2004 LAKE LAS VEGAS WATER QUALITY MONITORING REPORT

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NEVADA DIVISION OF ENVRIONMENTAL PROTECTION
(N.D.E.P.)
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I. INTRODUCTION

A. Project History

J. Carlton Adair, then President of the Port Holiday Authority conceived the idea of Lake Las Vegas in 1964. The 2243-acre development project was known as Port Holiday, and the lake was called "Lake Adair." Project land was acquired from the federal government under a land exchange act (PL88-639) authorized by Congress on October 8, 1964. Approximately 170 acres of privately owned land in the Lake Mead National Recreation Area (LMNRA) was exchanged for 2,243 acres in Las Vegas Wash (LVW). That property was located along the western border of the LMNRA in the LVW (Figure 1).

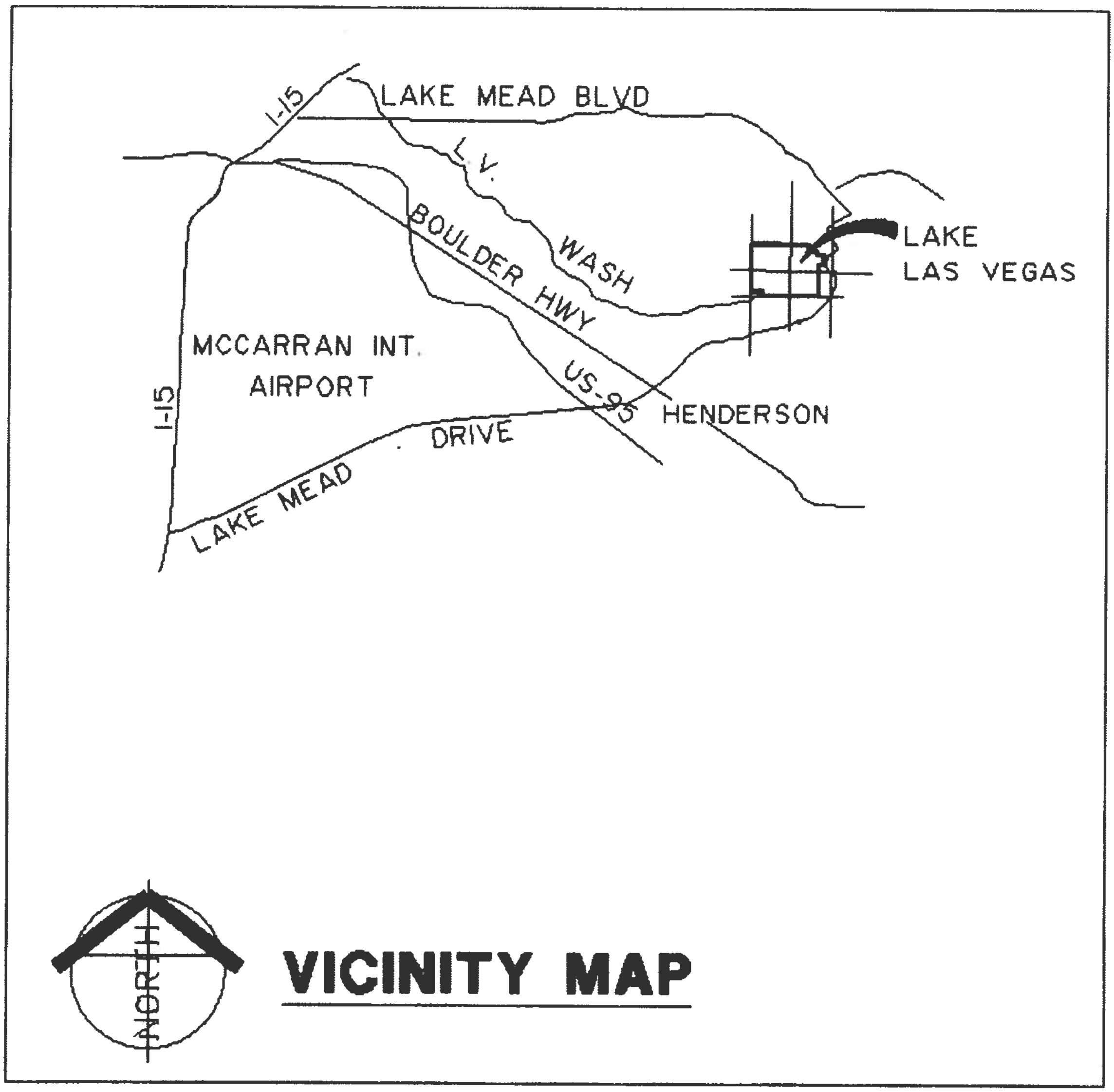
Carlton Adair halted the project in 1971, though a considerable amount of engineering and feasibility work had been done. The project remained idle until 1982 when it was reinitiated as the Lake at Las Vegas Project by Barry Silverton and the Pacific Malibu Development Corporation of Los Angeles, CA. Pacific Malibu and its prime consultant J. M. Montgomery (JMM) Consulting Engineers conducted extensive engineering and environmental studies during 1984-1987. Transcontinental Corporation of Santa Barbara, California, acquired controlling interest in the project in 1988. Transcontinental Corporation and its consultants completed the engineering and environmental studies and obtained the necessary local, state, and federal permits required to start construction of the project. Construction began on April 1, 1989. The project is now called "Lake Las Vegas Resort."

