07	0.05	3.42	159	0.004		0.10		204	0.0	13	A
15	3.66	7.87	94	0.07	0.05	3.58	156	0.010		0.10		202	0.0	13	
16	4.54	7.88	94	0.06	0.06	3.55	158	0.006	0.022	0.08	0.011	196	0.0	13	A
17	4.41	7.92	96	0.07	0.06	3.50	155	0.007		0.05		193	0.0	14	
18	4.49	7.87	94	0.07	0.06	3.47	159	0.006		0.03		198	0.0	14	A
19	4.42	7.83	93	0.07	0.06	3.35	156	0.004		0.04		200	0.0	14	
20	4.60	7.78	93	0.07	0.05	3.46	152	0.006		0.04		200	0.0	13	
21	4.29	7.84	97	0.06	0.06	3.51	159	0.007		0.13		185	0.0	15	A
22	4.50	7.91	94	0.06	0.06	3.53	161	0.007		0.19		201	0.0	16	
23	4.51	8.02	92	0.08	0.06	3.57	151	0.033	0.010	0.05	0.002	206	0.0	15	A
24	3.81	7.94	94	0.07	0.06	3.60	150	0.007		0.06		207	0.0	15	
25	4.57	7.92	96	0.07	0.05	3.47	150	0.004		0.07		193	0.0	15	A
26	4.44	7.96	97	0.07	0.04	3.41	157	0.006		0.06		191	0.0	15	
27	4.38	7.87	96	0.07	0.05	3.44	153	0.006		0.12		182	0.0	16	
28	4.21	7.81	93	0.07	0.06	3.46	150	0.006		0.10		178	0.0	14	A
29	3.87	7.87	94	0.08	0.05	3.33	147	0.004		0.12		188	0.0	15	
30	4.18	7.95	95	0.07	0.07	3.37	148	0.008	0.003	0.07		188	0.0	16	A
AVG	**4.32**	**7.86**	**93**	**0.07**	**0.06**	**3.50**	**154**	**0.006**	**0.013**	**0.07**	**0.009**	**196**	**0.0**	**13**	
TOTAL	**129.72**														
HIGH		**8.02**								**0.19**				**16**	
LOW		**7.67**								**0.02**				**8**	

HIGH SERVICE
May 2014 Water Quality Report

	PLANT EFFLUENT														
DATE	**Flow (mgd)**	**pH -**	**Alkalinity (mg/l)**	**Turbidity (NTU)**	**Free Cl2 (mg/l)**	**Total Cl2 (mg/l)**	**Hardness (mg/l)**	**Iron (mg/l)**	**Mn (mg/l)**	**NH_3 (mg/l)**	**NO_2 (mg/l)**	**TDS (mg/l)**	**Color (u)**	**Temp (°C)**	**Total Coliforms**
1	3.94	7.93	96	0.07	0.05	3.47	147	0.009		0.16		191	0.0	15	
2	4.03	7.95	97	0.07	0.05	3.41	158	0.012		0.07		187	0.0	13	A
3	4.29	7.93	95	0.08	0.06	3.37	150	0.008		0.04		192	0.0	14	
4	4.56	7.82	94	0.08	0.05	3.40	150	0.007		0.10		192	0.0	14	
5	4.38	7.76	100	0.08	0.05	3.52	157	0.011		0.12		185	0.0	16	A
6	4.97	7.87	99	0.08	0.05	3.43	156	0.045		0.18		191	0.0	17	
7	4.59	7.97	95	0.08	0.05	3.36	151	0.046	0.009	0.09	0.003	193	0.0	16	A
8	4.41	7.95	99	0.08	0.05	3.41	151	0.046		0.12		196	0.0	16	
9	4.65	7.97	96	0.08	0.06	3.31	151	0.008		0.12		189	0.0	17	A
10	5.06	7.97	100	0.09	0.06	3.24	154	0.016		0.15		194	0.0	18	
11	4.25	7.90	100	0.09	0.05	3.31	156	0.015		0.08		194	0.0	19	
12	4.15	7.79	96	0.08	0.06	3.39	150	0.012		0.09		198	0.0	19	A
13	4.36	7.85	97	0.08	0.05	3.34	150	0.053		0.12		189	0.0	19	
14	4.00	7.82	95	0.07	0.05	3.31	154	0.010	0.009	0.11	0.007	201	0.0	20	A
15	3.94	7.77	97	0.07	0.05	3.33	156	0.054		0.15		204	0.0	20	
16	4.47	7.77	98	0.07	0.05	3.37	156	0.005		0.11		210	0.0	19	A
17	3.89	7.78	99	0.06	0.04	3.41	165	0.007		0.11		208	0.0	18	
18	4.76	7.77	99	0.07	0.05	3.53	163	0.007		0.11		206	0.0	18	
19	4.33	7.81	97	0.07	0.06	3.43	155	0.014		0.09		206	0.0	18	A
20	4.83	7.83	99	0.07	0.06	3.49	160	0.003		0.09		204	0.0	17	
21	5.09	7.86	99	0.07	0.05	3.46	163	0.080	0.007	0.07	0.005	199	0.0	18	A
22	4.67	7.88	99	0.08	0.04	3.39	160	0.044		0.09		196	0.0	18	
23	4.93	7.90	100	0.08	0.05	3.36	155	0.011		0.13		196	0.0	18	A
24	4.58	7.90	103	0.10	0.05	3.37	158	0.009		0.11		192	0.5	20	
25	4.90	7.91	102	0.09	0.05	3.46	161	0.010		0.13		190	0.0	20	
26	4.92	7.95	102	0.08	0.05	3.42	160	0.009		0.12		196	0.0	19	A
27	5.19	7.93	102	0.08	0.05	3.48	159	0.007		0.08		201	0.0	20	
28	4.97	7.81	101	0.07	0.07	3.43	161	0.008	0.018	0.15	0.007	198	0.0	20	A
29	4.86	7.75	100	0.08	0.04	3.38	162	0.011		0.08		196	0.0	21	
30	4.73	7.75	102	0.07	0.05	3.23	160	0.008		0.08		189	0.0	23	A
31	5.07	7.76	100	0.07	0.05	3.34	160	0.008		0.08		196	0.0	22	
AVG	**4.57**	**7.86**	**99**	**0.08**	**0.05**	**3.39**	**156**	**0.019**	**0.011**	**0.11**	**0.006**	**196**	**0.0**	**18**	
TOTAL	**141.77**														

