2009 Lake Las Vegas Water Quality Monitoring Report

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Submitted to:

ndep NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

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I. INTRODUCTION

J. Carlton Adair conceived the idea of Lake Las Vegas in 1964. The lake was then called Lake Adair. Over time, that idea evolved into a 2,243-acre development project and was then known as Lake Las Vegas. However, Transcontinental Corporation of Santa Barbara, California, acquired controlling interest in the project in 1988 and began on construction on April 1, 1989. In 2008, the assets of the resort were acquired by the Atalon Group which is currently in the process of emerging from restructuring under bankruptcy protection. Currently the 320 acre lake is part of a 3,592 acre residential and commercial development called "Lake Las Vegas Resort". It is located less than 25 miles from both McCarran Airport and the Las Vegas Strip (Figure 1).

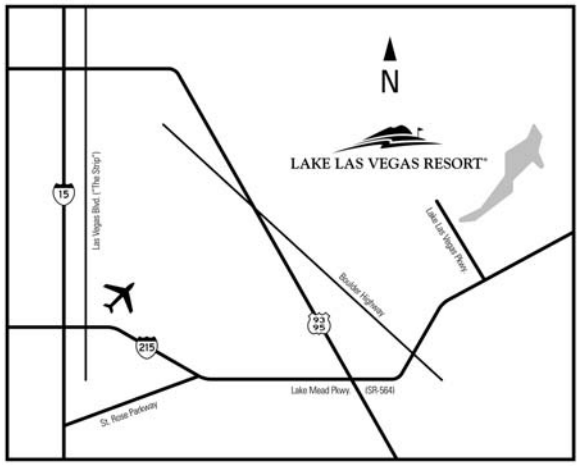

Figure 1. Location of Lake Las Vegas Resort, Clark County, Nevada.

At an elevation of 1,405.9 ft.(NAD88), the lake has a storage capacity of approximately 10,000 acre feet, comprising approximately a two mile length, a one mile width, and 12.3 miles of shoreline. Table 1 shows further details of the geometric characteristics of the lake. Lake fill water is drawn from Lake Mead, and conveyed by the Basic Water Company Pipeline (BWC). To meet the demands of irrigation, seepage, and evaporation approximately 7,000 acre-fee of fill water must be add to the lake each year.

Table 1. Approximate Geometric characteristics* of Lake Las Vegas, Clark County, Nevada.

Characteristic	Measurement
Drainage Area	1,800 square miles
Surface Area	320 acres
Maximum Length	2.1 miles
Maximum Width	1.0 miles
Maximum Depth	150 feet
Average Depth	33 feet
Volume	10,700 acre-feet
Length of Shoreline	12.6 miles

*Based on www.lakelasvegas.com/LLVResortFastFacts.pdf

Approved by the Clark County Board of County Commissioners on April 5, 1988 and certified by the State of Nevada on August 8, 1988, the approved Clark County 208 Water Management Plan required a water quality-monitoring program to be developed for Lake Las Vegas. The water quality monitoring program was implemented to ensure that the lake water's quality is maintained based on the water quality standards established by Lake Mead (NAC 445.1351) as part of County 208 Amendment in order to enhance the following beneficial uses at Lake Las Vegas:

1) Irrigation
2) Recreation not involving contact with the water (boating, sailing, canoeing),
3) Recreation involving contact with the water (swimming, bathing, diving),
4) Propagation of wildlife and propagation of aquatic life, including a warm water fishery

The following are the guidelines that the lake water should adhere to.

1. The lake waters should be free of:
    a. Visible floating, suspended, or settlable solids,
    b. Sludge banks, lime infestations, heavy growths of attached plants (Periphyton) and animals, or of floating algae mats,
    c. Discoloration or excessive turbidity,
    d. Visible oil or slicks,
    e. Surfactant concentrations that produce foam when water is agitated or aerated,
    f. Toxicants in toxic amounts;
2. The pH as measured in standard units should range between 7.0 and 9.0 in 90% of the measurements.
3. Dissolved oxygen concentrations should be 5 mg/L in the epilimnion during stratification, and 5 mg/L through out the water column the rest of the year.
4. The average chlorophyll-a concentration in the epilimnion (0-2.5 m) should not exceed 0.005 mg/L during April through September. The average must include at least two samples per month. The single value must not exceed .010 mg/L in 10% of the samples.
5. In all lake areas, the log mean of not less than five fecal coliform samples taken over a 30 day period during the recreational season (April-September) should not exceed 200 MPN/100 ml and not over 10% of such samples should exceed 400 MPN/100;
6. Average temperature in the epilimnion should not exceed 2°C above ambient temperature (e.g. temperature in epilimnion in Lake Mead)
7. Total dissolved solids concentrations should not exceed an annual average of 2000 mg/L throughout the water column;
8. Turbidity must not exceed that characteristic of natural conditions by more than 10 NTU.

Since June 1991 Lake Las Vegas has submitted annual reports to the Nevada Division of Environmental Protection for review. Through 2007, water quality monitoring was performed monthly in January, February, November, and December, biweekly in March and October, and weekly during the months from April through September at four sites within the Lake.

However, beginning in 2008, the water sampling protocol was changed to monthly sampling and approved by the Nevada Division of Environmental Protection. The water quality sampling locations were reduced to two sites LLV-1A and LLV-3 (Figure 2) and the new program required lake water sampling to be done at varying depths instead of the conventional sampling from water surface at all the sites. These modifications to the previous water monitoring protocol were made in order to better understand the overall limnological response of the reservoir besides understanding the surface water quality.

Figure 2. Water Quality monitoring sites at Lake Las Vegas.

II. METHODS

A. Lake Las Vegas Monitoring Sites

In accordance with the revised water quality monitoring protocol, and reduced sampling locations to monitoring sites LLV-1A and LLV-3 (Figure 2), vertical sampling was performed at 0m, 5m, 10m, and 20m depths and at 0m, 5m, and 10m depths respectively.

B. Field Measurements

Temperature, dissolved oxygen, pH, and specific conductance were measured throughout the vertical column at all sites with a Hydrolab Surveyor Model 4 a Water Quality Analyzer or an YSI Water Quality Analyzer (Table 2). Transparency was measured at each lake site with a Secchi disc. Duplicate measurements were made on approximately 10% of the measurements.

Table 2. 2008 Lake Las Vegas physical, chemical and biological analyses methods.

Sampling Program			
Measurements	Depth(s)	Frequency	Method(s)
Physical			
Temperature (°C)	1.0 m Intervals Surface to Bottom	Variable	Electronic Multimeter
Dissolved Oxygen (mg/L)	"	"	"
pH (Std. Units)	"	"	"
Conductivity (μmhos/cm)	"	"	"
Secchi Depth (m)	Variable	"	EPA 1991
Turbidity (NTU)	0 - 2.5 m Integrated	"	EPA 180.1
Chemical			
Total Nitrogen (μg/L)	0 - 2.5 m Integrated	"	SM 4500.N
Ammonia-N (μg/L)	"	"	EPA 350.2
Total Kjeldehl Nitrogen (μg/L)	"	"	EPA 351.3
Total Phosphorus (μg/L)	"	"	EPA 365.2
Ortho-Phosphorus (μg/L)	"	"	EPA 365.2
Total Suspended Solids (mg/L)	"	"	EPA 160.1
Total Dissolved Solids (mg/L)	"	"	EPA 160.2
Major Anions/Cations (mg/L)	"	"	EPA 200.7
Sulfate (mg/L)	"	"	EPA 375.4
BOD 5 (mg/L)	"	"	EPA 405.1
Biological			
Chlorophyll-a (μg/L)	"	"	SM 10200H
Phytoplankton Counts (mg/m^3)	"	"	Janik 1994
Zooplankton Counts (#/m^3)	0 - 15 m Net Tow	"	Janik 1994
Fecal Coliform (MPN/100ml)	"	"	SM 9223B

C. Chemical and Biological Measurements and Analysis

Depth integrated water samples were collected from 0-2.5 m at main-lake sampling sites (Figure 2) utilizing an integrated puc sampler known by the trade name of "Sludge Judge." Additional depth samples were also collected quarterly at 0 m, 5 m, 10 m, and 20 m at site LLV-1A and 0 m, 5 m, and 10 m at LLV-3 with a Van Dorn sampler. Samples requiring filtration were filtered through 0.45 μm millipore filters utilizing a hand operated pneumatic filler pump.

Analyses were run on field duplicates at a frequency of approximately 10% of the samples. A State of Nevada certified laboratory analyzed the chemical and biological analyses with EPA-approved methods. Samples were collected from the surface and near the bottom at site LLV-1A in December 2009 for analysis of toxic substances.

Monthly Zooplankton samples were collected at LLV-1A and LLV-3 in a vertical tow from 0-15 m with an 80 μm Wisconsin plankton net. Phytoplankton (algae) was collected quarterly from the surface (0-2.5 m) from site LLV-1A and LLV-3. Phytoplankton samples were identified and enumerated to the level of species when possible.

Phytoplankton

Utermohl Method

The inverted-microscope method or Utermohl method (Utermohl 1958, Kellar et al. 1980, Janik 1984) is used for enumeration and identification of phytoplankton samples.

Counting Procedure:

The procedure incorporates a stratified design using at least three (x 78, 280, 560) magnifications (Janik 1984). The rational for this approach is that phytoplankton in most lakes have greatest axial linear dimension (GALD) that spans three orders of magnitude from 1-2 μm to 1000 μm or more for filamentous taxa.

Sample Sedimentation:

Wild™ and Hydro-Bios™ combined plate chambers consisting of a top cylinder (Sedimentation cylinder) of 10 mL capacity and a bottom-plate chamber (base plate) are used. The bottom diameter of the base chamber is 25.5 mm. Volumes sedimented range from 2.0 – 10.0 mL depending on algal density.

Biovolumes:

Cell volumes are calculated based on the measurements of at least 20 individuals of each species and the geometrical formula which most closely approximate the cell shape (Lund et al. 1958). Cell sizes are measured at x 560 with a calibrated ocular micrometer. For most organisms the measurements are taken from outside cell wall to outside cell wall.

Zooplankton

Samples are analyzed with a Wild M40 inverted phase contrast microscope (Wetzel 1975 and Likens 1979). Samples will be counted at: x 78. Higher magnification of x 280 and 560 are available to facilitate identifications.

Sample Preparation and Counting Procedure

The zooplankton sample is mixed by gently inverting the sample bottle for 30 seconds. A wide-bore automatic pipette is used to withdraw 2.9 mL of sample and fill a Hydro-Bios combination plate chamber. A cover slip is then placed on top of the chamber and allowed to settle for 15 minutes before counting. A second chamber is then prepared for a total of 5.8 mL for each sample. The entire 510 mm^2 plate chamber is counted in continuous strips.

IV. WATER QUALITY RESULTS

A. Lake Water Surface Elevation

Water for Lake Las Vegas is pumped from Lake Mead through the Basic Water Company (BWC) pipelines. In 2009 Lake Las Vegas surface elevations fluctuated by approximately two (2) feet during the year with approximately three thousand five hundred twenty-three (3,523) acre-feet of Lake Mead water being added during 2009 (Figure 3). Two thousand forty (2,040) acre-feet of lake water were lost to seepage/evaporation.

Golf irrigation use was reduced in 2009 with the closing of the Falls Golf Course and the reflection Bay Golf Course. Both courses opted to not over seed so irrigation water use was minimal during the late fall.

In 2009, approximately two hundred fifty-four (254) acre-feet of storm water discharged into the lake. Additionally, Lake Las Vegas did not release any stormwater through the dam's appurtenance, back to the Las Vegas Wash. Elevations are referenced to NAVD88.

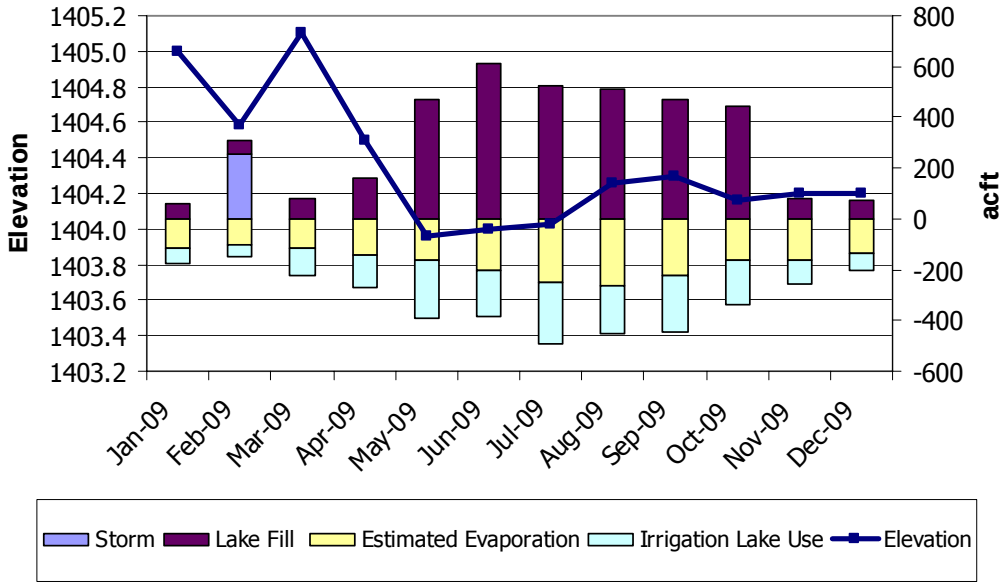

Figure 3. 2009 Lake Las Vegas Surface elevations and lake water budget.

B. Physical Analysis
Temperature

Deep reservoirs and lakes in temperate climates are subject to seasonal stratification due to solar thermal loading and wind induced mixing. During summer periods, as the day length increases with increased solar altitude, thermal loading of lakes and reservoirs significantly increases the thermal energy in the surface waters (Hutchinson 1959). Early in the season, wind often mixes these waters throughout the reservoir, both as the day length becomes progressively longer and solar thermal loading increases, wind generated mixing cannot thoroughly mix the solar warmed surface waters throughout the entire water body. The result in thermal stratification with warm, less dense waters on the surface, and cool denser waters at the bottom. Stratification typically results in three distinct vertical zones in the water column: the hypolimnion, the epilimnion, and the metalimnion (Wetzel 1975).

The hypolimnion is the deep water zone, filled with cold, dense water. It is often relatively quiescent because it is separated from contact with the atmosphere. Oxygen consumption due to decomposition of organic matter can lead to depressed levels of dissolved oxygen called hypolimnietic anoxia (Wetzel 1975). The epilimnion is the well-mixed surface layer that is in contact with the atmosphere and is thereby influenced by solar and wind energy. Primary production is a large component of the epilimnion because it generally corresponds with the photic zone and light availability. Between the hypolimnion and the epilimnion lies a transition layer called the metalimnion. The metalimnion is also called the thermocline because it is typified by a temperature gradient. The thermocline is an important physical factor for all biota, since it impedes vertical mixing and exchange between the epilimnion and the hypolimnion, acting to restrict nutrient and gas circulation due to the kinetic energy needed to pass from less dense, warm water through the gradient to denser, colder water (Hutchinson 1959).

Stratification in temperature zones is mostly seasonal. The stratification process is often reversed in the fall when cooler atmospheric temperatures reduce the surface temperatures of the reservoir. Differences in hypolimnion and epilimnion water temperatures and associated densities diminish allowing wind produced currents to mix the whole reservoir, a process known as turnover (Wetzel 1975).

Turnover has several important impacts on reservoir and lake systems. Top to bottom mixing in the fall redistributes the biotic and chemical components. This includes the reoxygenation of anoxic and depressed hypolimnetic waters, nutrient redistribution, and thermal homogeny.

Surface temperatures in Lake Las Vegas did not have considerable variations between the two sites throughout the year. Surface temperatures were measured at sites LLV-1A and LLV-3 with an observed average temperature of 18.4°C (range: 9.0 to 28.7°C) and 18.0°C (range: 5.9 to 27.8°C); respectively during 2009 (Figure 4). Temperature profiles reflected typical of lakes that stratify and destratify. The reservoir started to see the beginnings of thermal stratification in May and remained fully stratified during the months of June, July, August, and September at site LLV-1A (Figure 5a). 2009 was somewhat

unique in that the lake remained in a state of stratification longer due to an unseasonably warm spring and fall. The thermocline was clearly observed at a depth between 10 and 12 meters. Due to the shallow nature of site LLV-3, mixing continued during the entire year and thermal stratification did not occur (Figure 5b).

Dissolved Oxygen

The distribution of oxygen in reservoirs is closely related to photosynthesis and respiration, thermal stratification, and organic matter. Oxygen is important in that its presence or absence influences not only the ability of organisms to occupy a particular zone of the reservoir, but also its bearing on the type of chemical reactions that can occur with regard to nutrient cycling. Plants and animals consume oxygen during respiration, but when the appropriate amount of light and nutrients are available, plants can produce diffusion from the atmosphere (reaeration). Oxygen in water is typically measured as dissolved oxygen and the loss of dissolved oxygen due to biological activity in the breakdown of organic matter is called the biological oxygen demand (BOD); loss due to chemical activity is the chemical oxygen demand. A dynamic equilibrium exists between oxygen gas in the atmosphere and the DO levels in aquatic systems that is a function of atmospheric pressure, temperature, and oxygen levels in water. This theoretical equilibrium is termed saturation dissolved oxygen. Temperature and saturation oxygen concentration have an inverse relationship: cold water has higher saturation dissolved oxygen than warm water. Oxygen saturation levels are often useful to consider because over saturation may be an indicator of high levels of photosynthesis while under saturation can indicate an increase in organic matter and/or pollutants or phytoplankton respiration.

Both seasonal and diel variations in oxygen can affect the components of a reservoir system. Seasonally, oxygen may remain at or close to equilibrium levels throughout the depth of the reservoir under isothermal (unstratified) conditions. Once thermal stratification occurs, the oxygen levels decrease, especially in the photic zones where significant respiration takes place. Anoxia can occur in the hypolimnion. At the same time that the hypolimnion is under saturated, the epilimnion may be supersaturated due to intense photosynthesis. The reservoir will not reach equilibrium across the oxygen gradient due to the thermoline barrier. On a daily basis, oxygen in the photic zone may fall below saturation levels in the early morning, increase as the light and therefore photosynthesis increases until super saturation is reached in the afternoon, only to be depleted again once night time respiration begins.

Dissolved oxygen concentrations at the lake surface did not have considerable variations between the sites throughout the year. Surface dissolved oxygen concentrations were measured at sites LLV-1A and LLV-3 with an observed average concentration of 9.3 mg/L (range: 7.9 to 11.0 mg/L) and 9.7 mg/L (range: 13.6 to 7.6 mg/L); respectively during 2009 (Figure 4).

The Lake remained relatively well mixed during the late fall through late spring. Concentrations at depth exhibited the common dissolved oxygen trends found within monomictic lakes that stratify (Figure 6a and Figure 6b). During the months of thermal

stratification March through November, dissolved oxygen concentrations below the thermocline were less than 5.0 mg/L at site LLV-1A. As mentioned in reference to temperature, dissolved oxygen exhibited greater influence due to the warmer spring and fall. Evident by the less homogines profiles in February, March and November (Figure 6a). Dissolved oxygen concentrations did not drop below 5.0 mg/L at site LLV-3 during 2009 (Figure 6b).

Biological Oxygen Demand (BOD)

BOD is an indirect measure of the concentration of biologically degradable material present in organic wastes. It usually reflects the amount of oxygen consumed in five days by biological processes breaking down organic waste (NALMS 2009).

Surface BOD concentrations were measured at sites LLV-1A and LLV-3 with an observed average concentration of 2 mg/L (range: 2 to 4.4 mg/L) and 2 mg/L (range: 2 to 3.5 mg/L); respectively (Figure 7). BOD concentrations remained relatively flat throughout the year with exception of fall overturn in October. The lack of large storm inflows also contributed to low concentrations of organic matter in the lake.

