2016

REND 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. Rend Lake is located in Franklin and Jefferson Counties of southern Illinois. The dam is located on the Big Muddy River, 103.7 miles upstream from its confluence with the Mississippi River and approximately 3 miles northwest of Benton, Illinois. At pool elevation 405, the lake has a water surface area of 18,900 acres, shoreline of 162 miles and is 13 miles long. Two sub-impoundment dams are located on the Big Muddy and Casey Fork tributaries in the upper reaches of the lake. The State of Illinois is responsible for managing and maintaining these sub-impoundment dams. These dams are operated to maximize wildlife management and development. The lake is also a source for a public water supply.

The water of Rend Lake and the downstream river channel is generally good or within acceptable limits as recommended by the state of Illinois. The lake is a shallow reservoir susceptible to high winds. These conditions prevent the lake from stratifying for long periods during the summer months.

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. All other sampling sites met the appropriate state standards during 2016 with the following exceptions. Phosphorus was high at sites 2, 2-5, 3, 4, and 8. Total Suspended Solids (TSS) was high at 3, 4, and 8. Manganese was high at site 1. E. coli levels exceeded state standards at Dale Miller Beach (August), Marina Beach (August), and South Sandusky Beach (3 occurrences in August). Dissolved oxygen was low below the dam at site 1 on June 28 and September 20, 2016. Phosphorus and TSS levels have exceeded the state standard on a routine basis. Prior to each E. coli exceedance there were significant rain events either during sampling or within 24 to 72 hours. Routine water quality monitoring will continue to check future degradation of the watershed.

WATER QUALITY MONITORING PROGRAM

1.1 GENERAL OVERVIEW

This report summarizes water quality activities of the St. Louis District for Fiscal Year 2016 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 Sections major responsibilities. The objective is to maintain a reasonable environmental monitoring program for the Mississippi River and the 5 lakes under the St. Louis District's control. The District's reservoirs consist of Mark Twain and Wappapello Lakes in Missouri, and Shelbyville, Carlyle and Rend Lakes in Illinois. Water quality sampling is conducted within the lakes and their tributaries to establish trend analysis and to maintain water quality at or above state and federal regulations.

The main objective is to provide technical expertise of an environmental nature to all Corps elements requesting assistance in accordance with ER 1110-2-8154. This would include updating the water quality management priorities for the district's projects to ensure water quality meets the state and federal regulations, for protection of human health and the environment, and for the safety and economic welfare of those at Corps projects. Ongoing goals include ensuring that downstream water quality meets all state and federal regulations, and 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 typically monitor the three Corps lakes in Illinois. 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 Rend Lake impaired for total suspended solids, and total phosphorus. The lists of sources for these impairments are urban runoff, crop production, shore modifications, recreational pollution, and unknown sources. 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. In addition, much of the Big Muddy River downstream of Rend Lake is listed as impaired for sedimentation, sulfates, fecal coliform, TSS, dissolved oxygen, phosphorus, iron, and manganese.

1.2 INTRODUCTION

Rend Lake is within the Big Muddy River basin in south central Illinois. The lake serves as a heavy recreational usage lake and as a water supply to numerous communities. The land surrounding the lake is used predominately for agriculture and mining. Surrounding communities have existing industrial/commercial operations and residents which discharge wastewater into municipal wastewater treatment plants that ultimately discharge treated water into the Big Muddy River basin. Agricultural and coal mine runoff and municipal wastewater treatment facilities are the primary potential source of pollution into the Rend Lake watershed. Additional sources are marinas, nearby subdivisions, industrial activities, recreational watercraft discharges and the golf course adjacent to the lake property.

Water quality monitoring was conducted during 2016 to assure safe conditions for human recreation, wildlife and aquatic life as maintained and managed within the lake system. In 2016 3 sampling events were conducted at seven sites took place between April and September. The sampling sites include the following: Site 1 (Ren-1) Spillway, Site 2 (Ren-02) Lake side in front of Dam, Site 3 (Ren-3) Casey Fork Arm near Ina, Site 4 (Ren-4) Big Muddy Arm, Site 5 (Ren-5) Big Muddy at Hwy 15, Site 7 (Ren-7), Casey Fork at Hwy 37, and Site 8 (Ren-8), Gun Creek Arm. During the sampling period one site was selected for quality control duplication and denoted as REN-15. The locations of the seven sampling sites are depicted on the lake map in Figure 1.

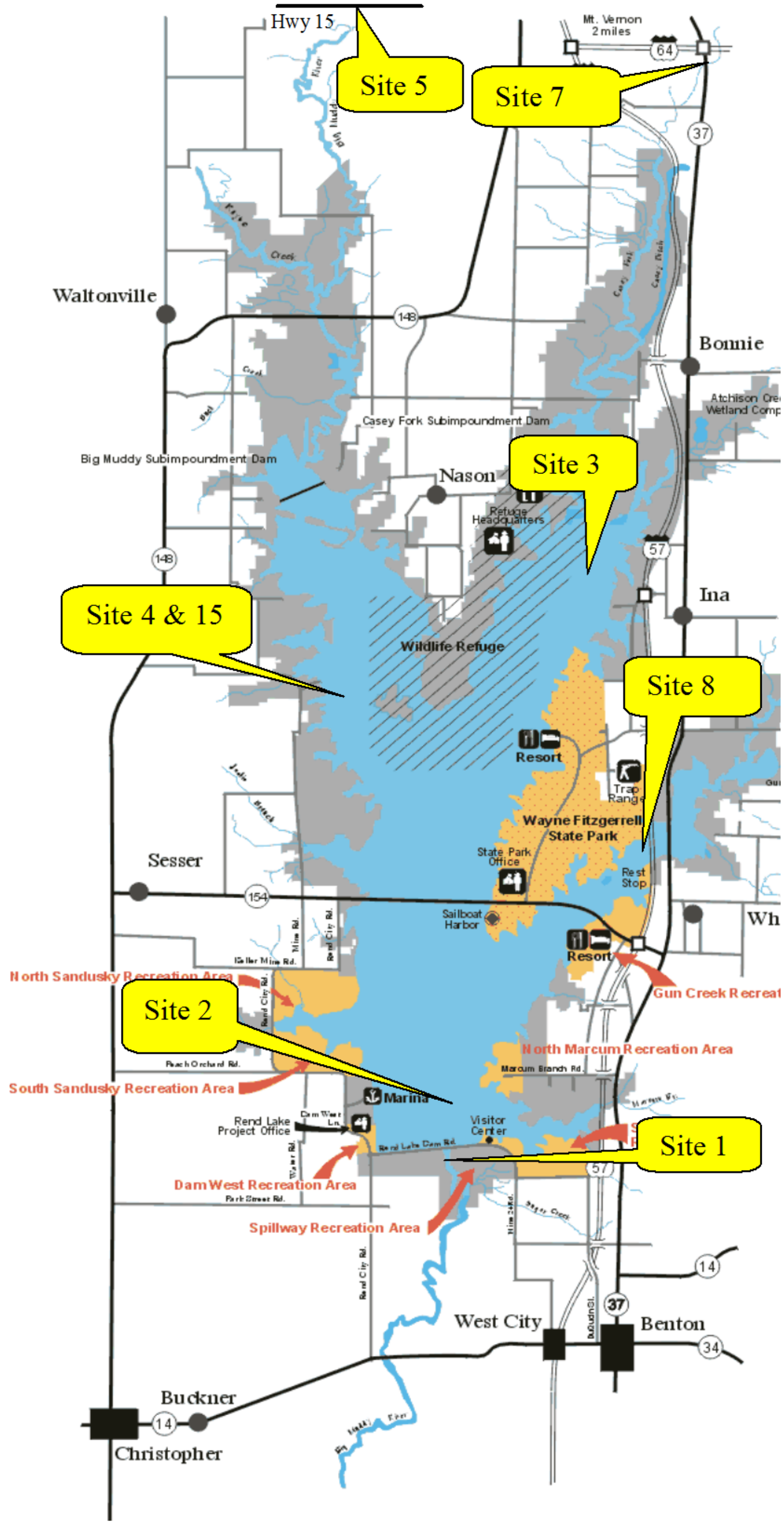


Figure 1
Location of sample sites

2.1 WATER QUALITY ASSESSMENT CRITERIA

2.2 Water Quality

The water quality assessment criteria, which has 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 samplings and analysis which were conducted at the Rend Lake sites reflect the minimal set of parameters needed to analyze the current status of water quality for the Rend Lake system.

The following parameters were analyzed in the Fiscal Year 2016 sampling at Rend Lake: Total Organic Carbon (TOC), iron, manganese, ammonia-nitrogen, nitrate-nitrogen, orthophosphate, total phosphate, Total Suspended Solids (TSS), Total Volatile Suspended Solids (TVSS), Escherichia coliform (E. coli), pH, temperature, dissolved oxygen, specific conductance, oxidation-reduction potential (ORP), chlorophyll, pheophytin-a, and 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 Chronic
Metolachlor	1.7mg/L Acute

Simazine	4.0ug/L [1]
Trifluralin	26ug/L Acute; 1.1ug/L Chronic

[1] Drinking Water Standard
[2] Acute
[3] Chronic

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, IEPA 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. 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. EPA's current guidance as of December 2016 for recreational Ambient Water Quality Criteria (AWQC) for Cyanotoxins is 4ug/L for microcystins and 8ug/L for Cylindrospermopsin.

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.

2.3 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 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

The monitoring program for Rend Lake during Fiscal Year 2016 revealed good water quality when compared to limits established by the IEPA for general use, secondary contact, and indigenous aquatic life. Agricultural nutrient runoffs were primary concerns for the lake's water quality. Better land management practices, erosion control and buffering zones are methods used to reduce such contaminants from entering the lake. Normally seasonal change brings on gradual lake stratification during the summer months.

E. coli are sampled at the marinas to ensure that the marina areas are not being contaminated by boats with restroom facilities. The E. coli samples that were taken at Dam West Marina were well within the Illinois standard of 235 per 100ml of sample water. In addition, the project office samples the swimming beaches every 2 weeks during the recreation season. The E. coli standard of 235 per 100ml was exceeded at Dale Miller Beach on August 3, Marina Beach on August 17, and South Sandusky Beach on August 3, 16, and 19. All subsequent samples were within the Illinois state standard. Rainfall events can trigger high levels of E. coli. Records indicate rain events preceded each of these dates where there were exceedances except the August 19 sample at South Sandusky.

Total iron and total manganese are sampled above the dam near the bottom of the channel (Ren-2-5) and in the spillway area (Ren-1). As was previously stated living organisms require trace amounts of metals, however excessive amounts can be harmful to the organism. All samples of iron and all but one sample of manganese were within the state standards during the 2016 sampling season. On June 28, 2016 manganese was measured at 6.4mg/l at site 1 below the dam. This is well above the state standard of 1.0mg/l, but is considered an outlier since the other measurements there were 0.39mg/l on April 19, 2016 and 0.25mg/l on September 20, 2016. Iron cycling is a function of oxidation-reduction processes. Elevated levels of iron near the bottom of the lake is not detrimental to the overall lake system unless maintained for a prolong period of time. Iron oxidizes relatively rapidly (minutes to hours); therefore any iron released through the spillway will be oxidized in a short period of time.

Nitrogen and phosphates are sampled at all sites. Nitrates did not exceed the state standard, however they are higher in the upper portion of the lake particularly in the tributaries. The 2016 phosphate results at the lake sites were above the 0.05 mg/L standard. Because phosphorus in water is not considered directly toxic to humans and animals 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. The nitrate levels of the Casey Fork (Ren-7) and Big Muddy (Ren-5) tributaries are considerably higher compared to the results of the other sites. This may be due to the fact that these tributaries are within watersheds consisting mainly of farm land, which may use large quantities of fertilizers. The lake appears to capture and use up nitrogen which reduces nutrient levels released from the lake. This reduction of nutrient levels traveling down stream results in an improvement of water quality. 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 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.

Chlorophyll *a* was sampled at 4 sites, Ren-2, Ren-3, Ren-4, Ren-8 and Ren-15 (duplicate of Ren-4). 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. 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. Illinois does not currently have a standard for chlorophyll. 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. EPA's current guidance as of December 2016 for recreational Ambient Water Quality Criteria (AWQC) for Cyanotoxins is 4ug/L for microcystins and 8ug/L for Cylindrospermopsin. Rend 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 analyized as part of the pesticide screening. All sample sites were within Illinois state 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. Suspended solid levels tend to be lower the closer you get to the dam because sediments drop out of the water column as they travel down the lake. 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. Illinois recommends a TSS standard of 116mg/L for streams and ≥12mg/L for lakes. Tributary sites were below the 116 mg/L suggested standard and the lake sites were above the suggested standard of 12mg/L. This may suggest that the lake is creating particulates such as algae which results in higher TSS in the lake. However, IEPA suggests that NVSS above 15mg/L could highly impair recreational lake use. A NVSS of 3 to 7mg/L might cause slight impairment.

Total Organic Carbon (TOC) is collected at all sites. TOC is an indicator of the organic character of water. The larger the carbon or organic content, the more oxygen is consumed. Illinois does not currently have a standard for TOC.

Temperature and dissolved oxygen levels were taken at all sites. Measurements were taken at 1 meter intervals at the lake sites. During the summer months the lake stratifies and a boundary is formed between the upper warmer water and the lower cooler water. This transition area is known as the thermocline, the area where the temperature drops significantly. Oxygen levels can also change drastically as a function of depth. This area where the oxygen level significantly drops is called the oxycline. The depth of the thermocline and oxycline can have an effect on the aquatic organisms. Occasionally the thermocline and oxycline are at or near the same depth.

pH is taken at all sites and at 1 meter intervals at lake sites. The June 28 sample at Ren-3 was 9.05. Records indicate that a 0.04 inch rain event occurred the day before sampling.

Variances in pH can be caused by increased runoff due to rainfall, unusual temperature extremes or erosion from land disturbances.

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.

Secchi readings were taken at lake sites to measure water transparency. Secchi disk readings were highest in front of the dam. This normally occurs because sediments drop out of the water column as the water moves down stream toward the dam. This results is improved water quality down stream.

3.2 Sediment Summary

Sediment sampling was not conducted in 2016. Sediment sampling is normally conducted every 5 years if funding is available. Sediment sampling was last conducted in 2007.

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

4.0 PLANNED 2017 STUDIES

The Rend Lake water quality monitoring will continue in Fiscal Year 2017 on a limited basis. A slight increase in funding will allow 4 sampling events in 2017. 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. Rend Lake is a source for drinking water for many communities and is a high usage recreational lake. The monitoring of water quality is imperative to assure the water quality is within acceptable limits for the designated usage.

The sampling sites include the following: Site 1 Ren-1 Spillway, Site 2 Ren-02 Lake side in front of Dam, Site 3 Ren-3 Casey Fork Arm near Ina, Site 4 Ren-4 Big Muddy Arm, Site 5 Ren-5 Big Muddy at Hwy 15, Site 7 Ren-7, Casey Fork at Hwy 37, and Site 8 Ren-8, Gun Creek Arm. This combination of sites effectively represents the incoming contaminants and their effects on the lake.

Sediment sampling will be conducted if funding is available.

APPENDIX A

DATA

Lab Data

Site #	Collection Date	Parameter	Flag	Reported Result	MDL	PQL	Units
REN-1	4/16/2016	Alachlor	<	0.21	0.21	0.21	UG/L
REN-1	6/2/2016	Alachlor	<	0.22	0.22	0.22	UG/L
REN-1	8/13/2016	Alachlor	<	0.21	0.21	0.21	UG/L
REN-15	4/16/2016	Alachlor	<	0.20	0.20	0.20	UG/L
REN-15	6/2/2016	Alachlor	<	0.21	0.21	0.21	UG/L
REN-15	8/13/2016	Alachlor	<	0.21	0.21	0.21	UG/L
REN-2	4/16/2016	Alachlor	<	0.20	0.20	0.20	UG/L
REN-2	6/2/2016	Alachlor	<	0.21	0.21	0.21	UG/L
REN-2	8/13/2016	Alachlor	<	0.25	0.25	0.25	UG/L
REN-3	4/16/2016	Alachlor	<	0.20	0.20	0.20	UG/L
REN-3	6/2/2016	Alachlor	<	0.21	0.21	0.21	UG/L
REN-3	8/13/2016	Alachlor	<	0.25	0.25	0.25	UG/L
REN-4	4/16/2016	Alachlor	<	0.20	0.20	0.20	UG/L
REN-4	6/2/2016	Alachlor	<	0.21	0.21	0.21	UG/L
REN-4	8/13/2016	Alachlor	<	0.22	0.22	0.22	UG/L
REN-5	4/16/2016	Alachlor	<	0.22	0.22	0.22	UG/L
REN-5	6/2/2016	Alachlor	<	0.21	0.21	0.21	UG/L
REN-5	8/13/2016	Alachlor	<	0.22	0.22	0.22	UG/L
REN-7	4/16/2016	Alachlor	<	0.21	0.21	0.21	UG/L
REN-7	6/2/2016	Alachlor	<	0.21	0.21	0.21	UG/L
REN-7	8/13/2016	Alachlor	<	0.22	0.22	0.22	UG/L
REN-8	4/16/2016	Alachlor	<	0.20	0.20	0.20	UG/L
REN-8	6/2/2016	Alachlor	<	0.22	0.22	0.22	UG/L
REN-8	8/13/2016	Alachlor	<	0.22	0.22	0.22	UG/L
REN-1	4/16/2016	Ammonia Nitrogen		0.16	0.030	0.030	MG/L
REN-1	6/2/2016	Ammonia Nitrogen		0.15	0.030	0.030	MG/L
REN-1	8/13/2016	Ammonia Nitrogen		0.43	0.030	0.030	MG/L
REN-15	4/16/2016	Ammonia Nitrogen		0.26	0.030	0.030	MG/L
REN-15	6/2/2016	Ammonia Nitrogen		0.10	0.030	0.030	MG/L
REN-15	8/13/2016	Ammonia Nitrogen		0.086	0.030	0.030	MG/L
REN-2	4/16/2016	Ammonia Nitrogen		0.045	0.030	0.030	MG/L
REN-2	6/2/2016	Ammonia Nitrogen		0.050	0.030	0.030	MG/L

Site #	Collection Date	Parameter	Flag	Reported Result	MDL	PQL	Units
REN-2	8/13/2016	Ammonia Nitrogen		0.082	0.030	0.030	MG/L
REN-2-5	4/16/2016	Ammonia Nitrogen		0.100	0.030	0.030	MG/L
REN-2-5	6/2/2016	Ammonia Nitrogen		0.079	0.030	0.030	MG/L
REN-2-5	8/13/2016	Ammonia Nitrogen		0.15	0.030	0.030	MG/L
REN-3	4/16/2016	Ammonia Nitrogen		0.055	0.030	0.030	MG/L
REN-3	6/2/2016	Ammonia Nitrogen		0.11	0.030	0.030	MG/L
REN-3	8/13/2016	Ammonia Nitrogen		0.12	0.030	0.030	MG/L
REN-4	4/16/2016	Ammonia Nitrogen		0.095	0.030	0.030	MG/L
REN-4	6/2/2016	Ammonia Nitrogen		0.051	0.030	0.030	MG/L
REN-4	8/13/2016	Ammonia Nitrogen		0.080	0.030	0.030	MG/L
REN-5	4/16/2016	Ammonia Nitrogen		0.16	0.030	0.030	MG/L
REN-5	6/2/2016	Ammonia Nitrogen		0.15	0.030	0.030	MG/L
REN-5	8/13/2016	Ammonia Nitrogen		0.11	0.030	0.030	MG/L
REN-7	4/16/2016	Ammonia Nitrogen		0.11	0.030	0.030	MG/L
REN-7	6/2/2016	Ammonia Nitrogen		0.11	0.030	0.030	MG/L
REN-7	8/13/2016	Ammonia Nitrogen		0.13	0.030	0.030	MG/L
REN-8	4/16/2016	Ammonia Nitrogen		0.18	0.030	0.030	MG/L
REN-8	6/2/2016	Ammonia Nitrogen		0.18	0.030	0.030	MG/L
REN-8	8/13/2016	Ammonia Nitrogen		0.10	0.030	0.030	MG/L
REN-1	4/16/2016	Atrazine		0.21	0.21	0.21	UG/L
REN-1	6/2/2016	Atrazine	<	0.22	0.22	0.22	UG/L
REN-1	8/13/2016	Atrazine		0.93	0.21	0.21	UG/L
REN-15	4/16/2016	Atrazine	<	0.20	0.20	0.20	UG/L
REN-15	6/2/2016	Atrazine		2.6	0.42	0.42	UG/L
REN-15	8/13/2016	Atrazine		0.67	0.21	0.21	UG/L
REN-2	4/16/2016	Atrazine	<	0.20	0.20	0.20	UG/L
REN-2	6/2/2016	Atrazine	<	0.21	0.21	0.21	UG/L
REN-2	8/13/2016	Atrazine		0.85	0.25	0.25	UG/L
REN-3	4/16/2016	Atrazine	<	0.20	0.20	0.20	UG/L
REN-3	6/2/2016	Atrazine		0.57	0.21	0.21	UG/L
REN-3	8/13/2016	Atrazine		0.54	0.25	0.25	UG/L
REN-4	4/16/2016	Atrazine	<	0.20	0.20	0.20	UG/L
REN-4	6/2/2016	Atrazine		2.2	0.21	0.21	UG/L
REN-4	8/13/2016	Atrazine		0.47	0.22	0.22	UG/L
REN-5	4/16/2016	Atrazine	<	0.22	0.22	0.22	UG/L
REN-5	6/2/2016	Atrazine		6.3	1.0	1.0	UG/L
REN-5	8/13/2016	Atrazine	<	0.22	0.22	0.22	UG/L

Site #	Collection Date	Parameter	Flag	Reported Result	MDL	PQL	Units
REN-7	4/16/2016	Atrazine	<	0.21	0.21	0.21	UG/L
REN-7	6/2/2016	Atrazine		3.5	0.42	0.42	UG/L
REN-7	8/13/2016	Atrazine	<	0.22	0.22	0.22	UG/L
REN-8	4/16/2016	Atrazine	<	0.20	0.20	0.20	UG/L
REN-8	6/2/2016	Atrazine		0.34	0.22	0.22	UG/L
REN-8	8/13/2016	Atrazine		0.23	0.22	0.22	UG/L
REN-15	4/16/2016	Chlorophyll a		9.6	2.0	2.0	MG/CU.M.
REN-15	6/2/2016	Chlorophyll a		3.4	2.0	2.0	MG/CU.M.
REN-15	8/13/2016	Chlorophyll a		14.2	2.0	2.0	MG/CU.M.
REN-2	4/16/2016	Chlorophyll a		2.4	2.0	2.0	MG/CU.M.
REN-2	6/2/2016	Chlorophyll a		5.1	2.0	2.0	MG/CU.M.
REN-2	8/13/2016	Chlorophyll a		15.6	2.0	2.0	MG/CU.M.
REN-3	4/16/2016	Chlorophyll a		2.2	2.0	2.0	MG/CU.M.
REN-3	6/2/2016	Chlorophyll a	<	2.0	2.0	2.0	MG/CU.M.
REN-3	8/13/2016	Chlorophyll a		15.7	2.0	2.0	MG/CU.M.
REN-4	4/16/2016	Chlorophyll a		7.5	2.0	2.0	MG/CU.M.
REN-4	6/2/2016	Chlorophyll a		2.6	2.0	2.0	MG/CU.M.
REN-4	8/13/2016	Chlorophyll a		13.9	2.0	2.0	MG/CU.M.
REN-8	4/16/2016	Chlorophyll a		21.9	2.0	2.0	MG/CU.M.
REN-8	6/2/2016	Chlorophyll a	<	2.0	2.0	2.0	MG/CU.M.
REN-8	8/13/2016	Chlorophyll a		13.7	2.0	2.0	MG/CU.M.
REN-1	4/16/2016	Chloropyrifos	<	0.21	0.21	0.21	UG/L
REN-15	4/16/2016	Chloropyrifos	<	0.20	0.20	0.20	UG/L
REN-2	4/16/2016	Chloropyrifos	<	0.20	0.20	0.20	UG/L
REN-3	4/16/2016	Chloropyrifos	<	0.20	0.20	0.20	UG/L
REN-4	4/16/2016	Chloropyrifos	<	0.20	0.20	0.20	UG/L
REN-5	4/16/2016	Chloropyrifos	<	0.22	0.22	0.22	UG/L
REN-7	4/16/2016	Chloropyrifos	<	0.21	0.21	0.21	UG/L
REN-8	4/16/2016	Chloropyrifos	<	0.20	0.20	0.20	UG/L
REN-1	6/2/2016	Chlorpyrifos	<	0.22	0.22	0.22	UG/L
REN-1	8/13/2016	Chlorpyrifos	<	0.21	0.21	0.21	UG/L
REN-15	6/2/2016	Chlorpyrifos	<	0.21	0.21	0.21	UG/L
REN-15	8/13/2016	Chlorpyrifos	<	0.21	0.21	0.21	UG/L
REN-2	6/2/2016	Chlorpyrifos	<	0.21	0.21	0.21	UG/L
REN-2	8/13/2016	Chlorpyrifos	<	0.25	0.25	0.25	UG/L
REN-3	6/2/2016	Chlorpyrifos	<	0.21	0.21	0.21	UG/L
REN-3	8/13/2016	Chlorpyrifos	<	0.25	0.25	0.25	UG/L