HIGH SERVICE
June 2014 Water Quality Report

	PLANT EFFLUENT														
DATE	Flow (mgd)	pH -	Alkalinity (mg/l)	Turbidity (NTU)	Free Cl2 (mg/l)	Total Cl2 (mg/l)	Hardness (mg/l)	Iron (mg/l)	Mn (mg/l)	NH_3 (mg/l)	NO_2 (mg/l)	TDS (mg/l)	Color (u)	Temp (°C)	Total Coliforms
1	4.80	7.78	100	0.08	0.06	3.30	160	0.006		0.09		198	0.0	22	
2	5.35	7.75	103	0.08	0.06	3.30	158	0.006		0.12		195	0.0	24	A
3	4.84	7.90	103	0.08	0.05	3.30	157	0.013		0.03		199	0.0	23	
4	4.75	7.98	101	0.08	0.06	3.41	161	0.046	0.012	0.07	0.007	202	0.0	23	A
5	4.27	8.03	104	0.08	0.06	3.26	156	0.090		0.09		200	0.0	23	
6	4.60	8.06	105	0.09	0.05	3.22	159	0.045		0.26		199	0.0	23	A
7	4.27	7.87	101	0.09	0.05	3.39	159	0.006		0.24		189	0.5	23	
8	4.39	8.09	101	0.08	0.04	3.42	160	0.003		0.11		191	0.0	23	
9	3.77	7.88	95	0.08	0.04	3.45	152	0.004		0.10		196	0.0	23	A
10	4.63	7.82	93	0.08	0.05	3.42	152	0.025		0.10		180	0.0	23	
11	4.71	7.90	93	0.07	0.05	3.51	159	0.006	0.032	0.07	0.008	192	0.0	22	A
12	4.32	7.94	94	0.07	0.05	3.47	147	0.004		0.13		188	0.0	22	
13	4.07	7.87	93	0.08	0.05	3.51	157	0.007		0.11		157	0.0	22	A
14	4.69	7.85	91	0.07	0.04	3.47	152	0.006		0.11		194	0.0	22	
15	4.41	7.81	92	0.07	0.04	3.51	152	0.007		0.12		200	0.0	22	
16	4.30	7.90	97	0.07	0.05	3.53	151	0.006		0.19		184	0.0	23	A
17	5.33	7.91	95	0.07	0.05	3.50	152	0.007		0.14		182	0.0	24	
18	5.25	7.98	91	0.08	0.07	3.58	147	0.005	0.009	0.08	0.001	193	0.0	24	A
19	5.14	8.07	90	0.07	0.05	3.61	151	0.055		0.09		215	0.0	24	
20	4.74	7.91	91	0.07	0.06	3.49	152	0.009		0.04		189	0.0	24	A
21	4.89	7.83	96	0.06	0.04	3.41	155	0.030		0.05		185	0.0	24	
22	4.72	7.87	97	0.06	0.04	3.43	156	0.009		0.09		190	0.0	24	
23	4.66	8.00	97	0.08	0.04	3.52	152	0.008		0.10		196	0.0	24	A
24	4.54	7.89	94	0.08	0.05	3.32	152	0.008		0.10		193	0.0	24	
25	5.21	7.97	95	0.07	0.05	3.42	154	0.004	0.008	0.09	0.009	186	0.0	25	A
26	4.91	7.99	97	0.06	0.05	3.41	156	0.004		0.15		194	0.0	25	
27	4.94	7.89	95	0.06	0.05	3.43	155	0.014		0.06		181	0.0	24	A
28	4.54	7.94	96	0.08	0.04	3.31	150	0.095		0.08		192	0.0	24	
29	4.78	7.91	96	0.07	0.05	3.34	150	0.065		0.09		196	0.0	24	
30	4.81	7.75	95	0.06	0.05	3.38	149	0.006		0.12		183	0.0	26	A
AVG	**4.69**	**7.91**	**96**	**0.07**	**0.05**	**3.42**	**154**	**0.020**	**0.015**	**0.10**	**0.006**	**191**	**0.0**	**23**	
TOTAL	**140.63**														
HIGH		**8.09**								**0.26**				**26**	
LOW		**7.75**								**0.03**				**22**	

HIGH SERVICE
July 2014 Water Quality Report

	PLANT EFFLUENT														
DATE	Flow (mgd)	pH -	Alkalinity (mg/l)	Turbidity (NTU)	Free Cl2 (mg/l)	Total Cl2 (mg/l)	Hardness (mg/l)	Iron (mg/l)	Mn (mg/l)	NH_3 (mg/l)	NO_2 (mg/l)	TDS (mg/l)	Color (u)	Temp (°C)	Total Coliforms
1	4.85	7.67	92	0.07	0.05	3.30	149	0.006		0.11		173	0.0	25	
2	4.54	7.66	90	0.07	0.05	3.31	152	0.008	0.020	0.07	0.002	186	0.0	25	A
3	4.41	7.83	92	0.07	0.04	3.32	147	0.007		0.08		190	0.0	24	
4	4.95	7.89	95	0.07	0.04	3.40	152	0.006		0.10		190	0.0	24	A
5	4.57	7.85	97	0.08	0.04	3.39	153	0.010		0.08		184	0.0	24	
6	4.67	7.85	99	0.08	0.05	3.32	154	0.007		0.06		184	0.0	24	
7	4.94	7.84	97	0.08	0.04	3.37	155	0.007		0.11		0	0.0	24	A
8	4.28	7.82	95	0.07	0.05	3.24	153	0.006		0.10		187	0.0	25	
9	4.11	7.85	96	0.07	0.05	3.28	155	0.006	0.016	0.04	0.007	189	0.0	24	A
10	4.33	7.83	98	0.07	0.05	3.32	153	0.009		0.10		183	0.0	25	
11	4.78	7.77	99	0.07	0.05	3.38	153	0.008		0.10		180	0.0	24	A
12	4.68	7.80	95	0.07	0.04	3.39	150	0.009		0.10		188	0.0	24	
13	4.45	7.90	95	0.07	0.04	3.36	151	0.007		0.10		190	0.0	24	
14	4.29	7.78	96	0.07	0.05	3.25	154	0.007		0.14		185	0.0	25	A
15	4.61	7.78	98	0.06	0.05	3.25	153	0.007		0.07		190	0.0	24	
16	3.88	7.86	95	0.07	0.05	3.36	155	0.008	0.015	0.08	0.009	191	0.0	24	A
17	4.91	7.86	98	0.06	0.05	3.40	154	0.006		0.10		191	0.0	24	
18	4.49	7.77	96	0.07	0.05	3.50	148	0.005		0.09		193	0.0	24	A
19	4.99	7.72	96	0.06	0.06	3.48	151	0.005		0.09		189	0.0	24	
20	4.86	7.85	98	0.06	0.05	3.47	150	0.004		0.14		189	0.0	24	
21	4.96	7.93	98	0.07	0.04	3.38	153	0.005		0.06		191	0.0	25	A
22	4.84	7.85	98	0.08	0.05	3.37	154	0.006		0.08		192	0.0	26	
23	4.90	7.86	98	0.06	0.05	3.26	152	0.007	0.012	0.10	0.009	195	0.0	26	A
24	4.71	7.90	100	0.07	0.05	3.37	155	0.008		0.14		193	0.0	26	
25	4.19	7.80	95	0.07	0.05	3.31	153	0.007		0.08		194	0.0	24	A
26	4.99	7.83	94	0.07	0.05	3.37	146	0.007		0.08		192	0.0	24	
27	4.38	7.90	95	0.07	0.04	3.41	147	0.008		0.09		190	0.0	24	
28	4.63	7.72	96	0.07	0.06	3.47	145	0.007		0.03		190	0.0	25	A
29	4.55	7.60	95	0.07	0.05	3.42	154	0.005		0.11		188	0.0	25	
30	4.45	7.72	92	0.08	0.06	3.34	151	0.007	0.012	0.10	0.004	193	0.0	25	A
31	4.56	7.69	95	0.08	0.05	3.42	147	0.006		0.09		192	0.0	25	
AVG	**4.60**	**7.81**	**96**	**0.07**	**0.05**	**3.36**	**152**	**0.007**	**0.015**	**0.09**	**0.006**	**182**	**0.0**	**24**	
TOTAL	**142.75**														

