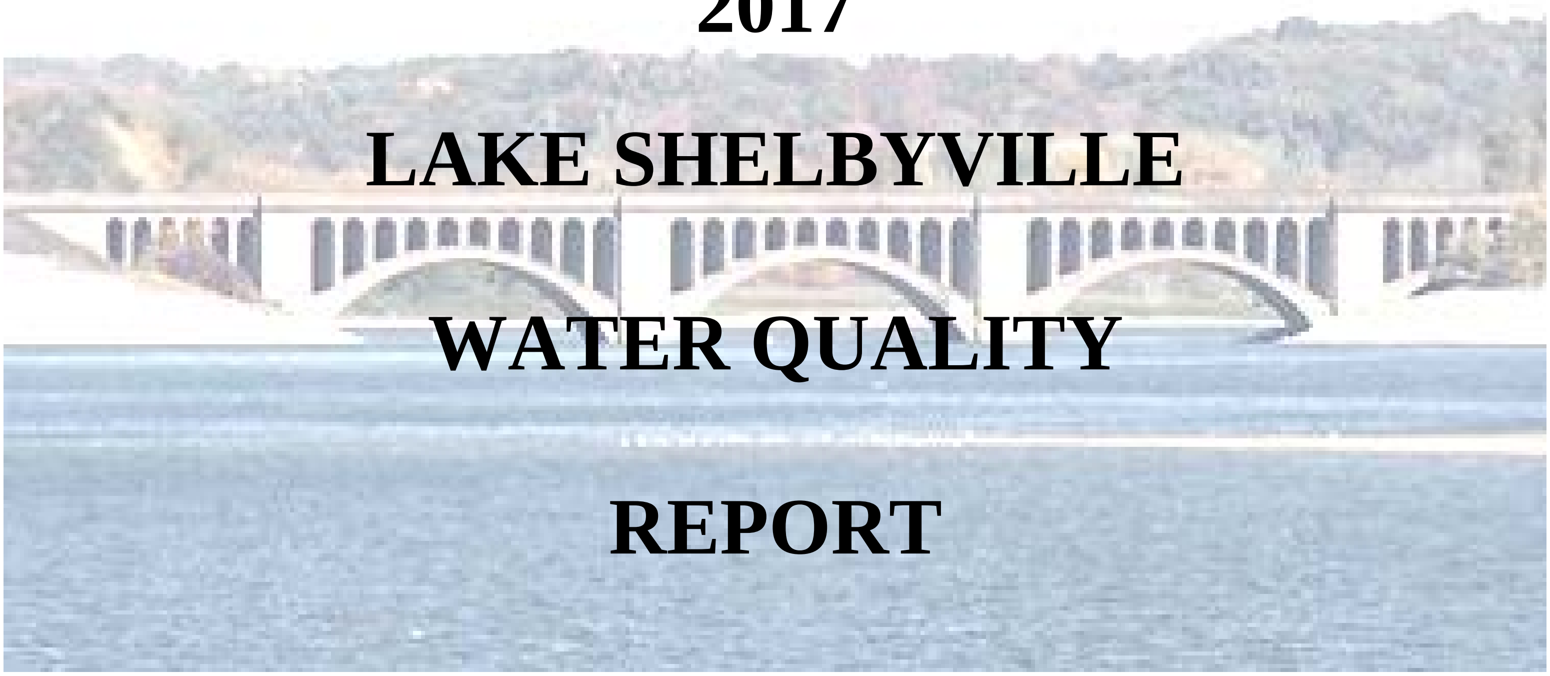
2017



LAKE SHELBYVILLE

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. Lake Shelbyville 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, 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.

Water quality sampling in 2017 revealed some minor issues at Lake Shelbyville. The following parameters exceeded state standards during the 2017 sampling season: phosphorus, total suspended solids, and E. coli. 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 altering release rates. No fish kills were observed during 2017.

All sampling sites met the appropriate state standards during 2017 except phosphorus, total suspended solids, and E. Coli. All E. coli beach samples met appropriate state standards except at Sullivan Creek in July. This bacteria exceedance was preceded by a rain event. Phosphorus levels at the lake sites have exceeded the state standard on a routine basis. Generally phosphorus 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 phosphorus. 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 2017 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) high levels of nutrients and poor lakeshore habitat are some of the most significant problems in our nation's lakes. Shoreline vegetation provides shelter for aquatic wildlife, reduces sediment and nutrient movement into the lake from runoff. The biology of a lake is characterized by the diversity of its organisms. The number and kinds of plant and animal species present is a direct measure of a lake's well-being. Water quality at Lake Shelbyville is directly assessed using stream and lake data from 5 site locations (see figure 1).

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 Lake Shelbyville. 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 Total Maximum Daily Loads (TMDL), to improve water quality.

Currently the Illinois Environmental Protection Agency (IEPA) has listed Lake Shelbyville impaired for Total Suspended Solids, while the Kaskaskia upstream of the Lake is impaired for PCB’s, dissolved oxygen, pH, Fecal Coliform, and mercury. 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

Lake Shelbyville 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 Lake Shelbyville watershed. Additional sources are marinas, recreational watercraft discharges and wildlife fecal material runoff.

Water quality monitoring was conducted during 2017 to assure the safe conditions for human recreation, wildlife and aquatic life was maintained and managed within the lake system. In 2017 four sampling events were conducted at six sites. The 2017 water quality monitoring program began in February and continued through August. 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 Lake Shelbyville from its tributaries.

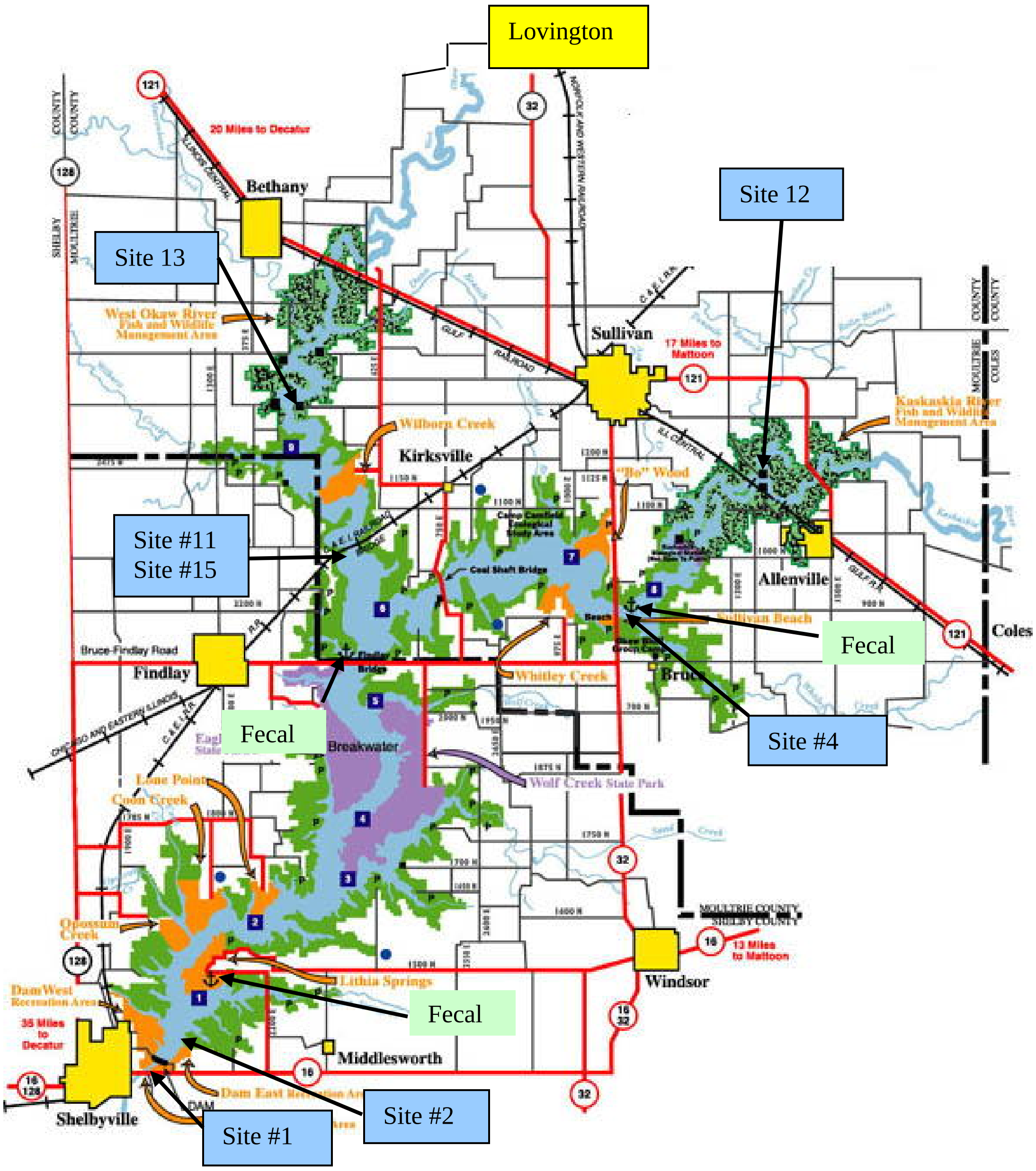


Figure 1
Location of sample sites
In 2014 sites 12 and 13 replaced sites 7 and 9 respectively.

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 Lake Shelbyville sites reflect the minimal set of parameters needed to analyze the current status of water quality for the Lake Shelbyville system.

The following water quality parameters were analyzed in Fiscal Year 2017 at Lake Shelbyville: 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. Phosphorus is typically the limiting nutrient in a water body. Therefore, addition of phosphorus to the ecosystem stimulates the growth of plants and algae. Phosphorus is delivered to lakes and streams by way of storm water runoff from agricultural fields, residential property, and construction sites. Other sources of phosphorus are anaerobic (absent of oxygen) decomposition of organic matter, leaking sewer systems, waterfowl, and point source pollution. The general standard for phosphorus in lake water is 0.05mg/L. Dissolved phosphorus, also called ortho-phosphorus, is generally found in much smaller concentrations than total phosphorus and is readily available for uptake. For this reason dissolved phosphorus 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. Metal 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) 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 is present in water. Total volatile suspended solids indicate the presence of organics in suspension; and, therefore, show additional demand levels of oxygen. Illinois 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 high 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 amoebic 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 235 colonies per 100ml per single sample water or geometric mean of 126 colonies per 100ml. 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 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 (5 mg/l or above). In spring, surface waters of the lake mix with the water below by 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. A rapid change in temperature within the metalimnion occurs and is referred to as a thermocline. 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 a neutral pH while readings below seven are acidic and above are alkaline. Most Illinois lakes range from 6 to 9 on the pH scale. If a body of water is alkaline, then it has the ability of act as buffer which can neutralize incoming acidic conditions. 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. Conversely, 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 of oxygen reduction activity. 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 while 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 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 are be 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, which is 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 are 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 Lake Shelbyville during Fiscal Year 2017 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.

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 FY17. The project office is notified as soon as any readings not meeting standards are received. Two E. coli 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 Sullivan Creek on July 12 (238.2 col/100ml). Rainfall events can trigger high levels of E. coli. Records indicate rain events preceded the July 12 sampling event by 2 days. 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.

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 2017 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 phosphorus levels downstream of the dam were lower than upstream levels. In effect the lake is acting as a sink for phosphorus. Phosphorus in water is not considered directly toxic to humans and animals therefore, no drinking water standards have been established for phosphorus. However, phosphorus 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. Nitrogen levels recorded at Lake Shelbyville did not exceed state standards during the 2017 sampling season. 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 phosphorus 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 2017.

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 to high range during the 4 sampling events with an average concentration of 45.7 mg/cu m overall. Chlorophyll levels were lower near the dam than the upper lake sites. High chlorophyll levels can be an indicator that the lake is eutrophic (nutrient rich). High levels often indicate poor water quality and low levels suggest good conditions. However, short term 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. Levels of chlorophyll 50 mg/cu m and greater are considered to create moderate risk according to the WHO. Lake Shelbyville was in the moderate risk of exposure category for chlorophyll. Illinois does not currently have a standard for chlorophyll. It is not unexpected for there to be elevated levels of chlorophyll in the tributaries and upper portions of the lake during the warmer months. Though it is not considered an immediate concern, continued monitoring will allow for detection of trends.

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.

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. Lake samples exceeded the Illinois standard of 12mg/L for most of the sites except site 2 (surface) by the dam. TSS measurements were lower near the dam and higher in the upper Lake 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. 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 downstream as well as sedimentation in the lake bottom.

Total Organic Carbon (TOC) is collected at all sites. Data indicates that TOC is higher in the upper portions of the lake. Shelbyville TOC levels are very similar to Carlyle TOC levels for the 2017 sampling season. 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. For the 2017 sampling season at Lake Shelbyville temperature and dissolved oxygen levels were well within the state guidelines.

pH is taken at all sites and at 1 meter intervals at lake sites. All sites were within the 6 to 9 pH range for the 2017 sampling season. 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. Site 2 by the dam secchi readings were greater than all the other Lake sites. 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 tends to be 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. Recorded dissolved oxygen at the tail water area remained above 5 mg/l for the season with the exception of a few days in August. The other occurrences are due to instrument maintenance rather than actual conditions. See the graph on page C16.

3.2 Sediment Summary

Sediment sampling was not conducted in 2017. Sediment sampling is normally conducted every 5 years if funding is available. Sediment sampling was last conducted in 2007.

4.0 PLANNED 2018 STUDIES

The Lake Shelbyville water quality monitoring will continue in Fiscal Year 2018. As in the previous year, there will be 4 water sampling events in 2018. The greater number of sampling events there are, the better the ability to 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. As with any record keeping or data analysis, the greater the sample size, the more reliable the findings. Lake Shelbyville 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 in the 2018 sampling season. One sampling event will occur for the year at all the Lake sites. The following parameters will be analyzed for: total phosphate, nitrate nitrogen, total kjeldahl nitrogen, total organic carbon, pesticides, and metals (arsenic, barium, boron, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc).

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

WASTE WATER TREATMENT PLANT ISSUE SULLIVAN

A limited investigation was started in October 2017 into the possibility of potential negative impacts to the Asa Creek arm of Lake Shelbyville and will continue as needed through 2018. In late October water quality staff was made aware of a complaint from a local landowner (near the Sullivan waste water treatment plant). The complainant said the outflow of the WWTP at Sullivan was not meeting state standards – there was a strong sewer smell throughout the area. Water quality staff made contact with the complainant and then started a limited investigation. The sampling plan included (approximately) monthly sampling at multiple locations in Asa Creek (see pg. E1) to monitor the following parameters: water temperature, dissolved oxygen, specific conductivity, total dissolved solids, pH, oxidation reduction potential, and turbidity. Initial findings (see pg. E2) indicate a negative effect on Asa Creek immediately downstream of the WWTP outflow, but not within the USACE boundary of Lake Shelbyville. USACE water quality staff will continue to investigate as needed and coordinate with Lake Shelbyville Project, IEPA, and affected landowners.

APPENDIX A

DATA

LAB DATA
WATER SAMPLES

Site #	Collection Date	Parameter	Flag	Reported Result	Units
SVL-1	3/2/2017	Alachlor	<	0.20	UG/L
	4/25/2017	Alachlor	<	0.20	UG/L
	6/27/2017	Alachlor	<	0.20	UG/L
	8/23/2017	Alachlor	<	0.20	UG/L
SVL-11	3/2/2017	Alachlor	<	0.20	UG/L
	4/25/2017	Alachlor	<	0.22	UG/L
	6/27/2017	Alachlor	<	0.20	UG/L
	8/23/2017	Alachlor	<	0.20	UG/L
SVL-12	4/24/2017	Alachlor	<	0.20	UG/L
	6/27/2017	Alachlor	<	0.20	UG/L
	8/23/2017	Alachlor	<	0.20	UG/L
SVL-13	3/2/2017	Alachlor	<	0.22	UG/L
	4/24/2017	Alachlor	<	0.20	UG/L
	6/27/2017	Alachlor	<	0.20	UG/L
	8/23/2017	Alachlor	<	0.20	UG/L
SVL-15	3/2/2017	Alachlor	<	0.20	UG/L
	4/25/2017	Alachlor	<	0.20	UG/L
	6/27/2017	Alachlor	<	0.22	UG/L
	8/23/2017	Alachlor	<	0.20	UG/L
SVL-2	3/2/2017	Alachlor	<	0.20	UG/L
	4/25/2017	Alachlor	<	0.20	UG/L
	6/27/2017	Alachlor	<	0.20	UG/L
	8/23/2017	Alachlor	<	0.20	UG/L
SVL-4	3/2/2017	Alachlor	<	0.20	UG/L
	4/25/2017	Alachlor	<	0.22	UG/L
	6/27/2017	Alachlor	<	0.20	UG/L
	8/23/2017	Alachlor	<	0.20	UG/L
SVL-1	3/2/2017	Ammonia Nitrogen		0.19	MG/L
	4/25/2017	Ammonia Nitrogen		0.067	MG/L
	6/27/2017	Ammonia Nitrogen		0.083	MG/L
	8/23/2017	Ammonia Nitrogen		1.1	MG/L
SVL-11	3/2/2017	Ammonia Nitrogen		0.043	MG/L
	4/25/2017	Ammonia Nitrogen		0.058	MG/L
	6/27/2017	Ammonia Nitrogen		0.12	MG/L
	8/23/2017	Ammonia Nitrogen		0.25	MG/L
SVL-12	4/24/2017	Ammonia Nitrogen		0.081	MG/L
	6/27/2017	Ammonia Nitrogen		0.082	MG/L
	8/23/2017	Ammonia Nitrogen		0.17	MG/L

SVL-13	3/2/2017	Ammonia Nitrogen		0.079	MG/L
	4/24/2017	Ammonia Nitrogen		0.11	MG/L
	6/27/2017	Ammonia Nitrogen		0.15	MG/L
	8/23/2017	Ammonia Nitrogen		0.27	MG/L
SVL-15	3/2/2017	Ammonia Nitrogen		0.038	MG/L
	4/25/2017	Ammonia Nitrogen		0.056	MG/L
	6/27/2017	Ammonia Nitrogen		0.095	MG/L
	8/23/2017	Ammonia Nitrogen		0.23	MG/L
SVL-2	3/2/2017	Ammonia Nitrogen		0.18	MG/L
	4/25/2017	Ammonia Nitrogen		0.075	MG/L
	6/27/2017	Ammonia Nitrogen		0.11	MG/L
	8/23/2017	Ammonia Nitrogen		0.12	MG/L
SVL-2-10	3/2/2017	Ammonia Nitrogen		0.18	MG/L
	4/25/2017	Ammonia Nitrogen		0.082	MG/L
	6/27/2017	Ammonia Nitrogen		0.081	MG/L
	8/23/2017	Ammonia Nitrogen		0.19	MG/L
SVL-4	3/2/2017	Ammonia Nitrogen		0.12	MG/L
	4/25/2017	Ammonia Nitrogen		0.28	MG/L
	6/27/2017	Ammonia Nitrogen		0.23	MG/L
	8/23/2017	Ammonia Nitrogen		0.15	MG/L
SVL-1	3/2/2017	Atrazine	<	0.20	UG/L
	4/25/2017	Atrazine	<	0.20	UG/L
	6/27/2017	Atrazine		0.62	UG/L
	8/23/2017	Atrazine		2.2	UG/L
SVL-11	3/2/2017	Atrazine	<	0.20	UG/L
	4/25/2017	Atrazine	<	0.22	UG/L
	6/27/2017	Atrazine		0.89	UG/L
	8/23/2017	Atrazine		0.97	UG/L
SVL-12	4/24/2017	Atrazine	<	0.20	UG/L
	6/27/2017	Atrazine		0.34	UG/L
	8/23/2017	Atrazine	<	0.20	UG/L
SVL-13	3/2/2017	Atrazine	<	0.22	UG/L
	4/24/2017	Atrazine	<	0.20	UG/L
	6/27/2017	Atrazine		1.0	UG/L
	8/23/2017	Atrazine		0.43	UG/L
SVL-15	3/2/2017	Atrazine	<	0.20	UG/L
	4/25/2017	Atrazine	<	0.20	UG/L
	6/27/2017	Atrazine		0.97	UG/L
	8/23/2017	Atrazine		0.94	UG/L
SVL-2	3/2/2017	Atrazine	<	0.20	UG/L
	4/25/2017	Atrazine	<	0.20	UG/L
	6/27/2017	Atrazine		0.51	UG/L
	8/23/2017	Atrazine		1.0	UG/L
SVL-4	3/2/2017	Atrazine	<	0.20	UG/L
	4/25/2017	Atrazine	<	0.22	UG/L

	6/27/2017	Atrazine		0.83	UG/L
	8/23/2017	Atrazine		0.48	UG/L
SVL-11	3/2/2017	Chlorophyll a		62.7	MG/CU.M.
	4/25/2017	Chlorophyll a		72.1	MG/CU.M.
	6/27/2017	Chlorophyll a		43.1	MG/CU.M.
	8/23/2017	Chlorophyll a		69.6	MG/CU.M.
SVL-15	3/2/2017	Chlorophyll a		64.9	MG/CU.M.
	4/25/2017	Chlorophyll a		74.8	MG/CU.M.
	6/27/2017	Chlorophyll a		41.4	MG/CU.M.
	8/23/2017	Chlorophyll a		71.3	MG/CU.M.
SVL-2	3/2/2017	Chlorophyll a		13.2	MG/CU.M.
	4/25/2017	Chlorophyll a		30.6	MG/CU.M.
	6/27/2017	Chlorophyll a		34.2	MG/CU.M.
	8/23/2017	Chlorophyll a		28.6	MG/CU.M.
SVL-4	3/2/2017	Chlorophyll a		11.0	MG/CU.M.
	4/25/2017	Chlorophyll a		4.3	MG/CU.M.
	6/27/2017	Chlorophyll a		33.7	MG/CU.M.
	8/23/2017	Chlorophyll a		76.0	MG/CU.M.
SVL-1	3/2/2017	Chlorpyrifos	<	0.20	UG/L
	4/25/2017	Chlorpyrifos	<	0.20	UG/L
	6/27/2017	Chlorpyrifos	<	0.20	UG/L
	8/23/2017	Chlorpyrifos	<	0.20	UG/L
SVL-11	3/2/2017	Chlorpyrifos	<	0.20	UG/L
	4/25/2017	Chlorpyrifos	<	0.22	UG/L
	6/27/2017	Chlorpyrifos	<	0.20	UG/L
	8/23/2017	Chlorpyrifos	<	0.20	UG/L
SVL-12	4/24/2017	Chlorpyrifos	<	0.20	UG/L
	6/27/2017	Chlorpyrifos	<	0.20	UG/L
	8/23/2017	Chlorpyrifos	<	0.20	UG/L
SVL-13	3/2/2017	Chlorpyrifos	<	0.22	UG/L
	4/24/2017	Chlorpyrifos	<	0.20	UG/L
	6/27/2017	Chlorpyrifos	<	0.20	UG/L
	8/23/2017	Chlorpyrifos	<	0.20	UG/L
SVL-15	3/2/2017	Chlorpyrifos	<	0.20	UG/L
	4/25/2017	Chlorpyrifos	<	0.20	UG/L
	6/27/2017	Chlorpyrifos	<	0.22	UG/L
	8/23/2017	Chlorpyrifos	<	0.20	UG/L
SVL-2	3/2/2017	Chlorpyrifos	<	0.20	UG/L
	4/25/2017	Chlorpyrifos	<	0.20	UG/L
	6/27/2017	Chlorpyrifos	<	0.20	UG/L
	8/23/2017	Chlorpyrifos	<	0.20	UG/L
SVL-4	3/2/2017	Chlorpyrifos	<	0.20	UG/L
	4/25/2017	Chlorpyrifos	<	0.22	UG/L
	6/27/2017	Chlorpyrifos	<	0.20	UG/L
	8/23/2017	Chlorpyrifos	<	0.20	UG/L

SVL-1	3/2/2017	Cyanazine	<	0.20	UG/L
	4/25/2017	Cyanazine	<	0.20	UG/L
	6/27/2017	Cyanazine	<	0.20	UG/L
	8/23/2017	Cyanazine	<	0.20	UG/L
SVL-11	3/2/2017	Cyanazine	<	0.20	UG/L
	4/25/2017	Cyanazine	<	0.22	UG/L
	6/27/2017	Cyanazine	<	0.20	UG/L
	8/23/2017	Cyanazine	<	0.20	UG/L
SVL-12	4/24/2017	Cyanazine	<	0.20	UG/L
	6/27/2017	Cyanazine	<	0.20	UG/L
	8/23/2017	Cyanazine	<	0.20	UG/L
SVL-13	3/2/2017	Cyanazine	<	0.22	UG/L
	4/24/2017	Cyanazine	<	0.20	UG/L
	6/27/2017	Cyanazine	<	0.20	UG/L
	8/23/2017	Cyanazine	<	0.20	UG/L
SVL-15	3/2/2017	Cyanazine	<	0.20	UG/L
	4/25/2017	Cyanazine	<	0.20	UG/L
	6/27/2017	Cyanazine	<	0.22	UG/L
	8/23/2017	Cyanazine	<	0.20	UG/L
SVL-2	3/2/2017	Cyanazine	<	0.20	UG/L
	4/25/2017	Cyanazine	<	0.20	UG/L
	6/27/2017	Cyanazine	<	0.20	UG/L
	8/23/2017	Cyanazine	<	0.20	UG/L
SVL-4	3/2/2017	Cyanazine	<	0.20	UG/L
	4/25/2017	Cyanazine	<	0.22	UG/L
	6/27/2017	Cyanazine	<	0.20	UG/L
	8/23/2017	Cyanazine	<	0.20	UG/L
FIN MARINA	6/27/2017	E. Coliform		25.0	COL/100 ML
FIN MARINA	8/23/2017	E. Coliform		19.0	COL/100 ML
LS MARINA	6/27/2017	E. Coliform		25.0	COL/100 ML
LS MARINA	8/23/2017	E. Coliform		5.0	COL/100 ML
SUL MARINA	6/27/2017	E. Coliform		52.0	COL/100 ML
SUL MARINA	8/23/2017	E. Coliform		150	COL/100 ML
SVL-1	3/2/2017	Iron		0.078	MG/L
	4/25/2017	Iron		0.24	MG/L
	6/27/2017	Iron		0.16	MG/L
	8/23/2017	Iron		0.25	MG/L
SVL-2-10	3/2/2017	Iron		0.075	MG/L
	4/25/2017	Iron		0.14	MG/L
	6/27/2017	Iron		0.17	MG/L
	8/23/2017	Iron		0.12	MG/L
SVL-1	3/2/2017	Manganese		0.028	MG/L
	4/25/2017	Manganese		0.020	MG/L
	6/27/2017	Manganese		0.018	MG/L
	8/23/2017	Manganese		0.30	MG/L

