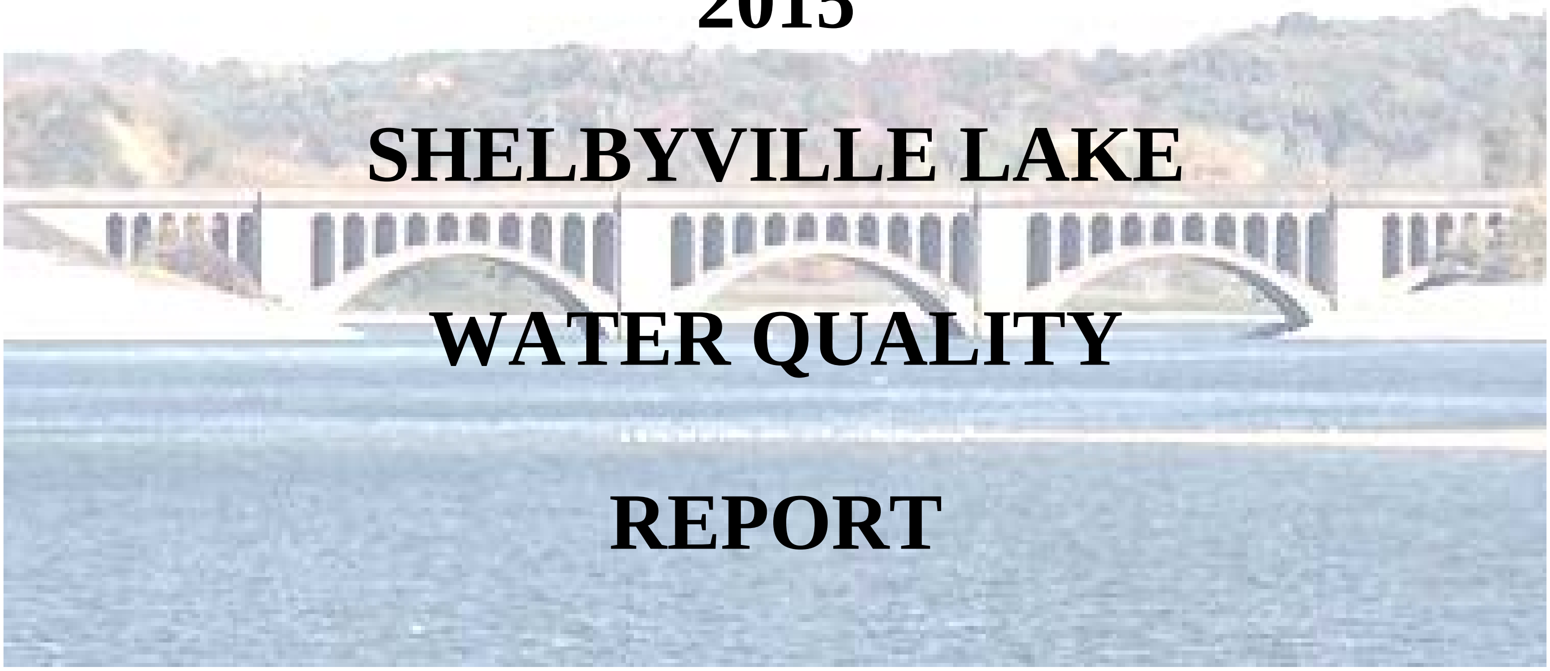
2015



SHELBYVILLE LAKE

WATER QUALITY

REPORT

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

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Executive Summary

The purpose of this report is to provide an annual analysis of the water quality in the lake for the past year. Shelbyville Lake is a multi-purpose reservoir located on the Kaskaskia River, one-half mile east and one-fourth mile north of the town of Shelbyville, Illinois and 120 miles northeast of St. Louis. The lake is 20 miles long and is 1 to 1.5 miles wide and has approximately 11,100 acres of water surface at summer pool. The lake is located on the Kaskaskia River at river mile 222 upstream from its confluence with the Mississippi River.

The water of Shelbyville Lake and the downstream river channel is generally good. The lake is a shallow reservoir susceptible to high winds. These conditions prevent the lake from stratifying for long periods during the summer months. Several years ago a remote sensor was installed on the spillway wall to allow the project as well as water quality personnel to remotely monitor temperature and oxygen readings to avoid fish kills by changing release rates. No fish kills were observed during this past year.

All sampling sites met the appropriate state standards during 2015 except for E. coli beach samples at Wilborn Creek in June. Phosphorous levels at the lake sites have exceeded the state standard on a routine basis. Generally phosphorous levels in the tailwater and lake site near the dam (site 2) 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 several pollution potentials, with agriculture probably being the major contributor; but 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 2015 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.

Water quality monitoring remains one of the Branch's 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 Illinois Environmental Protection Agency (IEPA) to be used in the Illinois Integrated Water Quality Report, which is required every two years by the Clean Water Act Sections 303(d) and 305(b). IEPA does not monitor Shelbyville Lake. However, IEPA has stated that since the Corps lakes are the 3 largest lakes in the state, it is critical that their quality be routinely assessed. The state indicated that having the federally collected water quality data available now and in the future is critical to the state of Illinois meeting their mission in complying with the Clean Water Act Sections 305(b) and 303(d).

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.

Currently the Illinois Environmental Protection Agency (IEPA) has listed Shelbyville Lake impaired for Total Suspended Solids and aquatic plants. The lists of sources for these impairments are runoff, crop production, shore modifications, and recreational pollution. 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

Shelbyville Lake is within the Kaskaskia River basin in central Illinois. The lake serves as a heavy recreational usage lake. The land surrounding the lake is used predominately for agriculture. Surrounding communities have existing industrial/commercial operations and residents which discharge wastewater into municipal wastewater treatment plants that ultimately discharge treated water into the Kaskaskia River basin. Agricultural runoff and municipal wastewater treatment facilities are the primary potential source of pollution into the Shelbyville Lake watershed. Additional sources are marinas, recreational watercraft discharges and wildlife fecal material runoff.

Water quality monitoring was conducted during 2015 to assure the safe conditions for human recreation, wildlife and aquatic life was maintained and managed within the lake system. In 2015 three sampling events were conducted at six sites. The 2015 water quality monitoring program began in April and continued through August. During the past several years, water quality monitoring has been reduced due to funding. Prior to 2009 five sampling events were conducted during the recreational season. In the initial phase of the sampling program during the 1970's and 80's six or seven sampling events were conducted. A restored number of sampling events would provide the ability to better evaluate water quality trends, to 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 sites include the following: Site 1 (SBV-1) Spillway, Site 2 (SBV-02) Lake side in front of Dam, Site 4 (SBV-04) Kaskaskia River arm near Sullivan Marina, Site 12 (SBV-12), at Jonathan Creek Access, Site 13 (SBV-13), at West Eden Access, and Site 11 (SBV-11), Okaw River Arm near the C. & E. I. railroad bridge. This combination of sites effectively represents the incoming contaminants and their effects on the lake. During each sampling period one site is selected for quality control duplication and denoted as SBV-15. The locations of the six sampling sites are depicted on the lake map in Figure 1. In 2014, it was decided to replace sites 7 and 9 with other locations closer to the lake. Sites 12 and 13 replaced sites 7 and 9, respectively. These new sites were chosen to provide tributary sample sites closer to the lake so that additional tributaries were incorporated into the samples. These samples provide a more concise account of the water quality coming directly into Shelbyville Lake from its tributaries.

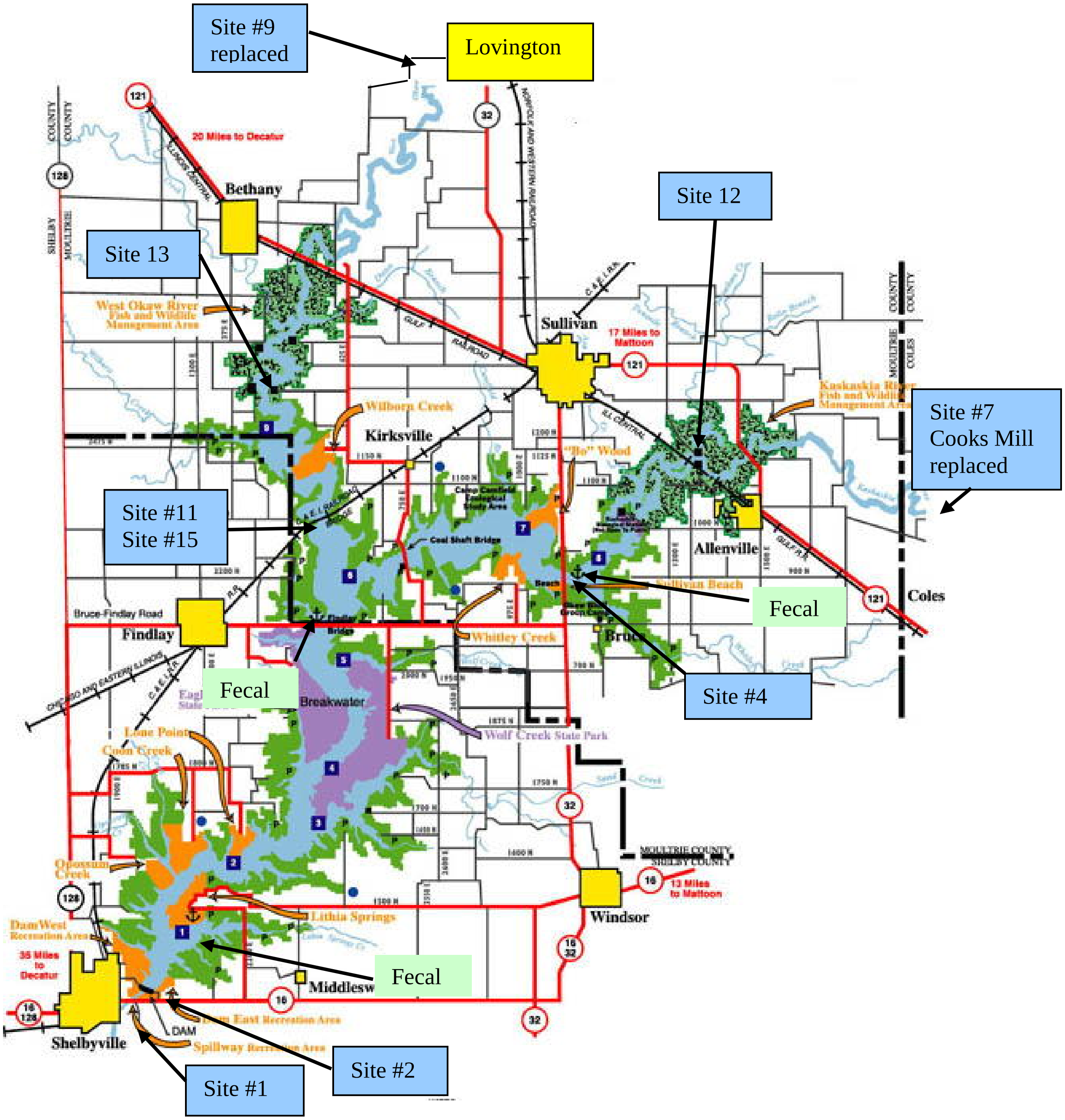


Figure 1
Location of sample sites
In 2014 sites 12 and 13 replaced sites 7 and 9 respectively.

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 Illinois regulatory limits for certain contaminants. The sampling and analysis which were conducted at the Shelbyville Lake sites reflect the minimal set of parameters needed to analyze the current status of water quality for the Shelbyville Lake system.

The following water quality parameters were analyzed in Fiscal Year 2015 at Shelbyville Lake: Total Organic Carbon (TOC), iron, manganese, ammonia-nitrogen, nitrate-nitrogen, orthophosphate, total phosphate, Total Suspended Solids (TSS), Total Volatile Suspended Solids (TVSS), Escherichia coli (E. coli), pH, temperature, dissolved oxygen, specific conductance, oxidation-reduction potential (ORP), chlorophyll, pheophytin-a, pesticides and herbicides,

The Illinois Environmental Protection Agency in Title 35, Subtitle, C, classifies water quality criteria based on end usage. Subpart B contains regulations for general use water, while subparts C and D delineate those for public and food processing water and secondary contact and indigenous aquatic life standards, respectively. 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 Illinois
Water Quality Standards

PARAMETER	LIMIT
Temperature	Rise of 2.8^{o}C above normal seasonal temp
Ammonia Nitrogen	15 mg/L
Nitrate Nitrogen	10 mg/L
Total Iron	2.0 mg/L (2nd Contact & Aquatic Life)
Manganese	1.0 mg/L
Total Phosphate	0.05 mg/L Lakes; 0.61 mg/L Streams
E. Coli	Illinois 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
Conductivity	1,667 *u*S/cm≈TDS of 1,000 mg/L
Total Suspended Solids (TSS)	116mg/L (Streams); >=12mg/L (Lakes)
Atrazine	0.003 mg/L[1]; 82ug/L[2]; 9ug/L[3]
Alachlor	0.002 mg/L (Drinking Water Standard)
Cyanazine	370ug/L Acute; 30ug/L[3]
Metolachlor	1.7mg/L Acute
Simazine	4.0ug/L [1]
Trifluralin	26ug/L Acute; 1.1ug/L[3]

Pendimethalin (PROWL)	70ug/L HSBL, 20ug/L[1]

[1] Drinking Water Standard
[2] Acute
[3] Chronic
Health Based Screening Levels (HBSL)

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) increase, 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), which is comprised of organic material and nonvolatile suspended solids (NVSS) that consist 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 is present in water. Total volatile solids indicate the presence of organics in suspension, and therefore, show additional demand levels of oxygen. Illinois recommends a TSS standard of 116mg/L for streams and ≥12mg/L for lakes. Literature suggests that Nonvolatile Suspended Solids (NVSS) which is a subdivision of TSS greater than 15mg/L could highly impair recreational lake use and 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 standard for fecal coliform is less than 500 colonies per 100ml of sample water. 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 and 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. Cold water holds 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^{o}C. 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 Illinois 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 established 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 measurement to oxidize materials. 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 indicate 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 characteristics. 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 Administration (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 Illinois for sediments. While not a direct correlation, sample results were compared against Illinois Tiered Approach to Corrective Action Objectives (TACO) and Non-TACO 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 Shelbyville Lake during Fiscal Year 2015 revealed good water quality when compared to limits established by the IEPA for general use, secondary contact, and indigenous aquatic life. Normally seasonal change brings on gradual lake stratification during the summer months. Water quality trends on a yearly basis are hard to determine when only conducting 3 to 4 sampling events. However, over the course of a 5 year period these 3 to 4 sampling events per year are adequate to determine trends in water quality. 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 Environmental Quality Section participates in the annual Kaskaskia Watershed Summit which provides information about the condition of the entire watershed.

E. coli are sampled at the marinas to ensure that the marina areas are not being contaminated by boats with restroom facilities. E. coli levels did not exceed the Illinois standard of 235 mpn/100ml at any of the marinas in FY15. The project office is notified as soon as any readings not meeting standards are received. Two samples at each beach are collected by the project every 2 weeks during the recreation season. All beaches were below the 235 standard during the recreational season except Wilborn Creek on June 24 (248.1). Rainfall events can trigger high levels of E. coli, but records indicate only 0.01 inches of rain fell during the previous couple of days prior to the sampling event. According to the Illinois Department of Health an E. coli count of greater than 235 colonies/100ml in any single of a two sample set shall require the submission of 2 additional samples to be collected on the same day within 24 hours after notification by the Department. Follow up samples were taken and the results were below the standard.

Total iron and total manganese are sampled above the dam near the bottom of the channel (SBV-2-10) and in the spillway area (SBV-1). As was previously stated, living organisms require trace amounts of metals, however excessive amounts can be harmful to the organism. Manganese did not exceed the IL standard of 1.0mg/L for general use. Iron cycling is a function of oxidation-reduction processes. Elevated levels of iron near the bottom of a lake is not immediately detrimental to the overall lake system. Iron oxidizes relatively rapidly (minutes to hours); therefore, any iron released through the spillway will be oxidized in a short period of time. Illinois has a secondary contact and aquatic life standard. It does not currently have a general use standard for iron. Neither iron nor manganese exceeded the Illinois standard.

Nitrogen and phosphates are sampled at all sites. As for the past several years the 2015 phosphate results at the lake sites are above the 0.05 mg/L standard for most of the sampling season. These higher levels may be contributed to application of fertilizers and/or rain events. The tributaries contribute high levels of phosphates into the lake. As in previous years phosphorous levels dropped below the dam. Later in the year the lake was consuming phosphate before it was discharged downstream through the dam. In effect water quality is improving at the lake. Phosphorous in water is not considered directly toxic to humans and animals therefore, 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 Illinois Water Quality Standard for ammonia nitrogen (NH_3-N) is 15mg/L. 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 throughout 2015. Sample sites SBV-4, and SBV-12 on the Kaskaskia River arm, and SBV-11 and SBV-13 on the West Okaw arm showed elevated levels of nitrogen in August. The lake appears to be capturing and utilizing this nutrient thus improving down stream water quality.

Chlorophyll *a* was sampled at 4 sites, SBV-2, SBV-4, SBV-11, and SBV-15. Chlorophyll *a* is a green pigment found in plants. 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. Chlorophyll levels were in the moderate range during the 3 sampling events. 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 is monitored to provide indicators of algae growth and therefore, potential oxygen depletion activity. 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. Shelbyville Lake was in the moderate risk of exposure category for chlorophyll. Illinois does not currently have a standard for chlorophyll. The data indicates a normal increase in chlorophyll levels during the warmer summer months, which is not a concern.

Atrazine and Alachlor are pesticides that were sampled at all sites. These chemicals are herbicides used to control weed growth. Normally pesticides are detected early in the year, in the months of April and May when farmers apply the chemicals. Cyanizine, Metolachlor, Trifluralin and Simazine were also analyzed as part of the pesticide screening. None of these constituents exceeded Illinois standards. These substances can enter water bodies as a result of drift during spraying, surface runoff, and leaching through soil. 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. In June SBV-4 and SBV-12 had elevated levels of atrazine, but did not exceed the state standard.

Total Suspended Solids (TSS) and Total Volatile Suspended Solids (TVSS) samples are collected at all sites. Tributary sites did not exceed the Illinois standard of 116mg/L for streams. All lake samples exceeded the Illinois standard of 12mg/L for lakes except SBV-2. 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. As is the case with many of the Illinois lakes they are shallow and susceptible to high winds. These winds are constantly producing wave erosion of the banks and suspending material in the water. These conditions attribute to the lake exceeding the Illinois standard for TSS in lakes. Suspended solids within the lake were significantly decreased or less than levels in the tributaries. The solids appear to be dropping out of the water column as the water moves towards the dam. This results in improved water quality down stream.

Total Organic Carbon (TOC) is collected at all sites. Data indicates that TOC is higher in the upper portions of the lake. TOC is an indicator of the organic character of water. The larger the carbon or organic content, the more oxygen is consumed. Illinois does not currently have a standard for TOC. Since Illinois does not have a standard for this parameter, observations of high or low are relative to the current sampling period.

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.

pH is taken at all sites and at 1 meter intervals at lake sites. All sites were within the 6 to 9 pH range. Variances in pH can be caused by increased runoff due to a rainfall event, unusual temperature extremes, or erosion from land disturbances. Another cause may be that photosynthesis uses up dissolved carbon dioxide, which acts like carbonic acid (H_2CO_3) in water. CO_2 removal in effect reduces the acidity of the water, thus the pH increases.

Secchi disk readings indicate that as the water travels down the lake it becomes clearer. This is most likely the result of sediments dropping out of the water column as the water moves down stream toward the dam. Early in the year secchi disk readings may be approximately the same through the length of the lake due to lake turn over or wind mixing.

Conductivity and redox are taken at all sites and at 1 meter intervals at lake sites. Illinois does not currently have a standard for redox, but does have a standard of less than 1,667 uS/cm for conductivity. No sampling sites even approached this standard.

The remote sensor in the spillway was monitored and maintained throughout the year to allow the project as well as water quality personnel to remotely monitor temperature and oxygen readings to acquire data to inform operational actions in order to avoid fish kills. During low flow, water is discharged through the sluice gates from the bottom of the lake. This water is low in oxygen and can create a low oxygen area below the dam. The sensor allows the project to monitor oxygen levels below the dam and make appropriate adjustments to avoid a possible fish kill. Normally allowing water to spill through the tainter gates or increasing the flow through the sluice gate will alleviate low oxygen levels below the dam. No fish kills were observed this year. The sonde was serviced approximately once each month from May through September. Dissolved oxygen dropped below the 5mg/l standard a few times during July and August and some of these times correlated to the changing out the sonde for maintenance.

3.2 Sediment Summary

Sediment sampling was not conducted in 2015. 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 <u>PLANNED 2016 STUDIES</u>

The Shelbyville Lake water quality monitoring will continue in Fiscal Year 2016 on a limited basis. Because of budgetary constraints there will only be 3 sampling events in 2016. A restored number of sampling events would provide the ability to better evaluate water quality trends, to 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. Shelbyville Lake is a high usage recreational lake. The monitoring of water quality is imperative to ensure the water quality is within acceptable limits for the designated usage.

The sampling sites include the following: Site 1 (SBV-1) Spillway, Site 2 (SBV-02) Lake side in front of Dam, Site 4 (SBV-04) Kaskaskia River arm near Sullivan Marina, Site 12 (SBV-12) at Jonathan Creek Access, Site 13 (SBV-13) at West Eden Access, and Site 11 (SBV-11) Okaw River Arm near the C. & E. I. railroad bridge. This combination of sites effectively represents the incoming contaminants and their effects on the lake.

Sediment sampling will be conducted if funding is available.

In addition, water quality personnel will continue to maintain and remotely monitor the DO & temperature probe in the spillway.

APPENDIX A

DATA

LAB DATA
WATER SAMPLES

Site #	Collection Date	Parameter	Flag	Reported Result	Units
SVL-1	4/23/15	Alachlor	<	0.21	UG/L
SVL-1	6/4/15	Alachlor	<	0.21	UG/L
SVL-1	8/20/15	Alachlor	<	0.22	UG/L
SVL-11	4/23/15	Alachlor	<	0.21	UG/L
SVL-11	6/4/15	Alachlor	<	0.22	UG/L
SVL-11	8/20/15	Alachlor	<	0.20	UG/L
SVL-12	4/23/15	Alachlor	<	0.21	UG/L
SVL-12	6/4/15	Alachlor	<	0.20	UG/L
SVL-12	8/20/15	Alachlor	<	0.21	UG/L
SVL-13	4/23/15	Alachlor	<	0.20	UG/L
SVL-13	6/4/15	Alachlor	<	0.20	UG/L
SVL-13	8/20/15	Alachlor	<	0.25	UG/L
SVL-15	4/23/15	Alachlor	<	0.21	UG/L
SVL-15	6/4/15	Alachlor	<	0.22	UG/L
SVL-15	8/20/15	Alachlor	<	0.25	UG/L
SVL-2	4/23/15	Alachlor	<	0.25	UG/L
SVL-2	6/4/15	Alachlor	<	0.25	UG/L
SVL-2	8/20/15	Alachlor	<	0.20	UG/L
SVL-4	4/23/15	Alachlor	<	0.22	UG/L
SVL-4	6/4/15	Alachlor	<	0.22	UG/L
SVL-4	8/20/15	Alachlor	<	0.24	UG/L
SVL-1	4/23/15	Ammonia Nitrogen		0.086	MG/L
SVL-1	6/4/15	Ammonia Nitrogen		0.060	MG/L
SVL-1	8/20/15	Ammonia Nitrogen		0.38	MG/L
SVL-11	4/23/15	Ammonia Nitrogen		0.042	MG/L
SVL-11	6/4/15	Ammonia Nitrogen		0.10	MG/L
SVL-11	8/20/15	Ammonia Nitrogen		0.21	MG/L
SVL-12	4/23/15	Ammonia Nitrogen		0.096	MG/L
SVL-12	6/4/15	Ammonia Nitrogen		0.14	MG/L
SVL-12	8/20/15	Ammonia Nitrogen		0.15	MG/L
SVL-13	4/23/15	Ammonia Nitrogen		0.053	MG/L
SVL-13	6/4/15	Ammonia Nitrogen		0.16	MG/L

Site #	Collection Date	Parameter	Flag	Reported Result	Units
SVL-13	8/20/15	Ammonia Nitrogen		0.22	MG/L
SVL-15	4/23/15	Ammonia Nitrogen		0.057	MG/L
SVL-15	6/4/15	Ammonia Nitrogen		0.051	MG/L
SVL-15	8/20/15	Ammonia Nitrogen		0.18	MG/L
SVL-2	4/23/15	Ammonia Nitrogen		0.066	MG/L
SVL-2	6/4/15	Ammonia Nitrogen		0.049	MG/L
SVL-2	8/20/15	Ammonia Nitrogen		0.26	MG/L
SVL-2-10	4/23/15	Ammonia Nitrogen		0.12	MG/L
SVL-2-10	6/4/15	Ammonia Nitrogen		0.080	MG/L
SVL-2-10	8/20/15	Ammonia Nitrogen		0.42	MG/L
SVL-4	4/23/15	Ammonia Nitrogen		0.15	MG/L
SVL-4	6/4/15	Ammonia Nitrogen		0.061	MG/L
SVL-4	8/20/15	Ammonia Nitrogen		0.47	MG/L
SVL-1	4/23/15	Atrazine	<	0.21	UG/L
SVL-1	6/4/15	Atrazine	<	0.21	UG/L
SVL-1	8/20/15	Atrazine		0.32	UG/L
SVL-11	4/23/15	Atrazine	<	0.21	UG/L
SVL-11	6/4/15	Atrazine		0.43	UG/L
SVL-11	8/20/15	Atrazine	<	0.20	UG/L
SVL-12	4/23/15	Atrazine	<	0.21	UG/L
SVL-12	6/4/15	Atrazine		1.5	UG/L
SVL-12	8/20/15	Atrazine	<	0.21	UG/L
SVL-13	4/23/15	Atrazine	<	0.20	UG/L
SVL-13	6/4/15	Atrazine	<	0.20	UG/L
SVL-13	8/20/15	Atrazine	<	0.25	UG/L
SVL-15	4/23/15	Atrazine	<	0.21	UG/L
SVL-15	6/4/15	Atrazine		0.26	UG/L
SVL-15	8/20/15	Atrazine	<	0.25	UG/L
SVL-2	4/23/15	Atrazine	<	0.25	UG/L
SVL-2	6/4/15	Atrazine	<	0.25	UG/L
SVL-2	8/20/15	Atrazine		0.30	UG/L
SVL-4	4/23/15	Atrazine	<	0.22	UG/L
SVL-4	6/4/15	Atrazine		1.5	UG/L
SVL-4	8/20/15	Atrazine	<	0.24	UG/L
SVL-11	4/23/15	Chlorophyll a		9.6	MG/CU.M.