HIGH SERVICE
August 2014 Water Quality Report

	PLANT EFFLUENT														
DATE	Flow (mgd)	pH -	Alkalinity (mg/l)	Turbidity (NTU)	Free Cl2 (mg/l)	Total Cl2 (mg/l)	Hardness (mg/l)	Iron (mg/l)	Mn (mg/l)	NH_3 (mg/l)	NO_2 (mg/l)	TDS (mg/l)	Color (u)	Temp (°C)	Total Coliforms
1	4.38	7.76	98	0.07	0.05	3.34	146	0.005		0.10		194	0.0	25	A
2	4.23	7.87	99	0.06	0.05	3.38	151	0.007		0.18		193	0.0	25	
3	4.91	7.93	100	0.06	0.05	3.41	153	0.007		0.07		200	0.0	25	
4	4.56	7.92	98	0.07	0.04	3.40	148	0.006		0.07		206	2.0	25	A
5	4.65	7.96	97	0.07	0.05	3.44	147	0.006		0.07		206	0.5	26	
6	4.20	7.90	97	0.07	0.05	3.39	155	0.007	0.011	0.06	0.006	206	0.0	25	A
7	4.14	7.77	98	0.07	0.05	3.30	152	0.004		0.08		259	0.0	26	
8	3.96	7.78	97	0.07	0.05	3.27	148	0.005		0.11		246	0.0	25	A
9	4.60	7.77	93	0.07	0.04	3.24	146	0.004		0.10		248	0.0	25	
10	4.18	7.90	96	0.06	0.04	3.42	150	0.038		0.10		248	0.0	25	
11	4.23	7.90	100	0.08	0.06	3.49	152	0.005		0.10		222	0.0	26	A
12	4.01	7.92	102	0.07	0.05	3.45	153	0.006		0.11		196	0.0	24	
13	4.28	7.85	98	0.07	0.04	3.37	145	0.011	0.007	0.10	0.009	240	0.0	25	A
14	4.31	7.89	99	0.07	0.04	3.40	149	0.006		0.11		245	0.0	25	
15	4.32	7.90	101	0.06	0.04	3.44	148	0.008		0.11		247	0.0	25	A
16	4.09	7.89	103	0.07	0.04	3.33	153	0.005		0.15		246	0.0	24	
17	3.97	7.86	104	0.06	0.04	3.29	159	0.005		0.05		245	0.0	25	
18	4.58	7.89	103	0.07	0.04	3.31	151	0.006		0.07		246	0.0	25	A
19	4.16	7.81	103	0.07	0.06	3.22	150	0.006		0.13		247	0.0	25	
20	4.15	7.80	103	0.07	0.06	3.24	154	0.006	0.013	0.12	0.080	243	0.0	25	A
21	4.21	7.92	106	0.06	0.06	3.43	155	0.006		0.17		241	0.0	25	
22	4.63	7.95	102	0.06	0.05	3.50	152	0.006		0.13		242	0.0	26	A
23	4.48	7.99	100	0.07	0.05	3.55	147	0.006		0.12		245	0.0	25	
24	4.74	8.04	102	0.07	0.05	3.50	150	0.007		0.12		254	0.0	25	
25	4.83	7.88	102	0.07	0.05	3.50	147	0.008		0.23		241	0.0	27	A
26	4.95	7.82	97	0.06	0.05	3.36	153	0.066		0.16		238	0.0	27	
27	4.38	7.89	96	0.08	0.05	3.40	141	0.150	0.020	0.12	0.004	236	0.0	25	A
28	4.67	7.96	97	0.07	0.05	3.41	145	0.006		0.13		234	0.0	27	
29	4.35	7.90	97	0.08	0.04	3.37	142	0.007		0.16		236	0.0	27	A
30	4.19	7.95	100	0.08	0.05	3.28	148	0.008		0.19		237	0.0	27	
31	4.67	7.87	96	0.08	0.04	3.26	145	0.009		0.21		236	0.0	27	
AVG	**4.39**	**7.89**	**99**	**0.07**	**0.05**	**3.38**	**149**	**0.014**	**0.013**	**0.12**	**0.025**	**233**	**0.1**	**25**	
TOTAL	**136.01**														
HIGH		**8.04**								**0.23**				**27**	
LOW		**7.76**								**0.05**				**24**	

HIGH SERVICE
September 2014 Water Quality Report

	PLANT EFFLUENT														
DATE	Flow (mgd)	pH -	Alkalinity (mg/l)	Turbidity (NTU)	Free Cl2 (mg/l)	Total Cl2 (mg/l)	Hardness (mg/l)	Iron (mg/l)	Mn (mg/l)	NH_3 (mg/l)	NO_2 (mg/l)	TDS (mg/l)	Color (u)	Temp (°C)	Total Coliforms
1	4.58	7.73	95	0.08	0.04	3.25	145	0.007		0.15		236	0.0	27	A
2	3.96	7.88	96	0.08	0.04	3.37	142	0.010		0.13		238	0.0	27	
3	4.43	7.95	99	0.08	0.05	3.27	146	0.009	0.014	0.09	0.008	239	0.0	27	A
4	4.38	7.83	98	0.08	0.05	3.24	144	0.011		0.12		237	0.0	27	
5	4.21	7.79	97	0.09	0.06	3.12	144	0.011		0.06		237	0.0	27	A
6	4.18	7.85	99	0.08	0.05	3.23	146	0.008		0.09		238	0.0	27	
7	4.10	7.83	98	0.10	0.03	3.05	140	0.006		0.10		243	0.0	27	
8	4.20	7.72	95	0.09	1.25	2.69	146	0.004		0.01		235	0.0	25	A
9	4.18	7.59	95	0.08	2.50	3.07	145	0.010		0.00		233	0.0	25	
10	3.73	7.65	94	0.08	2.95	3.45	147	0.010	0.010	0.00	0.004	236	0.0	25	A
11	3.78	7.69	94	0.08	2.78	3.25	146	0.006		0.00		238	0.0	27	
12	4.29	7.75	94	0.09	2.70	3.28	148	0.009		0.00		244	0.0	23	A
13	4.47	7.83	90	0.07	2.62	3.34	140	0.012		0.00		232	0.0	22	
14	4.52	7.87	86	0.06	2.71	3.44	140	0.005		0.00		222	0.0	21	
15	4.15	7.73	82	0.07	3.05	3.70	136	0.008		0.00		223	0.0	21	A
16	3.77	7.65	84	0.07	3.15	3.80	137	0.007		0.00		226	0.0	21	
17	4.44	7.78	90	0.05	2.88	3.69	141	0.005	0.030	0.00	0.008	228	0.0	20	A
18	4.68	7.80	92	0.06	2.91	3.67	143	0.007		0.00		228	0.0	20	
19	4.68	7.82	95	0.06	3.06	4.01	143	0.006		0.00		232	0.0	21	A
20	4.08	7.77	95	0.07	3.24	3.88	147	0.005		0.00		238	0.0	21	
21	4.58	7.84	94	0.08	3.11	3.73	140	0.005		0.00		238	0.0	21	
22	4.27	7.88	96	0.07	2.85	3.59	147	0.007		0.00		234	0.0	22	A
23	4.18	7.85	95	0.07	2.74	3.57	149	0.006		0.00		224	0.0	21	
24	4.59	7.80	90	0.06	3.02	3.57	144	0.006	0.017	0.00	0.012	223	0.0	23	A
25	4.60	7.82	91	0.07	3.21	3.71	149	0.004		0.00		220	0.0	21	
26	4.49	7.83	92	0.09	3.10	3.59	140	0.009		0.00		230	0.0	21	A
27	4.24	7.81	94	0.07	2.72	3.49	145	0.016		0.00		232	0.0	21	
28	4.23	7.83	97	0.06	2.63	3.40	148	0.014		0.00		231	0.0	22	
29	4.52	7.88	94	0.07	2.69	3.16	140	0.009		0.00		232	0.0	22	A
30	4.58	7.92	96	0.07	2.79	3.27	143	0.010		0.00		232	0.0	22	
AVG	**4.30**	**7.80**	**93**	**0.07**	**2.16**	**3.43**	**144**	**0.008**	**0.018**	**0.02**	**0.008**	**232**	**0.0**	**23**	
TOTAL	**129.09**														