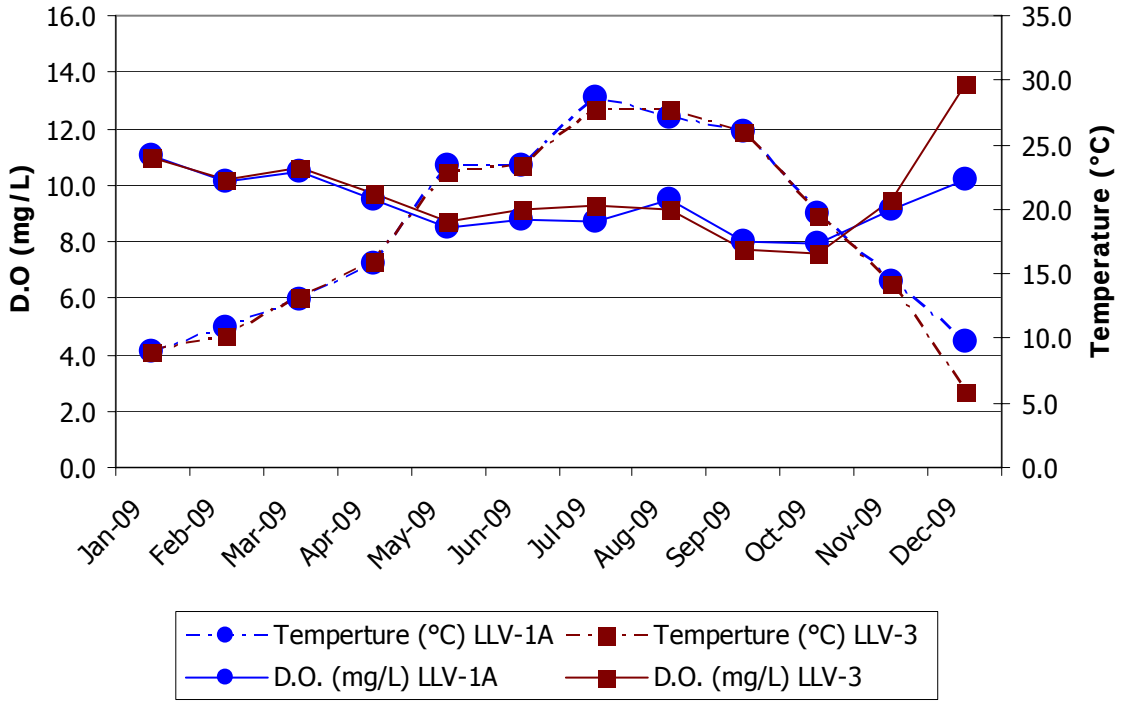

Figure 4. Lake Las Vegas surface water temperature (°C) and dissolved oxygen (mg/L) measurements at Lake monitoring sites in 2009.

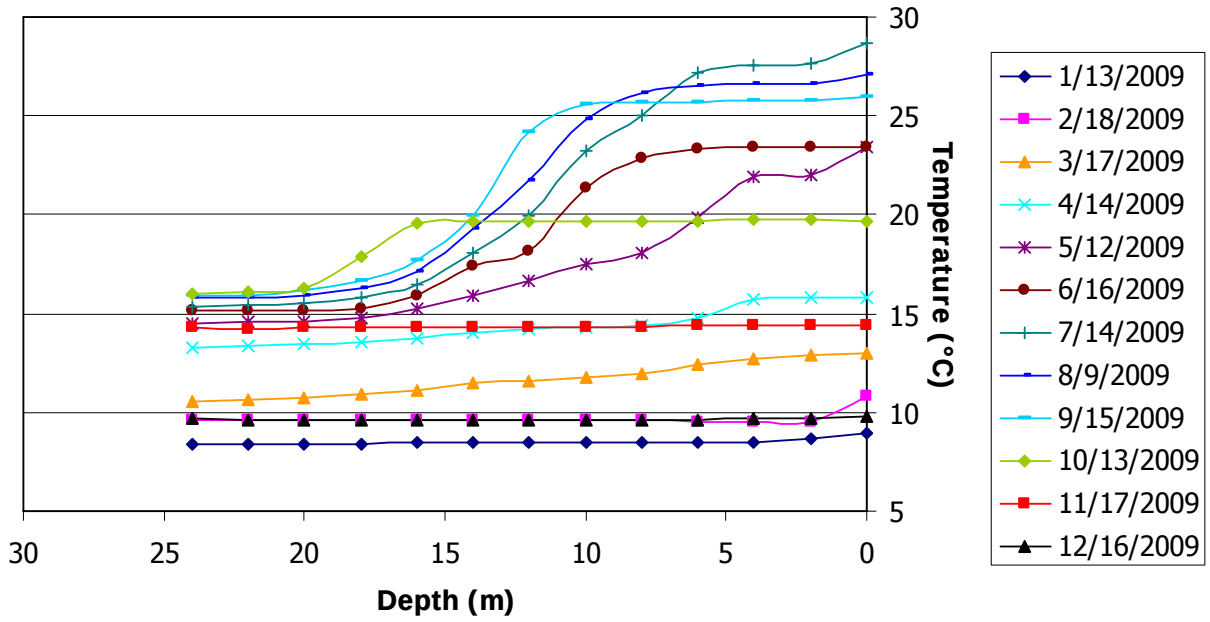

Figure 5a. Lake Las Vegas monthly temperature (°C) profiles at site LLV-1A during 2009.

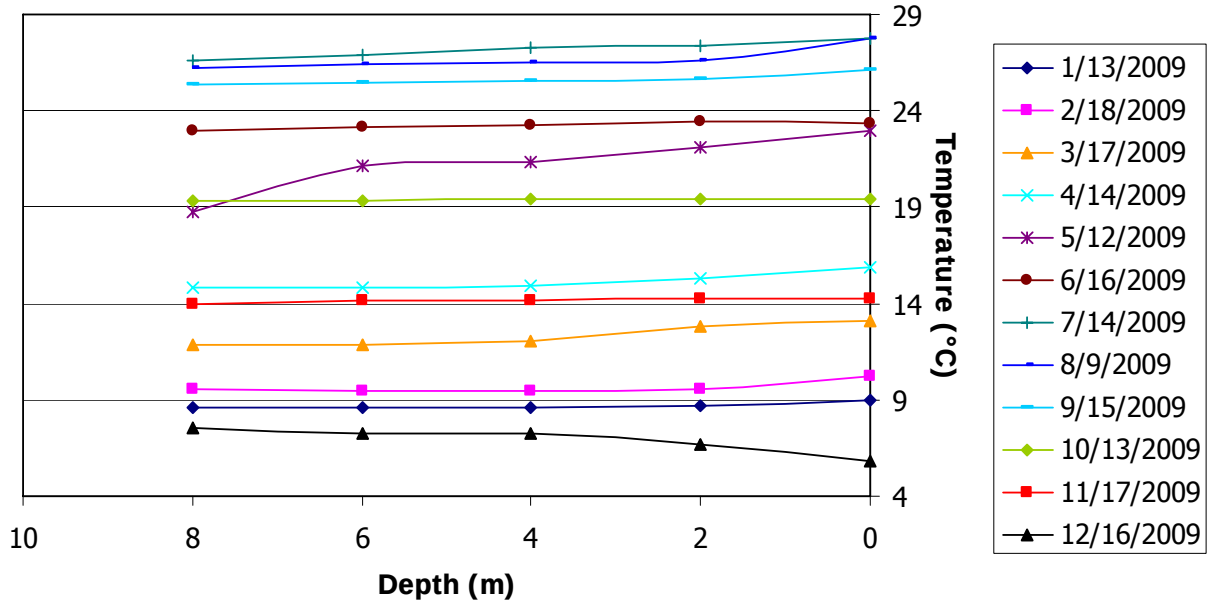

Figure 5b. Lake Las Vegas monthly temperature (°C) profiles at site LLV-3 during 2009.

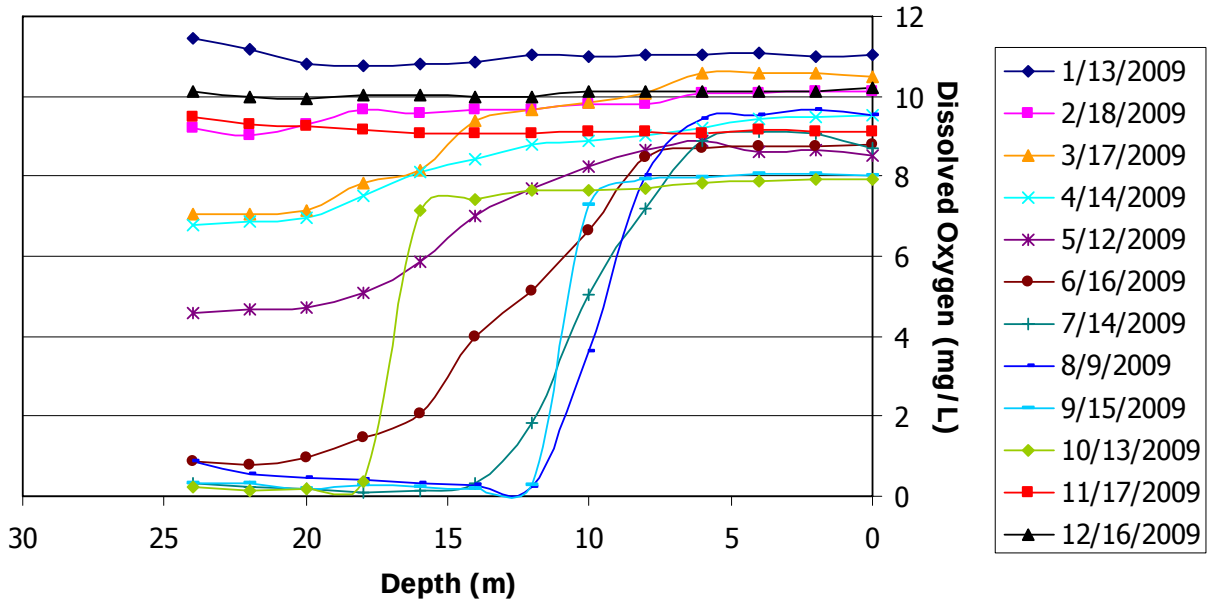

Figure 6a. Lake Las Vegas monthly dissolved oxygen profile at site LLV-1A during 2009.

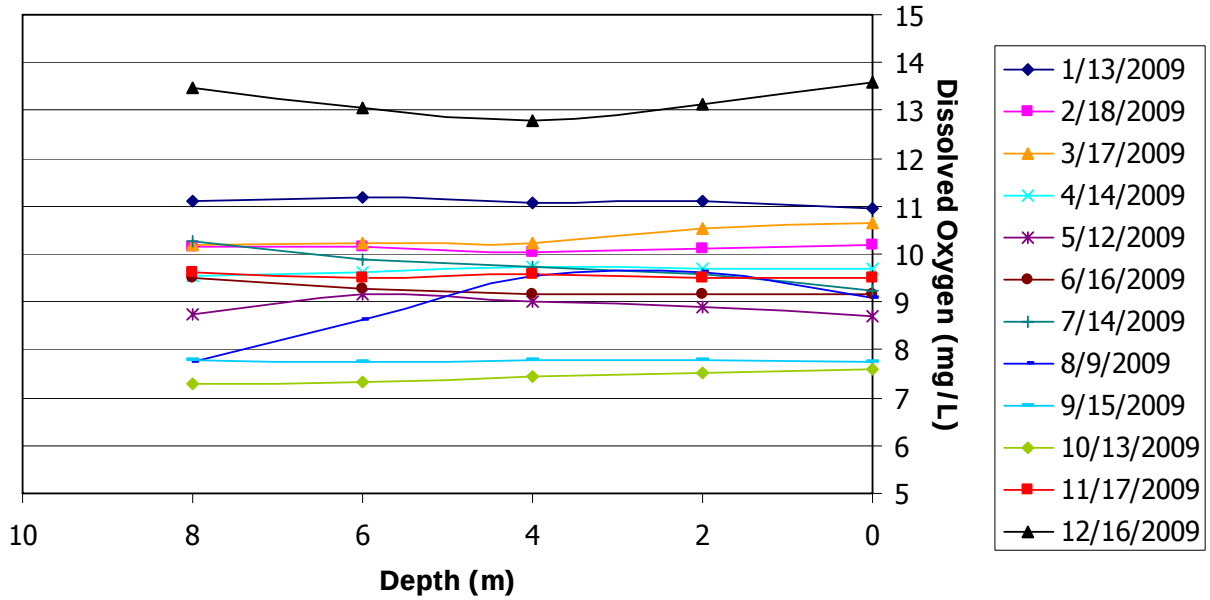

Table 6b. Lake Las Vegas monthly dissolved oxygen profile at site LLV-3 during 2009.

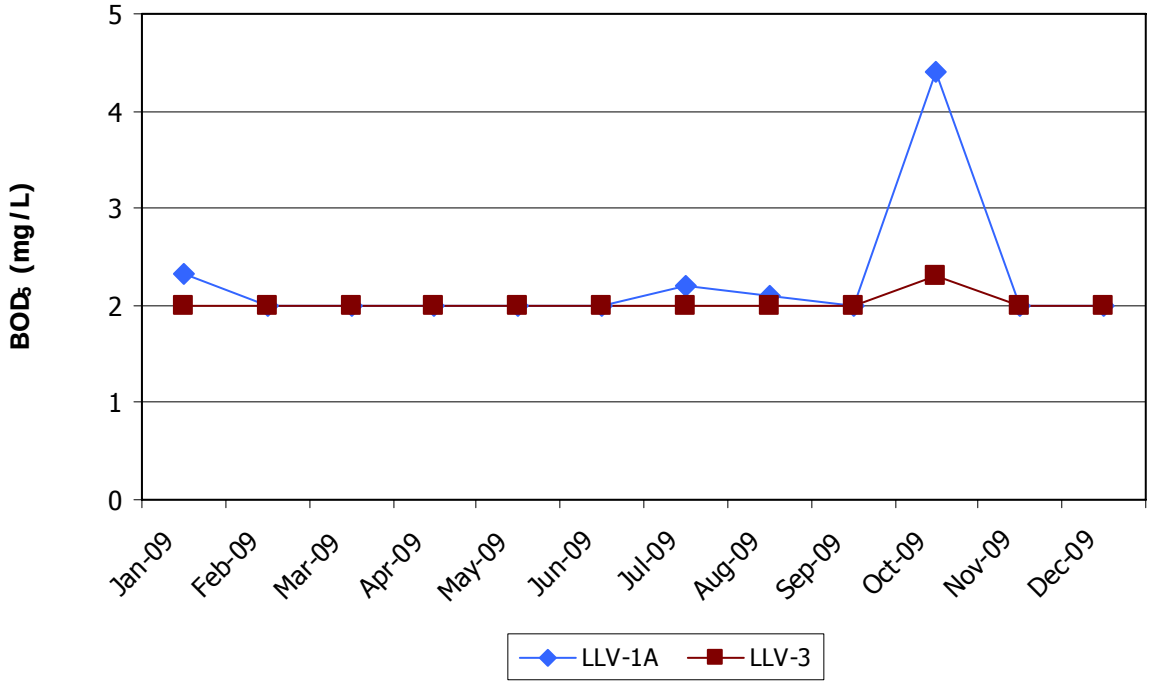

Figure 7. Lake Las Vegas Biochemical Oxygen Demand (mg/L) concentrations in surface waters at Lake monitoring site during 2009.

pH

The pH of a water body describes how acidic or alkaline the water is based on an exponential scale of 1 to 14. A pH reading of less than 7 indicates acidity, greater than 7 indicates alkaline conditions and a pH of 7 is considered neutral. Most lakes and reservoirs have a pH that ranges between 6 and 9. Changes in pH of a lake or reservoir may influence other nutrients and minerals including iron, ammonia, phosphate, and carbon dioxide. pH may vary with depth in a reservoir, especially during summer months when phytoplankton abundance and production may lead to higher pH values in areas of photosynthesis and lower in areas where respiration or decay of organic matter is occurring such as the hypolimnion. pH may be affected by photosynthesis and respiration since pH is closely related to the amount of and form of carbon the water column.

There was little seasonal variation in pH of surface waters in Lake Las Vegas during 2009. Surface water pH values were measured at sites LLV-1A and LLV-3 with an observed average concentration of 8.2 Std Units (range: 7.8 to 8.5 std units) and 8.1 std units (range: 7.9 to 8.5 std units); respectively (Figure 8). Minor variability can be attributed to spatial distribution of phytoplankton activity. Depth profiles of pH indicated the pH followed a similar trend of dissolved oxygen. During periods of stratification pH values decreased as bicarbonate concentrations declined with the onset of anaerobic conditions (Figure 9a and 9b).

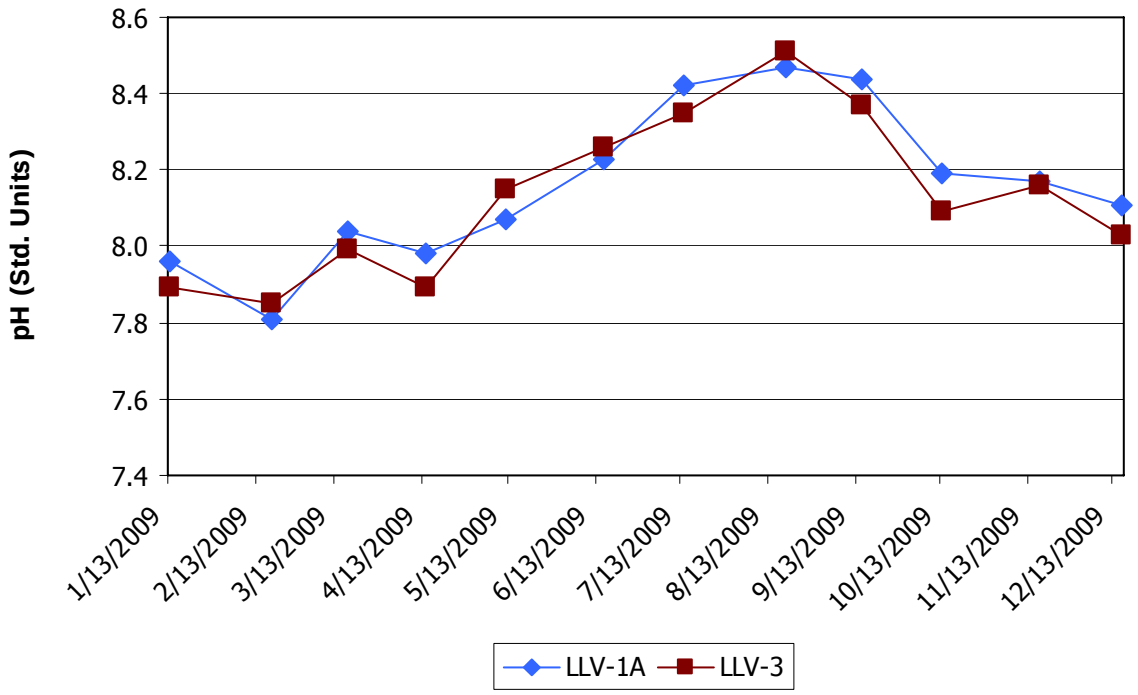

Figure 8. Lake Las Vegas surface water pH (standard units) measurements at Lake monitoring sites during 2009.

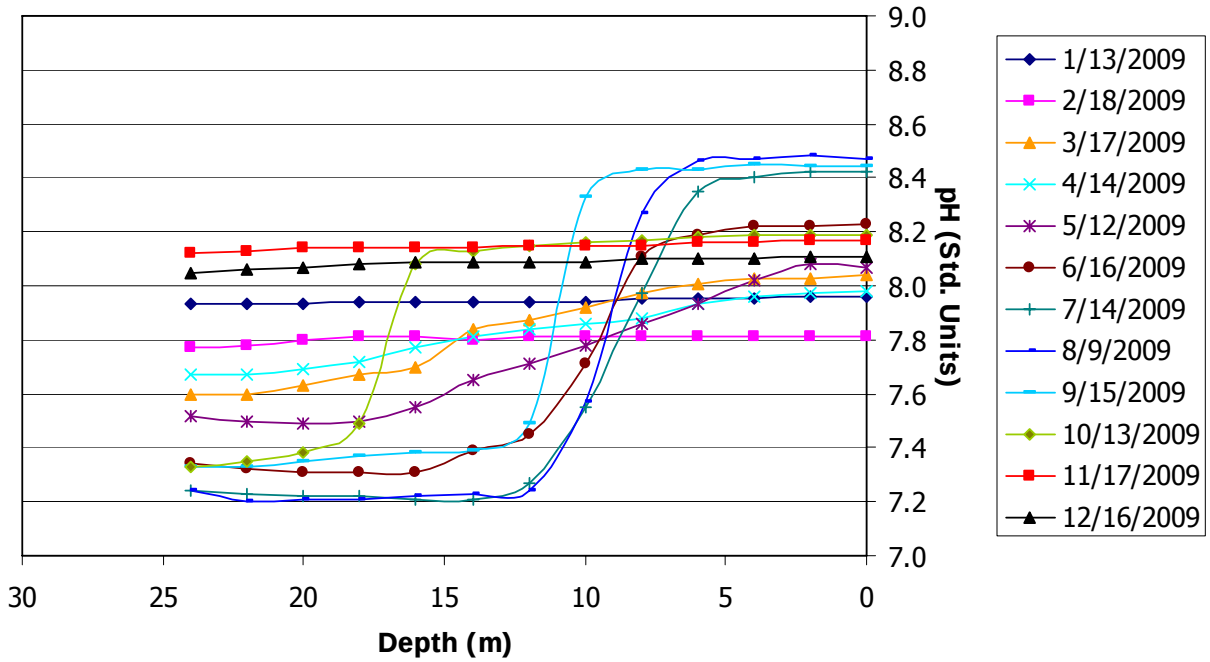

Figure 9a. Lake Las Vegas monthly pH (standard units) profiles at site LLV-1A during 2009.