Site #	Collection Date	Parameter	Flag	Reported Result	Units
SVL-11	6/4/15	Chlorophyll a		13.7	MG/CU.M.
SVL-11	8/20/15	Chlorophyll a		3.3	MG/CU.M.
SVL-15	4/23/15	Chlorophyll a		10.2	MG/CU.M.
SVL-15	6/4/15	Chlorophyll a		16.0	MG/CU.M.
SVL-15	8/20/15	Chlorophyll a		9.2	MG/CU.M.
SVL-2	4/23/15	Chlorophyll a		5.9	MG/CU.M.
SVL-2	6/4/15	Chlorophyll a	<	2.0	MG/CU.M.
SVL-2	8/20/15	Chlorophyll a		4.7	MG/CU.M.
SVL-4	4/23/15	Chlorophyll a	<	2.0	MG/CU.M.
SVL-4	6/4/15	Chlorophyll a		2.4	MG/CU.M.
SVL-4	8/20/15	Chlorophyll a		13.7	MG/CU.M.
SVL-1	4/23/15	Chloropyrifos	<	0.21	UG/L
SVL-1	6/4/15	Chloropyrifos	<	0.21	UG/L
SVL-1	8/20/15	Chloropyrifos	<	0.22	UG/L
SVL-11	4/23/15	Chloropyrifos	<	0.21	UG/L
SVL-11	6/4/15	Chloropyrifos	<	0.22	UG/L
SVL-11	8/20/15	Chloropyrifos	<	0.20	UG/L
SVL-12	4/23/15	Chloropyrifos	<	0.21	UG/L
SVL-12	6/4/15	Chloropyrifos	<	0.20	UG/L
SVL-12	8/20/15	Chloropyrifos	<	0.21	UG/L
SVL-13	4/23/15	Chloropyrifos	<	0.20	UG/L
SVL-13	6/4/15	Chloropyrifos	<	0.20	UG/L
SVL-13	8/20/15	Chloropyrifos	<	0.25	UG/L
SVL-15	4/23/15	Chloropyrifos	<	0.21	UG/L
SVL-15	6/4/15	Chloropyrifos	<	0.22	UG/L
SVL-15	8/20/15	Chloropyrifos	<	0.25	UG/L
SVL-2	4/23/15	Chloropyrifos	<	0.25	UG/L
SVL-2	6/4/15	Chloropyrifos	<	0.25	UG/L
SVL-2	8/20/15	Chloropyrifos	<	0.20	UG/L
SVL-4	4/23/15	Chloropyrifos	<	0.22	UG/L
SVL-4	6/4/15	Chloropyrifos	<	0.22	UG/L
SVL-4	8/20/15	Chloropyrifos	<	0.24	UG/L
SVL-1	4/23/15	Cyanazine	<	0.21	UG/L
SVL-1	6/4/15	Cyanazine	<	0.21	UG/L
SVL-1	8/20/15	Cyanazine	<	0.22	UG/L
SVL-11	4/23/15	Cyanazine	<	0.21	UG/L

Site #	Collection Date	Parameter	Flag	Reported Result	Units
SVL-11	6/4/15	Cyanazine	<	0.22	UG/L
SVL-11	8/20/15	Cyanazine	<	0.20	UG/L
SVL-12	4/23/15	Cyanazine	<	0.21	UG/L
SVL-12	6/4/15	Cyanazine	<	0.20	UG/L
SVL-12	8/20/15	Cyanazine	<	0.21	UG/L
SVL-13	4/23/15	Cyanazine	<	0.20	UG/L
SVL-13	6/4/15	Cyanazine	<	0.20	UG/L
SVL-13	8/20/15	Cyanazine	<	0.25	UG/L
SVL-15	4/23/15	Cyanazine	<	0.21	UG/L
SVL-15	6/4/15	Cyanazine	<	0.22	UG/L
SVL-15	8/20/15	Cyanazine	<	0.25	UG/L
SVL-2	4/23/15	Cyanazine	<	0.25	UG/L
SVL-2	6/4/15	Cyanazine	<	0.25	UG/L
SVL-2	8/20/15	Cyanazine	<	0.20	UG/L
SVL-4	4/23/15	Cyanazine	<	0.22	UG/L
SVL-4	6/4/15	Cyanazine	<	0.22	UG/L
SVL-4	8/20/15	Cyanazine	<	0.24	UG/L
FIN MARINA	8/20/15	E. Coliform		10.0	COL/100 ML
FIN-MAR	6/4/15	E. Coliform		20.0	COL/100 ML
LS MARINA	8/20/15	E. Coliform	<	10.0	COL/100 ML
LS-MAR	6/4/15	E. Coliform		20.0	COL/100 ML
SUL MARINA	8/20/15	E. Coliform	<	10.0	COL/100 ML
SUL-MAR	6/4/15	E. Coliform		30.0	COL/100 ML
SVL-1	4/23/15	Iron		0.16	MG/L
SVL-1	6/4/15	Iron		0.16	MG/L
SVL-1	8/20/15	Iron		0.086	MG/L
SVL-2-10	4/23/15	Iron		0.12	MG/L
SVL-2-10	6/4/15	Iron		0.086	MG/L
SVL-2-10	8/20/15	Iron		0.055	MG/L
SVL-1	4/23/15	Manganese		0.022	MG/L
SVL-1	6/4/15	Manganese		0.011	MG/L

Site #	Collection Date	Parameter	Flag	Reported Result	Units
SVL-1	8/20/15	Manganese		0.17	MG/L
SVL-2-10	4/23/15	Manganese		0.020	MG/L
SVL-2-10	6/4/15	Manganese		0.0055	MG/L
SVL-2-10	8/20/15	Manganese		0.082	MG/L
SVL-1	4/23/15	Metolachlor	<	0.21	UG/L
SVL-1	6/4/15	Metolachlor	<	0.21	UG/L
SVL-1	8/20/15	Metolachlor		0.57	UG/L
SVL-11	4/23/15	Metolachlor	<	0.21	UG/L
SVL-11	6/4/15	Metolachlor		0.31	UG/L
SVL-11	8/20/15	Metolachlor		0.27	UG/L
SVL-12	4/23/15	Metolachlor	<	0.21	UG/L
SVL-12	6/4/15	Metolachlor		1.0	UG/L
SVL-12	8/20/15	Metolachlor	<	0.21	UG/L
SVL-13	4/23/15	Metolachlor	<	0.20	UG/L
SVL-13	6/4/15	Metolachlor	<	0.20	UG/L
SVL-13	8/20/15	Metolachlor	<	0.25	UG/L
SVL-15	4/23/15	Metolachlor	<	0.21	UG/L
SVL-15	6/4/15	Metolachlor	<	0.22	UG/L
SVL-15	8/20/15	Metolachlor		0.31	UG/L
SVL-2	4/23/15	Metolachlor	<	0.25	UG/L
SVL-2	6/4/15	Metolachlor	<	0.25	UG/L
SVL-2	8/20/15	Metolachlor		0.50	UG/L
SVL-4	4/23/15	Metolachlor	<	0.22	UG/L
SVL-4	6/4/15	Metolachlor		1.7	UG/L
SVL-4	8/20/15	Metolachlor	<	0.24	UG/L
SVL-1	4/23/15	Metribuzin	<	0.21	UG/L
SVL-1	6/4/15	Metribuzin	<	0.21	UG/L
SVL-1	8/20/15	Metribuzin	<	0.22	UG/L
SVL-11	4/23/15	Metribuzin	<	0.21	UG/L
SVL-11	6/4/15	Metribuzin	<	0.22	UG/L
SVL-11	8/20/15	Metribuzin	<	0.20	UG/L
SVL-12	4/23/15	Metribuzin	<	0.21	UG/L
SVL-12	6/4/15	Metribuzin	<	0.20	UG/L
SVL-12	8/20/15	Metribuzin	<	0.21	UG/L
SVL-13	4/23/15	Metribuzin	<	0.20	UG/L
SVL-13	6/4/15	Metribuzin	<	0.20	UG/L

Site #	Collection Date	Parameter	Flag	Reported Result	Units
SVL-13	8/20/15	Metribuzin	<	0.25	UG/L
SVL-15	4/23/15	Metribuzin	<	0.21	UG/L
SVL-15	6/4/15	Metribuzin	<	0.22	UG/L
SVL-15	8/20/15	Metribuzin	<	0.25	UG/L
SVL-2	4/23/15	Metribuzin	<	0.25	UG/L
SVL-2	6/4/15	Metribuzin	<	0.25	UG/L
SVL-2	8/20/15	Metribuzin	<	0.20	UG/L
SVL-4	4/23/15	Metribuzin	<	0.22	UG/L
SVL-4	6/4/15	Metribuzin	<	0.22	UG/L
SVL-4	8/20/15	Metribuzin	<	0.24	UG/L
SVL-1	4/23/15	Nitrate as Nitrogen		5.2	MG/L
SVL-1	6/4/15	Nitrate as Nitrogen		4.8	MG/L
SVL-1	8/20/15	Nitrate as Nitrogen		1.5	MG/L
SVL-11	4/23/15	Nitrate as Nitrogen		7.4	MG/L
SVL-11	6/4/15	Nitrate as Nitrogen		4.4	MG/L
SVL-11	8/20/15	Nitrate as Nitrogen		1.1	MG/L
SVL-12	4/23/15	Nitrate as Nitrogen		9.4	MG/L
SVL-12	6/4/15	Nitrate as Nitrogen		13.2	MG/L
SVL-12	8/20/15	Nitrate as Nitrogen		0.81	MG/L
SVL-13	4/23/15	Nitrate as Nitrogen		9.3	MG/L
SVL-13	6/4/15	Nitrate as Nitrogen		12.5	MG/L
SVL-13	8/20/15	Nitrate as Nitrogen		0.17	MG/L
SVL-15	4/23/15	Nitrate as Nitrogen		7.9	MG/L
SVL-15	6/4/15	Nitrate as Nitrogen		4.2	MG/L
SVL-15	8/20/15	Nitrate as Nitrogen		1.0	MG/L
SVL-2	4/23/15	Nitrate as Nitrogen		5.7	MG/L
SVL-2	6/4/15	Nitrate as Nitrogen		4.9	MG/L
SVL-2	8/20/15	Nitrate as Nitrogen		1.6	MG/L
SVL-2-10	4/23/15	Nitrate as Nitrogen	<	0.020	MG/L
SVL-2-10	6/4/15	Nitrate as Nitrogen		5.0	MG/L
SVL-2-10	8/20/15	Nitrate as Nitrogen		1.6	MG/L
SVL-4	4/23/15	Nitrate as Nitrogen		8.7	MG/L
SVL-4	6/4/15	Nitrate as Nitrogen		10.7	MG/L
SVL-4	8/20/15	Nitrate as Nitrogen		0.40	MG/L
SVL-1	4/23/15	Pendimethalin	<	0.21	UG/L
SVL-1	6/4/15	Pendimethalin	<	0.21	UG/L

Site #	Collection Date	Parameter	Flag	Reported Result	Units
SVL-1	8/20/15	Pendimethalin	<	0.22	UG/L
SVL-11	4/23/15	Pendimethalin	<	0.21	UG/L
SVL-11	6/4/15	Pendimethalin	<	0.22	UG/L
SVL-11	8/20/15	Pendimethalin	<	0.20	UG/L
SVL-12	4/23/15	Pendimethalin	<	0.21	UG/L
SVL-12	6/4/15	Pendimethalin	<	0.20	UG/L
SVL-12	8/20/15	Pendimethalin	<	0.21	UG/L
SVL-13	4/23/15	Pendimethalin	<	0.20	UG/L
SVL-13	6/4/15	Pendimethalin	<	0.20	UG/L
SVL-13	8/20/15	Pendimethalin	<	0.25	UG/L
SVL-15	4/23/15	Pendimethalin	<	0.21	UG/L
SVL-15	6/4/15	Pendimethalin	<	0.22	UG/L
SVL-15	8/20/15	Pendimethalin	<	0.25	UG/L
SVL-2	4/23/15	Pendimethalin	<	0.25	UG/L
SVL-2	6/4/15	Pendimethalin	<	0.25	UG/L
SVL-2	8/20/15	Pendimethalin	<	0.20	UG/L
SVL-4	4/23/15	Pendimethalin	<	0.22	UG/L
SVL-4	6/4/15	Pendimethalin	<	0.22	UG/L
SVL-4	8/20/15	Pendimethalin	<	0.24	UG/L
SVL-11	4/23/15	Pheophytin a	<	2.0	MG/CU.M.
SVL-11	6/4/15	Pheophytin a	<	2.0	MG/CU.M.
SVL-11	8/20/15	Pheophytin a	<	2.0	MG/CU.M.
SVL-15	4/23/15	Pheophytin a	<	2.0	MG/CU.M.
SVL-15	6/4/15	Pheophytin a	<	2.0	MG/CU.M.
SVL-15	8/20/15	Pheophytin a	<	2.0	MG/CU.M.
SVL-2	4/23/15	Pheophytin a	<	2.0	MG/CU.M.
SVL-2	6/4/15	Pheophytin a	<	2.0	MG/CU.M.
SVL-2	8/20/15	Pheophytin a	<	2.0	MG/CU.M.
SVL-4	4/23/15	Pheophytin a	<	2.0	MG/CU.M.
SVL-4	6/4/15	Pheophytin a	<	2.0	MG/CU.M.
SVL-4	8/20/15	Pheophytin a	<	2.0	MG/CU.M.
SVL-1	4/23/15	Phosphorus		0.061	MG/L
SVL-1	6/4/15	Phosphorus		0.039	MG/L
SVL-1	8/20/15	Phosphorus		0.086	MG/L
SVL-11	4/23/15	Phosphorus		0.12	MG/L
SVL-11	6/4/15	Phosphorus		0.12	MG/L

Site #	Collection Date	Parameter	Flag	Reported Result	Units
SVL-11	8/20/15	Phosphorus		0.22	MG/L
SVL-12	4/23/15	Phosphorus		0.052	MG/L
SVL-12	6/4/15	Phosphorus		0.29	MG/L
SVL-12	8/20/15	Phosphorus		0.27	MG/L
SVL-13	4/23/15	Phosphorus		0.12	MG/L
SVL-13	6/4/15	Phosphorus		0.13	MG/L
SVL-13	8/20/15	Phosphorus		0.40	MG/L
SVL-15	4/23/15	Phosphorus		0.12	MG/L
SVL-15	6/4/15	Phosphorus		0.12	MG/L
SVL-15	8/20/15	Phosphorus		0.13	MG/L
SVL-2	4/23/15	Phosphorus		0.052	MG/L
SVL-2	6/4/15	Phosphorus		0.039	MG/L
SVL-2	8/20/15	Phosphorus		0.077	MG/L
SVL-2-10	4/23/15	Phosphorus		0.052	MG/L
SVL-2-10	6/4/15	Phosphorus		0.048	MG/L
SVL-2-10	8/20/15	Phosphorus		0.048	MG/L
SVL-4	4/23/15	Phosphorus		0.16	MG/L
SVL-4	6/4/15	Phosphorus		0.20	MG/L
SVL-4	8/20/15	Phosphorus		0.34	MG/L
SVL-1	4/23/15	Phosphorus, -ortho	<	0.010	MG/L
SVL-1	6/4/15	Phosphorus, -ortho	<	0.010	MG/L
SVL-1	8/20/15	Phosphorus, -ortho	<	0.010	MG/L
SVL-11	4/23/15	Phosphorus, -ortho		0.020	MG/L
SVL-11	6/4/15	Phosphorus, -ortho		0.013	MG/L
SVL-11	8/20/15	Phosphorus, -ortho		0.011	MG/L
SVL-12	4/23/15	Phosphorus, -ortho		0.014	MG/L
SVL-12	6/4/15	Phosphorus, -ortho		0.12	MG/L
SVL-12	8/20/15	Phosphorus, -ortho		0.15	MG/L
SVL-13	4/23/15	Phosphorus, -ortho		0.026	MG/L
SVL-13	6/4/15	Phosphorus, -ortho		0.033	MG/L
SVL-13	8/20/15	Phosphorus, -ortho		0.085	MG/L
SVL-15	4/23/15	Phosphorus, -ortho	<	0.010	MG/L
SVL-15	6/4/15	Phosphorus, -ortho		0.016	MG/L
SVL-15	8/20/15	Phosphorus, -ortho	<	0.010	MG/L
SVL-2	4/23/15	Phosphorus, -ortho	<	0.010	MG/L
SVL-2	6/4/15	Phosphorus, -ortho	<	0.010	MG/L

Site #	Collection Date	Parameter	Flag	Reported Result	Units
SVL-2	8/20/15	Phosphorus, -ortho		0.020	MG/L
SVL-2-10	4/23/15	Phosphorus, -ortho	<	0.010	MG/L
SVL-2-10	6/4/15	Phosphorus, -ortho	<	0.010	MG/L
SVL-2-10	8/20/15	Phosphorus, -ortho	<	0.010	MG/L
SVL-4	4/23/15	Phosphorus, -ortho		0.034	MG/L
SVL-4	6/4/15	Phosphorus, -ortho		0.11	MG/L
SVL-4	8/20/15	Phosphorus, -ortho		0.051	MG/L
SVL-1	4/23/15	Solids, Total Suspended		8.1	MG/L
SVL-1	6/4/15	Solids, Total Suspended		6.3	MG/L
SVL-1	8/20/15	Solids, Total Suspended		5.6	MG/L
SVL-11	4/23/15	Solids, Total Suspended		22.5	MG/L
SVL-11	6/4/15	Solids, Total Suspended		20.2	MG/L
SVL-11	8/20/15	Solids, Total Suspended		8.3	MG/L
SVL-12	4/23/15	Solids, Total Suspended		10.4	MG/L
SVL-12	6/4/15	Solids, Total Suspended		51.1	MG/L
SVL-12	8/20/15	Solids, Total Suspended		14.0	MG/L
SVL-13	4/23/15	Solids, Total Suspended		69.4	MG/L
SVL-13	6/4/15	Solids, Total Suspended		18.0	MG/L
SVL-13	8/20/15	Solids, Total Suspended		55.2	MG/L
SVL-15	4/23/15	Solids, Total Suspended		21.5	MG/L
SVL-15	6/4/15	Solids, Total Suspended		18.0	MG/L
SVL-15	8/20/15	Solids, Total Suspended		8.6	MG/L
SVL-2	4/23/15	Solids, Total Suspended		7.6	MG/L

Site #	Collection Date	Parameter	Flag	Reported Result	Units
SVL-2	6/4/15	Solids, Total Suspended		3.1	MG/L
SVL-2	8/20/15	Solids, Total Suspended		4.5	MG/L
SVL-2-10	4/23/15	Solids, Total Suspended		9.1	MG/L
SVL-2-10	6/4/15	Solids, Total Suspended		4.3	MG/L
SVL-2-10	8/20/15	Solids, Total Suspended		5.0	MG/L
SVL-4	4/23/15	Solids, Total Suspended		60.0	MG/L
SVL-4	6/4/15	Solids, Total Suspended		21.2	MG/L
SVL-4	8/20/15	Solids, Total Suspended		20.2	MG/L
SVL-1	4/23/15	Solids, Volatile Suspended		3.0	MG/L
SVL-1	6/4/15	Solids, Volatile Suspended		1.9	MG/L
SVL-1	8/20/15	Solids, Volatile Suspended		2.6	MG/L
SVL-11	4/23/15	Solids, Volatile Suspended		5.8	MG/L
SVL-11	6/4/15	Solids, Volatile Suspended		9.0	MG/L
SVL-11	8/20/15	Solids, Volatile Suspended		4.6	MG/L
SVL-12	4/23/15	Solids, Volatile Suspended		1.2	MG/L
SVL-12	6/4/15	Solids, Volatile Suspended		4.7	MG/L
SVL-12	8/20/15	Solids, Volatile Suspended		4.9	MG/L
SVL-13	4/23/15	Solids, Volatile Suspended		6.6	MG/L
SVL-13	6/4/15	Solids, Volatile Suspended		2.8	MG/L
SVL-13	8/20/15	Solids, Volatile Suspended		12.4	MG/L
SVL-15	4/23/15	Solids, Volatile Suspended		5.0	MG/L
SVL-15	6/4/15	Solids, Volatile Suspended		8.6	MG/L
SVL-15	8/20/15	Solids, Volatile Suspended		4.6	MG/L
SVL-2	4/23/15	Solids, Volatile Suspended		2.9	MG/L
SVL-2	6/4/15	Solids, Volatile Suspended		1.5	MG/L
SVL-2	8/20/15	Solids, Volatile Suspended		2.7	MG/L
SVL-2-10	4/23/15	Solids, Volatile Suspended		4.0	MG/L
SVL-2-10	6/4/15	Solids, Volatile Suspended		1.7	MG/L
SVL-2-10	8/20/15	Solids, Volatile Suspended		2.4	MG/L
SVL-4	4/23/15	Solids, Volatile Suspended		7.0	MG/L

Site #	Collection Date	Parameter		Flag	Reported Result
SVL-4	6/4/15	Solids, Volatile Suspended		4.0	MG/L
SVL-4	8/20/15	Solids, Volatile Suspended		7.0	MG/L
SVL-1	4/23/15	Total Organic Carbon		2.9	MG/L
SVL-1	6/4/15	Total Organic Carbon		2.2	MG/L
SVL-1	8/20/15	Total Organic Carbon		2.8	MG/L
SVL-11	4/23/15	Total Organic Carbon		2.6	MG/L
SVL-11	6/4/15	Total Organic Carbon		2.8	MG/L
SVL-11	8/20/15	Total Organic Carbon		3.2	MG/L
SVL-12	4/23/15	Total Organic Carbon		1.9	MG/L
SVL-12	6/4/15	Total Organic Carbon		2.2	MG/L
SVL-12	8/20/15	Total Organic Carbon		3.1	MG/L
SVL-13	4/23/15	Total Organic Carbon		2.0	MG/L
SVL-13	6/4/15	Total Organic Carbon		1.3	MG/L
SVL-13	8/20/15	Total Organic Carbon		4.0	MG/L
SVL-15	4/23/15	Total Organic Carbon		2.6	MG/L
SVL-15	6/4/15	Total Organic Carbon		3.0	MG/L
SVL-15	8/20/15	Total Organic Carbon		3.2	MG/L
SVL-2	4/23/15	Total Organic Carbon		3.4	MG/L
SVL-2	6/4/15	Total Organic Carbon		2.1	MG/L
SVL-2	8/20/15	Total Organic Carbon		2.9	MG/L
SVL-2-10	4/23/15	Total Organic Carbon		3.3	MG/L
SVL-2-10	6/4/15	Total Organic Carbon		2.2	MG/L
SVL-2-10	8/20/15	Total Organic Carbon		2.7	MG/L
SVL-4	4/23/15	Total Organic Carbon		2.2	MG/L
SVL-4	6/4/15	Total Organic Carbon		2.5	MG/L
SVL-4	8/20/15	Total Organic Carbon		3.5	MG/L
SVL-1	4/23/15	Trifluralin	<	0.21	UG/L
SVL-1	6/4/15	Trifluralin	<	0.21	UG/L
SVL-1	8/20/15	Trifluralin	<	0.22	UG/L
SVL-11	4/23/15	Trifluralin	<	0.21	UG/L
SVL-11	6/4/15	Trifluralin	<	0.22	UG/L
SVL-11	8/20/15	Trifluralin	<	0.20	UG/L
SVL-12	4/23/15	Trifluralin	<	0.21	UG/L
SVL-12	6/4/15	Trifluralin	<	0.20	UG/L
SVL-12	8/20/15	Trifluralin	<	0.21	UG/L
SVL-13	4/23/15	Trifluralin	<	0.20	UG/L

Site #	Collection Date	Parameter	Flag	Reported Result	Units
SVL-13	6/4/15	Trifluralin	<	0.20	UG/L
SVL-13	8/20/15	Trifluralin	<	0.25	UG/L
SVL-15	4/23/15	Trifluralin	<	0.21	UG/L
SVL-15	6/4/15	Trifluralin	<	0.22	UG/L
SVL-15	8/20/15	Trifluralin	<	0.25	UG/L
SVL-2	4/23/15	Trifluralin	<	0.25	UG/L
SVL-2	6/4/15	Trifluralin	<	0.25	UG/L
SVL-2	8/20/15	Trifluralin	<	0.20	UG/L
SVL-4	4/23/15	Trifluralin	<	0.22	UG/L
SVL-4	6/4/15	Trifluralin	<	0.22	UG/L
SVL-4	8/20/15	Trifluralin	<	0.24	UG/L