HIGH SERVICE
October 2014 Water Quality Report

	PLANT EFFLUENT														
DATE	**Flow (mgd)**	**pH -**	**Alkalinity (mg/l)**	**Turbidity (NTU)**	**Free Cl2 (mg/l)**	**Total Cl2 (mg/l)**	**Hardness (mg/l)**	**Iron (mg/l)**	**Mn (mg/l)**	**NH_3 (mg/l)**	**NO_2 (mg/l)**	**TDS (mg/l)**	**Color (u)**	**Temp (°C)**	**Total Coliforms**
1	3.84	7.80	96	0.07	2.75	3.31	144	0.006	0.018	0.00	0.008	227	0.0	22	A
2	4.55	7.69	94	0.07	2.85	3.41	148	0.006		0.00		228	0.0	21	
3	4.69	7.70	95	0.06	2.77	3.37	145	0.005		0.00		224	0.0	22	A
4	4.25	7.69	94	0.07	2.77	3.26	139	0.006		0.00		228	0.0	21	
5	4.33	7.69	92	0.07	2.63	3.15	143	0.006		0.00		229	0.0	20	
6	4.11	7.60	95	0.06	1.94	2.66	141	0.013		0.00		228	0.0	20	A
7	4.30	7.67	99	0.06	0.05	2.63	144	0.005		0.05		230	0.0	19	
8	4.29	7.72	97	0.07	0.05	3.00	143	0.006		0.12		234	0.0	19	A
9	3.76	7.81	98	0.07	0.04	3.15	141	0.006	0.019	0.09	0.002	226	0.0	20	
10	4.26	7.82	100	0.07	0.04	3.15	142	0.010		0.12		231	0.0	19	A
11	4.37	8.02	104	0.06	0.05	3.28	149	0.002		0.15		226	0.0	18	
12	4.11	8.04	102	0.06	0.05	3.41	148	0.006		0.07		224	0.0	18	
13	3.71	7.85	100	0.07	0.05	3.40	147	0.009		0.10		225	0.0	20	A
14	4.27	7.81	100	0.06	0.05	3.39	142	0.008		0.12		226	0.0	18	
15	4.13	7.84	96	0.06	0.05	3.49	145	0.006	0.001	0.15	0.002	223	0.0	18	A
16	4.08	7.85	95	0.05	0.06	3.38	138	0.005		0.11		221	0.0	18	
17	4.18	7.81	96	0.06	0.07	3.42	142	0.004		0.09		223	0.0	18	A
18	4.01	7.77	98	0.07	0.06	3.36	142	0.005		0.08		225	0.0	18	
19	4.32	7.78	100	0.07	0.05	3.41	144	0.007		0.10		236	0.0	19	
20	4.12	8.00	99	0.05	0.06	3.34	142	0.006		0.13		224	0.0	18	A
21	3.98	8.11	99	0.06	0.08	3.39	146	0.004		0.10		227	0.0	18	
22	4.46	8.00	98	0.07	0.09	3.47	140	0.004	0.015	0.08	0.004	226	0.0	18	A
23	4.40	7.98	99	0.07	0.07	3.68	142	0.006		0.10		224	0.0	18	
24	3.69	7.96	100	0.07	0.07	3.59	144	0.011		0.13		224	0.0	18	A
25	4.26	7.96	101	0.06	0.07	3.48	144	0.006		0.12		225	0.0	17	
26	4.36	7.95	102	0.06	0.07	3.58	145	0.012		0.09		223	0.0	17	
27	4.14	7.98	100	0.07	0.07	3.52	148	0.007		0.10		225	0.0	17	A
28	4.10	7.94	100	0.06	0.06	3.52	142	0.004		0.12		229	0.0	17	
29	4.29	7.90	100	0.06	0.07	3.49	149	0.003	0.006	0.08	0.009	225	0.0	17	A
30	3.74	7.86	102	0.06	0.08	3.52	141	0.008		0.12		224	0.0	17	
31	4.03	7.85	101	0.05	0.07	3.52	145	0.005		0.10		224	0.0	16	A
AVG	**4.17**	**7.85**	**98**	**0.06**	**0.55**	**3.35**	**144**	**0.006**	**0.012**	**0.08**	**0.005**	**226**	**0.0**	**18**	
TOTAL	**129.13**														