SVL-2-10	3/2/2017	Manganese		0.026	MG/L
	4/25/2017	Manganese		0.014	MG/L
	6/27/2017	Manganese		0.012	MG/L
	8/23/2017	Manganese		0.022	MG/L
SVL-1	3/2/2017	Metolachlor	<	0.20	UG/L
	4/25/2017	Metolachlor	<	0.20	UG/L
	6/27/2017	Metolachlor		2.7	UG/L
	8/23/2017	Metolachlor		4.0	UG/L
SVL-11	3/2/2017	Metolachlor	<	0.20	UG/L
	4/25/2017	Metolachlor	<	0.22	UG/L
	6/27/2017	Metolachlor		1.8	UG/L
	8/23/2017	Metolachlor		0.61	UG/L
SVL-12	4/24/2017	Metolachlor		0.24	UG/L
	6/27/2017	Metolachlor		0.20	UG/L
	8/23/2017	Metolachlor	<	0.20	UG/L
SVL-13	3/2/2017	Metolachlor		0.26	UG/L
	4/24/2017	Metolachlor	<	0.20	UG/L
	6/27/2017	Metolachlor		0.72	UG/L
	8/23/2017	Metolachlor	<	0.20	UG/L
SVL-15	3/2/2017	Metolachlor	<	0.20	UG/L
	4/25/2017	Metolachlor	<	0.20	UG/L
	6/27/2017	Metolachlor		1.9	UG/L
	8/23/2017	Metolachlor		0.57	UG/L
SVL-2	3/2/2017	Metolachlor	<	0.20	UG/L
	4/25/2017	Metolachlor	<	0.20	UG/L
	6/27/2017	Metolachlor		2.4	UG/L
	8/23/2017	Metolachlor		1.3	UG/L
SVL-4	3/2/2017	Metolachlor	<	0.20	UG/L
	4/25/2017	Metolachlor	<	0.22	UG/L
	6/27/2017	Metolachlor		0.60	UG/L
	8/23/2017	Metolachlor	<	0.20	UG/L
SVL-1	3/2/2017	Metribuzin	<	0.20	UG/L
	4/25/2017	Metribuzin	<	0.20	UG/L
	6/27/2017	Metribuzin	<	0.20	UG/L
	8/23/2017	Metribuzin		0.43	UG/L
SVL-11	3/2/2017	Metribuzin	<	0.20	UG/L
	4/25/2017	Metribuzin	<	0.22	UG/L
	6/27/2017	Metribuzin	<	0.20	UG/L
	8/23/2017	Metribuzin	<	0.20	UG/L
SVL-12	4/24/2017	Metribuzin	<	0.20	UG/L
	6/27/2017	Metribuzin	<	0.20	UG/L
	8/23/2017	Metribuzin	<	0.20	UG/L
SVL-13	3/2/2017	Metribuzin	<	0.22	UG/L
	4/24/2017	Metribuzin	<	0.20	UG/L
	6/27/2017	Metribuzin	<	0.20	UG/L

	8/23/2017	Metribuzin	<	0.20	UG/L
SVL-15	3/2/2017	Metribuzin	<	0.20	UG/L
	4/25/2017	Metribuzin	<	0.20	UG/L
	6/27/2017	Metribuzin	<	0.22	UG/L
	8/23/2017	Metribuzin	<	0.20	UG/L
SVL-2	3/2/2017	Metribuzin	<	0.20	UG/L
	4/25/2017	Metribuzin	<	0.20	UG/L
	6/27/2017	Metribuzin	<	0.20	UG/L
	8/23/2017	Metribuzin	<	0.20	UG/L
SVL-4	3/2/2017	Metribuzin	<	0.20	UG/L
	4/25/2017	Metribuzin	<	0.22	UG/L
	6/27/2017	Metribuzin	<	0.20	UG/L
	8/23/2017	Metribuzin	<	0.20	UG/L
SVL-1	3/2/2017	Nitrate as Nitrogen		5.4	MG/L
	4/25/2017	Nitrate as Nitrogen		5.6	MG/L
	6/27/2017	Nitrate as Nitrogen		4.5	MG/L
	8/23/2017	Nitrate as Nitrogen		2.2	MG/L
SVL-11	3/2/2017	Nitrate as Nitrogen		7.7	MG/L
	4/25/2017	Nitrate as Nitrogen		6.4	MG/L
	6/27/2017	Nitrate as Nitrogen		4.5	MG/L
	8/23/2017	Nitrate as Nitrogen		0.29	MG/L
SVL-12	4/24/2017	Nitrate as Nitrogen		9.1	MG/L
	6/27/2017	Nitrate as Nitrogen		5.8	MG/L
	8/23/2017	Nitrate as Nitrogen		0.059	MG/L
SVL-13	3/2/2017	Nitrate as Nitrogen		7.9	MG/L
	4/24/2017	Nitrate as Nitrogen		9.2	MG/L
	6/27/2017	Nitrate as Nitrogen		3.2	MG/L
	8/23/2017	Nitrate as Nitrogen		0.078	MG/L
SVL-15	3/2/2017	Nitrate as Nitrogen		7.5	MG/L
	4/25/2017	Nitrate as Nitrogen		6.5	MG/L
	6/27/2017	Nitrate as Nitrogen		4.7	MG/L
	8/23/2017	Nitrate as Nitrogen		0.27	MG/L
SVL-2	3/2/2017	Nitrate as Nitrogen		5.4	MG/L
	4/25/2017	Nitrate as Nitrogen		5.7	MG/L
	6/27/2017	Nitrate as Nitrogen		4.4	MG/L
	8/23/2017	Nitrate as Nitrogen		1.7	MG/L
SVL-2-10	3/2/2017	Nitrate as Nitrogen		5.8	MG/L
	4/25/2017	Nitrate as Nitrogen		5.5	MG/L
	6/27/2017	Nitrate as Nitrogen		4.3	MG/L
	8/23/2017	Nitrate as Nitrogen		1.7	MG/L
SVL-4	3/2/2017	Nitrate as Nitrogen		5.8	MG/L
	4/25/2017	Nitrate as Nitrogen		8.3	MG/L
	6/27/2017	Nitrate as Nitrogen		3.8	MG/L
	8/23/2017	Nitrate as Nitrogen		0.036	MG/L
SVL-1	3/2/2017	Pendimethalin	<	0.20	UG/L

	4/25/2017	Pendimethalin	<	0.20	UG/L
	6/27/2017	Pendimethalin	<	0.20	UG/L
	8/23/2017	Pendimethalin	<	0.20	UG/L
SVL-11	3/2/2017	Pendimethalin	<	0.20	UG/L
	4/25/2017	Pendimethalin	<	0.22	UG/L
	6/27/2017	Pendimethalin	<	0.20	UG/L
	8/23/2017	Pendimethalin	<	0.20	UG/L
SVL-12	4/24/2017	Pendimethalin	<	0.20	UG/L
	6/27/2017	Pendimethalin	<	0.20	UG/L
	8/23/2017	Pendimethalin	<	0.20	UG/L
SVL-13	3/2/2017	Pendimethalin	<	0.22	UG/L
	4/24/2017	Pendimethalin	<	0.20	UG/L
	6/27/2017	Pendimethalin	<	0.20	UG/L
	8/23/2017	Pendimethalin	<	0.20	UG/L
SVL-15	3/2/2017	Pendimethalin	<	0.20	UG/L
	4/25/2017	Pendimethalin	<	0.20	UG/L
	6/27/2017	Pendimethalin	<	0.22	UG/L
	8/23/2017	Pendimethalin	<	0.20	UG/L
SVL-2	3/2/2017	Pendimethalin	<	0.20	UG/L
	4/25/2017	Pendimethalin	<	0.20	UG/L
	6/27/2017	Pendimethalin	<	0.20	UG/L
	8/23/2017	Pendimethalin	<	0.20	UG/L
SVL-4	3/2/2017	Pendimethalin	<	0.20	UG/L
	4/25/2017	Pendimethalin	<	0.22	UG/L
	6/27/2017	Pendimethalin	<	0.20	UG/L
	8/23/2017	Pendimethalin	<	0.20	UG/L
SVL-11	3/2/2017	Pheophytin a		7.3	MG/CU.M.
	4/25/2017	Pheophytin-a		9.8	MG/CU.M.
	6/27/2017	Pheophytin-a		4.7	MG/CU.M.
	8/23/2017	Pheophytin-a		8.6	MG/CU.M.
SVL-15	3/2/2017	Pheophytin a		7.4	MG/CU.M.
	4/25/2017	Pheophytin-a		8.5	MG/CU.M.
	6/27/2017	Pheophytin-a		4.6	MG/CU.M.
	8/23/2017	Pheophytin-a		8.5	MG/CU.M.
SVL-2	3/2/2017	Pheophytin a		2.9	MG/CU.M.
	4/25/2017	Pheophytin-a		6.0	MG/CU.M.
	6/27/2017	Pheophytin-a		5.8	MG/CU.M.
	8/23/2017	Pheophytin-a		3.4	MG/CU.M.
SVL-4	3/2/2017	Pheophytin a		3.7	MG/CU.M.
	4/25/2017	Pheophytin-a		4.7	MG/CU.M.
	6/27/2017	Pheophytin-a		4.2	MG/CU.M.
	8/23/2017	Pheophytin-a		26.2	MG/CU.M.
SVL-1	3/2/2017	Phosphorus		0.045	MG/L
	4/25/2017	Phosphorus		0.072	MG/L
	6/27/2017	Phosphorus		0.067	MG/L

	8/23/2017	Phosphorus		0.12	MG/L
SVL-11	3/2/2017	Phosphorus		0.12	MG/L
	4/25/2017	Phosphorus		0.11	MG/L
	6/27/2017	Phosphorus		0.092	MG/L
	8/23/2017	Phosphorus		0.15	MG/L
SVL-12	4/24/2017	Phosphorus		0.10	MG/L
	6/27/2017	Phosphorus		0.17	MG/L
	8/23/2017	Phosphorus		0.55	MG/L
SVL-13	3/2/2017	Phosphorus		0.19	MG/L
	4/24/2017	Phosphorus		0.081	MG/L
	6/27/2017	Phosphorus		0.14	MG/L
	8/23/2017	Phosphorus		0.69	MG/L
SVL-15	3/2/2017	Phosphorus		0.12	MG/L
	4/25/2017	Phosphorus		0.16	MG/L
	6/27/2017	Phosphorus		0.084	MG/L
	8/23/2017	Phosphorus		0.13	MG/L
SVL-2	3/2/2017	Phosphorus		0.041	MG/L
	4/25/2017	Phosphorus		0.051	MG/L
	6/27/2017	Phosphorus		0.079	MG/L
	8/23/2017	Phosphorus		0.039	MG/L
SVL-2-10	3/2/2017	Phosphorus		0.041	MG/L
	4/25/2017	Phosphorus		0.051	MG/L
	6/27/2017	Phosphorus		0.075	MG/L
	8/23/2017	Phosphorus		0.044	MG/L
SVL-4	3/2/2017	Phosphorus		0.21	MG/L
	4/25/2017	Phosphorus		0.22	MG/L
	6/27/2017	Phosphorus		0.14	MG/L
	8/23/2017	Phosphorus		0.37	MG/L
SVL-1	3/2/2017	Phosphorus, -ortho	<	0.010	MG/L
	4/25/2017	Phosphorus, -ortho	<	0.0080	MG/L
	6/27/2017	Phosphorus, -ortho	<	0.0080	MG/L
	8/23/2017	Phosphorus, -ortho		0.16	MG/L
SVL-11	3/2/2017	Phosphorus, -ortho	<	0.010	MG/L
	4/25/2017	Phosphorus, -ortho		0.019	MG/L
	6/27/2017	Phosphorus, -ortho	<	0.0080	MG/L
	8/23/2017	Phosphorus, -ortho	J	0.0091	MG/L
SVL-12	4/24/2017	Phosphorus, -ortho		0.038	MG/L
	6/27/2017	Phosphorus, -ortho		0.100	MG/L
	8/23/2017	Phosphorus, -ortho		0.24	MG/L
SVL-13	3/2/2017	Phosphorus, -ortho		0.030	MG/L
	4/24/2017	Phosphorus, -ortho		0.019	MG/L
	6/27/2017	Phosphorus, -ortho		0.068	MG/L
	8/23/2017	Phosphorus, -ortho		0.18	MG/L
SVL-15	3/2/2017	Phosphorus, -ortho		0.011	MG/L
	4/25/2017	Phosphorus, -ortho		0.014	MG/L

	6/27/2017	Phosphorus, -ortho	<	0.0080	MG/L
	8/23/2017	Phosphorus, -ortho	J	0.0091	MG/L
SVL-2	3/2/2017	Phosphorus, -ortho		0.011	MG/L
	4/25/2017	Phosphorus, -ortho	<	0.0080	MG/L
	6/27/2017	Phosphorus, -ortho	<	0.0080	MG/L
	8/23/2017	Phosphorus, -ortho	<	0.0080	MG/L
SVL-2-10	3/2/2017	Phosphorus, -ortho	<	0.010	MG/L
	4/25/2017	Phosphorus, -ortho	<	0.0080	MG/L
	6/27/2017	Phosphorus, -ortho		0.016	MG/L
	8/23/2017	Phosphorus, -ortho	<	0.0080	MG/L
SVL-4	3/2/2017	Phosphorus, -ortho		0.038	MG/L
	4/25/2017	Phosphorus, -ortho		0.059	MG/L
	6/27/2017	Phosphorus, -ortho		0.047	MG/L
	8/23/2017	Phosphorus, -ortho		0.14	MG/L
SVL-1	3/2/2017	Solids, Total Suspended		4.4	MG/L
	4/25/2017	Solids, Total Suspended		11.6	MG/L
	6/27/2017	Solids, Total Suspended		8.4	MG/L
	8/23/2017	Solids, Total Suspended		5.5	MG/L
SVL-11	3/2/2017	Solids, Total Suspended		15.0	MG/L
	4/25/2017	Solids, Total Suspended		14.6	MG/L
	6/27/2017	Solids, Total Suspended		8.2	MG/L
	8/23/2017	Solids, Total Suspended		12.2	MG/L
SVL-12	4/24/2017	Solids, Total Suspended		20.5	MG/L
	6/27/2017	Solids, Total Suspended		9.0	MG/L
SVL-13	3/2/2017	Solids, Total Suspended		185	MG/L
	4/24/2017	Solids, Total Suspended		26.4	MG/L
	6/27/2017	Solids, Total Suspended		9.4	MG/L
	8/23/2017	Solids, Total Suspended		94.7	MG/L
SVL-15	3/2/2017	Solids, Total Suspended		16.4	MG/L
	4/25/2017	Solids, Total Suspended		17.2	MG/L
	6/27/2017	Solids, Total Suspended		8.8	MG/L
	8/23/2017	Solids, Total Suspended		12.5	MG/L
SVL-2	3/2/2017	Solids, Total Suspended		3.7	MG/L
	4/25/2017	Solids, Total Suspended		11.3	MG/L
	6/27/2017	Solids, Total Suspended		8.8	MG/L
	8/23/2017	Solids, Total Suspended		6.7	MG/L
SVL-2-10	3/2/2017	Solids, Total Suspended		4.0	MG/L
	4/25/2017	Solids, Total Suspended		16.4	MG/L
	6/27/2017	Solids, Total Suspended		7.8	MG/L
	8/23/2017	Solids, Total Suspended		6.4	MG/L
SVL-4	3/2/2017	Solids, Total Suspended		47.2	MG/L
	4/25/2017	Solids, Total Suspended		39.4	MG/L
	6/27/2017	Solids, Total Suspended		10.5	MG/L
	8/23/2017	Solids, Total Suspended		38.0	MG/L
SVL-1	3/2/2017	Solids, Volatile Suspended		2.4	MG/L

	4/25/2017	Solids, Volatile Suspended		3.5	MG/L
	6/27/2017	Solids, Volatile Suspended		3.8	MG/L
	8/23/2017	Solids, Volatile Suspended		1.7	MG/L
SVL-11	3/2/2017	Solids, Volatile Suspended		5.6	MG/L
	4/25/2017	Solids, Volatile Suspended		5.0	MG/L
	6/27/2017	Solids, Volatile Suspended		5.4	MG/L
	8/23/2017	Solids, Volatile Suspended		7.3	MG/L
SVL-12	4/24/2017	Solids, Volatile Suspended		1.5	MG/L
	6/27/2017	Solids, Volatile Suspended		3.0	MG/L
SVL-13	3/2/2017	Solids, Volatile Suspended		14.4	MG/L
	4/24/2017	Solids, Volatile Suspended		2.2	MG/L
	6/27/2017	Solids, Volatile Suspended		2.4	MG/L
	8/23/2017	Solids, Volatile Suspended		20.7	MG/L
SVL-15	3/2/2017	Solids, Volatile Suspended		5.8	MG/L
	4/25/2017	Solids, Volatile Suspended		6.4	MG/L
	6/27/2017	Solids, Volatile Suspended		5.8	MG/L
	8/23/2017	Solids, Volatile Suspended		7.0	MG/L
SVL-2	3/2/2017	Solids, Volatile Suspended		2.3	MG/L
	4/25/2017	Solids, Volatile Suspended		3.8	MG/L
	6/27/2017	Solids, Volatile Suspended		4.8	MG/L
	8/23/2017	Solids, Volatile Suspended		4.3	MG/L
SVL-2-10	3/2/2017	Solids, Volatile Suspended		2.4	MG/L
	4/25/2017	Solids, Volatile Suspended		5.0	MG/L
	6/27/2017	Solids, Volatile Suspended		3.8	MG/L
	8/23/2017	Solids, Volatile Suspended		3.4	MG/L
SVL-4	3/2/2017	Solids, Volatile Suspended		6.4	MG/L
	4/25/2017	Solids, Volatile Suspended		3.7	MG/L
	6/27/2017	Solids, Volatile Suspended		4.8	MG/L
	8/23/2017	Solids, Volatile Suspended		11.3	MG/L
SVL-1	3/2/2017	Total Organic Carbon		2.5	MG/L
	4/25/2017	Total Organic Carbon		3.1	MG/L
	6/27/2017	Total Organic Carbon		3.9	MG/L
	8/23/2017	Total Organic Carbon		5.1	MG/L
SVL-11	3/2/2017	Total Organic Carbon		3.6	MG/L
	4/25/2017	Total Organic Carbon		3.4	MG/L
	6/27/2017	Total Organic Carbon		4.4	MG/L
	8/23/2017	Total Organic Carbon		5.4	MG/L
SVL-12	4/24/2017	Total Organic Carbon		2.8	MG/L
	6/27/2017	Total Organic Carbon		4.1	MG/L
	8/23/2017	Total Organic Carbon		5.0	MG/L
SVL-13	3/2/2017	Total Organic Carbon		2.3	MG/L
	4/24/2017	Total Organic Carbon		2.1	MG/L
	6/27/2017	Total Organic Carbon		4.7	MG/L
	8/23/2017	Total Organic Carbon		7.0	MG/L
SVL-15	3/2/2017	Total Organic Carbon		2.7	MG/L

	4/25/2017	Total Organic Carbon		3.4	MG/L
	6/27/2017	Total Organic Carbon		4.1	MG/L
	8/23/2017	Total Organic Carbon		4.8	MG/L
SVL-2	3/2/2017	Total Organic Carbon		2.8	MG/L
	4/25/2017	Total Organic Carbon		3.4	MG/L
	6/27/2017	Total Organic Carbon		4.4	MG/L
	8/23/2017	Total Organic Carbon		3.6	MG/L
SVL-2-10	3/2/2017	Total Organic Carbon		2.9	MG/L
	4/25/2017	Total Organic Carbon		3.6	MG/L
	6/27/2017	Total Organic Carbon		4.6	MG/L
	8/23/2017	Total Organic Carbon		3.8	MG/L
SVL-4	3/2/2017	Total Organic Carbon		2.7	MG/L
	4/25/2017	Total Organic Carbon		2.3	MG/L
	6/27/2017	Total Organic Carbon		4.9	MG/L
	8/23/2017	Total Organic Carbon		5.7	MG/L
SVL-1	3/2/2017	Trifluralin	<	0.20	UG/L
	4/25/2017	Trifluralin	<	0.20	UG/L
	6/27/2017	Trifluralin	<	0.20	UG/L
	8/23/2017	Trifluralin	<	0.20	UG/L
SVL-11	3/2/2017	Trifluralin	<	0.20	UG/L
	4/25/2017	Trifluralin	<	0.22	UG/L
	6/27/2017	Trifluralin	<	0.20	UG/L
	8/23/2017	Trifluralin	<	0.20	UG/L
SVL-12	4/24/2017	Trifluralin	<	0.20	UG/L
	6/27/2017	Trifluralin	<	0.20	UG/L
	8/23/2017	Trifluralin	<	0.20	UG/L
SVL-13	3/2/2017	Trifluralin	<	0.22	UG/L
	4/24/2017	Trifluralin	<	0.20	UG/L
	6/27/2017	Trifluralin	<	0.20	UG/L
	8/23/2017	Trifluralin	<	0.20	UG/L
SVL-15	3/2/2017	Trifluralin	<	0.20	UG/L
	4/25/2017	Trifluralin	<	0.20	UG/L
	6/27/2017	Trifluralin	<	0.22	UG/L
	8/23/2017	Trifluralin	<	0.20	UG/L
SVL-2	3/2/2017	Trifluralin	<	0.20	UG/L
	4/25/2017	Trifluralin	<	0.20	UG/L
	6/27/2017	Trifluralin	<	0.20	UG/L
	8/23/2017	Trifluralin	<	0.20	UG/L
SVL-4	3/2/2017	Trifluralin	<	0.20	UG/L
	4/25/2017	Trifluralin	<	0.22	UG/L
	6/27/2017	Trifluralin	<	0.20	UG/L
	8/23/2017	Trifluralin	<	0.20	UG/L

2017 Beach Sample Report - IDPH
Lake Shelbyville

Sample Date	Location	E. coli per 100mL Shallow	E. coli per 100mL Deep
6/28/2017	Coon Creek Rec Area	0	0
7/12/2017	Coon Creek Rec Area	0	0
7/26/2017	Coon Creek Rec Area	1	0
8/9/2017	Coon Creek Rec Area	0	0
8/23/2017	Coon Creek Rec Area	1	0
9/6/2017	Coon Creek Rec Area	0	1
6/28/2017	Dam West Beach	0	0
7/12/2017	Dam West Beach	0	0
7/26/2017	Dam West Beach	1	0
8/9/2017	Dam West Beach	0	0
8/23/2017	Dam West Beach	0	0
9/6/2017	Dam West Beach	1	0
6/28/2017	Lithia Springs Rec Area	0	1
7/12/2017	Lithia Springs Rec Area	0	2
7/26/2017	Lithia Springs Rec Area	1	0
8/9/2017	Lithia Springs Rec Area	0	0
8/23/2017	Lithia Springs Rec Area	0	1
9/6/2017	Lithia Springs Rec Area	0	0
6/28/2017	Sullivan Beach	3.1	1
7/12/2017	Sullivan Beach	238.2	5.2
7/26/2017	Sullivan Beach	11	4.1
8/9/2017	Sullivan Beach	4.1	1
8/23/2017	Sullivan Beach	5.2	2
9/6/2017	Sullivan Beach	2	0
6/28/2017	Wilborn Creek Rec Area	2	3
7/12/2017	Wilborn Creek Rec Area	0	0
7/26/2017	Wilborn Creek Rec Area	0	1
8/9/2017	Wilborn Creek Rec Area	1	1
8/23/2017	Wilborn Creek Rec Area	0	0
9/6/2017	Wilborn Creek Rec Area	0	1