Site #	Collection Date	Parameter	Flag	Reported Result	MDL	PQL	Units
REN-4	6/2/2016	Chlorpyrifos	<	0.21	0.21	0.21	UG/L
REN-4	8/13/2016	Chlorpyrifos	<	0.22	0.22	0.22	UG/L
REN-5	6/2/2016	Chlorpyrifos	<	0.21	0.21	0.21	UG/L
REN-5	8/13/2016	Chlorpyrifos	<	0.22	0.22	0.22	UG/L
REN-7	6/2/2016	Chlorpyrifos	<	0.21	0.21	0.21	UG/L
REN-7	8/13/2016	Chlorpyrifos	<	0.22	0.22	0.22	UG/L
REN-8	6/2/2016	Chlorpyrifos	<	0.22	0.22	0.22	UG/L
REN-8	8/13/2016	Chlorpyrifos	<	0.22	0.22	0.22	UG/L
REN-1	4/16/2016	Cyanazine	<	0.21	0.21	0.21	UG/L
REN-1	6/2/2016	Cyanazine	<	0.22	0.22	0.22	UG/L
REN-1	8/13/2016	Cyanazine	<	0.21	0.21	0.21	UG/L
REN-15	4/16/2016	Cyanazine	<	0.20	0.20	0.20	UG/L
REN-15	6/2/2016	Cyanazine	<	0.21	0.21	0.21	UG/L
REN-15	8/13/2016	Cyanazine	<	0.21	0.21	0.21	UG/L
REN-2	4/16/2016	Cyanazine	<	0.20	0.20	0.20	UG/L
REN-2	6/2/2016	Cyanazine	<	0.21	0.21	0.21	UG/L
REN-2	8/13/2016	Cyanazine	<	0.25	0.25	0.25	UG/L
REN-3	4/16/2016	Cyanazine	<	0.20	0.20	0.20	UG/L
REN-3	6/2/2016	Cyanazine	<	0.21	0.21	0.21	UG/L
REN-3	8/13/2016	Cyanazine	<	0.25	0.25	0.25	UG/L
REN-4	4/16/2016	Cyanazine	<	0.20	0.20	0.20	UG/L
REN-4	6/2/2016	Cyanazine	<	0.21	0.21	0.21	UG/L
REN-4	8/13/2016	Cyanazine	<	0.22	0.22	0.22	UG/L
REN-5	4/16/2016	Cyanazine	<	0.22	0.22	0.22	UG/L
REN-5	6/2/2016	Cyanazine	<	0.21	0.21	0.21	UG/L
REN-5	8/13/2016	Cyanazine	<	0.22	0.22	0.22	UG/L
REN-7	4/16/2016	Cyanazine	<	0.21	0.21	0.21	UG/L
REN-7	6/2/2016	Cyanazine	<	0.21	0.21	0.21	UG/L
REN-7	8/13/2016	Cyanazine	<	0.22	0.22	0.22	UG/L
REN-8	4/16/2016	Cyanazine	<	0.20	0.20	0.20	UG/L
REN-8	6/2/2016	Cyanazine	<	0.22	0.22	0.22	UG/L
REN-8	8/13/2016	Cyanazine	<	0.22	0.22	0.22	UG/L
REN-RL MARINA	6/2/2016	E. Coliform		20.0	1.0	1.0	COL/100 ML
REN-RL-MARINA	8/13/2016	E. Coliform		6.0	1.0	1.0	COL/100 ML
REN-1	4/16/2016	Iron		0.21	0.050	0.10	MG/L

Site #	Collection Date	Parameter	Flag	Reported Result	MDL	PQL	Units
REN-1	6/2/2016	Iron		0.22	0.050	0.10	MG/L
REN-1	8/13/2016	Iron		0.22	0.050	0.10	MG/L
REN-2-5	4/16/2016	Iron		0.19	0.050	0.10	MG/L
REN-2-5	6/2/2016	Iron		0.20	0.050	0.10	MG/L
REN-2-5	8/13/2016	Iron		0.082	0.050	0.10	MG/L
REN-1	4/16/2016	Manganese		0.21	0.0050	0.010	MG/L
REN-1	6/2/2016	Manganese		0.26	0.0050	0.010	MG/L
REN-1	8/13/2016	Manganese		0.97	0.0050	0.010	MG/L
REN-2-5	4/16/2016	Manganese		0.22	0.0050	0.010	MG/L
REN-2-5	6/2/2016	Manganese		0.24	0.0050	0.010	MG/L
REN-2-5	8/13/2016	Manganese		0.25	0.0050	0.010	MG/L
REN-1	4/16/2016	Metolachlor	<	0.21	0.21	0.21	UG/L
REN-1	6/2/2016	Metolachlor	<	0.22	0.22	0.22	UG/L
REN-1	8/13/2016	Metolachlor		0.54	0.21	0.21	UG/L
REN-15	4/16/2016	Metolachlor	<	0.20	0.20	0.20	UG/L
REN-15	6/2/2016	Metolachlor		0.73	0.21	0.21	UG/L
REN-15	8/13/2016	Metolachlor		0.63	0.21	0.21	UG/L
REN-2	4/16/2016	Metolachlor	<	0.20	0.20	0.20	UG/L
REN-2	6/2/2016	Metolachlor	<	0.21	0.21	0.21	UG/L
REN-2	8/13/2016	Metolachlor		0.49	0.25	0.25	UG/L
REN-3	4/16/2016	Metolachlor	<	0.20	0.20	0.20	UG/L
REN-3	6/2/2016	Metolachlor		0.22	0.21	0.21	UG/L
REN-3	8/13/2016	Metolachlor		0.30	0.25	0.25	UG/L
REN-4	4/16/2016	Metolachlor	<	0.20	0.20	0.20	UG/L
REN-4	6/2/2016	Metolachlor		0.61	0.21	0.21	UG/L
REN-4	8/13/2016	Metolachlor		0.44	0.22	0.22	UG/L
REN-5	4/16/2016	Metolachlor	<	0.22	0.22	0.22	UG/L
REN-5	6/2/2016	Metolachlor		4.5	1.0	1.0	UG/L
REN-5	8/13/2016	Metolachlor	<	0.22	0.22	0.22	UG/L
REN-7	4/16/2016	Metolachlor		0.22	0.21	0.21	UG/L
REN-7	6/2/2016	Metolachlor		2.6	0.42	0.42	UG/L
REN-7	8/13/2016	Metolachlor	<	0.22	0.22	0.22	UG/L
REN-8	4/16/2016	Metolachlor	<	0.20	0.20	0.20	UG/L
REN-8	6/2/2016	Metolachlor	<	0.22	0.22	0.22	UG/L
REN-8	8/13/2016	Metolachlor		0.27	0.22	0.22	UG/L
REN-1	4/16/2016	Metribuzin	<	0.21	0.21	0.21	UG/L
REN-1	6/2/2016	Metribuzin	<	0.22	0.22	0.22	UG/L

Site #	Collection Date	Parameter	Flag	Reported Result	MDL	PQL	Units
REN-1	8/13/2016	Metribuzin	<	0.21	0.21	0.21	UG/L
REN-15	4/16/2016	Metribuzin	<	0.20	0.20	0.20	UG/L
REN-15	6/2/2016	Metribuzin	<	0.21	0.21	0.21	UG/L
REN-15	8/13/2016	Metribuzin	<	0.21	0.21	0.21	UG/L
REN-2	4/16/2016	Metribuzin	<	0.20	0.20	0.20	UG/L
REN-2	6/2/2016	Metribuzin	<	0.21	0.21	0.21	UG/L
REN-2	8/13/2016	Metribuzin	<	0.25	0.25	0.25	UG/L
REN-3	4/16/2016	Metribuzin	<	0.20	0.20	0.20	UG/L
REN-3	6/2/2016	Metribuzin	<	0.21	0.21	0.21	UG/L
REN-3	8/13/2016	Metribuzin	<	0.25	0.25	0.25	UG/L
REN-4	4/16/2016	Metribuzin	<	0.20	0.20	0.20	UG/L
REN-4	6/2/2016	Metribuzin	<	0.21	0.21	0.21	UG/L
REN-4	8/13/2016	Metribuzin	<	0.22	0.22	0.22	UG/L
REN-5	4/16/2016	Metribuzin	<	0.22	0.22	0.22	UG/L
REN-5	6/2/2016	Metribuzin		0.53	0.21	0.21	UG/L
REN-5	8/13/2016	Metribuzin	<	0.22	0.22	0.22	UG/L
REN-7	4/16/2016	Metribuzin	<	0.21	0.21	0.21	UG/L
REN-7	6/2/2016	Metribuzin	<	0.21	0.21	0.21	UG/L
REN-7	8/13/2016	Metribuzin	<	0.22	0.22	0.22	UG/L
REN-8	4/16/2016	Metribuzin	<	0.20	0.20	0.20	UG/L
REN-8	6/2/2016	Metribuzin	<	0.22	0.22	0.22	UG/L
REN-8	8/13/2016	Metribuzin	<	0.22	0.22	0.22	UG/L
REN-1	4/16/2016	Nitrate as Nitrogen	<	0.040	0.040	0.040	MG/L
REN-1	6/2/2016	Nitrate as Nitrogen		0.086	0.040	0.040	MG/L
REN-1	8/13/2016	Nitrate as Nitrogen		0.088	0.040	0.040	MG/L
REN-15	4/16/2016	Nitrate as Nitrogen	<	0.040	0.040	0.040	MG/L
REN-15	6/2/2016	Nitrate as Nitrogen	<	0.040	0.040	0.040	MG/L
REN-15	8/13/2016	Nitrate as Nitrogen		0.042	0.040	0.040	MG/L
REN-2	4/16/2016	Nitrate as Nitrogen	<	0.040	0.040	0.040	MG/L
REN-2	6/2/2016	Nitrate as Nitrogen		0.042	0.040	0.040	MG/L
REN-2	8/13/2016	Nitrate as Nitrogen	<	0.040	0.040	0.040	MG/L
REN-2-5	4/16/2016	Nitrate as Nitrogen	<	0.040	0.040	0.040	MG/L
REN-2-5	6/2/2016	Nitrate as Nitrogen	<	0.040	0.040	0.040	MG/L
REN-2-5	8/13/2016	Nitrate as Nitrogen		0.11	0.040	0.040	MG/L
REN-3	4/16/2016	Nitrate as Nitrogen	<	0.040	0.040	0.040	MG/L
REN-3	6/2/2016	Nitrate as Nitrogen	<	0.040	0.040	0.040	MG/L
REN-3	8/13/2016	Nitrate as Nitrogen		0.040	0.040	0.040	MG/L

Site #	Collection Date	Parameter	Flag	Reported Result	MDL	PQL	Units
REN-4	4/16/2016	Nitrate as Nitrogen	<	0.040	0.040	0.040	MG/L
REN-4	6/2/2016	Nitrate as Nitrogen	<	0.040	0.040	0.040	MG/L
REN-4	8/13/2016	Nitrate as Nitrogen	<	0.040	0.040	0.040	MG/L
REN-5	4/16/2016	Nitrate as Nitrogen		0.12	0.040	0.040	MG/L
REN-5	6/2/2016	Nitrate as Nitrogen		0.58	0.040	0.040	MG/L
REN-5	8/13/2016	Nitrate as Nitrogen		0.30	0.040	0.040	MG/L
REN-7	4/16/2016	Nitrate as Nitrogen		0.41	0.040	0.040	MG/L
REN-7	6/2/2016	Nitrate as Nitrogen		0.63	0.040	0.040	MG/L
REN-7	8/13/2016	Nitrate as Nitrogen		1.4	0.040	0.040	MG/L
REN-8	4/16/2016	Nitrate as Nitrogen		0.12	0.040	0.040	MG/L
REN-8	6/2/2016	Nitrate as Nitrogen		3.2	0.040	0.040	MG/L
REN-8	8/13/2016	Nitrate as Nitrogen		0.15	0.040	0.040	MG/L
REN-1	4/16/2016	Pendimethalin	<	0.21	0.21	0.21	UG/L
REN-1	6/2/2016	Pendimethalin	<	0.22	0.22	0.22	UG/L
REN-1	8/13/2016	Pendimethalin	<	0.21	0.21	0.21	UG/L
REN-15	4/16/2016	Pendimethalin	<	0.20	0.20	0.20	UG/L
REN-15	6/2/2016	Pendimethalin	<	0.21	0.21	0.21	UG/L
REN-15	8/13/2016	Pendimethalin	<	0.21	0.21	0.21	UG/L
REN-2	4/16/2016	Pendimethalin	<	0.20	0.20	0.20	UG/L
REN-2	6/2/2016	Pendimethalin	<	0.21	0.21	0.21	UG/L
REN-2	8/13/2016	Pendimethalin	<	0.25	0.25	0.25	UG/L
REN-3	4/16/2016	Pendimethalin	<	0.20	0.20	0.20	UG/L
REN-3	6/2/2016	Pendimethalin	<	0.21	0.21	0.21	UG/L
REN-3	8/13/2016	Pendimethalin	<	0.25	0.25	0.25	UG/L
REN-4	4/16/2016	Pendimethalin	<	0.20	0.20	0.20	UG/L
REN-4	6/2/2016	Pendimethalin	<	0.21	0.21	0.21	UG/L
REN-4	8/13/2016	Pendimethalin	<	0.22	0.22	0.22	UG/L
REN-5	4/16/2016	Pendimethalin	<	0.22	0.22	0.22	UG/L
REN-5	6/2/2016	Pendimethalin	<	0.21	0.21	0.21	UG/L
REN-5	8/13/2016	Pendimethalin	<	0.22	0.22	0.22	UG/L
REN-7	4/16/2016	Pendimethalin	<	0.21	0.21	0.21	UG/L
REN-7	6/2/2016	Pendimethalin	<	0.21	0.21	0.21	UG/L
REN-7	8/13/2016	Pendimethalin	<	0.22	0.22	0.22	UG/L
REN-8	4/16/2016	Pendimethalin	<	0.20	0.20	0.20	UG/L
REN-8	6/2/2016	Pendimethalin	<	0.22	0.22	0.22	UG/L
REN-8	8/13/2016	Pendimethalin	<	0.22	0.22	0.22	UG/L
REN-15	4/16/2016	Pheophytin a	<	2.0	2.0	2.0	MG/CU.M.

Site #	Collection Date	Parameter	Flag	Reported Result	MDL	PQL	Units
REN-15	6/2/2016	Pheophytin a	<	2.0	2.0	2.0	MG/CU.M.
REN-15	8/13/2016	Pheophytin a	<	2.0	2.0	2.0	MG/CU.M.
REN-2	4/16/2016	Pheophytin a	<	2.0	2.0	2.0	MG/CU.M.
REN-2	6/2/2016	Pheophytin a	<	2.0	2.0	2.0	MG/CU.M.
REN-2	8/13/2016	Pheophytin a	<	2.0	2.0	2.0	MG/CU.M.
REN-3	4/16/2016	Pheophytin a	<	2.0	2.0	2.0	MG/CU.M.
REN-3	6/2/2016	Pheophytin a	<	2.0	2.0	2.0	MG/CU.M.
REN-3	8/13/2016	Pheophytin a	<	2.0	2.0	2.0	MG/CU.M.
REN-4	4/16/2016	Pheophytin a	<	2.0	2.0	2.0	MG/CU.M.
REN-4	6/2/2016	Pheophytin a	<	2.0	2.0	2.0	MG/CU.M.
REN-4	8/13/2016	Pheophytin a	<	2.0	2.0	2.0	MG/CU.M.
REN-8	4/16/2016	Pheophytin a	<	2.0	2.0	2.0	MG/CU.M.
REN-8	6/2/2016	Pheophytin a		8.4	2.0	2.0	MG/CU.M.
REN-8	8/13/2016	Pheophytin a	<	2.0	2.0	2.0	MG/CU.M.
REN-1	4/16/2016	Phosphorus		0.093	0.010	0.010	MG/L
REN-1	6/2/2016	Phosphorus		0.11	0.010	0.010	MG/L
REN-1	8/13/2016	Phosphorus		0.30	0.010	0.010	MG/L
REN-15	4/16/2016	Phosphorus		0.15	0.010	0.010	MG/L
REN-15	6/2/2016	Phosphorus		0.13	0.010	0.010	MG/L
REN-15	8/13/2016	Phosphorus		0.19	0.010	0.010	MG/L
REN-2	4/16/2016	Phosphorus		0.084	0.010	0.010	MG/L
REN-2	6/2/2016	Phosphorus		0.090	0.010	0.010	MG/L
REN-2	8/13/2016	Phosphorus		0.19	0.010	0.010	MG/L
REN-2-5	4/16/2016	Phosphorus		0.11	0.010	0.010	MG/L
REN-2-5	6/2/2016	Phosphorus		0.090	0.010	0.010	MG/L
REN-2-5	8/13/2016	Phosphorus		0.22	0.010	0.010	MG/L
REN-3	4/16/2016	Phosphorus		0.093	0.010	0.010	MG/L
REN-3	6/2/2016	Phosphorus		0.090	0.010	0.010	MG/L
REN-3	8/13/2016	Phosphorus		0.21	0.010	0.010	MG/L
REN-4	4/16/2016	Phosphorus		0.15	0.010	0.010	MG/L
REN-4	6/2/2016	Phosphorus		0.14	0.010	0.010	MG/L
REN-4	8/13/2016	Phosphorus		0.20	0.010	0.010	MG/L
REN-5	4/16/2016	Phosphorus		0.15	0.010	0.010	MG/L
REN-5	6/2/2016	Phosphorus		0.25	0.010	0.010	MG/L
REN-5	8/13/2016	Phosphorus		0.23	0.010	0.010	MG/L
REN-7	4/16/2016	Phosphorus		0.16	0.010	0.010	MG/L
REN-7	6/2/2016	Phosphorus		0.15	0.010	0.010	MG/L

Site #	Collection Date	Parameter	Flag	Reported Result	MDL	PQL	Units
REN-7	8/13/2016	Phosphorus		0.19	0.010	0.010	MG/L
REN-8	4/16/2016	Phosphorus		0.31	0.010	0.010	MG/L
REN-8	6/2/2016	Phosphorus		0.16	0.010	0.010	MG/L
REN-8	8/13/2016	Phosphorus		0.23	0.010	0.010	MG/L
REN-1	4/16/2016	Phosphorus, -ortho		0.017	0.010	0.010	MG/L
REN-1	6/2/2016	Phosphorus, -ortho		0.029	0.010	0.010	MG/L
REN-1	8/13/2016	Phosphorus, -ortho		0.17	0.010	0.010	MG/L
REN-15	4/16/2016	Phosphorus, -ortho	<	0.010	0.010	0.010	MG/L
REN-15	6/2/2016	Phosphorus, -ortho		0.052	0.010	0.010	MG/L
REN-15	8/13/2016	Phosphorus, -ortho		0.073	0.010	0.010	MG/L
REN-2	4/16/2016	Phosphorus, -ortho	<	0.010	0.010	0.010	MG/L
REN-2	6/2/2016	Phosphorus, -ortho		0.026	0.010	0.010	MG/L
REN-2	8/13/2016	Phosphorus, -ortho		0.088	0.010	0.010	MG/L
REN-2-5	4/16/2016	Phosphorus, -ortho	<	0.010	0.010	0.010	MG/L
REN-2-5	6/2/2016	Phosphorus, -ortho		0.026	0.010	0.010	MG/L
REN-2-5	8/13/2016	Phosphorus, -ortho		0.11	0.010	0.010	MG/L
REN-3	4/16/2016	Phosphorus, -ortho	<	0.010	0.010	0.010	MG/L
REN-3	6/2/2016	Phosphorus, -ortho		0.043	0.010	0.010	MG/L
REN-3	8/13/2016	Phosphorus, -ortho		0.068	0.010	0.010	MG/L
REN-4	4/16/2016	Phosphorus, -ortho		0.015	0.010	0.010	MG/L
REN-4	6/2/2016	Phosphorus, -ortho		0.043	0.010	0.010	MG/L
REN-4	8/13/2016	Phosphorus, -ortho		0.073	0.010	0.010	MG/L
REN-5	4/16/2016	Phosphorus, -ortho		0.017	0.010	0.010	MG/L
REN-5	6/2/2016	Phosphorus, -ortho		0.046	0.010	0.010	MG/L
REN-5	8/13/2016	Phosphorus, -ortho		0.036	0.010	0.010	MG/L
REN-7	4/16/2016	Phosphorus, -ortho		0.020	0.010	0.010	MG/L
REN-7	6/2/2016	Phosphorus, -ortho		0.046	0.010	0.010	MG/L
REN-7	8/13/2016	Phosphorus, -ortho		0.085	0.010	0.010	MG/L
REN-8	4/16/2016	Phosphorus, -ortho		0.079	0.010	0.010	MG/L
REN-8	6/2/2016	Phosphorus, -ortho		0.054	0.010	0.010	MG/L
REN-8	8/13/2016	Phosphorus, -ortho		0.076	0.010	0.010	MG/L
REN-1	4/16/2016	Solids, Total Suspended		9.6	1.8	1.8	MG/L
REN-1	6/2/2016	Solids, Total Suspended		8.5	1.7	1.7	MG/L
REN-1	8/13/2016	Solids, Total Suspended		12.3	2.9	2.9	MG/L
REN-15	4/16/2016	Solids, Total Suspended		13.8	1.7	1.7	MG/L
REN-15	6/2/2016	Solids, Total Suspended		15.6	2.2	2.2	MG/L
REN-15	8/13/2016	Solids, Total Suspended		13.3	2.5	2.5	MG/L

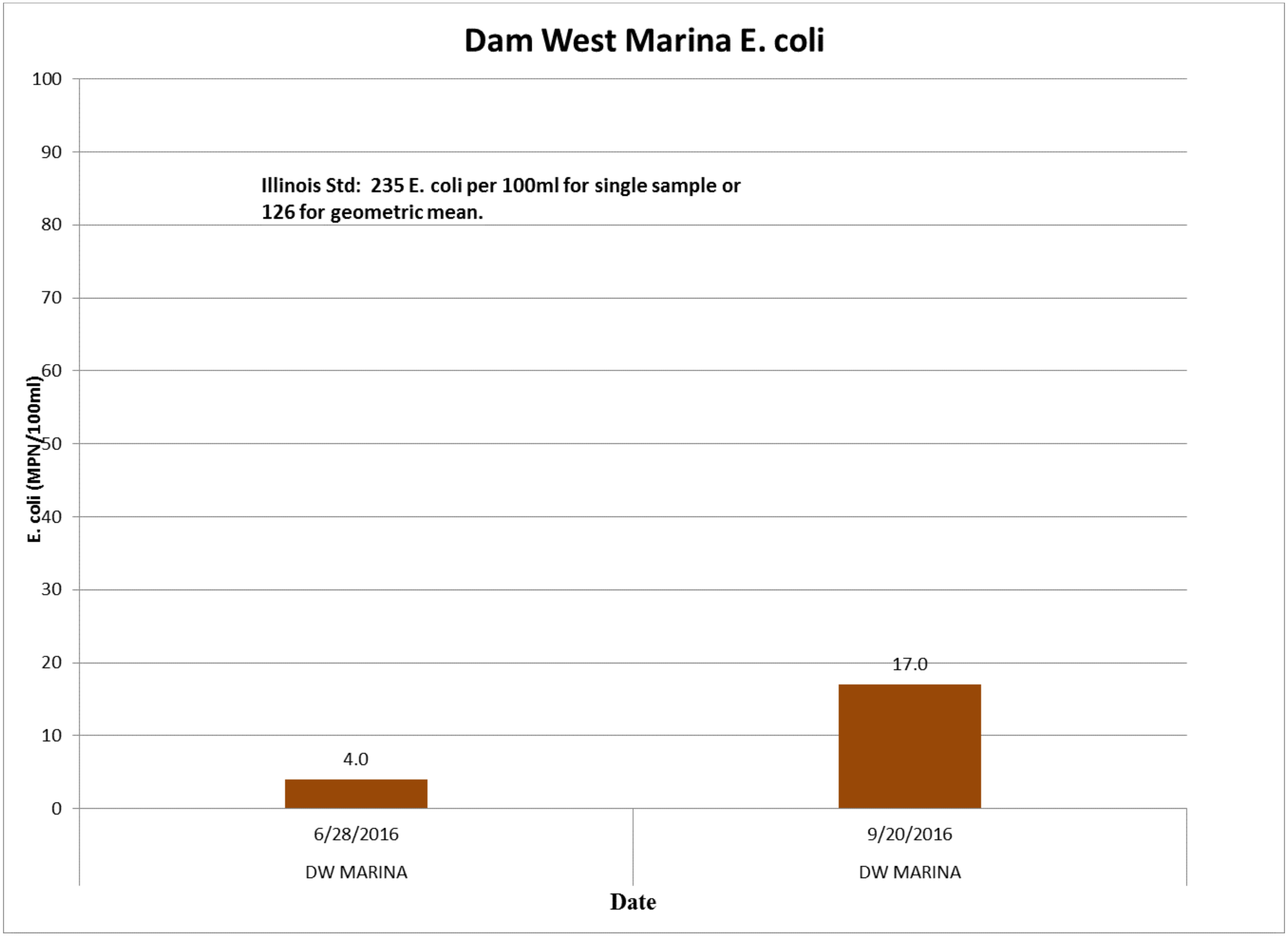
Site #	Collection Date	Parameter	Flag	Reported Result	MDL	PQL	Units
REN-2	4/16/2016	Solids, Total Suspended		4.9	1.5	1.5	MG/L
REN-2	6/2/2016	Solids, Total Suspended		7.8	1.7	1.7	MG/L
REN-2	8/13/2016	Solids, Total Suspended		11.4	2.0	2.0	MG/L
REN-2-5	4/16/2016	Solids, Total Suspended		7.8	1.8	1.8	MG/L
REN-2-5	6/2/2016	Solids, Total Suspended		10.2	2.0	2.0	MG/L
REN-2-5	8/13/2016	Solids, Total Suspended		9.2	2.0	2.0	MG/L
REN-3	4/16/2016	Solids, Total Suspended		9.7	1.7	1.7	MG/L
REN-3	6/2/2016	Solids, Total Suspended		11.2	2.0	2.0	MG/L
REN-3	8/13/2016	Solids, Total Suspended		15.3	3.3	3.3	MG/L
REN-4	4/16/2016	Solids, Total Suspended		13.5	1.8	1.8	MG/L
REN-4	6/2/2016	Solids, Total Suspended		14.9	2.4	2.4	MG/L
REN-4	8/13/2016	Solids, Total Suspended		14.0	2.5	2.5	MG/L
REN-5	4/16/2016	Solids, Total Suspended		17.3	1.7	1.7	MG/L
REN-5	6/2/2016	Solids, Total Suspended		46.7	2.2	2.2	MG/L
REN-5	8/13/2016	Solids, Total Suspended		31.3	1.9	1.9	MG/L
REN-7	4/16/2016	Solids, Total Suspended		32.9	1.8	1.8	MG/L
REN-7	6/2/2016	Solids, Total Suspended		27.0	2.0	2.0	MG/L
REN-7	8/13/2016	Solids, Total Suspended		11.9	1.0	1.0	MG/L
REN-8	4/16/2016	Solids, Total Suspended		20.0	2.5	2.5	MG/L
REN-8	6/2/2016	Solids, Total Suspended		18.6	2.9	2.9	MG/L
REN-8	8/13/2016	Solids, Total Suspended		15.5	3.0	3.0	MG/L
REN-1	4/16/2016	Solids, Volatile Suspended		3.6	1.8	1.8	MG/L
REN-1	6/2/2016	Solids, Volatile Suspended		3.0	1.7	1.7	MG/L
REN-1	8/13/2016	Solids, Volatile Suspended		6.3	2.9	2.9	MG/L
REN-15	4/16/2016	Solids, Volatile Suspended		5.2	1.7	1.7	MG/L
REN-15	6/2/2016	Solids, Volatile Suspended		4.4	2.2	2.2	MG/L
REN-15	8/13/2016	Solids, Volatile Suspended		10.0	2.5	2.5	MG/L
REN-2	4/16/2016	Solids, Volatile Suspended		2.6	1.5	1.5	MG/L
REN-2	6/2/2016	Solids, Volatile Suspended		2.8	1.7	1.7	MG/L
REN-2	8/13/2016	Solids, Volatile Suspended		8.6	2.0	2.0	MG/L
REN-2-5	4/16/2016	Solids, Volatile Suspended		3.6	1.8	1.8	MG/L
REN-2-5	6/2/2016	Solids, Volatile Suspended		3.8	2.0	2.0	MG/L
REN-2-5	8/13/2016	Solids, Volatile Suspended		6.2	2.0	2.0	MG/L
REN-3	4/16/2016	Solids, Volatile Suspended		3.5	1.7	1.7	MG/L
REN-3	6/2/2016	Solids, Volatile Suspended		3.6	2.0	2.0	MG/L
REN-3	8/13/2016	Solids, Volatile Suspended		11.3	3.3	3.3	MG/L
REN-4	4/16/2016	Solids, Volatile Suspended		4.9	1.8	1.8	MG/L