Marinas

Site #	Collection Date	Parameter	Flag	Reported Result	Units
FIN MARINA	8/20/15	E. Coliform		10.0	COL/100 ML
FIN-MAR	6/4/15	E. Coliform		20.0	COL/100 ML
LS MARINA	8/20/15	E. Coliform	<	10.0	COL/100 ML
LS-MAR	6/4/15	E. Coliform		20.0	COL/100 ML
SUL MARINA	8/20/15	E. Coliform	<	10.0	COL/100 ML
SUL-MAR	6/4/15	E. Coliform		30.0	COL/100 ML

2015 Beach Sample Report - IDPH
Lake Shelbyville

		E. coli per 100mL	
Sample Date	**Location**	**Shallow**	**Deep**
5/12/2015	Coon Creek Rec Area		
5/26/2015	Coon Creek Rec Area	4.1	4.1
6/10/2015	Coon Creek Rec Area	37.9	29.2
6/24/2015	Coon Creek Rec Area	33.2	21.3
7/7/2015	Coon Creek Rec Area	20.1	1
7/22/2015	Coon Creek Rec Area	6.3	1
8/5/2015	Coon Creek Rec Area	1	1
8/18/2015	Coon Creek Rec Area	1	1
9/2/2015	Coon Creek Rec Area	1	1
5/12/2015	Dam West Beach	5.2	5.2
5/26/2015	Dam West Beach	3.1	1
6/10/2015	Dam West Beach	57.6	8.5
6/24/2015	Dam West Beach	12.2	15.8
7/7/2015	Dam West Beach	9.7	2
7/22/2015	Dam West Beach	1	1
8/5/2015	Dam West Beach	5.2	1
8/18/2015	Dam West Beach	1	1
9/2/2015	Dam West Beach	1	1
5/12/2015	Lithia Springs Rec Area	3.1	2
5/26/2015	Lithia Springs Rec Area	5.2	1
6/10/2015	Lithia Springs Rec Area	54.5	9.8
6/24/2015	Lithia Springs Rec Area	42.8	43.2
7/7/2015	Lithia Springs Rec Area	3.1	3
7/22/2015	Lithia Springs Rec Area	1	1
8/5/2015	Lithia Springs Rec Area	2	2
8/18/2015	Lithia Springs Rec Area	2	2
9/2/2015	Lithia Springs Rec Area	2	1
5/19/2015	Sullivan Beach	19.9	13.5
5/26/2015	Sullivan Beach	13.4	2
6/10/2015	Sullivan Beach	111.2	12.1
6/24/2015	Sullivan Beach	67	34.1

2015 Beach Sample Report - IDPH
Lake Shelbyville

Sample Date	Location	E. coli per 100mL Shallow	Deep
7/7/2015	Sullivan Beach	12.2	24.3
7/22/2015	Sullivan Beach	3.1	1
8/5/2015	Sullivan Beach	3.1	1
8/18/2015	Sullivan Beach	1	2
9/2/2015	Sullivan Beach	2	1
5/12/2015	Wilborn Creek Rec Area	44.1	17.1
5/26/2015	Wilborn Creek Rec Area	16.1	4.1
6/10/2015	Wilborn Creek Rec Area	53.8	12.2
6/24/2015	Wilborn Creek Rec Area	248.1	224.7
7/7/2015	Wilborn Creek Rec Area		
7/22/2015	Wilborn Creek Rec Area	8.6	2
8/5/2015	Wilborn Creek Rec Area	86.2	1
8/18/2015	Wilborn Creek Rec Area	1	3.1
9/2/2015	Wilborn Creek Rec Area	1	1

FIELD DATA

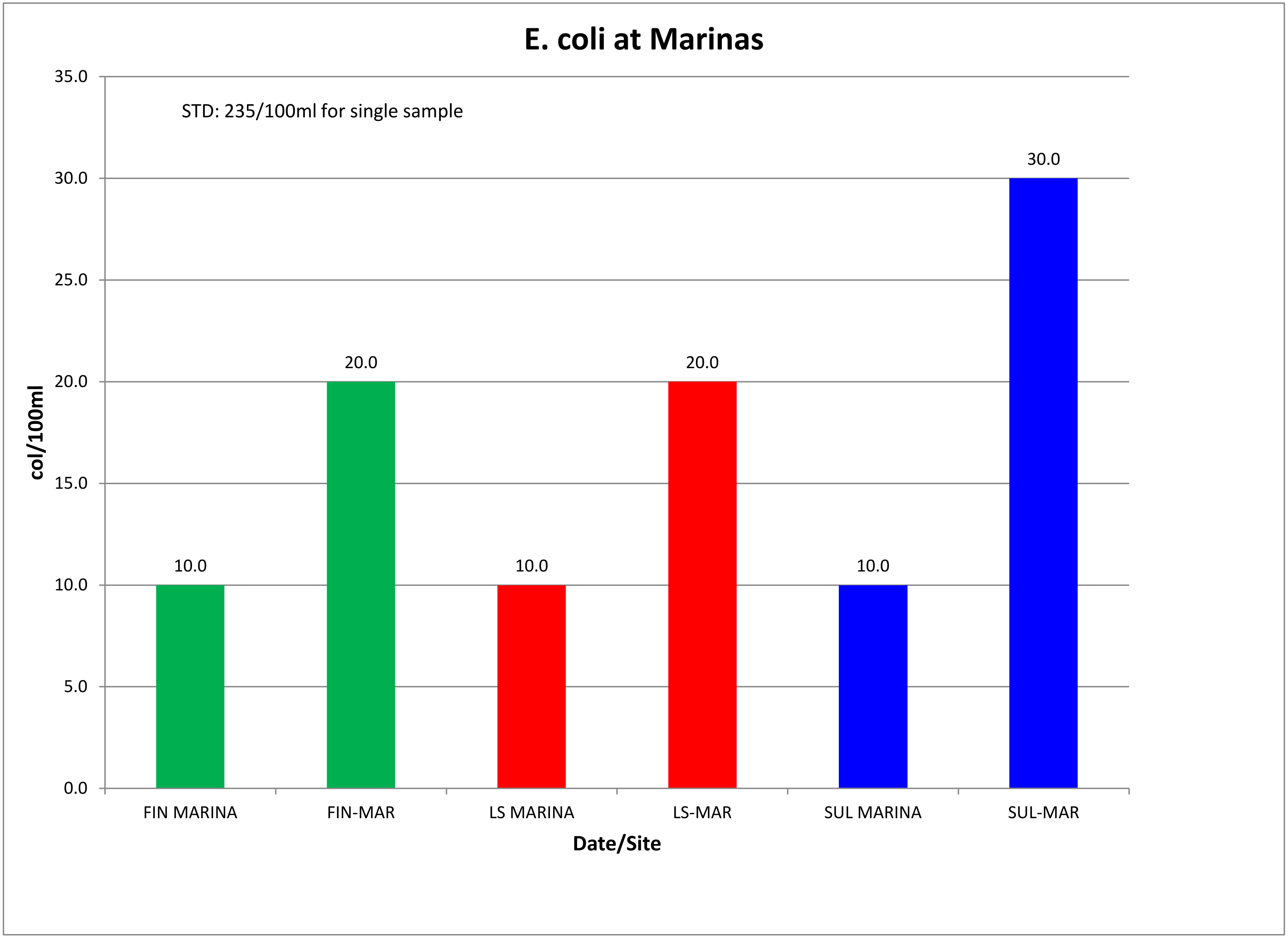
Site	Date	Depth	Water Temp (oC)	Redox (mv)	Cond (uS)	DO %	DO mg/l	pH	Time	Seechi (in)
SBV-1	4/23/2015	1.1	12.99	520	555.9	107.5	11.32	8.27	940	
SBV-1	6/4/2015	1.6	20.62	330	542	105	9.52	8.1	9:35	
SBV-1	8/20/2015	2.2	24.22	330	448	99.9	8.29	7.43	930	
SBV-2	4/23/2015	0.5	13.04	494	568	105.7	11.13	8.32	1040	
SBV-2	4/23/2015	1	13.05	487	567	105.8	11.13	8.36		
SBV-2	4/23/2015	2	13.04	485	567	105.6	11.13	8.36		
SBV-2	4/23/2015	3	13.06	480	566	105.6	11.13	8.37		
SBV-2	4/23/2015	4	13.05	478	566	105.6	11.11	8.38		
SBV-2	4/23/2015	5	13	473	565	105.4	11.11	8.38		
SBV-2	4/23/2015	6	12.99	472	565	103.8	10.89	8.37		
SBV-2	4/23/2015	7	12.96	472	566	101.5	10.67	8.32		
SBV-2	4/23/2015	8	12.78	473	567	98.1	10.21	8.28	1128	
SBV-2	6/4/2015	1.7	21.33	381	544	114	10.17	8.39	10:10	72
SBV-2	6/4/2015	2.7	21.04	381	544	114	10.21	8.37	10:10	
SBV-2	6/4/2015	3.7	20.74	381	544	110	9.82	8.33	10:10	
SBV-2	6/4/2015	4.7	20.52	382	543.5	103.1	9.31	8.3	10:11	
SBV-2	6/4/2015	5.7	20.47	382	543	97	8.82	8.25	10:12	
SBV-2	6/4/2015	6.7	20.37	384	543	95	8.52	8.21	10:13	
SBV-2	6/4/2015	7.7	20.32	385	544	90	8.13	8.16		
SBV-2	6/4/2015	8.7	20.15	387	545	80.3	7.26	8.07		
SBV-2	6/4/2015	9.7	19.98	389	546	68.5	6.23	8		
SBV-2	6/4/2015	10.7	19.58	393	550	55.6	4.98	7.89		
SBV-2	6/4/2015	11.7	18.97	400	556	16	1.28	7.05		
SBV-2	8/20/2015	0.5	23.91	352	0.1	102.8	8.62	7.15	1015	41
SBV-2	8/20/2015	1	24.08	353	0.3	102.9	8.64	7.12		
SBV-2	8/20/2015	2	24.41	356	0.1	102.9	8.57	7.1		
SBV-2	8/20/2015	3	24.39	354	0.1	103.6	8.61	7.11		
SBV-2	8/20/2015	4	24.6	346	0.1	103.1	8.54	7.28		
SBV-2	8/20/2015	5	24.7	344	0.1	102.9	8.51	7.26		
SBV-2	8/20/2015	6	24.66	347	0.1	103.3	8.54	7.23		
SBV-2	8/20/2015	7	23.91	350	0.1	103	8.64	7.3		
SBV-2	8/20/2015	8	23.37	350	0.1	103.2	8.75	7.15		
SBV-4	4/23/2015	0.5	11.33	422	690	95.1	10.07	8.08	12:08	5

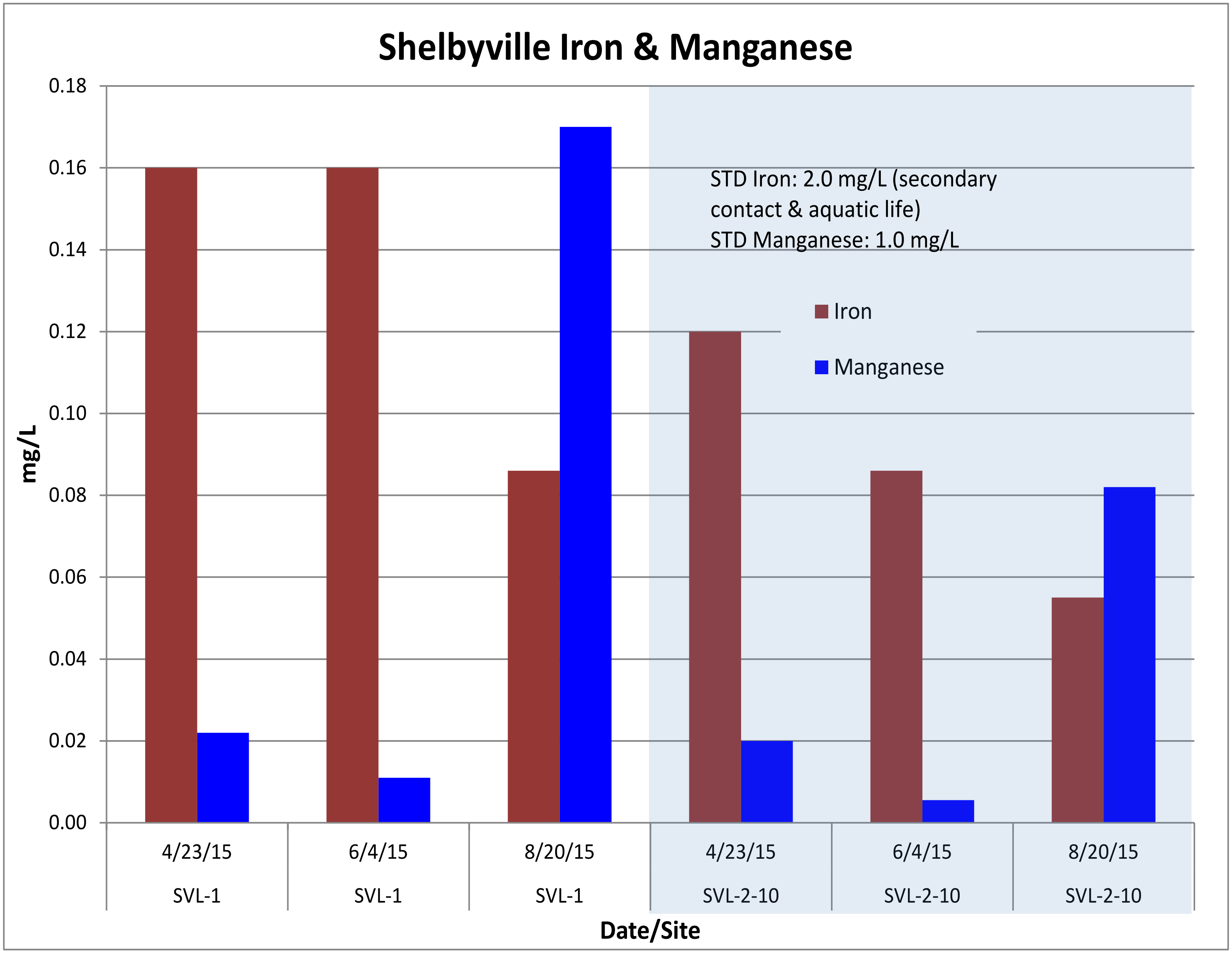
Site	Date	Depth	Water Temp (oC)	Redox (mv)	Cond (uS)	DO %	DO mg/l	pH	Time	Seechi (in)
SBV-4	6/4/2015	1.7	21.29	374	365	105	9.44	8.03	11:53	15
SBV-4	6/4/2015	2	20.49	375	640	101	9.29	7.99		
SBV-4	6/4/2015	3	20.06	378	640	101	9.12	7.88		
SBV-4	8/20/2015	0.5	26.66	281	492.2	84.8	6.76	7.85	1209	18
SBV-4	8/20/2015	1	26.63	282	492.5	81.1	6.45	7.78		
SBV-4	8/20/2015	2	26.52	285	492.8	75.6	5.85	7.74		
SBV-4	8/20/2015	3	26.33	288	493.3	54.9	4.35	7.62		
SBV-4	8/20/2015	3.5	26.25	0.33	665.2	0	0	7.07		
SBV-11	4/23/2015	0.5	14.64	440	620	100.8	10.23	8.24		14
SBV-11	4/23/2015	1	14.6	439	620	101.2	10.27	8.32		
SBV-11	4/23/2015	2	14.56	437	620	100.7	10.24	8.31		
SBV-11	4/23/2015	3	14.52	436	619	100.6	10.23	8.32		
SBV-11	4/23/2015	4	14.43	435	617	99.3	10.14	8.31		
SBV-11	4/23/2015	5	14.36	434	611	97.4	9.88	8.33		
SBV-11	4/23/2015	6	14.26	433	613	98.9	10.11	8.34		
SBV-11	4/23/2015	7	14.05	433	612	76.8	8.24	8.28		
SBV-11	6/4/2015	1.8	23.31	368	512	173	14.8	8.52	11:21	22
SBV-11	6/4/2015	2	23.2	359	515	161	13.9	8.5	11:23	
SBV-11	6/4/2015	3	23.2	372	514	173	14.8	8.49		
SBV-11	6/4/2015	4	23	373	514.3	168	14.43	8.46		
SBV-11	6/4/2015	5	22.9	373	514	165.2	14.16	8.45		
SBV-11	6/4/2015	6	22	380	531	139	11.9	8.25		
SBV-11	6/4/2015	7	21.09	393	558	74.8	5.75	7.78		
SBV-11	6/4/2015	8	20.22	400	598	42.4	3.82	7.76		
SBV-11	8/20/2015	0.5	27.13	321	379.3	76.4	6.02	7.89	1130	22
SBV-11	8/20/2015	1	27.12	319	379.3	75.1	5.93	7.95		
SBV-11	8/20/2015	2	27.08	319	379.4	73.3	5.82	7.96		
SBV-11	8/20/2015	3	27.01	320	380	68.9	5.4	7.94		
SBV-11	8/20/2015	4	26.93	321	381.1	63.5	5.03	7.9		
SBV-11	8/20/2015	5	26.92	320	381	65.9	5.22	7.91		
SBV-11	8/20/2015	6	26.9	320	380.4	68.4	5.42	7.94		
SBV-11	8/20/2015	7	26.86	320	379.9	68.4	5.44	7.94		
SBV-11	8/20/2015	7.5	26.57	0.18	390.7	0	0	6.89		
SBV-12	4/23/2015	0.3	12.47	447	691	125	13.4	8.13	1201	
SBV-12	6/4/2015	0.9	18.6	311	686	84.3	7.84	7.81	12:00	
SBV-12	8/20/2015	1	25.65	251	620	101.5	8.24	8.26	1140	

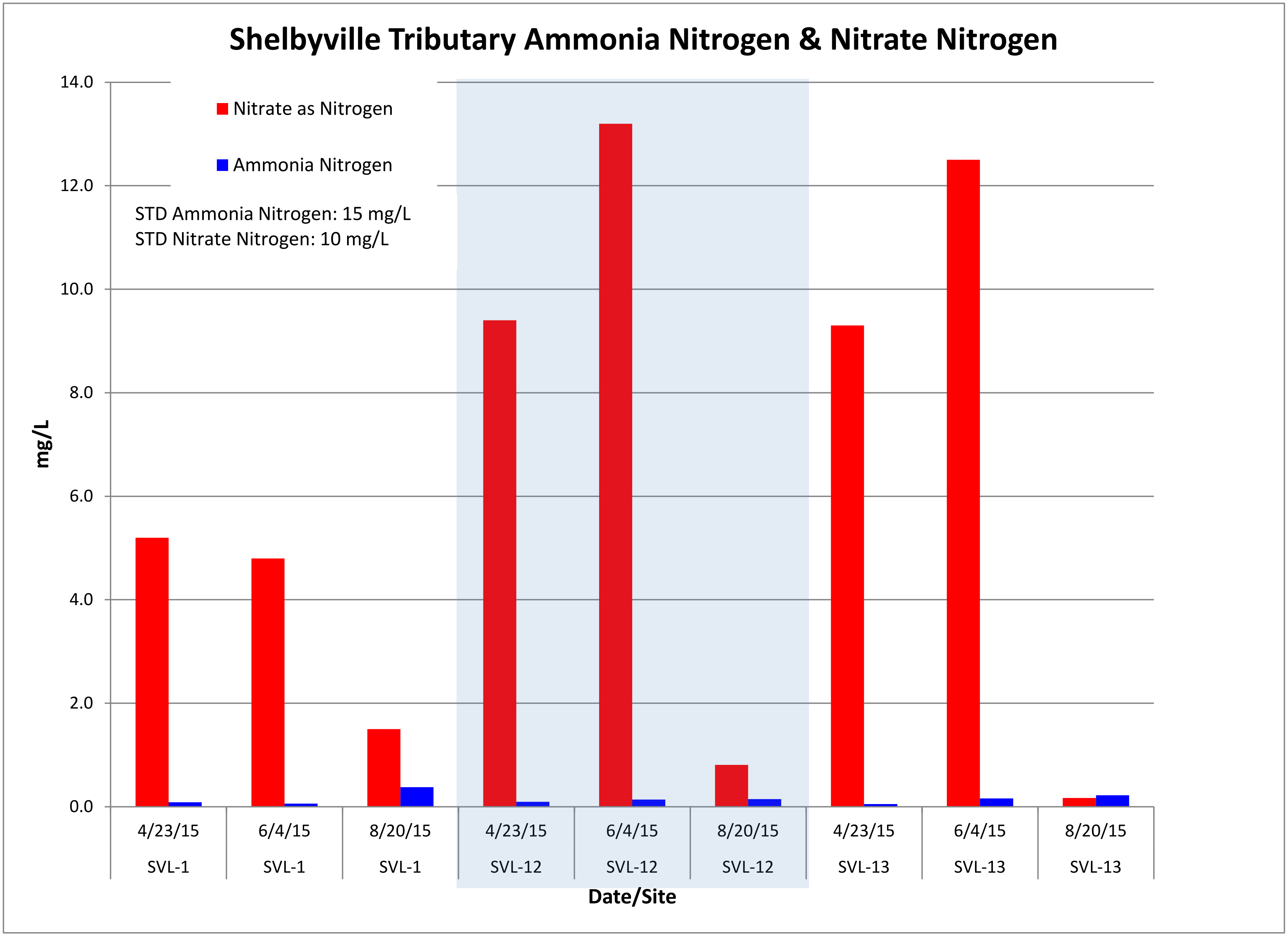
Site	Date	Depth	Water Temp (oC)	Redox (mv)	Cond (uS)	DO %	DO mg/l	pH	Time	Seechi (in)
SBV-13	4/23/2015	0.2	14.27	465	675	118	12.14	8.24	1138	
SBV-13	6/4/2015	0.7	22	312	723	107	9.38	7.95	11:15	
SBV-13	8/20/2015	0.1	27.32	282	415	113.9	8.94	8.61	1125	