FIELD DATA

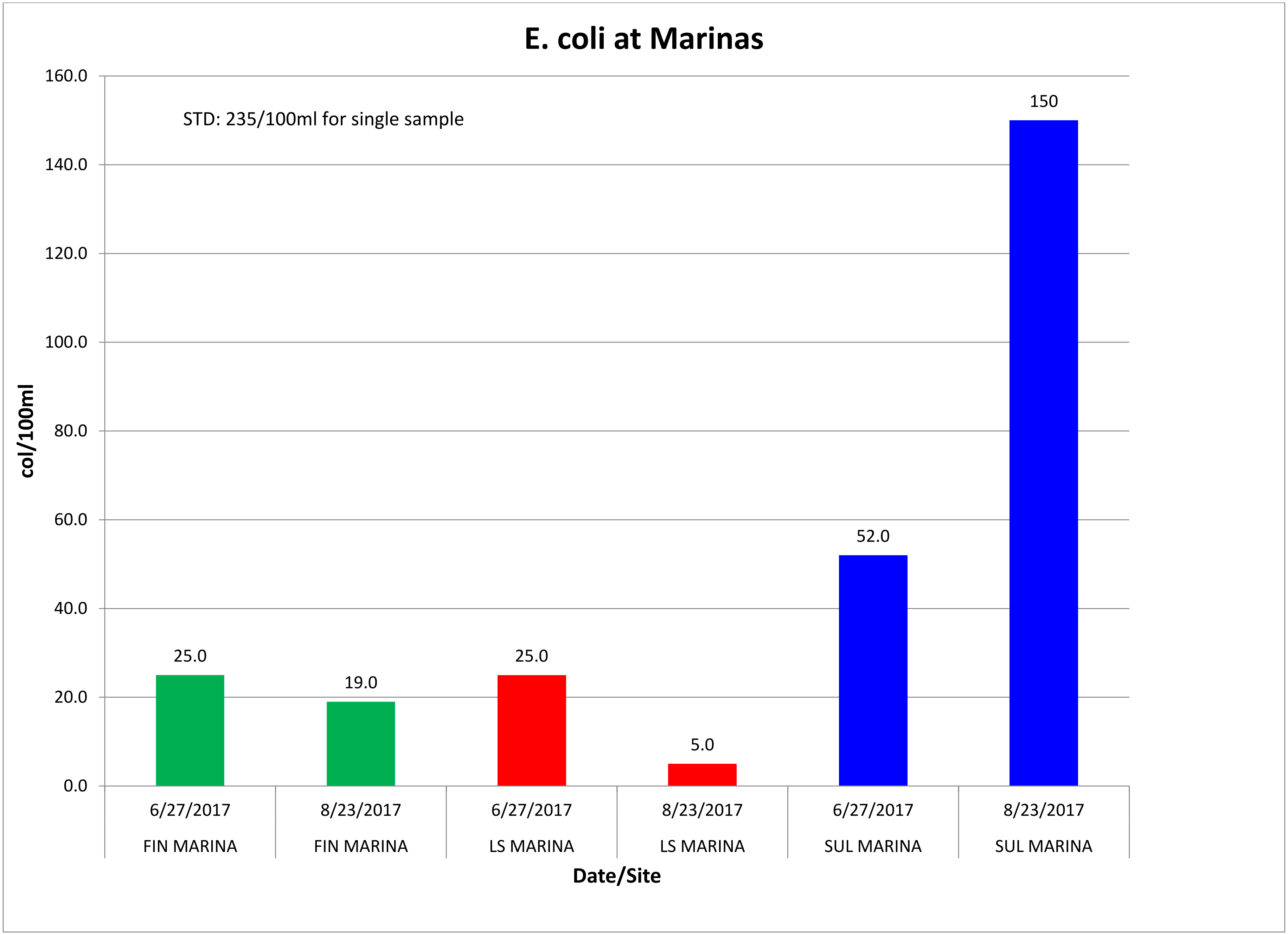
Site	Date	Depth	Water Temp (oC)	Redox (mv)	Cond (uS)	DO %	DO mg/l	pH	Time	Seechi (in)
SVL-1	3/2/2017	1.2	6.83	239	580.1	117.5	14.08	8.35	1000	
SVL-1	4/25/2017	1.4	15.46	407	553.1	102	9.99	7.84	900	
SVL-1	6/27/2017	1.8	23.33	228	372.5	103.8	8.64	8.37	900	
SVL-1	8/23/2017	0.0	25.40	84.2	346	95.6	7.83	8.57	950	
SVL-11	3/2/2017	1.3	9.04	174	589.1	116.1	13.31	8.62	1200	2
SVL-11		2.1	9.00	180	599.4	115.2	13.2	8.64	1200	
SVL-11		3.2	8.87	184	599.1	114.1	13.11	8.65	1200	
SVL-11		4.0	8.79	188	602.7	114.2	13.01	8.68	1200	
SVL-11		5.1	8.71	190	603.1	112.2	12.87	8.68	1200	
SVL-11		6.2	8.64	188	602.1	104.2	11.58	8.62	1200	
SVL-11	4/25/2017	0.0	17.90	430	570	145	13.4	8.42	1000	16
SVL-11		1.0	17.39	430	570	145	13.4	8.40	1000	
SVL-11		2.0	17.74	431	571	140	13	8.43	1000	
SVL-11		3.0	17.62	431	571	137	12.7	8.41	1000	
SVL-11		4.0	16.80	436	571	107	9.9	8.20	1000	
SVL-11		5.0	15.70	442	601	87	8.3	8.10	1000	
SVL-11	6/27/2017	0.0	24.55	237	365	130	10.57	8.75	1315	
SVL-11		1.0	24.01	240	368.1	115	8.25	8.71	1315	
SVL-11		2.5	23.96	245	372.3	78.3	6.44	8.44	1315	
SVL-11		5.5	23.72	249	376.7	60.5	4.99	8.30	1315	
SVL-11		8.3	20.65	247	532.6	0	0	7.90	1315	
SVL-11	8/23/2017	0.0	26.60		338.8	91.5	7.34	8.65	1230	20
SVL-11		1.0	26.00		340.3	62.2	5.04	8.41	1230	
SVL-11		2.0	25.90		343	60.1	4.88	8.39	1230	
SVL-11		3.0	25.90		343.6	60.1	4.88	8.38	1230	
SVL-11		4.0	25.90		343.4	60.7	4.93	8.39	1230	
SVL-11		5.0	25.90		343.3	61.5	4.99	8.40	1230	
SVL-11		6.0	25.80		344.6	61.1	4.97	8.37	1230	
SVL-12	4/24/2017	0.3	17.18	208	719.3	113.5	10.91	8.67	1330	
SVL-12	6/27/2017	0.6	24.09	266	698.3	107.7	8.76	8.13	1415	
SVL-12	8/23/2017	0.2	29.00	188.6	778	109.1	8.37	8.39	1400	
SVL-13	3/2/2017	0.3	8.76	148	644.4	91.3	10.46	8.20	1410	
SVL-13	4/24/2017	0.3	21.84	258	660.8	179.7	15.54	8.97	1200	

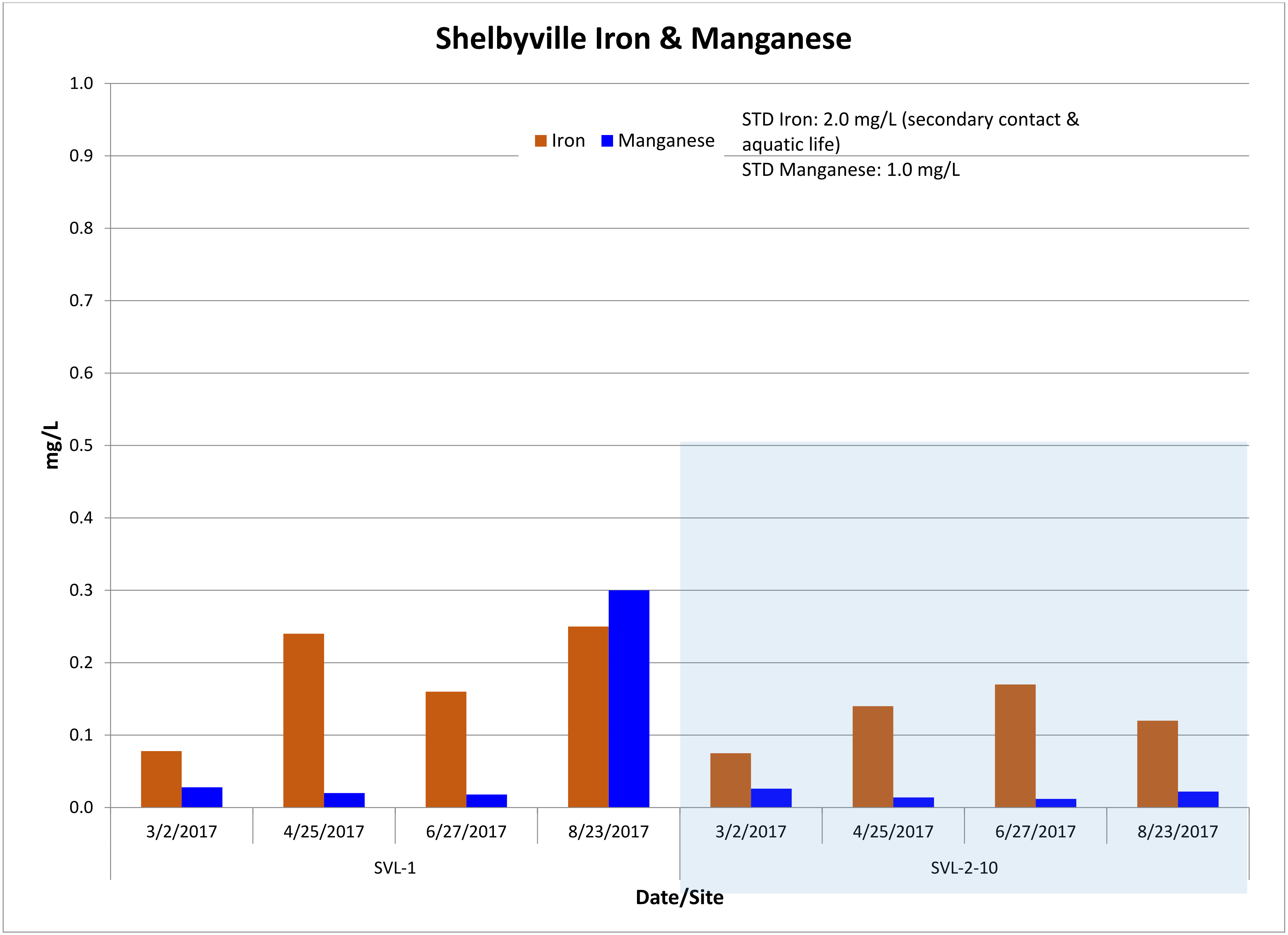
SVL-13	6/27/2017	0.6	25.30	267	540.3	104.2	8.01	7.99	1236	
SVL-13	8/23/2017	0.3	26.20	226.1	441.1	97.9	7.91	8.48	1125	
SVL-2	3/2/2017	0.8	6.76	198	583.1	103.9	12.55	8.54	1030	4
SVL-2		1.9	6.81	203	584.1	104.5	12.63	8.53	1030	
SVL-2		3.0	6.74	205	583.5	104.2	12.56	8.51	1030	
SVL-2		4.1	6.71	206	583.1	103.4	12.53	8.51	1030	
SVL-2		5.2	6.72	202	582.1	103.8	12.55	8.51	1030	
SVL-2		6.2	6.71	201	583.4	104.3	12.54	8.51	1030	
SVL-2		8.5	6.74	202	583.1	104.7	12.67	8.53	1030	
SVL-2		9.4	6.72	203	583.5	104.9	12.67	8.51	1030	
SVL-2	4/25/2017	0.0	16.80	423.00	547	135	12.8	8.20	930	36
SVL-2		1.0	16.70	422.00	547	135	12.8	8.30	930	
SVL-2		2.0	16.50	423.00	549	130	12.3	8.29	930	
SVL-2		3.0	16.20	424.00	550	123	11.8	8.26	930	
SVL-2		4.0	15.70	424.00	551	118	11.4	8.24	930	
SVL-2		5.0	15.50	425.00	552	112	10.8	8.22	930	
SVL-2		6.0	15.20	427.00	553	102	10	8.18	930	
SVL-2	6/27/2017	0.0	23.90	232	367	104.5	8.63	8.66	945	32
SVL-2		1.0	23.70	235	368.7	95.1	7.87	8.60	945	
SVL-2		2.0	23.63	238	369	88.5	7.31	8.53	945	
SVL-2		3.0	23.61	239	369.4	88.2	7.3	8.53	945	
SVL-2		4.0	23.58	241	369.5	87.2	7.26	8.53	945	
SVL-2		5.0	23.55	242	369.4	88	7.3	8.53	945	
SVL-2		6.0	23.49	243	369.5	85.1	7.09	8.50	945	
SVL-2		7.0	22.54	251	381.6	38	3.3	8.03	945	
SVL-2	8/23/2017	1.0	25.30		346.7	90.2	7.41	8.53	950	32
SVL-2		2.0	25.20		348	82.1	6.76	8.44	950	
SVL-2		3.0	25.20		349	76.6	6.3	8.37	950	
SVL-2		4.0	25.20		348.7	79.1	6.51	8.41	950	
SVL-2		5.0	25.20		348.9	77.76	6.4	8.39	950	
SVL-2		6.0	25.00		351.3	60.8	5.01	8.21	950	
SVL-4	3/2/2017	0.4	7.25	174	604.7	113.4	13.43	8.46	1240	0.2
SVL-4	4/25/2017	0.0	18.50	454	710	88	8	8.20	1045	8
SVL-4		1.0	17.60	455	716	82	7.6	8.10	1045	
SVL-4	6/27/2017	0.0	27.14	246	533.7	110	8.52	8.29	1440	
SVL-4		1.0	25.33	250	526.4	95.4	7.65	8.21	1440	
SVL-4		2.0	24.30	255	528	64.3	5.25	8.03	1440	
SVL-4		3.0	24.19	258	527.1	58.4	4.78	7.97	1440	

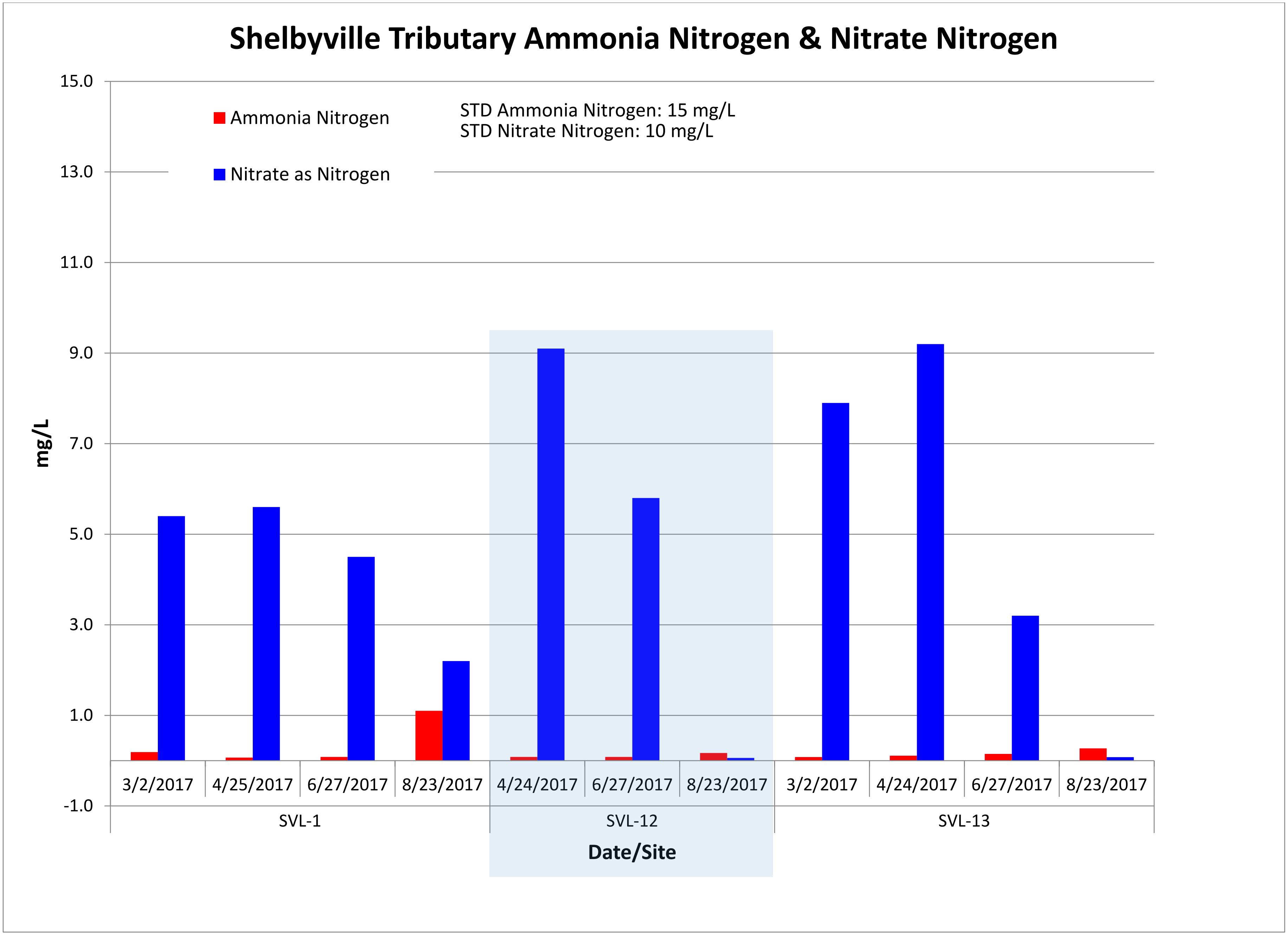
SVL-4		4.0	24.06	261	523.4	50.8	4.16	7.92	1440	
SVL-4	8/23/2017	0.0	26.80		496.1	96	7.66	8.49	1300	8
SVL-4		1.0	25.80		529	39.7	3.23	8.16	1300	
SVL-4		1.3	25.60		538	34.8	2.84	8.14	1300	
SVL-4		4.0	24.06	261	523.4	50.8	4.16	7.92	1440	

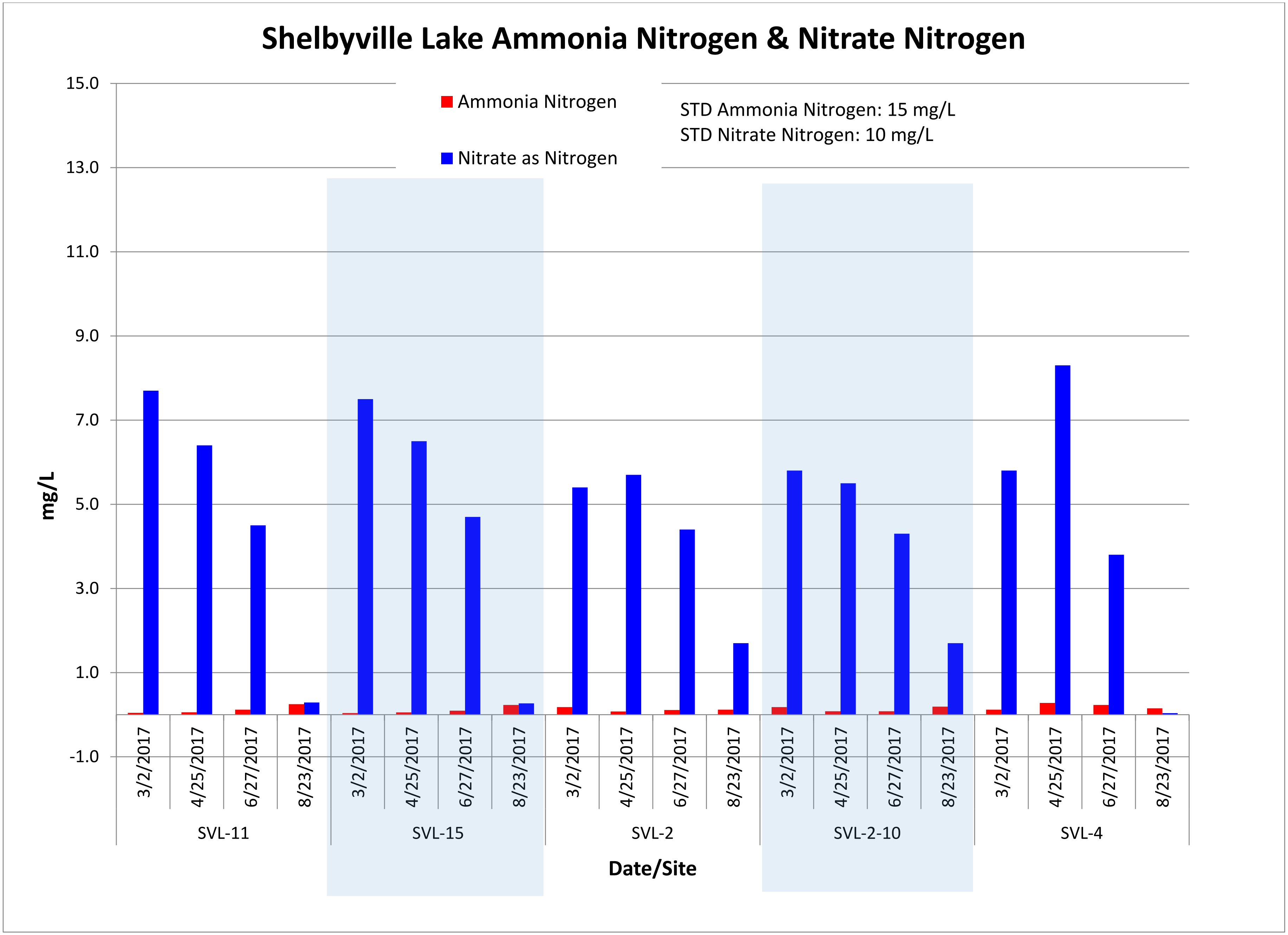
APPENDIX B

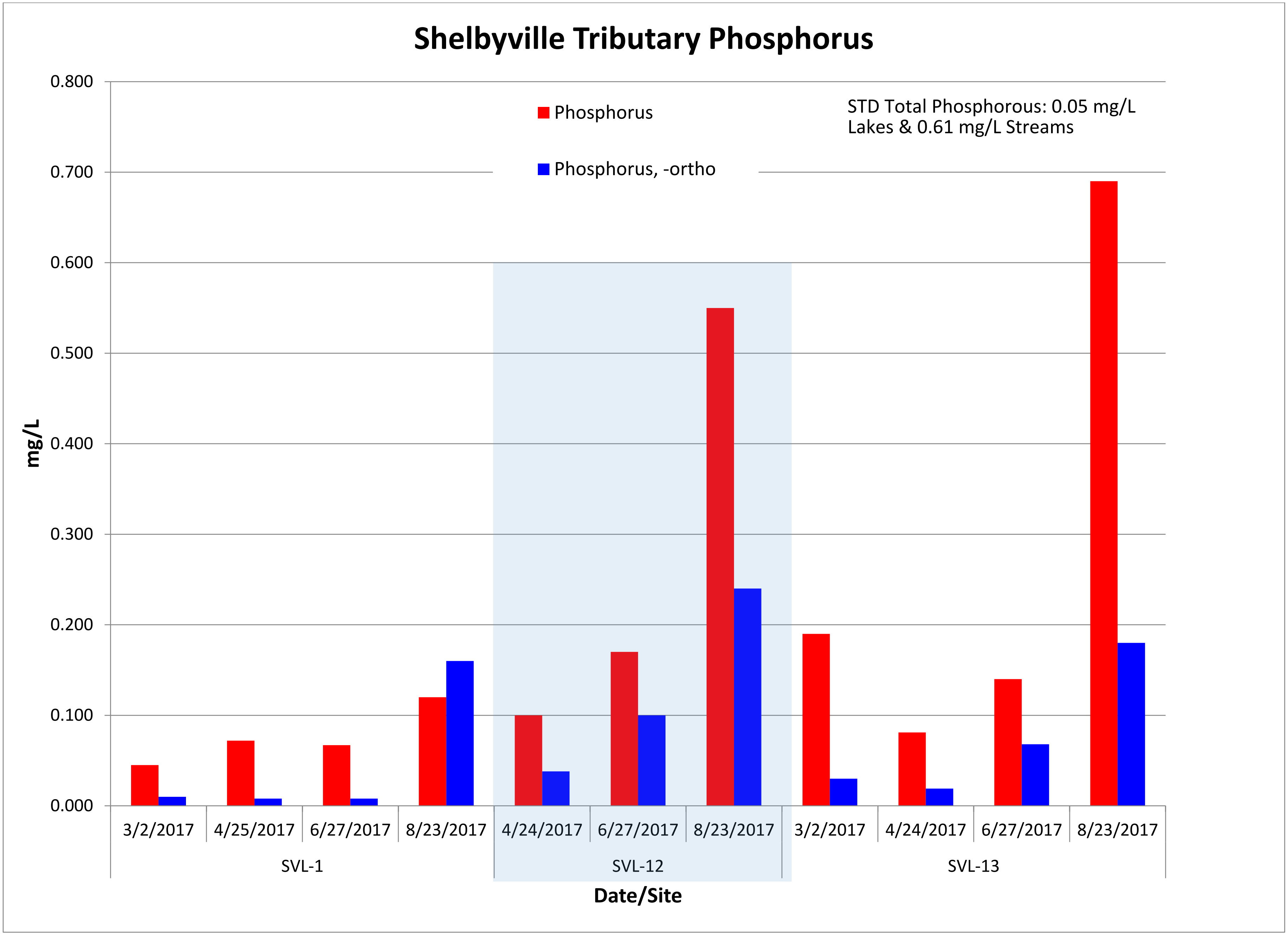
LAB DATA
GRAPHS


E. coli at Marinas
STD: 235/100ml for single sample
col/100ml
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
25.0
19.0
25.0
5.0
52.0
150
6/27/2017
FIN MARINA
8/23/2017
FIN MARINA
6/27/2017
LS MARINA
8/23/2017
LS MARINA
6/27/2017
SUL MARINA
8/23/2017
SUL MARINA
Date/Site