HIGH SERVICE
November 2014 Water Quality Report

	PLANT EFFLUENT														
DATE	Flow (mgd)	pH -	Alkalinity (mg/l)	Turbidity (NTU)	Free Cl2 (mg/l)	Total Cl2 (mg/l)	Hardness (mg/l)	Iron (mg/l)	Mn (mg/l)	NH_3 (mg/l)	NO_2 (mg/l)	TDS (mg/l)	Color (u)	Temp (°C)	Total Coliforms
1	4.28	7.84	100	0.07	0.07	3.52	144	0.006		0.11		228	0.0	16	
2	3.68	7.89	100	0.07	0.07	3.56	144	0.006		0.11		226	0.0	16	
3	4.69	7.90	103	0.06	0.07	3.61	147	0.004		0.07		226	0.0	16	A
4	3.72	7.89	101	0.06	0.08	3.56	149	0.004		0.08		227	0.0	15	
5	4.48	7.89	99	0.07	0.06	3.71	151	0.005	0.005	0.02	0.100	227	0.0	16	A
6	3.70	7.90	99	0.07	0.07	3.72	149	0.007		0.11		236	0.0	16	
7	4.03	7.92	100	0.07	0.07	3.64	145	0.004		0.11		228	0.0	15	A
8	4.32	7.97	102	0.06	0.08	3.57	148	0.006		0.08		229	0.0	14	
9	4.33	7.91	102	0.07	0.08	3.52	151	0.004		0.08		228	0.0	14	
10	4.06	7.85	100	0.08	0.07	3.50	147	0.006		0.10		228	0.0	15	A
11	4.25	7.82	99	0.07	0.06	3.52	146	0.005		0.11		226	0.0	15	
12	3.81	7.83	100	0.06	0.08	3.67	153	0.003	0.008	0.07	0.008	226	0.0	13	A
13	4.26	7.92	101	0.07	0.08	3.86	154	0.005		0.02		227	0.0	13	
14	3.75	7.93	98	0.06	0.09	3.69	153	0.006		0.11		214	0.0	12	A
15	4.45	7.88	98	0.07	0.07	3.68	151	0.006		0.12		220	0.0	12	
16	4.45	7.85	94	0.07	0.07	3.82	144	0.004		0.07		229	0.0	13	
17	4.51	7.88	98	0.07	0.07	3.48	147	0.003		0.06		227	0.0	9	A
18	3.91	7.92	101	0.05	0.10	3.70	158	0.002		0.06		228	0.0	11	
19	4.35	7.84	98	0.06	0.08	3.83	146	0.005	0.009	0.05	0.007	229	0.0	12	A
20	4.36	7.80	99	0.09	0.07	3.73	150	0.007		0.10		228	0.0	12	
21	4.17	7.83	98	0.07	0.09	3.83	150	0.005		0.03		226	0.0	10	A
22	4.16	7.87	98	0.06	0.08	3.68	146	0.008		0.03		229	0.0	9	
23	4.41	7.89	100	0.06	0.08	3.68	147	0.004		0.03		227	0.0	10	
24	4.01	7.90	98	0.07	0.07	3.63	147	0.005		0.08		228	0.0	10	A
25	4.25	7.94	99	0.08	0.09	3.68	147	0.004		0.08		227	0.0	9	
26	4.46	7.97	99	0.06	0.07	3.79	155	0.004	0.022	0.01	0.009	226	0.0	10	A
27	3.74	7.81	97	0.05	0.08	3.74	149	0.007		0.03		226	0.0	9	
28	4.30	7.75	99	0.05	0.09	3.83	155	0.002		0.07		227	0.0	9	A
29	4.05	7.70	98	0.07	0.09	3.84	156	0.006		0.09		230	0.0	8	
30	4.20	7.80	99	0.07	0.08	3.65	146	0.005		0.09		232	0.0	10	
AVG	**4.17**	**7.87**	**99**	**0.07**	**0.08**	**3.67**	**149**	**0.005**	**0.011**	**0.07**	**0.031**	**227**	**0.0**	**12**	
TOTAL	**125.14**														

HIGH SERVICE
December 2014 Water Quality Report

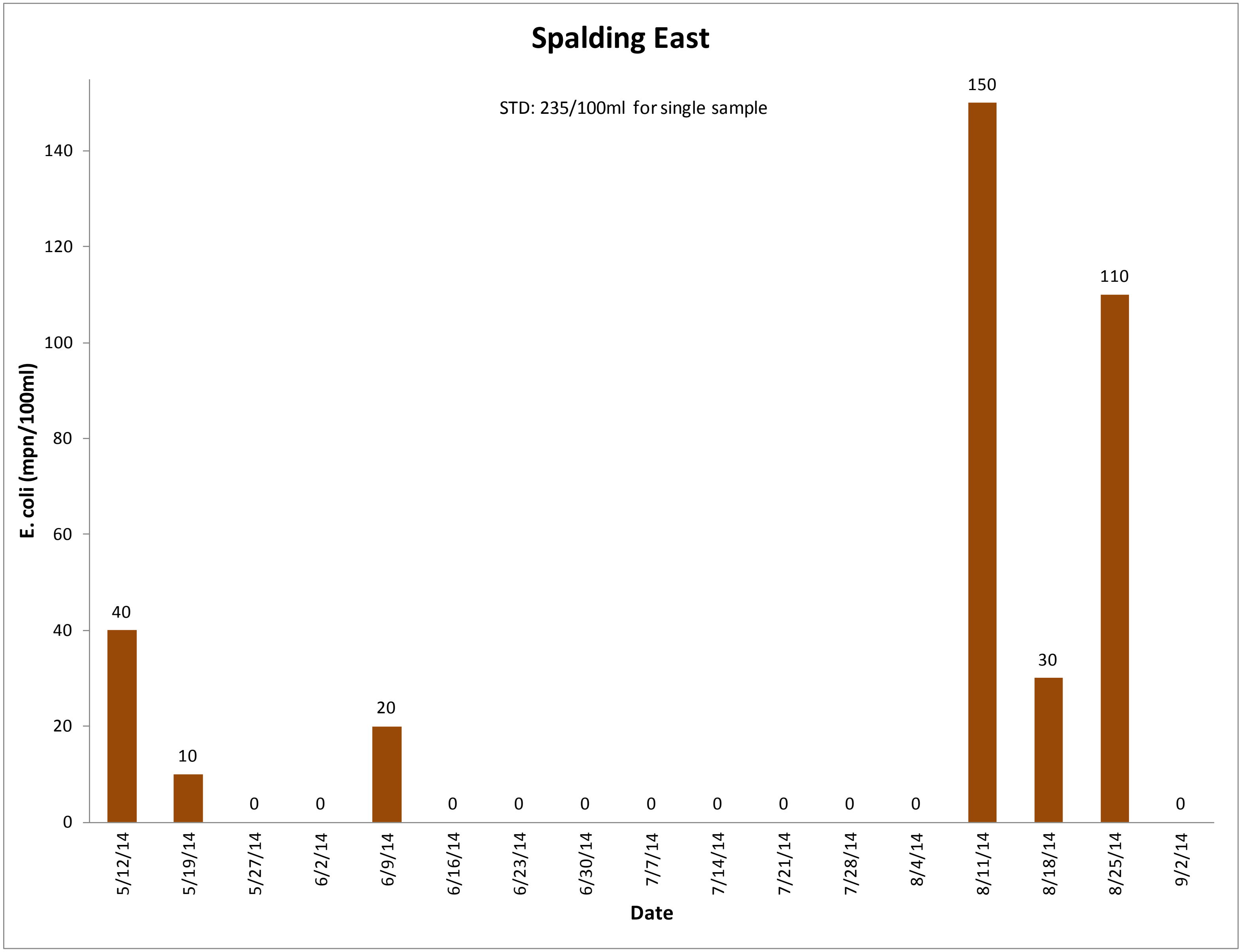
	PLANT EFFLUENT														
DATE	Flow (mgd)	pH -	Alkalinity (mg/l)	Turbidity (NTU)	Free Cl2 (mg/l)	Total Cl2 (mg/l)	Hardness (mg/l)	Iron (mg/l)	Mn (mg/l)	NH_3 (mg/l)	NO_2 (mg/l)	TDS (mg/l)	Color (u)	Temp (°C)	Total Coliforms
1	4.32	7.84	100	0.06	0.07	3.70	151	0.003		0.05		228	0.0	8	A
2	3.74	7.88	98	0.06	0.09	3.81	156	0.003		0.05		229	0.0	9	
3	4.30	7.87	95	0.07	0.09	3.89	146	0.004	0.009	0.07	0.008	228	0.0	8	A
4	3.81	7.90	94	0.08	0.07	3.70	144	0.003		0.07		230	0.0	7	
5	4.10	7.91	95	0.06	0.07	3.55	148	0.002		0.12		223	0.0	7	A
6	3.52	7.86	101	0.05	0.07	3.82	155	0.002		0.09		234	0.0	8	
7	4.02	7.86	101	0.05	0.07	3.70	152	0.004		0.08		230	0.0	7	
8	3.80	7.85	99	0.07	0.09	3.71	152	0.010		0.12		230	0.0	8	A
9	4.26	7.83	99	0.06	0.09	3.64	150	0.003		0.09		232	0.0	7	
10	3.60	7.81	100	0.05	0.10	3.74	149	0.003	0.014	0.07	0.008	232	0.0	9	A
11	4.12	7.83	102	0.06	0.10	3.91	148	0.004		0.03		231	0.0	8	
12	4.13	7.78	103	0.05	0.10	3.73	158	0.003		0.11		233	0.0	8	A
13	3.90	7.77	100	0.07	0.08	3.68	150	0.005		0.11		232	0.0	9	
14	3.97	7.75	100	0.06	0.08	3.78	153	0.006		0.11		214	0.0	8	
15	4.35	7.79	104	0.06	0.08	3.72	155	0.011		0.11		235	0.0	7	A
16	3.67	7.82	104	0.06	0.09	3.79	153	0.006		0.10		242	0.0	11	
17	3.88	7.84	103	0.06	0.08	3.66	155	0.007	0.007	0.10	0.004	233	0.0	10	A
18	4.55	7.87	101	0.07	0.07	3.68	155	0.005		0.11		236	0.0	9	
19	3.74	7.86	103	0.06	0.07	3.55	151	0.002		0.10		228	0.0	6	A
20	4.47	7.88	109	0.05	0.08	3.74	159	0.003		0.08		244	0.0	8	
21	4.21	7.90	110	0.05	0.10	3.61	158	0.012		0.05		242	0.0	8	
22	4.46	7.87	106	0.07	0.08	3.61	156	0.085		0.08		240	0.0	6	A
23	3.92	7.82	107	0.07	0.07	3.53	165	0.006		0.11		243	0.0	7	
24	4.42	7.85	110	0.06	0.08	3.57	166	0.013	0.010	0.08	0.008	249	0.0	8	A
25	3.83	7.84	111	0.06	0.52	3.71	160	0.005		0.02		237	0.0	8	
26	4.42	7.82	113	0.06	0.09	3.70	167	0.047		0.08		245	0.0	8	A
27	4.17	7.80	108	0.07	0.09	3.66	164	0.009		0.06		245	0.0	7	
28	3.97	7.78	107	0.07	0.08	3.77	158	0.016		0.09		247	0.0	7	
29	4.39	7.86	112	0.06	0.10	3.53	163	0.006		0.04		245	0.0	8	A
30	3.81	7.82	106	0.07	0.08	3.60	159	0.007		0.07		245	0.0	6	
31	4.42	7.82	103	0.07	0.09	3.78	158	0.011	0.009	0.11	0.004	243	0.0	7	A
AVG	**4.07**	**7.84**	**103**	**0.06**	**0.10**	**3.69**	**155**	**0.010**	**0.010**	**0.08**	**0.006**	**235**	**0.0**	**8**	
TOTAL	**126.27**														