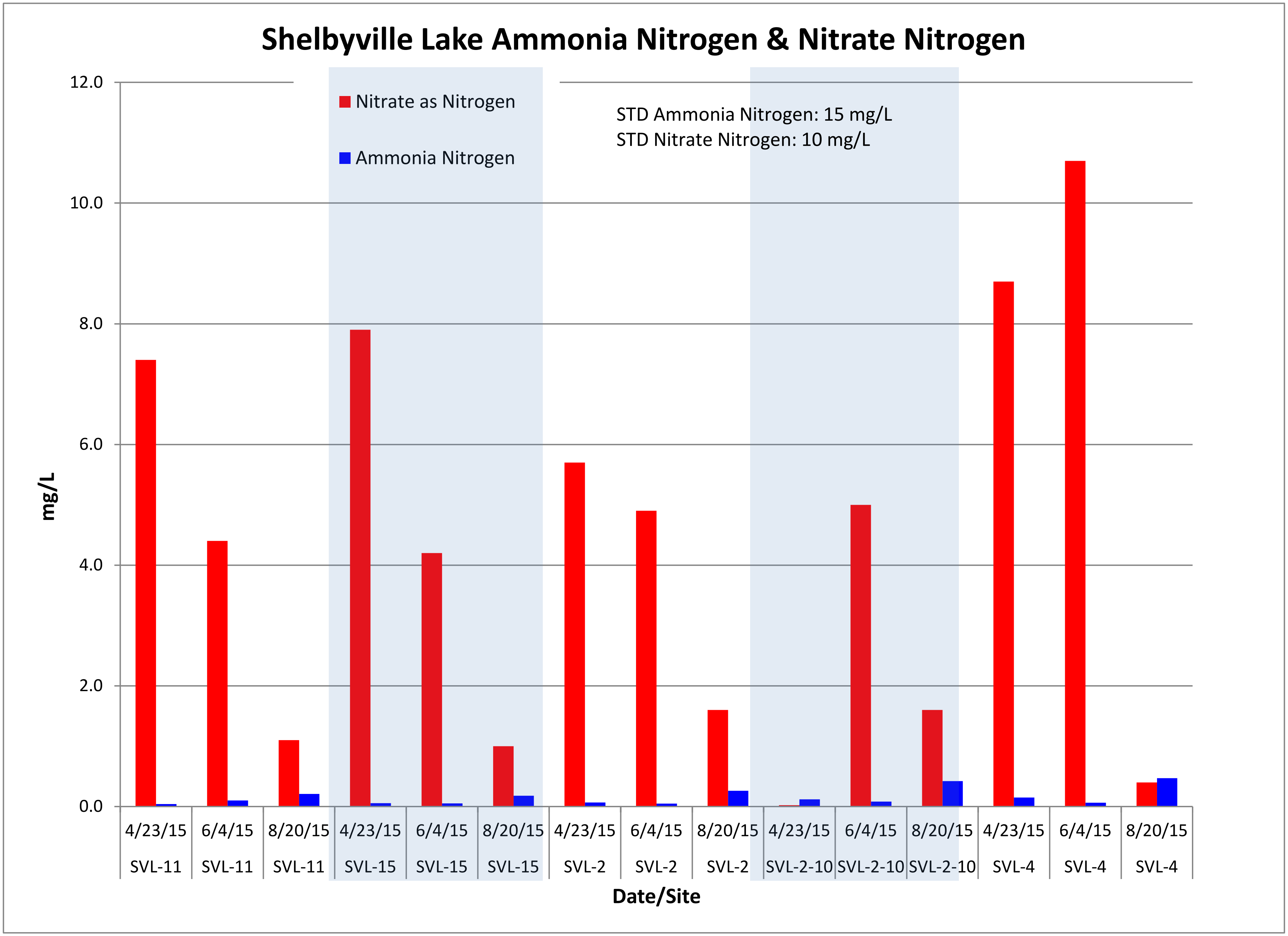
APPENDIX B

LAB DATA
GRAPHS

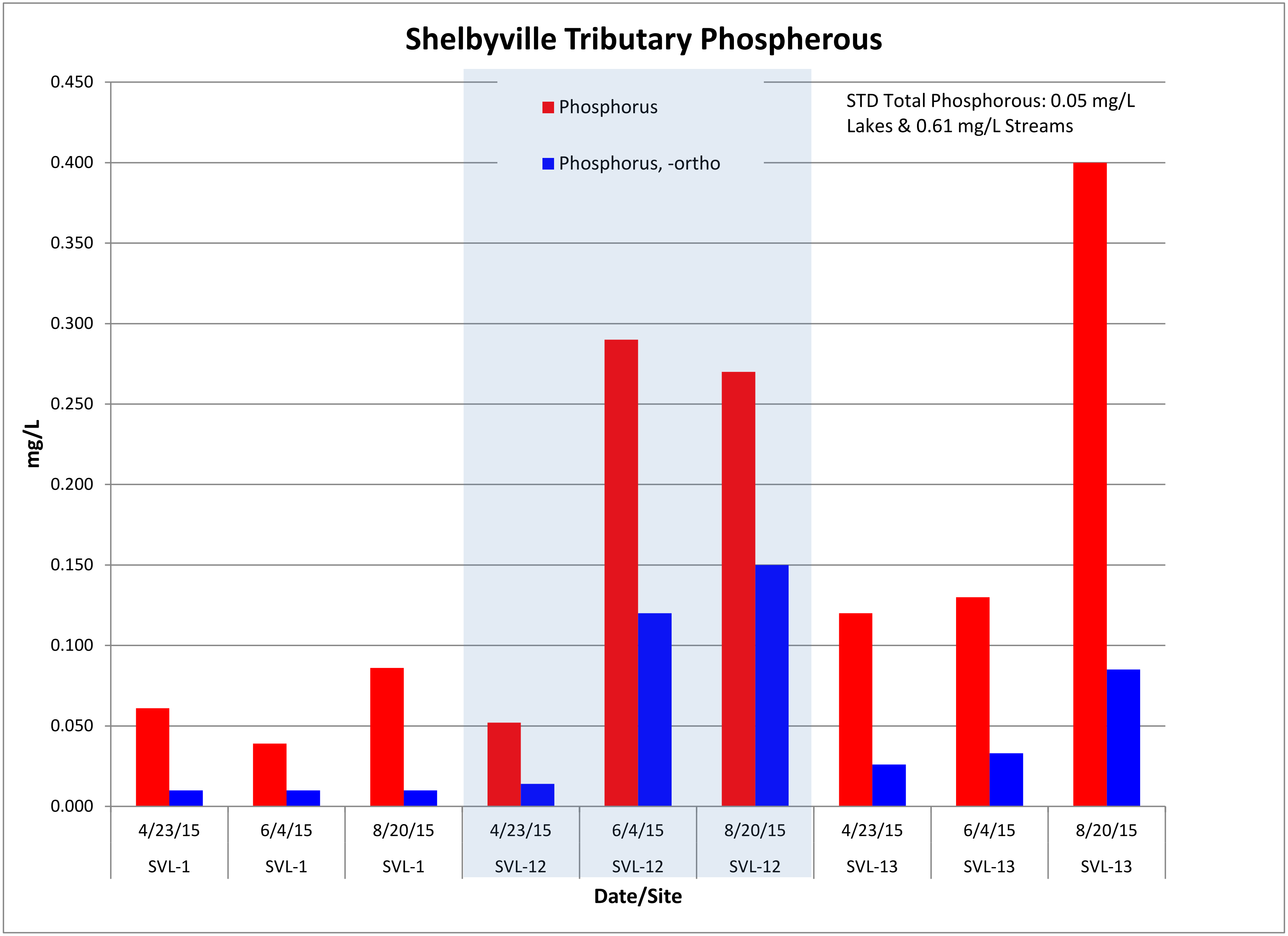

E. coli at Marinas
STD: 235/100ml for single sample
col/100ml
Date/Site
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
10.0
20.0
10.0
20.0
10.0
30.0
FIN MARINA
FIN-MAR
LS MARINA
LS-MAR
SUL MARINA
SUL-MAR

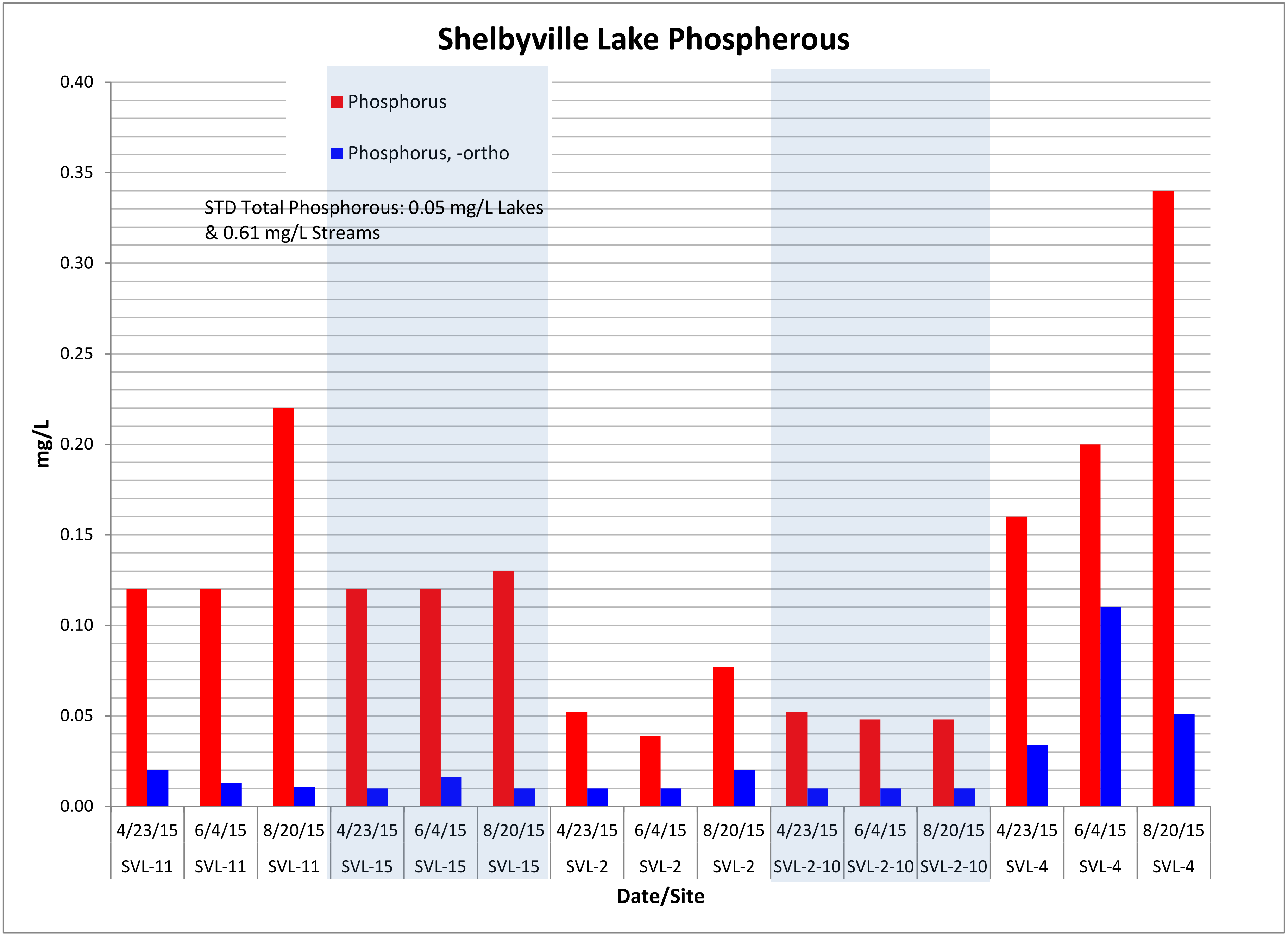

Shelbyville Iron & Manganese
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
mg/L
STD Iron: 2.0 mg/L (secondary contact & aquatic life)
STD Manganese: 1.0 mg/L
Iron
Manganese
4/23/15
SVL-1
6/4/15
SVL-1
8/20/15
SVL-1
4/23/15
SVL-2-10
6/4/15
SVL-2-10
8/20/15
SVL-2-10
Date/Site

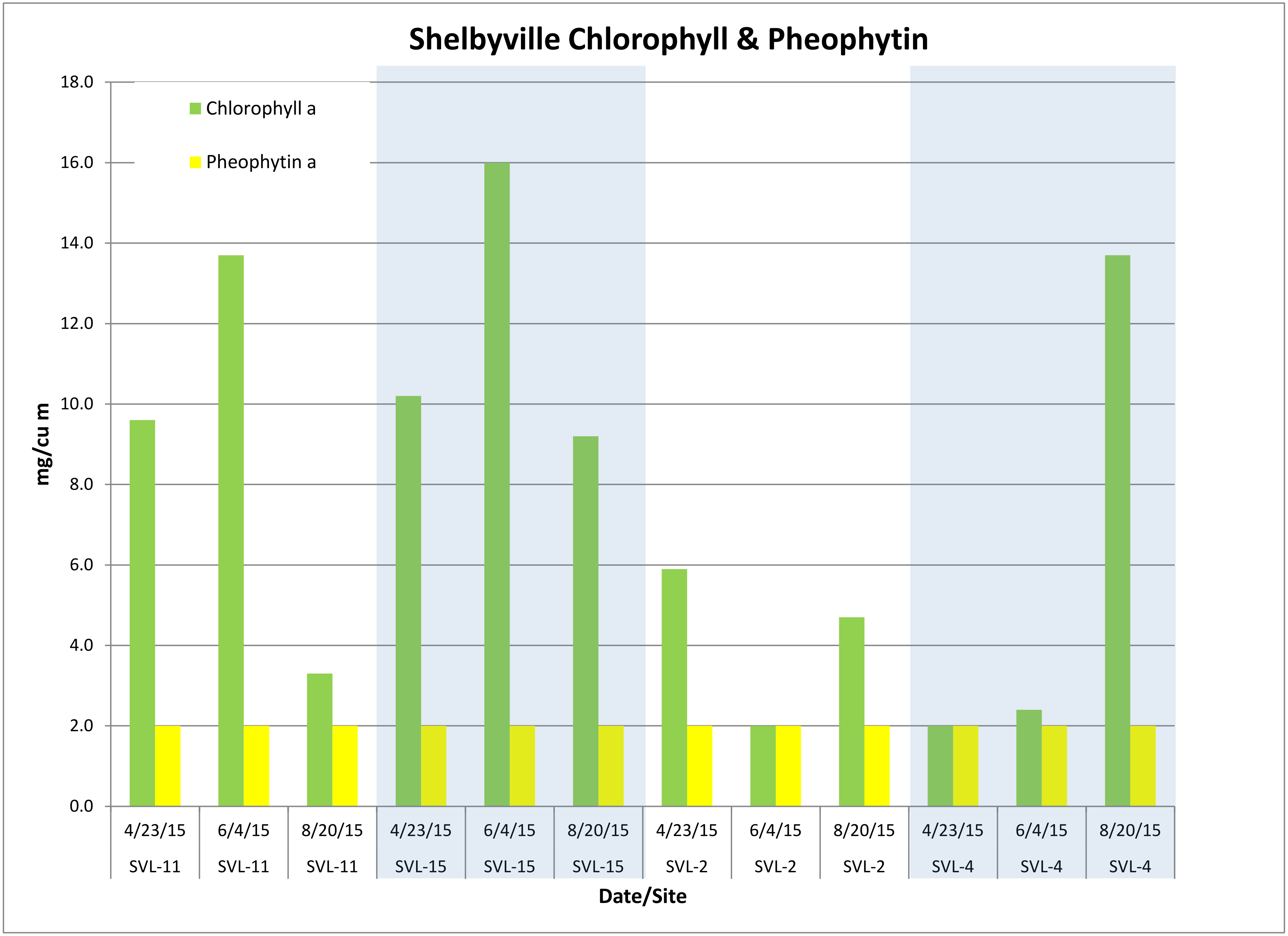

Shelbyville Tributary Ammonia Nitrogen & Nitrate Nitrogen
Nitrate as Nitrogen
Ammonia Nitrogen
STD Ammonia Nitrogen: 15 mg/L
STD Nitrate Nitrogen: 10 mg/L
mg/L
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
4/23/15
SVL-1
6/4/15
SVL-1
8/20/15
SVL-1
4/23/15
SVL-12
6/4/15
SVL-12
8/20/15
SVL-12
4/23/15
SVL-13
6/4/15
SVL-13
8/20/15
SVL-13
Date/Site

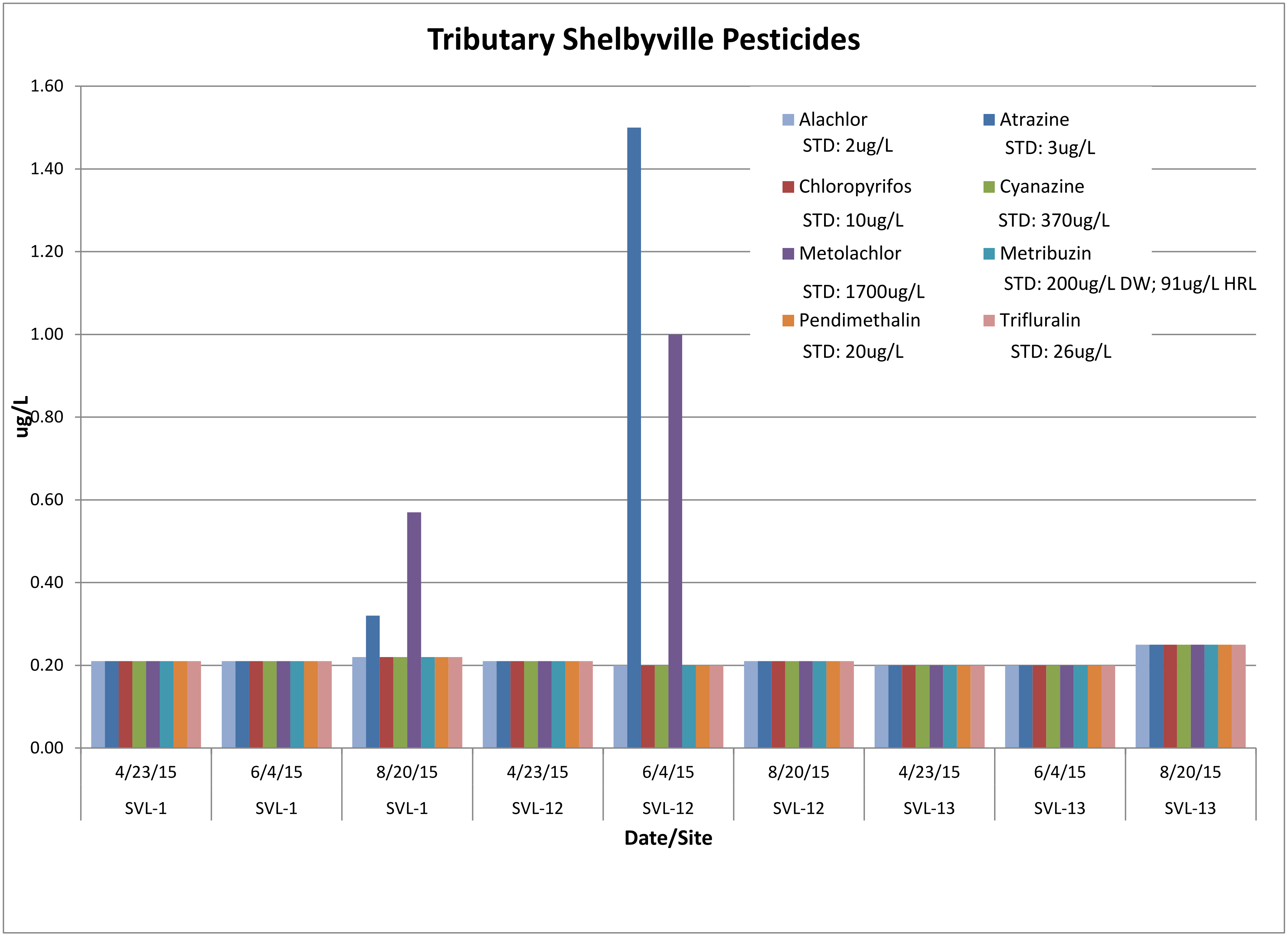


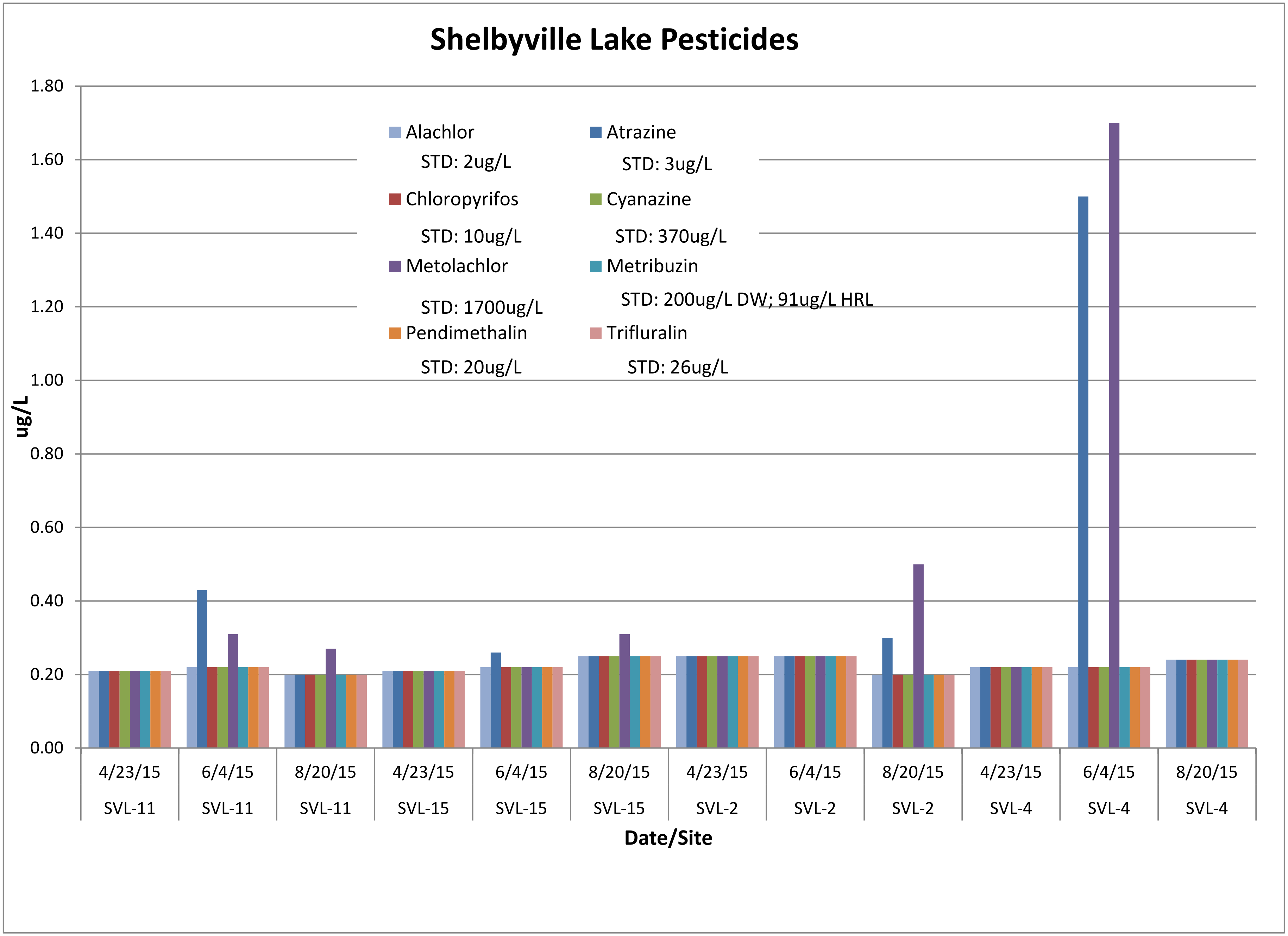
Shelbyville Lake Ammonia Nitrogen & Nitrate Nitrogen
12.0
10.0
8.0
6.0
4.0
2.0
0.0
mg/L
Nitrate as Nitrogen
Ammonia Nitrogen
STD Ammonia Nitrogen: 15 mg/L
STD Nitrate Nitrogen: 10 mg/L
4/23/15 SVL-11
6/4/15 SVL-11
8/20/15 SVL-11
4/23/15 SVL-15
6/4/15 SVL-15
8/20/15 SVL-15
4/23/15 SVL-2
6/4/15 SVL-2
8/20/15 SVL-2
4/23/15 SVL-2-10
6/4/15 SVL-2-10
8/20/15 SVL-2-10
4/23/15 SVL-4
6/4/15 SVL-4
8/20/15 SVL-4
Date/Site

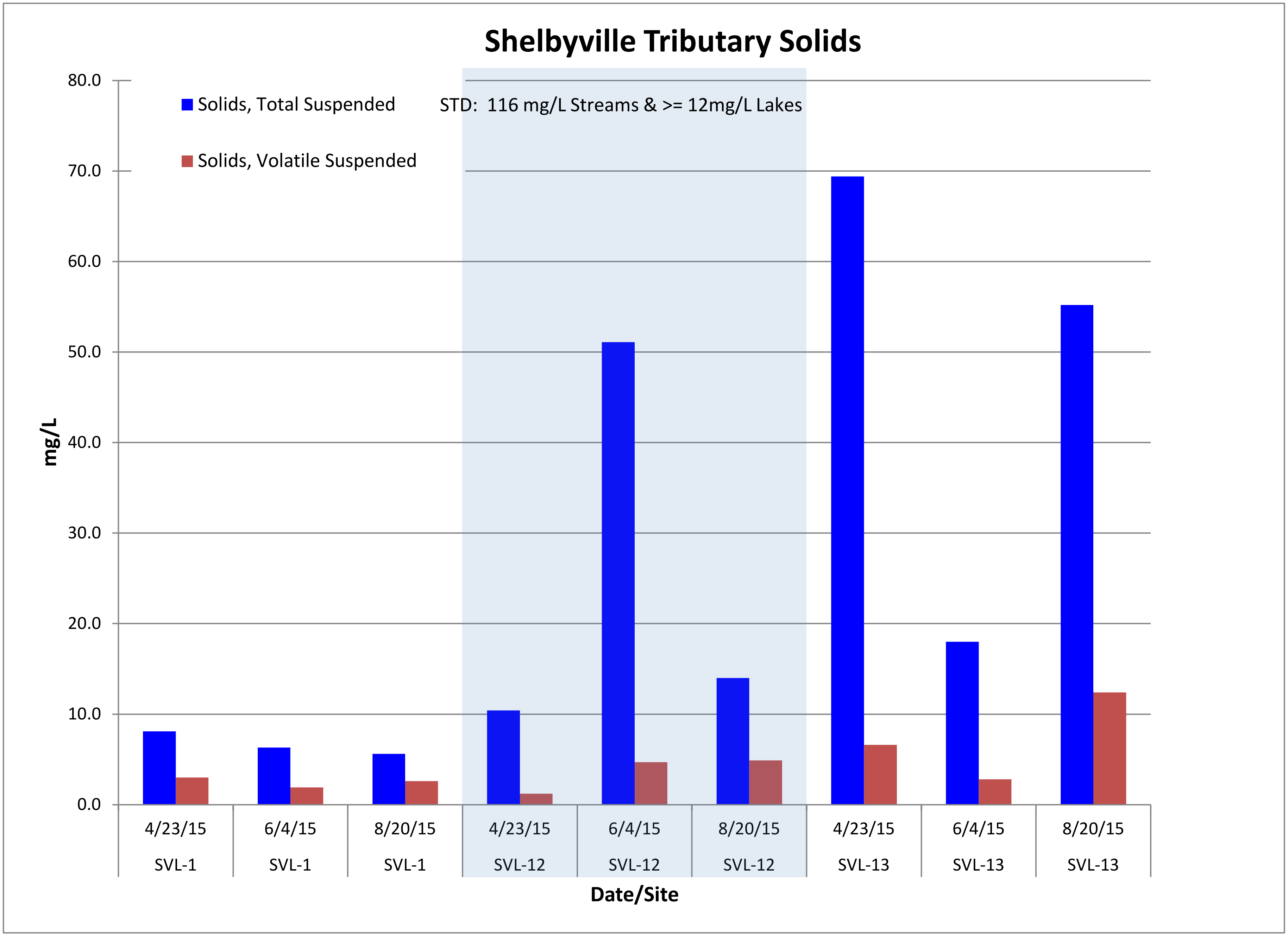

Shelbyville Tributary Phospherous
Phosphorus
Phosphorus, -ortho
STD Total Phosphorous: 0.05 mg/L Lakes & 0.61 mg/L Streams
mg/L
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
4/23/15 SVL-1
6/4/15 SVL-1
8/20/15 SVL-1
4/23/15 SVL-12
6/4/15 SVL-12
8/20/15 SVL-12
4/23/15 SVL-13
6/4/15 SVL-13
8/20/15 SVL-13
Date/Site