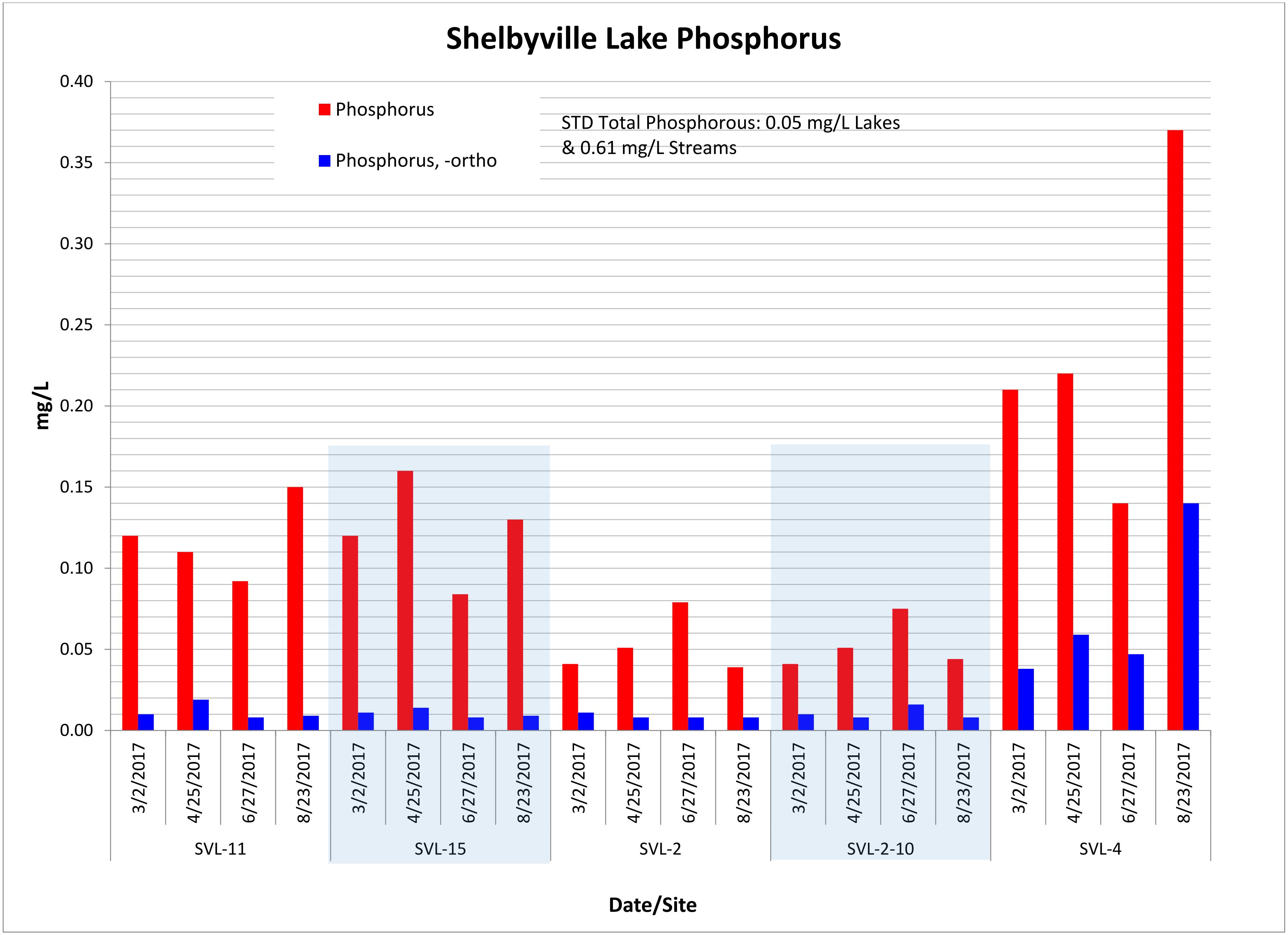

Shelbyville Iron & Manganese
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
mg/L
Iron
Manganese
STD Iron: 2.0 mg/L (secondary contact & aquatic life)
STD Manganese: 1.0 mg/L
3/2/2017
4/25/2017
6/27/2017
8/23/2017
3/2/2017
4/25/2017
6/27/2017
8/23/2017
SVL-1
SVL-2-10
Date/Site

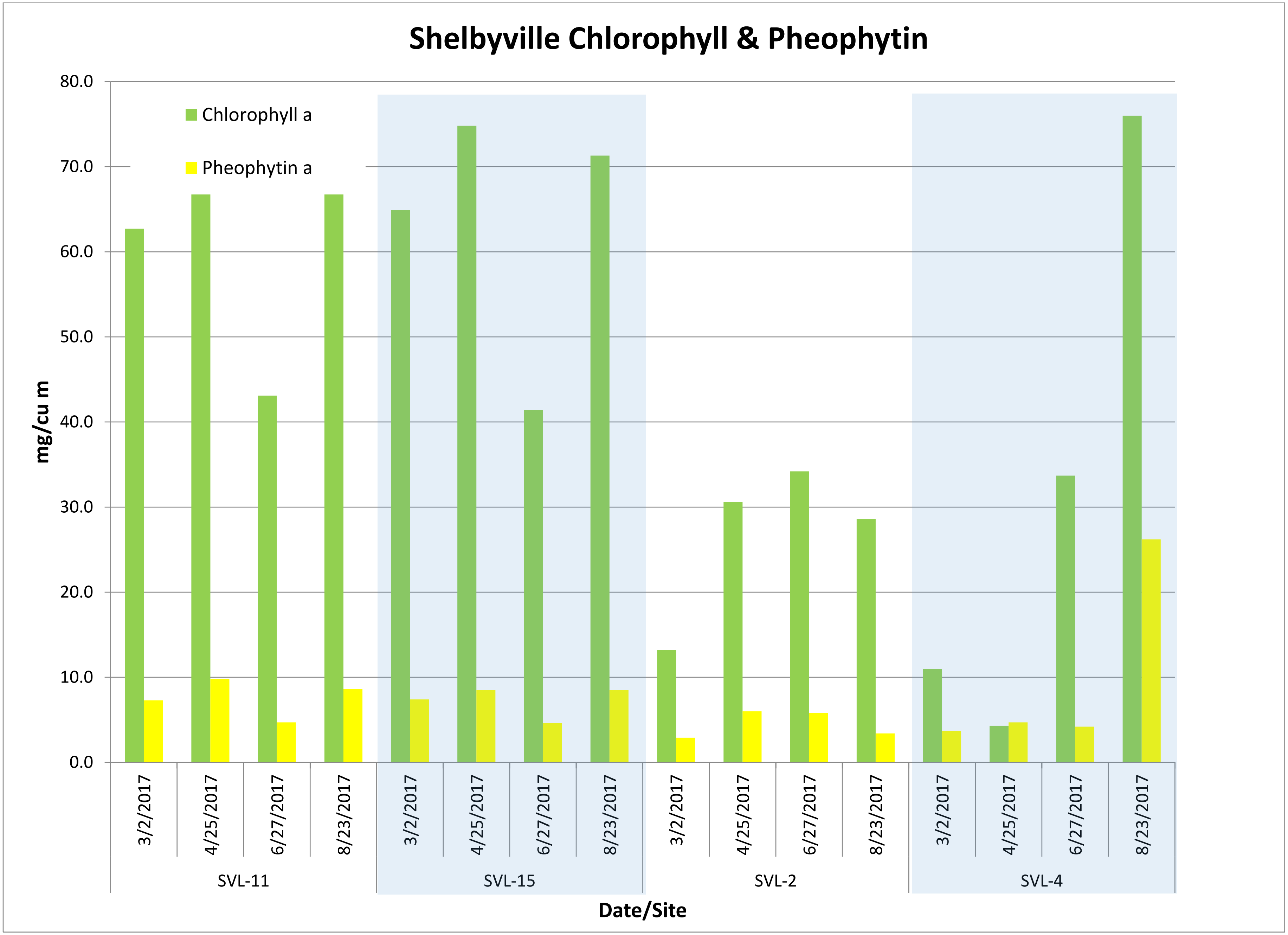

Shelbyville Tributary Ammonia Nitrogen & Nitrate Nitrogen
Ammonia Nitrogen
Nitrate as Nitrogen
STD Ammonia Nitrogen: 15 mg/L
STD Nitrate Nitrogen: 10 mg/L
mg/L
15.0
13.0
11.0
9.0
7.0
5.0
3.0
1.0
-1.0
3/2/2017
4/25/2017
6/27/2017
8/23/2017
4/24/2017
6/27/2017
8/23/2017
3/2/2017
4/24/2017
6/27/2017
8/23/2017
SVL-1
SVL-12
SVL-13
Date/Site


Shelbyville Lake Ammonia Nitrogen & Nitrate Nitrogen
Ammonia Nitrogen
Nitrate as Nitrogen
STD Ammonia Nitrogen: 15 mg/L
STD Nitrate Nitrogen: 10 mg/L
mg/L
15.0
13.0
11.0
9.0
7.0
5.0
3.0
1.0
-1.0
3/2/2017
4/25/2017
6/27/2017
8/23/2017
SVL-11
SVL-15
SVL-2
SVL-2-10
SVL-4
Date/Site

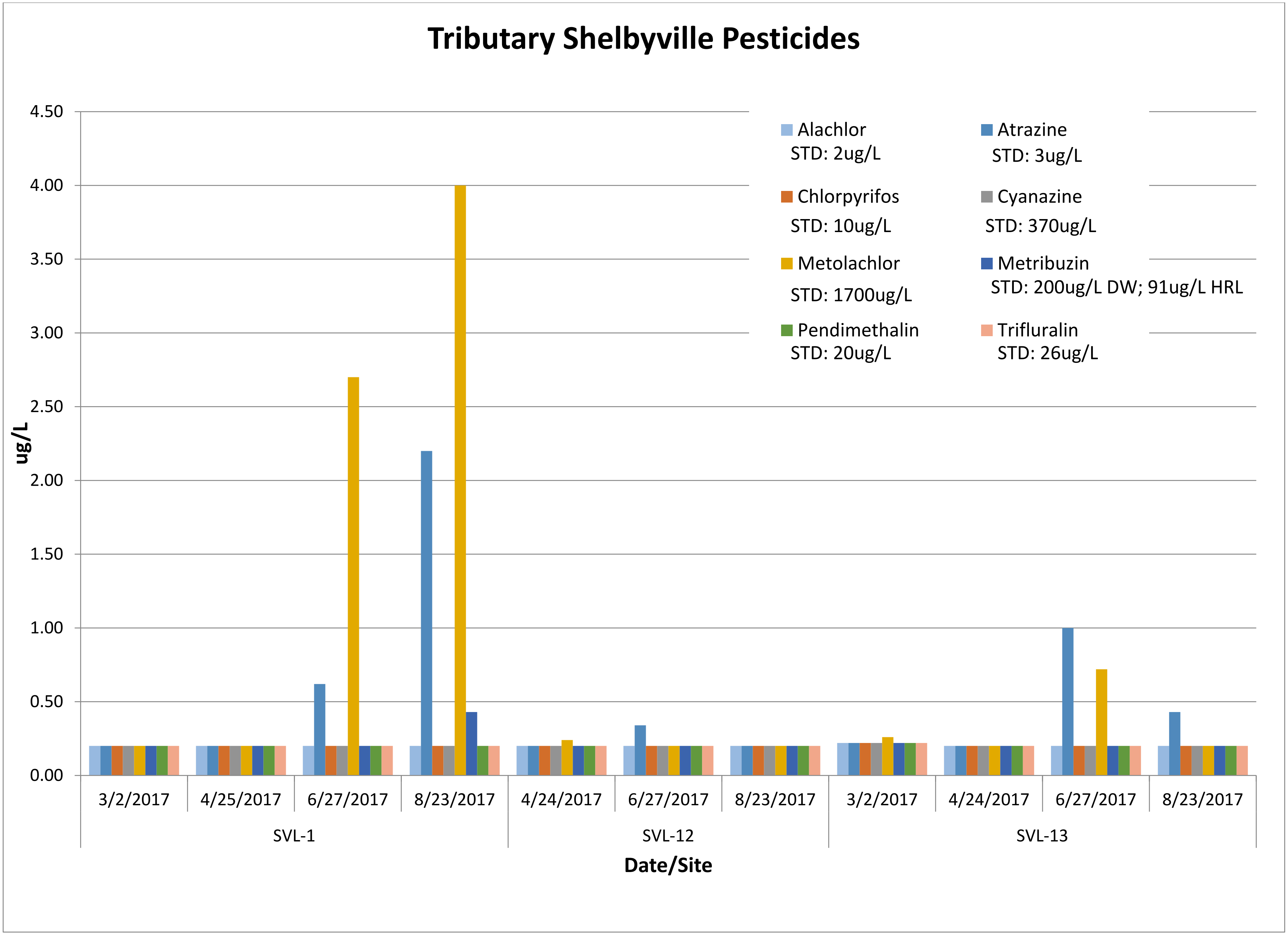


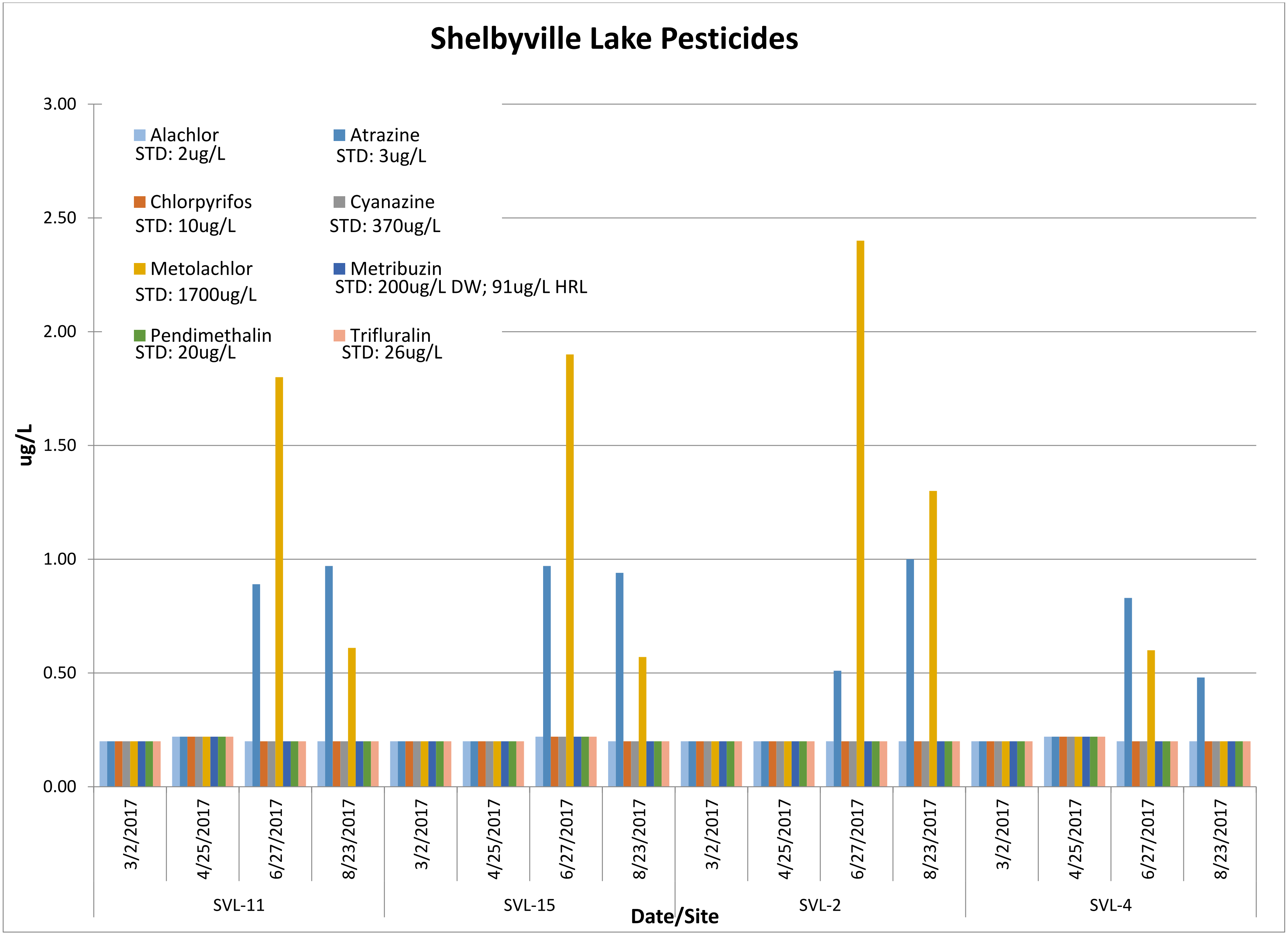
Shelbyville Tributary Phosphorus
Phosphorus
Phosphorus, -ortho
STD Total Phosphorous: 0.05 mg/L Lakes & 0.61 mg/L Streams
mg/L
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
3/2/2017
4/25/2017
6/27/2017
8/23/2017
4/24/2017
6/27/2017
8/23/2017
3/2/2017
4/24/2017
6/27/2017
8/23/2017
SVL-1
SVL-12
SVL-13
Date/Site

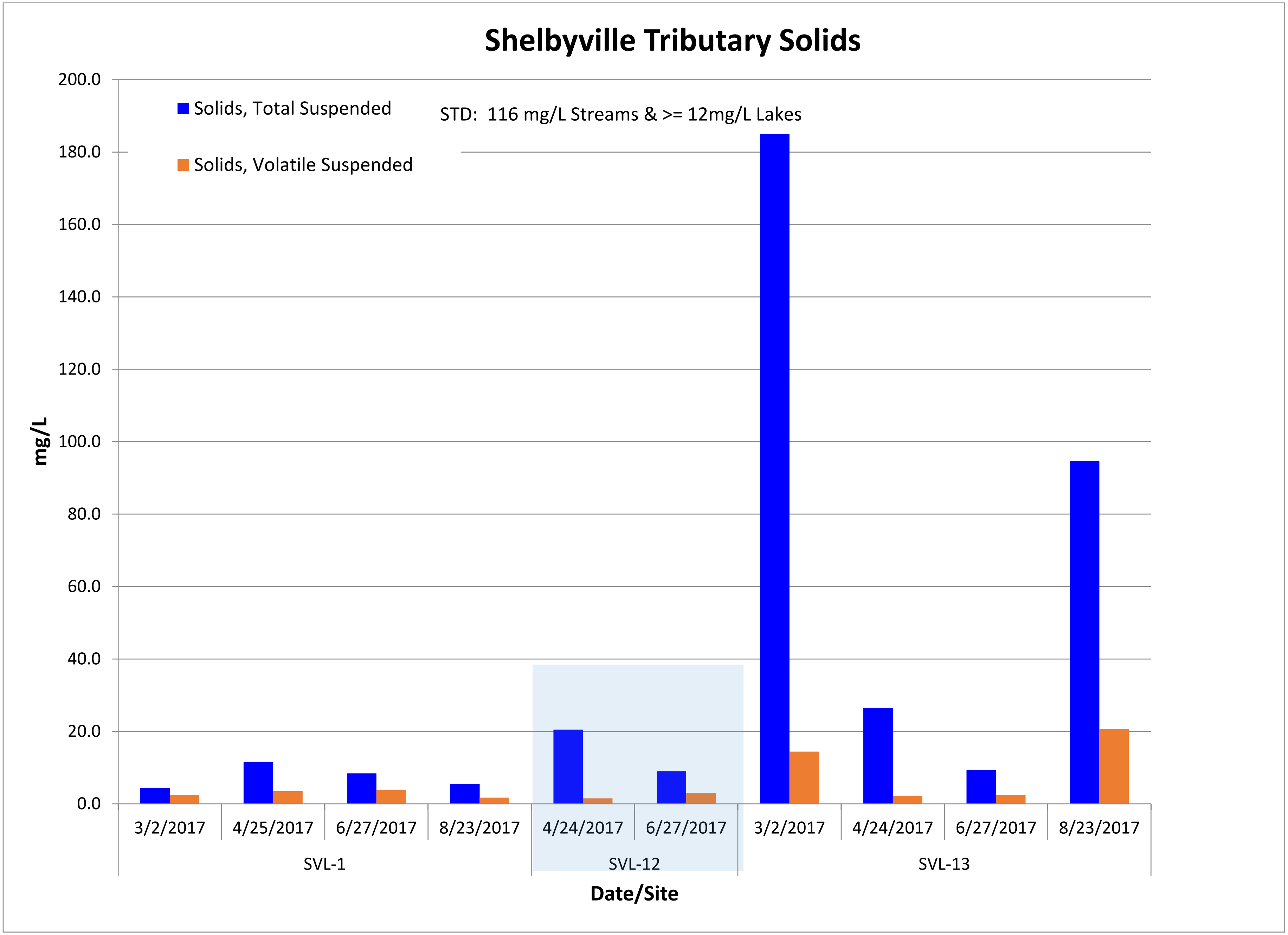

Shelbyville Lake Phosphorus
Phosphorus
Phosphorus, -ortho
STD Total Phosphorous: 0.05 mg/L Lakes
& 0.61 mg/L Streams
mg/L
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
3/2/2017
4/25/2017
6/27/2017
8/23/2017
SVL-11
SVL-15
SVL-2
SVL-2-10
SVL-4
Date/Site



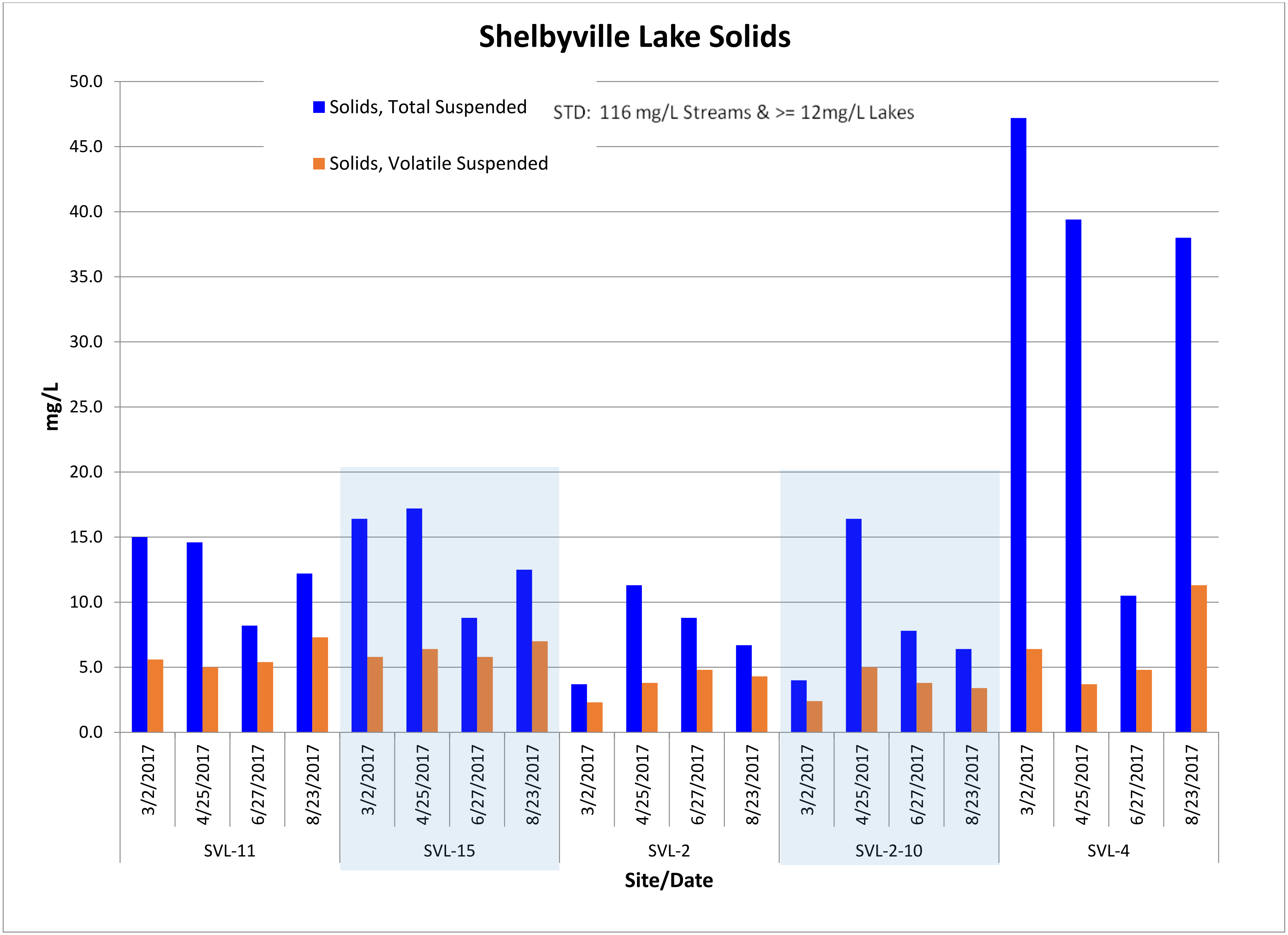
Shelbyville Chlorophyll & Pheophytin
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
mg/cu m
Chlorophyll a
Pheophytin a
3/2/2017
4/25/2017
6/27/2017
8/23/2017
SVL-11
SVL-15
SVL-2
SVL-4
Date/Site