APPENDIX F

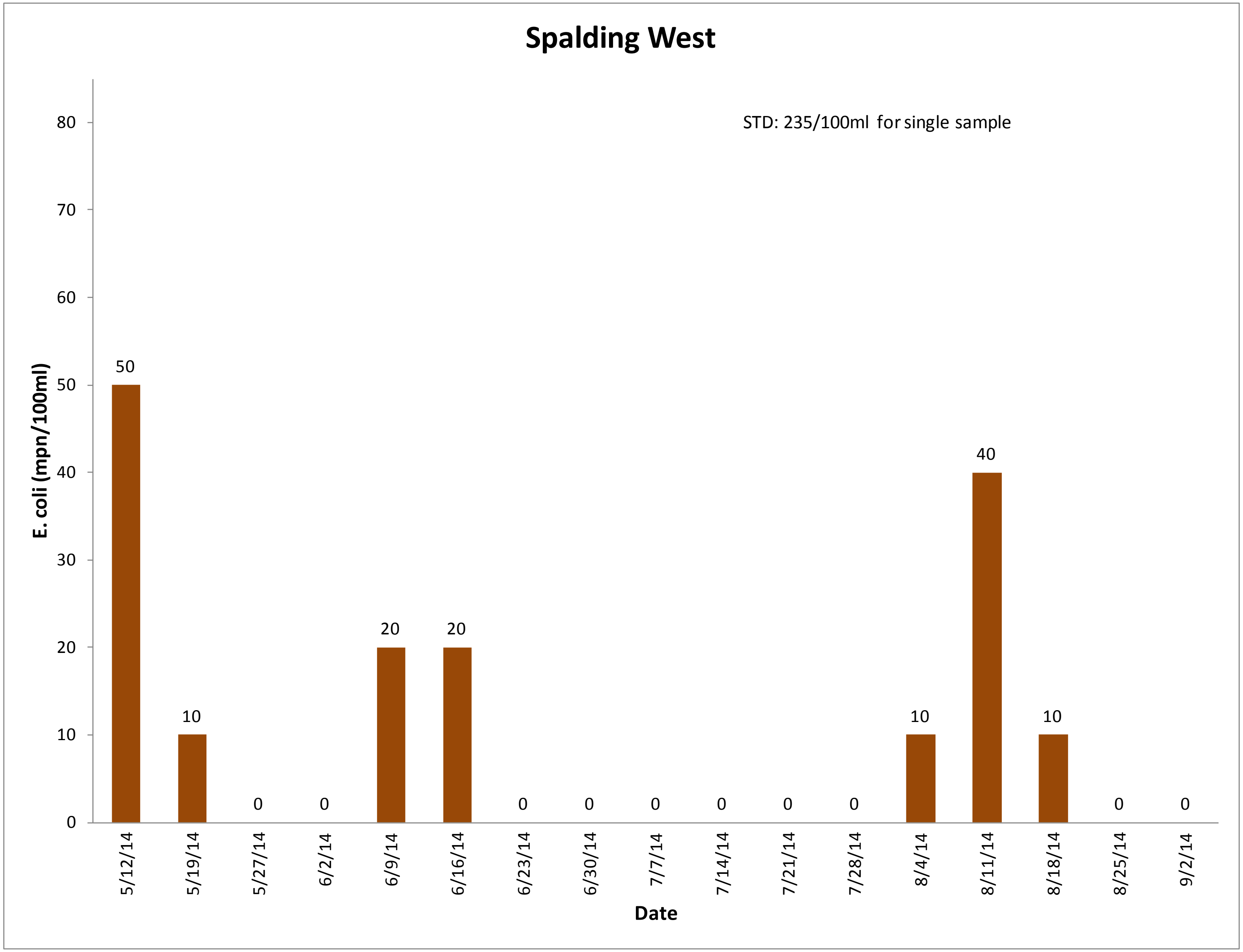
Beach Data & Graphs

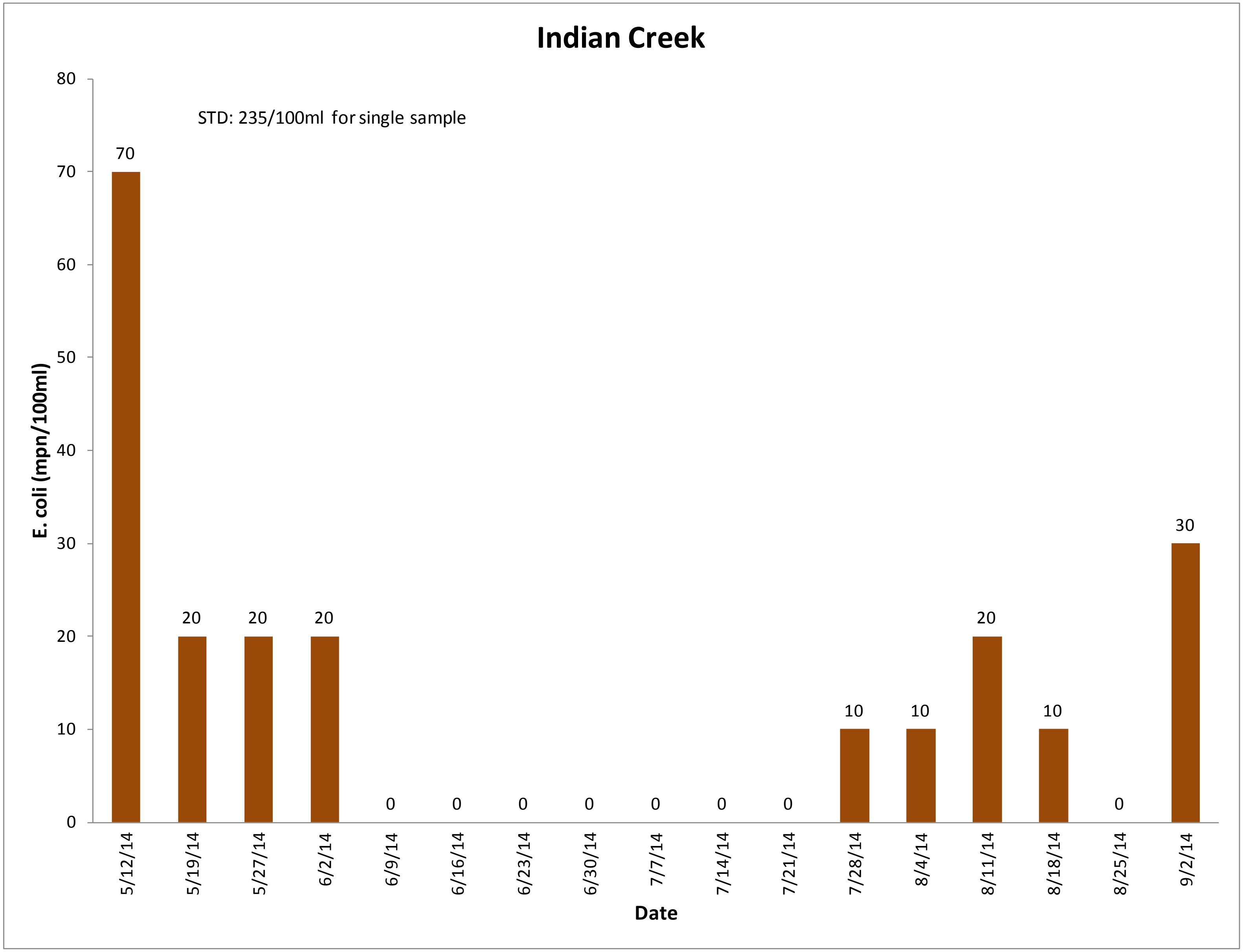
2014 Beach Data

Date	Bottle Number	Spalding East (E. Coli / 100 ml)	Bottle Number	Spalding West (E. Coli / 100 ml)	Bottle Number	Indian Creek (E. Coli / 100 ml)
5/12/2014	1840	40	1843	50	1844	70
5/19/2014	5743	10	5741	10	5744	20
5/27/2014	5746	0	5752	0	5753	20
6/2/2014	5759	0	5758	0	5760	20
6/9/2014	5766	20	5767	20	5768	0
6/16/2014	5952	0	5961	20	5969	0
6/23/2014	5839	0	5847	0	5920	0
6/30/2014	5808	0	5822	0	5939	0
7/7/2014	5960	0	5970	0	5972	0