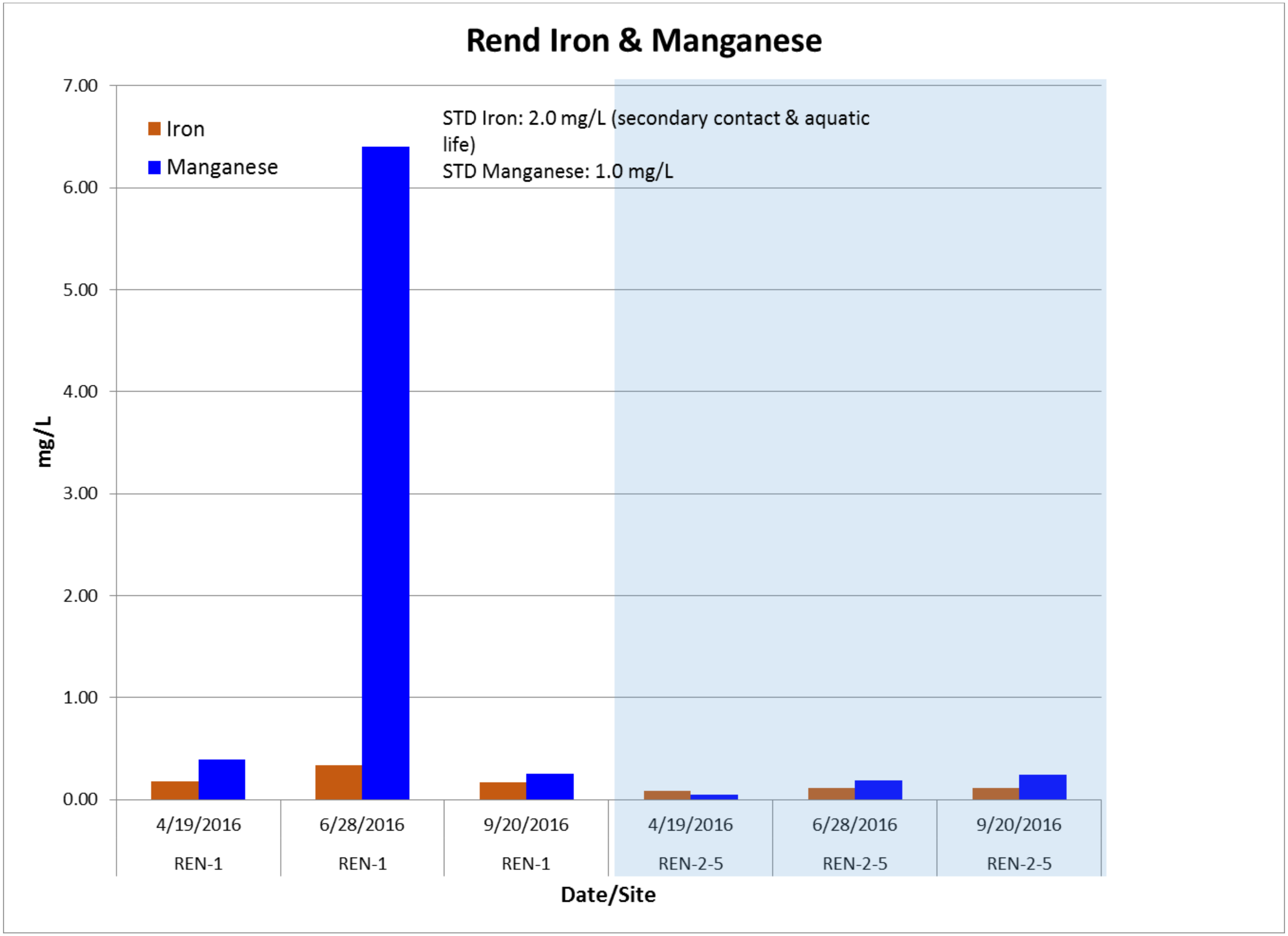
Site #	Collection Date	Parameter	Flag	Reported Result	MDL	PQL	Units
REN-4	6/2/2016	Solids, Volatile Suspended		4.4	2.4	2.4	MG/L
REN-4	8/13/2016	Solids, Volatile Suspended		9.0	2.5	2.5	MG/L
REN-5	4/16/2016	Solids, Volatile Suspended		2.7	1.7	1.7	MG/L
REN-5	6/2/2016	Solids, Volatile Suspended		5.1	2.2	2.2	MG/L
REN-5	8/13/2016	Solids, Volatile Suspended		2.7	1.9	1.9	MG/L
REN-7	4/16/2016	Solids, Volatile Suspended		3.5	1.8	1.8	MG/L
REN-7	6/2/2016	Solids, Volatile Suspended		3.0	2.0	2.0	MG/L
REN-7	8/13/2016	Solids, Volatile Suspended		1.3	1.0	1.0	MG/L
REN-8	4/16/2016	Solids, Volatile Suspended		7.2	2.5	2.5	MG/L
REN-8	6/2/2016	Solids, Volatile Suspended		6.3	2.9	2.9	MG/L
REN-8	8/13/2016	Solids, Volatile Suspended		8.8	3.0	3.0	MG/L
REN-1	4/16/2016	Total Organic Carbon		5.2	1.0	1.0	MG/L
REN-1	6/2/2016	Total Organic Carbon		5.8	1.0	1.0	MG/L
REN-1	8/13/2016	Total Organic Carbon		6.1	1.0	1.0	MG/L
REN-15	4/16/2016	Total Organic Carbon		6.4	1.0	1.0	MG/L
REN-15	6/2/2016	Total Organic Carbon		6.2	1.0	1.0	MG/L
REN-15	8/13/2016	Total Organic Carbon		6.8	1.0	1.0	MG/L
REN-2	4/16/2016	Total Organic Carbon		5.3	1.0	1.0	MG/L
REN-2	6/2/2016	Total Organic Carbon		5.2	1.0	1.0	MG/L
REN-2	8/13/2016	Total Organic Carbon		6.2	1.0	1.0	MG/L
REN-2-5	4/16/2016	Total Organic Carbon		5.3	1.0	1.0	MG/L
REN-2-5	6/2/2016	Total Organic Carbon		5.7	1.0	1.0	MG/L
REN-2-5	8/13/2016	Total Organic Carbon		5.8	1.0	1.0	MG/L
REN-3	4/16/2016	Total Organic Carbon		6.1	1.0	1.0	MG/L
REN-3	6/2/2016	Total Organic Carbon		6.0	1.0	1.0	MG/L
REN-3	8/13/2016	Total Organic Carbon		7.3	1.0	1.0	MG/L
REN-4	4/16/2016	Total Organic Carbon		6.3	1.0	1.0	MG/L
REN-4	6/2/2016	Total Organic Carbon		6.3	1.0	1.0	MG/L
REN-4	8/13/2016	Total Organic Carbon		6.9	1.0	1.0	MG/L
REN-5	4/16/2016	Total Organic Carbon		5.4	1.0	1.0	MG/L
REN-5	6/2/2016	Total Organic Carbon		7.9	1.0	1.0	MG/L
REN-5	8/13/2016	Total Organic Carbon		6.5	1.0	1.0	MG/L
REN-7	4/16/2016	Total Organic Carbon		5.5	1.0	1.0	MG/L
REN-7	6/2/2016	Total Organic Carbon		7.0	1.0	1.0	MG/L
REN-7	8/13/2016	Total Organic Carbon		6.3	1.0	1.0	MG/L
REN-8	4/16/2016	Total Organic Carbon		7.4	1.0	1.0	MG/L
REN-8	6/2/2016	Total Organic Carbon		6.3	1.0	1.0	MG/L

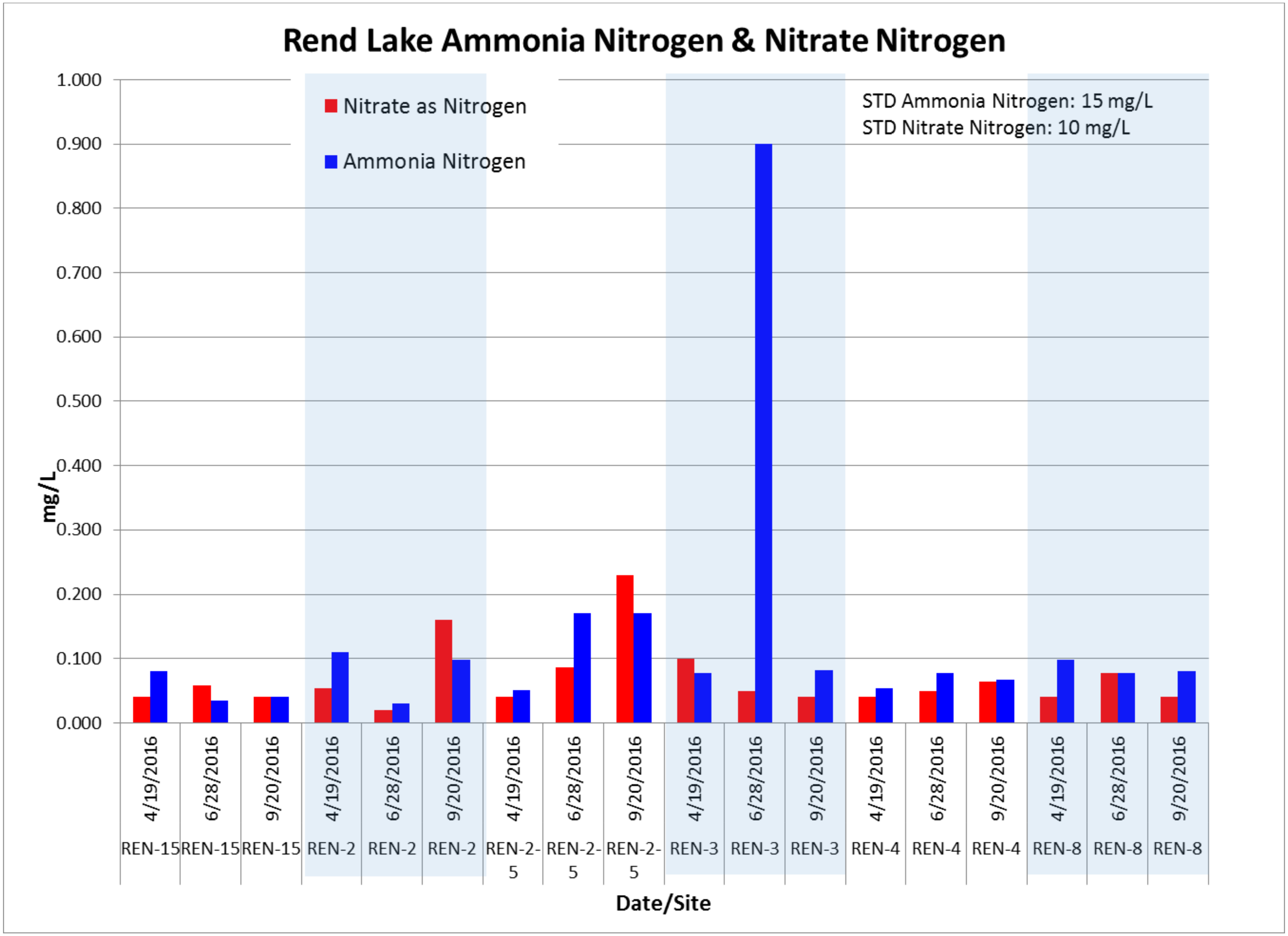
Site #	Collection Date	Parameter	Flag	Reported Result	MDL	PQL	Units
REN-8	8/13/2016	Total Organic Carbon		7.2	1.0	1.0	MG/L
REN-1	4/16/2016	Trifluralin	<	0.21	0.21	0.21	UG/L
REN-1	6/2/2016	Trifluralin	<	0.22	0.22	0.22	UG/L
REN-1	8/13/2016	Trifluralin	<	0.21	0.21	0.21	UG/L
REN-15	4/16/2016	Trifluralin	<	0.20	0.20	0.20	UG/L
REN-15	6/2/2016	Trifluralin	<	0.21	0.21	0.21	UG/L
REN-15	8/13/2016	Trifluralin	<	0.21	0.21	0.21	UG/L
REN-2	4/16/2016	Trifluralin	<	0.20	0.20	0.20	UG/L
REN-2	6/2/2016	Trifluralin	<	0.21	0.21	0.21	UG/L
REN-2	8/13/2016	Trifluralin	<	0.25	0.25	0.25	UG/L
REN-3	4/16/2016	Trifluralin	<	0.20	0.20	0.20	UG/L
REN-3	6/2/2016	Trifluralin	<	0.21	0.21	0.21	UG/L
REN-3	8/13/2016	Trifluralin	<	0.25	0.25	0.25	UG/L
REN-4	4/16/2016	Trifluralin	<	0.20	0.20	0.20	UG/L
REN-4	6/2/2016	Trifluralin	<	0.21	0.21	0.21	UG/L
REN-4	8/13/2016	Trifluralin	<	0.22	0.22	0.22	UG/L
REN-5	4/16/2016	Trifluralin	<	0.22	0.22	0.22	UG/L
REN-5	6/2/2016	Trifluralin	<	0.21	0.21	0.21	UG/L
REN-5	8/13/2016	Trifluralin	<	0.22	0.22	0.22	UG/L
REN-7	4/16/2016	Trifluralin	<	0.21	0.21	0.21	UG/L
REN-7	6/2/2016	Trifluralin	<	0.21	0.21	0.21	UG/L
REN-7	8/13/2016	Trifluralin	<	0.22	0.22	0.22	UG/L
REN-8	4/16/2016	Trifluralin	<	0.20	0.20	0.20	UG/L
REN-8	6/2/2016	Trifluralin	<	0.22	0.22	0.22	UG/L
REN-8	8/13/2016	Trifluralin	<	0.22	0.22	0.22	UG/L

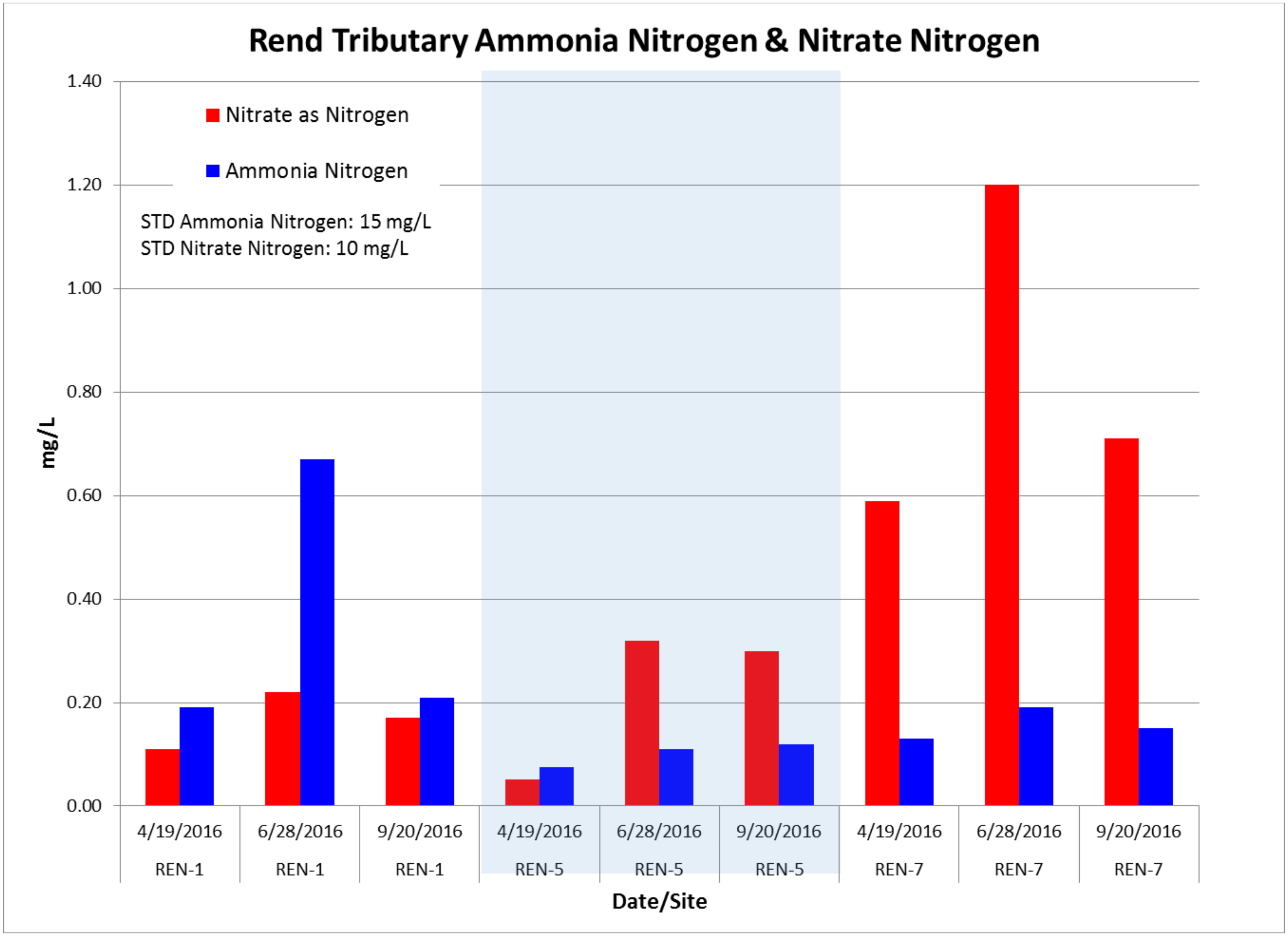
APPENDIX B

LAB DATA
GRAPHS

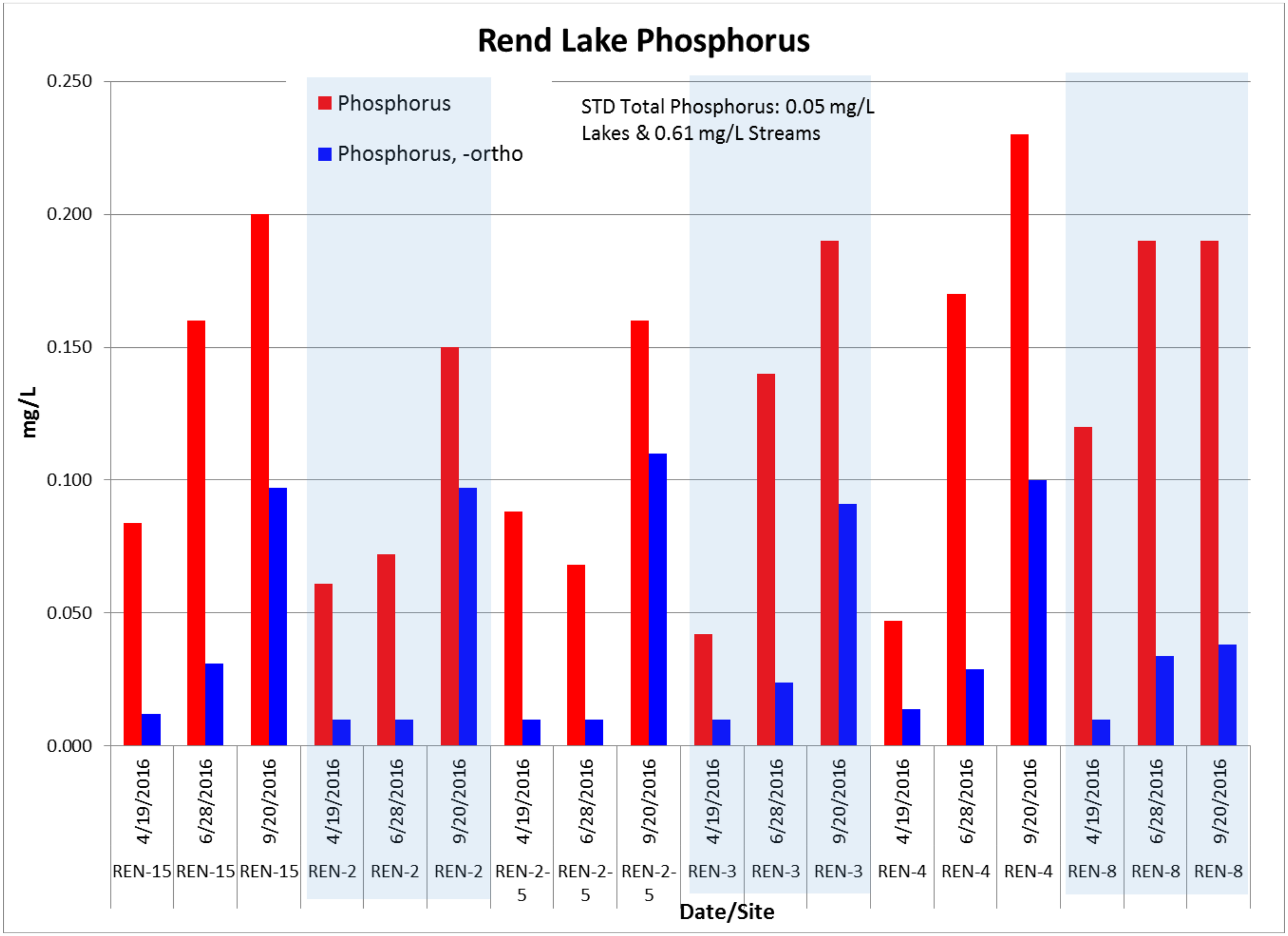

Dam West Marina E. coli
100
90
80
70
60
50
40
30
20
10
0
E. coli (MPN/100ml)
Illinois Std: 235 E. coli per 100ml for single sample or
126 for geometric mean.
4.0
17.0
6/28/2016
DW MARINA
9/20/2016
DW MARINA
Date


Rend Iron & Manganese
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
mg/L
Iron
Manganese
STD Iron: 2.0 mg/L (secondary contact & aquatic life)
STD Manganese: 1.0 mg/L
4/19/2016
REN-1
6/28/2016
REN-1
9/20/2016
REN-1
4/19/2016
REN-2-5
6/28/2016
REN-2-5
9/20/2016
REN-2-5
Date/Site