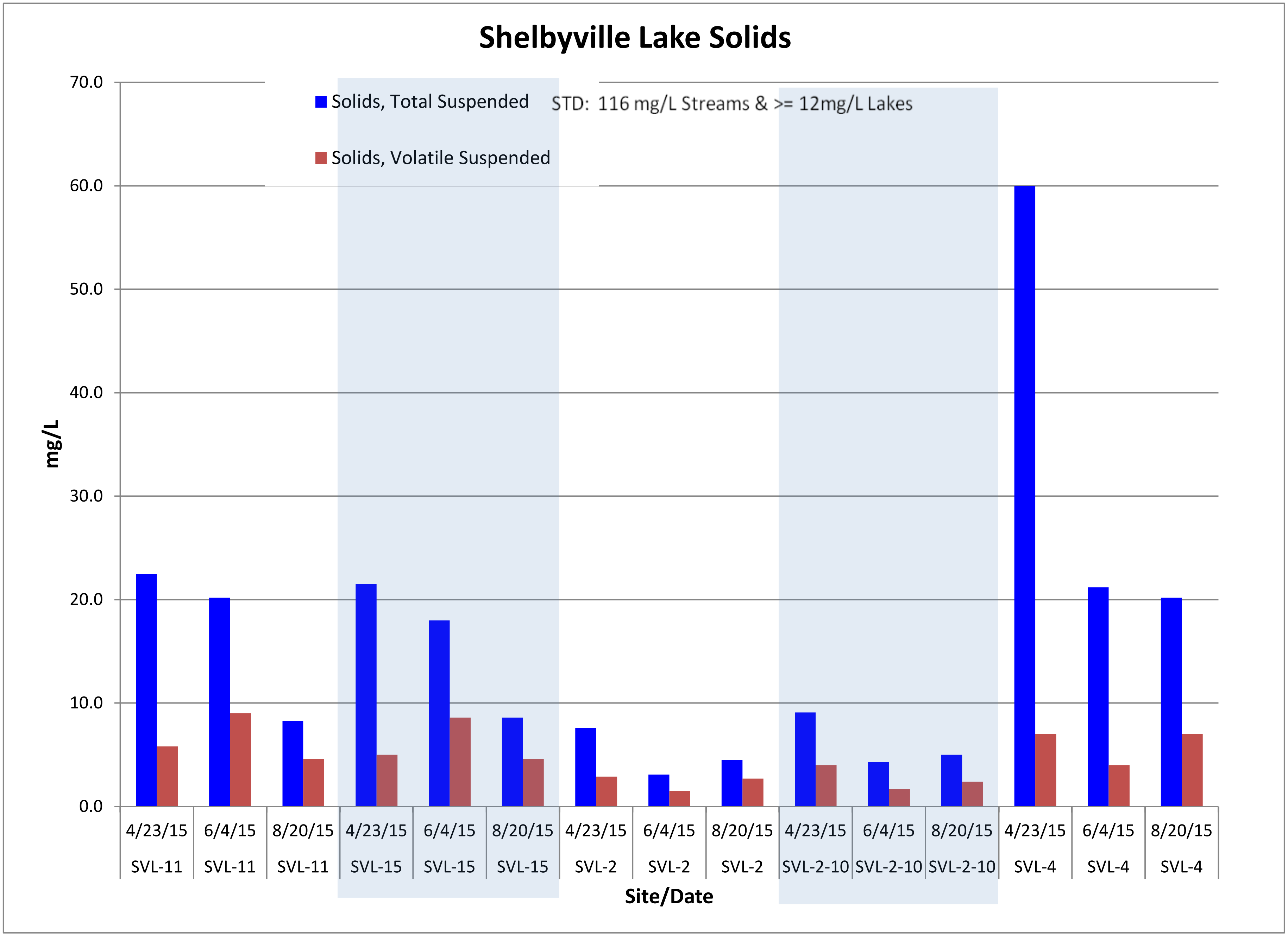

Shelbyville Lake Phospherous
Phosphorus
Phosphorus, -ortho
STD Total Phosphorous: 0.05 mg/L Lakes
& 0.61 mg/L Streams
mg/L
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
4/23/15 SVL-11
6/4/15 SVL-11
8/20/15 SVL-11
4/23/15 SVL-15
6/4/15 SVL-15
8/20/15 SVL-15
4/23/15 SVL-2
6/4/15 SVL-2
8/20/15 SVL-2
4/23/15 SVL-2-10
6/4/15 SVL-2-10
8/20/15 SVL-2-10
4/23/15 SVL-4
6/4/15 SVL-4
8/20/15 SVL-4
Date/Site


Shelbyville Chlorophyll & Pheophytin
Chlorophyll a
Pheophytin a
mg/cu m
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
4/23/15
SVL-11
6/4/15
SVL-11
8/20/15
SVL-11
4/23/15
SVL-15
6/4/15
SVL-15
8/20/15
SVL-15
4/23/15
SVL-2
6/4/15
SVL-2
8/20/15
SVL-2
4/23/15
SVL-4
6/4/15
SVL-4
8/20/15
SVL-4
Date/Site

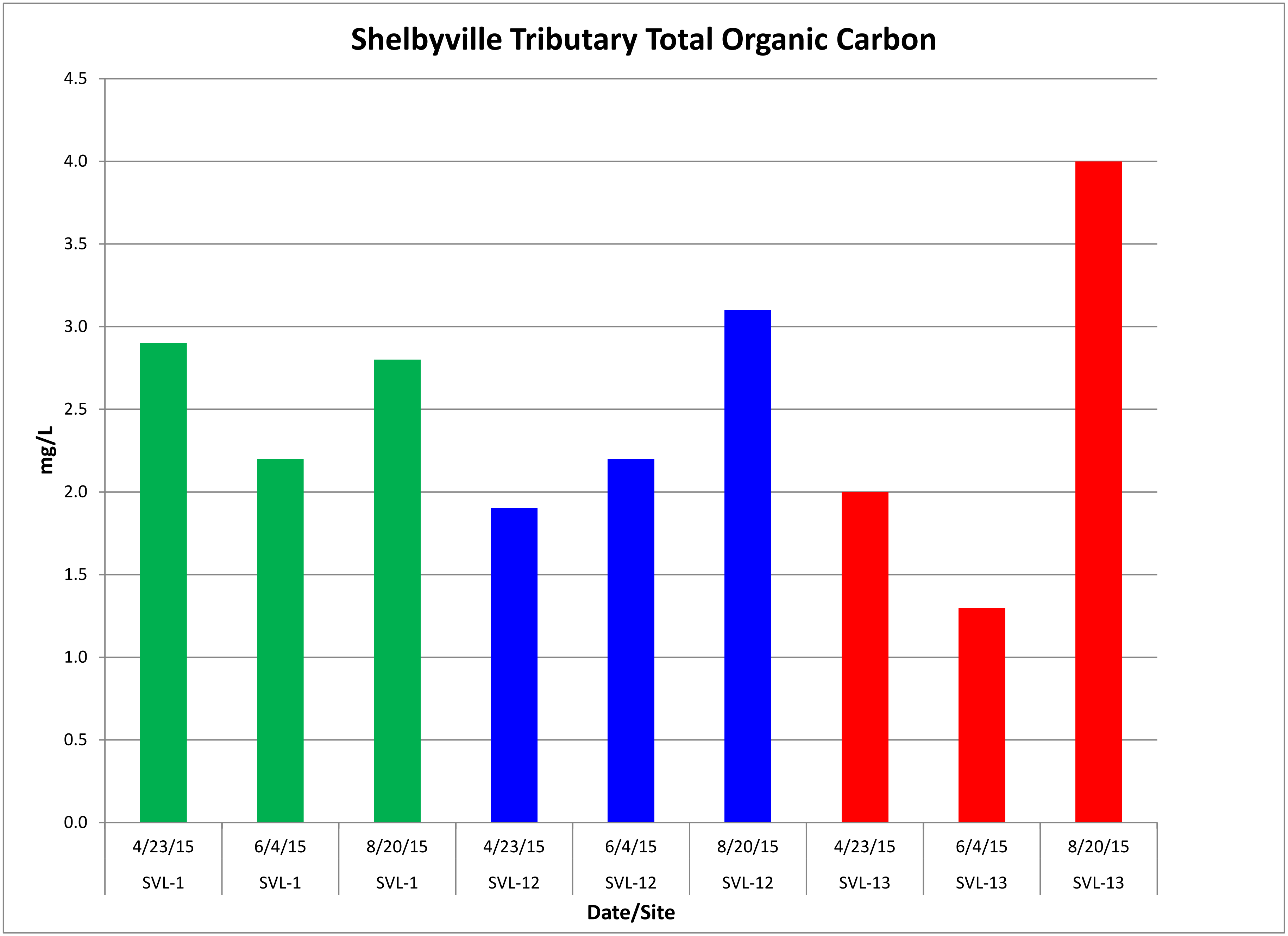

Tributary Shelbyville Pesticides
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
ug/L
Alachlor
STD: 2ug/L
Atrazine
STD: 3ug/L
Chloropyrifos
STD: 10ug/L
Cyanazine
STD: 370ug/L
Metolachlor
STD: 1700ug/L
Metribuzin
STD: 200ug/L DW; 91ug/L HRL
Pendimethalin
STD: 20ug/L
Trifluralin
STD: 26ug/L
4/23/15 SVL-1
6/4/15 SVL-1
8/20/15 SVL-1
4/23/15 SVL-12
6/4/15 SVL-12
8/20/15 SVL-12
4/23/15 SVL-13
6/4/15 SVL-13
8/20/15 SVL-13
Date/Site

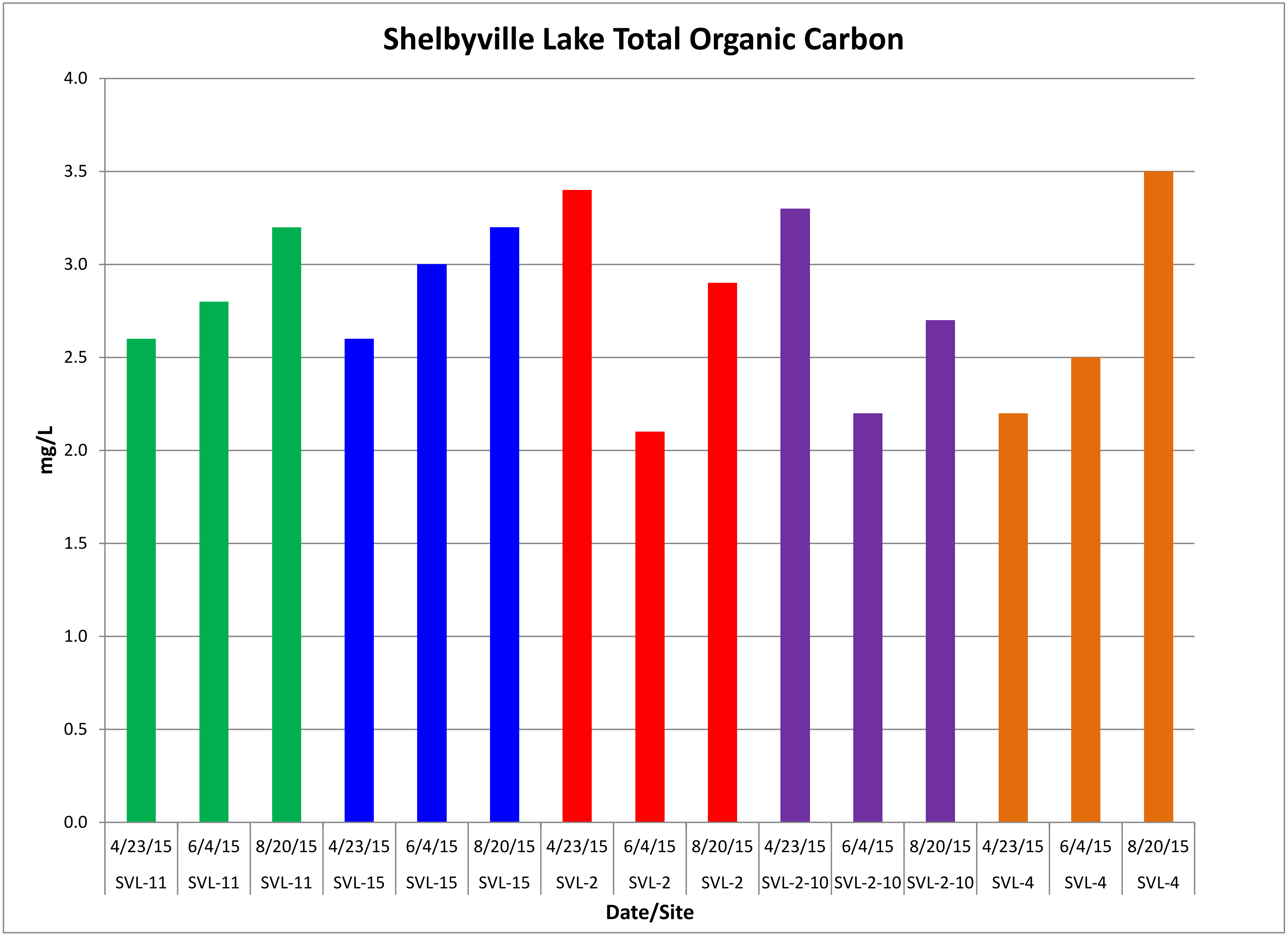

Shelbyville Lake Pesticides
Alachlor STD: 2ug/L
Atrazine STD: 3ug/L
Chloropyrifos STD: 10ug/L
Cyanazine STD: 370ug/L
Metolachlor STD: 1700ug/L
Metribuzin STD: 200ug/L DW; 91ug/L HRL
Pendimethalin STD: 20ug/L
Trifluralin STD: 26ug/L
ug/L
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
4/23/15 SVL-11
6/4/15 SVL-11
8/20/15 SVL-11
4/23/15 SVL-15
6/4/15 SVL-15
8/20/15 SVL-15
4/23/15 SVL-2
6/4/15 SVL-2
8/20/15 SVL-2
4/23/15 SVL-4
6/4/15 SVL-4
8/20/15 SVL-4
Date/Site


Shelbyville Tributary Solids
Solids, Total Suspended
Solids, Volatile Suspended
STD: 116 mg/L Streams & >= 12mg/L Lakes
mg/L
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
4/23/15
SVL-1
6/4/15
SVL-1
8/20/15
SVL-1
4/23/15
SVL-12
6/4/15
SVL-12
8/20/15
SVL-12
4/23/15
SVL-13
6/4/15
SVL-13
8/20/15
SVL-13
Date/Site



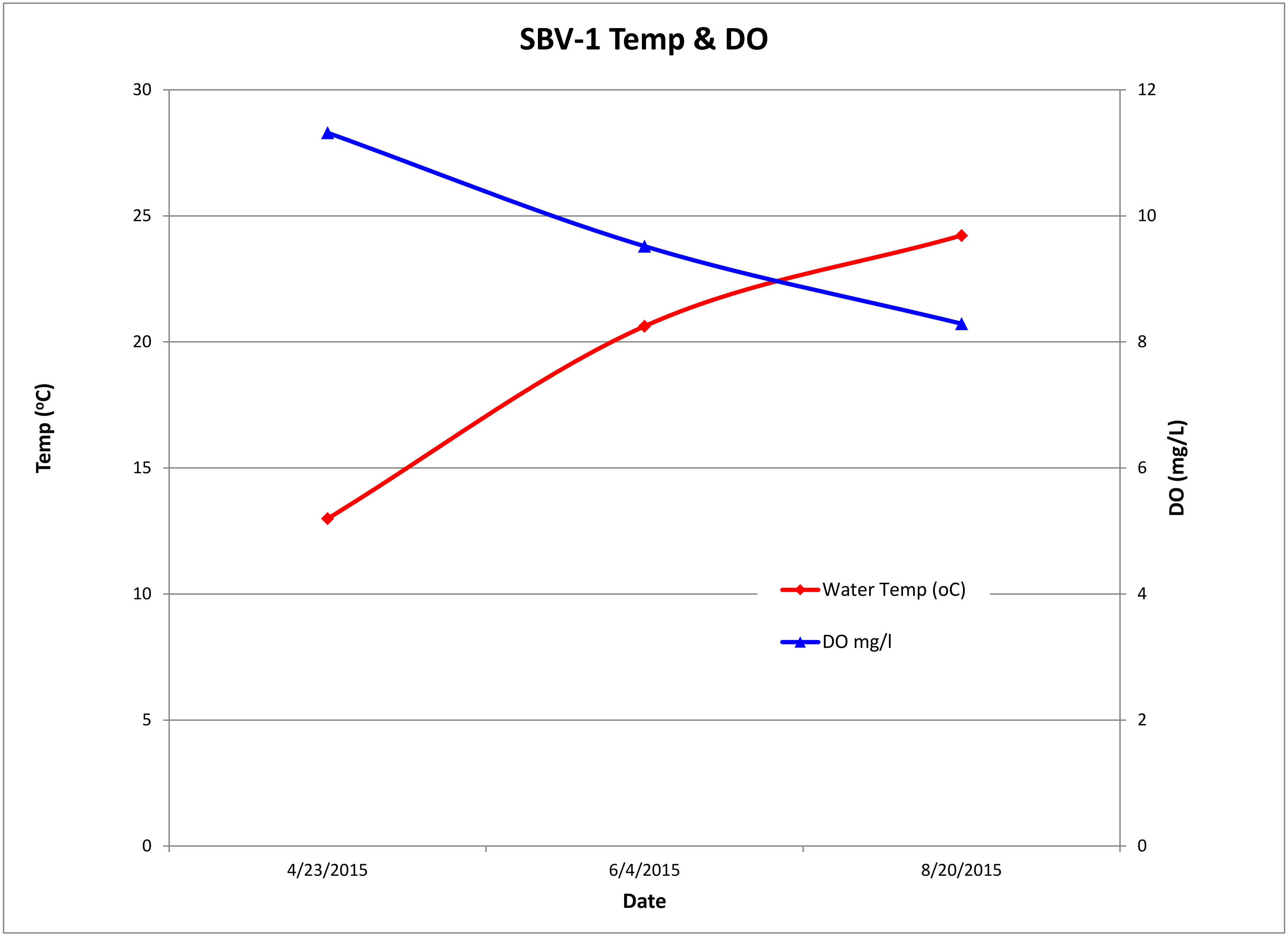
Shelbyville Lake Solids
Solids, Total Suspended
Solids, Volatile Suspended
STD: 116 mg/L Streams & >= 12mg/L Lakes
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
mg/L
4/23/15
6/4/15
8/20/15
4/23/15
6/4/15
8/20/15
4/23/15
6/4/15
8/20/15
4/23/15
6/4/15
8/20/15
4/23/15
6/4/15
8/20/15
SVL-11
SVL-11
SVL-11
SVL-15
SVL-15
SVL-15
SVL-2
SVL-2
SVL-2
SVL-2-10
SVL-2-10
SVL-2-10
SVL-4
SVL-4
SVL-4
Site/Date


Shelbyville Tributary Total Organic Carbon
mg/L
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
4/23/15
SVL-1
6/4/15
SVL-1
8/20/15
SVL-1
4/23/15
SVL-12
6/4/15
SVL-12
8/20/15
SVL-12
4/23/15
SVL-13
6/4/15
SVL-13
8/20/15
SVL-13
Date/Site

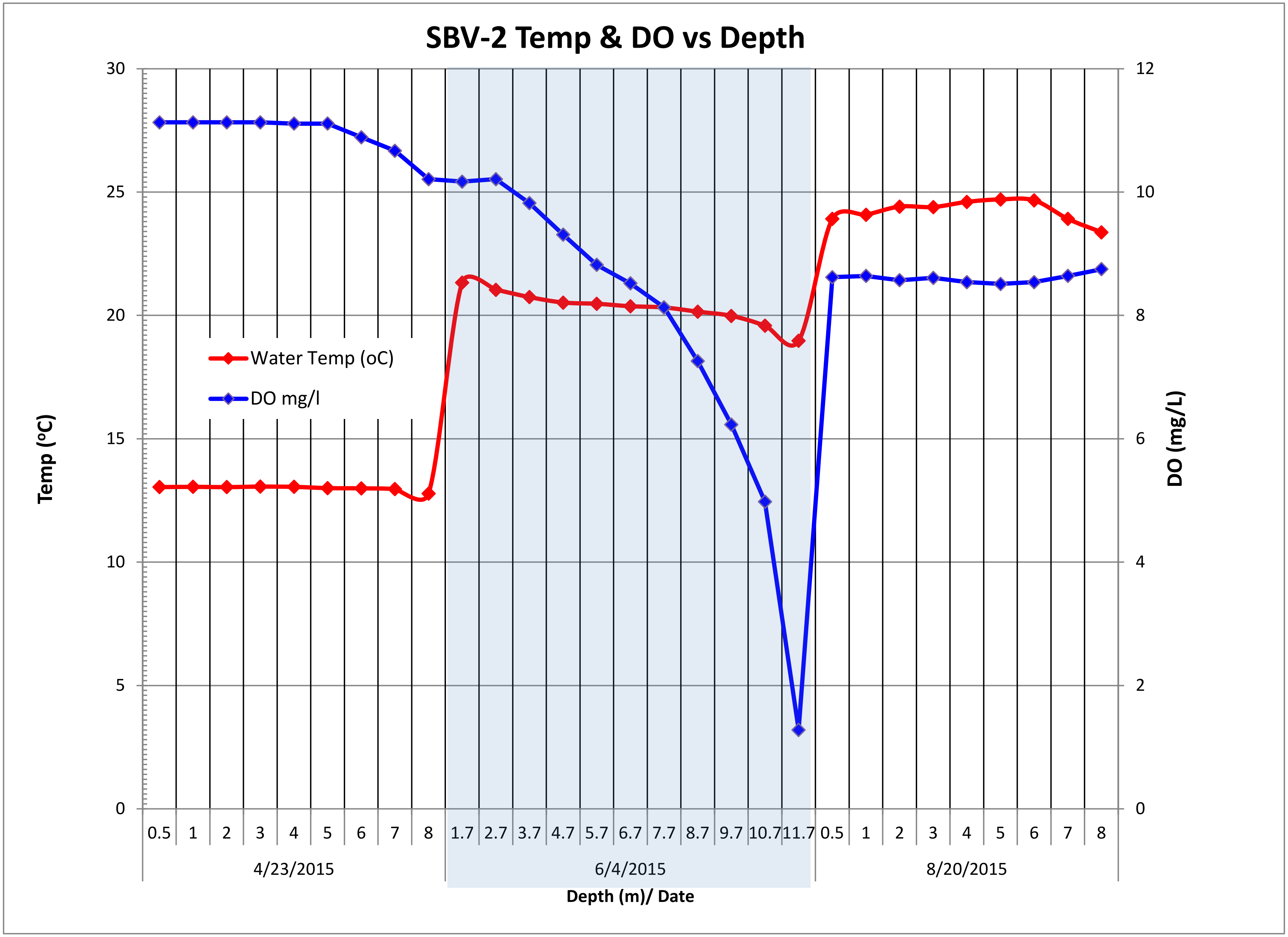

Shelbyville Lake Total Organic Carbon
mg/L
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
4/23/15 SVL-11
6/4/15 SVL-11
8/20/15 SVL-11
4/23/15 SVL-15
6/4/15 SVL-15
8/20/15 SVL-15
4/23/15 SVL-2
6/4/15 SVL-2
8/20/15 SVL-2
4/23/15 SVL-2-10
6/4/15 SVL-2-10
8/20/15 SVL-2-10
4/23/15 SVL-4
6/4/15 SVL-4
8/20/15 SVL-4
Date/Site