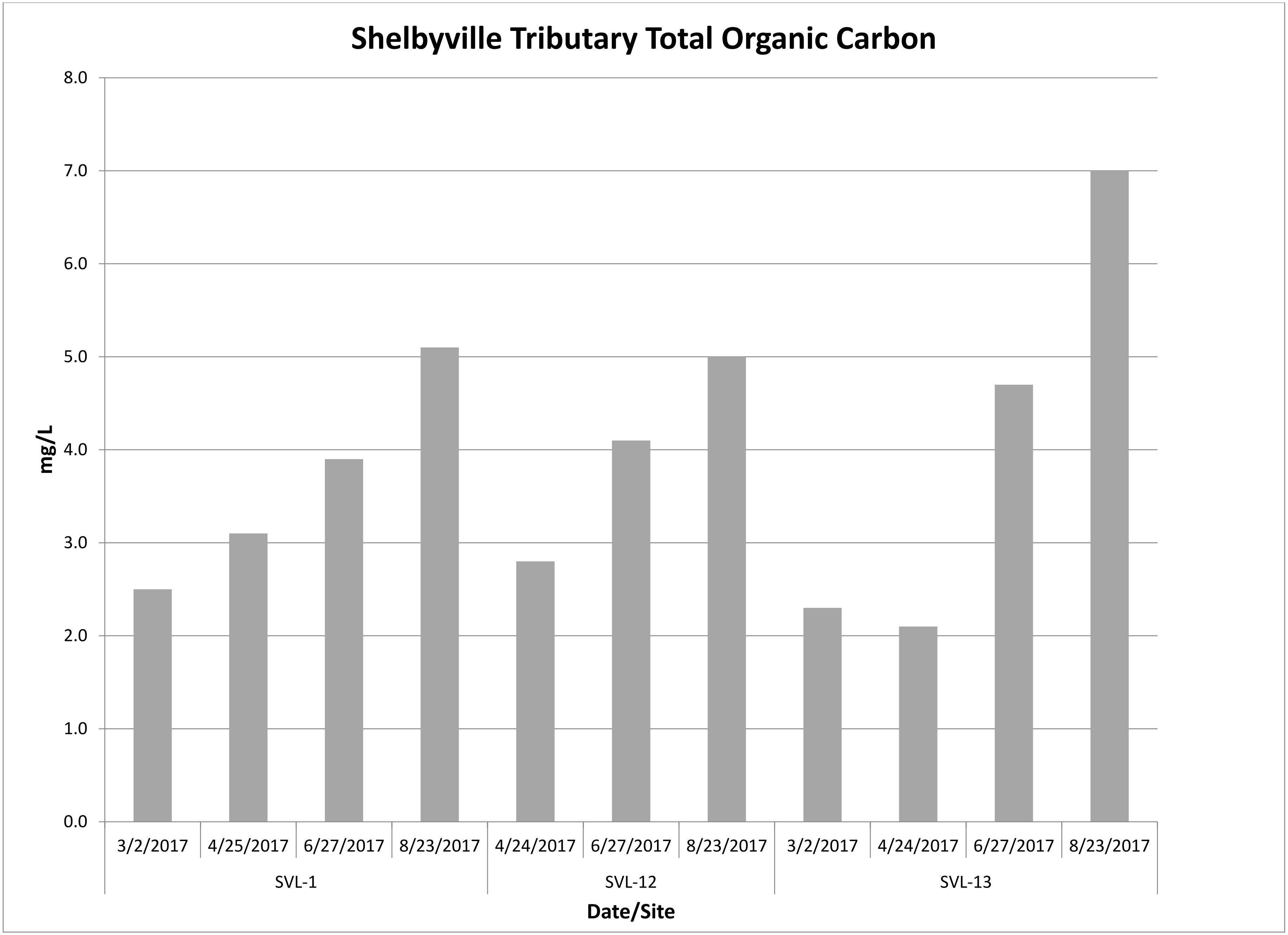

Tributary Shelbyville Pesticides
ug/L
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Alachlor STD: 2ug/L
Atrazine STD: 3ug/L
Chlorpyrifos STD: 10ug/L
Cyanazine STD: 370ug/L
Metolachlor STD: 1700ug/L
Metribuzin STD: 200ug/L DW; 91ug/L HRL
Pendimethalin STD: 20ug/L
Trifluralin STD: 26ug/L
3/2/2017
4/25/2017
6/27/2017
8/23/2017
4/24/2017
6/27/2017
8/23/2017
3/2/2017
4/24/2017
6/27/2017
8/23/2017
SVL-1
SVL-12
SVL-13
Date/Site

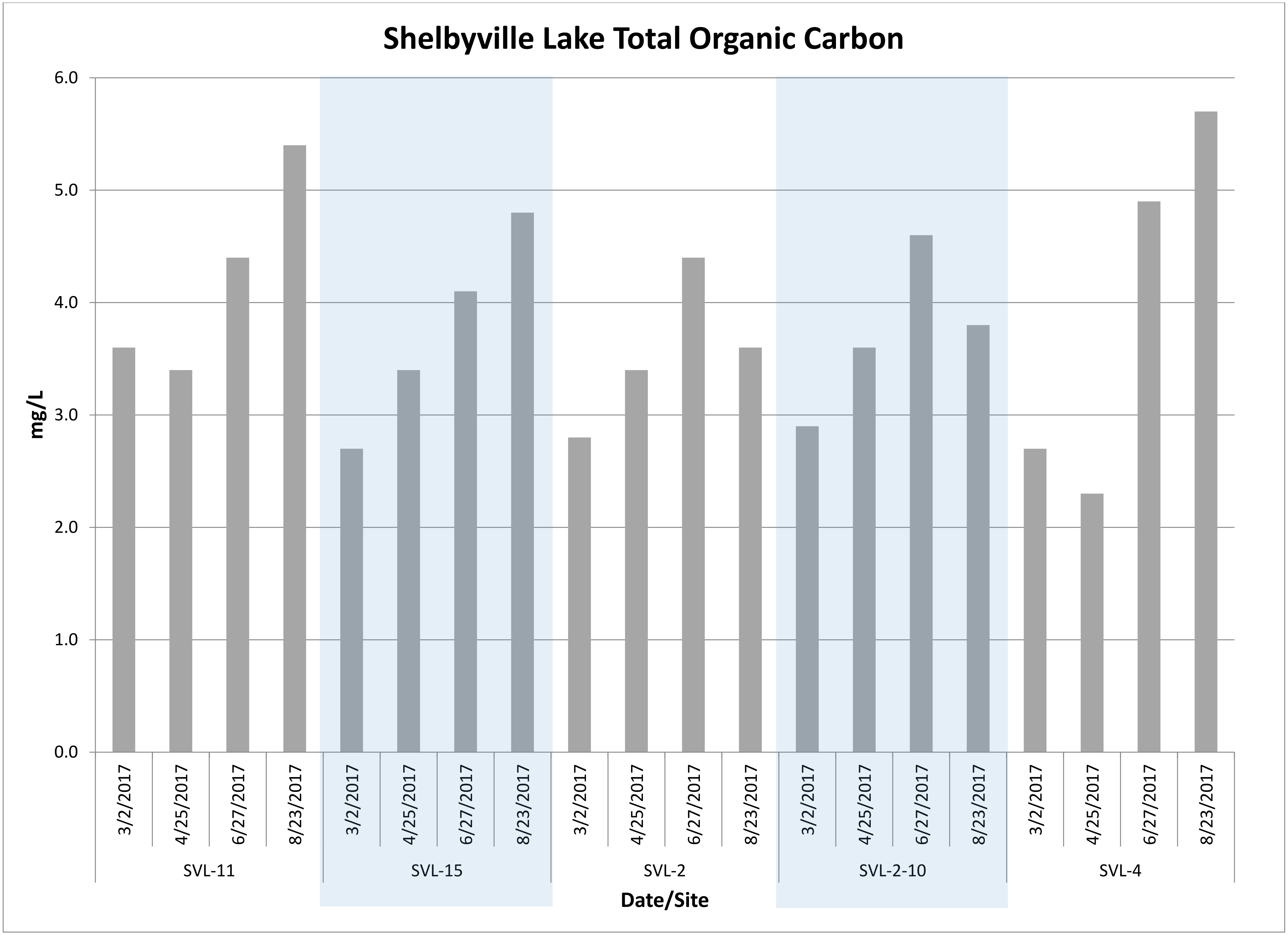

Shelbyville Lake Pesticides
Alachlor
STD: 2ug/L
Atrazine
STD: 3ug/L
Chlorpyrifos
STD: 10ug/L
Cyanazine
STD: 370ug/L
Metolachlor
STD: 1700ug/L
Metribuzin
STD: 200ug/L DW; 91ug/L HRL
Pendimethalin
STD: 20ug/L
Trifluralin
STD: 26ug/L
ug/L
3.00
2.50
2.00
1.50
1.00
0.50
0.00
3/2/2017
4/25/2017
6/27/2017
8/23/2017
SVL-11
SVL-15
SVL-2
SVL-4
Date/Site



Shelbyville Tributary Solids
Solids, Total Suspended
Solids, Volatile Suspended
STD: 116 mg/L Streams & >= 12mg/L Lakes
mg/L
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
3/2/2017
4/25/2017
6/27/2017
8/23/2017
4/24/2017
6/27/2017
3/2/2017
4/24/2017
6/27/2017
8/23/2017
SVL-1
SVL-12
SVL-13
Date/Site

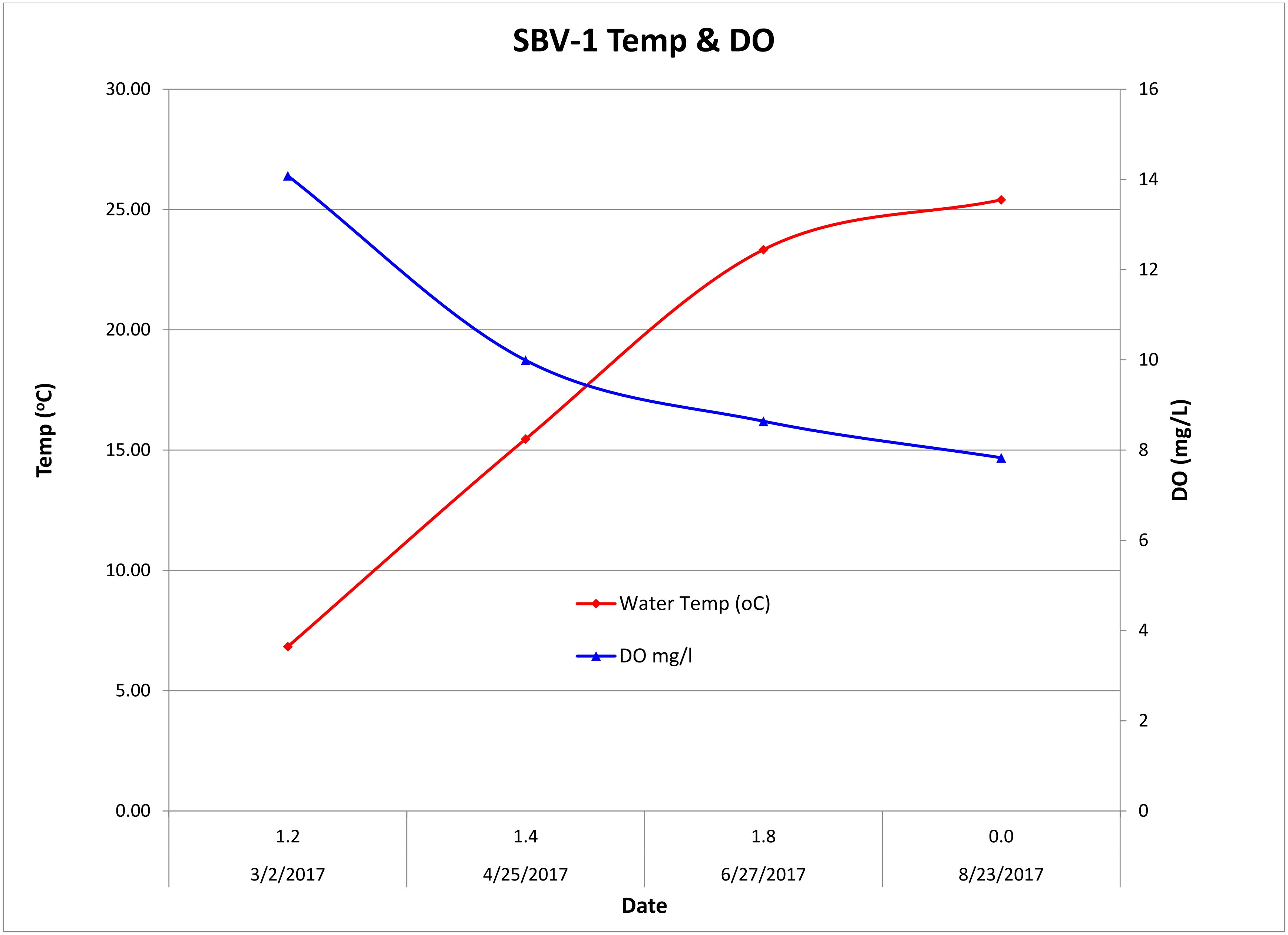

Shelbyville Lake Solids
Solids, Total Suspended
Solids, Volatile Suspended
STD: 116 mg/L Streams & >= 12mg/L Lakes
mg/L
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
3/2/2017
4/25/2017
6/27/2017
8/23/2017
SVL-11
SVL-15
SVL-2
SVL-2-10
SVL-4
Site/Date

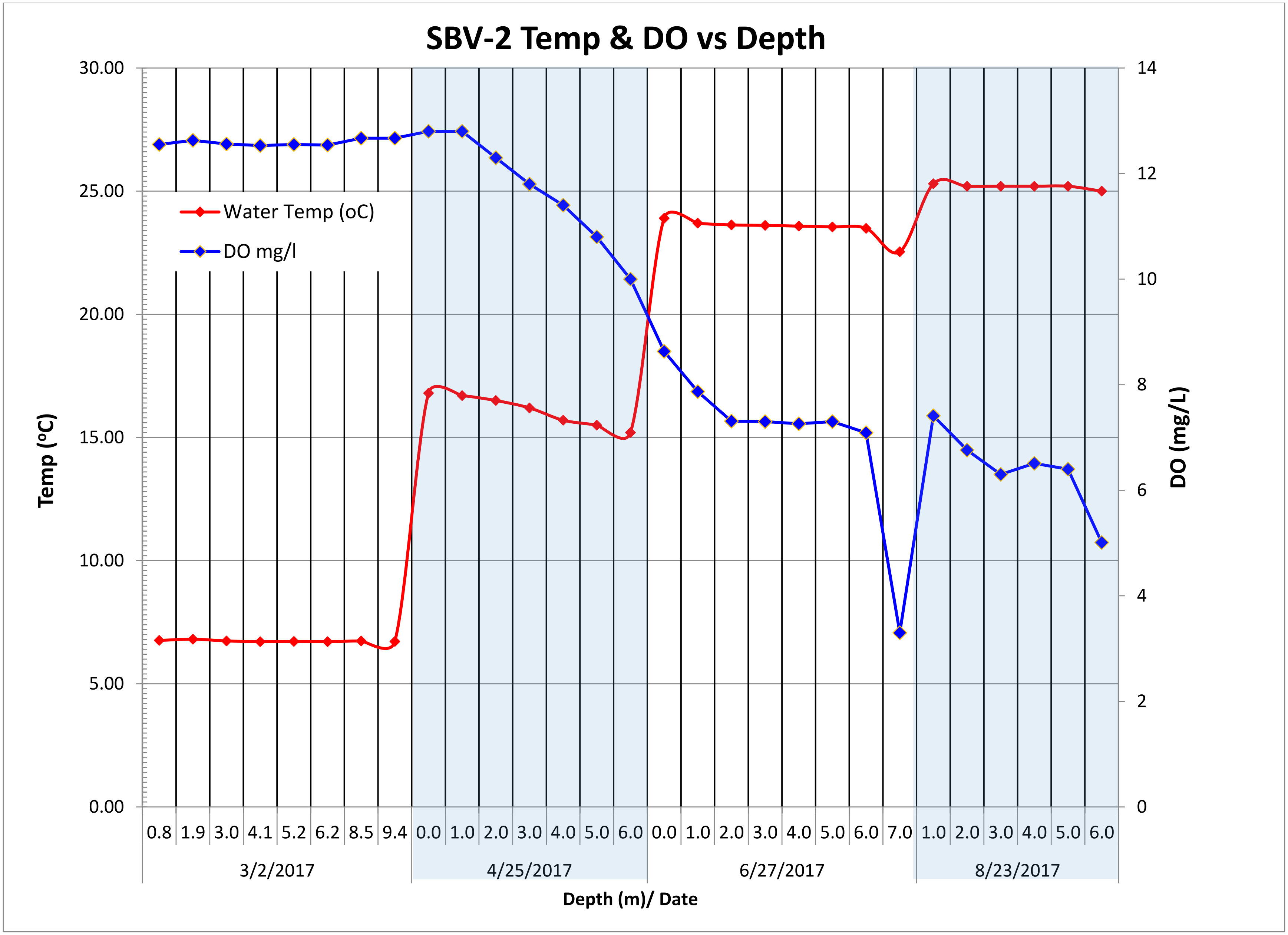

Shelbyville Tributary Total Organic Carbon
mg/L
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
3/2/2017
4/25/2017
6/27/2017
8/23/2017
4/24/2017
6/27/2017
8/23/2017
3/2/2017
4/24/2017
6/27/2017
8/23/2017
SVL-1
SVL-12
SVL-13
Date/Site

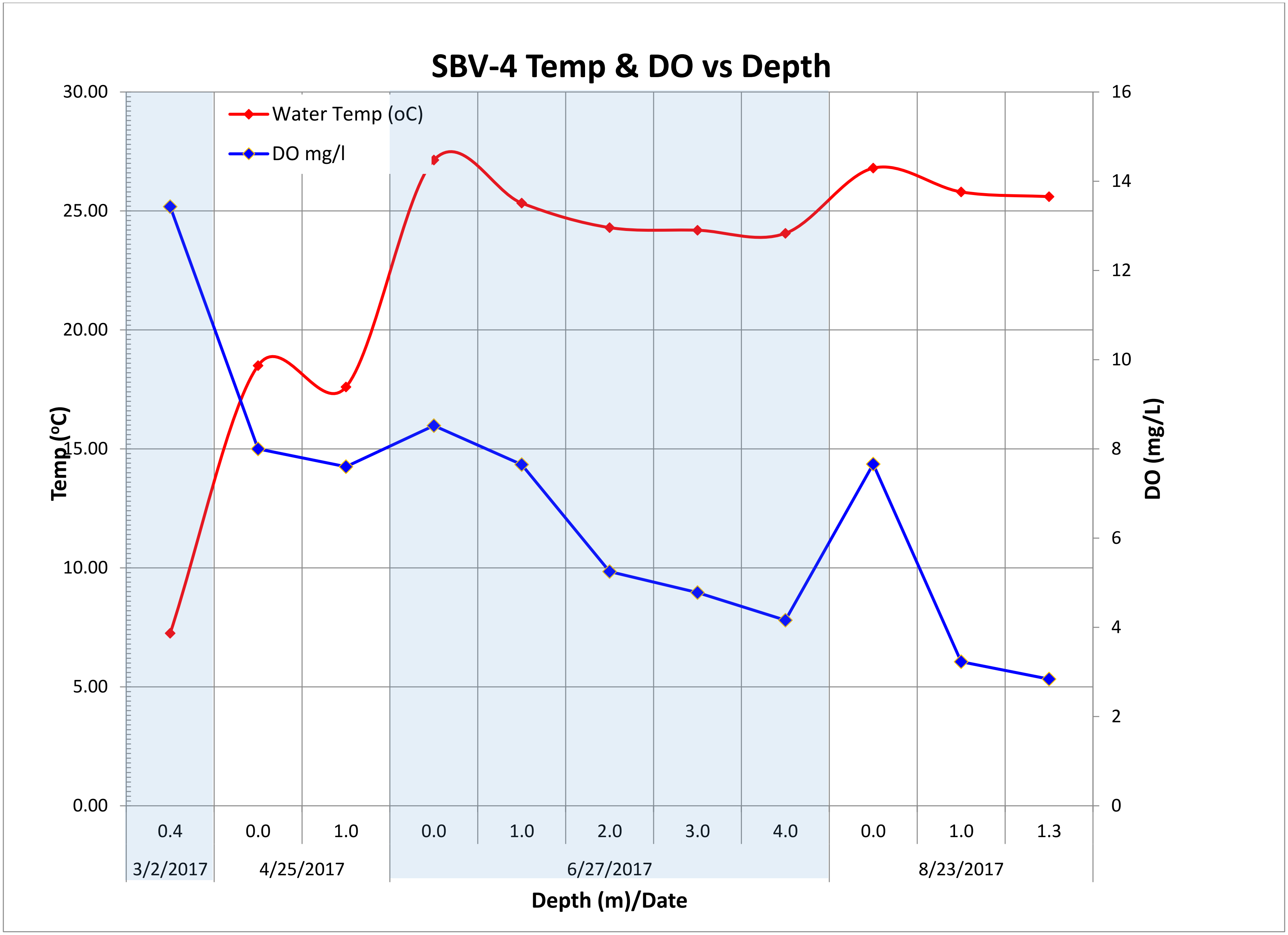

Shelbyville Lake Total Organic Carbon
mg/L
6.0
5.0
4.0
3.0
2.0
1.0
0.0
3/2/2017
4/25/2017
6/27/2017
8/23/2017
SVL-11
SVL-15
SVL-2
SVL-2-10
SVL-4
Date/Site

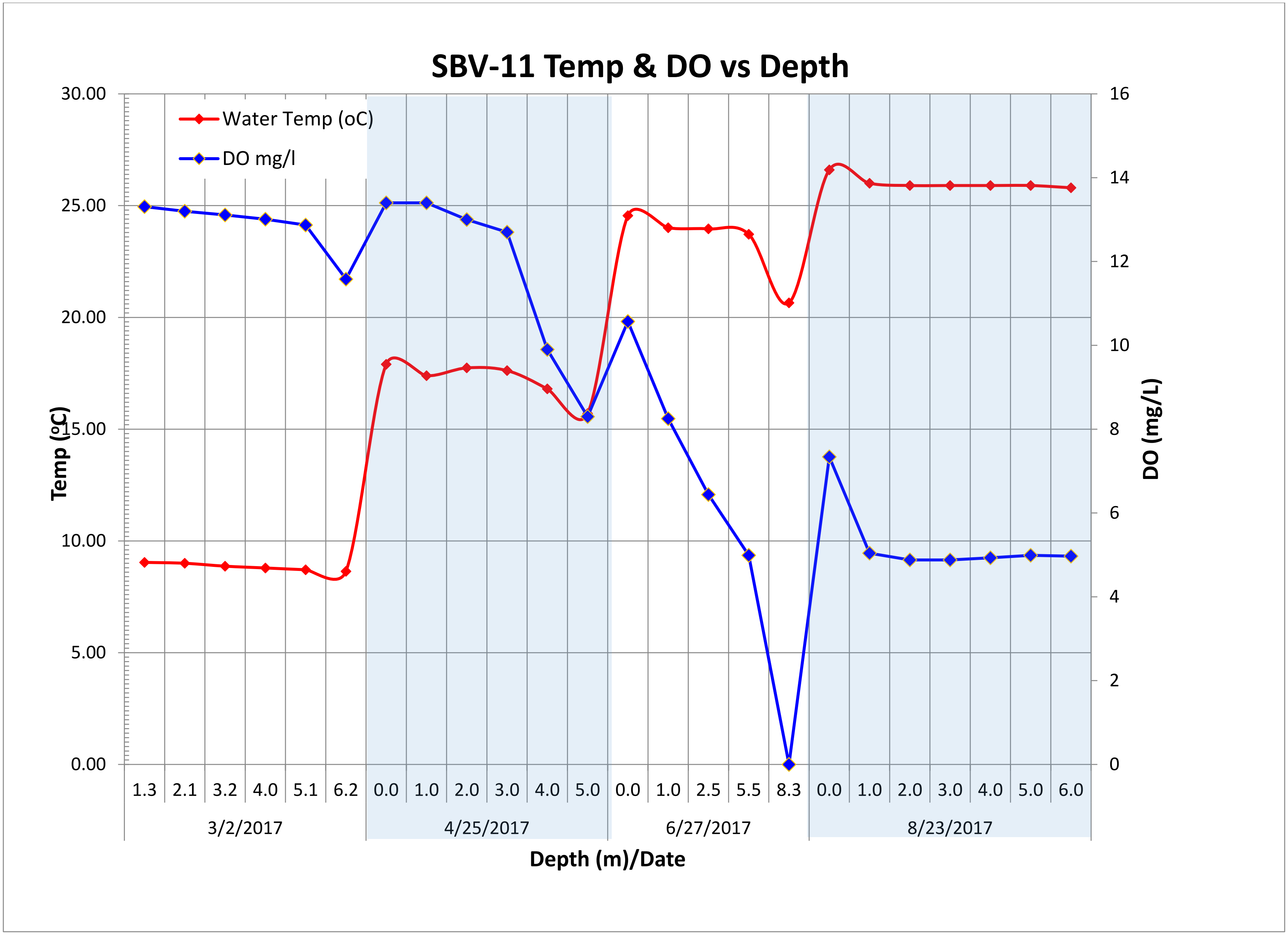
APPENDIX C

FIELD DATA
GRAPHS

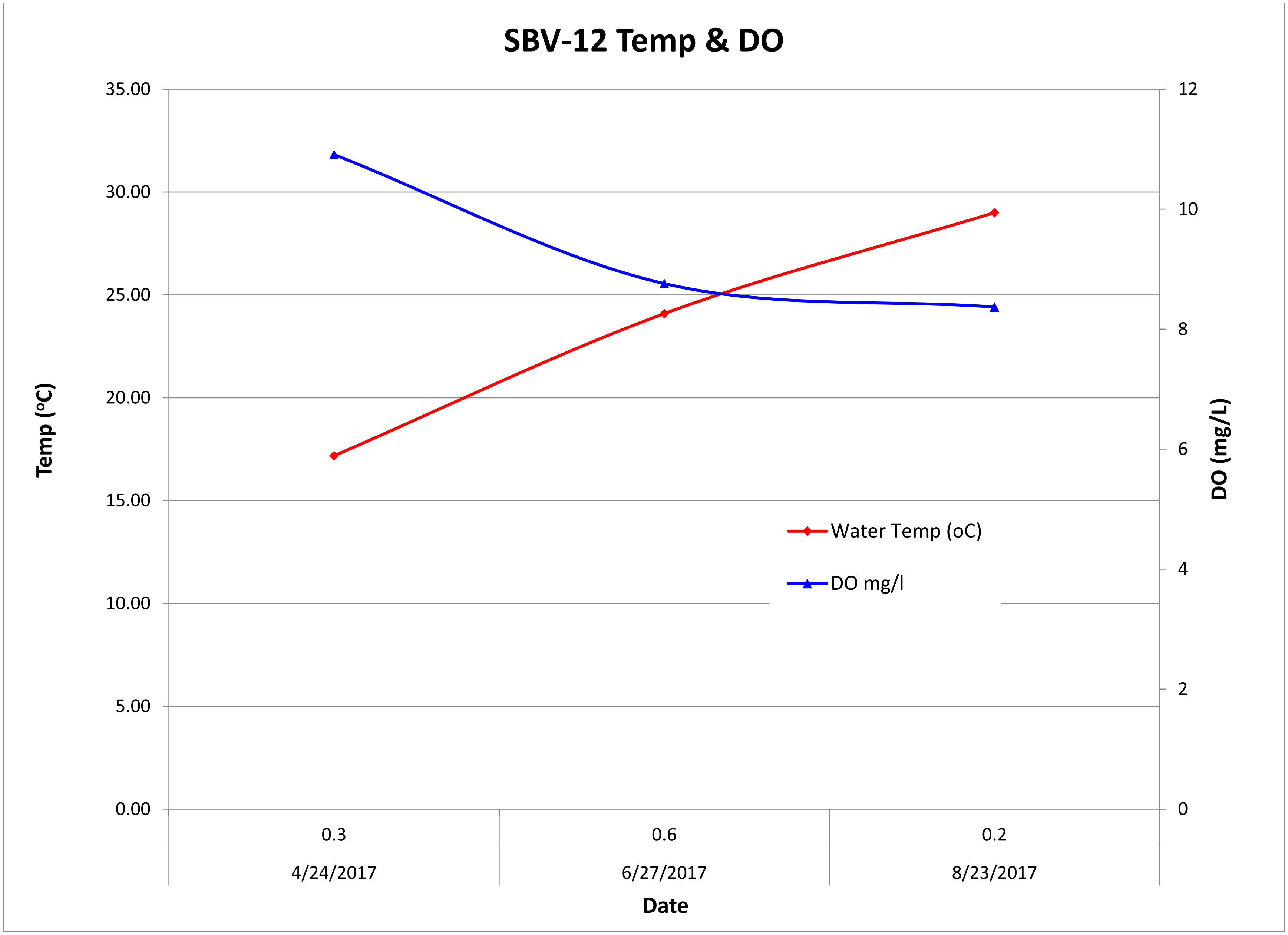

SBV-1 Temp & DO
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Temp (ºC)
16
14
12
10
8
6
4
2
0
DO (mg/L)
Water Temp (oC)
DO mg/l
1.2
3/2/2017
1.4
4/25/2017
1.8
6/27/2017
0.0
8/23/2017
Date