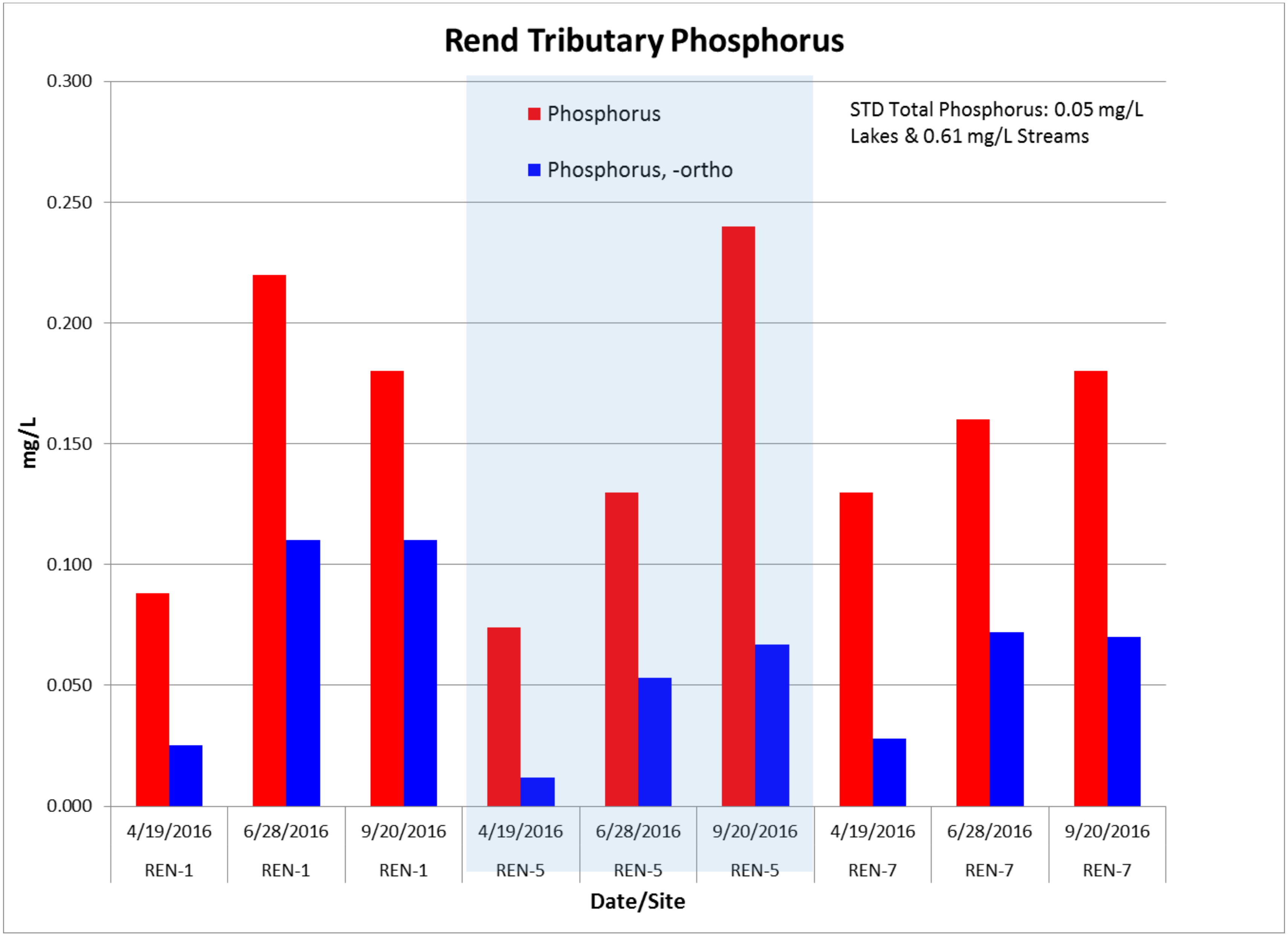

Rend Lake Ammonia Nitrogen & Nitrate Nitrogen
Nitrate as Nitrogen
Ammonia Nitrogen
STD Ammonia Nitrogen: 15 mg/L
STD Nitrate Nitrogen: 10 mg/L
mg/L
1.000
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
4/19/2016
6/28/2016
9/20/2016
REN-15
REN-2
REN-2-5
REN-3
REN-4
REN-8
Date/Site



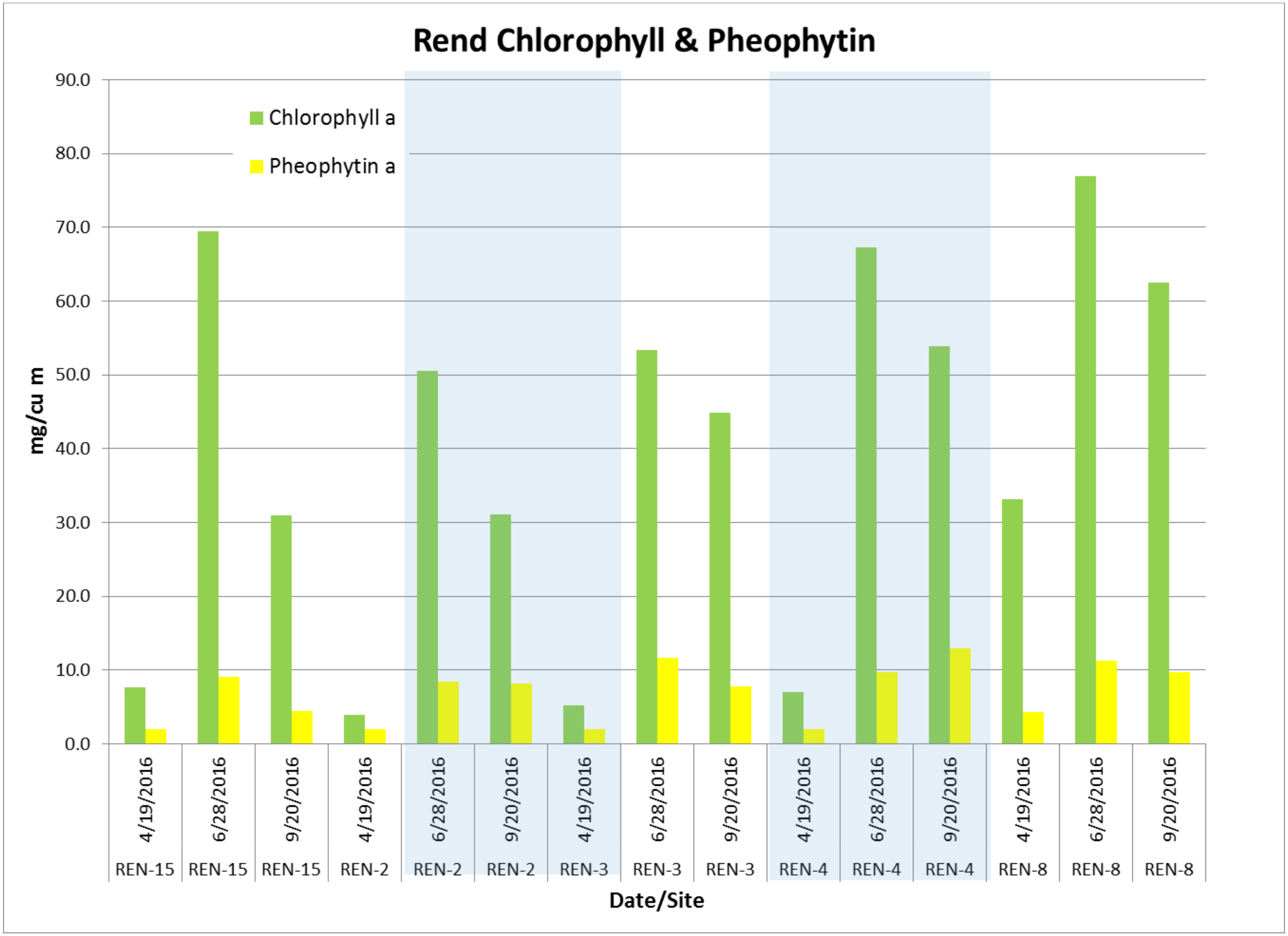
Rend Tributary Ammonia Nitrogen & Nitrate Nitrogen
Nitrate as Nitrogen
Ammonia Nitrogen
STD Ammonia Nitrogen: 15 mg/L
STD Nitrate Nitrogen: 10 mg/L
mg/L
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
4/19/2016
REN-1
6/28/2016
REN-1
9/20/2016
REN-1
4/19/2016
REN-5
6/28/2016
REN-5
9/20/2016
REN-5
4/19/2016
REN-7
6/28/2016
REN-7
9/20/2016
REN-7
Date/Site

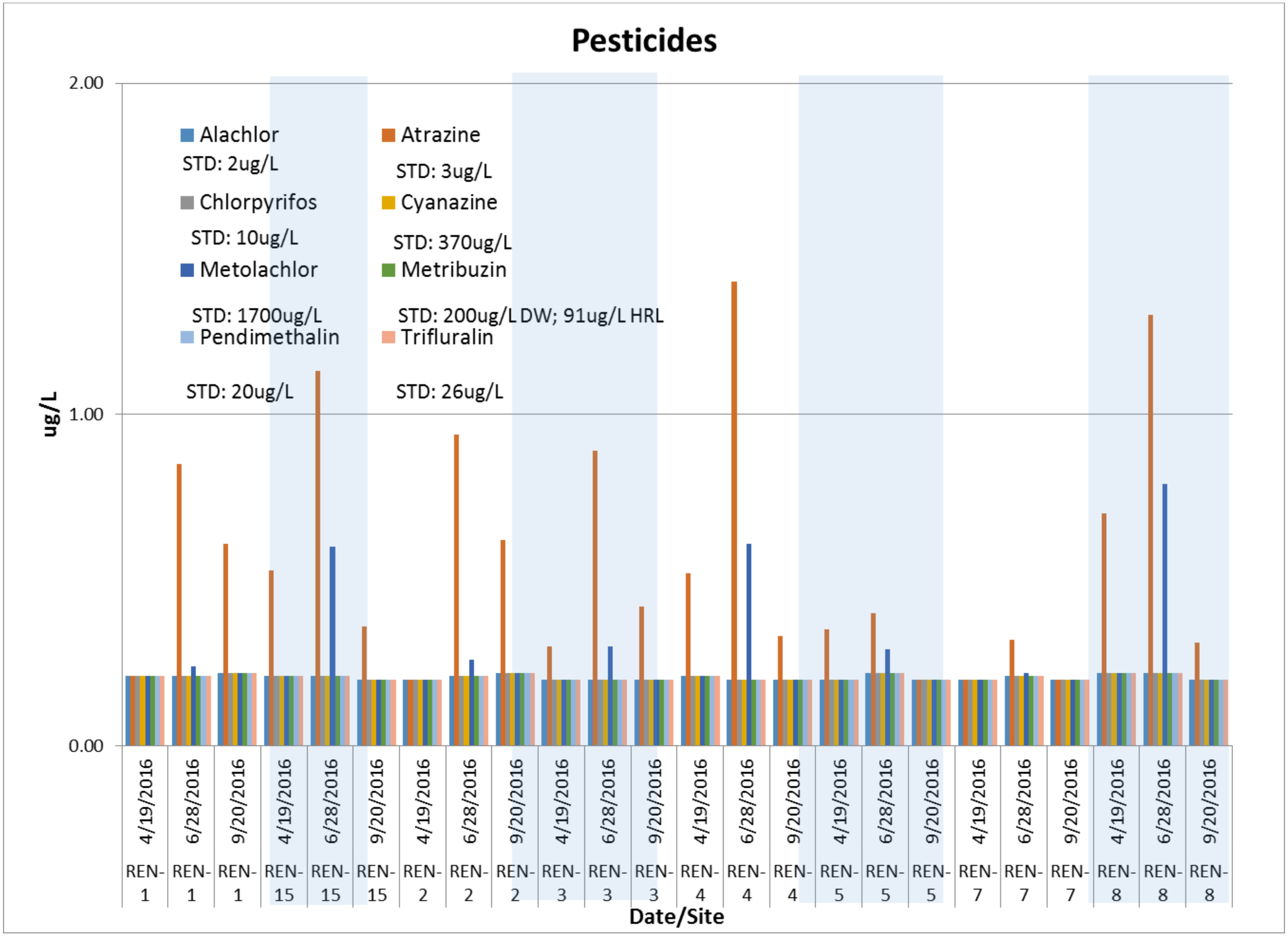


Rend Lake Phosphorus
Phosphorus
Phosphorus, -ortho
STD Total Phosphorus: 0.05 mg/L
Lakes & 0.61 mg/L Streams
0.250
0.200
0.150
0.100
0.050
0.000
mg/L
4/19/2016
6/28/2016
9/20/2016
REN-15
REN-2
REN-2-5
REN-3
REN-4
REN-8
Date/Site

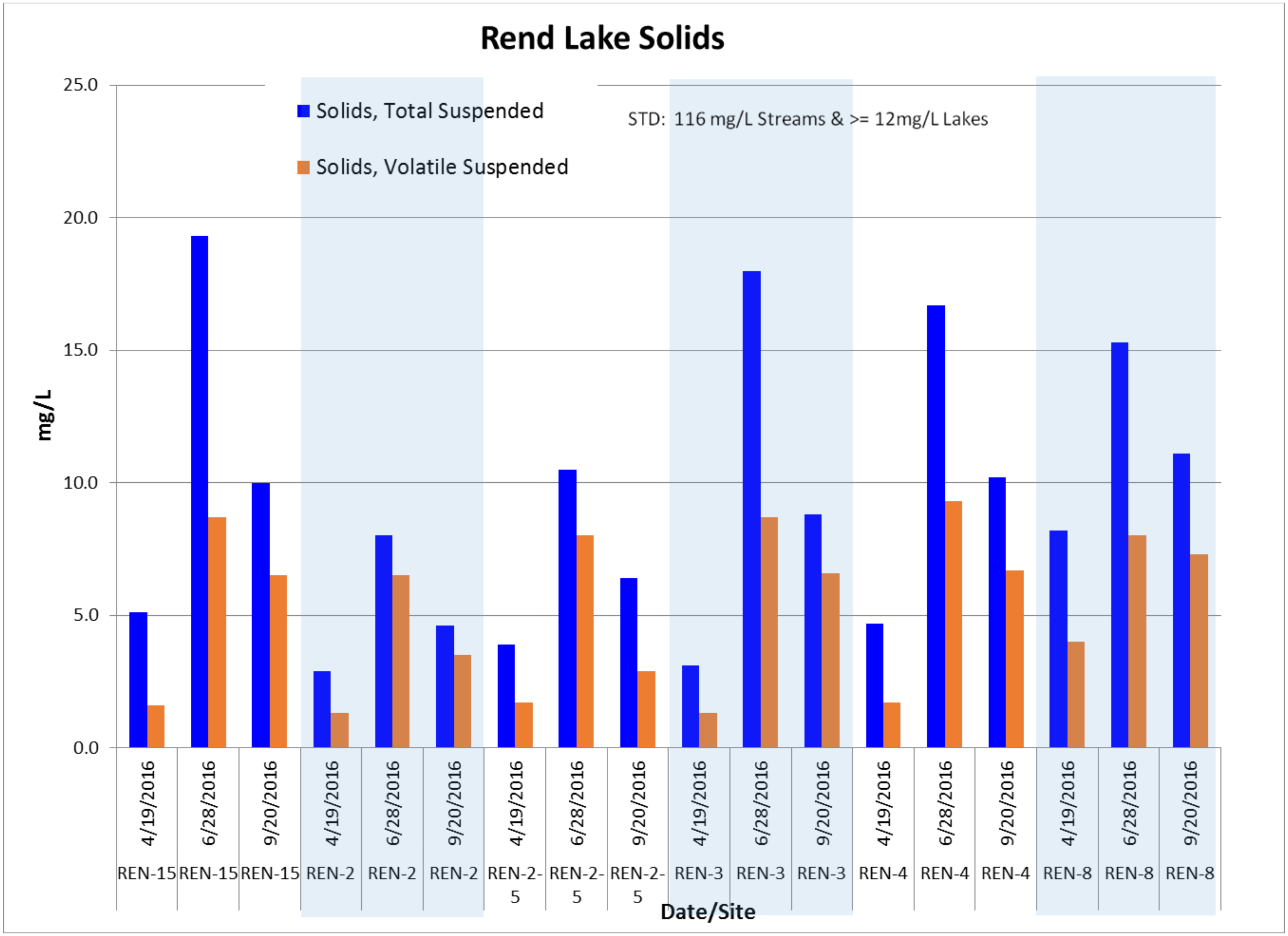


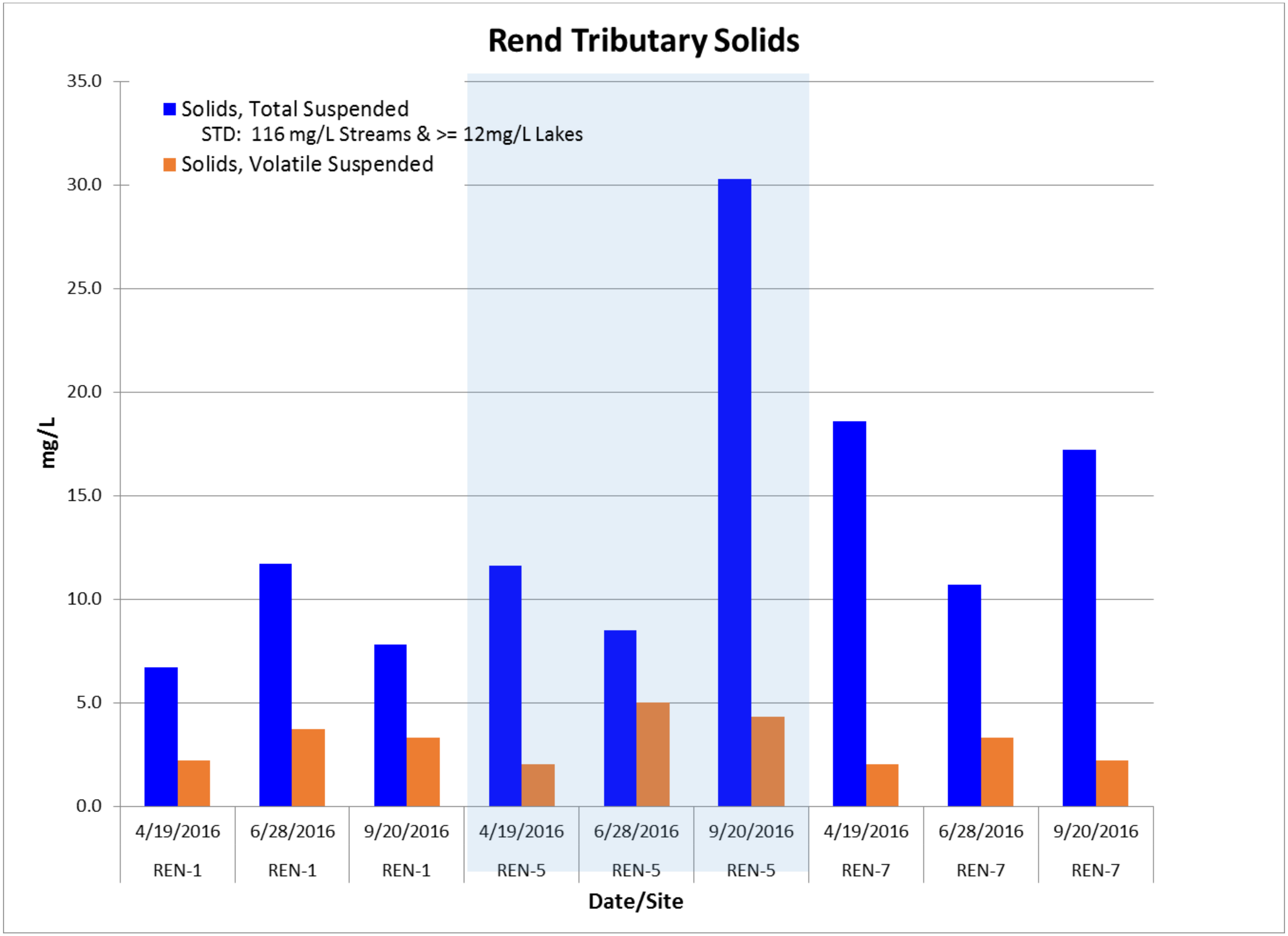
Rend Tributary Phosphorus
Phosphorus
Phosphorus, -ortho
STD Total Phosphorus: 0.05 mg/L Lakes & 0.61 mg/L Streams
mg/L
0.300
0.250
0.200
0.150
0.100
0.050
0.000
4/19/2016 REN-1
6/28/2016 REN-1
9/20/2016 REN-1
4/19/2016 REN-5
6/28/2016 REN-5
9/20/2016 REN-5
4/19/2016 REN-7
6/28/2016 REN-7
9/20/2016 REN-7
Date/Site

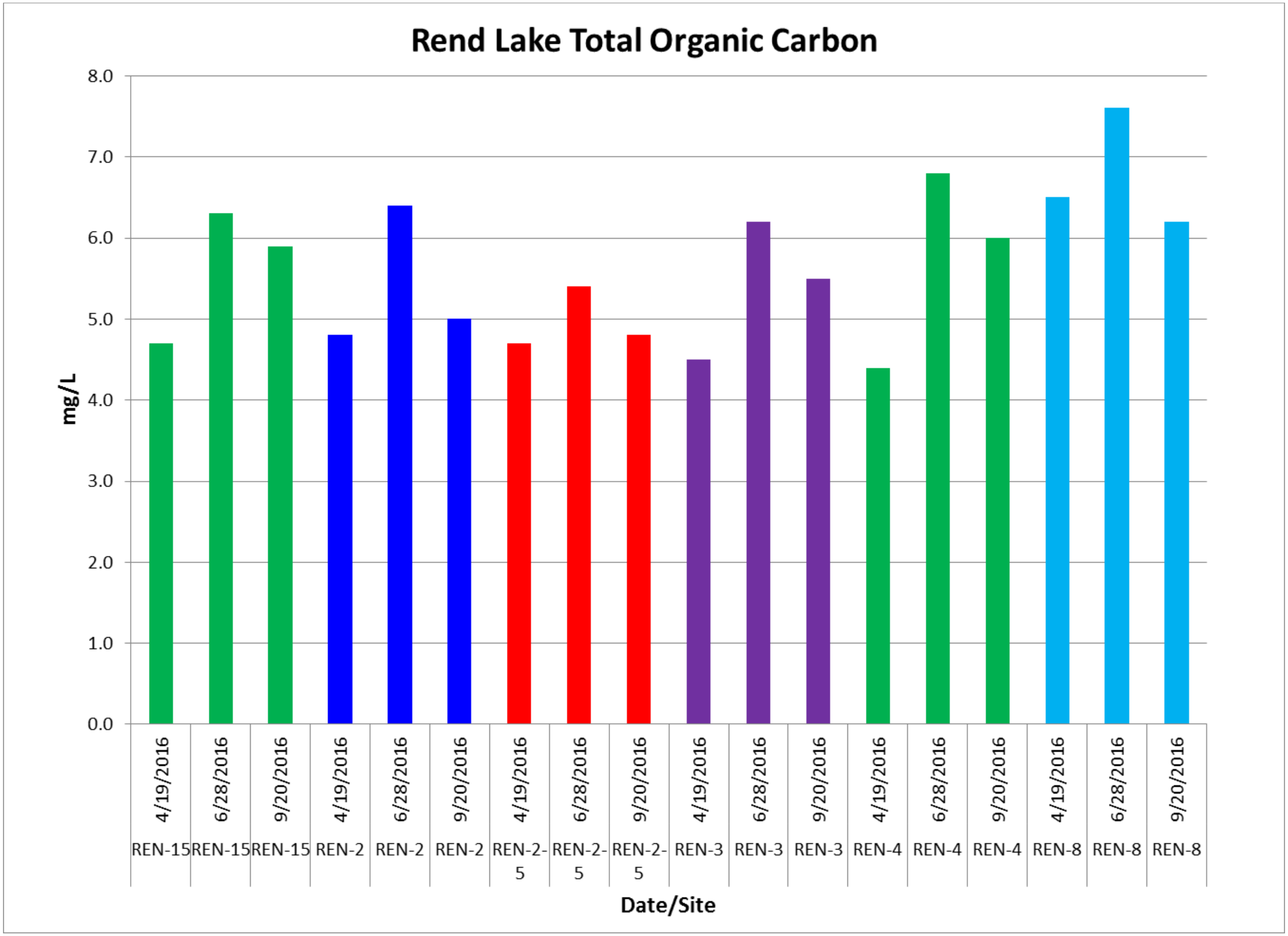

Rend Chlorophyll & Pheophytin
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
mg/cu m
Chlorophyll a
Pheophytin a
4/19/2016
6/28/2016
9/20/2016
4/19/2016
6/28/2016
9/20/2016
4/19/2016
6/28/2016
9/20/2016
4/19/2016
6/28/2016
9/20/2016
4/19/2016
6/28/2016
9/20/2016
REN-15
REN-15
REN-15
REN-2
REN-2
REN-2
REN-3
REN-3
REN-3
REN-4
REN-4
REN-4
REN-8
REN-8
REN-8
Date/Site

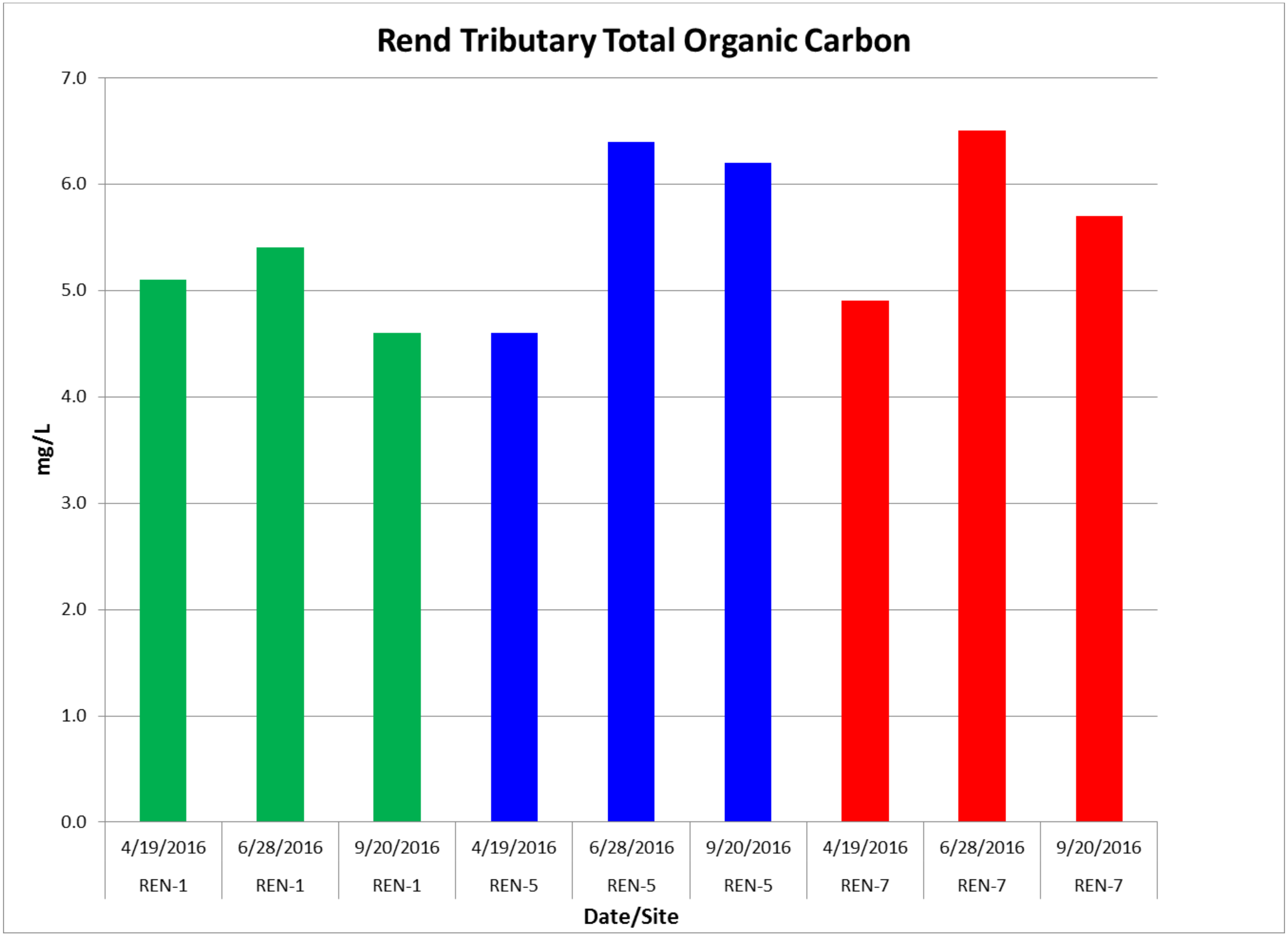


Pesticides
2.00
1.00
0.00
ug/L
Alachlor
STD: 2ug/L
Atrazine
STD: 3ug/L
Chlorpyrifos
STD: 10ug/L
Cyanazine
STD: 370ug/L
Metolachlor
STD: 1700ug/L
Metribuzin
STD: 200ug/L DW; 91ug/L HRL
Pendimethalin
STD: 20ug/L
Trifluralin
STD: 26ug/L
4/19/2016 REN-1
6/28/2016 REN-1
9/20/2016 REN-1
4/19/2016 REN-15
6/28/2016 REN-15
9/20/2016 REN-15
4/19/2016 REN-2
6/28/2016 REN-2
9/20/2016 REN-2
4/19/2016 REN-3
6/28/2016 REN-3
9/20/2016 REN-3
4/19/2016 REN-4
6/28/2016 REN-4
9/20/2016 REN-4
4/19/2016 REN-5
6/28/2016 REN-5
9/20/2016 REN-5
4/19/2016 REN-7
6/28/2016 REN-7
9/20/2016 REN-7
4/19/2016 REN-8
6/28/2016 REN-8
9/20/2016 REN-8
Date/Site