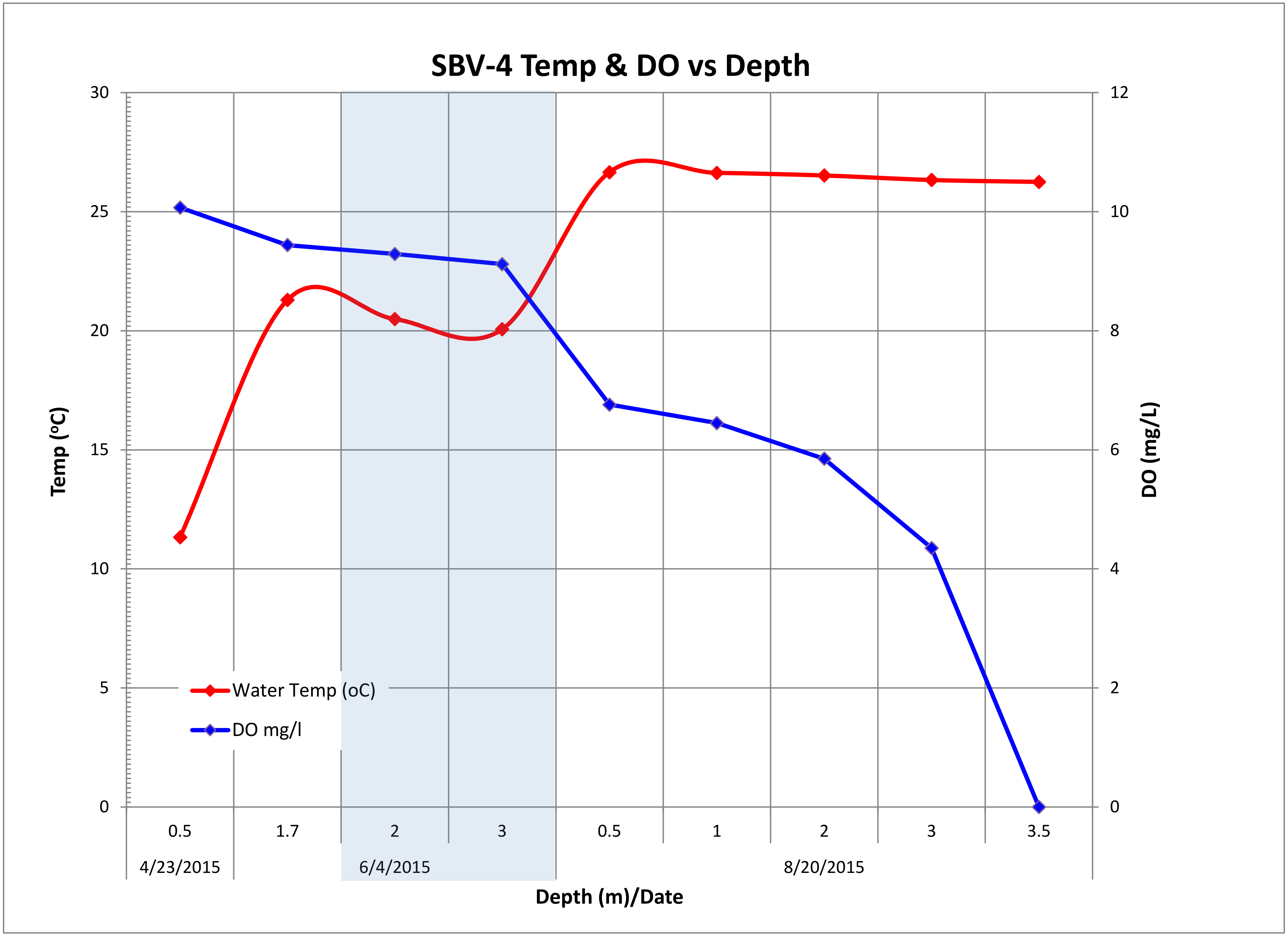
APPENDIX C

FIELD DATA
GRAPHS

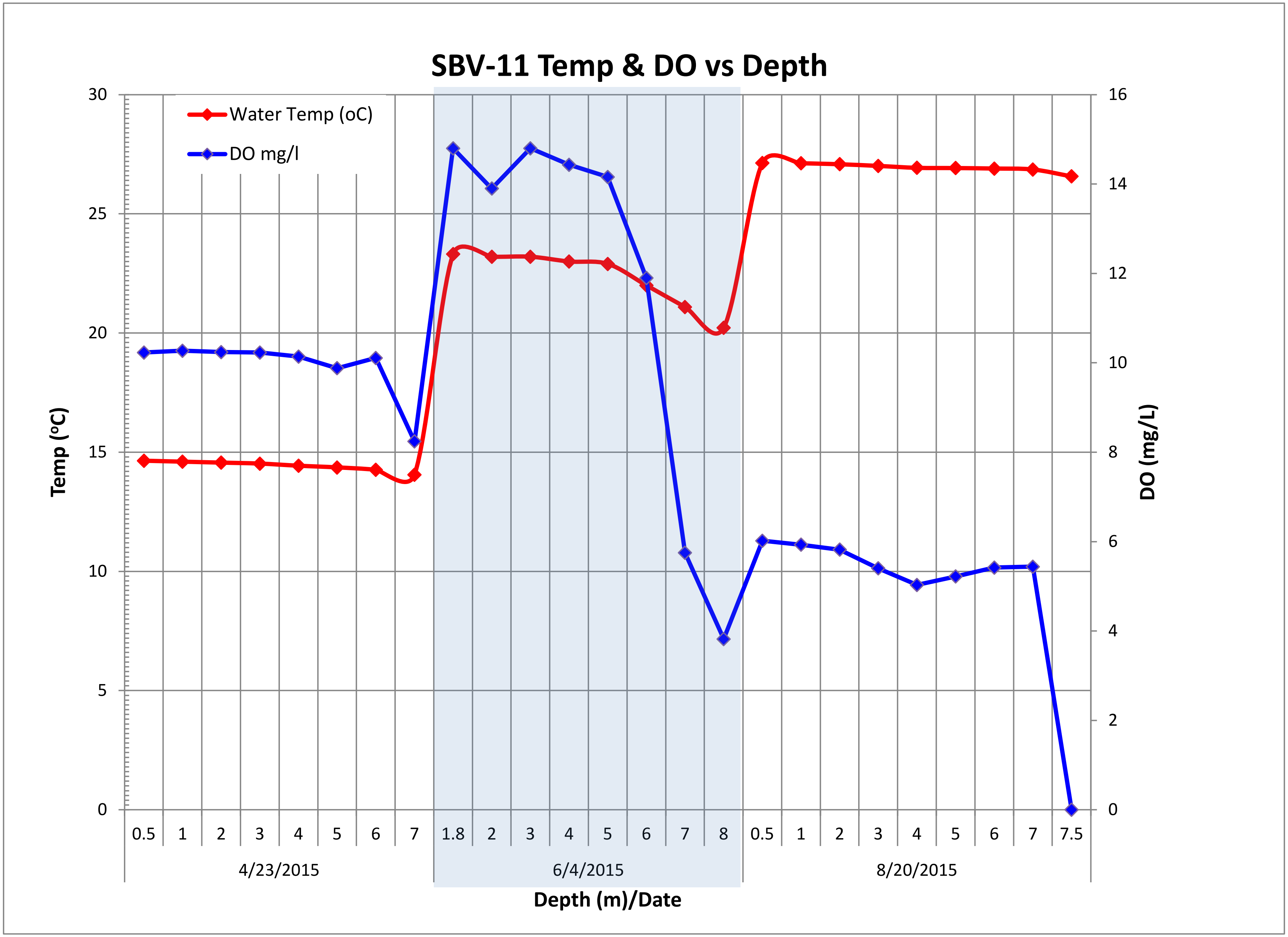


SBV-1 Temp & DO
30
25
20
15
10
5
0
12
10
8
6
4
2
0
Temp (ºC)
DO (mg/L)
Water Temp (oC)
DO mg/l
4/23/2015
6/4/2015
8/20/2015
Date

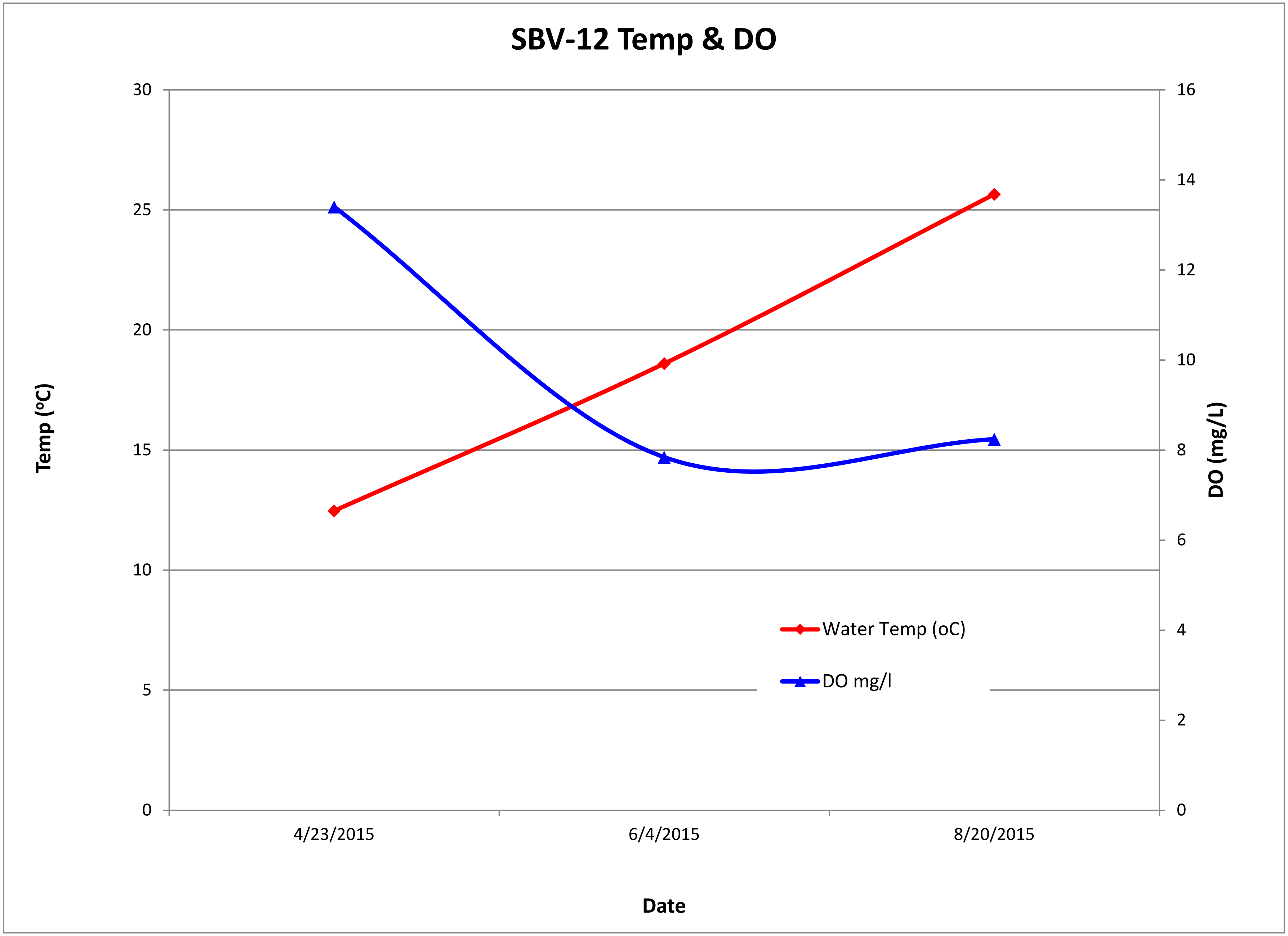

SBV-2 Temp & DO vs Depth
Temp (oC)
DO (mg/L)
Water Temp (oC)
DO mg/l
0.5
1
2
3
4
5
6
7
8
1.7
2.7
3.7
4.7
5.7
6.7
7.7
8.7
9.7
10.7
11.7
0.5
1
2
3
4
5
6
7
8
4/23/2015
6/4/2015
8/20/2015
Depth (m)/ Date

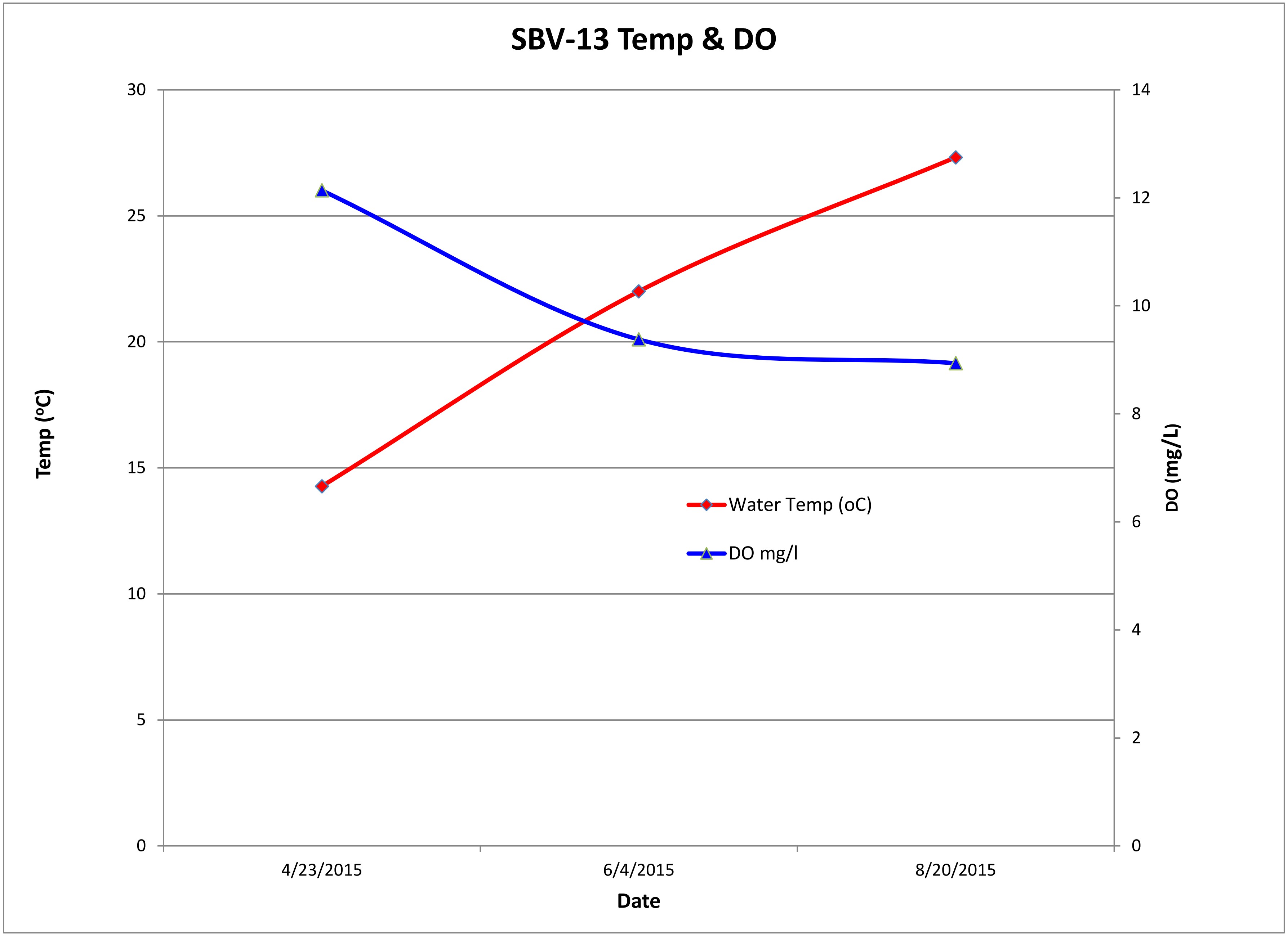


SBV-4 Temp & DO vs Depth
Temp (ºC)
DO (mg/L)
30
25
20
15
10
5
0
12
10
8
6
4
2
0
Water Temp (oC)
DO mg/l
0.5
1.7
2
3
0.5
1
2
3
3.5
4/23/2015
6/4/2015
8/20/2015
Depth (m)/Date

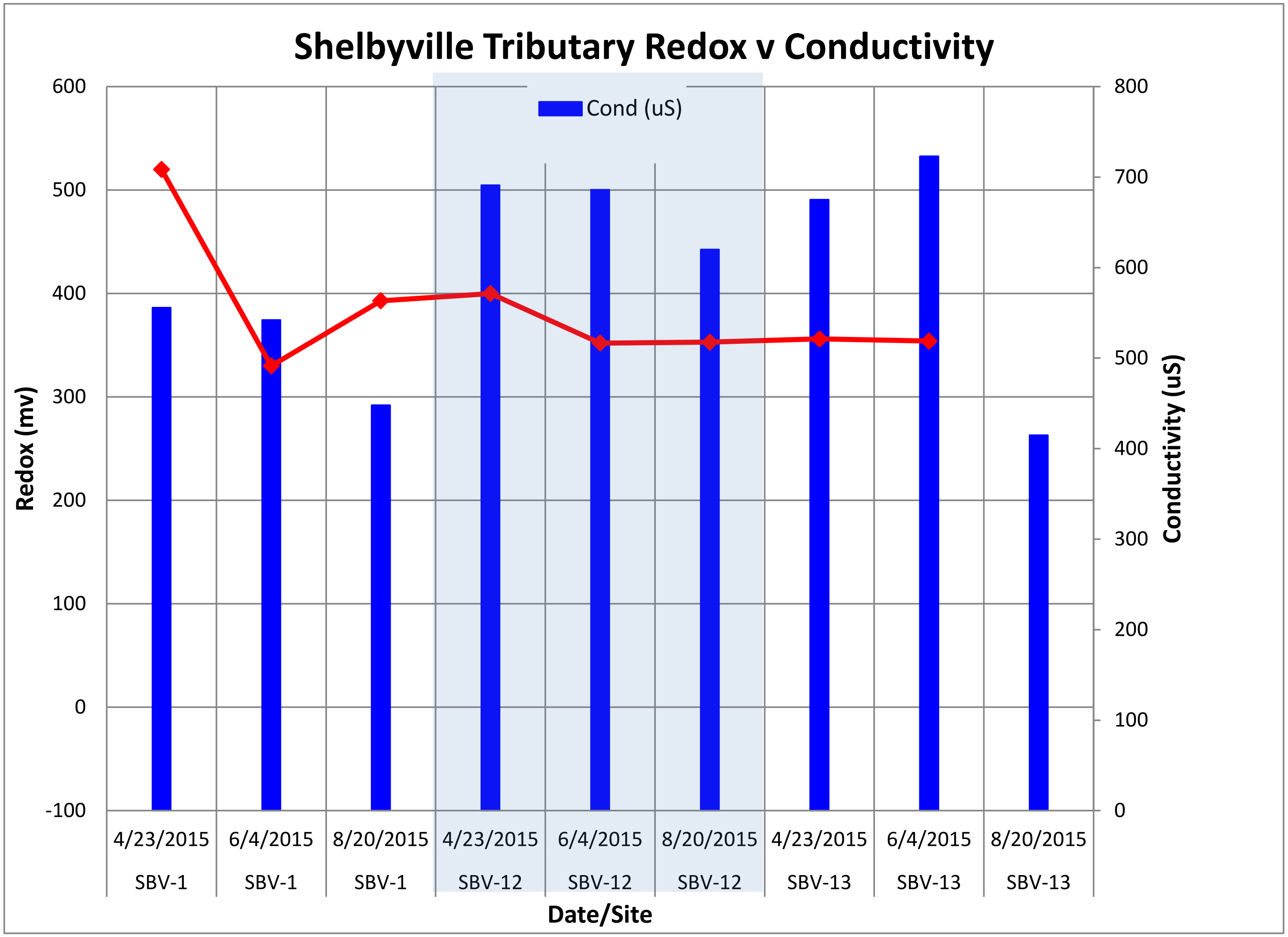


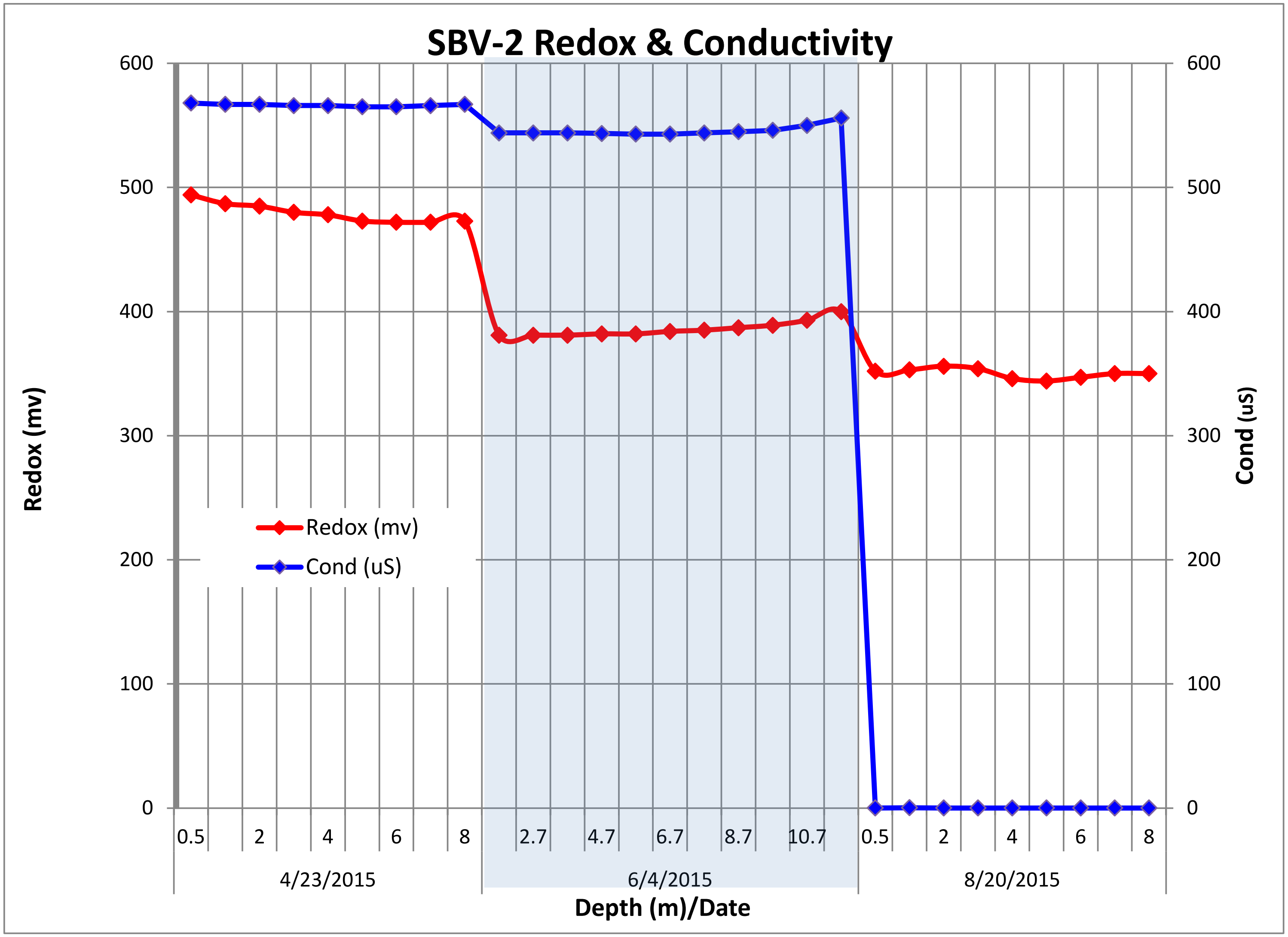
SBV-11 Temp & DO vs Depth
Water Temp (oC)
DO mg/l
Temp (ºC)
DO (mg/L)
30
25
20
15
10
5
0
16
14
12
10
8
6
4
2
0
0.5
1
2
3
4
5
6
7
1.8
2
3
4
5
6
7
8
0.5
1
2
3
4
5
6
7
7.5
4/23/2015
6/4/2015
8/20/2015
Depth (m)/Date

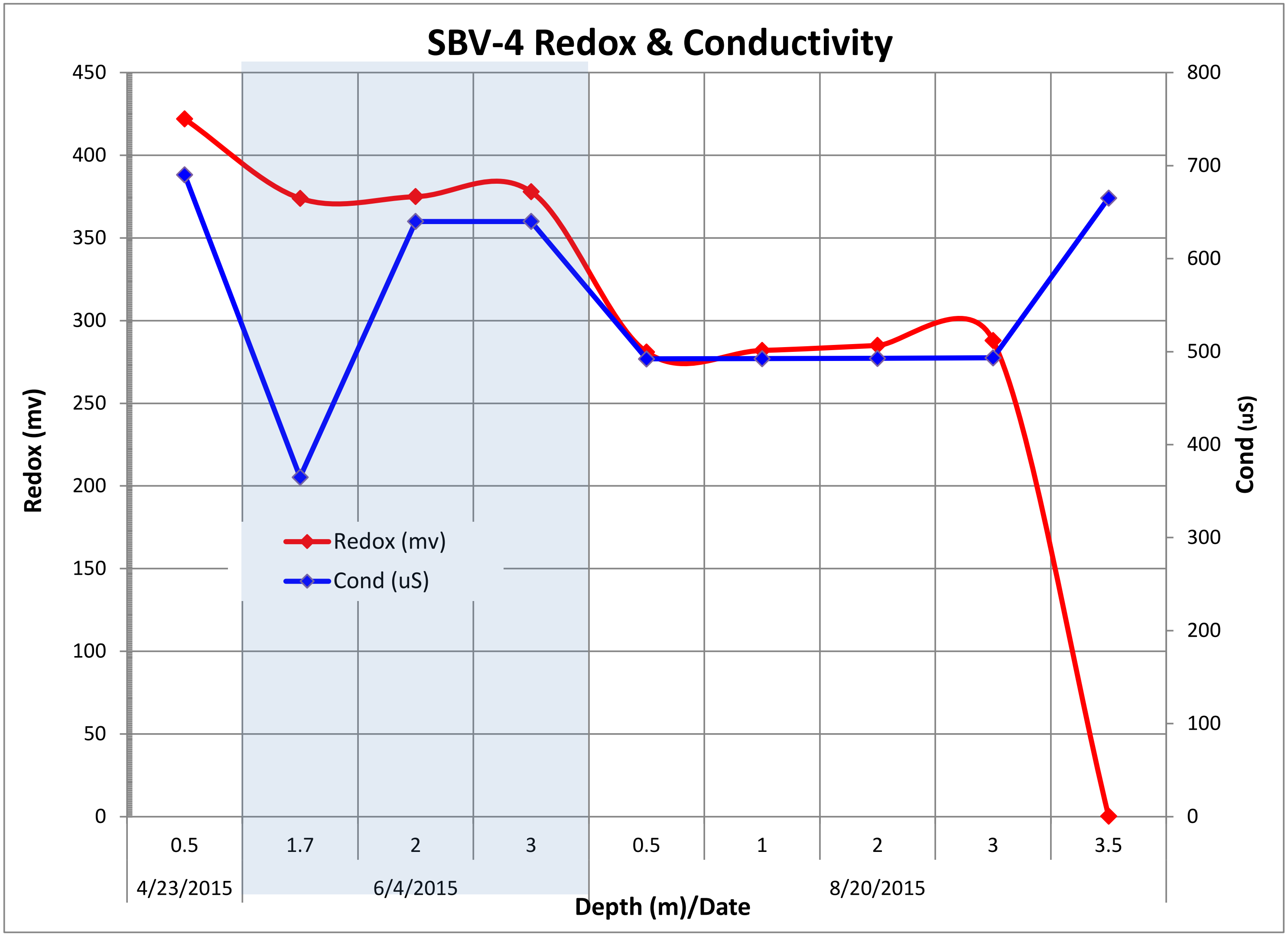

SBV-12 Temp & DO
Temp (ºC)
DO (mg/L)
Date
30
25
20
15
10
5
0
16
14
12
10
8
6
4
2
0
4/23/2015
6/4/2015
8/20/2015
Water Temp (oC)
DO mg/l