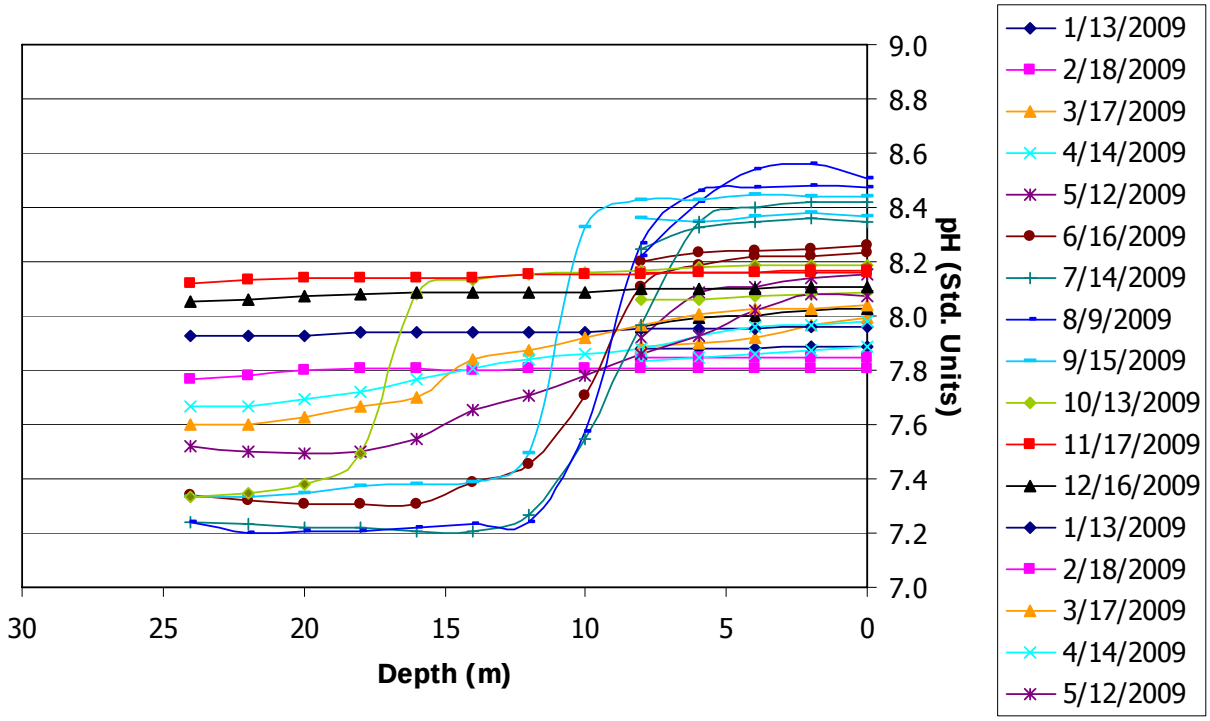

Figure 9b. Lake Las Vegas monthly pH (standard units) profiles at site LLV-3 during 2009.

Major Ion Concentrations

The spatial and temporal distribution of the major cations are separable into conservative ions, whose concentrations within a lake undergo relatively minor changes from biotic utilization or biotical mediated changes in the environment and dynamic ions whose concentrations can be influenced strongly by metabolism. Of the major cations, magnesium, sodium, and potassium ions are relatively conservative both in their chemical reactivity under typical freshwater conditions and their small biotic requirements (Wetzel 1975).

Quarterly depth samples did not vary significantly at site LLV-1A for the ions of calcium, sodium, chloride, potassium, sulfate and magnesium and bicarbonate (Table 3).

A slight increase in calcium, magnesium, sodium and chlorides is related to the increase in total dissolved solids due to evaporation.

Table 3. 2009 Lake Las Vegas chemical concentrations at site LLV-1A during the months of March, June, September and December at 0, 5, 10 and 20m depths.

Date	Depth	Ca (mg/L)	Cl (mg/L)	HCO_3 (mg/L)	SO_4 (mg/L)	Na (mg/L)	K (mg/L)	Mg (mg/L)
3/17/09	0	175	368	90	876	251	20	60
3/17/09	5	173	356	85	877	261	21	59
3/17/09	10	183	351	100	762	254	21	62
3/17/09	20	187	339	90	765	254	21	61
6/16/09	0	215	405	105	903	490	35	66
6/16/09	5	214	390	100	911	513	32	66
6/16/09	10	214	381	110	907	507	32	65
6/16/09	20	220	370	105	897	463	36	67
9/15/09	0	198	364	75	830	542	33	72
9/15/09	5	199	351	55	845	558	34	72
9/15/09	10	214	346	80	827	578	35	74
9/15/09	20	236	384	120	846	592	38	77
12/16/09	0	216	406	90	957	375	28	75
12/16/09	5	216	391	90	945	446	35	79
12/16/09	10	210	364	90	899	417	34	74
12/16/09	20	211	384	95	882	429	34	74

Specific Conductance

Electrical conductivity is a measure of a body of water's ability to conduct electricity, and therefore a measure of the water's ionic activity and content. Higher concentrations of ionic (dissolved) constituents in a lake or reservoir lead to higher conductivity. Conductivity of the same water changes substantially as its temperature changes. Electrical Conductivity that is normalized at a temperature of 25 °C is called specific conductance, allowing direct comparison of various water samples or water bodies.

Surface conductivity was measured at sites LLV-1A and LLV-3 with an observed average conductivity of 2,749 µmhos/cm (range: 2,543 to 2,856 µmhos/cm) and 2768 µmhos/cm (range: 2,536 to 3,287 µmhos/cm); respectively (Figure 10) during 2009. Specific conductivity did not vary significantly between the two lake sites or with depth (Figure 11a and 11b).

Total Dissolved Solids (TDS)

Total Dissolved Solids (TDS) is a measure of the amount of material dissolved in water (mostly inorganic salts). Typically aggregates of carbonates, bicarbonates, chlorides, sulfates, phosphates, nitrates, etc. of calcium, magnesium, manganese, sodium, potassium, and other cations which form salts. The inorganic salts are measured by filtering a water sample to remove any suspended particulate material, evaporating the water, and weighing the solids that remain. An important use of the measure involves the examination of the quality of drinking water. Water that has a high content of inorganic material frequently has taste problems and/or water hardness problems. As an example, water that contains an excessive amount of dissolved salt (sodium chloride) is not suitable for drinking. High TDS solutions have the capability of changing the chemical nature of water. High TDS concentrations exert varying degrees of osmotic pressures and often become lethal to the biological inhabitants of an aquatic environment (NALMS 2009).

Monthly surface TDS concentrations were relatively stable throughout the spring and summer periods with an increase during late fall to early winter (Figure 10) due to a decrease in lake fill from Lake Mead and reduced use by golf irrigation (Figure 3). Monthly concentrations were measured at sites LLV-1A and LLV-3 with an observed average concentration of 1898 mg/L (range: 1782 to 2058 mg/L) and 1876 mg/L (range: 1780 to 2070 mg/L); respectively during 2009. The difference between the average concentration at the surface water and max depth of 20 meters is 51 mg/L at site LLV-1A (Figure 12a) and the difference between the average concentration at the surface water and max depth of 10 meters is 4 mg/L at site LLV-3 (Figure 12b). TDS concentrations continue to remain below the 2,000 mg/L guideline for irrigation purposes.

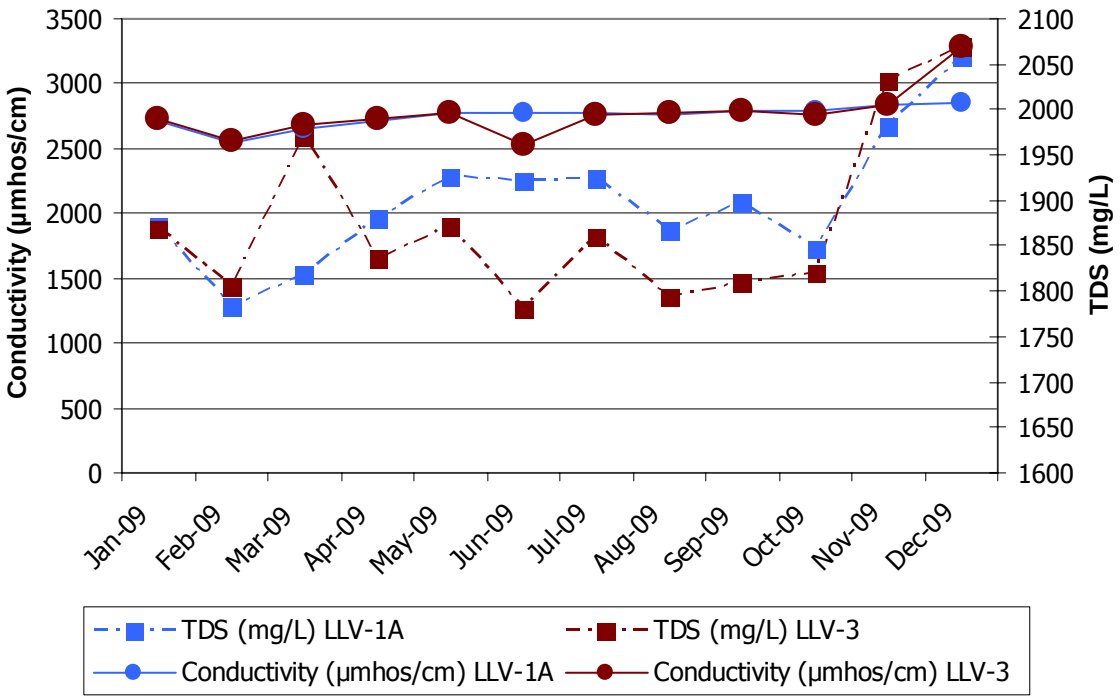

Figure 10. Lake Las Vegas surface conductance (µmhos/cm) measurement at Lake monitoring sites during 2009.

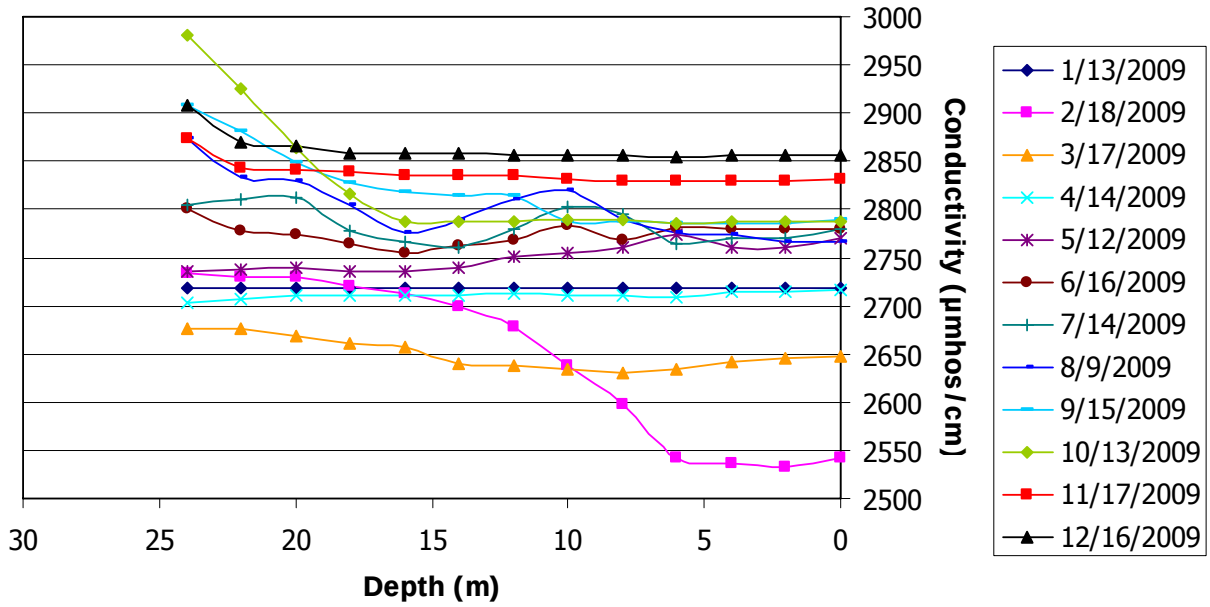

Figure 11a. Lake Las Vegas monthly conductance (µmhos/cm) profiles at site LLV-1A during 2009.

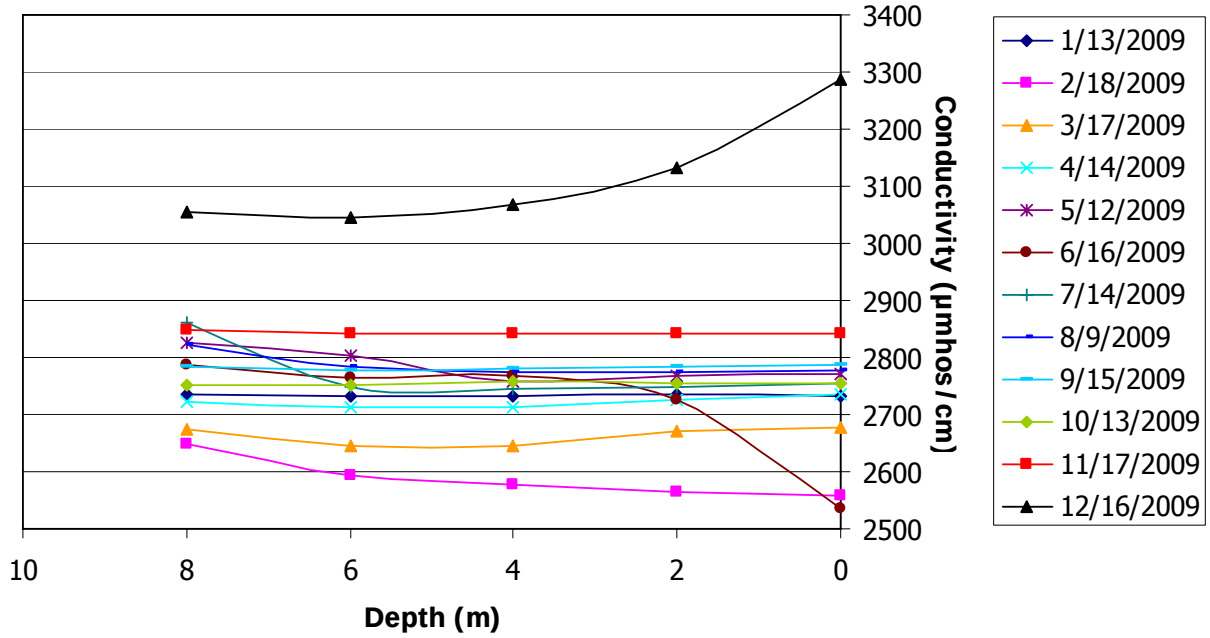

Figure 11b. Lake Las Vegas monthly conductance (µmhos/cm) profiles at site LLV-3 during 2009.

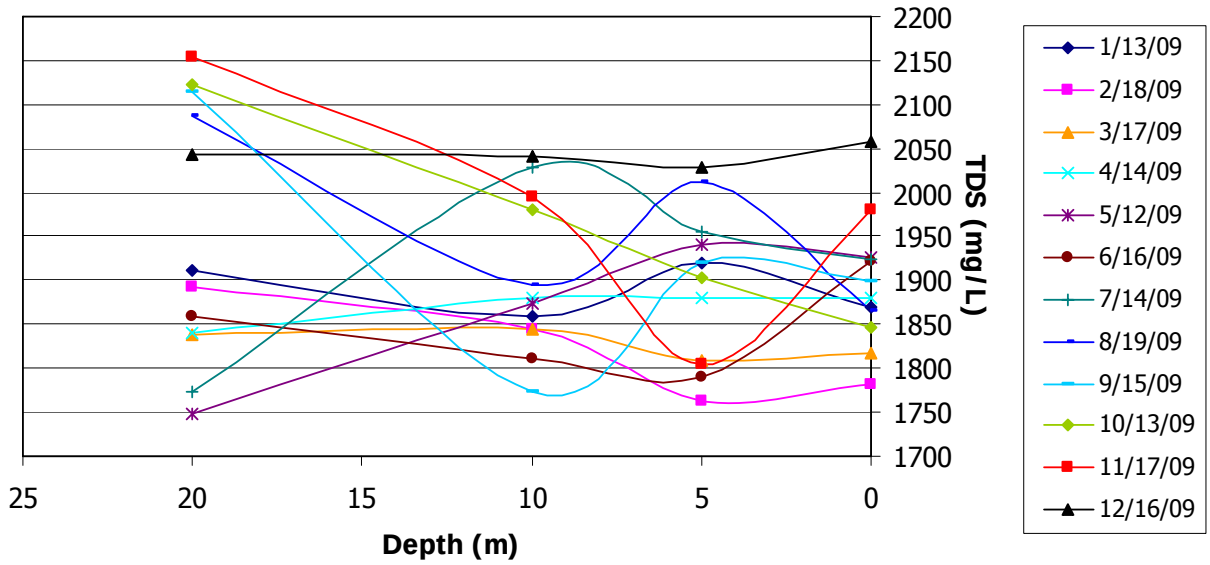

Figure 12a. Lake Las Vegas monthly dissolved solids (mg/L) profiles at site LLV-1A during 2009.

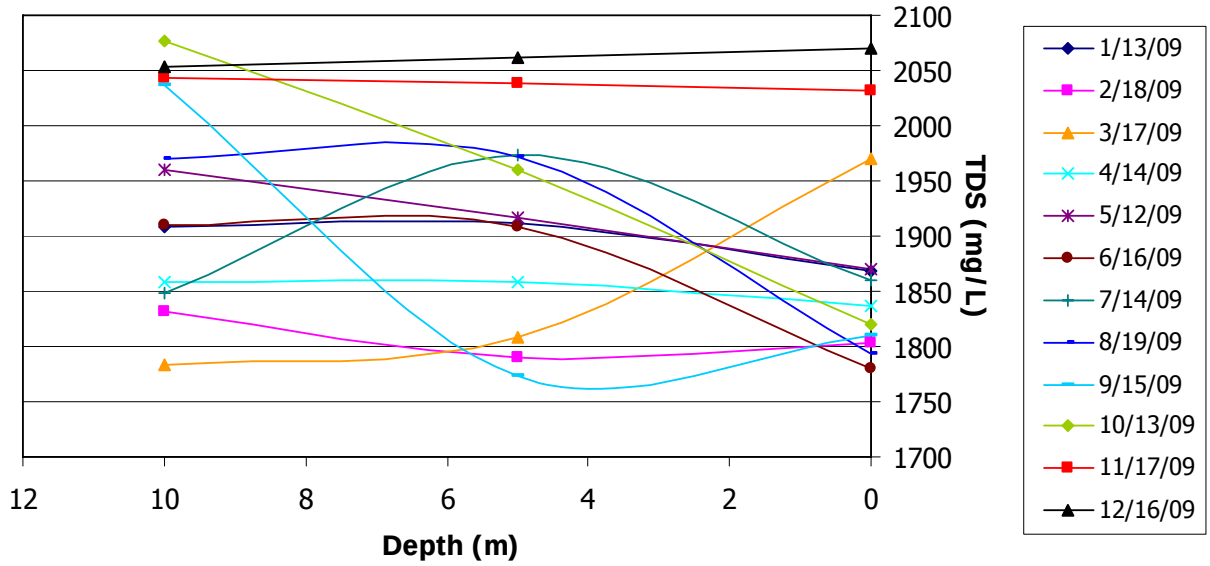

Figure 12b. Lake Las Vegas monthly dissolved solids (mg/L) profiles at site LLV-3 during 2009.