Rend Lake Solids
25.0
20.0
15.0
10.0
5.0
0.0
mg/L
Solids, Total Suspended
Solids, Volatile Suspended
STD: 116 mg/L Streams & >= 12mg/L Lakes
4/19/2016
6/28/2016
9/20/2016
REN-15
REN-2
REN-2-5
REN-3
REN-4
REN-8
Date/Site


Rend Tributary Solids
Solids, Total Suspended
STD: 116 mg/L Streams & >= 12mg/L Lakes
Solids, Volatile Suspended
mg/L
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
4/19/2016
6/28/2016
9/20/2016
4/19/2016
6/28/2016
9/20/2016
4/19/2016
6/28/2016
9/20/2016
REN-1
REN-1
REN-1
REN-5
REN-5
REN-5
REN-7
REN-7
REN-7
Date/Site


Rend Lake Total Organic Carbon
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
mg/L
4/19/2016
6/28/2016
9/20/2016
REN-15
REN-2
REN-2-5
REN-3
REN-4
REN-8
Date/Site


Rend Tributary Total Organic Carbon
mg/L
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
4/19/2016 REN-1
6/28/2016 REN-1
9/20/2016 REN-1
4/19/2016 REN-5
6/28/2016 REN-5
9/20/2016 REN-5
4/19/2016 REN-7
6/28/2016 REN-7
9/20/2016 REN-7
Date/Site

APPENDIX C

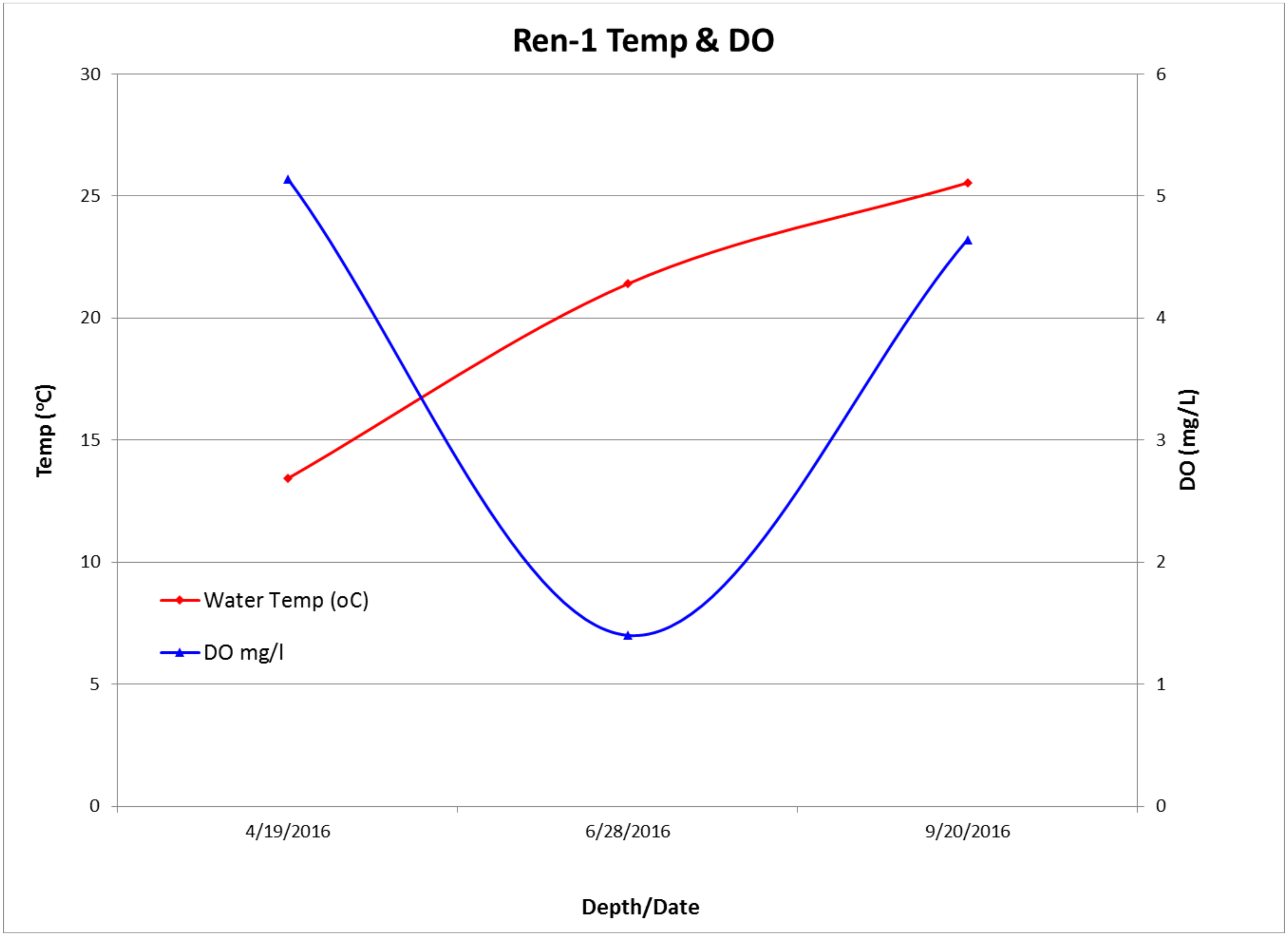
FIELD DATA & GRAPHS

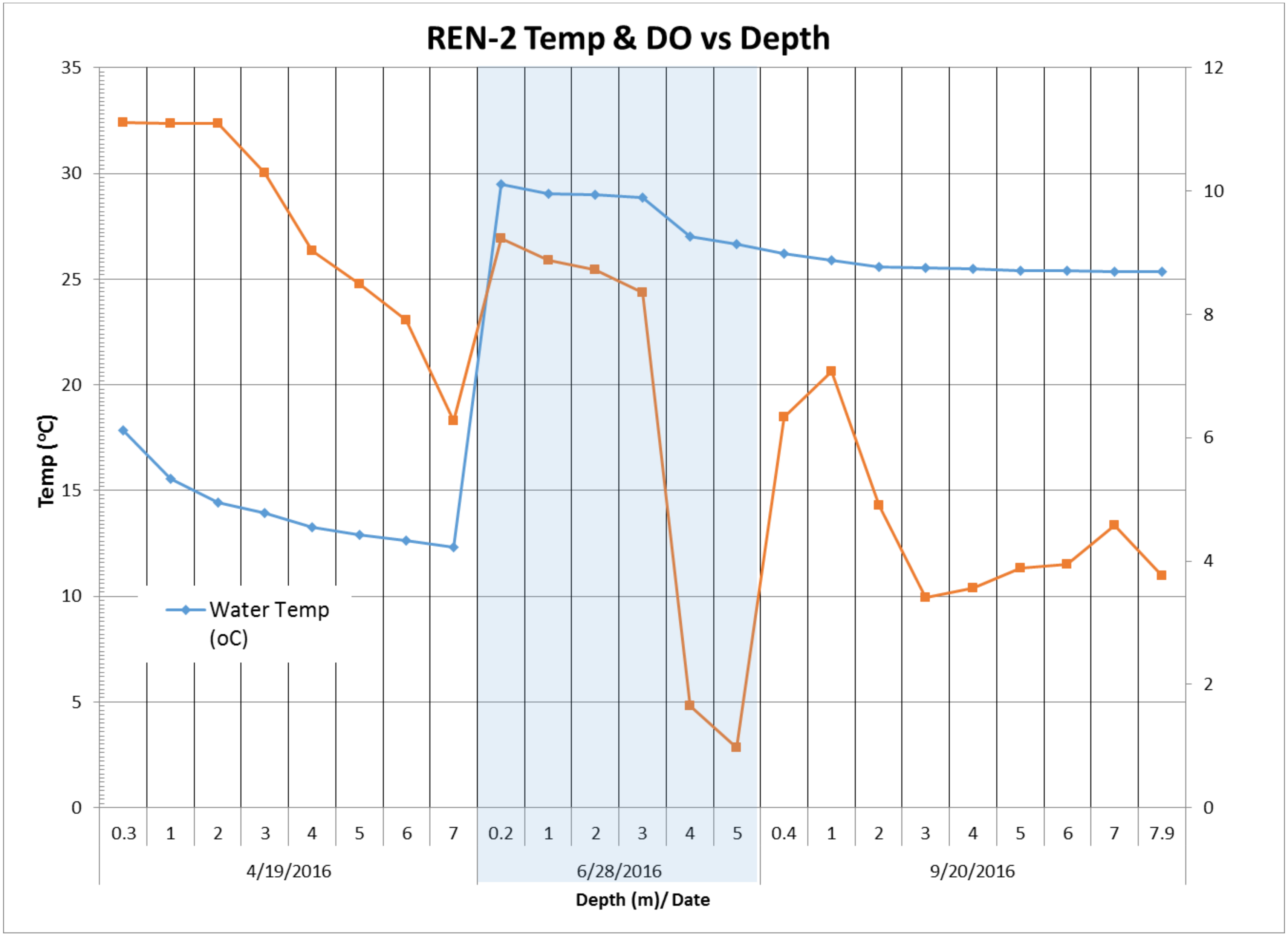
Field Data

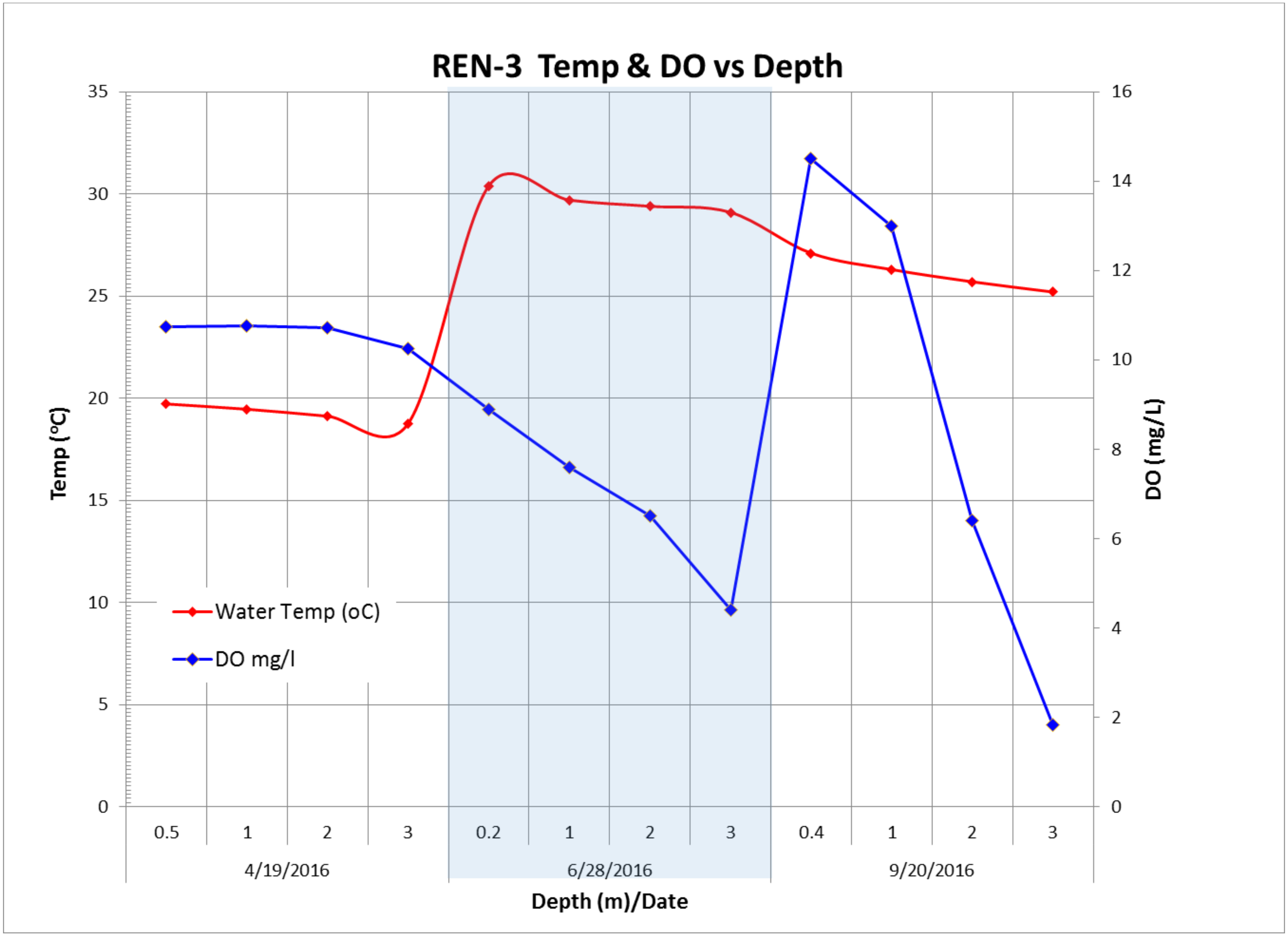
Site	Date	Depth	Water Temp (oC)	Redox (mv)	Cond (uS)	DO %	DO mg/l	pH	Time	Seechi (in)
REN-1	4/16/2016	3.1	14.51	402	300	80.4	8.15	7.77	9:30	
REN-1	6/2/2016	1.4	20.95	518	306.6	86.8	7.78	7.51	10:17	
REN-1	8/13/2016	1	27.48	326	243.2	37	2.9	7.47	942	
REN-2	4/16/2016	2	15.01	395	299.8	105.3	10.61	8.05	10:08	28
REN-2	4/16/2016	3	14.79	398	299	98.5	9.95	7.84	10:09	
REN-2	4/16/2016	4	14.76	398	298.8	96.8	9.79	7.79	10:10	
REN-2	4/16/2016	5	14.73	398	298.5	96.7	9.8	7.78	10:11	
REN-2	4/16/2016	6	14.28	402	296.1	87.9	8.98	7.62	10:12	
REN-2	4/16/2016	7	14.25	403	296	86.3	8.81	7.59	10:12	
REN-2	4/16/2016	8	14.24	404	295.8	85.6	8.77	7.56	10:13	
REN-2	4/16/2016	9	14.2	404	295.6	84.7	8.68	7.55	10:13	
REN-2	4/16/2016	9.8	14.01	358	297.1	71.4	7.23	7.4	10:13	
REN-2	6/2/2016	0.5	21.48	510	302.3	88	7.79	7.58	10:49	30
REN-2	6/2/2016	1	21.5	506	302	88.3	7.83	7.59		
REN-2	6/2/2016	2	21.49	505	302.8	87.7	7.79	7.59		
REN-2	6/2/2016	3	21.47	504	302.3	88	7.81	7.58		
REN-2	6/2/2016	4	21.4	503	302.8	88.1	7.87	7.5		
REN-2	6/2/2016	5	21.4	502	302.1	88.2	7.84	7.58		
REN-2	6/2/2016	6	21.38	501	302.2	88.4	7.86	7.57		
REN-2	6/2/2016	7	21.3	500	302.7	86.4	7.65	7.54		
REN-2	8/13/2016	0.5	29.18	250	234.8	173.2	13.48	9.31	1021	19
REN-2	8/13/2016	1	28.92	249	234.3	172.5	13.35	9.3	1021	
REN-2	8/13/2016	2	28.71	258	233.9	149.2	11.76	9.21	1022	
REN-2	8/13/2016	3	28.07	283	235.6	95.1	7.18	8.57	1022	
REN-2	8/13/2016	4	27.9	297	236.9	68.3	4.95	8.22	1023	
REN-2	8/13/2016	5	27.83	307	236.3	52.8	4.11	7.95	1024	
REN-2	8/13/2016	6	27.72	319	238	33	2.54	7.63	1024	
REN-2	8/13/2016	7	27.51	329	241.5	0	0	7.35	1025	
REN-3	4/16/2016	2	16.4	394	305.7	105.3	10.3	7.89	11:07	24
REN-3	4/16/2016	3	15.42	390	307	100.1	10	7.8	11:08	
REN-3	4/16/2016	4	15.27	396	309	99.1	9.91	7.78	11:08	
REN-3	4/16/2016	5	15.12	400	309.9	90.7	9.11	7.62	11:10	
REN-3	4/16/2016	5.4	15.07	387	309.9	85.5	8.6	7.52	11:11	
REN-3	6/2/2016	0.5	22.14	411	314.1	86.1	7.48	7.46	0:00	18
REN-3	6/2/2016	1	22.14	408	314.5	84.9	7.43	7.46		

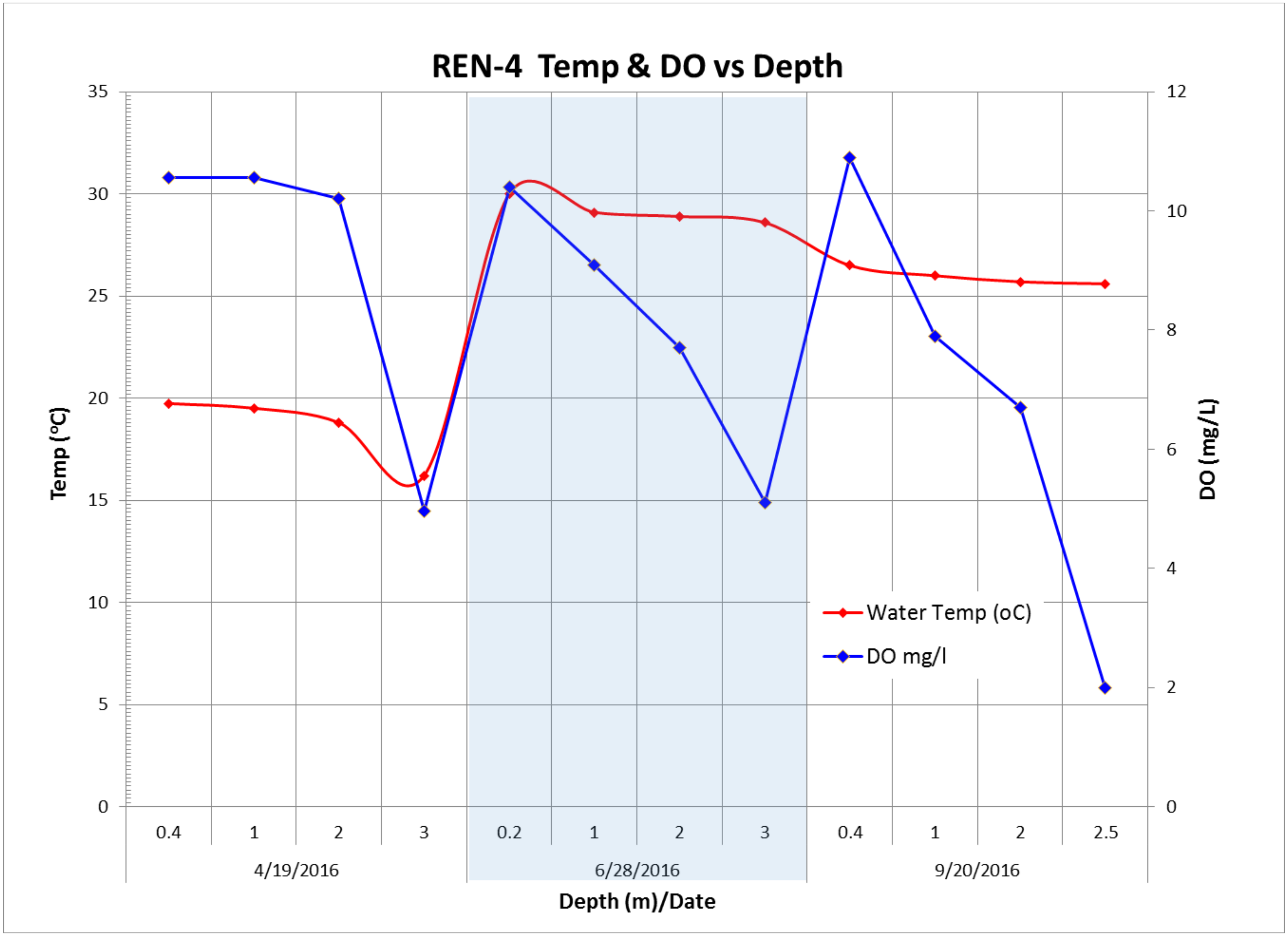
Site	Date	Depth	Water Temp (oC)	Redox (mv)	Cond (uS)	DO %	DO mg/l	pH	Time	Seechi (in)
REN-3	6/2/2016	2	22.12	405	314.4	83.8	7.32	7.43		
REN-3	6/2/2016	3	22.07	403	314.1	83.7	7.35	7.44		
REN-3	6/2/2016	4	22.07	303	314.3	81.8	7.19	7.42		
REN-3	8/13/2016	0.5	29.46	253	221.4	174	13.4	9.25	1111	16
REN-3	8/13/2016	1	27.74	269	221.7	128	10.27	8.88		
REN-3	8/13/2016	2	27.47	296	224.2	78.3	6.04	8.22		
REN-3	8/13/2016	3	27.33	318	227	36.1	2.76	7.73		
REN-3	8/13/2016	3.7	27.21	257	231.2	0	0	7.5		
REN-4	4/16/2016	2	16.62	381	312.7	110.5	11.32	8.31	11:32	15
REN-4	4/16/2016	3	16.12	393	314	100.5	9.86	7.82	11:33	
REN-4	4/16/2016	4	16.09	395	313.6	98.2	9.65	7.75	11:34	
REN-4	4/16/2016	5	16.05	398	313.5	94.7	9.3	7.65	11:34	
REN-4	4/16/2016	5.3	16.1	325	314.3	8	8.63	7.56	11:30	
REN-4	6/2/2016	0.5	21.69	397	334.2	86.3	7.64	7.5	0:00	15
REN-4	6/2/2016	1	21.73	395	334.8	86	7.58	7.4		
REN-4	6/2/2016	2	21.72	393	332.4	86	7.6	7.48		
REN-4	6/2/2016	3	21.12	392	331.6	86.4	7.62	7.48		
REN-4	6/2/2016	4	21.69	226	333.7	84.6	7.48	7.46		
REN-4	8/13/2016	0.5	29.26	262	228.6	166.8	12.89	9.05	1131	35
REN-4	8/13/2016	1	28.33	272	230.4	148.1	11.27	8.86		
REN-4	8/13/2016	2	27.87	288	230.7	108.6	8.33	8.47		
REN-4	8/13/2016	3	27.55	314	233.2	52.4	4.02	7.85		
REN-4	8/13/2016	4	27.42	326	237.2	33.2	2.56	7.57	1319	
REN-5	4/16/2016	2.3	15.07	394	669.6	82.6	8.29	7.71	8:34	
REN-5	6/2/2016	1.1	17.4	547	505.2	78.9	7.6	7.23	9:16	
REN-5	8/13/2016	0.7	23.32	323	344.4	72.1	6.07	7.5	836	
REN-7	4/16/2016	1.9	15.34	407	510.3	90.7	9.06	7.57	12:53	
REN-7	6/2/2016	0.3	17.92	363	511	86.7	8.25	7.31	1:44	
REN-7	8/13/2016	0.7	24.42	252	459.2	82.3	6.83	7.56	1139	
REN-8	4/16/2016	2	16.62	394	221.2	87.6	8.59	7.56	10:37	12
REN-8	4/16/2016	3	15.89	390	246.5	82.6	8.1	7.45	10:38	
REN-8	4/16/2016	4	15.72	397	253	78.5	7.96	7.43	10:38	
REN-8	4/16/2016	5	15.41	400	259.8	70.7	7	7.34	10:39	
REN-8	4/16/2016	6	15.36	401	259.9	68.5	6.84	7.3	10:40	
REN-8	4/16/2016	6.7	15.36	399	260	67.7	6.76	7.29	10:41	
REN-8	6/2/2016	0.5	22.2	392	282	70	6	7.32	0:00	16