B. Project Description

The focal point of the project is a 320-acre recreational lake that is developed behind a 4800-ft., S-shaped earthen dam, 1500 ft. upstream of North Shore Road. The 190-ft. high dam was constructed with 3.0 million cubic yards of locally available materials. Lake elevation is maintained between 1401.85 ft. and 1404.85 ft. (NAVD 88). At an elevation of 1404.85 ft., the Lake has a storage capacity of approximately 10,000 acre feet, comprises 320 surface acres, a two mile length, a one mile width, and 12.3 miles of shoreline. Lake fill water is drawn from Lake Mead, and conveyed by the Basic Management Incorporated Pipeline (BMI). Approximately 7,000 – 9,000 acre-feet are required annually for project irrigation, seepage, evaporative losses from the lake.

Las Vegas Wash flows are by-passed under the lake through two 84-inch diameter reinforced concrete pipelines. The bypass system is 9,450 ft. in length and designed to pass Las Vegas Wash (LVW) flows up to approximately 1,200 cubic feet per second (cfs). Flows currently average about 252 cubic feet per second in LVW in 2004.

Figure 1. **Location and description of Lake Las Vegas Resort (Las Vegas Review Journal map by Jim Day July 28, 1999)**



II. METHODS

The revised Clark County 208 Water Management Plan was approved by the Clark County Board of County Commissioners on April 5, 1988 and certified by the State of Nevada on August 8, 1988. This plan required a water quality-monitoring program be developed for Lake Las Vegas Resort. The monitoring was required to insure that construction activities and operations of the reservoir did not violate the Las Vegas Wash water quality standards. The water quality-monitoring program was initiated in June 1991, and Lake Las Vegas has submitted annual reports to Nevada Division of Environmental Protection for review.

A. Lake Las Vegas Monitoring Sites

Since 1991, water quality monitoring was conducted on Lake Las Vegas monthly in January, February, November, and December, biweekly during March and October, and weekly during April through September.

Water quality monitoring was conducted at sites shown in Figure 2, at fixed points along the historical center channel in the deepest part of the Lake.

Figure 2. **Location of water quality monitoring stations at Lake Las Vegas.**

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 a YSI Water Quality Analyzer (Table 1). Transparency was measured at each lake site with a Secchi disc. Duplicate measurements were made on approximately 10% of the measurements.

Table 1. **2003 Lake Las Vegas physical, chemical and biological analyses.**

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)	Surface	"	"
Turbidity (NTU)	0 - 2.5 m Int.	"	EPA 180.1
Chemical			
Total Nitrogen (µg/l)	0 - 2.5 m Int.	"	APHA (1995)
Ammonia-N (µg/l)	"	"	EPA 350.2
Total Kjeldehl Nitrogen	"	"	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	"	"	EPA 375.4
BOD 5	"	"	EPA 405.1
Biological			
Chlorophyll-a (µg/l)	"	"	Janik
Phytoplankton Counts (ng/m3)	"	"	"
Zooplankton Counts (No./l)	0 - 15 m Tow	"	"
Fecal Coliform (MPN/100ml)	"	"	"

C. Chemical and Biological Analysis

Depth integrated water samples were collected from 0 - 2.5 m at main-lake sampling sites (Figure 2). Additional depth samples were also collected quarterly at 5 m, 10 m, and 20 m at site LLV-1A with a Van Dorn sampler. Samples requiring filtration were filtered through 0.45 µm millipore filters.