Transparency (Secchi) and Total Suspended Solids (TSS)

Transparency is a measure of the clarity of lake water. The more suspended particles (TSS) in the water the less clear or transparent the lake water becomes. These reflective properties of lake water are usually measured by lowering a secchi disk into the water until it can no longer be seen. An average of two measurements is taken. Measurements vary throughout the summer due to algae populations. Transparency is related to total suspended solids influence by both internal and external sources such as: dust particles, phytoplankton, and organic matter. Transparency is effected by wind action, precipitation and land use practices.

There was considerable seasonal and spatial variability in lake transparency values during 2009. Monthly values were measured at sites LLV-1A and LLV-3 with an observed average concentration of 4.9 m (range: 1.8 to 9 m) and 3.3 m (range: 1.3 to 5.8 m); respectively during 2009 (Figure 13). Transparency was high during the spring and fall and lower during the summer months. Sampling location LLV-3 continues to exhibit lower transparency values due to the shallow nature of the west end of the lake. This site is influenced by wind and boat activity. Since transparency as estimated by secchi measurement is highly dependent on the concentration of suspended solids measured, we tend to see similar inverse trends.

Total Suspended Solids (TSS), are dissolved inorganic material by evaporation found in a water system. (Wetzel 1975).

Monthly surface total suspended solids concentrations were measured at sites LLV-1A and LLV-3 with an observed average concentration of 4 mg/L (range: 1.2 to 10 mg/L) and 4 mg/L (range: 1.2 to 12 mg/L); respectively during 2009 (Figure 13). The higher observed concentration at site LLV-3 relates to the shallow depths of the lake adjacent to this site and the strong influence of wind action resuspending the soft sediments. Total suspended concentrations at depth were consistent with those observed in previous years. A number of observations at the bottom depths appear to be artificially elevated due to sampling equipment stirring the bottom sediments. (Figure 14b). This increase with depth was also observed in the chlorophyll-a data and reflects the presence of a phytoplankton bloom (Figures 26a and 26b). The difference between the average concentration at the surface water and max depth of 20 meters is 1.8 at site LLV-1A (Figure 14a). The difference between the average concentration at the surface water and max depth of 10 meters is 15 at site LLV-3.

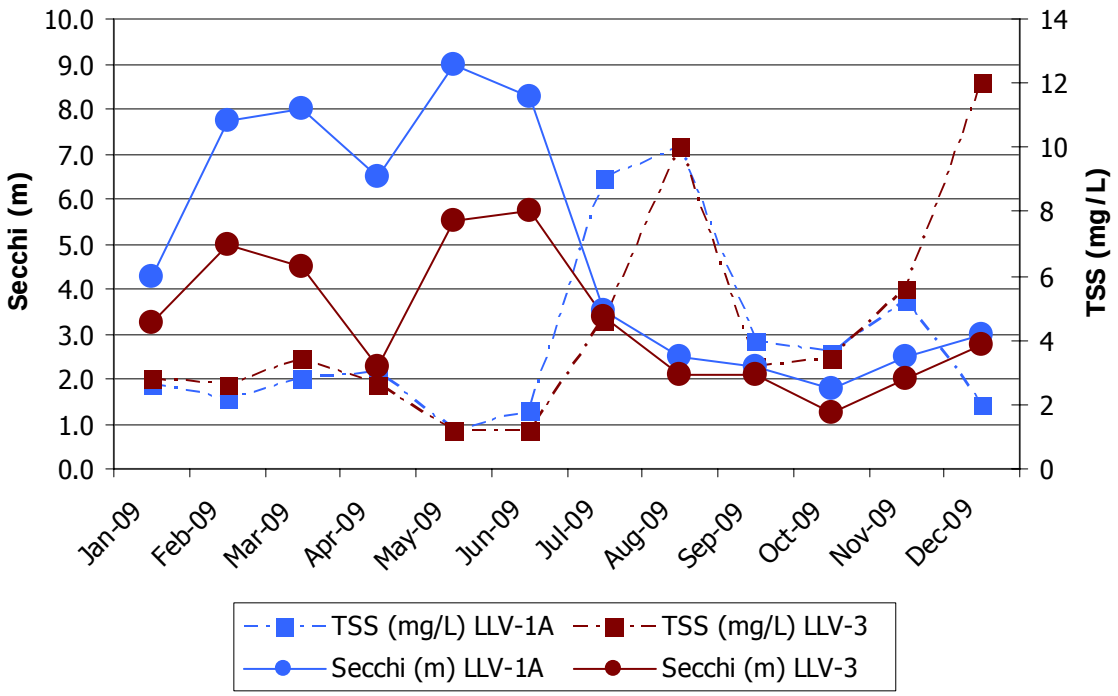

Figure 13. Lake Las Vegas surface total suspended solids (mg/L) measurements at Lake monitoring sites during 2009.

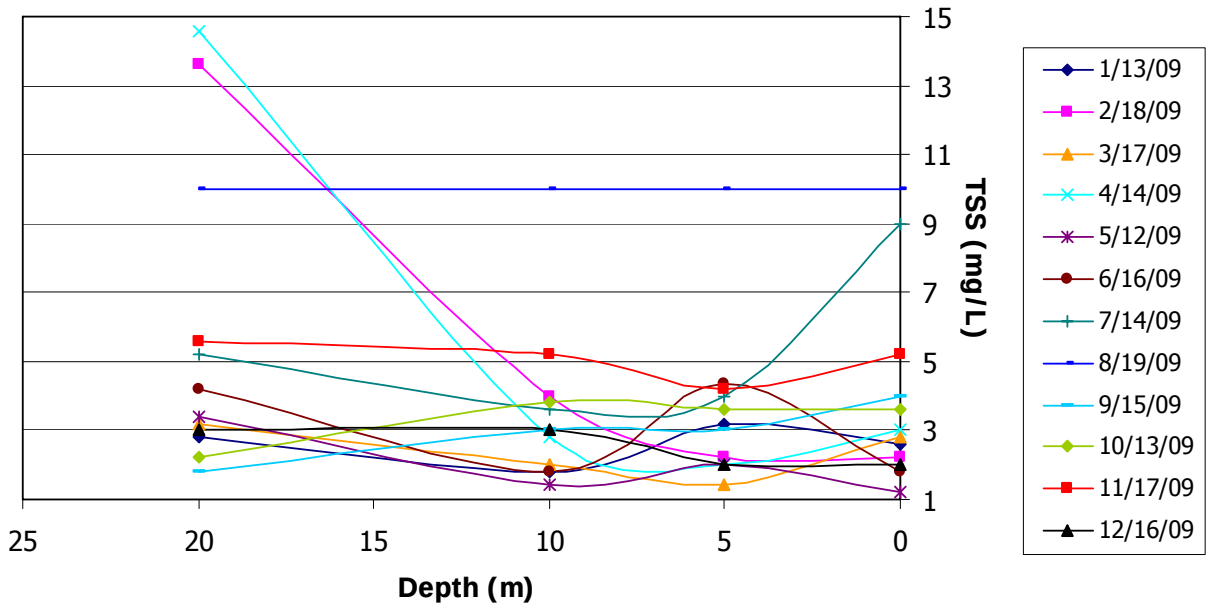

Figure 14a. Lake Las Vegas monthly total suspended solids (mg/L) profiles at site LLV-1A during 2009.

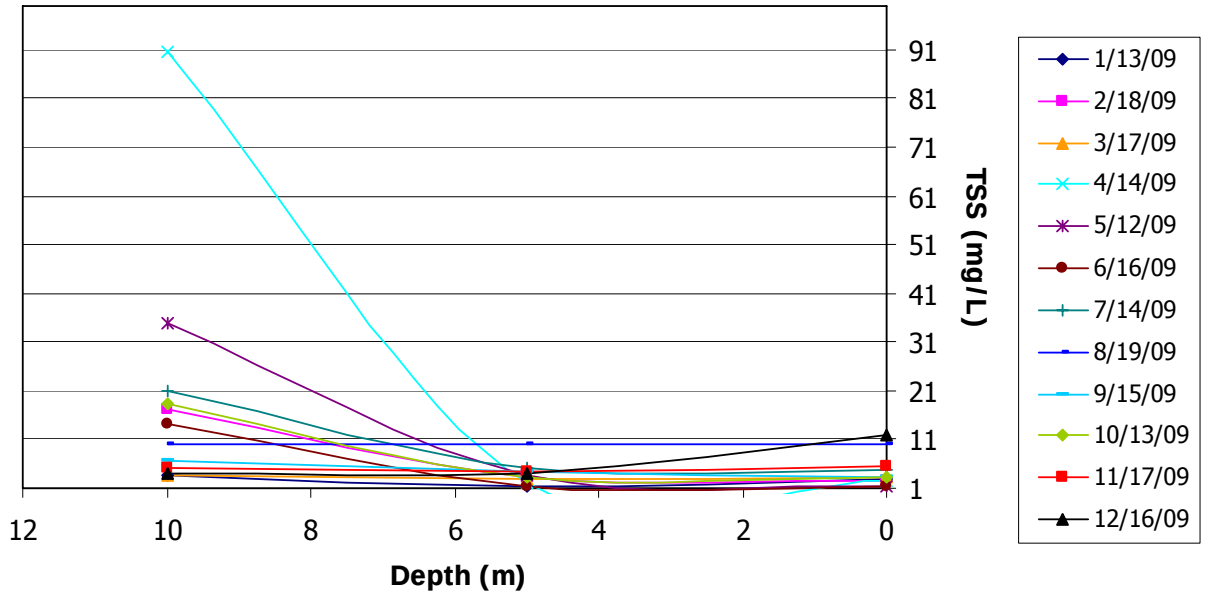

Figure 14b. Lake Las Vegas monthly total suspended solids (mg/L) profiles at site LLV-3 during 2009.

C. Chemical Analysis

Phosphorus

Phosphorus is a common growth limiting nutrient in phytoplankton even though the quantity needed by plants is much smaller than other nutrients, such as carbon or nitrogen. Phosphorus's critical role as a growth limiting nutrient is partially due to the fact that the only biological available form of phosphorus is soluble phosphate (PO_4). (Wetzel 1975) Most phosphorus is unavailable to biota because it tends to strongly adsorb to particles in the water, with the exception of anoxic conditions. Phosphate may accumulate over the winter when primary production is at a minimum, but by late spring the levels of available phosphate may be reduced to less that 2.0 µg/L through algal uptake. This lack of available phosphate results in a system where phosphate is continuously recycled back to phytoplankton after excretion from fish, zooplankton, or bacterial activity. Internal loading from the sediments and lake mixing are important methods of returning phosphates that have left the photic zone and return them to the epilimnion for use. (Hutchinson 1957)

Monthly concentrations of total phosphorus did not have considerable variations between the sites throughout the year. Surface total phosphorus concentrations were measured at sites LLV-1A and LLV-3 with an observed average concentration of 18 µg/L (range: 5 to 45 µg/L) and 14 µg/L (range: 7 to 25 µg/L); respectively (Figure 15). Variation in phosphorus concentrations with depth were observed and reflected the expected trend of diluted values during the destratification period where phosphorus is capable of migrating through the entire water column and conversely higher concentrations observed during the stratified summer months. (Figure 16a and 16b) Monthly total phosphorus concentrations varied with depth and were consistent with typical stratified lake (Figures 16a and 16b).

Monthly surface ortho-phosphorus concentrations did not have considerable variation between the sites throughout the year. Surface otho phosphorus concentrations were measured at sites LLV-1A and LLV-3 with an observed average concentration of 6 µg/L (range: 5 to 17 µg/L) and 7 µg/L (range: 5 to 17 µg/L); respectively (Figure 15).

Monthly ortho-phosphorus concentrations did now show significant differences between depths with exception of those samples collected near the bottom were elevated (Figure 17a and 17b).

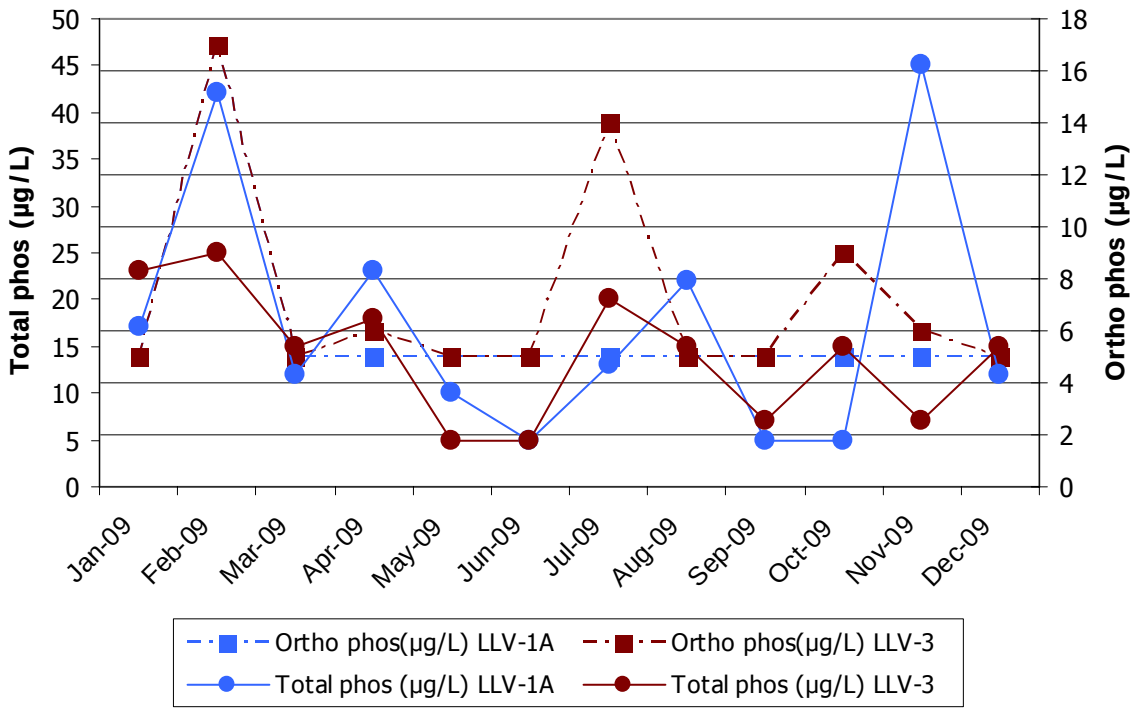

Figure 15. Lake Las Vegas surface total phosphorus (µg/L) and Ortho phos (µg/L) profiles at Lake monitoring sites during 2009.

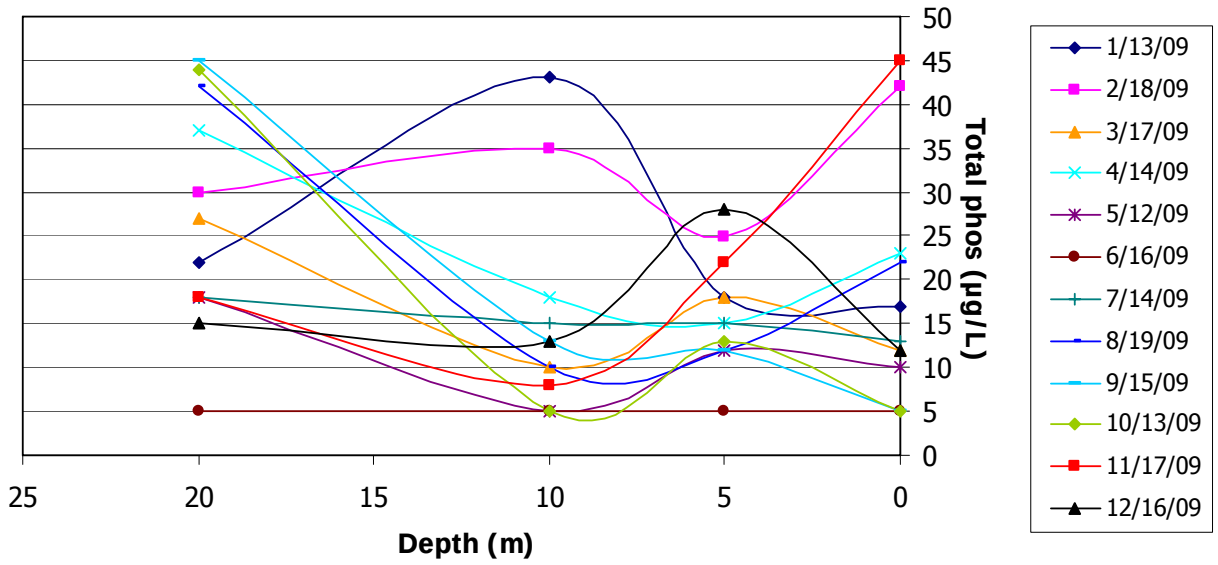

Figure 16a. Lake Las Vegas monthly total phosphorus (µg/L) profiles at site LLV-1A during 2009.

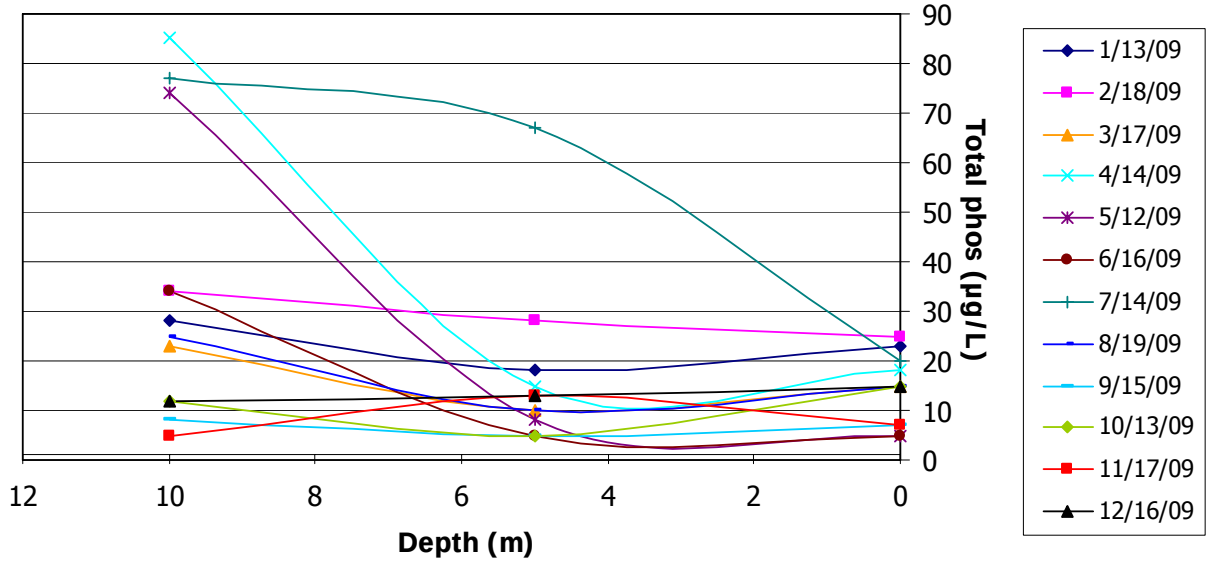

Figure 16b. Lake Las Vegas monthly total phosphorus (µg/L) profiles at site LLV-3 during 2009.

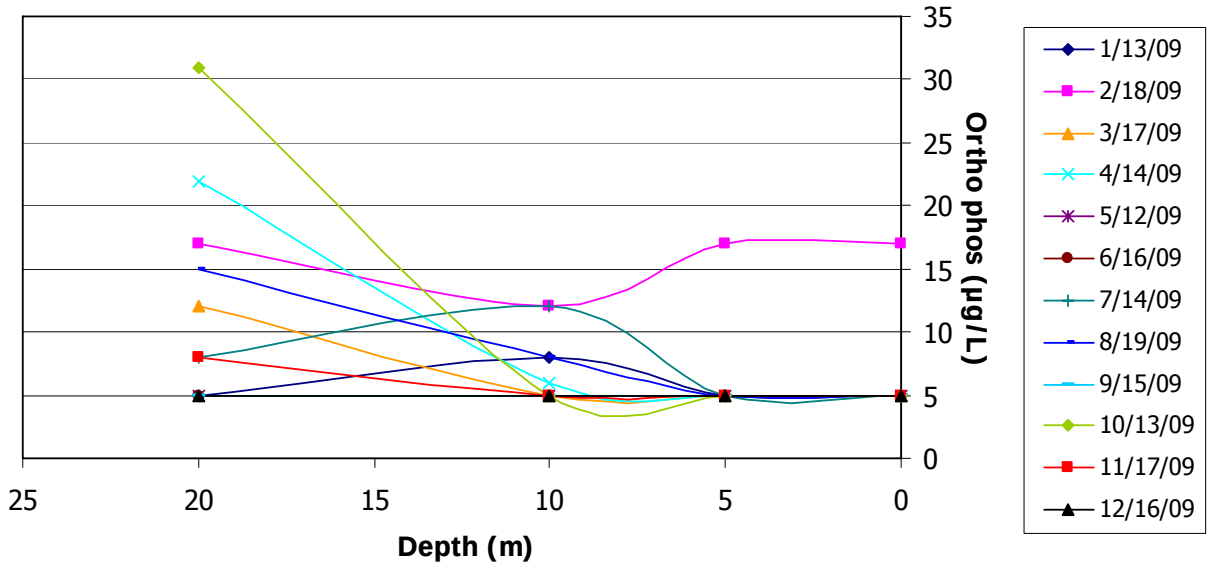

Figure 17a. Lake Las Vegas monthly ortho-phosphorus µg/L profiles site LLV-1A during 2009.