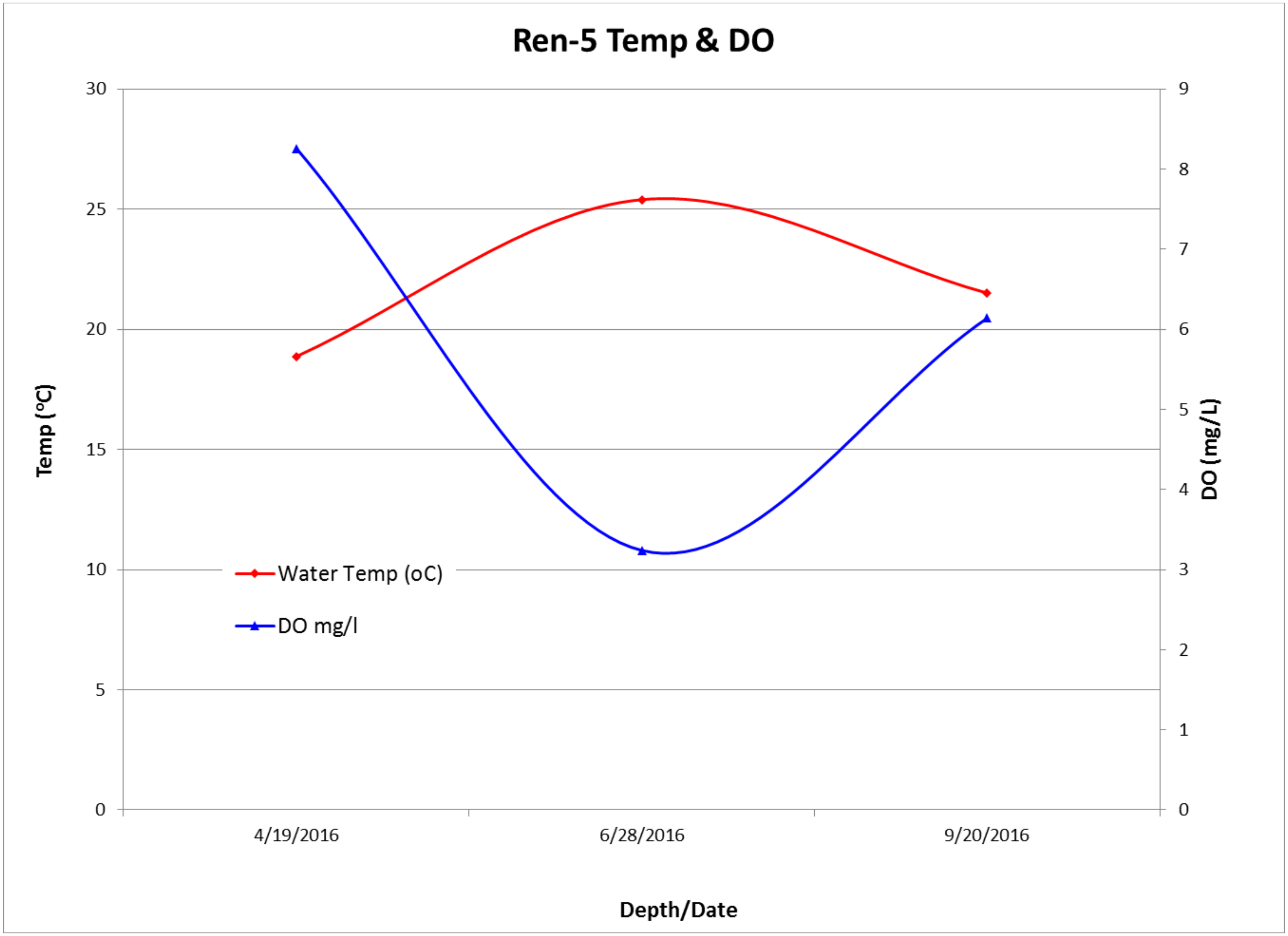
Site	Date	Depth	Water Temp (oC)	Redox (mv)	Cond (uS)	DO %	DO mg/l	pH	Time	Seechi (in)
REN-8	6/2/2016	1	22	396	282	67	5.84	7.28		
REN-8	6/2/2016	2	22.26	396	281.7	66	5.78	7.25		
REN-8	6/2/2016	3	22.26	394	282.5	65	5.72	7.23		
REN-8	6/2/2016	4	22.24	393	283.1	64	5.6	7.2		
REN-8	8/13/2016	0.5	23.34	301	205	81.4	6.21	8.1	1046	17
REN-8	8/13/2016	1	27.94	319	209.7	65.7	6.15	7.99		
REN-8	8/13/2016	2	27.76	317	213.3	65.3	5.03	7.75		
REN-8	8/13/2016	3	27.63	327	213.5	55	4.32	7.58		
REN-8	8/13/2016	4	27.58	335	215.4	40.8	3.15	7.42		
REN-8	8/13/2016	5	27.58	338	216.5	30.4	2.43	7.37		


Ren-1 Temp & DO
30
25
20
15
10
5
0
6
5
4
3
2
1
0
Temp (°C)
DO (mg/L)
Water Temp (oC)
DO mg/l
4/19/2016
6/28/2016
9/20/2016
Depth/Date

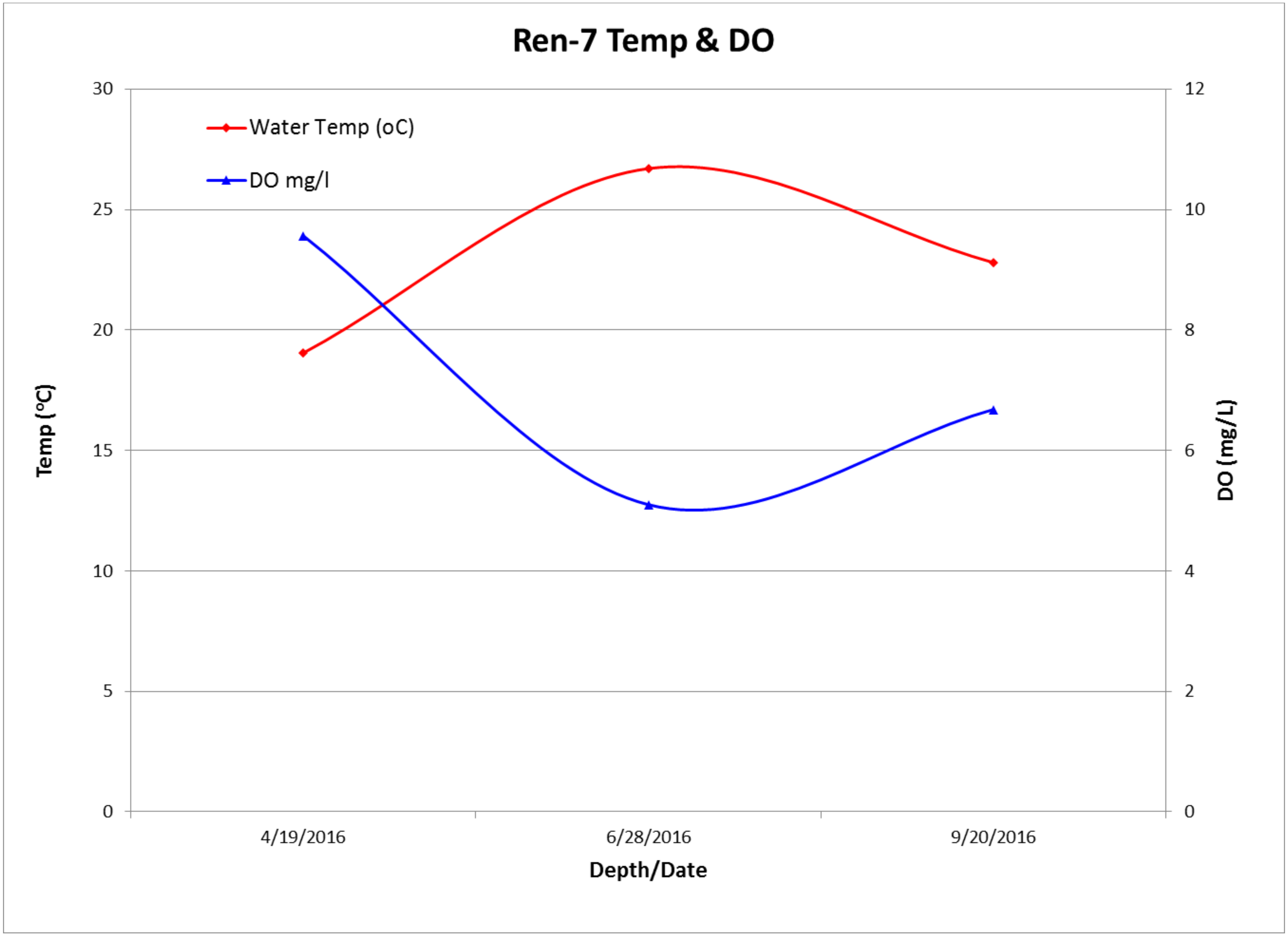

REN-2 Temp & DO vs Depth
Temp (°C)
35
30
25
20
15
10
5
0
12
10
8
6
4
2
0
Water Temp (oC)
0.3 1 2 3 4 5 6 7
4/19/2016
0.2 1 2 3 4 5
6/28/2016
0.4 1 2 3 4 5 6 7 7.9
9/20/2016
Depth (m)/ Date

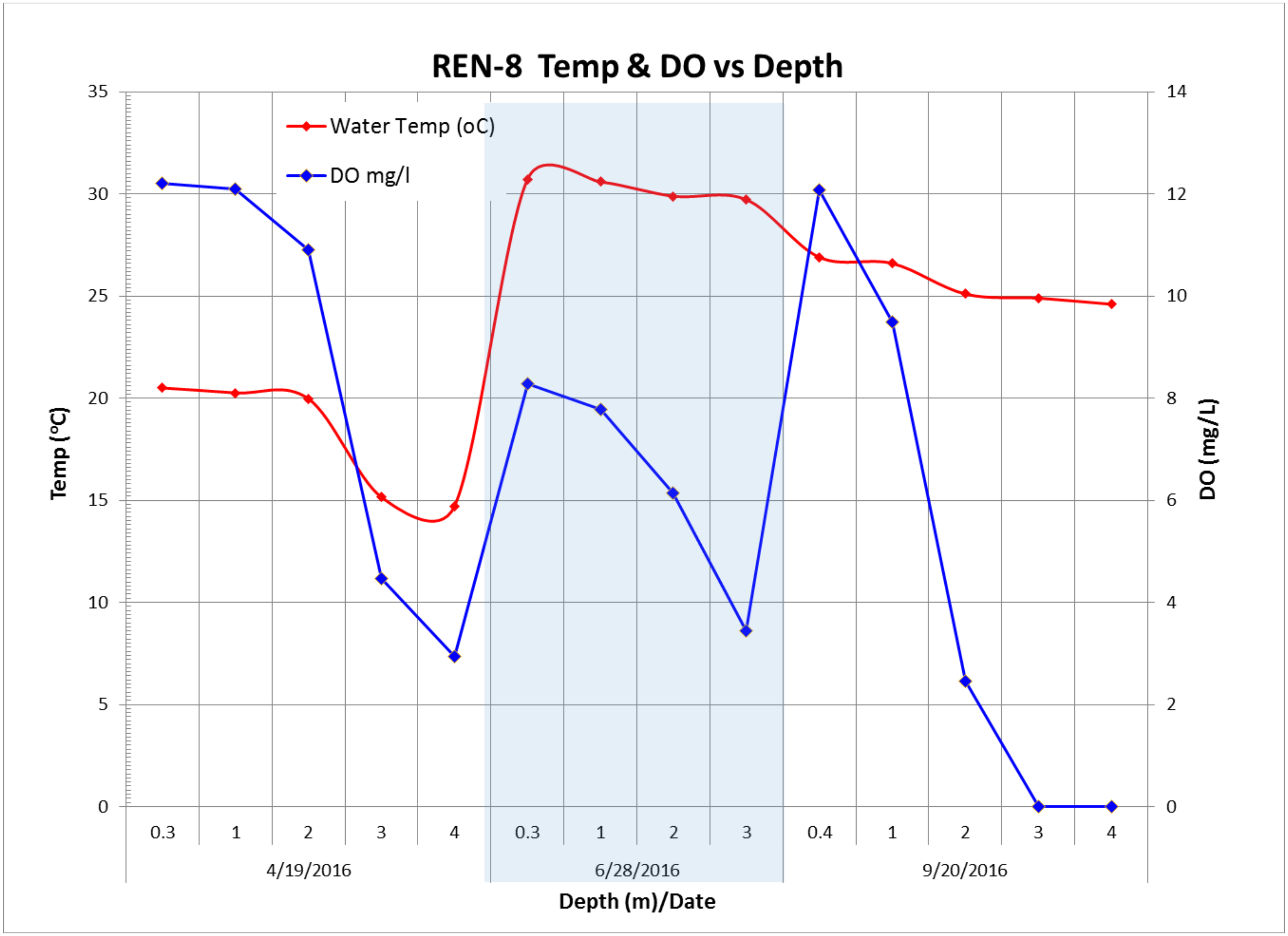

REN-3 Temp & DO vs Depth
Temp (°C)
DO (mg/L)
35
30
25
20
15
10
5
0
16
14
12
10
8
6
4
2
0
Water Temp (oC)
DO mg/l
0.5
1
2
3
0.2
1
2
3
0.4
1
2
3
4/19/2016
6/28/2016
9/20/2016
Depth (m)/Date

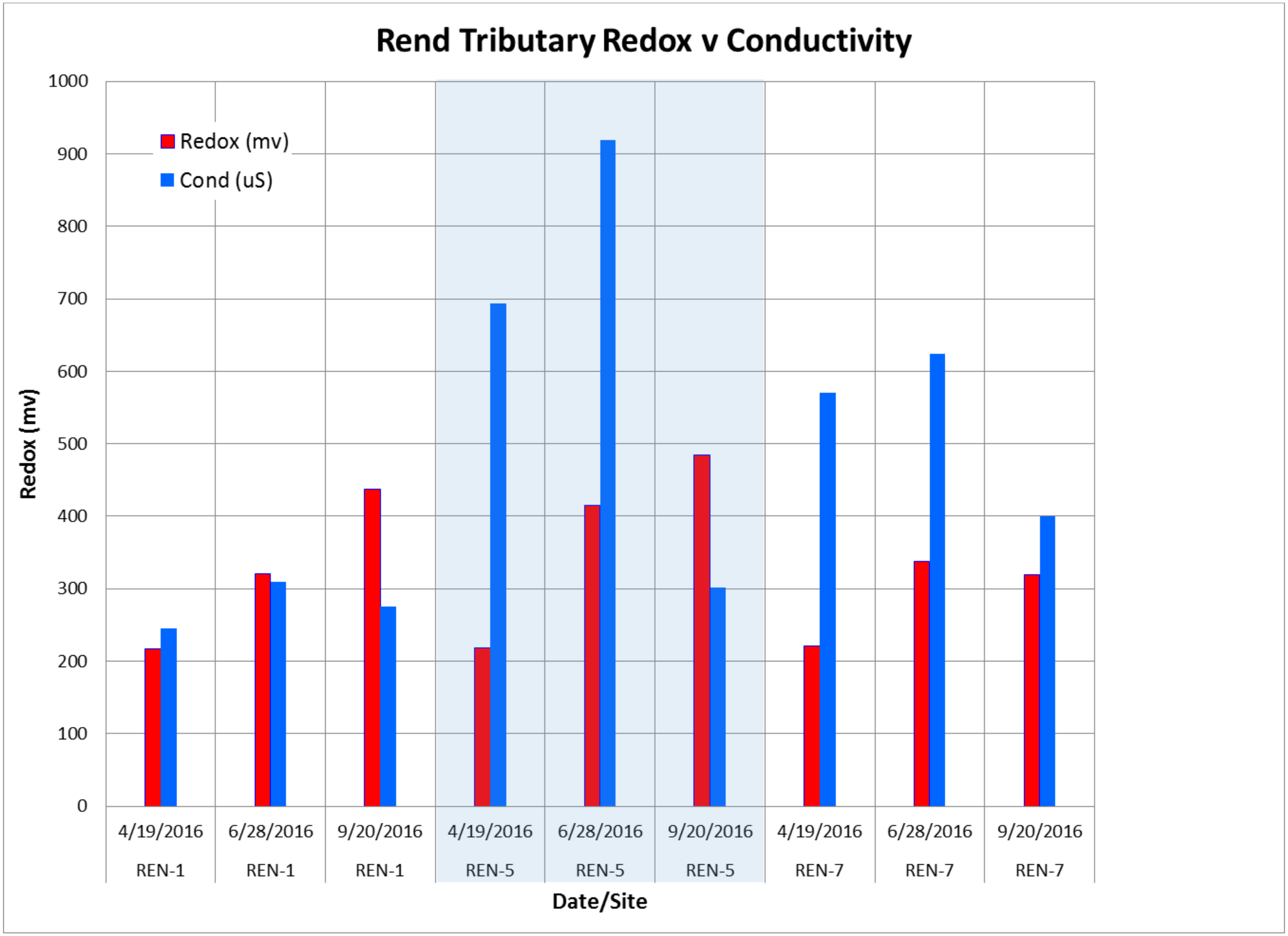

REN-4 Temp & DO vs Depth
Temp (°C)
DO (mg/L)
35
30
25
20
15
10
5
0
12
10
8
6
4
2
0
Water Temp (oC)
DO mg/l
0.4
1
2
3
0.2
1
2
3
0.4
1
2
2.5
4/19/2016
6/28/2016
9/20/2016
Depth (m)/Date

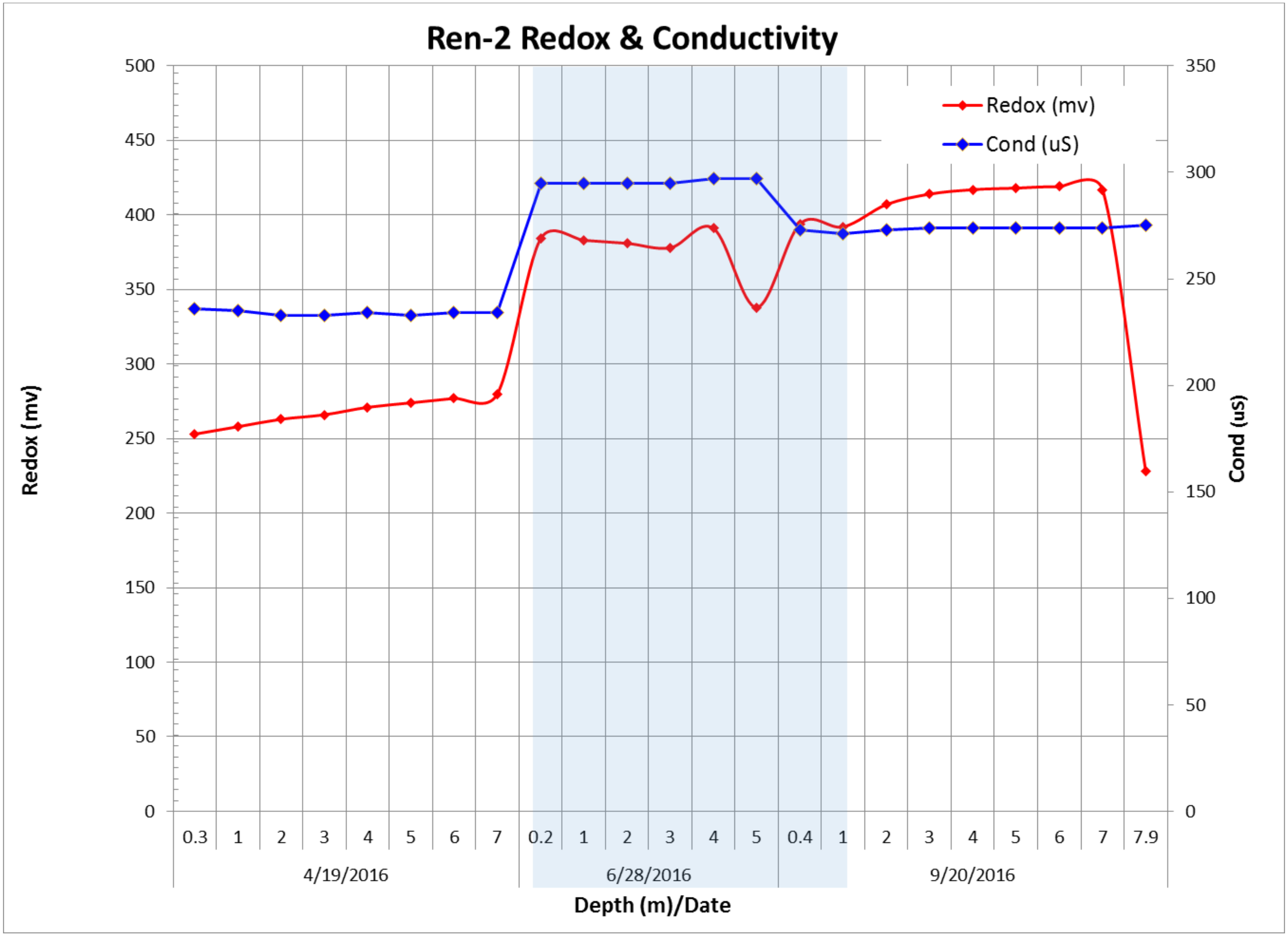


Ren-5 Temp & DO
30
25
20
15
10
5
0
9
8
7
6
5
4
3
2
1
0
Temp (ºC)
DO (mg/L)
Water Temp (oC)
DO mg/l
4/19/2016
6/28/2016
9/20/2016
Depth/Date

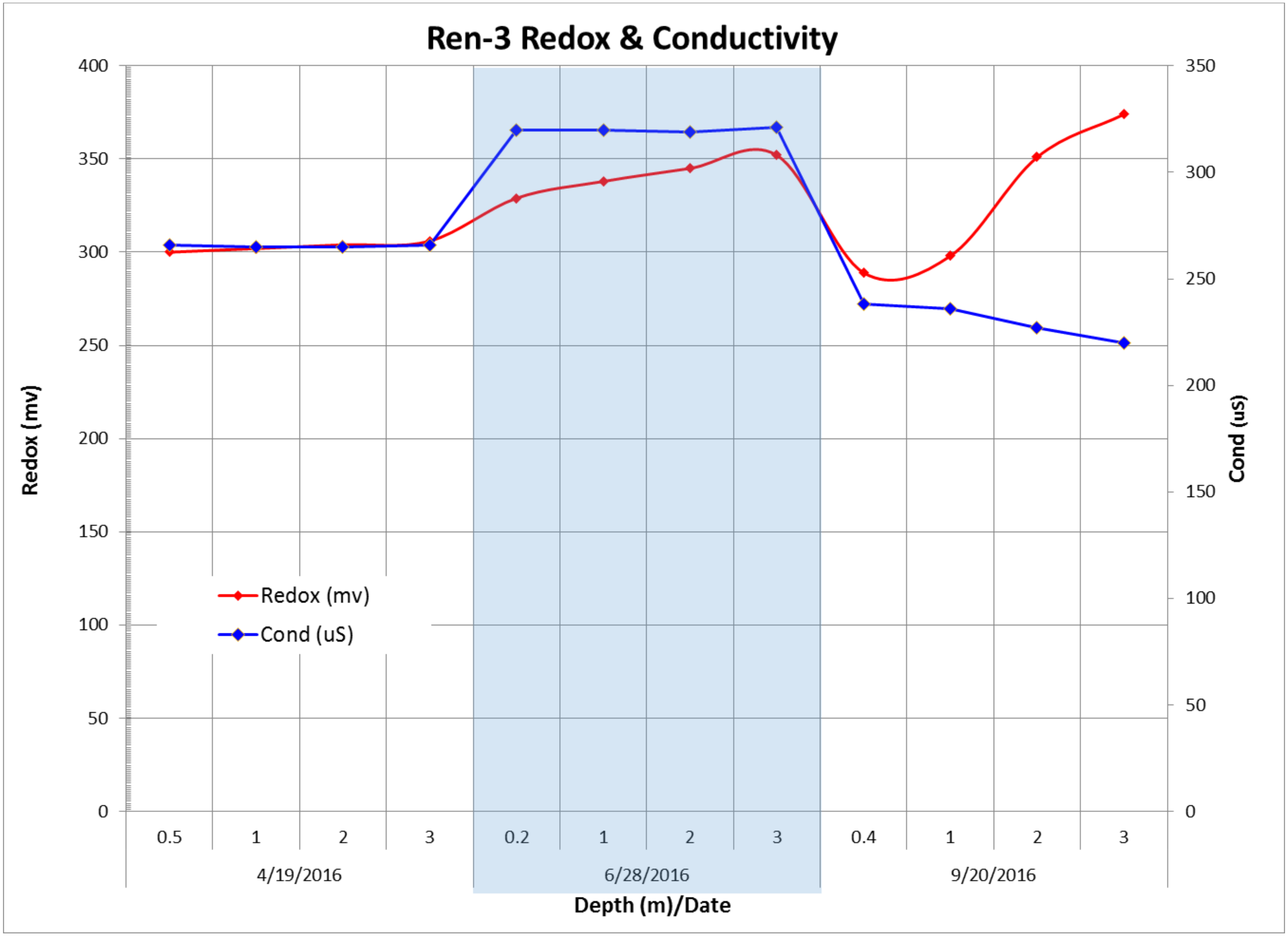

Ren-7 Temp & DO
Water Temp (oC)
DO mg/l
Temp (ºC)
DO (mg/L)
30
25
20
15
10
5
0
12
10
8
6
4
2
0
4/19/2016
6/28/2016
9/20/2016
Depth/Date