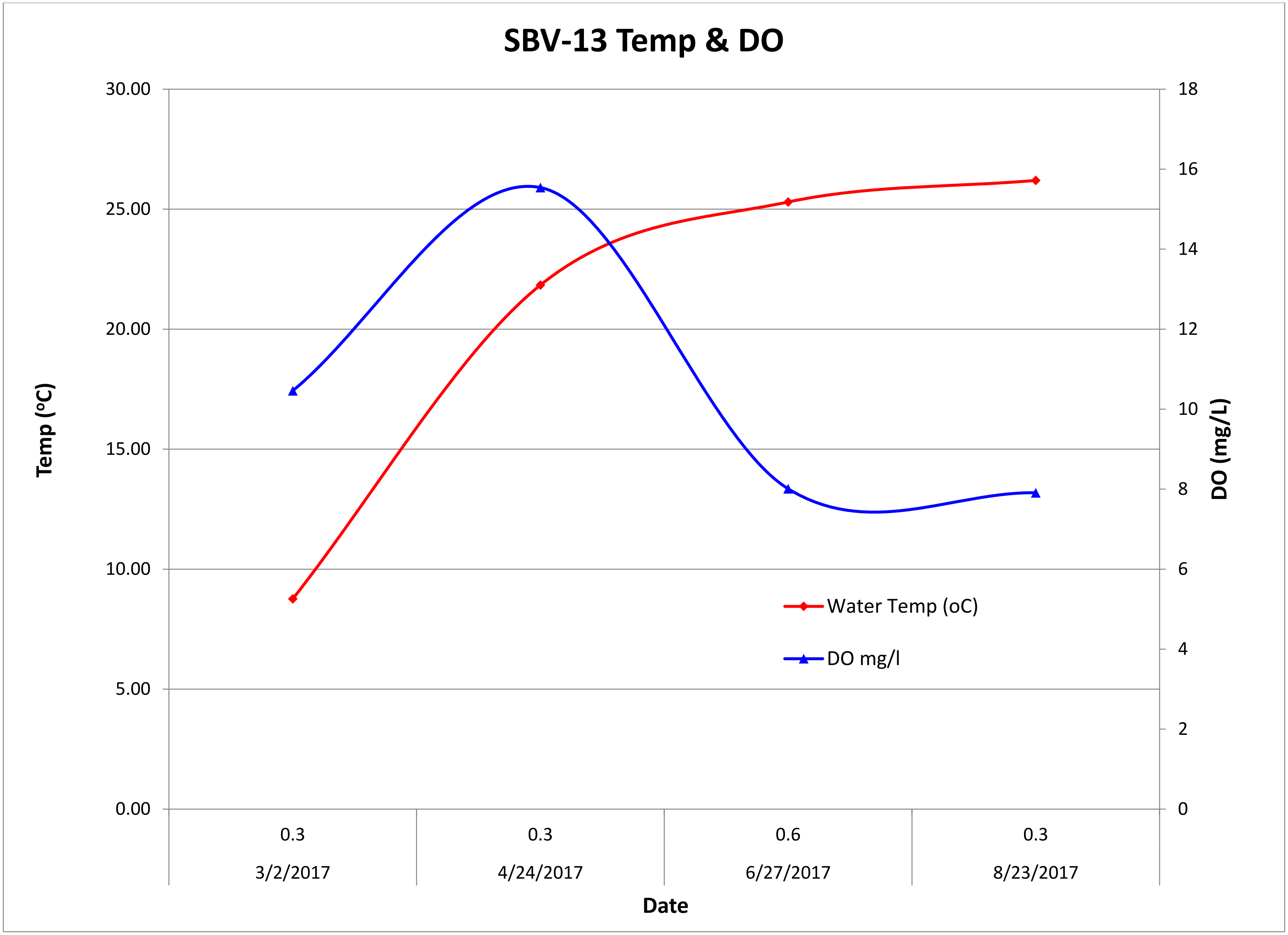

SBV-2 Temp & DO vs Depth
Water Temp (oC)
DO mg/l
Temp (oC)
DO (mg/L)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
14
12
10
8
6
4
2
0
0.8 1.9 3.0 4.1 5.2 6.2 8.5 9.4
3/2/2017
0.0 1.0 2.0 3.0 4.0 5.0 6.0
4/25/2017
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0
6/27/2017
1.0 2.0 3.0 4.0 5.0 6.0
8/23/2017
Depth (m)/ Date

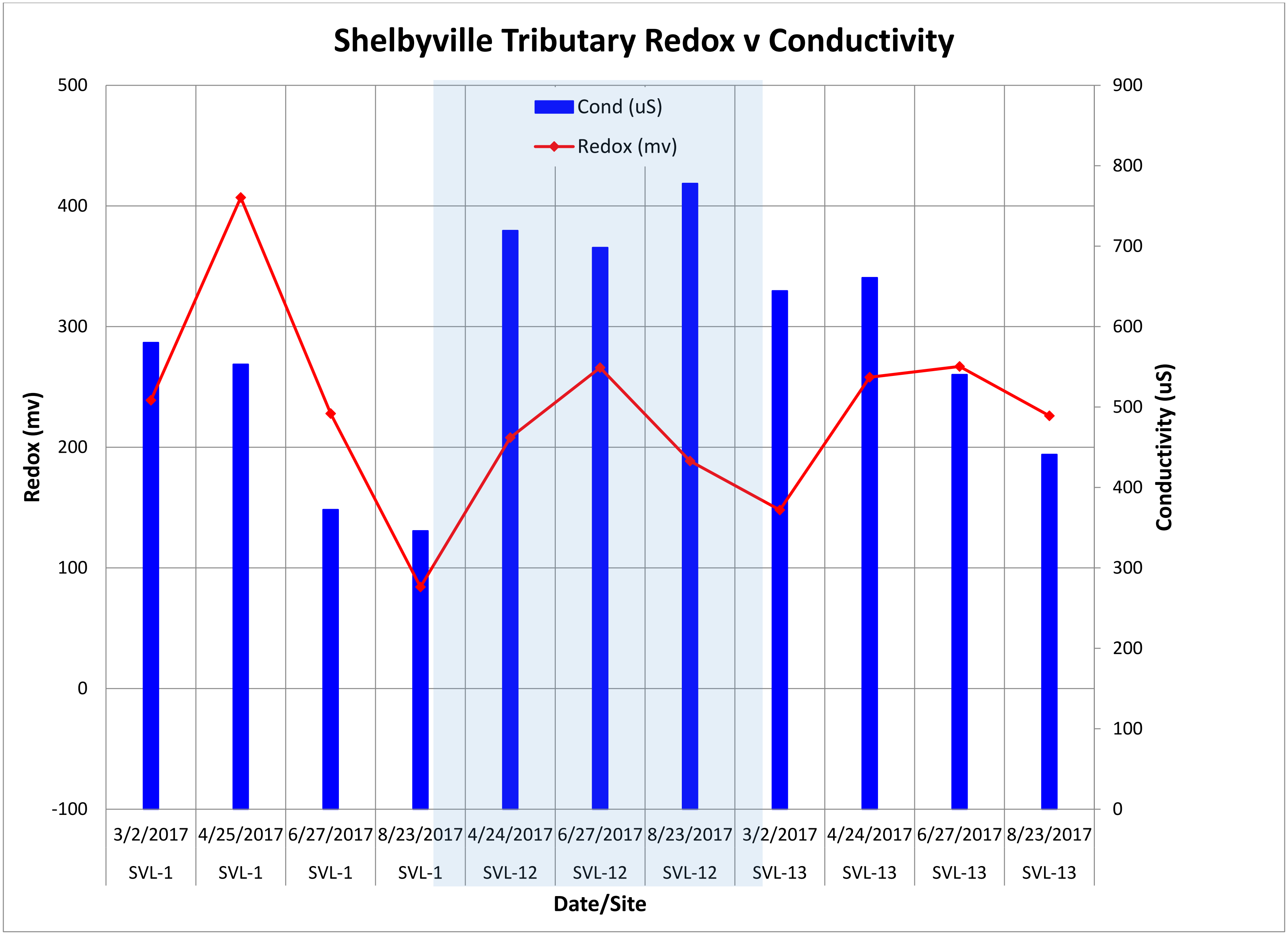

SBV-4 Temp & DO vs Depth
Water Temp (oC)
DO mg/l
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Temp (ºC)
16
14
12
10
8
6
4
2
0
DO (mg/L)
0.4
0.0
1.0
0.0
1.0
2.0
3.0
4.0
0.0
1.0
1.3
3/2/2017
4/25/2017
6/27/2017
8/23/2017
Depth (m)/Date

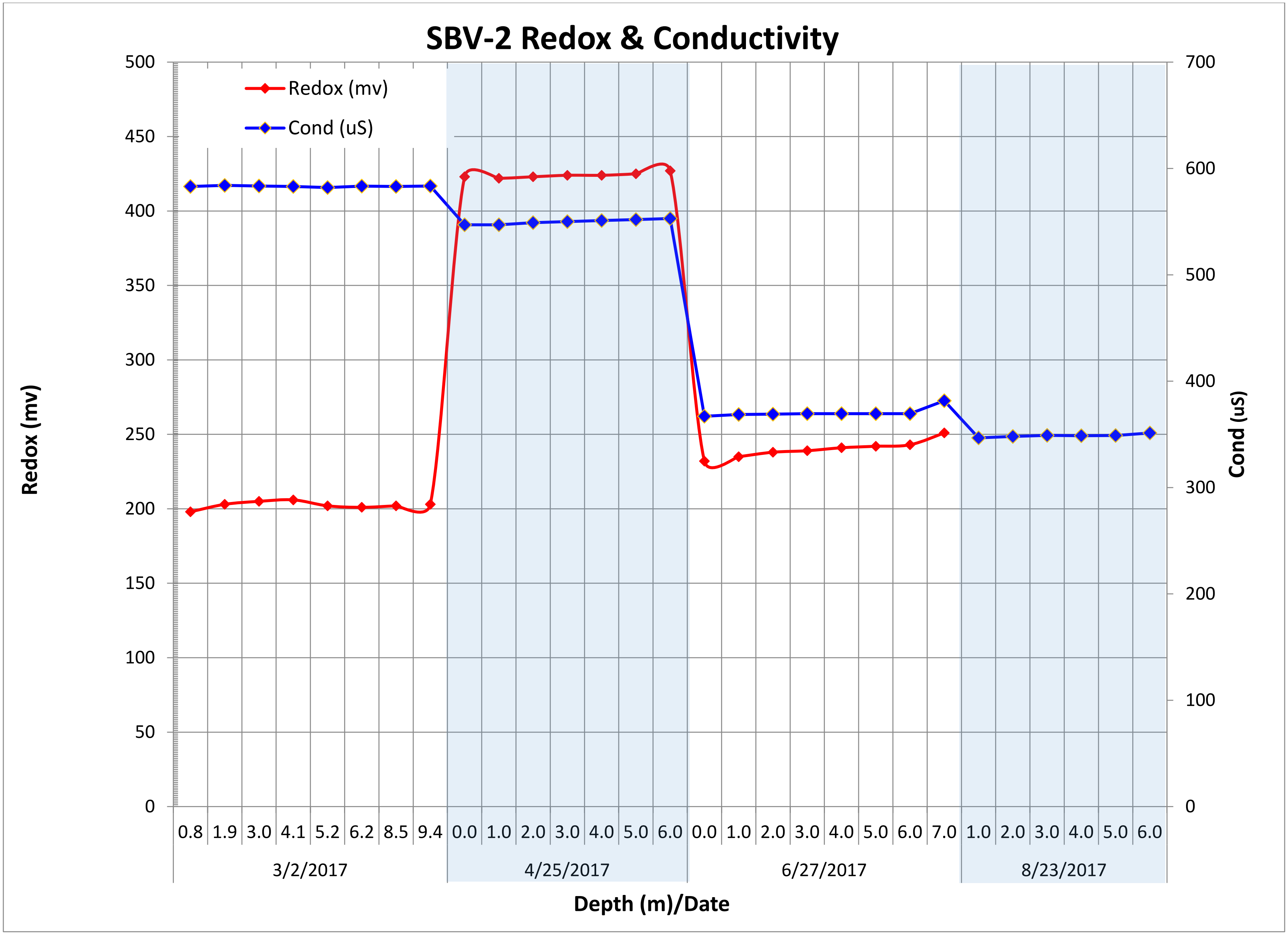


SBV-11 Temp & DO vs Depth
Water Temp (oC)
DO mg/l
Temp (ºC)
DO (mg/L)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
16
14
12
10
8
6
4
2
0
1.3 2.1 3.2 4.0 5.1 6.2
0.0 1.0 2.0 3.0 4.0 5.0
0.0 1.0 2.5 5.5 8.3
0.0 1.0 2.0 3.0 4.0 5.0 6.0
3/2/2017
4/25/2017
6/27/2017
8/23/2017
Depth (m)/Date

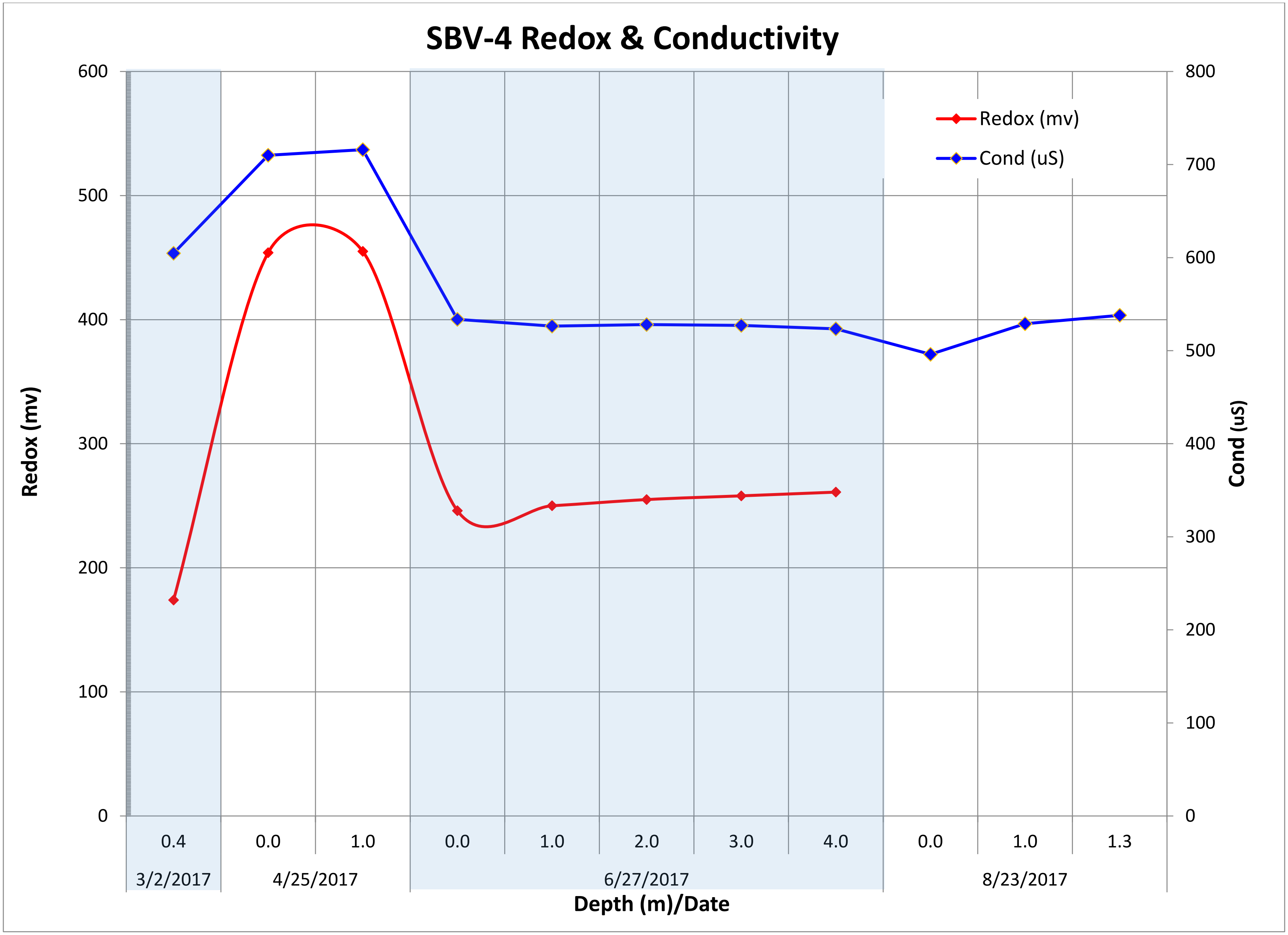

SBV-12 Temp & DO
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Temp (oC)
12
10
8
6
4
2
0
DO (mg/L)
Water Temp (oC)
DO mg/l
0.3
4/24/2017
0.6
6/27/2017
0.2
8/23/2017
Date


SBV-13 Temp & DO
Temp (oC)
DO (mg/L)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
18
16
14
12
10
8
6
4
2
0
Water Temp (oC)
DO mg/l
0.3
3/2/2017
0.3
4/24/2017
0.6
6/27/2017
0.3
8/23/2017
Date

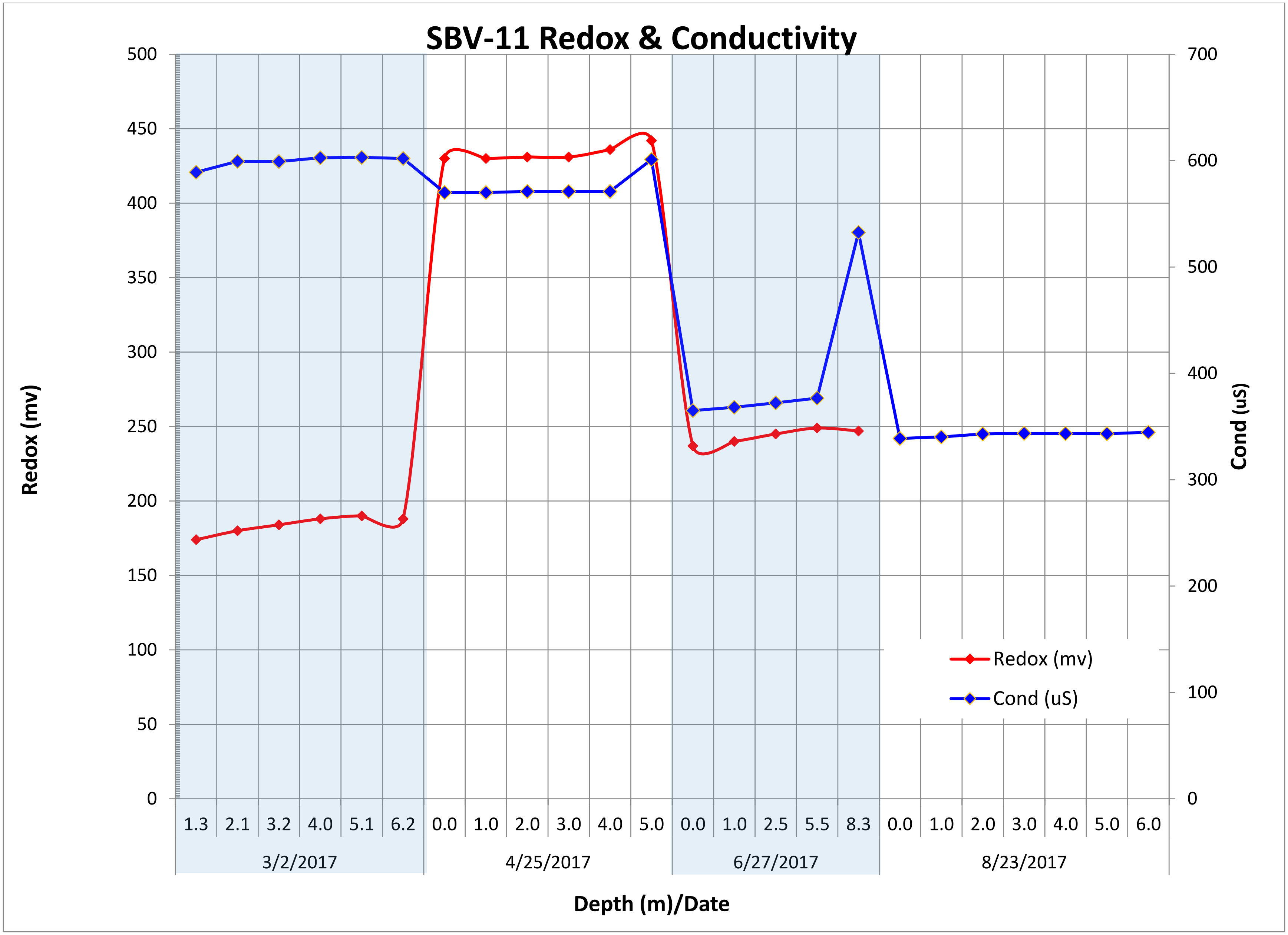

Shelbyville Tributary Redox v Conductivity
Cond (uS)
Redox (mv)
Redox (mv)
Conductivity (uS)
500
400
300
200
100
0
-100
900
800
700
600
500
400
300
200
100
0
3/2/2017
SVL-1
4/25/2017
SVL-1
6/27/2017
SVL-1
8/23/2017
SVL-1
4/24/2017
SVL-12
6/27/2017
SVL-12
8/23/2017
SVL-12
3/2/2017
SVL-13
4/24/2017
SVL-13
6/27/2017
SVL-13
8/23/2017
SVL-13
Date/Site