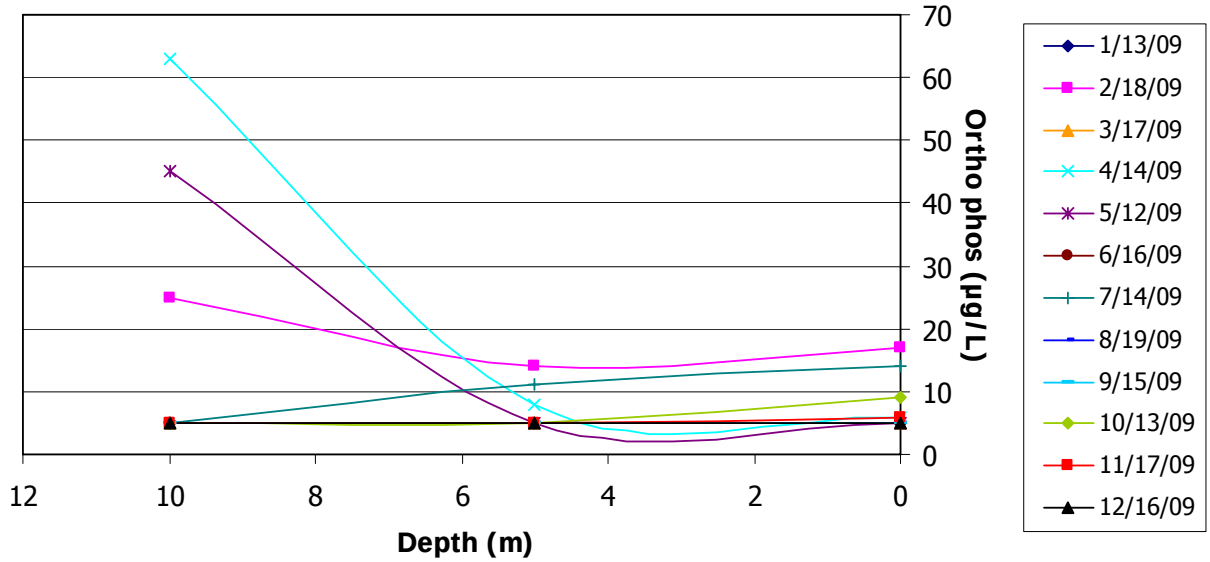

Figure 17b. Lake Las Vegas monthly ortho-phosphorus µg/L profiles sites LLV-3 during 2009.

Nitrogen

Nitrogen enters lakes and reservoirs as nitrate in rainfall and atmospheric deposition in the watershed, moving freely through soils and streams. In addition, decomposing bacteria breaks down organic matter and convert the nitrate to ammonia.

Nitrogen in aquatic systems may exist in several forms: dissolved nitrogen gas (N_2), organic nitrogen incorporated into organic matter, ionized (NH_4^+) and undissociated ammonia (NH_40H+NH_3), nitrite ion (NO_2^-) and nitrate ion (NO_3^-). The prevalence of ionized versus undissociated ammonia is primarily pH dependent, such that the fraction as unionized species (NH_40H+NH_3) increases significantly above pH = 8. As noted previously, unionized ammonia is toxic to aquatic life.(Wetzel 1975) Under aerobic conditions, bacteria mediate the oxidation of ammonia to nitrate, with an intermediate step of nitrite, in a process known as nitrification. In the nitrification reaction, 1.0 g of ammonia consumes 4.57 g of oxygen (Charpa 1997). In the absence of oxygen, bacteria mediate the reduction of nitrate to nitrogen gas.

Monthly Surface nitrite plus nitrate concentrations were measured at sites LLV-1A and LLV-3 with an observed average concentration of 729 µg/L (range: 380 to 1134 µg/L) and 707 µg/L (range: 410 to 1136 µg/L); respectively (Figure 18a and 18b). Concentrations varied by depth between 346 and 1,090 µg/L and were heavily influenced by thermal stratification and the presence of anaerobic conditions (Figure 19a and 19b).

Ammonia - Nitrogen

Monthly ammonia surface water concentrations did not have considerable variations between the two sites throughout the year. Surface ammonia concentrations were measured at sites LLV-1A and LLV-3 with an observed average concentration of 111 µg/L (range: 50 to 340 µg/L) and 95 µg/L (range: 50 to 270 µg/L); respectively (Figure 18a and 18b). Variability in concentrations between depths was not found significant for ammonia during 2009 (Figure 20a and 20b). The difference between the average concentration at the surface water and max depth of 20 meters is 157 (µg/L) at site LLV-1A. The difference between the average concentration at the surface water and max depth of 10 meters is 2 (µg/L) at site LLV-3. These concentrations at depth are expected during stratification where denitrification occurs.

Organic Nitrogen

Organic Nitrogen is calculated by subtracting ammonia from the total kjeldahl nitrogen (TKN). Organic Nitrogen is comprised of detritus and plankton suspended within the water column, and remaining insoluble until decomposition breaks down the organic matter and bacteria process and release the nitrogen back into the system.

Monthly organic nitrogen concentrations were measured at sites LLV-1A and LLV-3 with an observed average concentration of 1306 µg/L (range 670 to 2070 µg/L) and 1132 µg/L (range 640 to 1670 µg/L respectively (Figure 18a and 18b). An observed increase in organic

nitrogen was measured in May at site LLV-1A (Figure 21a). This increase correspondence to an increase in phytoplankton activity during the same period within the epilimnion, causing organic nitrogen concentrations to follow the same trend. Due to the shallow nature of site LLV-3, organic nitrogen concentration is more erratic due to influences of wind on the constant mixing of the shallow sediments immediately west of this site (Figure 21b)

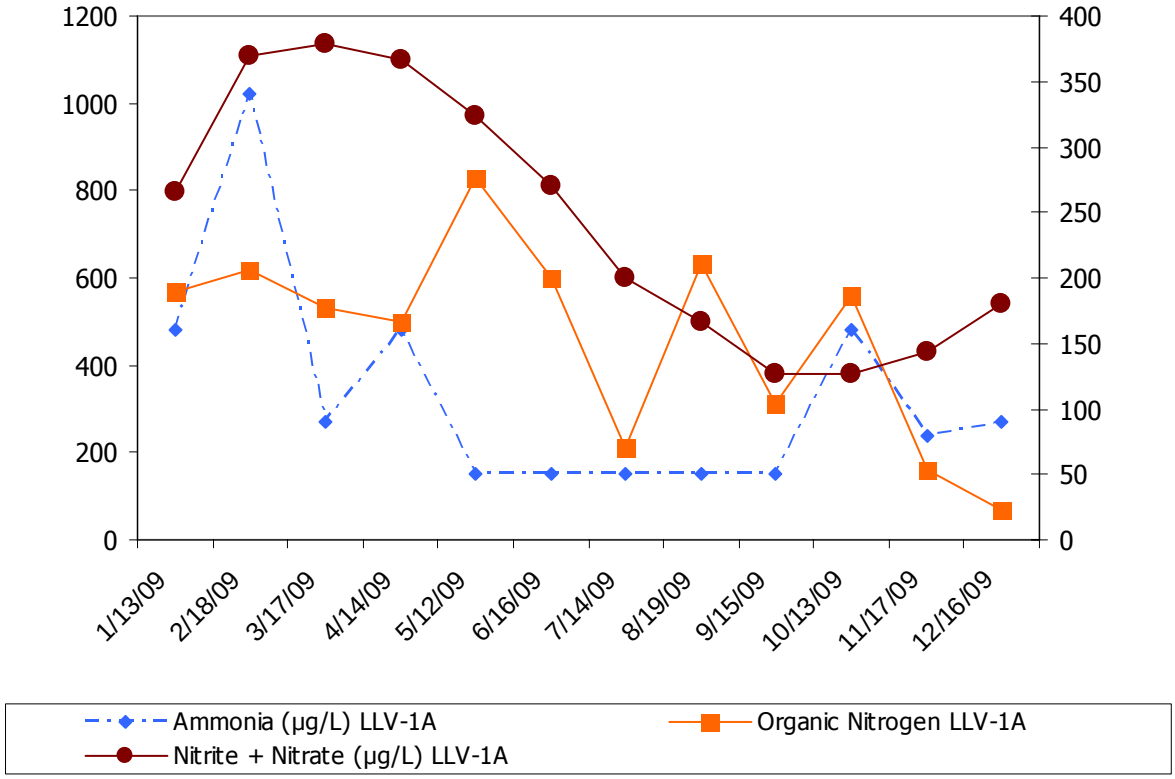

Figure 18a. Lake Las Vegas surface nitrite + nitrate (µg/L), ammonia (µg/L), and Organic Nitrogen (µg/L) measures at Lake monitoring site LLV-1A during 2009.

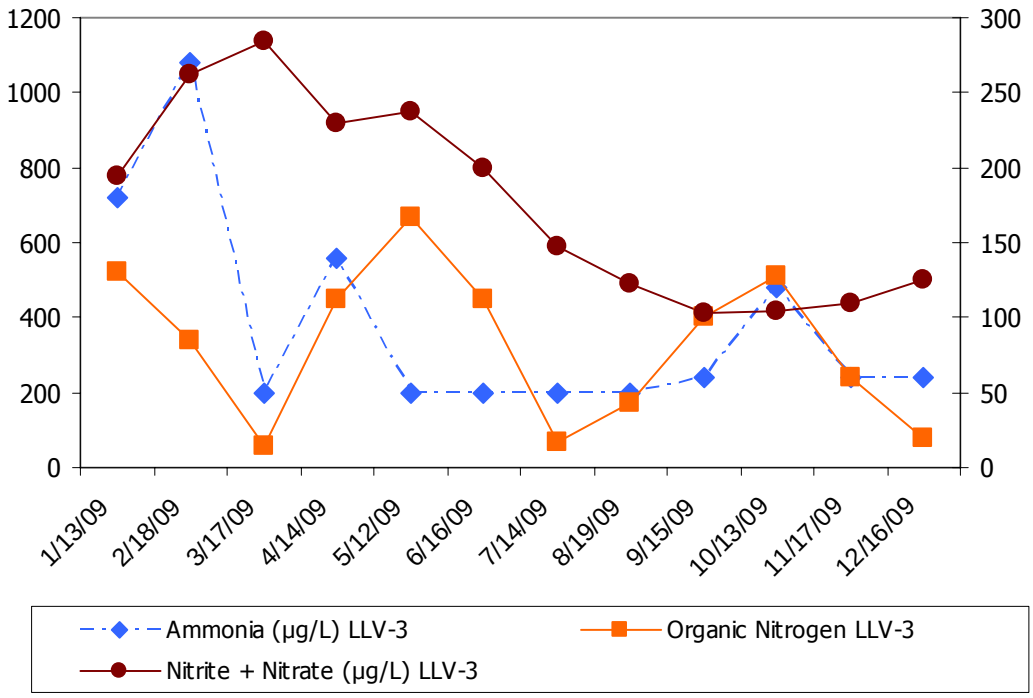

Figure 18b. Lake Las Vegas surface nitrite + nitrate (µg/L), ammonia (µg/L), and Organic Nitrogen (µg/L) measures at Lake monitoring site LLV-3 during 2009.

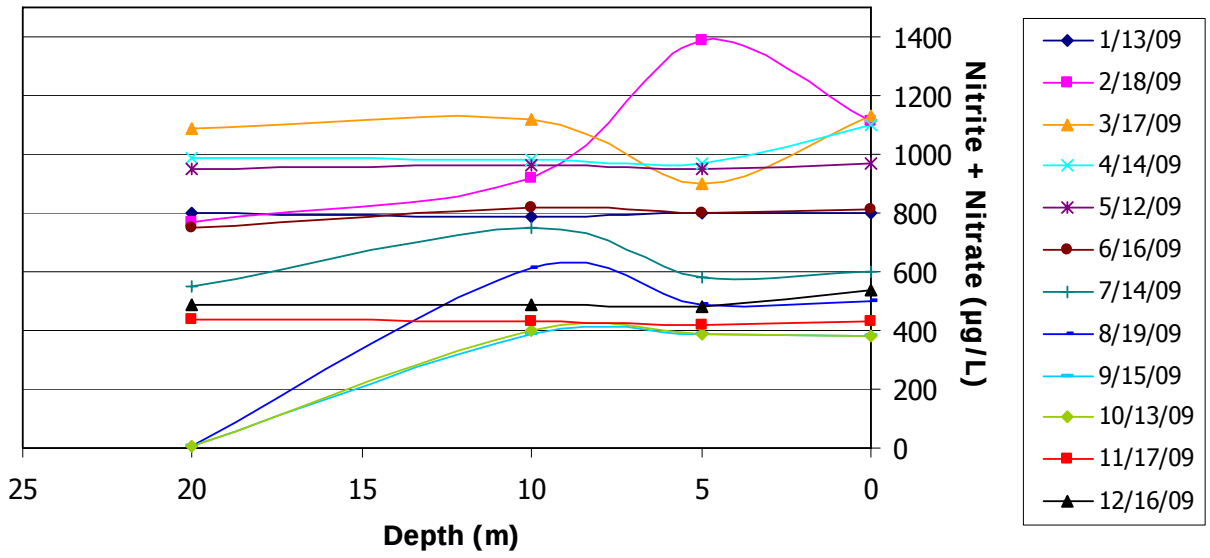

Figure 19a. Lake Las Vegas monthly nitrite + nitrate (µg/L) profiles at site LLV-1A during 2009.

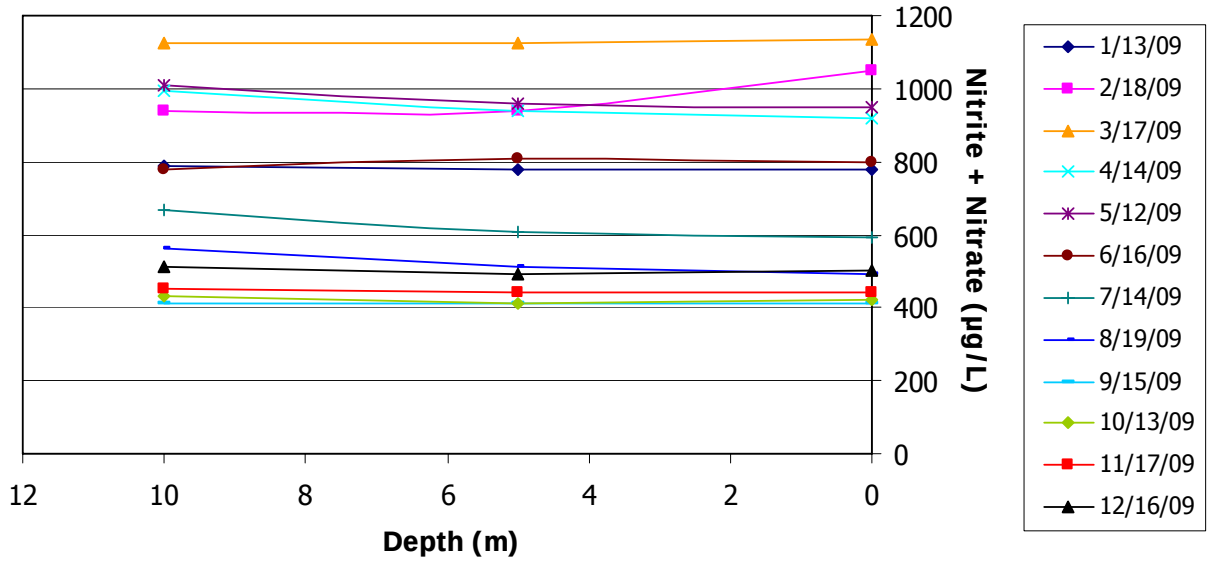

Figure 19b. Lake Las Vegas monthly nitrite + nitrate (µg/L) profiles at site LLV-3 during 2009.

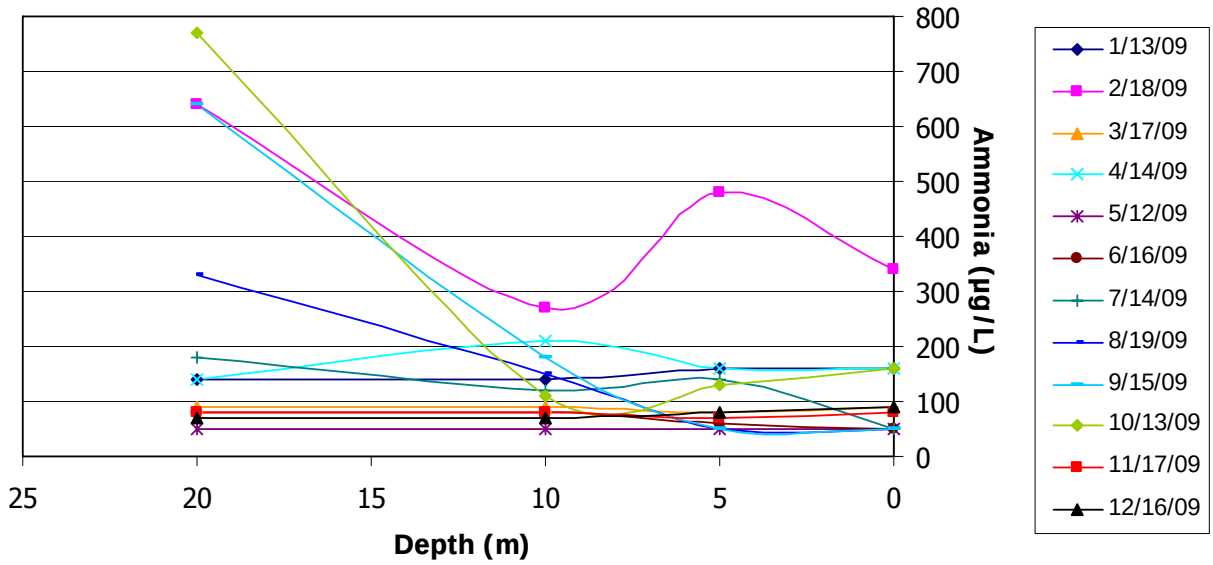

Figure 20a. Lake Las Vegas monthly ammonia (µg/L) profiles at site LLV-1A during 2009.

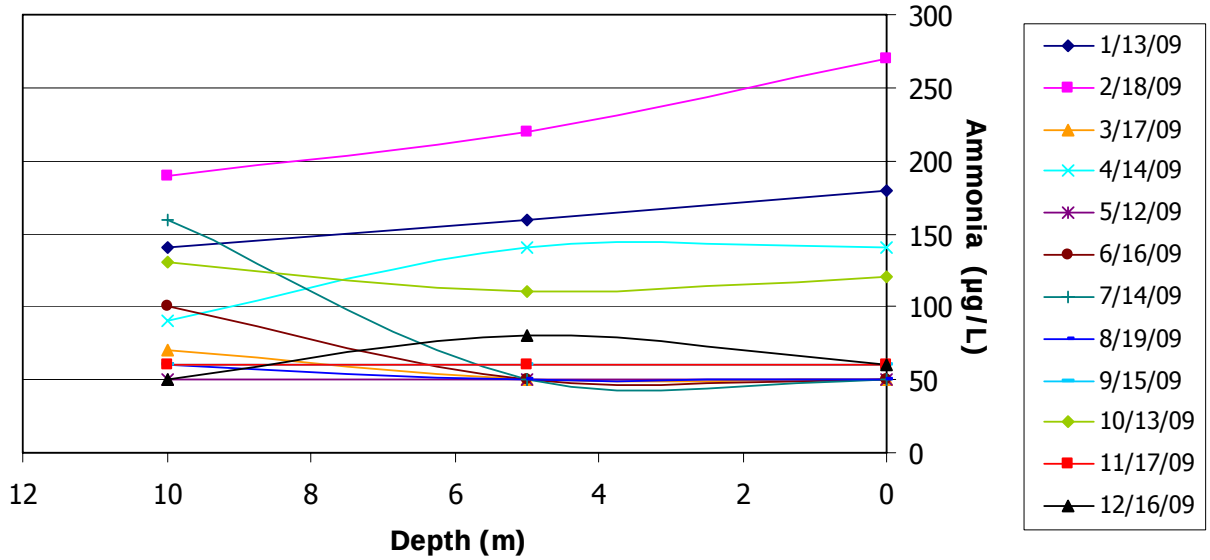

Figure 20b. Lake Las Vegas monthly ammonia (µg/L) profiles at site LLV-3 during 2009.