Analyses were run on field duplicates at a frequency of approximately 10% of the samples. A State of Nevada certified laboratory ran 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 2004 for analysis of toxic substances.

Monthly Zooplankton samples were collected at LLV-1 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-1. Phytoplankton samples were identified to the level of species when possible.

Phytoplankton

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

<u>Counting Procedure:</u>
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) than spans three orders of magnitude from 1-2 µm to 1000 µm or more for filamentous taxa.

<u>Sample Sedimentation:</u>
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 of algal density.

<u>Biovolumes:</u>
Cell volumes are calculated based on the measurements of at least 20 individuals of each species and the geometrical formulae which most closely approximates 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 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 chambers 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.

D. Statistical Analysis

Statistical analysis was performed using Jandels Sigma Stat Analytical software. All data sets were tested for normality and heterogeneity. Data sets were analyzed using appropriate non-parametric statistical tests for non-normal distributed data. Statistical significance was defined at an alpha of < 0.05 unless otherwise noted.

E. Water Quality Guidelines

The water quality guidelines presented in table 2 are patterned after standards established for Lake Mead (NAC 445.1351). These guidelines were established and adapted as part of the Clark County 208 Amendment to protect and 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
5) Propagation of aquatic life, including a warm water fishery

Table 2. **Water quality guidelines for Lake Las Vegas**

1. The lake waters should be free of:
    a. Visible floating, suspended, or settleable 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 5mg/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.

III. WATER QUALITY RESULTS

A. Lake Water Surface Elevation

Water for Lake Las Vegas is pumped from the hypolimnion of Lake Mead through the Basic Management Incorporated (BMI) pipelines. Lake Las Vegas; Lake Mead inflows totaled eight hundred ninety eight (898) acre-feet during 2004 (Figure 3). Two thousand seventy eight (2,078) acre-feet of lake water were lost to seepage/evaporation.

In 2004, approximately thirteen thousand five hundred (13,500) acre-feet of storm water discharged into the lake. Additionally, Lake Las Vegas released approximately eleven thousand five hundred forty (11,540) acre-feet through the dam's appurtenance, back to the Las Vegas Wash.

There was a two-foot drop in lake elevation in 2004. Elevations are now referenced to the NAVD88.