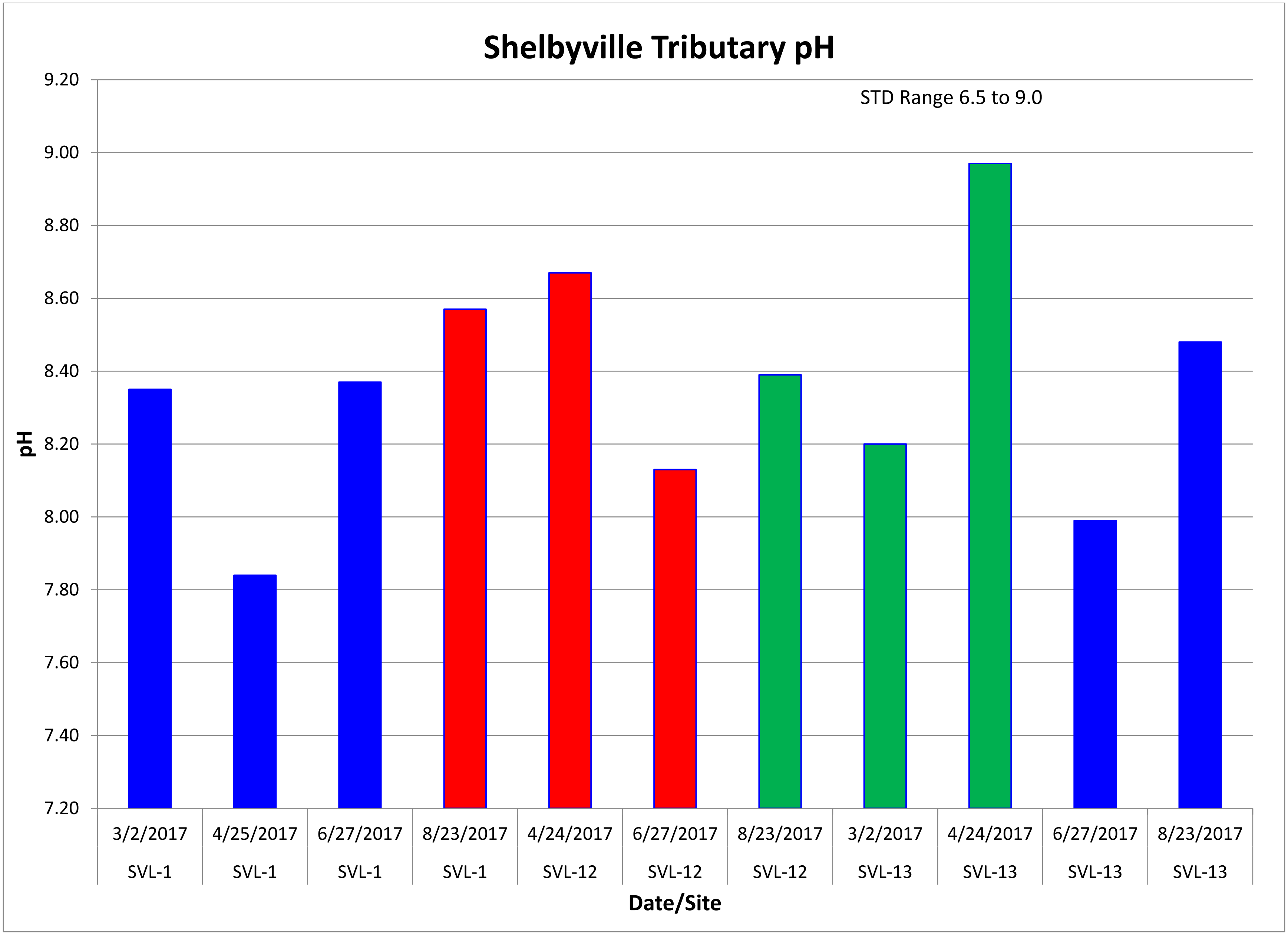


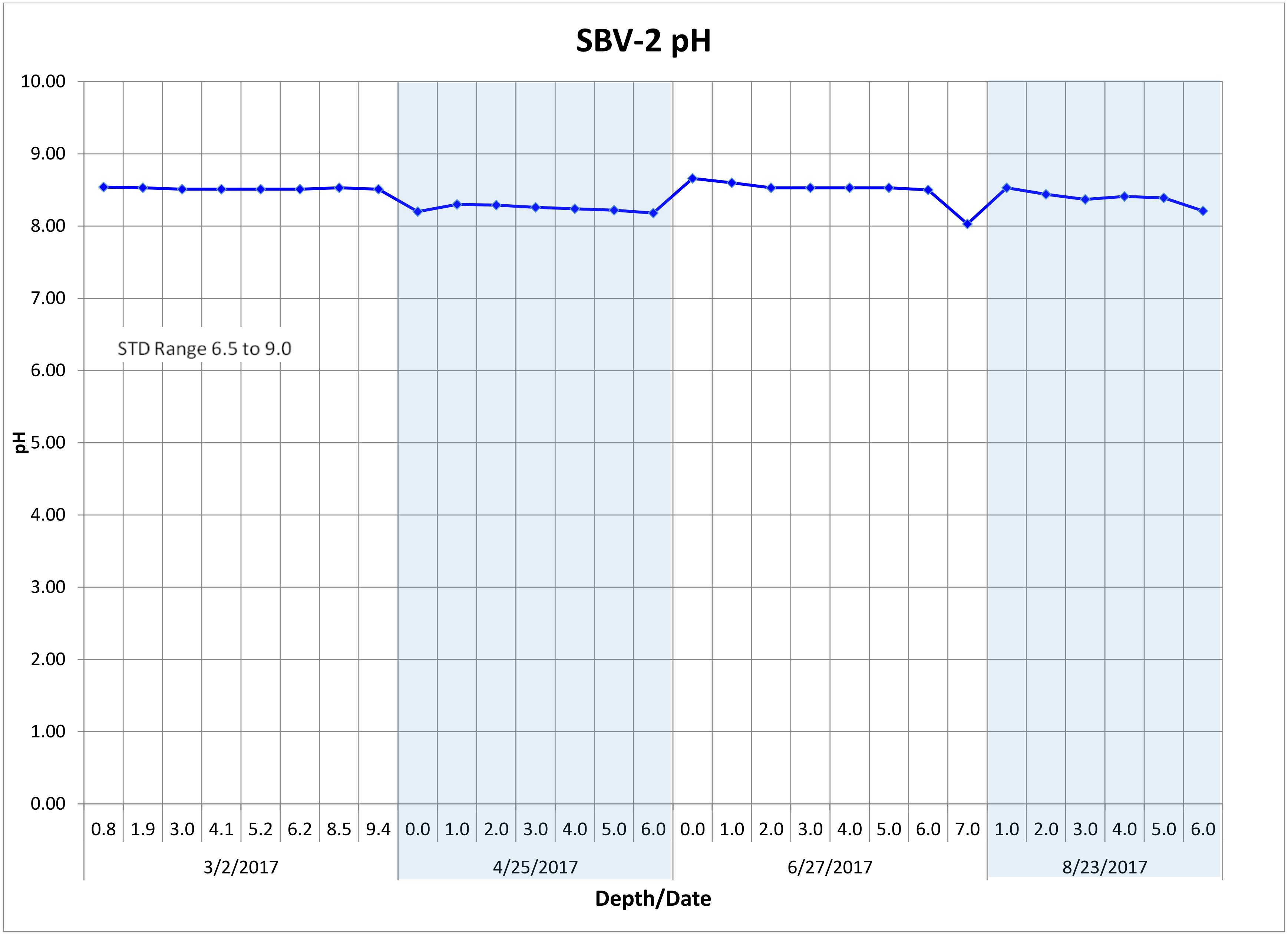
SBV-2 Redox & Conductivity
Redox (mv)
Cond (uS)
500
450
400
350
300
250
200
150
100
50
0
700
600
500
400
300
200
100
0
Redox (mv)
Cond (us)
0.8 1.9 3.0 4.1 5.2 6.2 8.5 9.4
3/2/2017
0.0 1.0 2.0 3.0 4.0 5.0 6.0
4/25/2017
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0
6/27/2017
1.0 2.0 3.0 4.0 5.0 6.0
8/23/2017
Depth (m)/Date

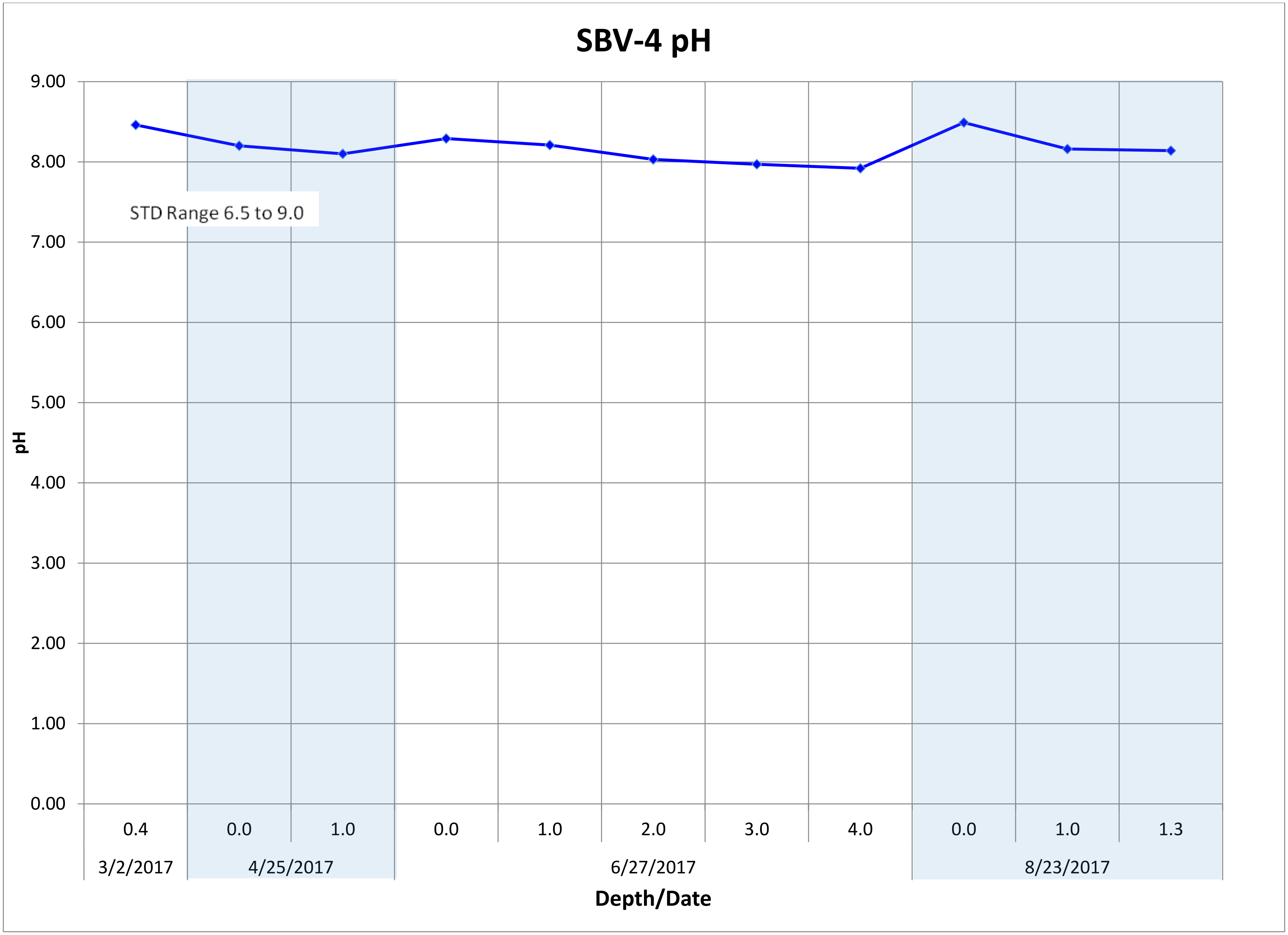


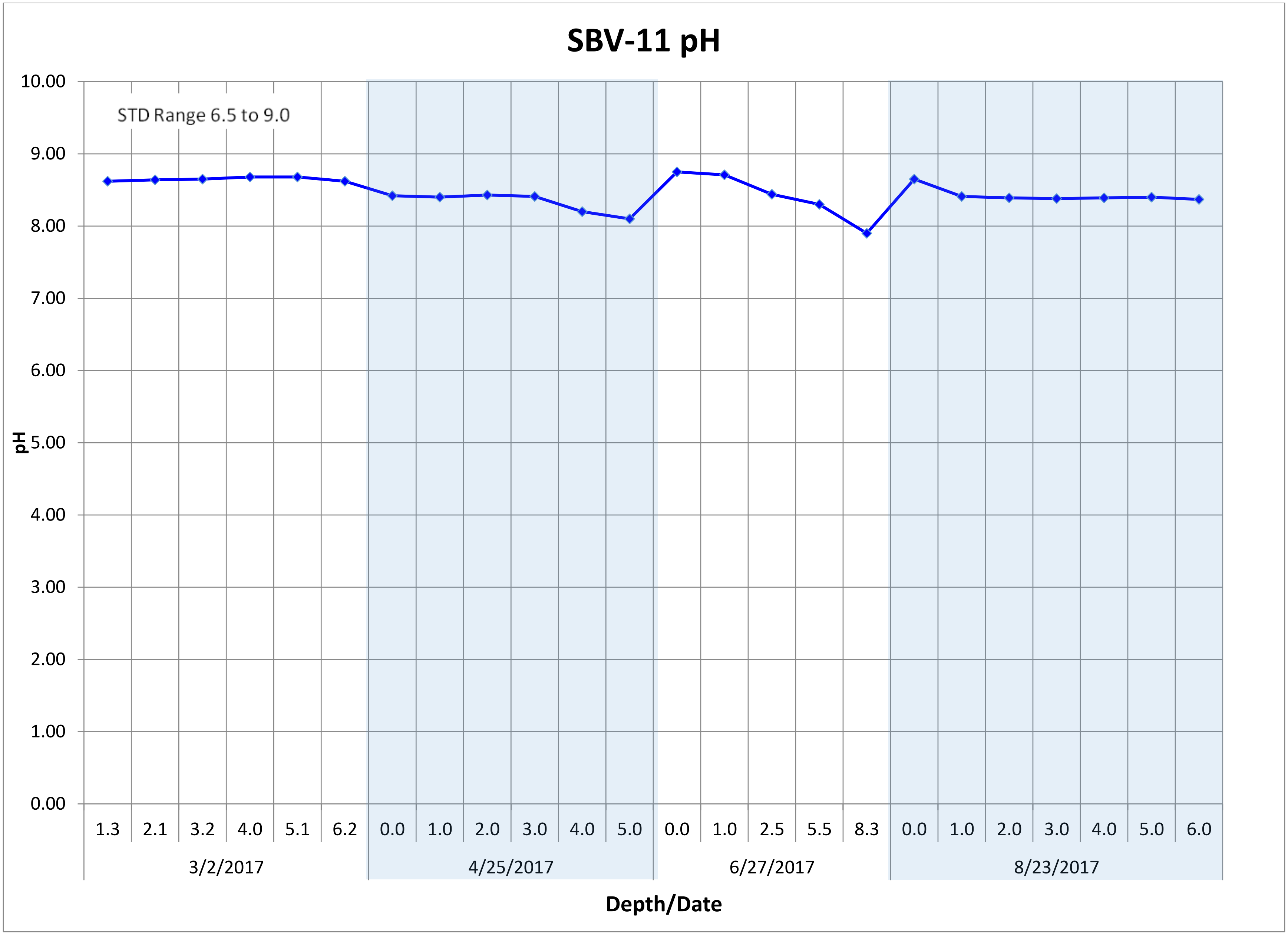
SBV-4 Redox & Conductivity
Redox (mv)
Cond (uS)
600
500
400
300
200
100
0
800
700
600
500
400
300
200
100
0
0.4
0.0
1.0
0.0
1.0
2.0
3.0
4.0
0.0
1.0
1.3
3/2/2017
4/25/2017
6/27/2017
8/23/2017
Depth (m)/Date
Redox (mv)
Cond (uS)


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
1.3 2.1 3.2 4.0 5.1 6.2 0.0 1.0 2.0 3.0 4.0 5.0 0.0 1.0 2.5 5.5 8.3 0.0 1.0 2.0 3.0 4.0 5.0 6.0
3/2/2017
4/25/2017
6/27/2017
8/23/2017
Depth (m)/Date
Redox (mv)
Cond (uS)

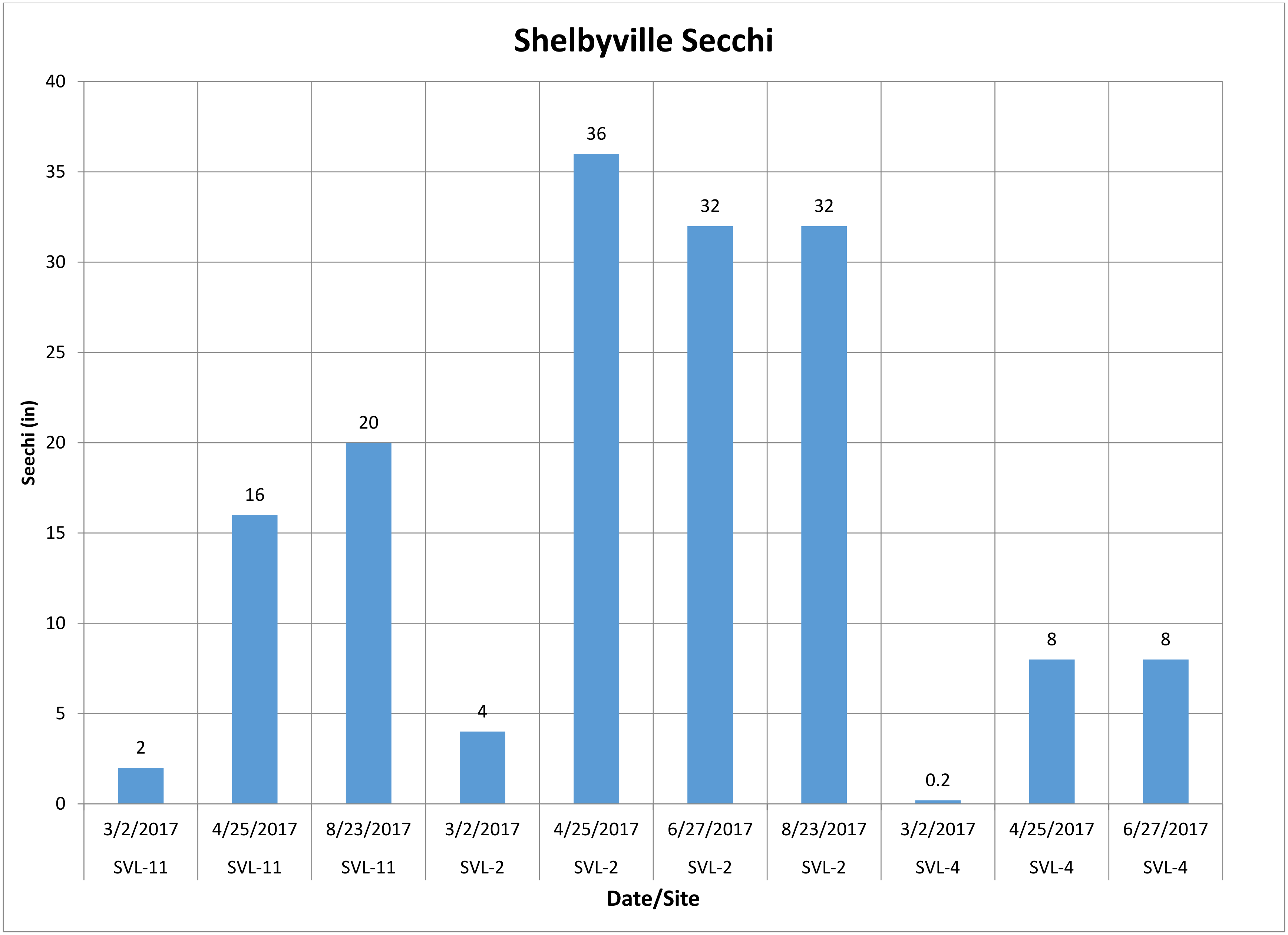

Shelbyville Tributary pH
STD Range 6.5 to 9.0
pH
9.20
9.00
8.80
8.60
8.40
8.20
8.00
7.80
7.60
7.40
7.20
3/2/2017 SVL-1
4/25/2017 SVL-1
6/27/2017 SVL-1
8/23/2017 SVL-1
4/24/2017 SVL-12
6/27/2017 SVL-12
8/23/2017 SVL-12
3/2/2017 SVL-13
4/24/2017 SVL-13
6/27/2017 SVL-13
8/23/2017 SVL-13
Date/Site

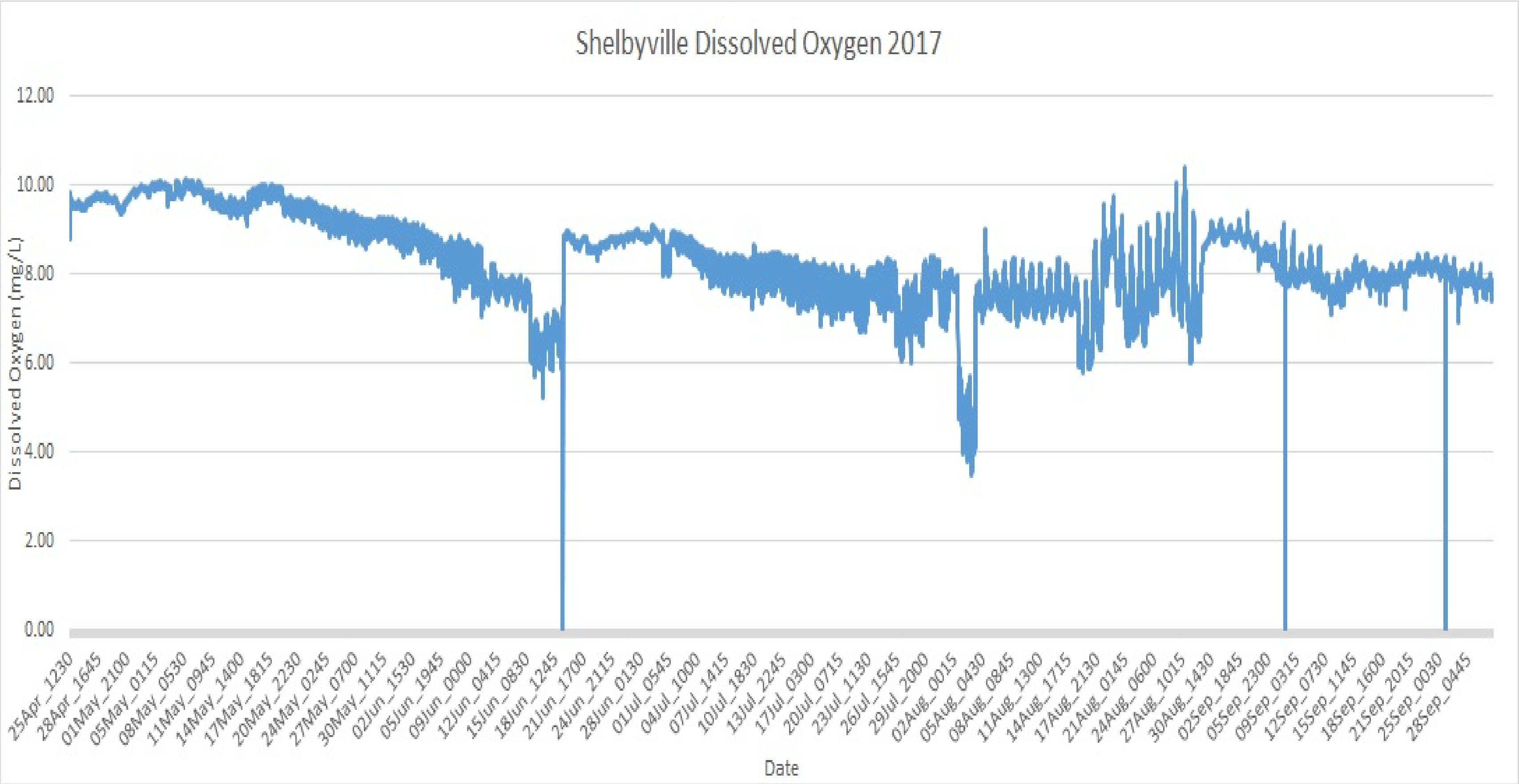

SBV-2 pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
pH
STD Range 6.5 to 9.0
0.8 1.9 3.0 4.1 5.2 6.2 8.5 9.4 0.0 1.0 2.0 3.0 4.0 5.0 6.0 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 1.0 2.0 3.0 4.0 5.0 6.0
3/2/2017
4/25/2017
6/27/2017
8/23/2017
Depth/Date


SBV-4 pH
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
pH
STD Range 6.5 to 9.0
0.4
0.0
1.0
0.0
1.0
2.0
3.0
4.0
0.0
1.0
1.3
3/2/2017
4/25/2017
6/27/2017
8/23/2017
Depth/Date



SBV-11 pH
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
pH
STD Range 6.5 to 9.0
1.3 2.1 3.2 4.0 5.1 6.2
3/2/2017
0.0 1.0 2.0 3.0 4.0 5.0
4/25/2017
0.0 1.0 2.5 5.5 8.3
6/27/2017
0.0 1.0 2.0 3.0 4.0 5.0 6.0
8/23/2017
Depth/Date

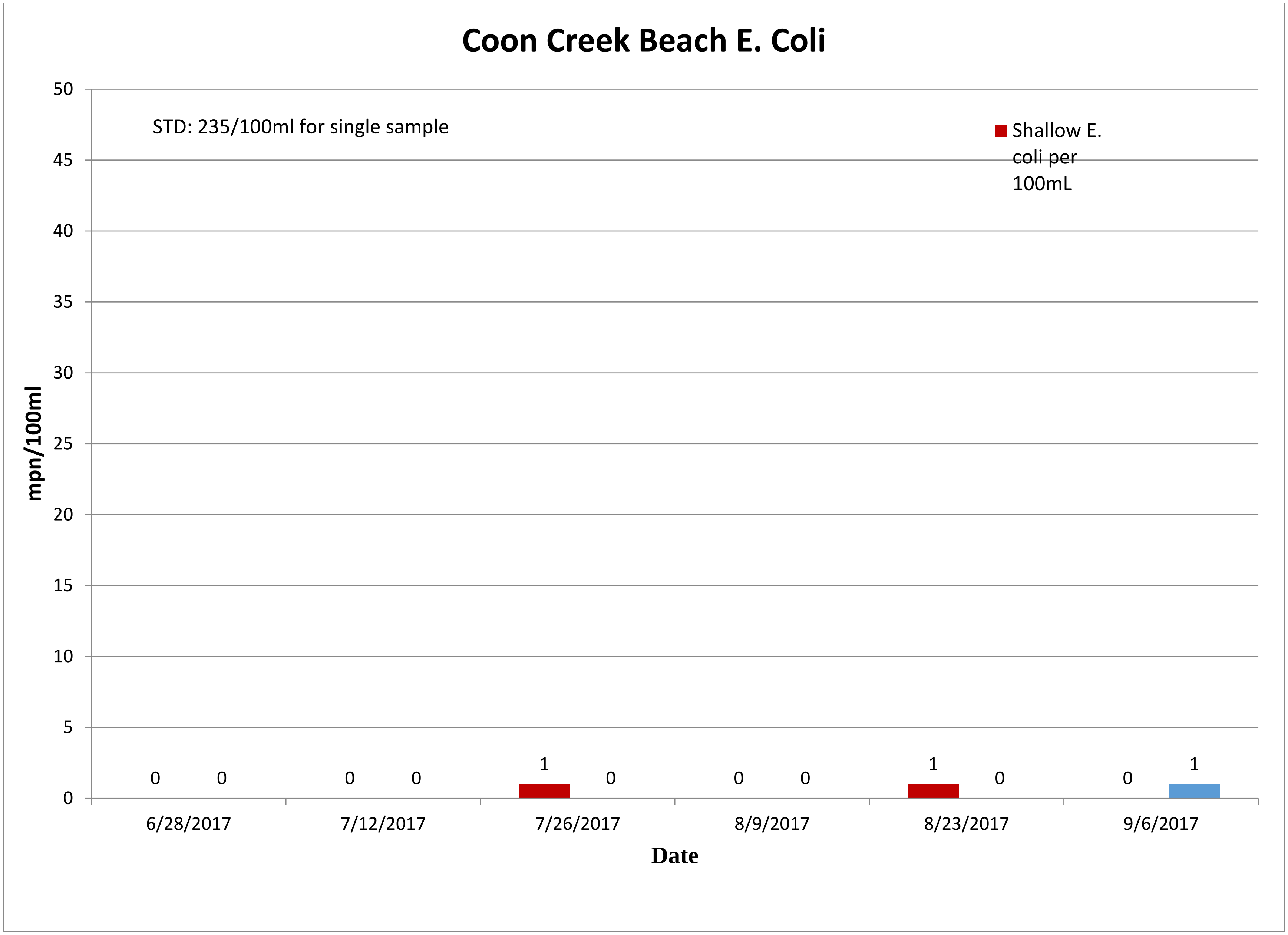

Shelbyville Secchi
Seechi (in)
40
35
30
25
20
15
10
5
0
2
16
20
4
36
32
32
0.2
8
8
3/2/2017
SVL-11
4/25/2017
SVL-11
8/23/2017
SVL-11
3/2/2017
SVL-2
4/25/2017
SVL-2
6/27/2017
SVL-2
8/23/2017
SVL-2
3/2/2017
SVL-4
4/25/2017
SVL-4
6/27/2017
SVL-4
Date/Site