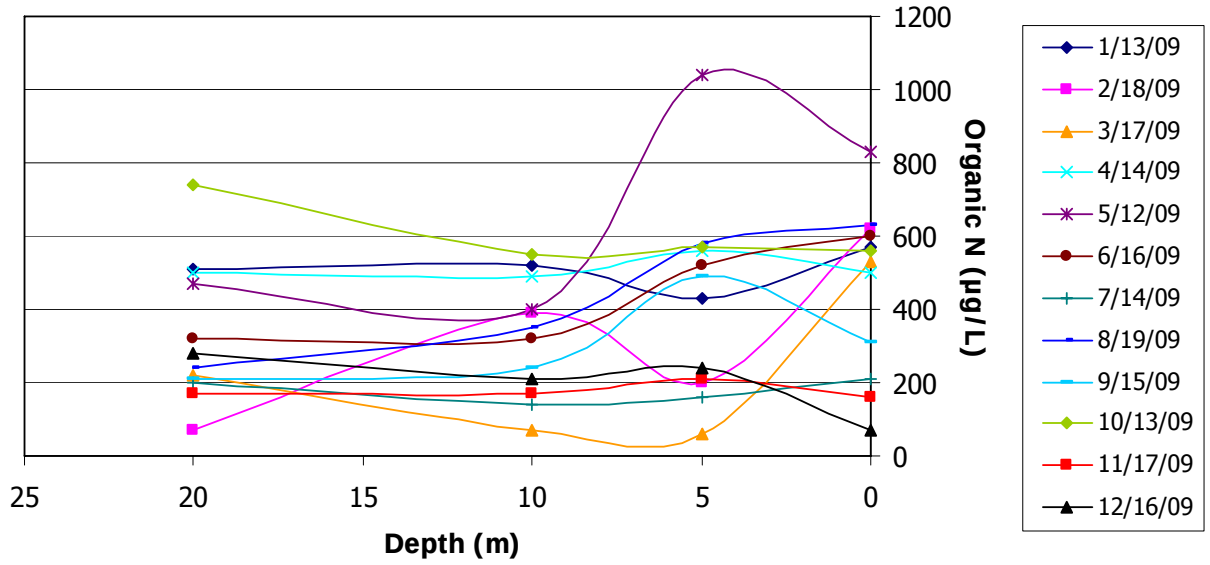

Figure 21a. Lake Las Vegas monthly Organic Nitrogen (µg/L) profiles at site LLV-1A during 2009.

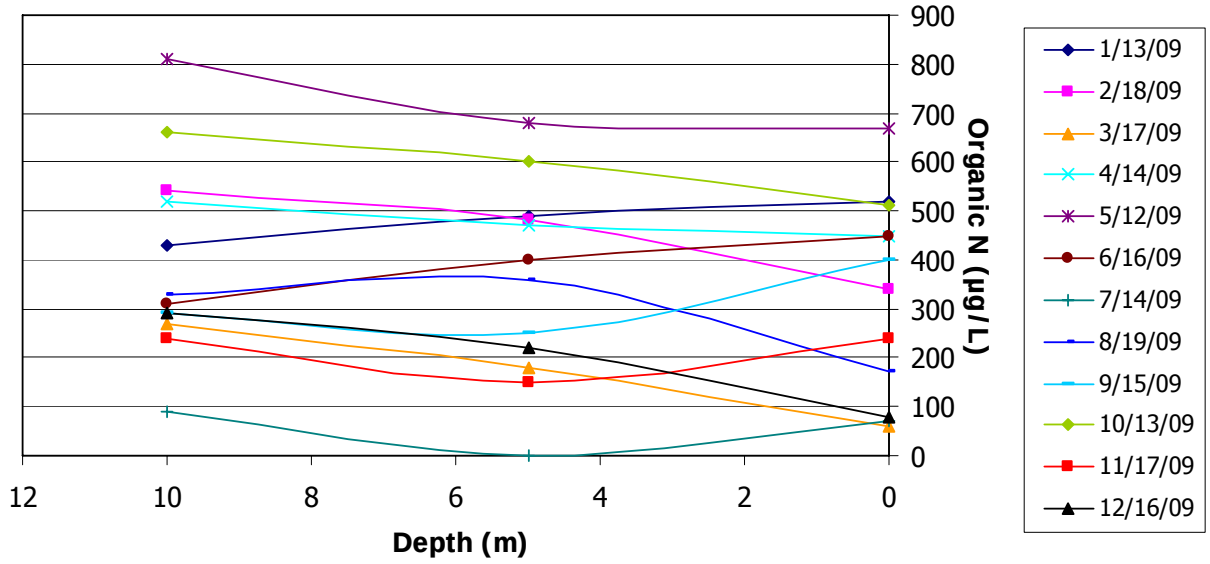

Figure 21b. Lake Las Vegas monthly Organic Nitrogen (µg/L) profiles at site LLV-3 during 2009.

D. Biological Analysis

Zooplankton Species Composition and Abundance

Copepods dominated the population with a frequency of 73.0%, and 73% of the biomass at site LLV-1A and LLV-3 respectively, followed by Cladocerans (19% LLV-1A and 18% LLV-3) and Rotifers (8% LLV-1A and 9% LLV-3) during 2009 (Figure 22). Numerous species of zooplankton have been identified in the 0 – 15 m vertical plankton tows at site LLV-1 in 2009 (Figure 23). A total of fourteen species were observed in 2009, but approximately 80% of the biomass was attributed to three species, reflecting an overall lower diversity of zooplankton (Figure 23).

Nauplii (Copepods) exhibited the greatest average annual average density in 2009 (Figure 22).

Zooplankton frequencies were consistent during most of the year, and greatest during the month of March and April (Figure 24). In general, populations were greater during the spring months, corresponding to periods of food (phytoplankton) availability.

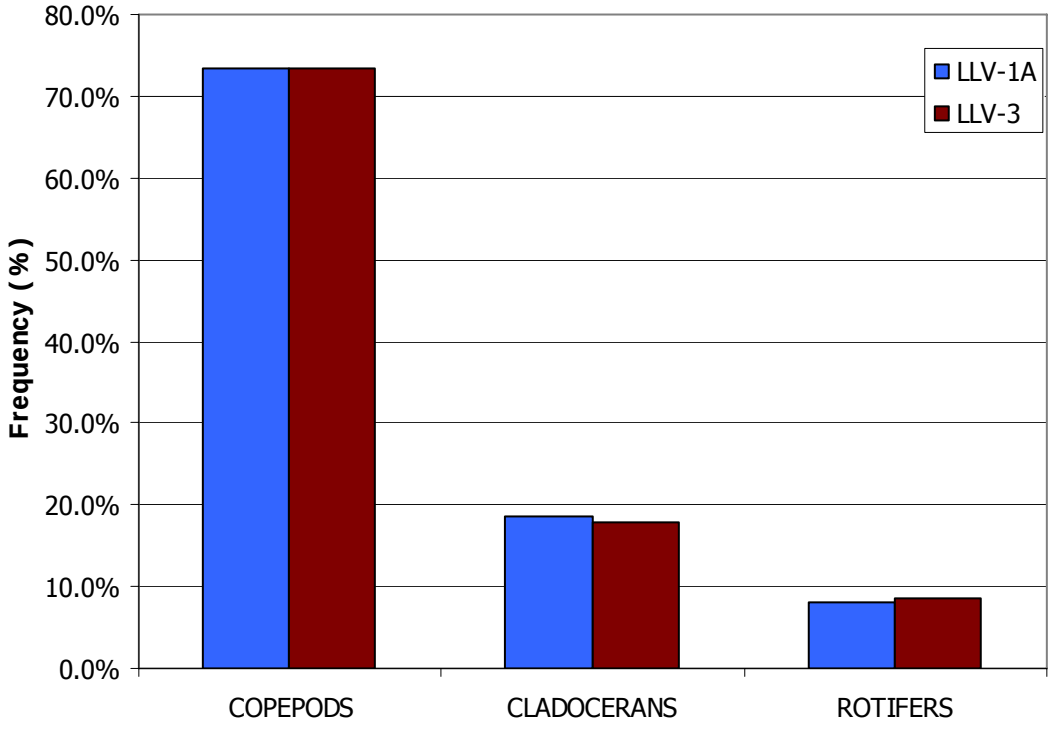

Figure 22. Lake Las Vegas Zooplankton frequency by species at site LLV-1A and LLV-3 during 2009.

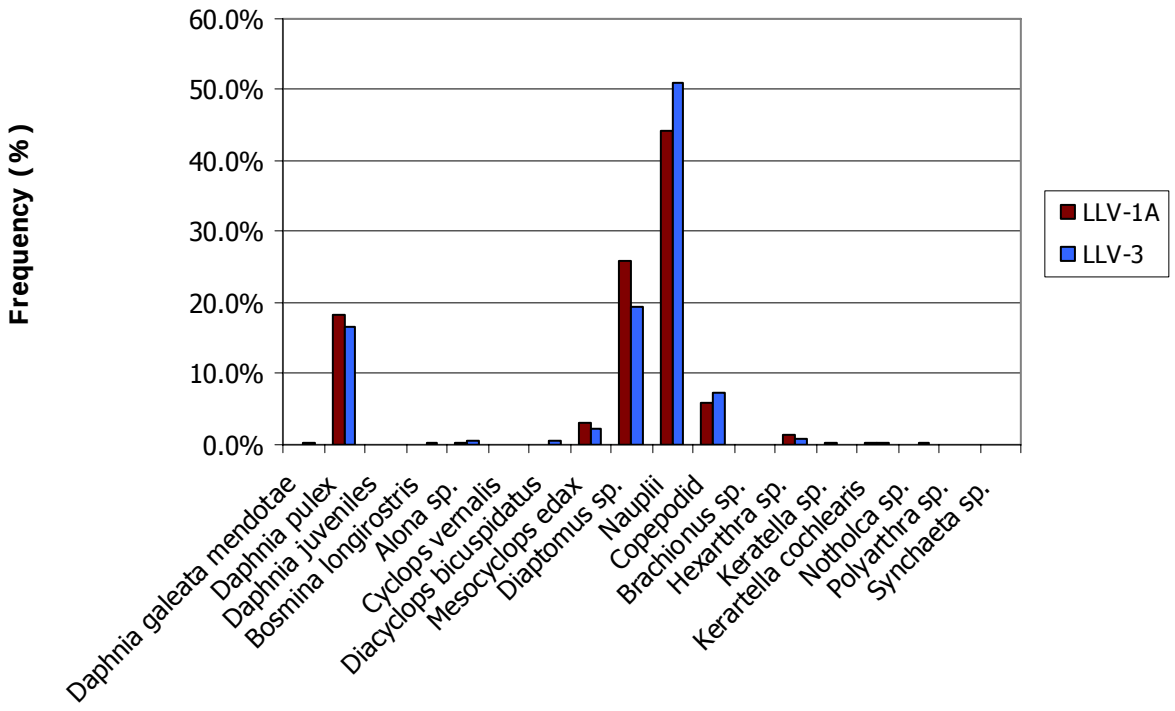

Figure 23. Lake Las Vegas Zooplankton frequency by species at site LLV-1A and LLV-3 during 2009.

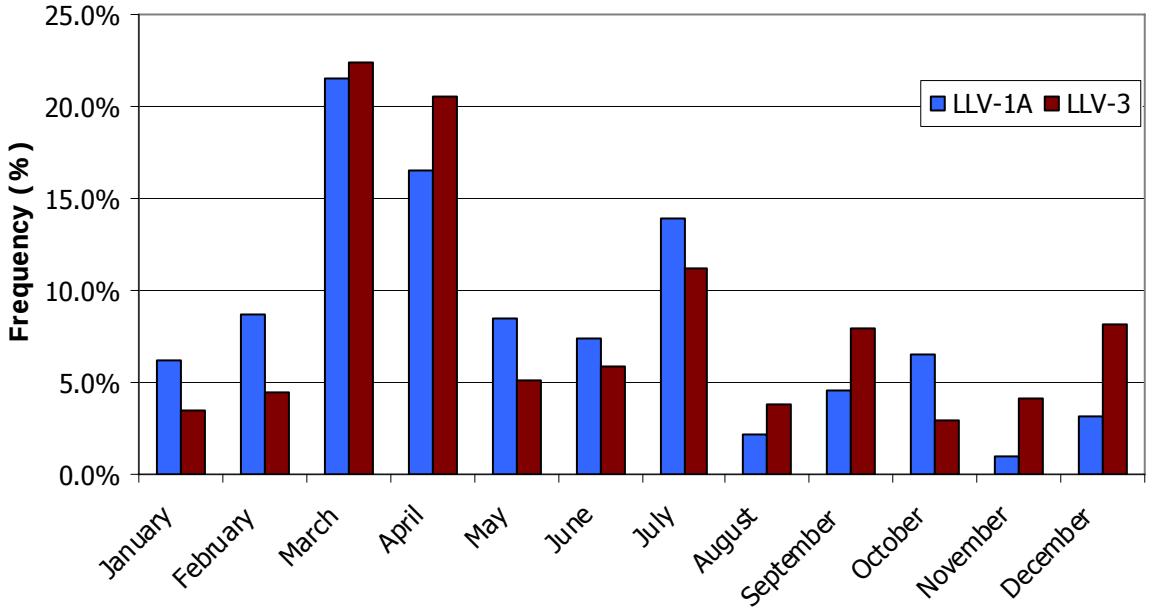

Figure 24. Lake Las Vegas Zooplankton frequency by month at site LLV-1A and site LLV-3 during 2009.

Chlorophyll-a

Chlorophyll is the green pigments found in plants tissues. There are seven known types of chlorophyll; *Chlorophyll a* and *Chlorophyll b* are the two most common forms. Chlorophyll is a major light gathering pigment of all photosynthetic organisms and is essential for the process of photosynthesis. The amount present in lake water depends on the amount of algae and is therefore used as a common indicator of water quality (NALMS 2009).

Surface chlorophyll-a concentrations were measured at sites LLV-1A and LLV-3 with an observed average concentration of 2 µg/L (range: 1 to 5.9 µg/L) and 5 µg/L (range: 1 to 28.3 µg/L); respectively (Figure 25). Concentrations with depth varied during the seasons with a maximum observed measurement in December at 0 meter depths of 28 µg/L at site LLV-3 (Figures 26a and 26b). Concentrations were relatively low throughout the year with the exception of two observations in April and December at LLV-3 (Figure 26b)

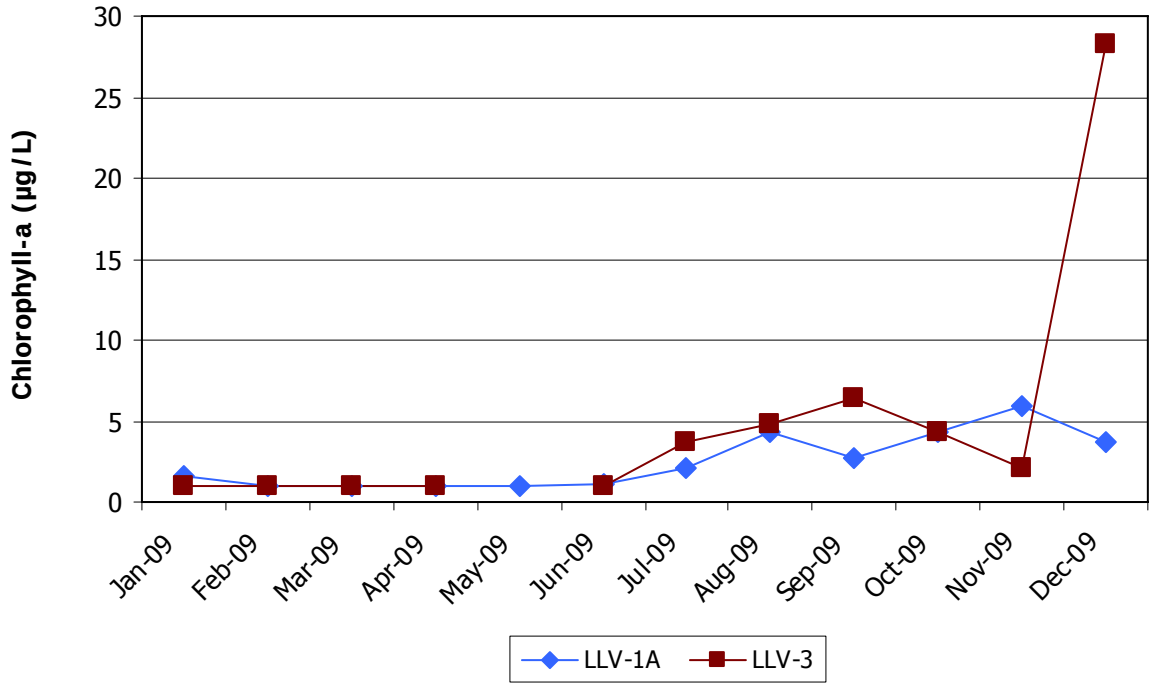

Figure 25. Lake Las Vegas Chlorophyll-a (µg/L) concentrations in surface waters at Lake monitoring sites during 2009.

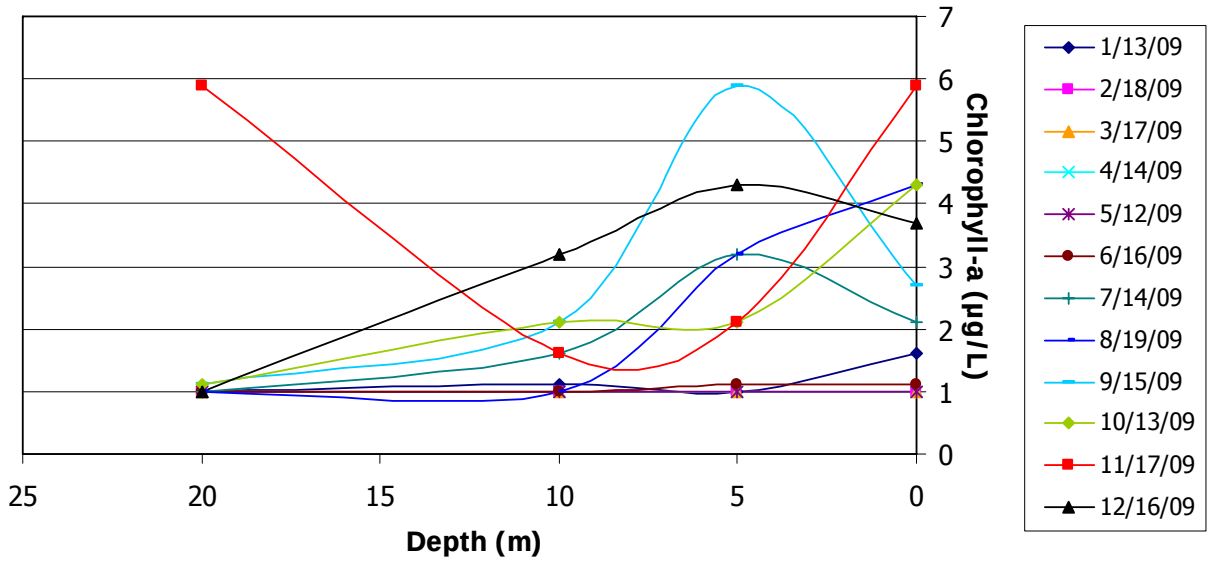

Figure 26a. Lake Las Vegas monthly Chlorophyll-a (µg/L) profile at site LLV-1A during 2009.