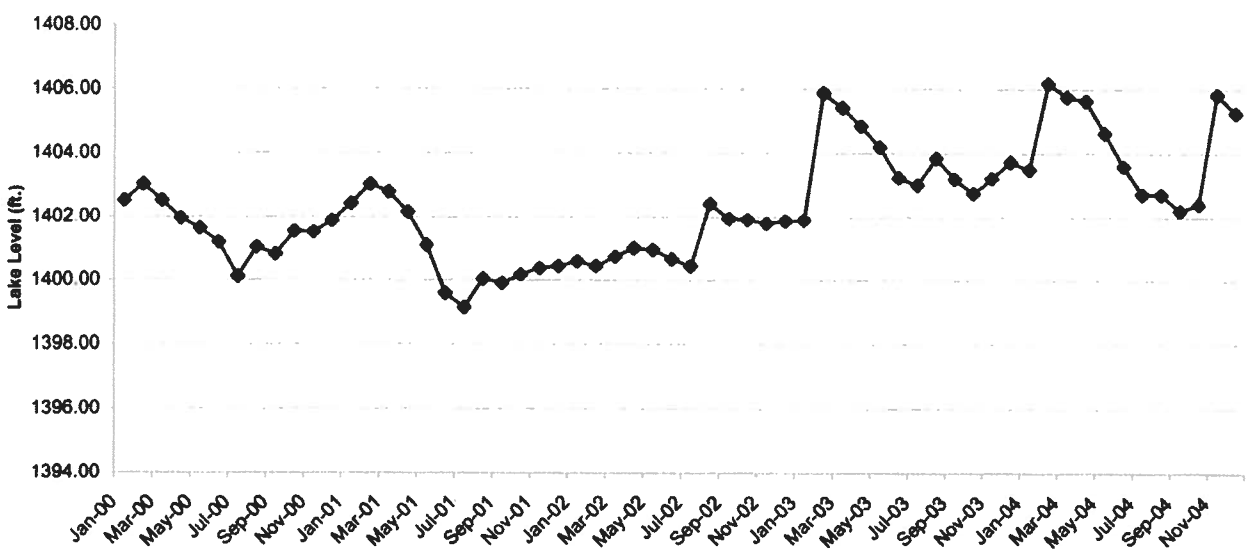


Figure 3. **2000-2004 Lake Las Vegas Surface elevations.**

B. Physical Analysis

Temperature

Surface temperatures in Lake Las Vegas ranged from 8.9°C to 29.2°C during 2004, with the lowest temperatures found in January and the highest in July (Figure 4). The Lake was uniformly mixed top to bottom during December, but reflected various stages of thermal stratification during the remaining quarters through early spring. By March, the Lake began to stratify with the thermocline developing between ten to fourteen meters (Table 3). The Lake remained stratified during the summer and early fall months.

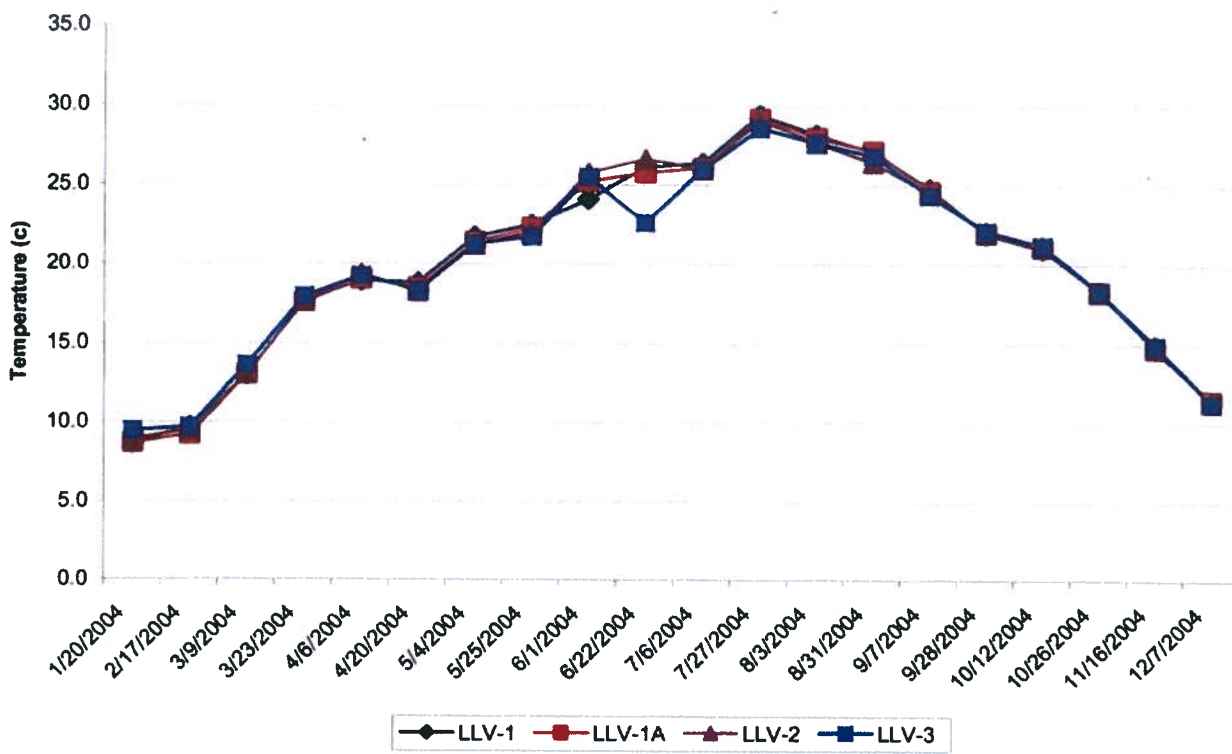


Figure 4. **Surface temperature measurements at Lake Las Vegas monitoring stations LLV-1, LLV-1A, LLV-2, LLV-3 in 2004.**

Depth (m)	3/23/2004	6/22/2004	9/21/2004	12/7/2004
0	17.6	25.8	22.5	11.5
2	17.3	25.4	22.5	11.4
4	16.6	25.2	22.5	11.4
6	15.7	24.6	22.5	11.4
8	12.9	22.2	22.4	11.3
10	10.3	18.9	22.5	11.3
12	9.9	15.1	21.2	11.3
14	9.7	12.3	14.6	11.3
16	9.6	11.6	12.5	11.3
18	9.6	11.6	12.1	11.3
20	9.6	11.6	11.8	11.4
22	9.6	11.6	11.7	11.5