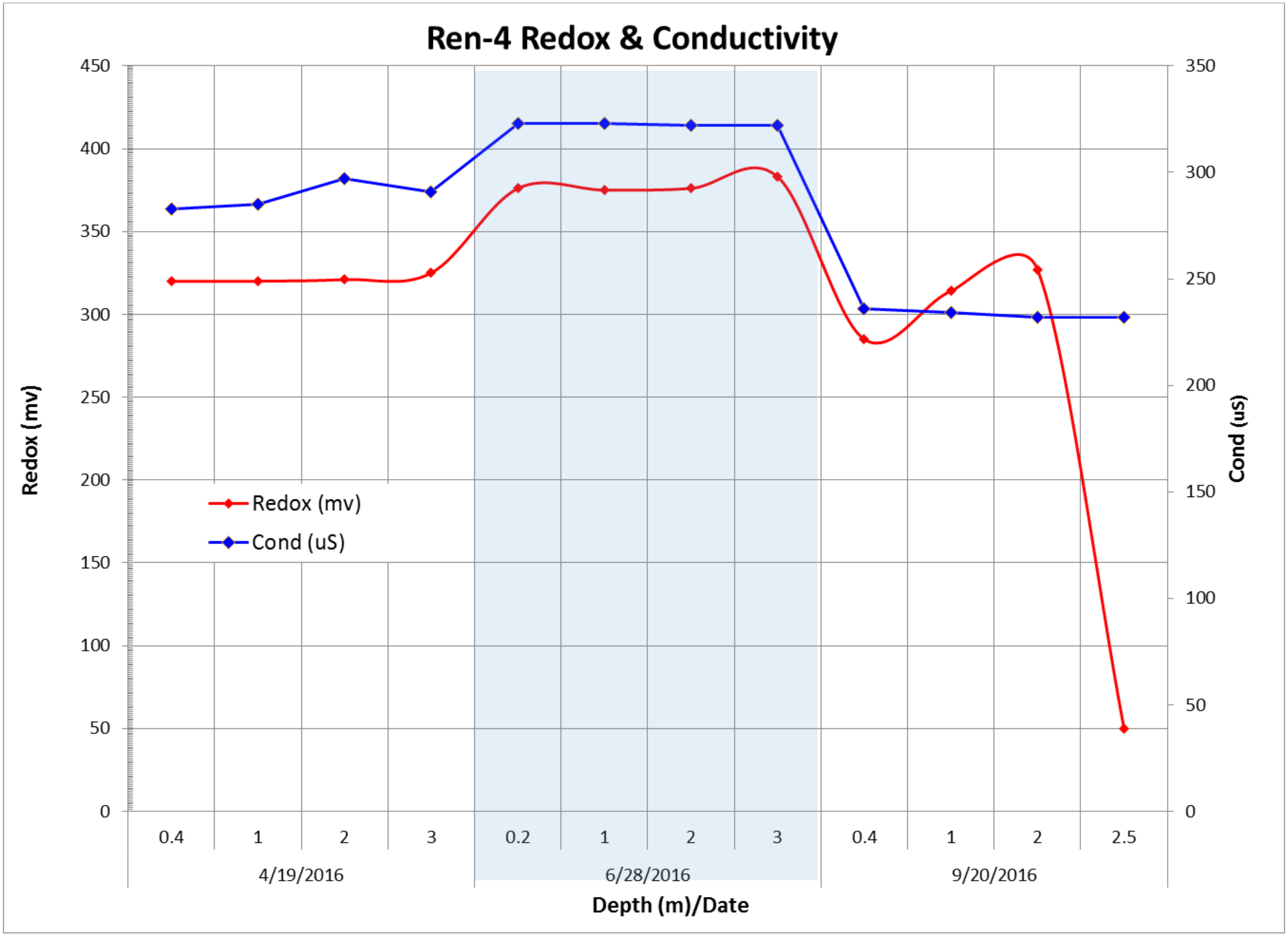

REN-8 Temp & DO vs Depth
Water Temp (oC)
DO mg/l
Temp (°C)
DO (mg/L)
35
30
25
20
15
10
5
0
14
12
10
8
6
4
2
0
0.3
1
2
3
4
0.3
1
2
3
0.4
1
2
3
4
4/19/2016
6/28/2016
9/20/2016
Depth (m)/Date


Rend Tributary Redox v Conductivity
Redox (mv)
Cond (uS)
Redox (mv)
1000
900
800
700
600
500
400
300
200
100
0
4/19/2016
REN-1
6/28/2016
REN-1
9/20/2016
REN-1
4/19/2016
REN-5
6/28/2016
REN-5
9/20/2016
REN-5
4/19/2016
REN-7
6/28/2016
REN-7
9/20/2016
REN-7
Date/Site

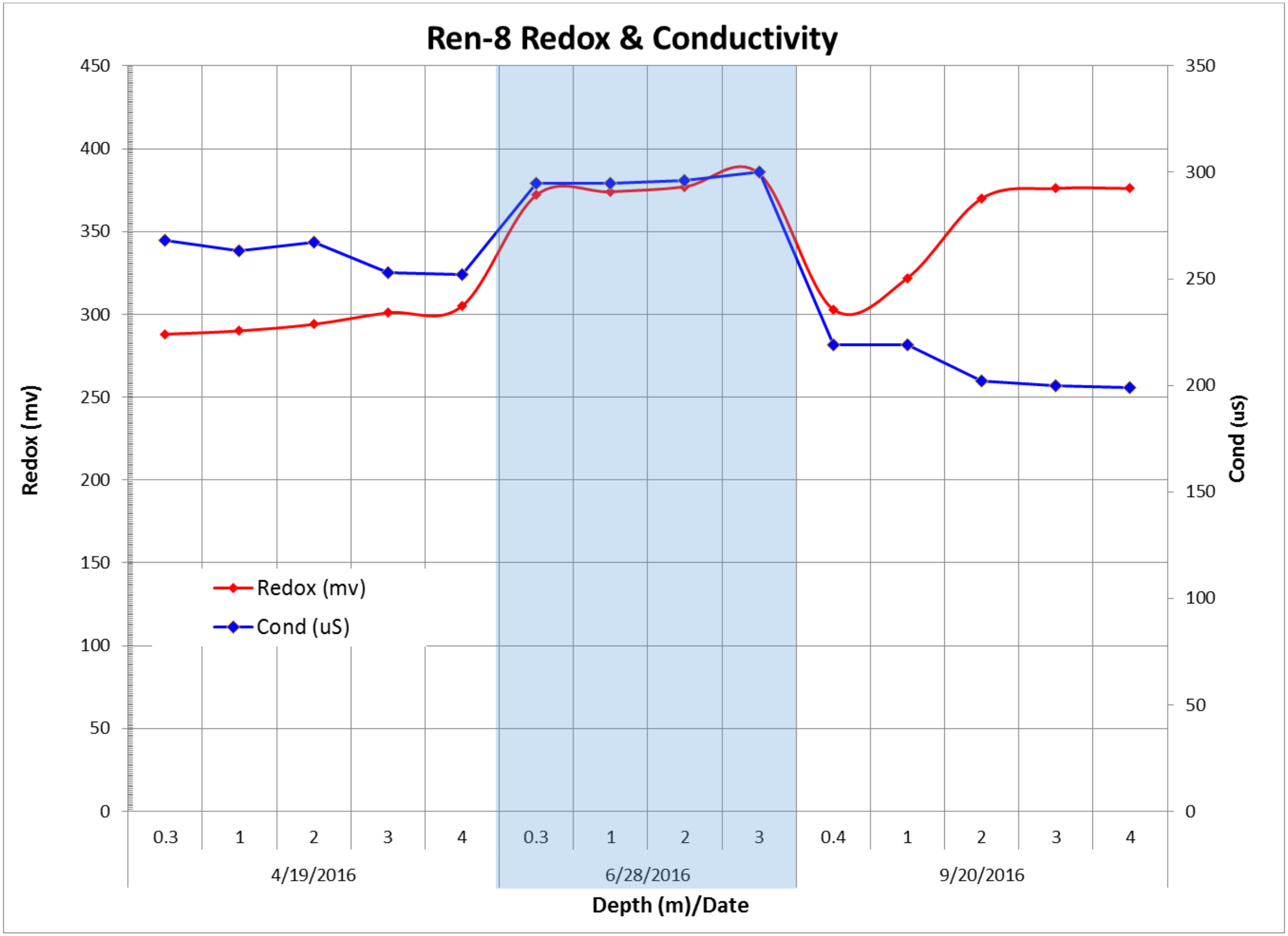


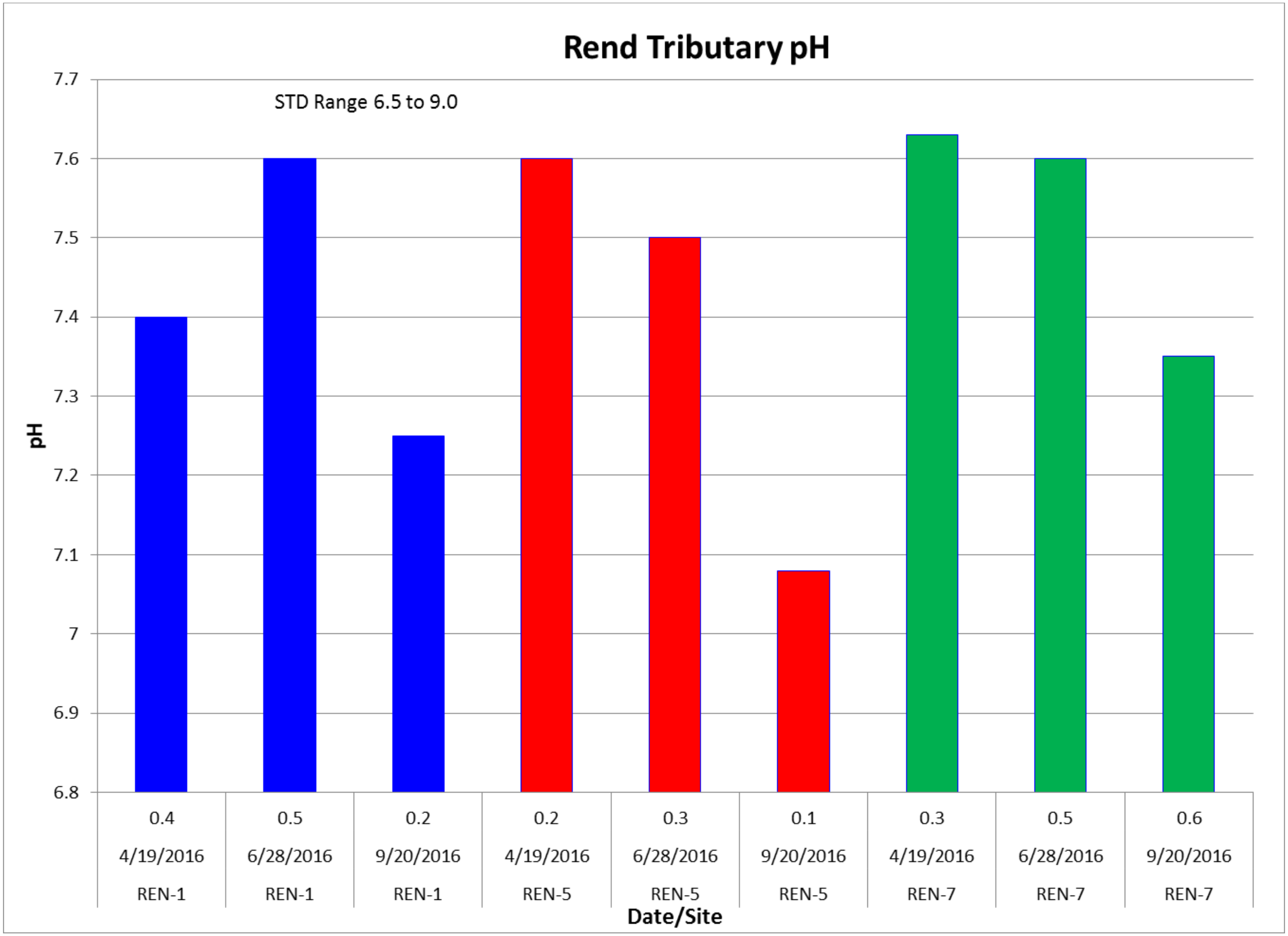
Ren-2 Redox & Conductivity
Redox (mv)
Cond (uS)
500
450
400
350
300
250
200
150
100
50
0
350
300
250
200
150
100
50
0
Redox (mv)
Cond (us)
0.3 1 2 3 4 5 6 7 0.2 1 2 3 4 5 0.4 1 2 3 4 5 6 7 7.9
4/19/2016
6/28/2016
9/20/2016
Depth (m)/Date


Ren-3 Redox & Conductivity
Redox (mv)
Cond (us)
400
350
300
250
200
150
100
50
0
0
50
100
150
200
250
300
350
Redox (mv)
Cond (uS)
0.5
1
2
3
0.2
1
2
3
0.4
1
2
3
4/19/2016
6/28/2016
9/20/2016
Depth (m)/Date

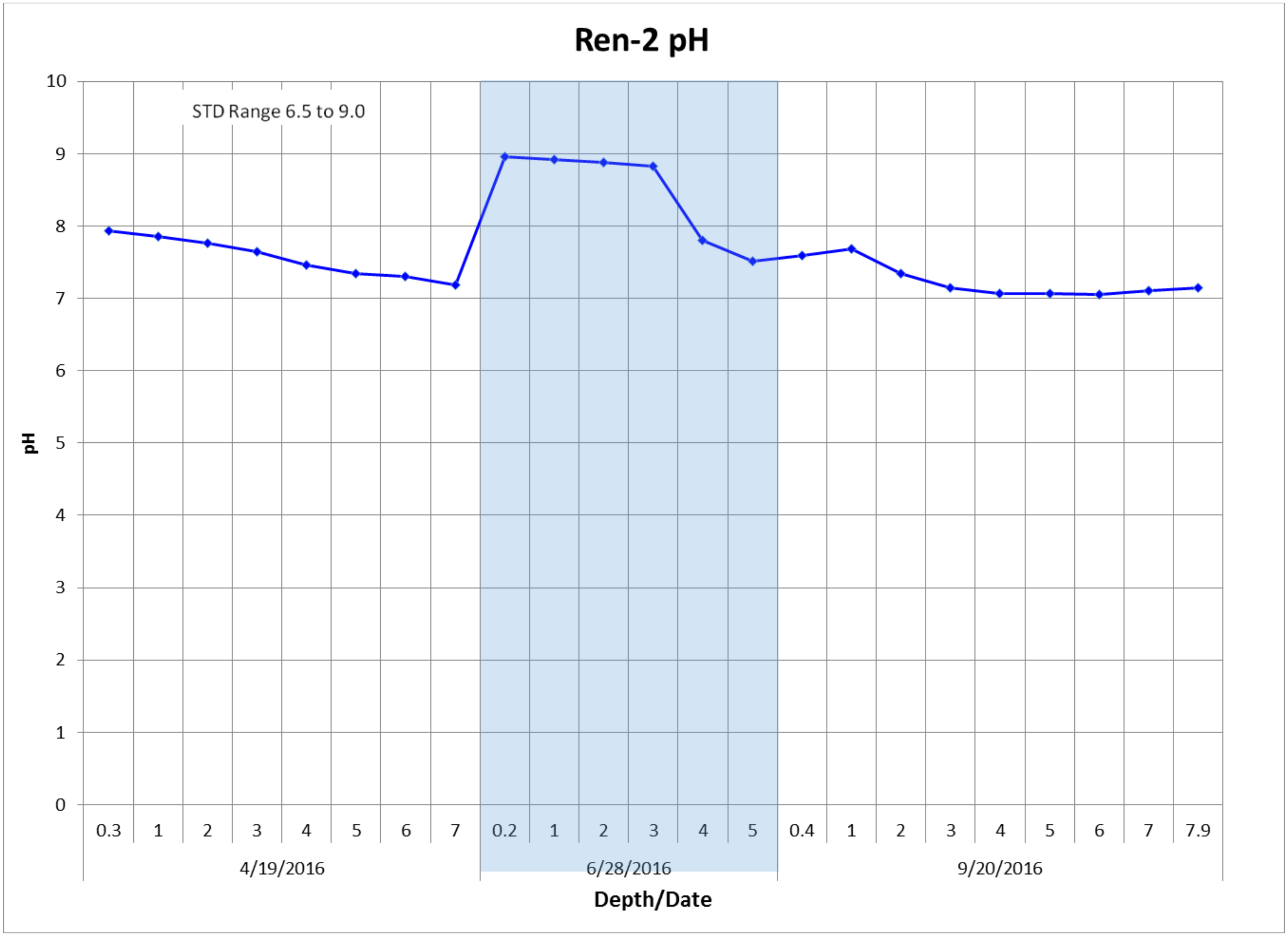


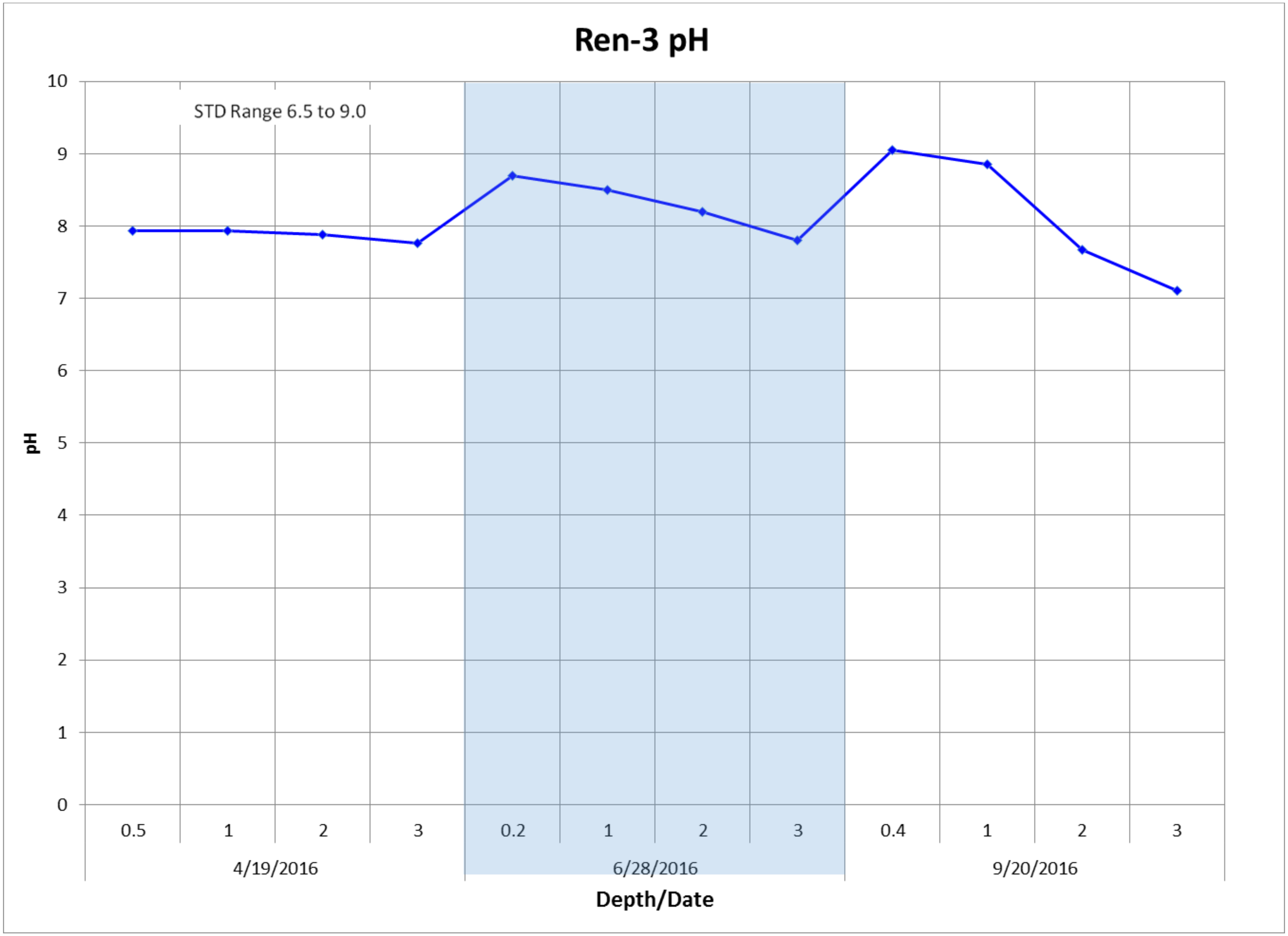
Ren-4 Redox & Conductivity
450
400
350
300
250
200
150
100
50
0
Redox (mv)
350
300
250
200
150
100
50
0
Cond (us)
Redox (mv)
Cond (uS)
0.4
1
2
3
0.2
1
2
3
0.4
1
2
2.5
4/19/2016
6/28/2016
9/20/2016
Depth (m)/Date


Ren-8 Redox & Conductivity
Redox (mv)
Cond (us)
450
400
350
300
250
200
150
100
50
0
350
300
250
200
150
100
50
0
Redox (mv)
Cond (uS)
0.3
1
2
3
4
0.3
1
2
3
0.4
1
2
3
4
4/19/2016
6/28/2016
9/20/2016
Depth (m)/Date

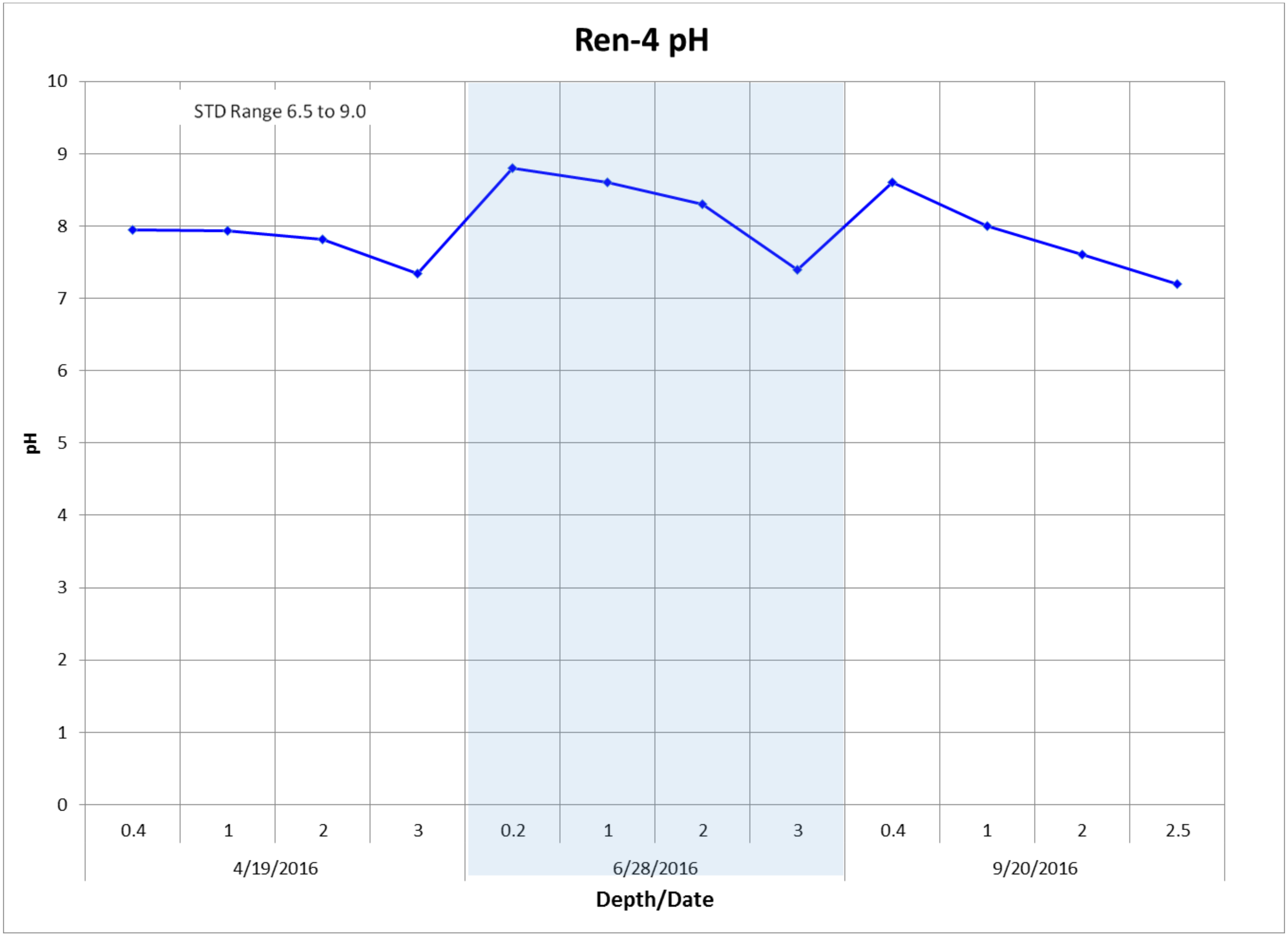


Rend Tributary pH
STD Range 6.5 to 9.0
pH
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7
6.9
6.8
0.4
4/19/2016
REN-1
0.5
6/28/2016
REN-1
0.2
9/20/2016
REN-1
0.2
4/19/2016
REN-5
0.3
6/28/2016
REN-5
0.1
9/20/2016
REN-5
0.3
4/19/2016
REN-7
0.5
6/28/2016
REN-7
0.6
9/20/2016
REN-7
Date/Site