7/14/2014	5784	0	5900	0	5953	0
7/21/2014	5803	0	5809	0	5841	0
7/28/2014	5924	0	5962	0	5973	10
8/4/2014	5824	0	5891	10	5910	10
8/11/2014	5892	150	5911	40	5937	20
8/18/2014	5854	30	5871	10	5878	10
8/25/2014	5981	110	6002	0	5992	0
9/2/2014	5967	0	5968	0	5984	30



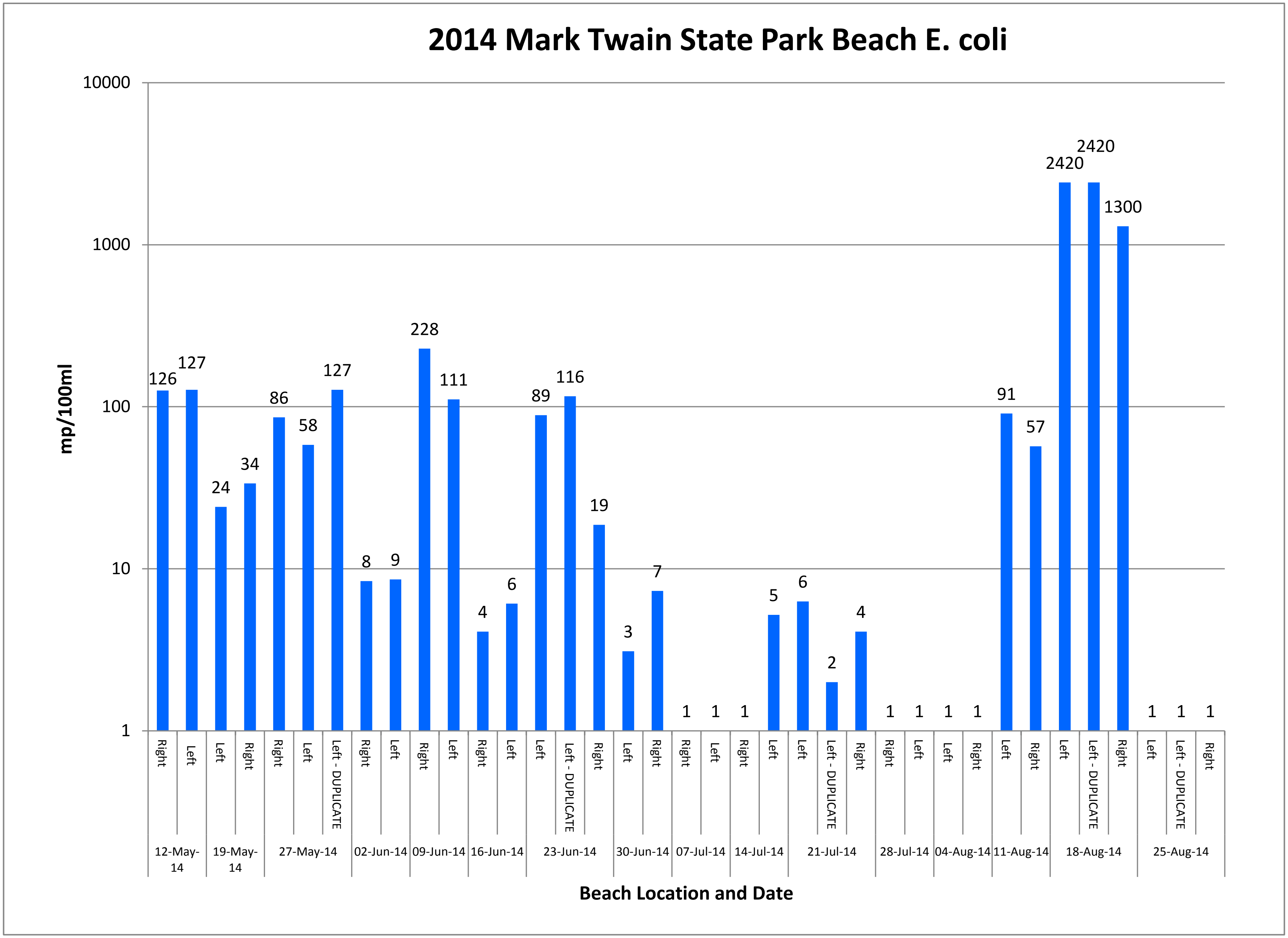
Spalding East
STD: 235/100ml for single sample
E. coli (mpn/100ml)
0
20
40
60
80
100
120
140
40
10
0
0
20
0
0
0
0
0
0
0
0
150
30
110
0
5/12/14
5/19/14
5/27/14
6/2/14
6/9/14
6/16/14
6/23/14
6/30/14
7/7/14
7/14/14
7/21/14
7/28/14
8/4/14
8/11/14
8/18/14
8/25/14
9/2/14
Date