Table 3. **Lake Las Vegas temperature profiles at Lake monitoring station LLV-1A during March, June, September, and December 2004.**

Dissolved Oxygen

Dissolved oxygen concentrations at the lake surface had considerable variations between the sites throughout the year (Figure 5). Concentration ranged from approximately 10.3 to 10.8 ppm. Concentrations at depth exhibited the common dissolved oxygen trends found within dimictic lakes that stratify (Table 4).

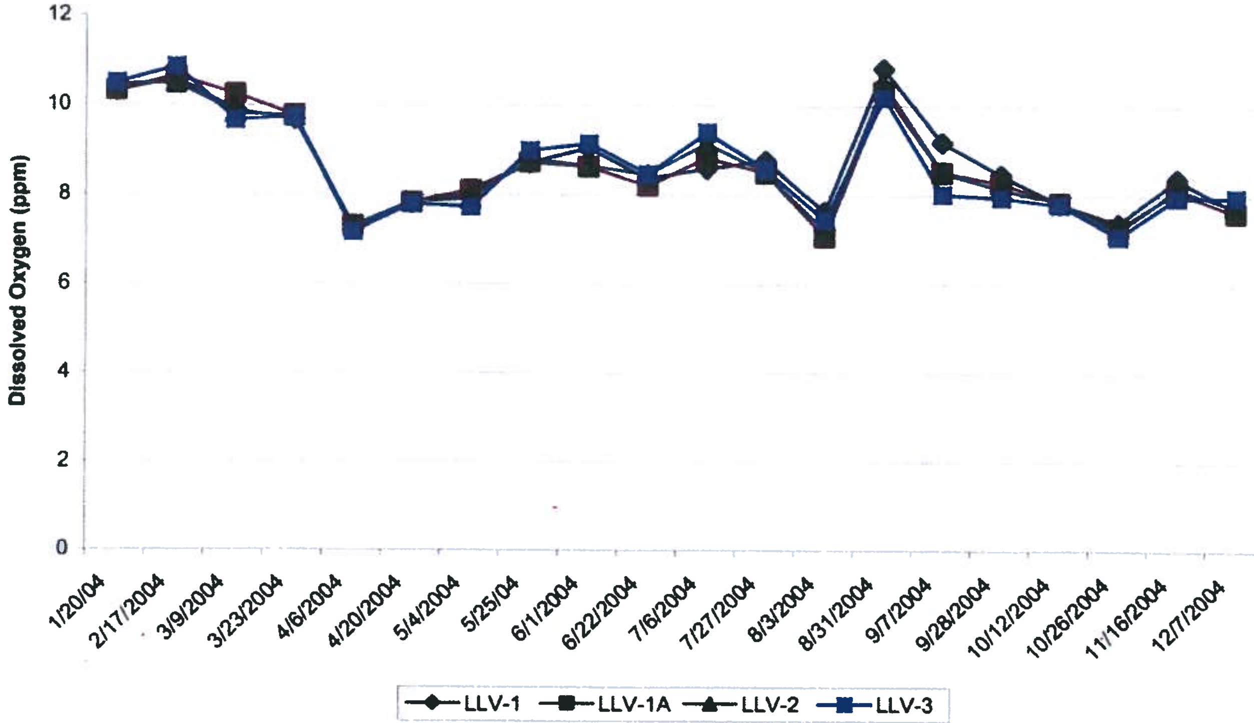


Figure 5. **Lake Las Vegas dissolved oxygen in surface waters at Lake monitoring stations during January – December 2004.**

The Lake remained relatively well mixed during the late fall through late spring. During the period of stratification, dissolved oxygen concentrations, below the thermocline, were less than 5.0 ppm (Table 4).