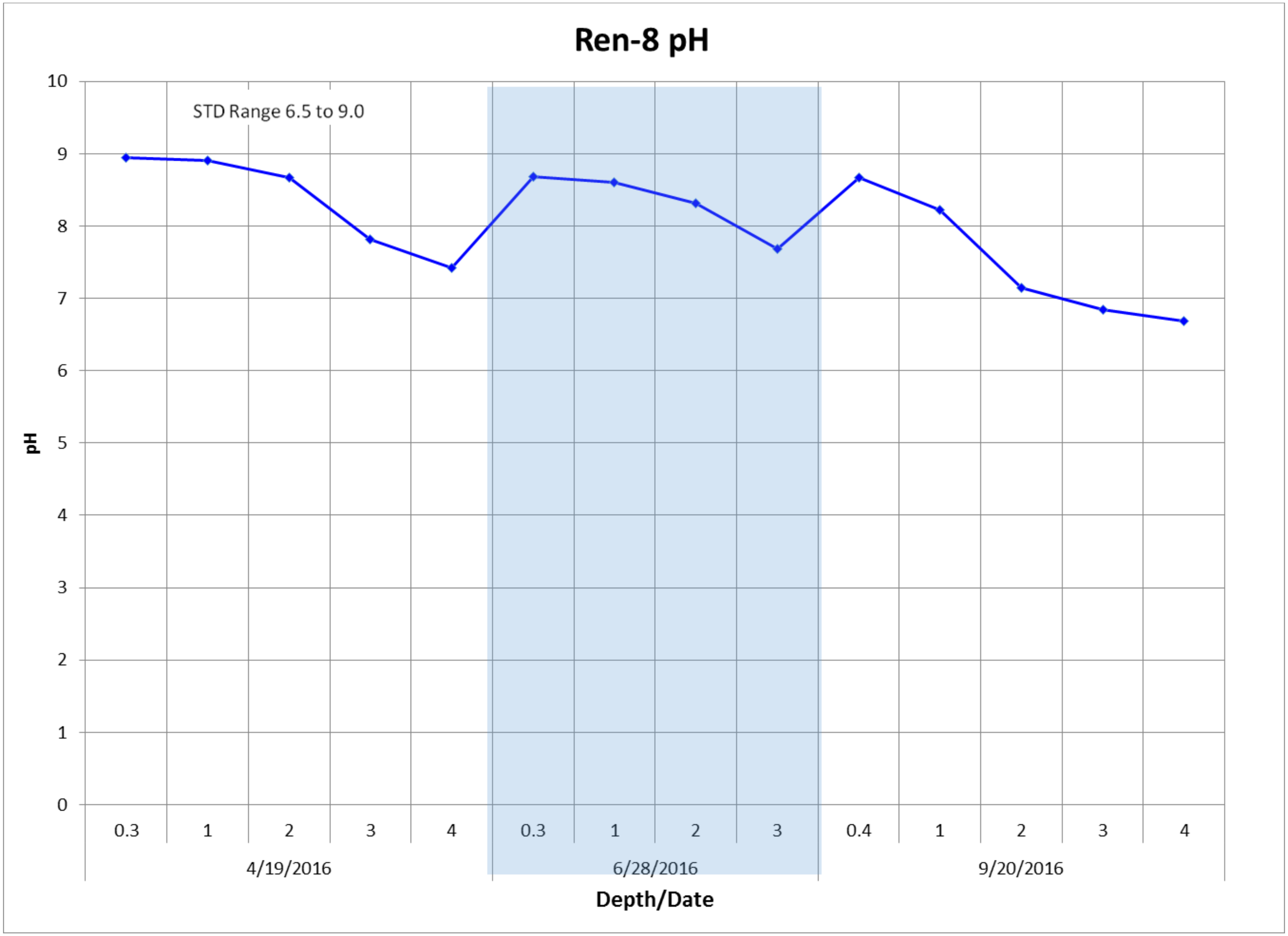

Ren-2 pH
STD Range 6.5 to 9.0
pH
0
1
2
3
4
5
6
7
8
9
10
0.3 1 2 3 4 5 6 7 0.2 1 2 3 4 5 0.4 1 2 3 4 5 6 7 7.9
4/19/2016
6/28/2016
9/20/2016
Depth/Date

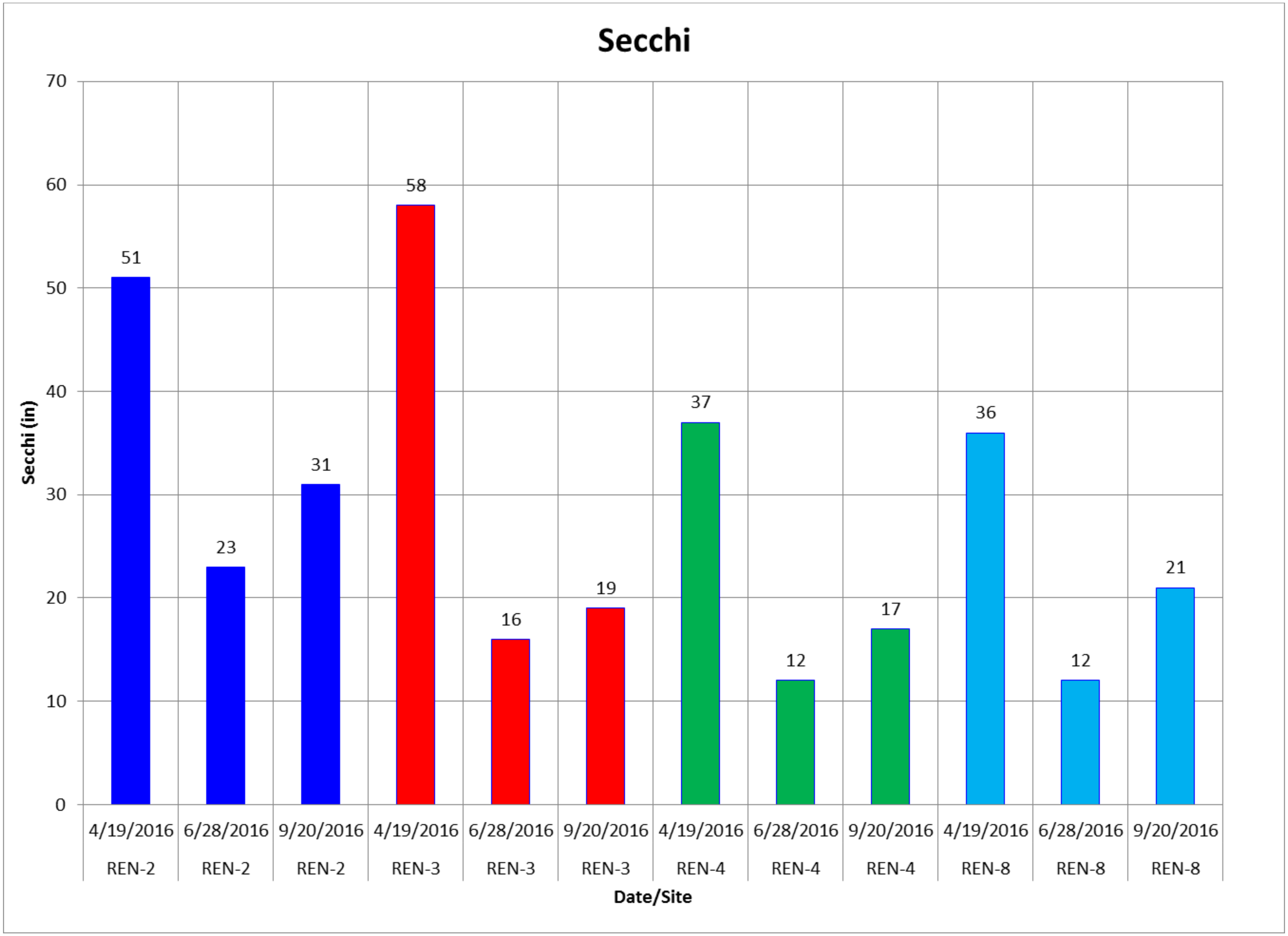


Ren-3 pH
STD Range 6.5 to 9.0
pH
10
9
8
7
6
5
4
3
2
1
0
0.5
1
2
3
0.2
1
2
3
0.4
1
2
3
4/19/2016
6/28/2016
9/20/2016
Depth/Date



Ren-4 pH
10
9
8
7
6
5
4
3
2
1
0
STD Range 6.5 to 9.0
pH
0.4
1
2
3
0.2
1
2
3
0.4
1
2
2.5
4/19/2016
6/28/2016
9/20/2016
Depth/Date


Ren-8 pH
STD Range 6.5 to 9.0
pH
10
9
8
7
6
5
4
3
2
1
0
0.3
1
2
3
4
0.3
1
2
3
0.4
1
2
3
4
4/19/2016
6/28/2016
9/20/2016
Depth/Date


Secchi
70
60
50
40
30
20
10
0
Secchi (in)
51
23
31
58
16
19
37
12
17
36
12
21
4/19/2016
6/28/2016
9/20/2016
4/19/2016
6/28/2016
9/20/2016
4/19/2016
6/28/2016
9/20/2016
4/19/2016
6/28/2016
9/20/2016
REN-2
REN-2
REN-2
REN-3
REN-3
REN-3
REN-4
REN-4
REN-4
REN-8
REN-8
REN-8
Date/Site

APPENDIX D

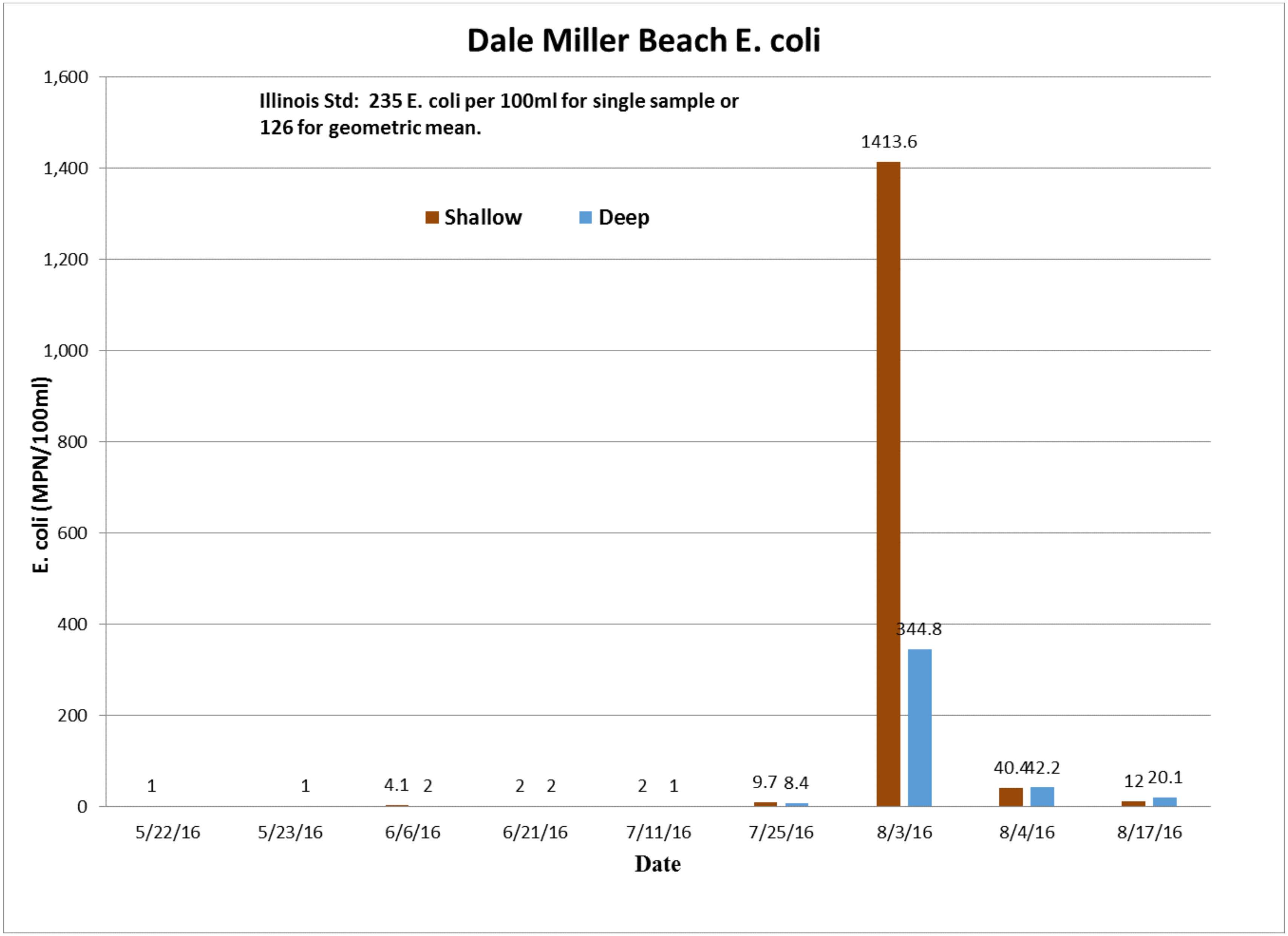
BEACH DATA
& GRAPHS

E. Coli Beach Data

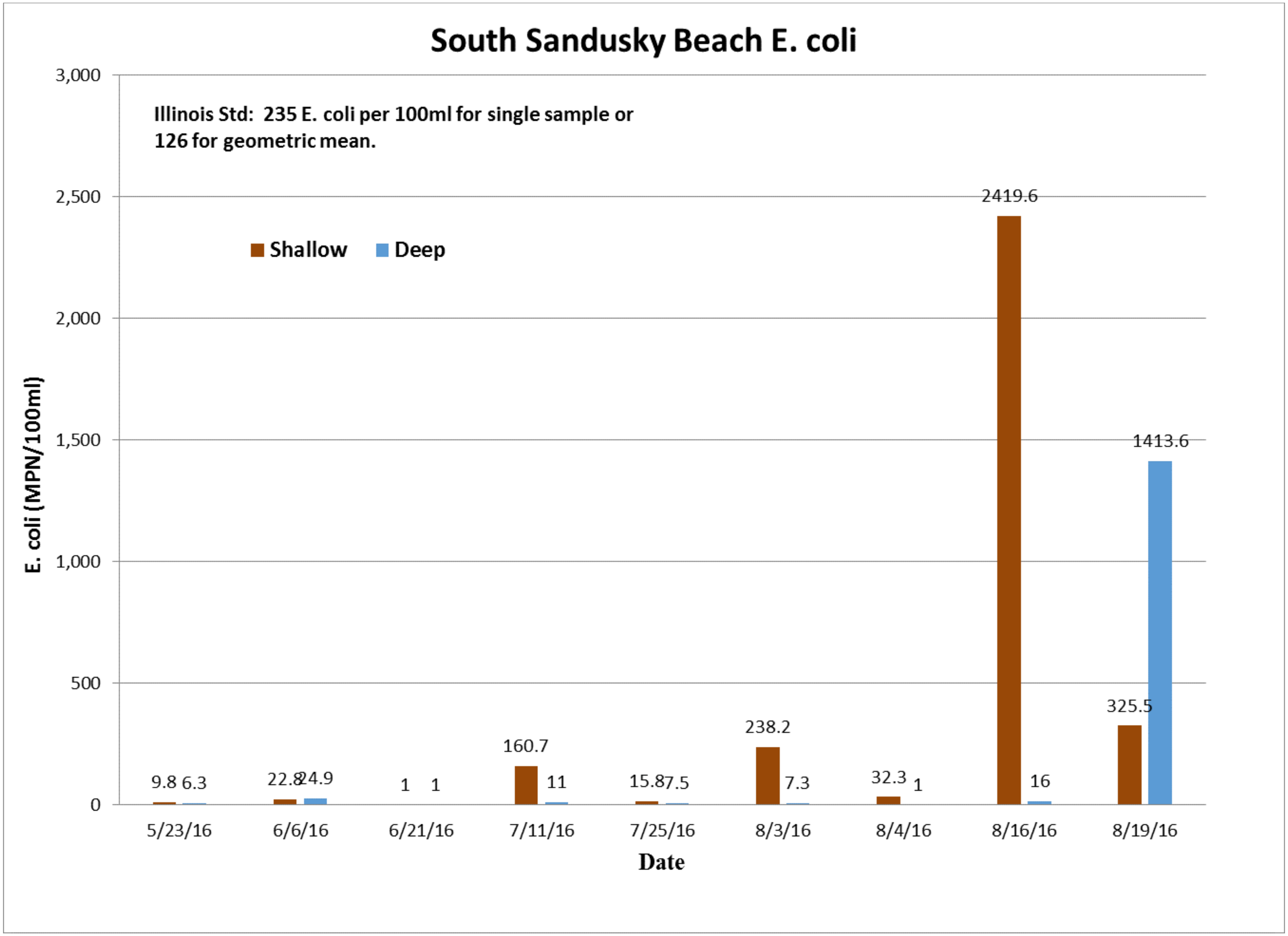
Site	Date Collected	Matrix	Result	Qualifier	Unit	Analyte Name	Location
Beach Data							
Dale Miller	5/12/2016	w	4.1		MPN/100ml	E. coli	Deep
Dale Miller	5/27/2016	w	1		MPN/100ml	E. coli	Deep
Dale Miller	6/9/2016	w	396.8		MPN/100ml	E. coli	Deep
Dale Miller	6/10/2016	w	128.1		MPN/100ml	E. coli	Deep
Dale Miller	6/10/2016	w	128.1		MPN/100ml	E. coli	Deep
Dale Miller	6/23/2016	w	9.8		MPN/100ml	E. coli	Deep
Dale Miller	7/6/2016	w	1	<	MPN/100ml	E. coli	Deep
Dale Miller	7/20/2016	w	7.4	<	MPN/100ml	E. coli	Deep
Dale Miller	8/3/2016	w	1		MPN/100ml	E. coli	Deep
Dale Miller	8/17/2016	w	1	<	MPN/100ml	E. coli	Deep
Dale Miller	9/1/2016	w	1		MPN/100ml	E. coli	Deep
Dale Miller	5/12/2016	w	10.8		MPN/100ml	E. coli	Shallow
Dale Miller	5/27/2016	w	1		MPN/100ml	E. coli	Shallow
Dale Miller	6/9/2016	w	272.3		MPN/100ml	E. coli	Shallow
Dale Miller	6/10/2016	w	34.1		MPN/100ml	E. coli	Shallow
Dale Miller	6/10/2016	w	34.1		MPN/100ml	E. coli	Shallow
Dale Miller	6/23/2016	w	18.9		MPN/100ml	E. coli	Shallow
Dale Miller	7/6/2016	w	1	<	MPN/100ml	E. coli	Shallow
Dale Miller	7/20/2016	w	7.2		MPN/100ml	E. coli	Shallow
Dale Miller	8/17/2016	w	1		MPN/100ml	E. coli	Shallow
Dale Miller	9/1/2016	w	1	<	MPN/100ml	E. coli	Shallow
Dale Miller	8/3/2016	w	1	<	MPN/100ml	E. coli	Shallow
Marina Beach	5/12/2016	w	13.4		MPN/100ml	E. coli	Deep
Marina Beach	5/27/2016	w	3		MPN/100ml	E. coli	Deep
Marina Beach	6/9/2016	w	172.2		MPN/100ml	E. coli	Deep
Marina Beach	6/23/2016	w	23.3		MPN/100ml	E. coli	Deep
Marina Beach	7/6/2016	w	28.5		MPN/100ml	E. coli	Deep
Marina Beach	7/20/2016	w	16		MPN/100ml	E. coli	Deep
Marina Beach	8/3/2016	w	1	<	MPN/100ml	E. coli	Deep
Marina Beach	8/17/2016	w	47.3		MPN/100ml	E. coli	Deep

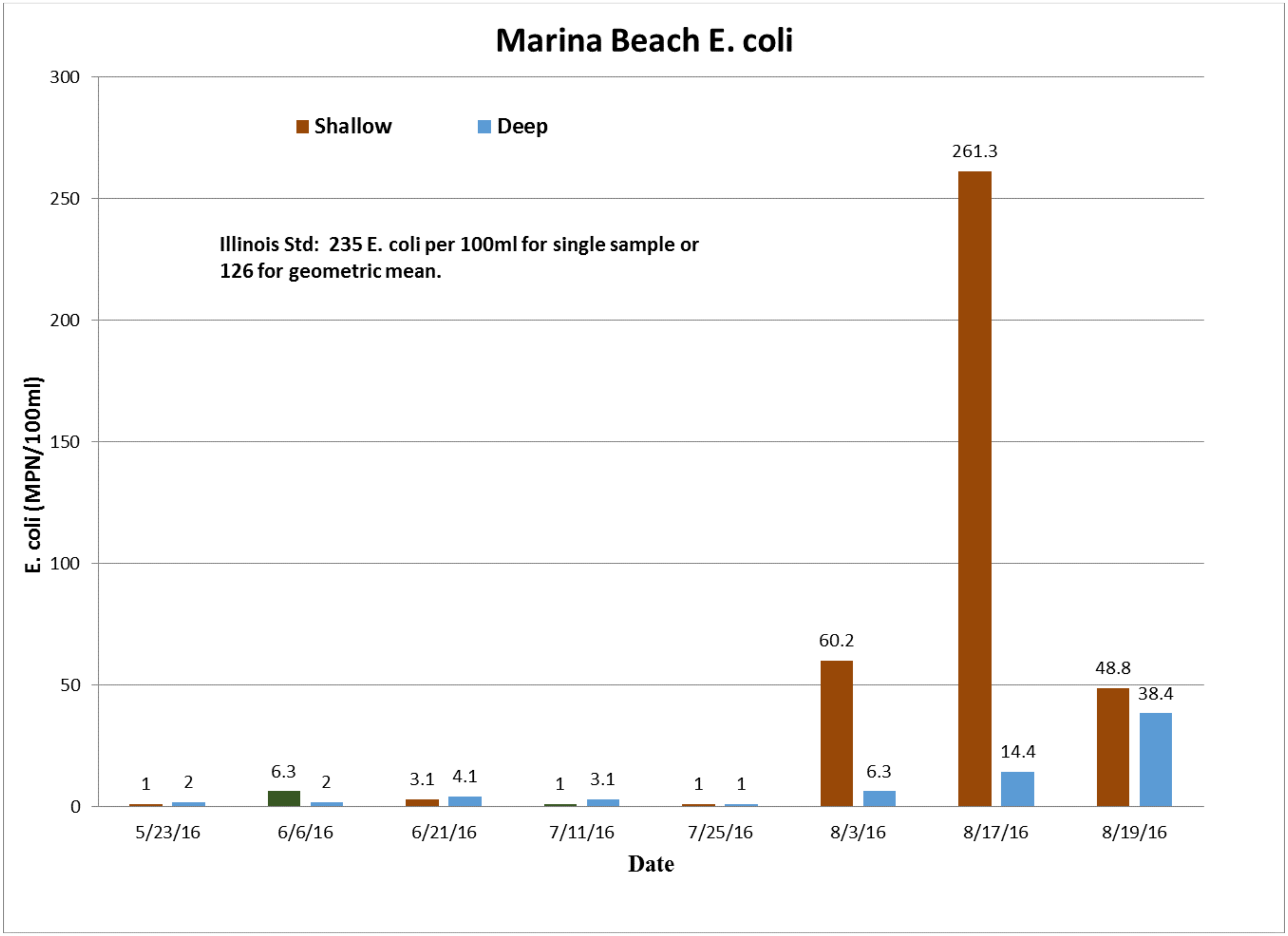
Site	Date Collected	Matrix	Result	Qualifier	Unit	Analyte Name	Location
Marina Beach	8/20/2016	w	12.1		MPN/100ml	E. coli	Deep
Marina Beach	9/1/2016	w	1	<	MPN/100ml	E. coli	Deep
Marina Beach	5/12/2016	w	12.2		MPN/100ml	E. coli	Shallow
Marina Beach	5/27/2016	w	3		MPN/100ml	E. coli	Shallow
Marina Beach	6/9/2016	w	193.5		MPN/100ml	E. coli	Shallow
Marina Beach	6/23/2016	w	21.8		MPN/100ml	E. coli	Shallow
Marina Beach	7/6/2016	w	28.8		MPN/100ml	E. coli	Shallow
Marina Beach	7/20/2016	w	25.6		MPN/100ml	E. coli	Shallow
Marina Beach	8/3/2016	w	1		MPN/100ml	E. coli	Shallow
Marina Beach	8/17/2016	w	235.9		MPN/100ml	E. coli	Shallow
Marina Beach	8/20/2016	w	26.9		MPN/100ml	E. coli	Shallow
Marina Beach	9/1/2016	w	3.1		MPN/100ml	E. coli	Shallow
South Sandusky	5/12/2016	w	1	<	MPN/100ml	E. coli	Deep
South Sandusky	5/27/2016	w	1	<	MPN/100ml	E. coli	Deep
South Sandusky	6/9/2016	w	44.1		MPN/100ml	E. coli	Deep
South Sandusky	6/23/2016	w	2		MPN/100ml	E. coli	Deep
South Sandusky	7/6/2016	w	6.3		MPN/100ml	E. coli	Deep
South Sandusky	7/20/2016	w	62		MPN/100ml	E. coli	Deep
South Sandusky	8/3/2016	w	3		MPN/100ml	E. coli	Deep
South Sandusky	8/17/2016	w	27.2		MPN/100ml	E. coli	Deep
South Sandusky	9/1/2016	w	1		MPN/100ml	E. coli	Deep
South Sandusky	5/12/2016	w	4.1		MPN/100ml	E. coli	Shallow
South Sandusky	5/27/2016	w	4.1		MPN/100ml	E. coli	Shallow
South Sandusky	6/9/2016	w	36.8		MPN/100ml	E. coli	Shallow
South Sandusky	6/23/2016	w	5.2	<	MPN/100ml	E. coli	Shallow
South Sandusky	7/6/2016	w	16.9		MPN/100ml	E. coli	Shallow
South Sandusky	7/20/2016	w	13.5		MPN/100ml	E. coli	Shallow
South Sandusky	8/17/2016	w	2		MPN/100ml	E. coli	Shallow
South Sandusky	9/1/2016	w	8.6		MPN/100ml	E. coli	Shallow
South Sandusky	8/3/2016	w	8.5		MPN/100ml	E. coli	Shallow

Data provided by the project office which contracted with Illinois Department of Health for the analysis.
Illinois standard is 235 E. coli per 100ml for single sample and 126 for geometric mean.



Dale Miller Beach E. coli
Illinois Std: 235 E. coli per 100ml for single sample or
126 for geometric mean.
Shallow
Deep
E. coli (MPN/100ml)
1,600
1,400
1,200
1,000
800
600
400
200
0
1413.6
344.8
1
1
4.1
2
2
2
2
1
9.7
8.4
40.4
42.2
12
20.1
5/22/16
5/23/16
6/6/16
6/21/16
7/11/16
7/25/16
8/3/16
8/4/16
8/17/16
Date


South Sandusky Beach E. coli
Illinois Std: 235 E. coli per 100ml for single sample or
126 for geometric mean.
Shallow
Deep
E. coli (MPN/100ml)
3,000
2,500
2,000
1,500
1,000
500
0
2419.6
1413.6
325.5
238.2
160.7
9.8
6.3
22.8
24.9
1
1
11
15.8
7.5
7.3
32.3
1
16
5/23/16
6/6/16
6/21/16
7/11/16
7/25/16
8/3/16
8/4/16
8/16/16
8/19/16
Date



Marina Beach E. coli
Shallow
Deep
Illinois Std: 235 E. coli per 100ml for single sample or
126 for geometric mean.
E. coli (MPN/100ml)
300
250
200
150
100
50
0
261.3
60.2
48.8
38.4
14.4
6.3
1
2
6.3
2
3.1
4.1
1
3.1
1
1
5/23/16
6/6/16
6/21/16
7/11/16
7/25/16
8/3/16
8/17/16
8/19/16
Date