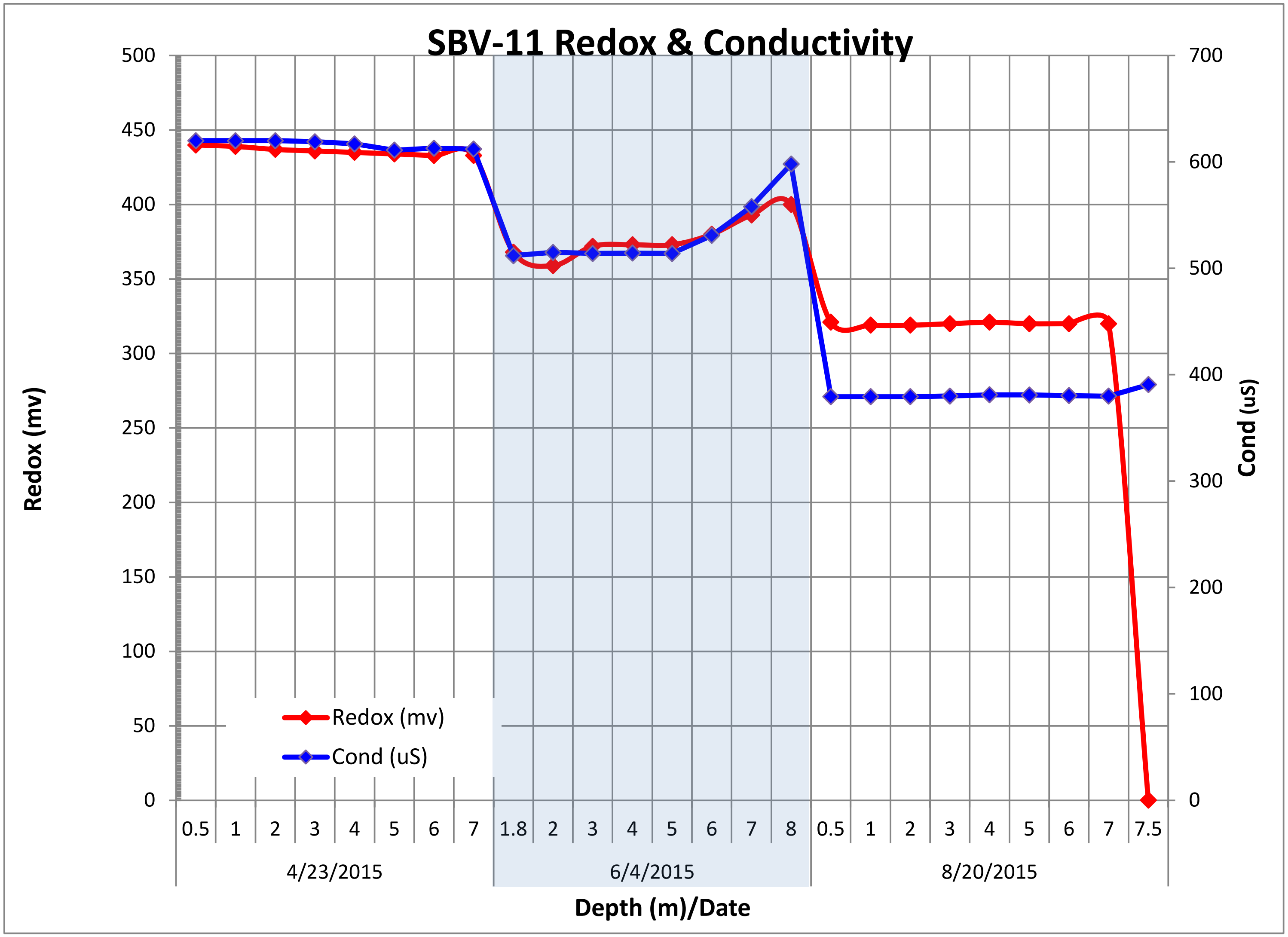
SBV-13 Temp & DO
30
25
20
15
10
5
0
14
12
10
8
6
4
2
0
Temp (ºC)
DO (mg/L)
Water Temp (oC)
DO mg/l
4/23/2015
6/4/2015
8/20/2015
Date

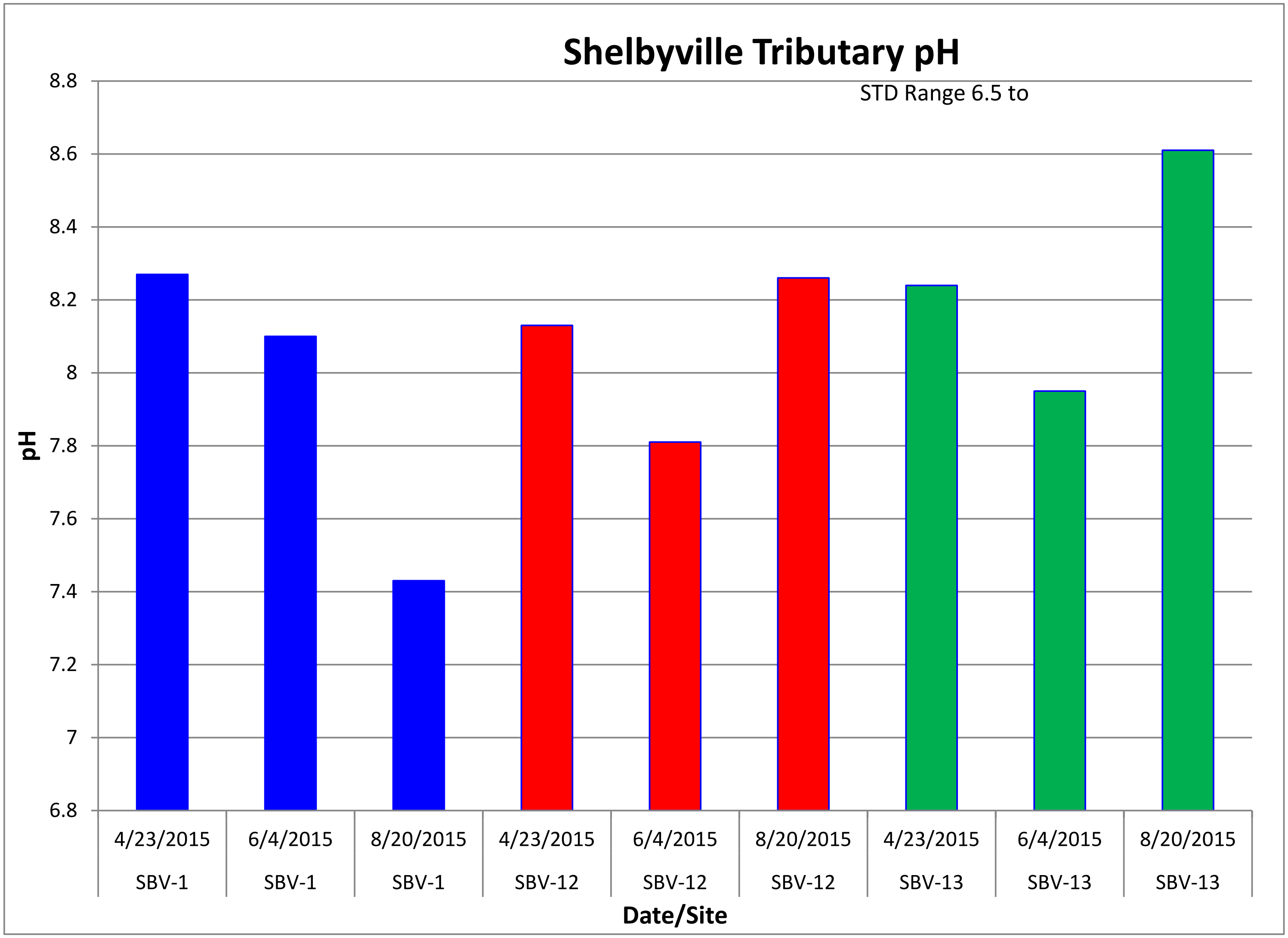

Shelbyville Tributary Redox v Conductivity
Cond (uS)
Redox (mv)
Conductivity (uS)
Date/Site
600
500
400
300
200
100
0
-100
800
700
600
500
400
300
200
100
0
4/23/2015
6/4/2015
8/20/2015
SBV-1
SBV-12
SBV-13


SBV-2 Redox & Conductivity
Redox (mv)
Cond (uS)
Redox (mv)
Cond (uS)
600
500
400
300
200
100
0
0.5
2
4
6
8
2.7
4.7
6.7
8.7
10.7
0.5
2
4
6
8
4/23/2015
6/4/2015
8/20/2015
Depth (m)/Date

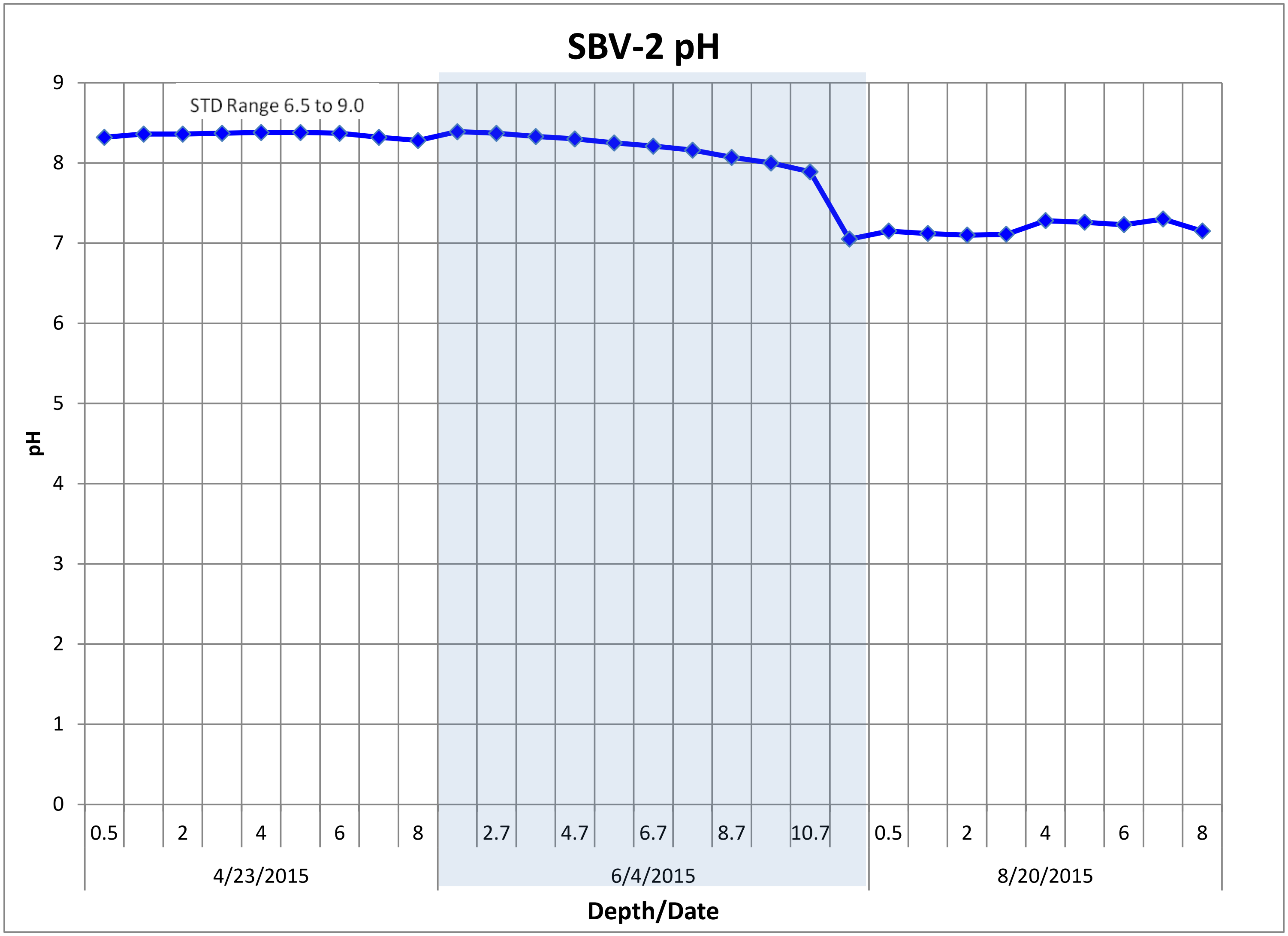


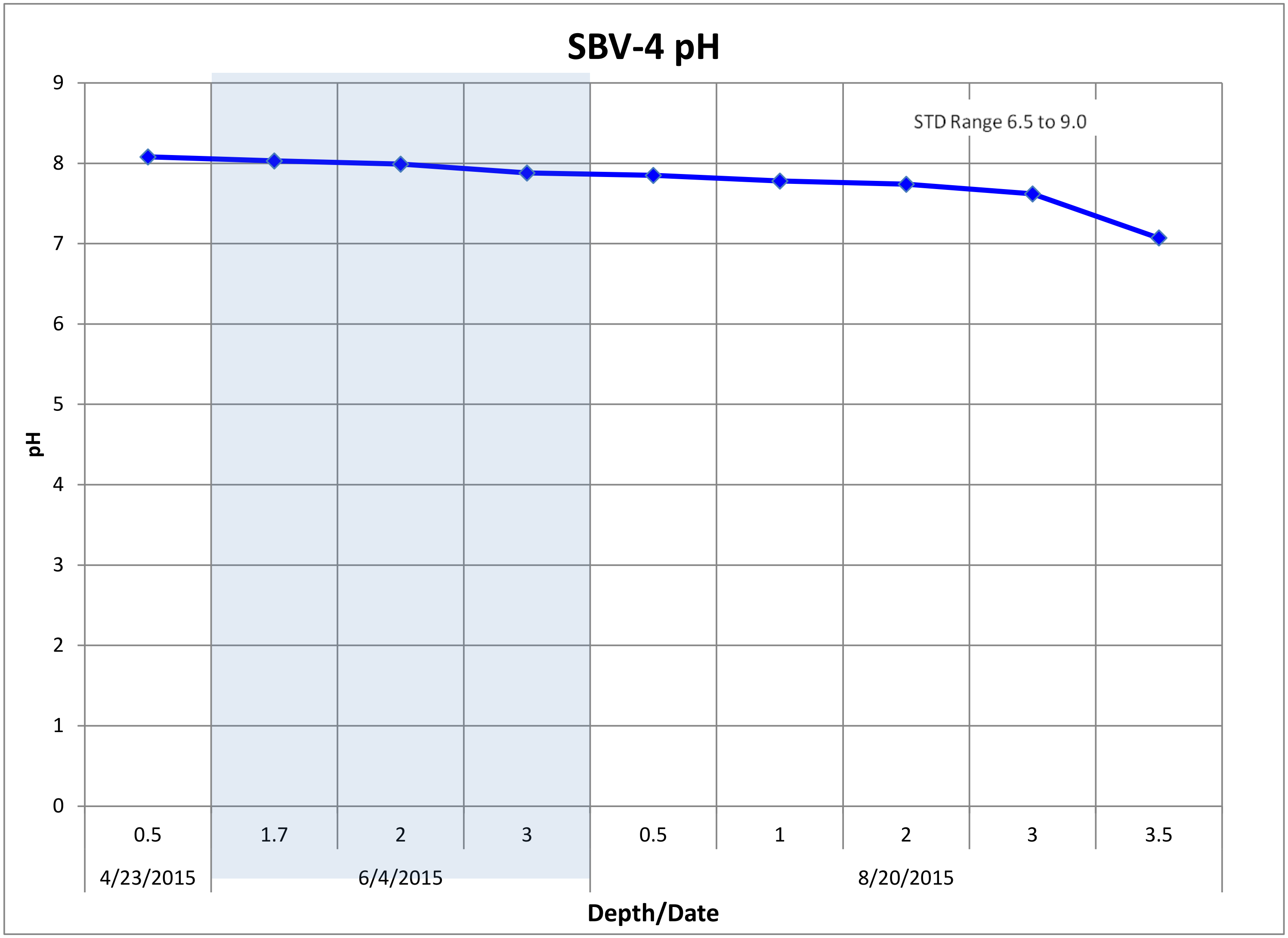
SBV-4 Redox & Conductivity
Redox (mv)
Cond (uS)
Depth (m)/Date
450
400
350
300
250
200
150
100
50
0
800
700
600
500
400
300
200
100
0
0.5
1.7
2
3
0.5
1
2
3
3.5
4/23/2015
6/4/2015
8/20/2015
Redox (mv)
Cond (uS)

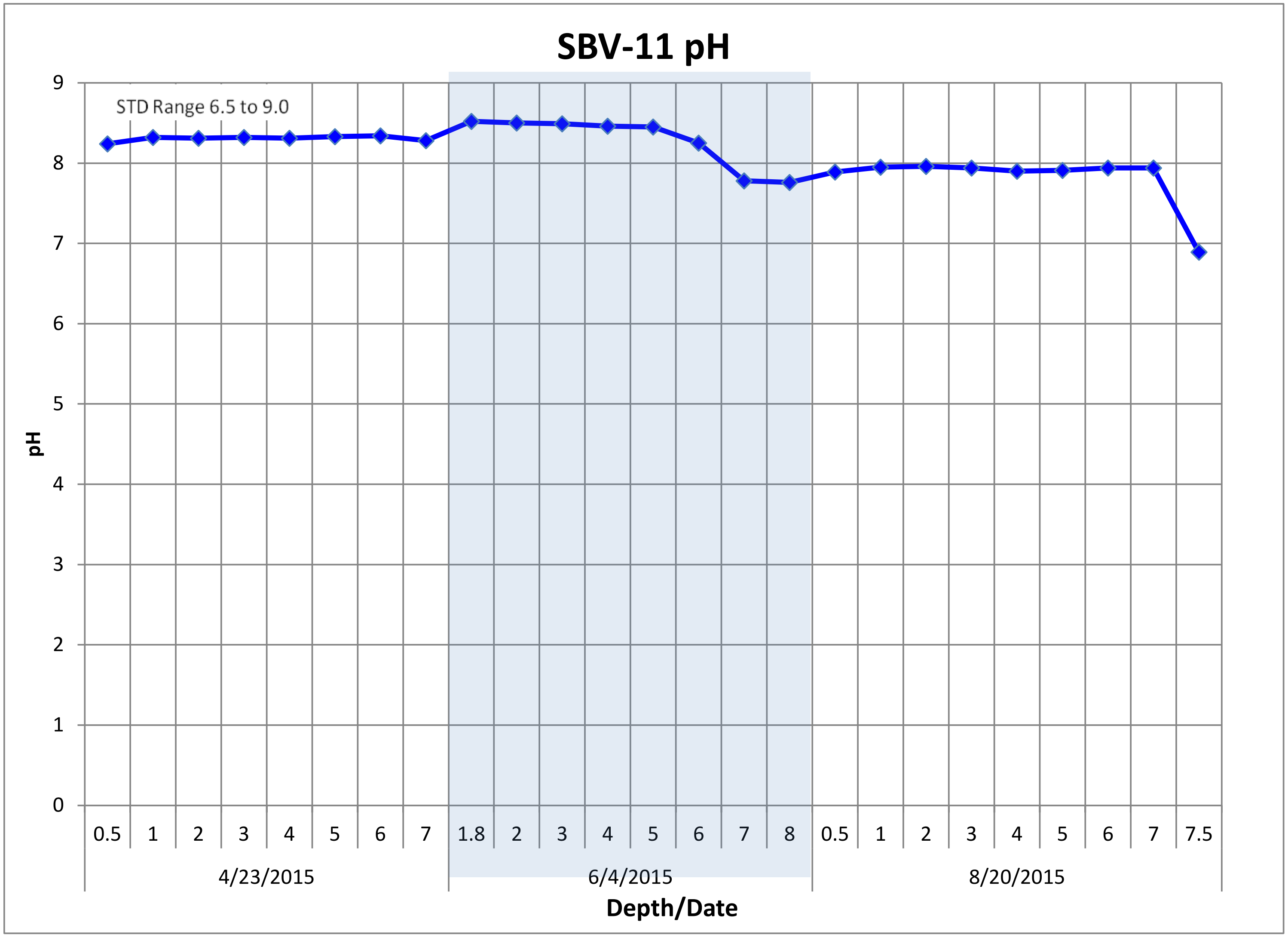

SBV-11 Redox & Conductivity
Redox (mv)
Cond (uS)
500
450
400
350
300
250
200
150
100
50
0
700
600
500
400
300
200
100
0
0.5 1 2 3 4 5 6 7
4/23/2015
1.8 2 3 4 5 6 7 8
6/4/2015
0.5 1 2 3 4 5 6 7 7.5
8/20/2015
Depth (m)/Date

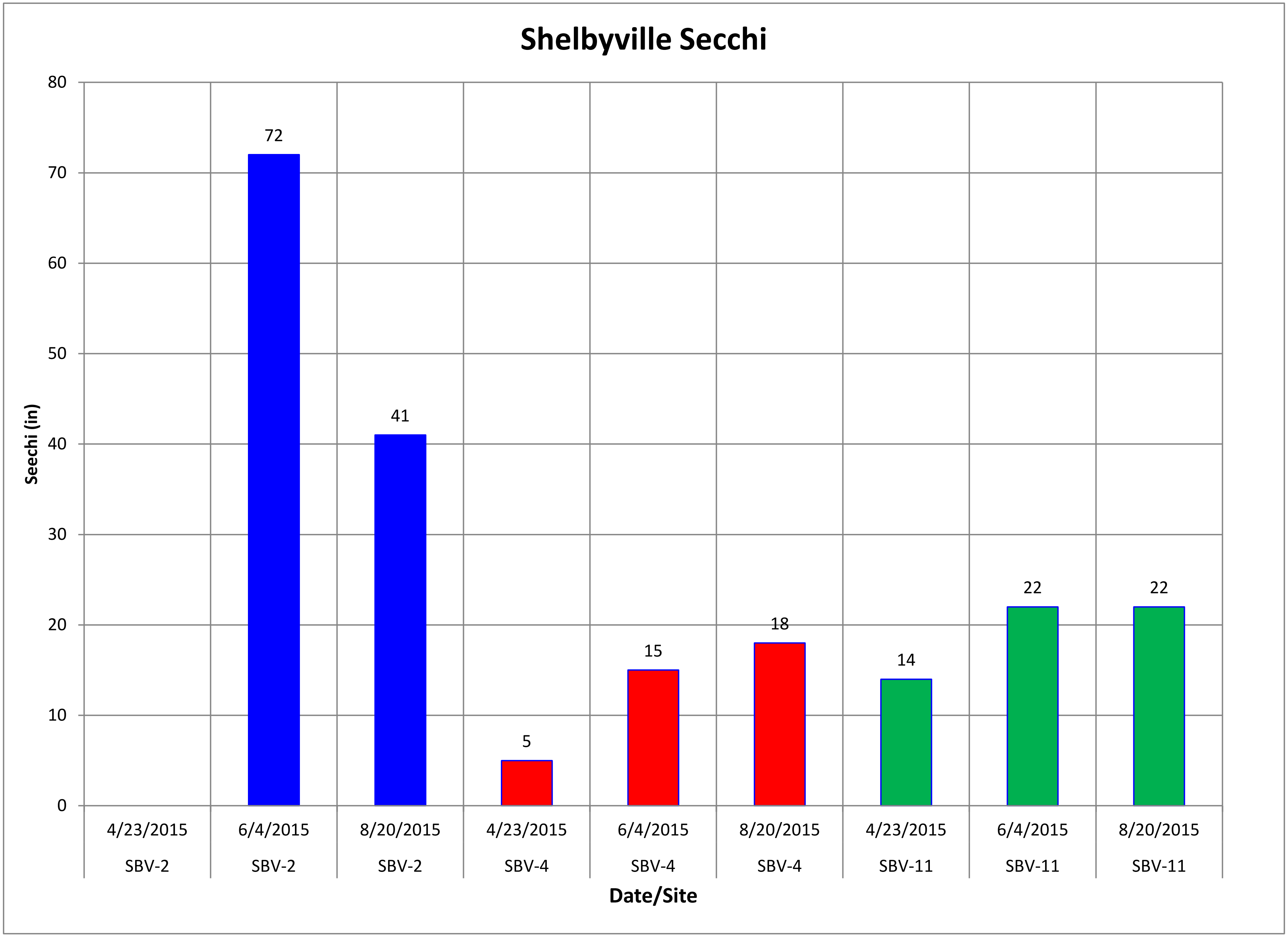


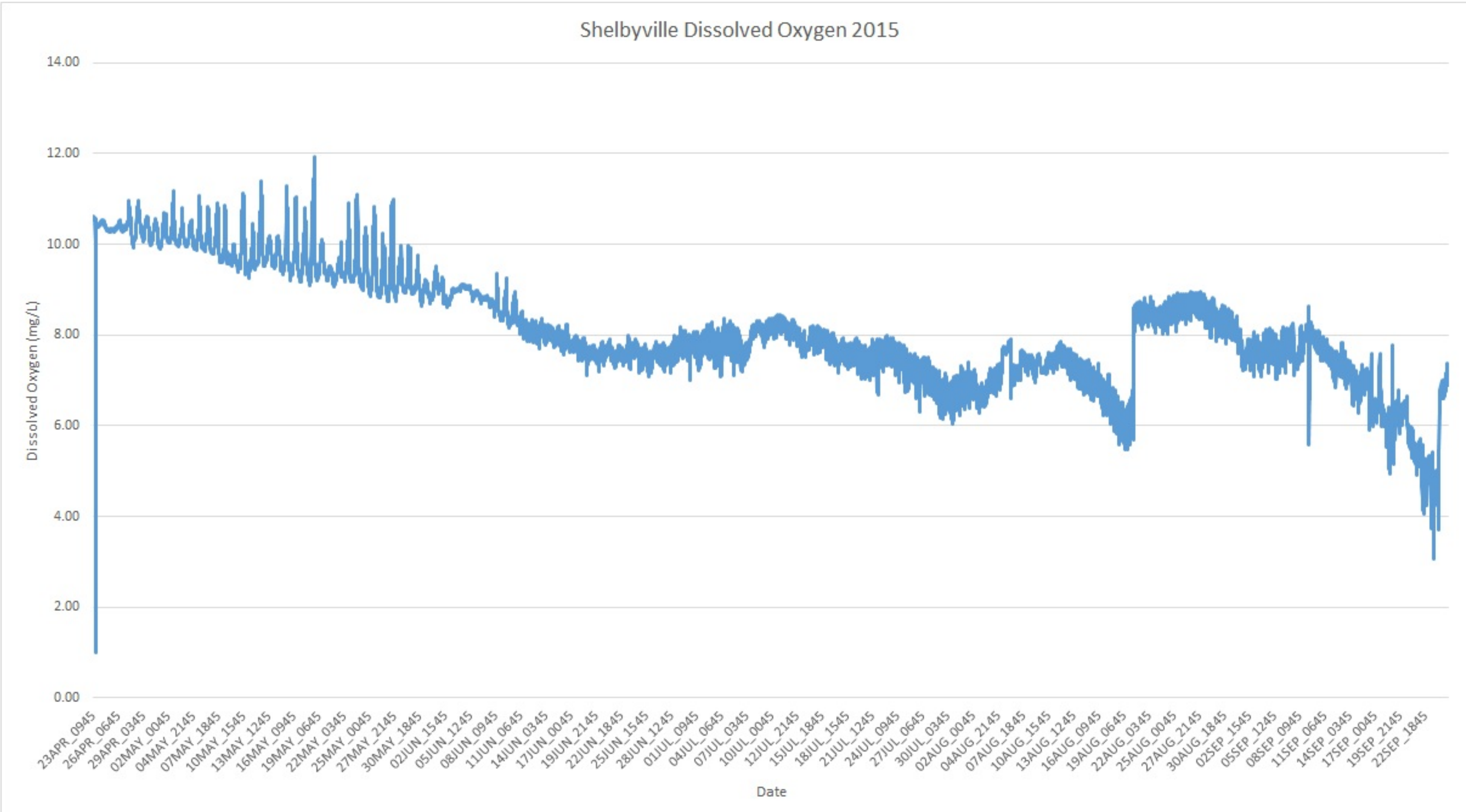
Shelbyville Tributary pH
STD Range 6.5 to
8.8
8.6
8.4
8.2
8
7.8
7.6
7.4
7.2
7
6.8
pH
4/23/2015
SBV-1
6/4/2015
SBV-1
8/20/2015
SBV-1
4/23/2015
SBV-12
6/4/2015
SBV-12
8/20/2015
SBV-12
4/23/2015
SBV-13
6/4/2015
SBV-13
8/20/2015
SBV-13
Date/Site