Depth (m)	3/23/2004	6/22/2004	9/21/2004	12/7/2004
0	10.0	8.0	7.0	8.0
2	10.0	8.0	7.0	8.0
4	10.0	8.0	7.0	8.0
6	10.0	8.0	7.0	8.0
8	10.0	6.0	7.0	8.0
10	9.0	3.0	7.0	8.0
12	8.0	1.0	4.0	7.0
14	8.0	0.0	0.0	7.0
16	8.0	0.0	0.0	7.0
18	8.0	1.0	0.0	7.0
20	8.0	1.0	0.0	7.0
22	8.0	1.0	0.0	4.0

Table 4. **Lake Las Vegas dissolved oxygen profiles at station LLV-1A during March, June, September, and December 2004.**

pH

There were some seasonal variation in pH of surface waters in Lake Las Vegas during 2004 (Figure 6). Surface water pH values varied slightly between the four Lake sites ranging between 7.6 and 9.4 in 2004 (Figure 6). Minor variability's 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 vales decreased as bicarbonate concentrations declined with the onset of anaerobic conditions (Table 5).

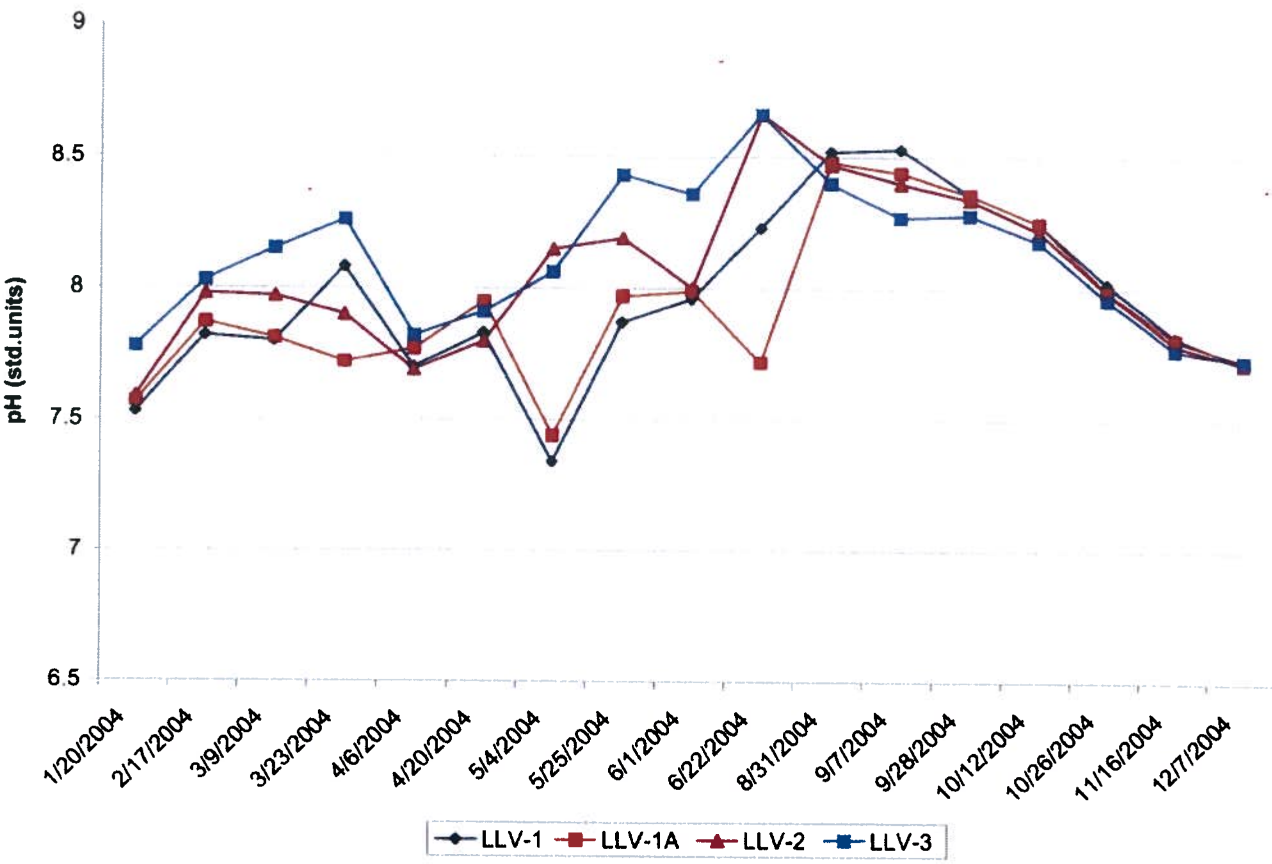


Figure 6. **Lake Las Vegas pH in surface water at the main-lake monitoring stations during January – December 2004.**