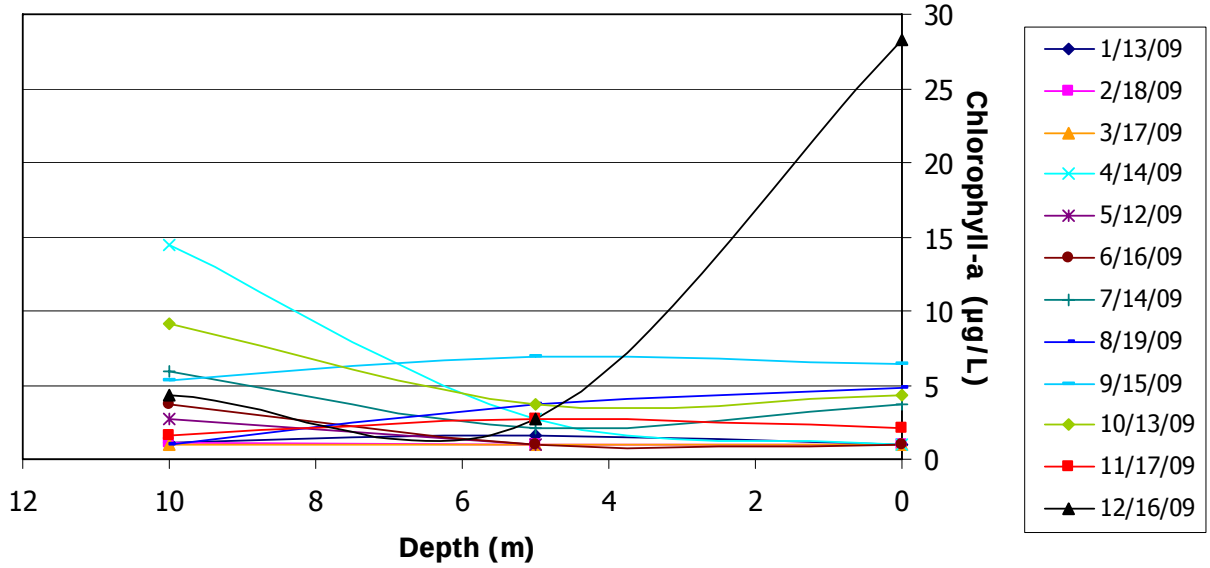

Figure 26b. Lake Las Vegas monthly Chlorophyll-a (µg/L) profile at site LLV-3 during 2009.

Phytoplankton

Phytoplankton, also commonly known as algae, are microscopic plants that grow in sunlit water that contains phosphates, nitrates, and other nutrients. Algae, like all aquatic plants, add oxygen to the water and are important in the fish food chain. Phytoplankton is either suspended in water (plankton) or attached to rocks and other substrates (periphyton). Their abundance, as measured by the amount of chlorophyll *a* (green pigment) in an open water sample, is commonly used to classify the trophic status of a lake. Phytoplankton are a essential part of the lake ecosystem and provides the food base for most lake organisms, including fish. Phytoplankton populations vary widely from day to day, as life cycles are short (NALMS 2009).

Eight (8) taxonomic divisions of phytoplankton were found at site LLV-1 and LLV-3 during 2009 (Figure 27). By biomass the most frequently observed division in 2009 was Cyanophyta (LLV-1A, 43% and LLV-3, 32%). The remaining seven (7) divisions relative frequencies were as follows: Chlorophyta (LLV-A 1.5% and LLV-3, 1.4%), Bacillariophyceae (LLV-1A, 34.2% and LLV-3, 35.2%), Cryptophyta (LLV-1A, 2.5% and LLV-3, 4.3%), Haptophyta (LLV-1A 4.8% and LLV-3, 4.1%), Chrysophyta (LLV-1A, 2.2% and LLV-3, 3.7%), Microflagellates (LLV-1A, 0.2% and LLV-3, 0.2%), Pyrrhophyta (LLV-1A 11.2% and LLV-3, 13.1%) were distributed in relation to Cycnophyta during the year.

Figure 28 illustrates relative frequency of the species of phytoplankton measured in 2009. Anabaena aphanizomenoides of the division, Cyanophyta dominated the phytoplankton community at site LLV-1A and LLV-3 22.6% and 19.7% respectively. Cylinderospermopsis raciborskii and cyclotella glomerata also contributed to a large portion of the observed annual biomass.

Phytoplankton populations were the most abundant during the summer months and declined gradually through December (Figure 29). This was also observed in the chlorophyll concentrations found in Figure 25.

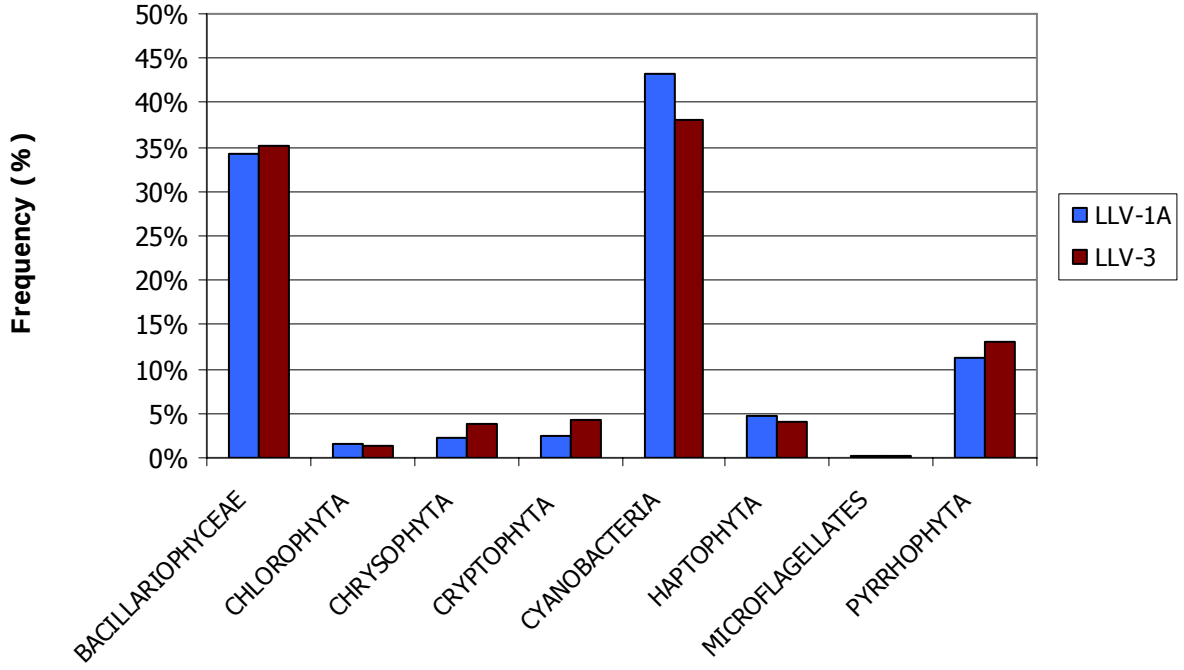

Figure 27. Lake Las Vegas Phytoplankton frequency by division at sites LLV-1A and LLV-3 during 2009.

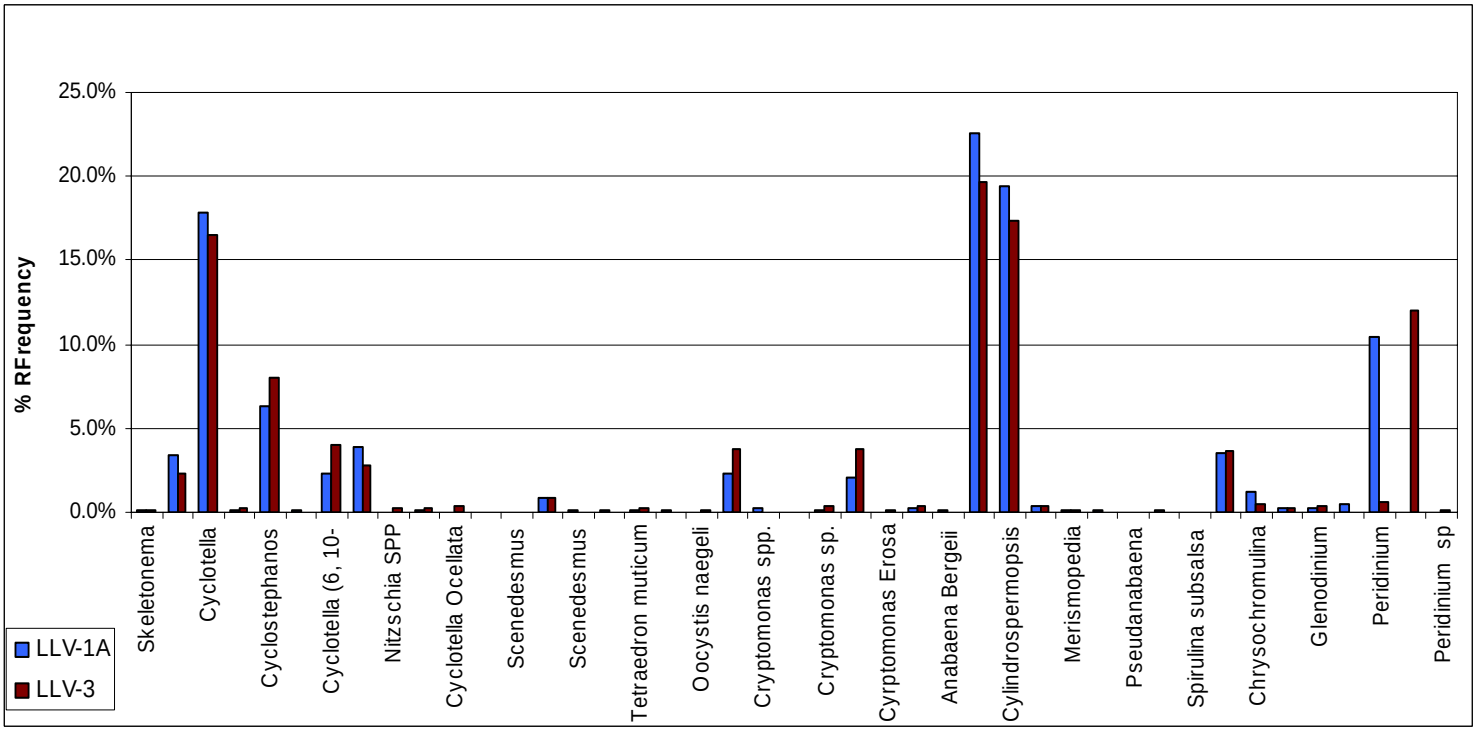

Figure 28. Lake Las Vegas Phytoplankton frequency by species at sites LLV-1A and LLV-3 during 2009.

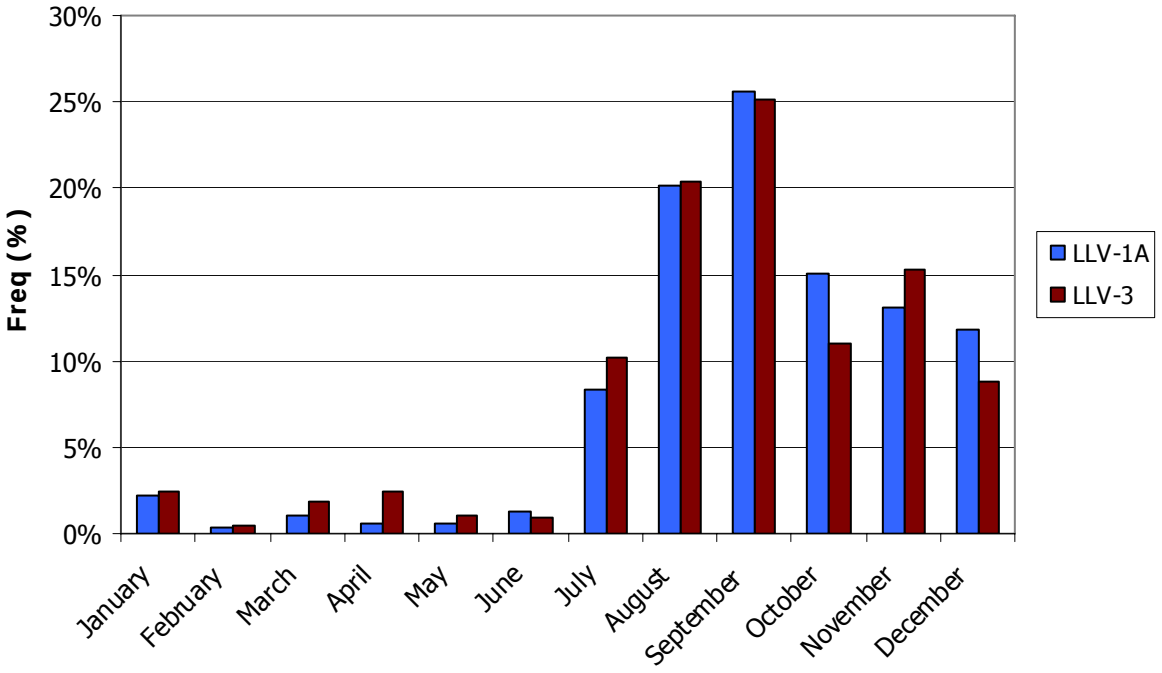

Figure 29. Lake Las Vegas Phytoplankton by month at sites LLV-1A and LLV-3 during 2009.

Bacteria

Fecal coliform monitoring was completed on a monthly basis at both sites in 2009. In 2009, bacteria sampling frequency was completed monthly. Fecal coliform counts in surface waters were below body contact limits in 2009 (Figure 30). Fecal coliform averaged 1 MPN/100mL and ranged from 1 to 4 MPN/100mL at site LLV-1A and averaged 2 MPN/100mL and ranged from 1 to 4 MPN/100mL at site LLV-3.

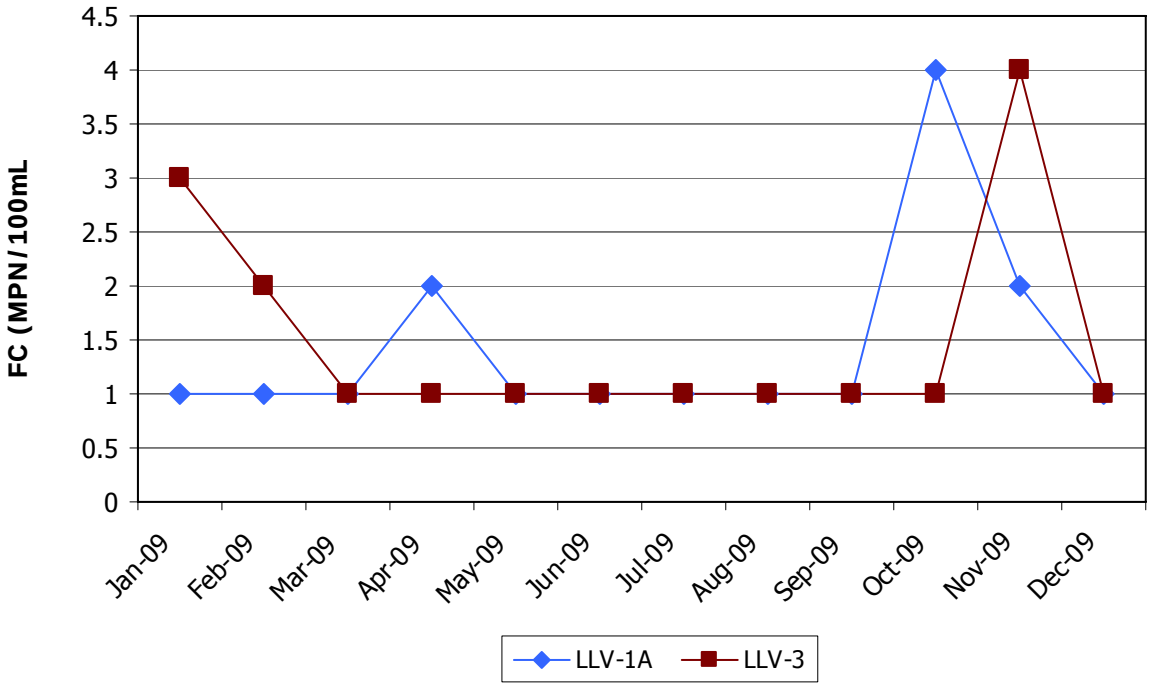

Figure 30. Lake Las Vegas fecal coliform counts (MPN/100ml) in surface waters at Lake monitoring sites during 2009.

Toxic Substances

Water samples for toxic analysis were collected from the surface (0m) and bottom (1m from bottom) of site LLV-1A during December 2009, when the lake was completely mixed. These samples were analyzed for toxic metals, trihalomethanes, pesticides, herbicides, PCBs, and various other organic and inorganic chemicals. Trace metal concentrations were well below the recommended MCLs. Concentrations of pesticides, herbicides and other toxic organic compounds also were also below levels of detection. (Appendix A).

Low levels of Bis(2-ethylhexyl) phthalate (DEHP) were found in the lake water. DEHP is used as a plasticizer in the production of polyvinyl chloride (PVC) and other polymers including rubber, cellulose and styrene. Packaging materials and tubings used in the production of foods and beverages. The EPA's maximum contamination level for DEHP in

drinking water is 6 ppb. Levels in the lake were at 1.67 ppb at 0 m and 2.99 ppb 20 m on December 30, 2009.

IV. SUMMARY

The water quality in Lake Las Vegas was within the proposed water quality guidelines for recreational uses. Average chlorophyll-a concentrations were at or below the proposed guideline of five (5) µg/L. The chlorophyll-a guideline is applied at that time of year to protect water quality during the peak recreation period. Fecal coliform bacteria were below the action level of 200 MPN/100ml. Concentrations of toxic metals, pesticides, herbicides and other toxic organic compounds were below detection limits. Water quality in Lake Las Vegas continues to be very good. The total dissolved solids and associated ions were exhibiting the highest concentrations in late fall due to summer evaporations. At the current concentrations, irrigation water is being removed from the lake without the need to blend with Lake Mead Water.