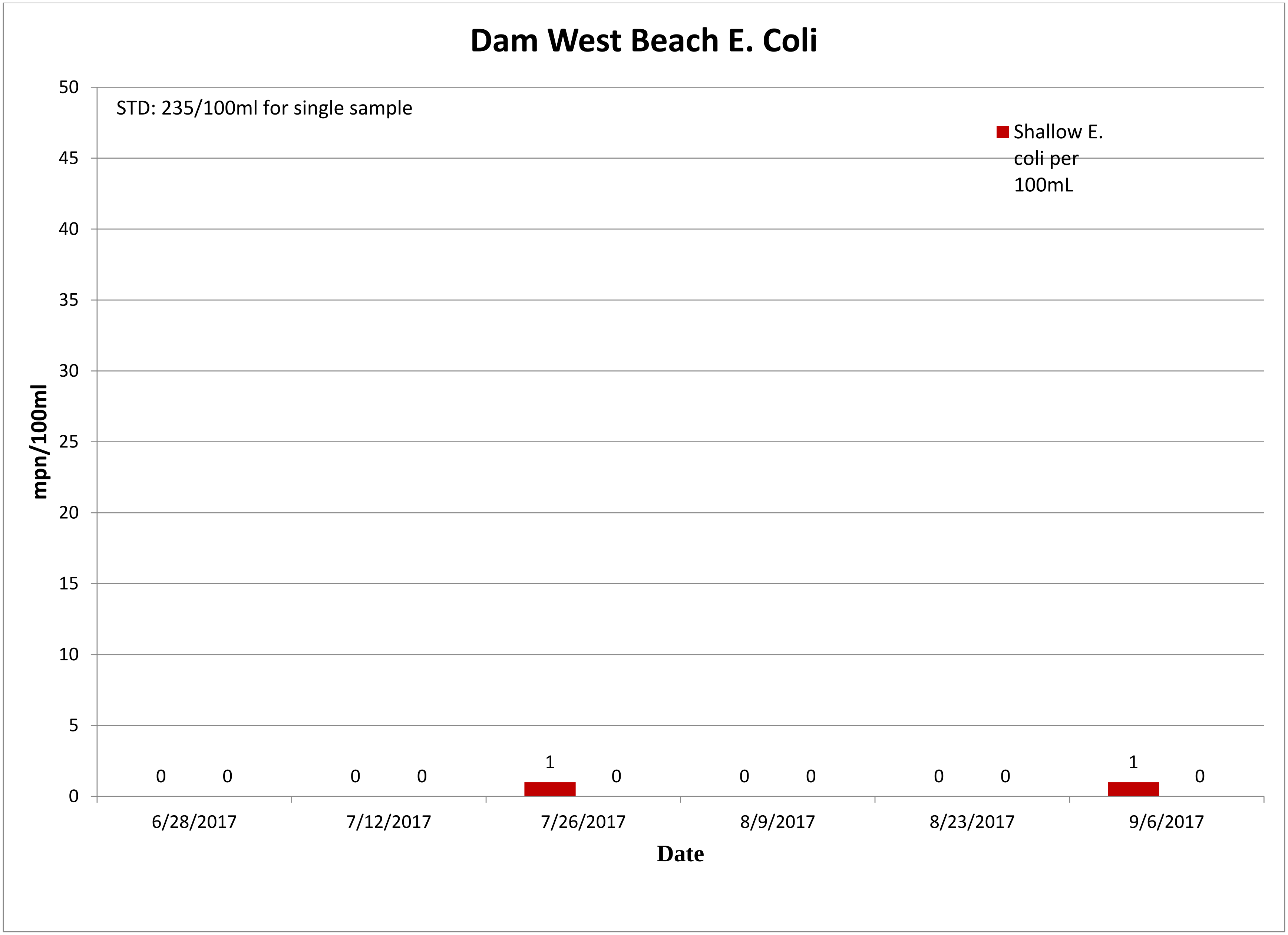
Dissolved Oxygen in spillway as monitored by remote sonde.

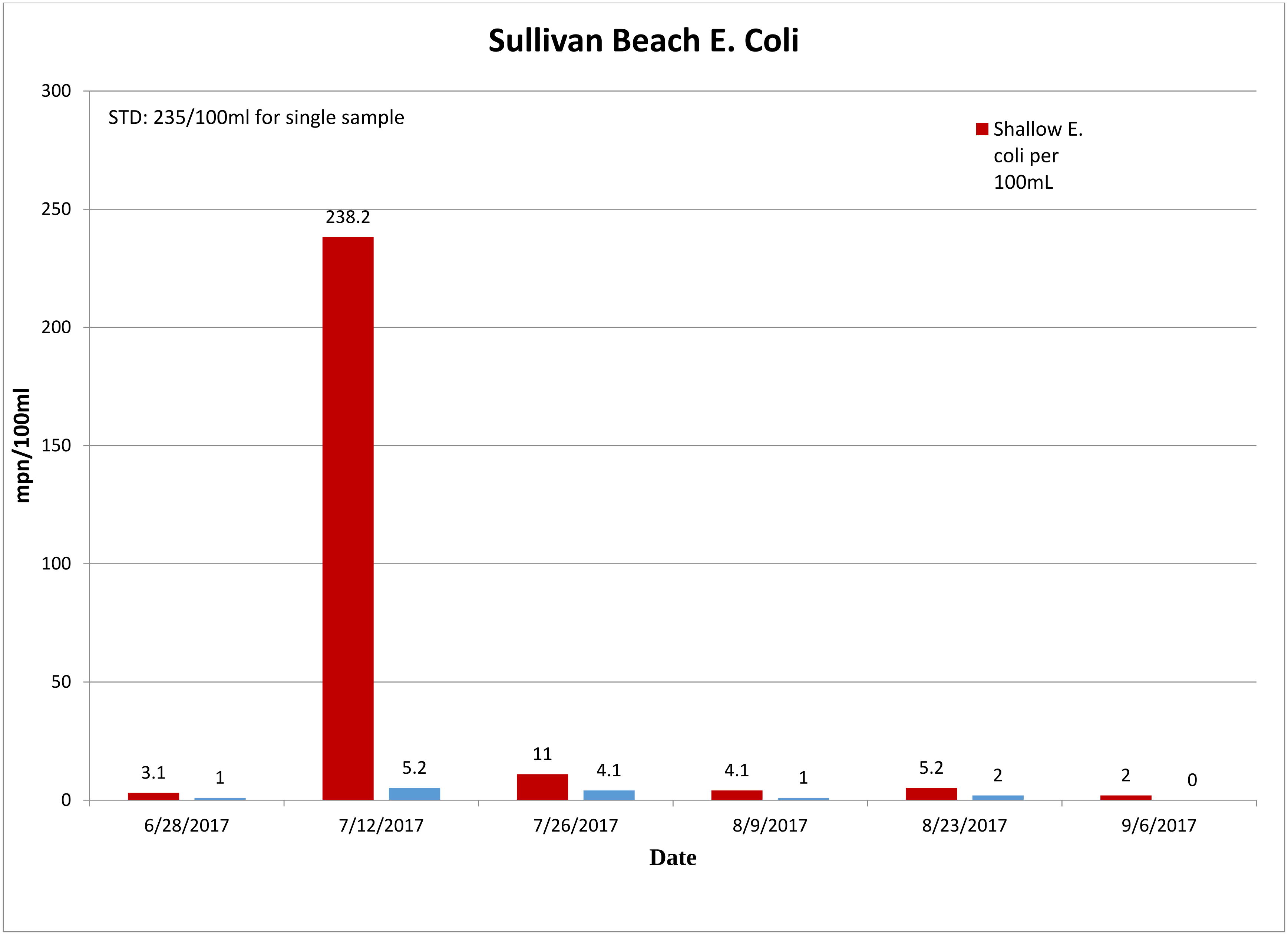
APPENDIX D

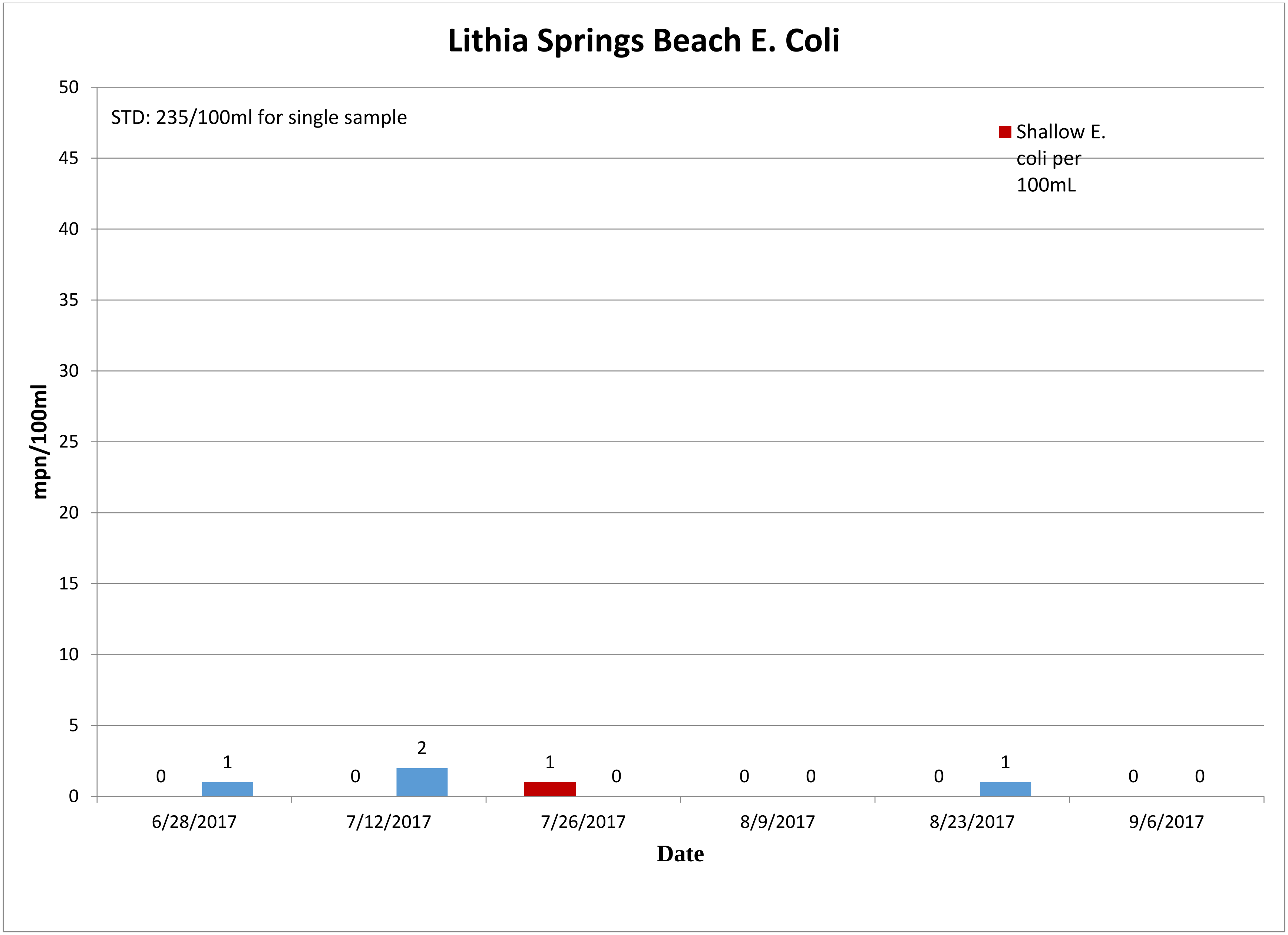
BEACH GRAPHS



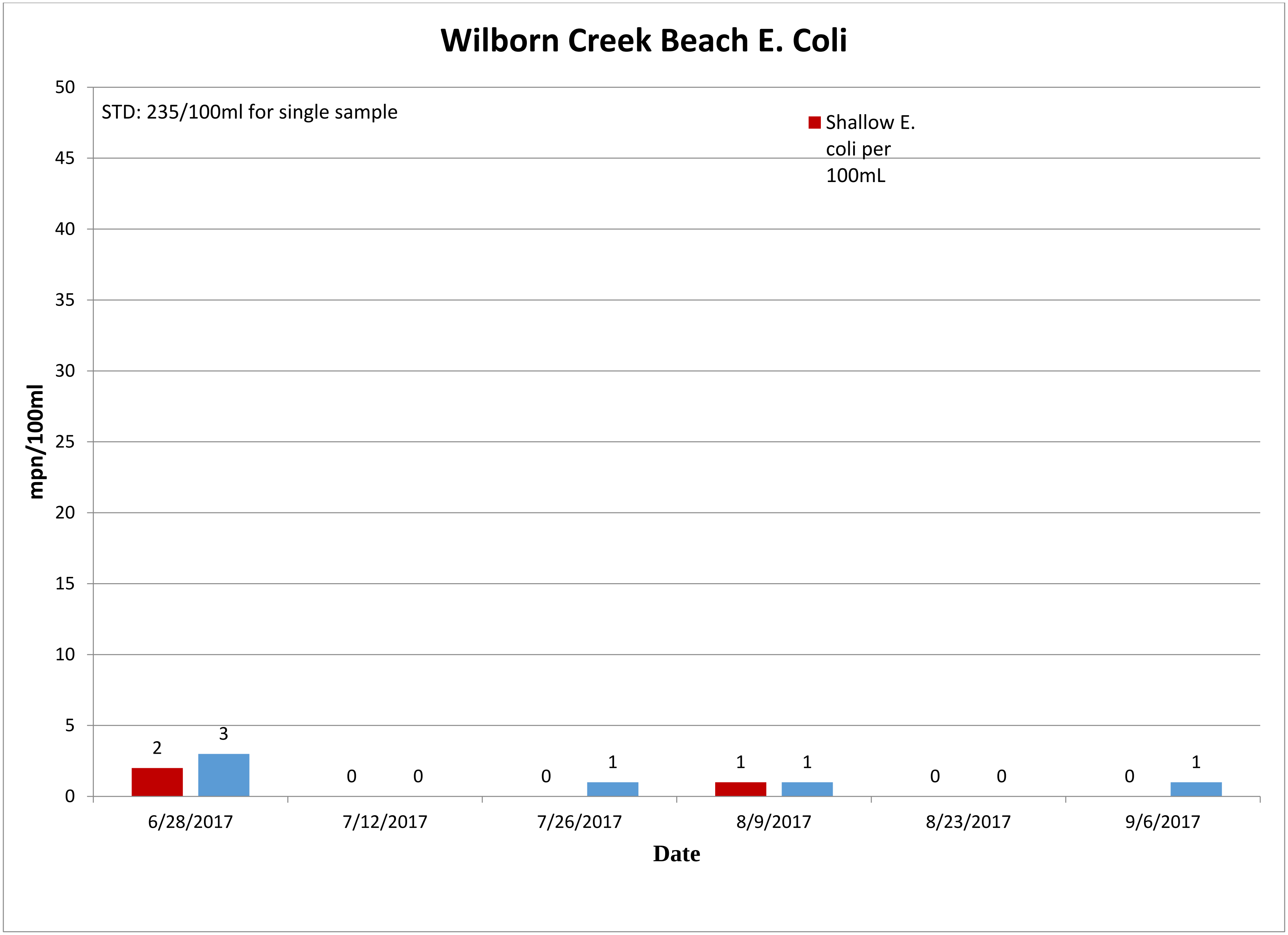
Coon Creek Beach E. Coli
STD: 235/100ml for single sample
Shallow E. coli per 100mL
mpn/100ml
50
45
40
35
30
25
20
15
10
5
0
0 0 0 0 1 0 0 0 1 0 0 1
6/28/2017
7/12/2017
7/26/2017
8/9/2017
8/23/2017
9/6/2017
Date


Dam West Beach E. Coli
STD: 235/100ml for single sample
Shallow E. coli per 100mL
mpn/100ml
50
45
40
35
30
25
20
15
10
5
0
0 0 0 0 1 0 0 0 0 0 1 0
6/28/2017
7/12/2017
7/26/2017
8/9/2017
8/23/2017
9/6/2017
Date


Sullivan Beach E. Coli
STD: 235/100ml for single sample
Shallow E. coli per 100mL
mpn/100ml
300
250
200
150
100
50
0
238.2
3.1
1
5.2
11
4.1
4.1
1
5.2
2
2
0
6/28/2017
7/12/2017
7/26/2017
8/9/2017
8/23/2017
9/6/2017
Date



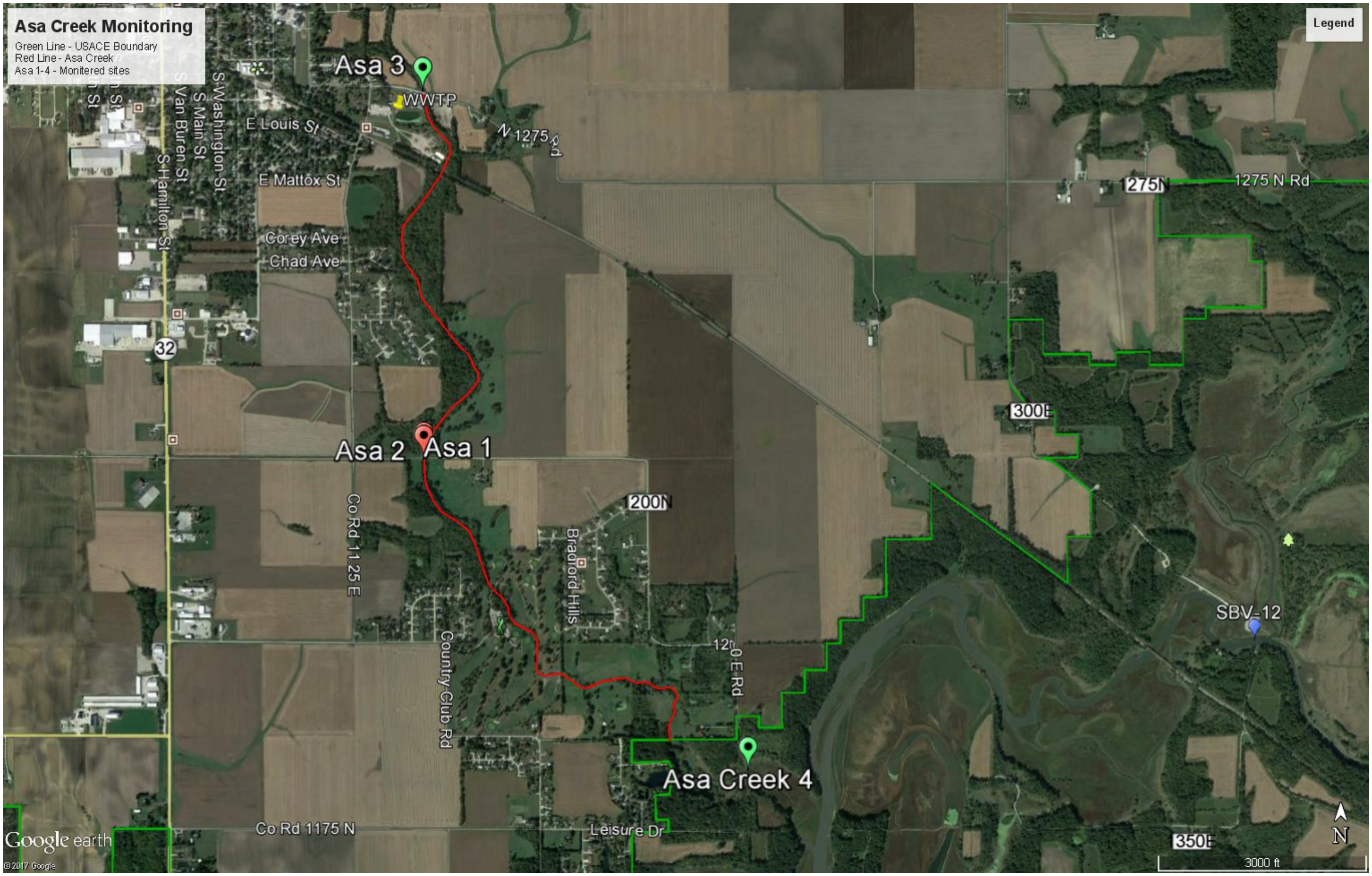
Lithia Springs Beach E. Coli
STD: 235/100ml for single sample
Shallow E. coli per 100mL
mpn/100ml
50
45
40
35
30
25
20
15
10
5
0
0
1
0
2
1
0
0
0
0
1
0
0
6/28/2017
7/12/2017
7/26/2017
8/9/2017
8/23/2017
9/6/2017
Date


Wilborn Creek Beach E. Coli
STD: 235/100ml for single sample
Shallow E. coli per 100mL
mpn/100ml
50
45
40
35
30
25
20
15
10
5
0
2
3
0
0
0
1
1
1
0
0
0
1
6/28/2017
7/12/2017
7/26/2017
8/9/2017
8/23/2017
9/6/2017
Date

APPENDIX E

WASTE WATER TREATMENT PLANT ISSUE SULLIVAN

MAP & INITIAL DATA



Asa Creek Monitoring
Green Line - USACE Boundary
Red Line - Asa Creek
Asa 1-4 - Monitered sites
Legend
Asa 3
WWTP
E Louis St
N 1275 Rd
E Mattox St
Corey Ave
Chad Ave
S Van Buren St
S Main St
S Washington St
S Hamilton St
32
1275N
1275 N Rd
300E
Asa 2
Asa 1
200N
Co Rd 11 25 E
Bradford Hills
Country Club Rd
SBV-12
Asa Creek 4
Co Rd 1175 N
Leisure Dr
350E
N
3000 ft
Google earth
© 2017 Google

USACE Lake Shelbyville / Asa Creek Tributary Monitoring: Sullivan Treatment Plant to Lake. Fall 2017

Time	Site	Date	Water Temp (oC)	Dissolved Oxygen (%)	Dissolved Oxygen mg/L	Specific Conductivity uS/cm	Total Dissolved Solids	pH	Oxidation Reduction Potential	Turbidity (FNU)	Depth (meters)	Notes
1037	Asa 1	10/26/2017	11.00	18.90	2.08	727	472.6	7.57	134.00	8.60	0.13	Just upstream of 1200/country club rd bridge. DO is very low.
1043	Asa 2	10/26/2017	10.90	27.90	3.07	713	463.2	7.71	121.20	7.90	0.09	Just downstream of 1200/country club rd bridge. DO is very low.
1115	Asa 3	10/26/2017	na	na	na	na	na	na	na	na	na	Just upstream of WWTP effluent. Data measured on site, but equipment failed to log. Technician noted all parameters were well within normal limits for good water quality.
1130	Asa 4	10/26/2017	na	na	na	na	na	na	na	na	na	Data measured on site, but equipment failed to log. Technician noted all parameters were well within normal limits for good water quality.
1005	Asa 3	11/16/2017	6.60	75.00	9.18	532	345.92	8.02	292.30	2.40	0.09	Just upstream of WWTP effluent.
1010	Asa WWTP effluent (Ac4e)	11/16/2017	12.70	83.60	8.85	637	414.23	7.94	136.50	21.10	0.06	Bottom algea present on sediment.
1025	Asa 1	11/16/2017	8.20	46.00	5.41	637	414.1	7.62	176.60	3.70	0.01	Just upstream of 1200/country club rd bridge
1031	Asa 2	11/16/2017	8.00	52.90	6.25	619	402.527	7.74	161.90	3.60	0.70	Just downstream of 1200/country club rd bridge
1037	Asa 5	11/16/2017	8.10	52.90	6.23	620	402.7	7.76	164.20	3.90	0.21	Located approximately 40' downstream of 1200 bridge. Bottom algea present on sediment. 'Sewer' smell on water.
1112	Asa golf course 1 (Acg1)	11/16/2017	8.10	62.70	7.36	619	402.432	7.81	173.00	4.20	0.14	Bottom algea present on sediment.
1130	Asa 4	11/16/2017	na	na	na	na	na	na	na	na	na	Site not accessable due to hunting. Took readings at Golf Course just upstream instead.