SBV-2 pH
STD Range 6.5 to 9.0
pH
9
8
7
6
5
4
3
2
1
0
0.5
2
4
6
8
2.7
4.7
6.7
8.7
10.7
0.5
2
4
6
8
4/23/2015
6/4/2015
8/20/2015
Depth/Date


SBV-4 pH
pH
9
8
7
6
5
4
3
2
1
0
STD Range 6.5 to 9.0
0.5
1.7
2
3
0.5
1
2
3
3.5
4/23/2015
6/4/2015
8/20/2015
Depth/Date


SBV-11 pH
STD Range 6.5 to 9.0
pH
9
8
7
6
5
4
3
2
1
0
0.5 1 2 3 4 5 6 7
4/23/2015
1.8 2 3 4 5 6 7 8
6/4/2015
0.5 1 2 3 4 5 6 7 7.5
8/20/2015
Depth/Date

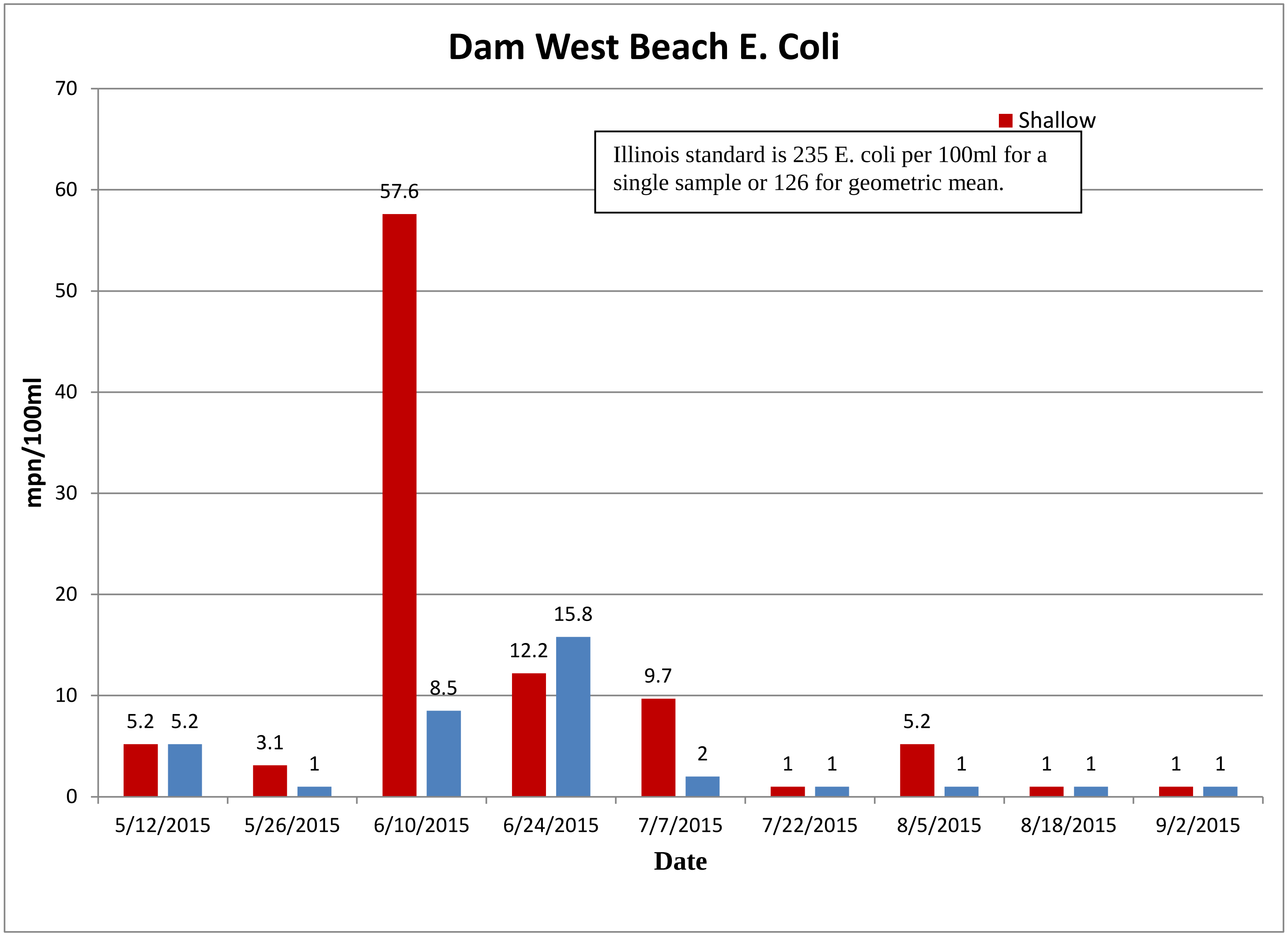

Shelbyville Secchi
Seechi (in)
80
70
60
50
40
30
20
10
0
72
41
5
15
18
14
22
22
4/23/2015
SBV-2
6/4/2015
SBV-2
8/20/2015
SBV-2
4/23/2015
SBV-4
6/4/2015
SBV-4
8/20/2015
SBV-4
4/23/2015
SBV-11
6/4/2015
SBV-11
8/20/2015
SBV-11
Date/Site



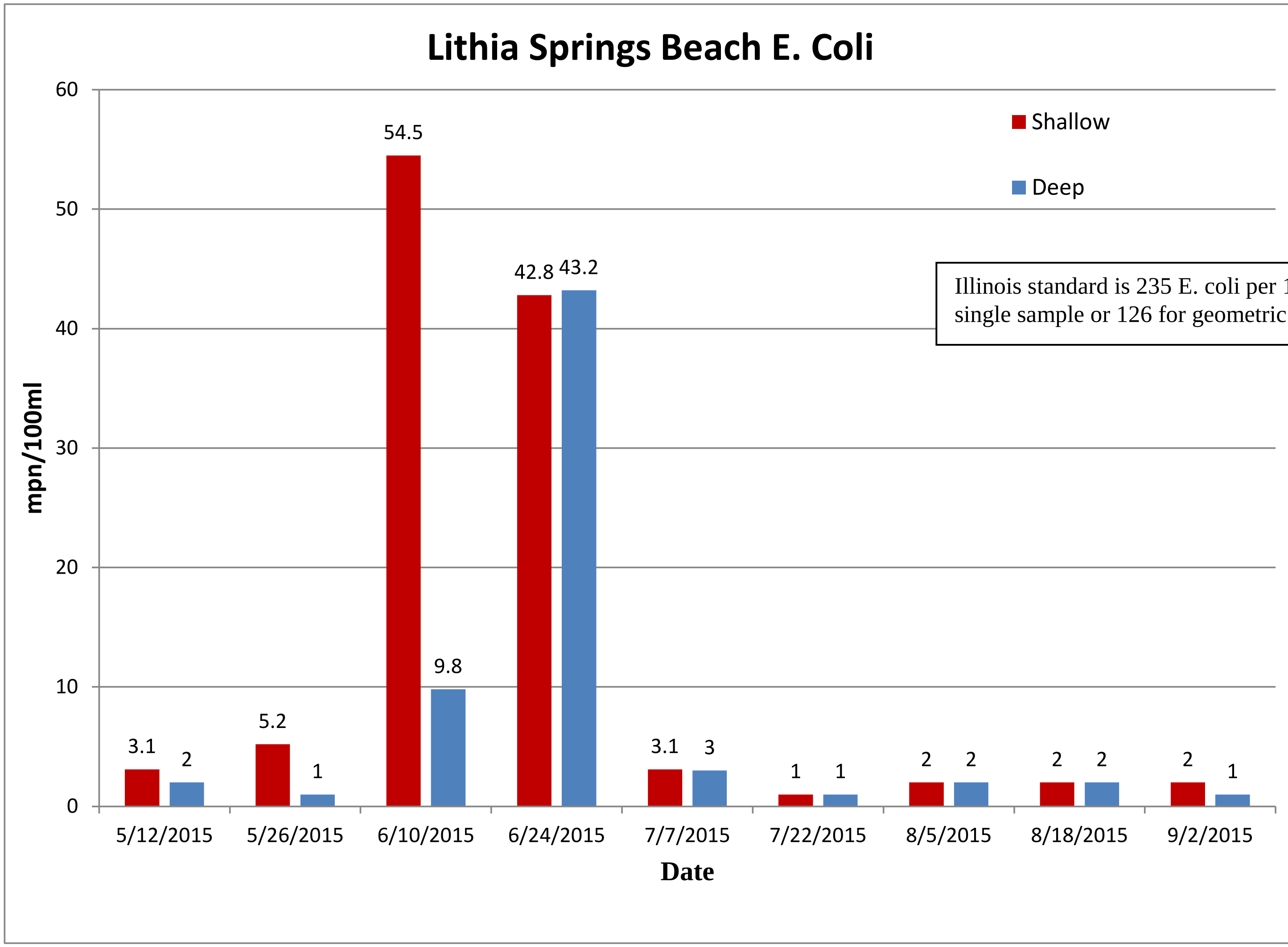
Dissolved Oxygen in spillway as monitored by remote sonde

APPENDIX D

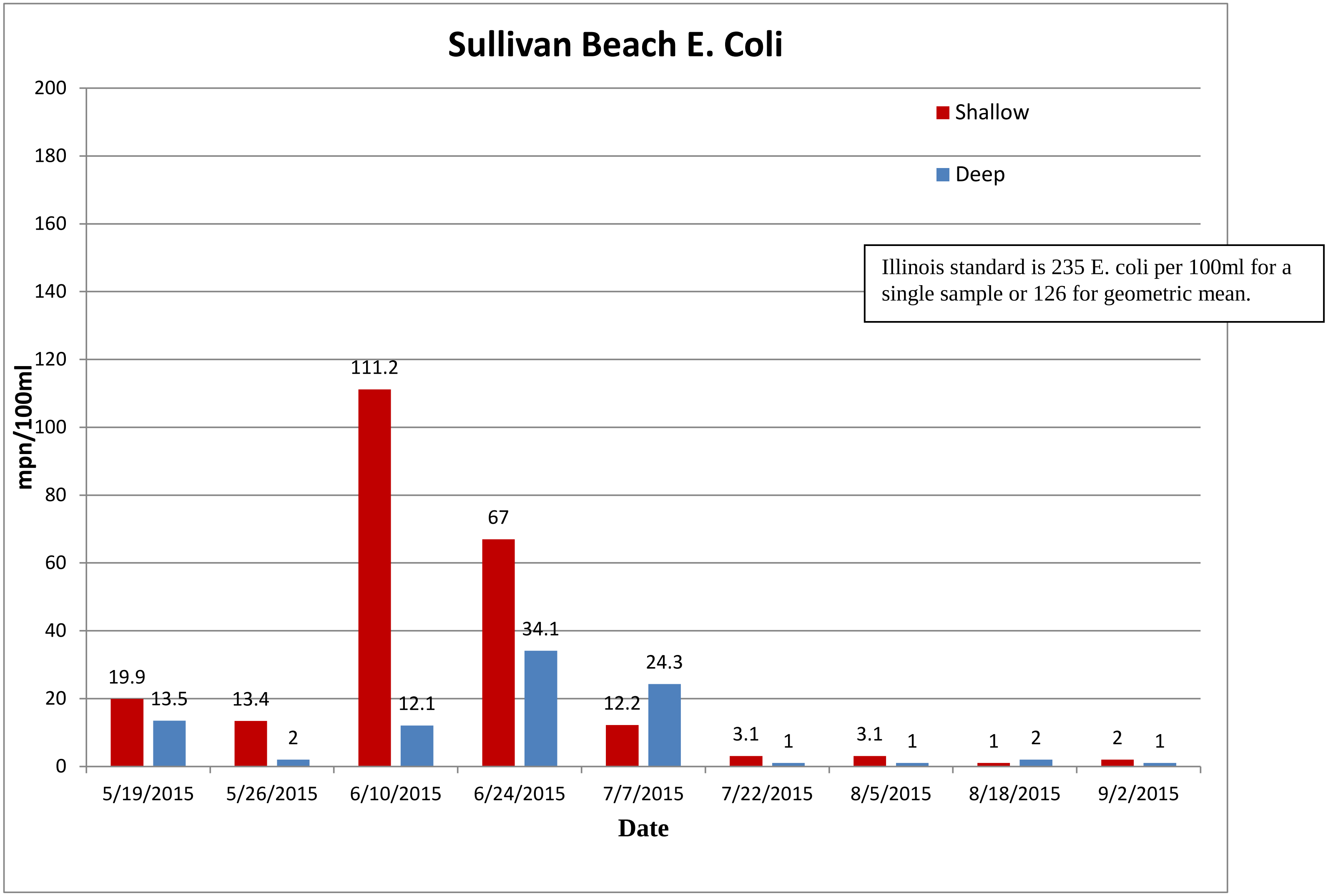
BEACH GRAPHS

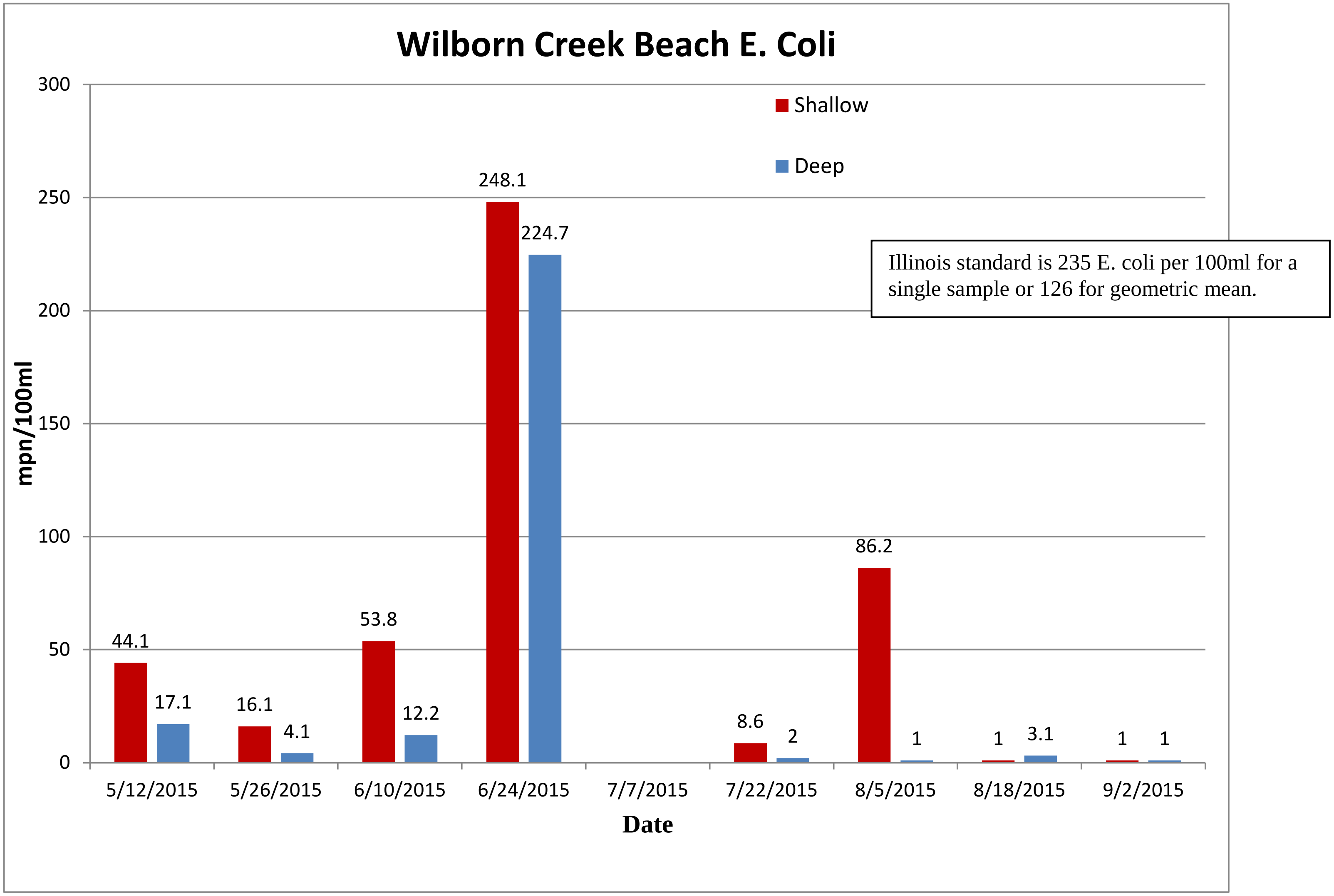


Dam West Beach E. Coli
Shallow
Illinois standard is 235 E. coli per 100ml for a single sample or 126 for geometric mean.
mpn/100ml
70
60
50
40
30
20
10
0
5.2
5.2
3.1
1
57.6
8.5
12.2
15.8
9.7
2
1
1
5.2
1
1
1
1
1
5/12/2015
5/26/2015
6/10/2015
6/24/2015
7/7/2015
7/22/2015
8/5/2015
8/18/2015
9/2/2015
Date

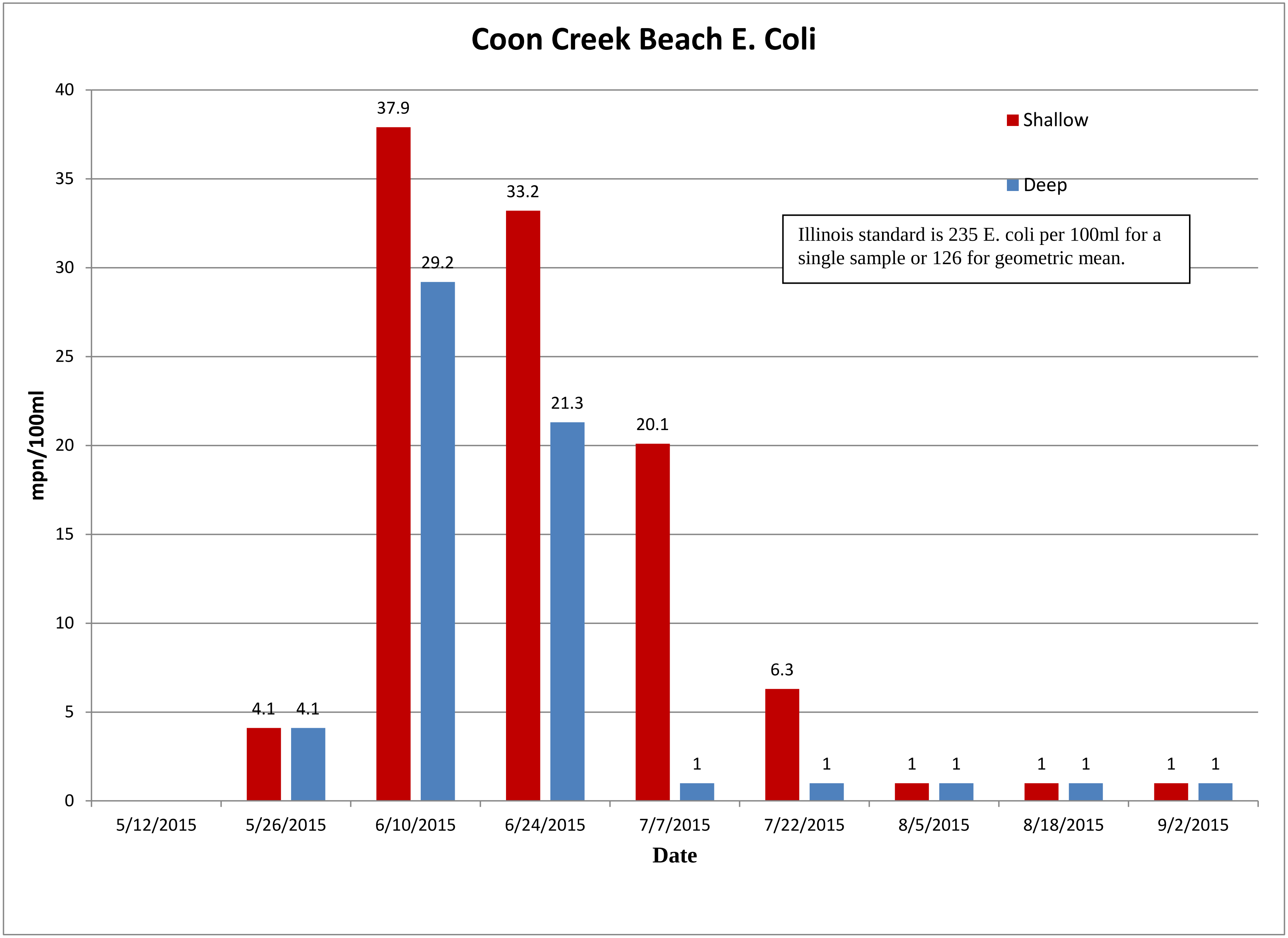


Illinois standard is 235 E. coli per 100ml for a single sample or 126 for geometric mean.


Sullivan Beach E. Coli
Shallow
Deep
Illinois standard is 235 E. coli per 100ml for a single sample or 126 for geometric mean.
mpn/100ml
200
180
160
140
120
100
80
60
40
20
0
19.9
13.5
13.4
2
111.2
12.1
67
34.1
12.2
24.3
3.1
1
3.1
1
1
2
2
1
5/19/2015
5/26/2015
6/10/2015
6/24/2015
7/7/2015
7/22/2015
8/5/2015
8/18/2015
9/2/2015
Date



Wilborn Creek Beach E. Coli
Shallow
Deep
mpn/100ml
300
250
200
150
100
50
0
44.1
17.1
16.1
4.1
53.8
12.2
248.1
224.7
8.6
2
86.2
1
1
3.1
1
1
5/12/2015
5/26/2015
6/10/2015
6/24/2015
7/7/2015
7/22/2015
8/5/2015
8/18/2015
9/2/2015
Date
Illinois standard is 235 E. coli per 100ml for a single sample or 126 for geometric mean.


Coon Creek Beach E. Coli
Shallow
Deep
Illinois standard is 235 E. coli per 100ml for a single sample or 126 for geometric mean.
mpn/100ml
40
35
30
25
20
15
10
5
0
37.9
29.2
33.2
21.3
20.1
4.1
4.1
6.3
1
1
1
1
1
1
1
1
5/12/2015
5/26/2015
6/10/2015
6/24/2015
7/7/2015
7/22/2015
8/5/2015
8/18/2015
9/2/2015
Date