Spalding West
STD: 235/100ml for single sample
E. coli (mpn/100ml)
80
70
60
50
40
30
20
10
0
50
10
0
0
20
20
0
0
0
0
0
0
10
40
10
0
0
5/12/14
5/19/14
5/27/14
6/2/14
6/9/14
6/16/14
6/23/14
6/30/14
7/7/14
7/14/14
7/21/14
7/28/14
8/4/14
8/11/14
8/18/14
8/25/14
9/2/14
Date


Indian Creek
STD: 235/100ml for single sample
E. coli (mpn/100ml)
0
10
20
30
40
50
60
70
80
70
20
20
20
0
0
0
0
0
0
0
10
10
20
10
0
30
5/12/14
5/19/14
5/27/14
6/2/14
6/9/14
6/16/14
6/23/14
6/30/14
7/7/14
7/14/14
7/21/14
7/28/14
8/4/14
8/11/14
8/18/14
8/25/14
9/2/14
Date

2014 Mark Twain State Park Beach Data

Park	Sample Number	Date Time Collected	Ecoli	Turbidity	Comments
Mark Twain SP	AC24253	5/12/14 8:50	125.9	78	Public Beach - Right
Mark Twain SP	AC24252	5/12/14 8:52	127.4		Public Beach - Left
Mark Twain SP	AC26049	5/19/14 10:45	24.1		Public Beach - Left
Mark Twain SP	AC26050	5/19/14 10:48	33.6	330	Public Beach - Right
Mark Twain SP	AC26182	5/27/14 9:05	86.0	97	Public Beach - Right
Mark Twain SP	AC26180	5/27/14 9:10	58.3		Public Beach - Left
Mark Twain SP	AC26181	5/27/14 9:10	127.4		Public Beach - Left - DUPLICATE
Mark Twain SP	AC27346	6/2/14 9:00	8.4	70	Public Beach - Right
Mark Twain SP	AC27345	6/2/14 9:05	8.6		Public Beach - Left
Mark Twain SP	AC28352	6/9/14 10:55	228.2	102.0	Public Beach - Right
Mark Twain SP	AC28351	6/9/14 11:00	111.2		Public Beach - Left
Mark Twain SP	AC28900	6/16/14 9:30	4.1	55	Public Beach - Right
Mark Twain SP	AC28899	6/16/14 9:35	6.1		Public Beach - Left
Mark Twain SP	AC29005	6/23/14 9:30	88.8		Public Beach - Left
Mark Twain SP	AC29006	6/23/14 9:30	116.0		Public Beach - Left - DUPLICATE
Mark Twain SP	AC29007	6/23/14 9:35	18.7	60	Public Beach - Right
Mark Twain SP	AC30127	6/30/14 9:30	3.1		Public Beach - Left
Mark Twain SP	AC30128	6/30/14 9:35	7.3	46	Public Beach - Right
Mark Twain SP	AC29080	7/7/14 11:00	<1	34	Public Beach - Right
Mark Twain SP	AC29079	7/7/14 11:10	<1		Public Beach - Left
Mark Twain SP	AC30410	7/14/14 8:40	<1	22	Public Beach - Right
Mark Twain SP	AC30409	7/14/14 8:42	5.2		Public Beach - Left
Mark Twain SP	AC30966	7/21/14 12:00	6.3		Public Beach - Left
Mark Twain SP	AC30967	7/21/14 12:00	2.0		Public Beach - Left - DUPLICATE
Mark Twain SP	AC30968	7/21/14 12:00	4.1	170	Public Beach - Right
Mark Twain SP	AC31127	7/28/14 9:30	1.0	12	Public Beach - Right
Mark Twain SP	AC31126	7/28/14 9:32	<1		Public Beach - Left
Mark Twain SP	AC32672	8/4/14 9:00	<1		Public Beach - Left
Mark Twain SP	AC32673	8/4/14 9:05	1.0	18	Public Beach - Right
Mark Twain SP	AC32975	8/11/14 9:00	90.8		Public Beach - Left
Mark Twain SP	AC32976	8/11/14 9:05	57.1	16	Public Beach - Right
Mark Twain SP	AC34097	8/18/14 9:00	>2419.6		Public Beach - Left
Mark Twain SP	AC34098	8/18/14 9:00	>2419.6		Public Beach - Left - DUPLICATE
Mark Twain SP	AC34099	8/18/14 9:05	1299.7	64	Public Beach - Right
Mark Twain SP	AC34523	8/25/14 8:30	<1		Public Beach - Left
Mark Twain SP	AC34524	8/25/14 8:30	1.0		Public Beach - Left - DUPLICATE
Mark Twain SP	AC34525	8/25/14 8:32	1.0	6.8	Public Beach - Right


2014 Mark Twain State Park Beach E. coli
mp/100ml
10000
1000
100
10
1
Beach Location and Date
126
127
24
34
86
58
127
8
9
228
111
4
6
89
116
19
3
7
1
1
1
5
6
2
4
1
1
1
1
91
57
2420
2420
1300
1
1
1
Right
Left
Left - DUPLICATE
12-May-14
19-May-14
27-May-14
02-Jun-14
09-Jun-14
16-Jun-14
23-Jun-14
30-Jun-14
07-Jul-14
14-Jul-14
21-Jul-14
28-Jul-14
04-Aug-14
11-Aug-14
18-Aug-14
25-Aug-14