V. REFERENCES

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VI. APPENDIX A

Annual Toxicity Analysis

Silver State Analytical Laboratories
Report Number: 09-4112
December 23, 2009

Sample ID: LLV-1A 0m
Method: 8260B GCMS

Analyzed by: JS
Date Analyzed: 12/23/09

Compound	Result µg/L	Reporting Limit µg/L	Compound	Result µg/L	Reporting Limit µg/L
Bromomethane	ND	5	Carbon disulfide	ND	15
Bromobenzene	ND	5	Carbon tetrachloride	ND	5
Bromochloromethane	ND	5	Chlorobenzene	ND	5
Bromodichloromethane	ND	5	Chloroethane	ND	5
Bromoform	ND	5	Chloroform	ND	5
2-Butanone (MEK)	ND	25	Chloromethane	ND	5
2-Chloroethyl vinyl ether	ND	5	cis-1,2-Dichloroethene	ND	5
2-Chlorotoluene	ND	5	cis-1,3-Dichloropropene	ND	5
2-Hexanone	ND	20	Dibromochloromethane	ND	5
4-Chlorotoluene	ND	5	Dibromomethane	ND	5
4-Methyl-2-Pentanone	ND	20	Dichlorodifluoromethane	ND	5
Acrylonitrile	ND	20	Dimethyl Disulfide	ND	5
Benzene	ND	4	Ethylbenzene	ND	5
1,1,1,2-Tetrachloroethane	ND	5	Hexachlorobutadiene	ND	5
1,1,1-Trichloroethane	ND	5	Isopropylbenzene (Cumene)	ND	5
1,1,2,2- Tetrachloroethane	ND	5	m and p-Xylene	ND	5
1,1,2-Trichloroethane	ND	5	Methylene chloride	ND	5
1,1-Dichloroethane	ND	5	Methyl-tert-butylether	ND	5
1,1-Dichloroethene	ND	5	Naphthalene	ND	5
1,1-Dichloropropene	ND	5	n-Butylbenzene	ND	5
1,2,3-Trichlorobenzene	ND	5	n-Propylbenzene	ND	5
1,2,3-Trichloropropane	ND	5	o-Xylene	ND	5
1,2,4-Trichlorobenzene	ND	5	p-Isopropyltoluene	ND	5
1,2,4-Trimethylbenzene	ND	5	sec-Butylbenzene	ND	5
1,2-Dibromo-3-chloropropane	ND	5	Styrene	ND	5
1,2-Dibromoethane	ND	5	tert-Butylbenzene	ND	5
1,2-Dichlorobenzene	ND	5	Tetrachloroethene	ND	4
1,2-Dichloroethane	ND	5	Toluene	ND	5
1,2-Dichloropropane	ND	5	trans-1,2-Dichloroethene	ND	5
1,3,5-Trimethylbenzene	ND	5	trans-1,3-Dichloropropene	ND	5
1,3-Dichlorobenzene	ND	5	Trichloroethene	ND	5
1,3-Dichloropropane	ND	5	Trichlorofluoromethane	ND	5
1,4-Dichlorobenzene	ND	5	Vinyl chloride	ND	5
2,2-Dichloropropane	ND	5			

ND: non-detect
EPA Flag: none

Silver State Analytical Laboratories
Report Number: 09-4112
December 23, 2009

Sample ID: LLV-1A 20m
Method: 8260B GCMS

Analyzed by: JS
Date Analyzed: 12/23/09

Compound	Result µg/L	Reporting Limit µg/L	Compound	Result µg/L	Reporting Limit µg/L
Bromomethane	ND	5	Carbon disulfide	ND	15
Bromobenzene	ND	5	Carbon tetrachloride	ND	5
Bromochloromethane	ND	5	Chlorobenzene	ND	5
Bromodichloromethane	ND	5	Chloroethane	ND	5
Bromoform	ND	5	Chloroform	ND	5
2-Butanone (MEK)	ND	25	Chloromethane	ND	5
2-Chloroethyl vinyl ether	ND	5	cis-1,2-Dichloroethene	ND	5
2-Chlorotoluene	ND	5	cis-1,3-Dichloropropene	ND	5
2-Hexanone	ND	20	Dibromochloromethane	ND	5
4-Chlorotoluene	ND	5	Dibromomethane	ND	5
4-Methyl-2-Pentanone	ND	20	Dichlorodifluoromethane	ND	5
Acrylonitrile	ND	20	Dimethyl Disulfide	ND	5
Benzene	ND	4	Ethylbenzene	ND	5
1,1,1,2-Tetrachloroethane	ND	5	Hexachlorobutadiene	ND	5
1,1,1-Trichloroethane	ND	5	Isopropylbenzene (Cumene)	ND	5
1,1,2,2- Tetrachloroethane	ND	5	m and p-Xylene	ND	5
1,1,2-Trichloroethane	ND	5	Methylene chloride	ND	5
1,1-Dichloroethane	ND	5	Methyl-tert-butylether	ND	5
1,1-Dichloroethene	ND	5	Naphthalene	ND	5
1,1-Dichloropropene	ND	5	n-Butylbenzene	ND	5
1,2,3-Trichlorobenzene	ND	5	n-Propylbenzene	ND	5
1,2,3-Trichloropropane	ND	5	o-Xylene	ND	5
1,2,4-Trichlorobenzene	ND	5	p-Isopropyltoluene	ND	5
1,2,4-Trimethylbenzene	ND	5	sec-Butylbenzene	ND	5
1,2-Dibromo-3-chloropropane	ND	5	Styrene	ND	5
1,2-Dibromoethane	ND	5	tert-Butylbenzene	ND	5
1,2-Dichlorobenzene	ND	5	Tetrachloroethene	ND	4
1,2-Dichloroethane	ND	5	Toluene	ND	5
1,2-Dichloropropane	ND	5	trans-1,2-Dichloroethene	ND	5
1,3,5-Trimethylbenzene	ND	5	trans-1,3-Dichloropropene	ND	5
1,3-Dichlorobenzene	ND	5	Trichloroethene	ND	5
1,3-Dichloropropane	ND	5	Trichlorofluoromethane	ND	5
1,4-Dichlorobenzene	ND	5	Vinyl chloride	ND	5
2,2-Dichloropropane	ND	5			

ND: non-detect
EPA Flag: none

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Client:	SILVER STATE ANALYTICAL LABS	**Batch #:**	091221001
Address:	3638 E. SUNSET ROAD LAS VEGAS, NV 89120	**Project Name:**	LAB ID 4112
Attn:	RON WINTER		

Analytical Results Report

Sample Number	091221001-001	**Sampling Date**	12/16/2009	**Date/Time Received**	12/18/2009 12:10 PM
Client Sample ID	LLV1A 0M / 4112-1	**Sampling Time**		**Extraction Date**	12/21/2009
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
4,4-DDD	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
4,4-DDE	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
4,4-DDT	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Aldrin	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
alpha-BHC	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Aroclor 1016 (PCB-1016)	ND	ug/L	0.2	12/21/2009	SAT	EPA 608	
Aroclor 1221 (PCB-1221)	ND	ug/L	0.2	12/21/2009	SAT	EPA 608	
Aroclor 1232 (PCB-1232)	ND	ug/L	0.2	12/21/2009	SAT	EPA 608	
Aroclor 1242 (PCB-1242)	ND	ug/L	0.2	12/21/2009	SAT	EPA 608	
Aroclor 1248 (PCB-1248)	ND	ug/L	0.2	12/21/2009	SAT	EPA 608	
Aroclor 1254 (PCB-1254)	ND	ug/L	0.2	12/21/2009	SAT	EPA 608	
Aroclor 1260 (PCB-1260)	ND	ug/L	0.2	12/21/2009	SAT	EPA 608	
beta-BHC	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Chlordane	ND	ug/L	0.1	12/21/2009	SAT	EPA 608	
delta-BHC	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Dieldrin	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Endosulfan I	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Endosulfan II	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Endosulfan sulfate	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Endrin	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Endrin aldehyde	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Endrin ketone	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	

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Certifications held by Anatek Labs WA: EPA:WA00169; CA:Cert2632; ID:WA00169; WA:C1267

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Client: SILVER STATE ANALYTICAL LABS
Address: 3638 E. SUNSET ROAD
LAS VEGAS, NV 89120
Attn: RON WINTER

Batch #: 091221001
Project Name: LAB ID 4112

Analytical Results Report

Sample Number	091221001-001	**Sampling Date**	12/16/2009	**Date/Time Received**	12/18/2009 12:10 PM
Client Sample ID	LLV1A 0M / 4112-1	**Sampling Time**		**Extraction Date**	12/21/2009
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
gamma-BHC (Lindane)	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Heptachlor	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Heptachlor epoxide	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Methoxychlor	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Toxaphene	ND	ug/L	0.1	12/21/2009	SAT	EPA 608	

Surrogate Data

Sample Number 091221001-001

Surrogate Standard	Method	Percent Recovery	Control Limits
DCB	EPA 608	81.4	30-130

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Client:	SILVER STATE ANALYTICAL LABS	**Batch #:**	091221001
Address:	3638 E. SUNSET ROAD LAS VEGAS, NV 89120	**Project Name:**	LAB ID 4112
Attn:	RON WINTER		

Analytical Results Report

Sample Number	091221001-002	**Sampling Date**	12/16/2009	**Date/Time Received**	12/18/2009 12:10 PM
Client Sample ID	LLV-1A 20M / 4112-2	**Sampling Time**		**Extraction Date**	12/21/2009
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
4,4-DDD	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
4,4-DDE	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
4,4-DDT	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Aldrin	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
alpha-BHC	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Aroclor 1016 (PCB-1016)	ND	ug/L	0.2	12/21/2009	SAT	EPA 608	
Aroclor 1221 (PCB-1221)	ND	ug/L	0.2	12/21/2009	SAT	EPA 608	
Aroclor 1232 (PCB-1232)	ND	ug/L	0.2	12/21/2009	SAT	EPA 608	
Aroclor 1242 (PCB-1242)	ND	ug/L	0.2	12/21/2009	SAT	EPA 608	
Aroclor 1248 (PCB-1248)	ND	ug/L	0.2	12/21/2009	SAT	EPA 608	
Aroclor 1254 (PCB-1254)	ND	ug/L	0.2	12/21/2009	SAT	EPA 608	
Aroclor 1260 (PCB-1260)	ND	ug/L	0.2	12/21/2009	SAT	EPA 608	
beta-BHC	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Chlordane	ND	ug/L	0.1	12/21/2009	SAT	EPA 608	
delta-BHC	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Dieldrin	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Endosulfan I	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Endosulfan II	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Endosulfan sulfate	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Endrin	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Endrin aldehyde	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Endrin ketone	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
gamma-BHC (Lindane)	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	

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Client:	SILVER STATE ANALYTICAL LABS	**Batch #:**	091221001
Address:	3638 E. SUNSET ROAD LAS VEGAS, NV 89120	**Project Name:**	LAB ID 4112
Attn:	RON WINTER		

Analytical Results Report

Sample Number	091221001-002	**Sampling Date**	12/16/2009	**Date/Time Received**	12/18/2009 12:10 PM
Client Sample ID	LLV-1A 20M / 4112-2	**Sampling Time**		**Extraction Date**	12/21/2009
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Heptachlor	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Heptachlor epoxide	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Methoxychlor	ND	ug/L	0.01	12/21/2009	SAT	EPA 608	
Toxaphene	ND	ug/L	0.1	12/21/2009	SAT	EPA 608	

Surrogate Data

Sample Number 091221001-002

Surrogate Standard	Method	Percent Recovery	Control Limits
DCB	EPA 608	95.0	30-130

Authorized Signature

John Coddington, Lab Manager

MCL EPA's Maximum Contaminant Level
ND Not Detected
PQL Practical Quantitation Limit

This report shall not be reproduced except in full, without the written approval of the laboratory.
The results reported relate only to the samples indicated.
Soil/solid results are reported on a dry-weight basis unless otherwise noted.

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Certifications held by Anatek Labs WA: EPA:WA00169; CA:Cert2632; ID:WA00169; WA:C1287

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Client:	SILVER STATE ANALYTICAL LABS	**Batch #:**	091221001
Address:	3638 E. SUNSET ROAD LAS VEGAS, NV 89120	**Project Name:**	LAB ID 4112
Attn:	RON WINTER		

Analytical Results Report

Sample Number	091221001-001	**Sampling Date**	12/16/2009	**Date/Time Received**	12/18/2009 12:10 PM
Client Sample ID	LLV1A 0M / 4112-1	**Sampling Time**		**Extraction Date**	12/21/2009
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
1,2,4-Trichlorobenzene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
1,2-Dichlorobenzene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
1,2-Diphenyl hydrazine	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
1,3-Dichlorobenzene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
1,4-Dichlorobenzene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
1-Methylnaphthalene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,3,4,6-Tetrachlorophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,3,5,6-Tetrachlorophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,4,5-Trichlorophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,4,6-Trichlorophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,4-Dichlorophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,4-Dimethylphenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,4-Dinitrophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,4-Dinitrotoluene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,6-Dinitrotoluene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2-Chloronaphthalene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2-Chlorophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2-Methylnaphthalene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2-Methylphenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2-Nitroaniline	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2-Nitrophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
3,3'-Dichlorobenzidine	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
3+4-Methylphenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
3-Nitroaniline	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
4,6-Dinitro-2-methylphenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
4-Bromophenyl-phenylether	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
4-Chloro-3-methylphenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
4-Chloroaniline	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
4-Chlorophenyl-phenylether	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
4-Nitroaniline	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
4-Nitrophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Acenaphthene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Acenaphthylene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Aniline	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87893; ID:ID00013; IN:C-ID-01; KY:90142; MT:CERT0026; NM: ID00013; OR:ID200001-002; WA:C1320
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Client: SILVER STATE ANALYTICAL LABS
Address: 3638 E. SUNSET ROAD
LAS VEGAS, NV 89120
Attn: RON WINTER

Batch #: 091221001
Project Name: LAB ID 4112

Analytical Results Report

Sample Number	091221001-001	**Sampling Date**	12/16/2009	**Date/Time Received**	12/18/2009 12:10 PM
Client Sample ID	LLV1A 0M / 4112-1	**Sampling Time**		**Extraction Date**	12/21/2009
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Anthracene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Benzidine	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Benzo(ghi)perylene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Benzo[a]anthracene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Benzo[a]pyrene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Benzo[b]fluoranthene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Benzo[k]fluoranthene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Benzyl alcohol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
bis(2-Chloroethoxy)methane	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
bis(2-Chloroethyl)ether	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
bis(2-chloroisopropyl)ether	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
bis(2-Ethylhexyl)phthalate	1.67	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Butylbenzylphthalate	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Carbazole	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Chrysene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Dibenz[a,h]anthracene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Dibenzofuran	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Diethylphthalate	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Dimethylphthalate	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Di-n-butylphthalate	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Di-n-octylphthalate	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Fluoranthene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Fluorene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Hexachlorobenzene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Hexachlorobutadiene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Hexachlorocyclopentadiene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Hexachloroethane	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Indeno[1,2,3-cd]pyrene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Isophorone	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Naphthalene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Nitrobenzene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Nitrosodimethylamine	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
n-Nitroso-di-n-propylamine	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
n-Nitrosodiphenylamine	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Pentachlorophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	

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Client:	SILVER STATE ANALYTICAL LABS	**Batch #:**	091221001
Address:	3638 E. SUNSET ROAD LAS VEGAS, NV 89120	**Project Name:**	LAB ID 4112
Attn:	RON WINTER		

Analytical Results Report

Sample Number	091221001-001	**Sampling Date**	12/16/2009	**Date/Time Received**	12/18/2009 12:10 PM
Client Sample ID	LLV1A 0M / 4112-1	**Sampling Time**		**Extraction Date**	12/21/2009
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Phenanthrene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Phenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Pyrene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Pyridine	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	

Surrogate Data

Sample Number 091221001-001

Surrogate Standard	Method	Percent Recovery	Control Limits
2,4,6-Tribromophenol	EPA 8270C	86.1	53-122
2-Fluorobiphenyl	EPA 8270C	64.7	12-116
2-Fluorophenol	EPA 8270C	75.7	10-139
Nitrobenzene-d5	EPA 8270C	73.2	68-118
Phenol-d5	EPA 8270C	80.5	28-154
Terphenyl-d14	EPA 8270C	91.8	52-144

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Client:	SILVER STATE ANALYTICAL LABS	**Batch #:**	091221001
Address:	3638 E. SUNSET ROAD LAS VEGAS, NV 89120	**Project Name:**	LAB ID 4112
Attn:	RON WINTER		

Analytical Results Report

Sample Number	091221001-002	**Sampling Date**	12/16/2009	**Date/Time Received**	12/18/2009 12:10 PM
Client Sample ID	LLV-1A 20M / 4112-2	**Sampling Time**		**Extraction Date**	12/21/2009
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
1,2,4-Trichlorobenzene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
1,2-Dichlorobenzene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
1,2-Diphenyl hydrazine	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
1,3-Dichlorobenzene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
1,4-Dichlorobenzene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
1-Methylnaphthalene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,3,4,6-Tetrachlorophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,3,5,6-Tetrachlorophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,4,5-Trichlorophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,4,6-Trichlorophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,4-Dichlorophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,4-Dimethylphenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,4-Dinitrophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,4-Dinitrotoluene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2,6-Dinitrotoluene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2-Chloronaphthalene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2-Chlorophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2-Methylnaphthalene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2-Methylphenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2-Nitroaniline	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
2-Nitrophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
3,3'-Dichlorobenzidine	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
3+4-Methylphenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
3-Nitroaniline	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
4,6-Dinitro-2-methylphenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
4-Bromophenyl-phenylether	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
4-Chloro-3-methylphenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
4-Chloroaniline	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
4-Chlorophenyl-phenylether	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
4-Nitroaniline	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
4-Nitrophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Acenaphthene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Acenaphthylene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Aniline	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Anthracene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	

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Client: SILVER STATE ANALYTICAL LABS
Address: 3638 E. SUNSET ROAD
LAS VEGAS, NV 89120
Attn: RON WINTER

Batch #: 091221001
Project Name: LAB ID 4112

Analytical Results Report

Sample Number	091221001-002	**Sampling Date**	12/16/2009	**Date/Time Received**	12/18/2009 12:10 PM
Client Sample ID	LLV-1A 20M / 4112-2	**Sampling Time**		**Extraction Date**	12/21/2009
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Benzidine	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Benzo(ghi)perylene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Benzo[a]anthracene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Benzo[a]pyrene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Benzo[b]fluoranthene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Benzo[k]fluoranthene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Benzyl alcohol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
bis(2-Chloroethoxy)methane	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
bis(2-Chloroethyl)ether	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
bis(2-chloroisopropyl)ether	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
bis(2-Ethylhexyl)phthalate	2.99	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Butylbenzylphthalate	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Carbazole	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Chrysene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Dibenz[a,h]anthracene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Dibenzofuran	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Diethylphthalate	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Dimethylphthalate	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Di-n-butylphthalate	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Di-n-octylphthalate	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Fluoranthene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Fluorene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Hexachlorobenzene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Hexachlorobutadiene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Hexachlorocyclopentadiene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Hexachloroethane	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Indeno[1,2,3-cd]pyrene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Isophorone	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Naphthalene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Nitrobenzene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Nitrosodimethylamine	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
n-Nitroso-di-n-propylamine	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
n-Nitrosodiphenylamine	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Pentachlorophenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Phenanthrene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	

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Client:	SILVER STATE ANALYTICAL LABS	**Batch #:**	091221001
Address:	3638 E. SUNSET ROAD LAS VEGAS, NV 89120	**Project Name:**	LAB ID 4112
Attn:	RON WINTER		

Analytical Results Report

Sample Number	091221001-002	**Sampling Date**	12/16/2009	**Date/Time Received**	12/18/2009 12:10 PM
Client Sample ID	LLV-1A 20M / 4112-2	**Sampling Time**		**Extraction Date**	12/21/2009
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Phenol	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Pyrene	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	
Pyridine	ND	ug/L	0.5	12/30/2009	EMP	EPA 8270C	

Surrogate Data

Sample Number 091221001-002

Surrogate Standard	Method	Percent Recovery	Control Limits
2,4,6-Tribromophenol	EPA 8270C	87.1	53-122
2-Fluorobiphenyl	EPA 8270C	69.1	12-116
2-Fluorophenol	EPA 8270C	75.1	10-139
Nitrobenzene-d5	EPA 8270C	74.2	68-118
Phenol-d5	EPA 8270C	79.8	28-154
Terphenyl-d14	EPA 8270C	89.4	52-144

Authorized Signature

John Coddington, Lab Manager

MCL EPA's Maximum Contaminant Level
ND Not Detected
PQL Practical Quantitation Limit

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Soil/solid results are reported on a dry-weight basis unless otherwise noted.

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Client:	SILVER STATE ANALYTICAL LABS	**Batch #:**	091221001
Address:	3638 E. SUNSET ROAD LAS VEGAS, NV 89120	**Project Name:**	LAB ID 4112
Attn:	RON WINTER		

Analytical Results Report

Sample Number	091221001-001	**Sampling Date**	12/16/2009	**Date/Time Received**	12/18/2009 12:10 PM
Client Sample ID	LLV1A 0M / 4112-1	**Sampling Time**		**Extraction Date**	12/21/2009
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
2,4,5-T	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
2,4,5-TP (Silvex)	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
2,4-D	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
2,4-DB	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Chloramben	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Dacthal	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Dalapon	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Dicamba	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Dichloroprop	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Dinoseb	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Pentachlorophenol	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Picloram	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	

Surrogate Data

Sample Number 091221001-001

Surrogate Standard	Method	Percent Recovery	Control Limits
3,5-Dichlorobenzoic Acid	EPA 8151A	95.0	35-145

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Client:	SILVER STATE ANALYTICAL LABS	**Batch #:**	091221001
Address:	3638 E. SUNSET ROAD LAS VEGAS, NV 89120	**Project Name:**	LAB ID 4112
Attn:	RON WINTER		

Analytical Results Report

Sample Number	091221001-002	**Sampling Date**	12/16/2009	**Date/Time Received**	12/18/2009 12:10 PM
Client Sample ID	LLV-1A 20M / 4112-2	**Sampling Time**		**Extraction Date**	12/21/2009
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
2,4,5-T	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
2,4,5-TP (Silvex)	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
2,4-D	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
2,4-DB	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Chloramben	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Dacthal	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Dalapon	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Dicamba	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Dichloroprop	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Dinoseb	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Pentachlorophenol	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	
Picloram	ND	ug/L	0.1	12/22/2009	SAT	EPA 8151A	

Surrogate Data

Sample Number 091221001-002

Surrogate Standard	Method	Percent Recovery	Control Limits
3,5-Dichlorobenzoic Acid	EPA 8151A	101.5	35-145

Authorized Signature

John Coddington, Lab Manager

MCL EPA's Maximum Contaminant Level
ND Not Detected
PQL Practical Quantitation Limit

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