Depth (m)	3/23/2004	6/22/2004	9/21/2004	12/7/2004
0	8	8	8	8
2	8	8	8	8
4	8	8	8	8
6	8	8	8	8

Depth (m)	3/23/2004	6/22/2004	9/21/2004	12/7/2004
8	8	8	8	8
10	8	8	8	8
12	8	9	7	8
14	8	10	7	8
16	8	10	7	8
18	8	10	7	8
20	8	10	7	8
22	8	10	7	8

Table 5. **Lake Las Vegas pH profiles at station LLV-1A during March, June, September and December 2004.**

Conductance

Lake water conductivity ranged between roughly 3160 µmho/cm 3702 µmho/cm at the surface during 2004 (Figure 7). Conductivity did not vary significantly between the four lake sites. Conductivity did not vary greatly with depth.

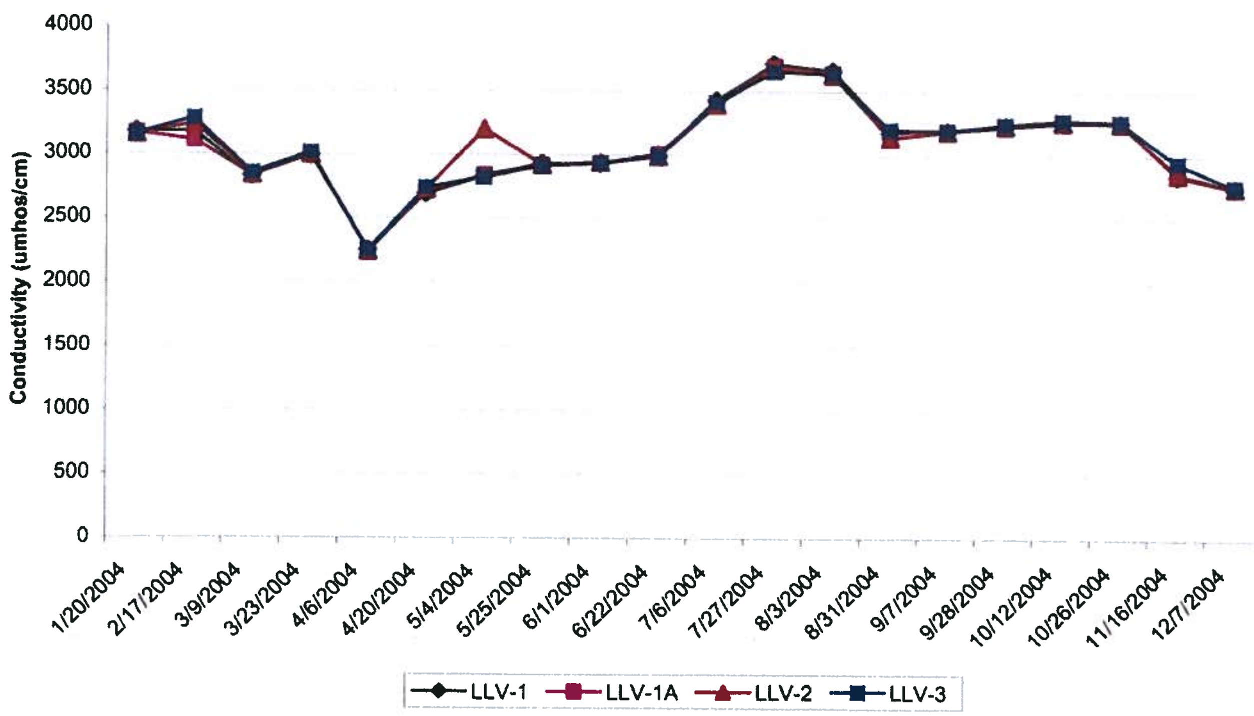


Figure 7. **Lake Las Vegas conductance in surface waters at main-lake stations during January – December 2004.**

Depth (m)	3/23/2004	6/22/2004	9/21/2004	12/7/2004
0	3000	3010	3209	2761
2	2990	3000	3208	2759
4	2980	3010	3210	2759
6	2970	3030	3206	2760
8	3180	3010	3210	2760
10	3170	3050	3210	2760
12	3140	3180	3210	2761
14	3150	3260	3216	2761
16	3190	3210	3240	2761
18	3260	3230	3247	2763
20	3260	3220	3268	2763
22	3290	3220	3258	2791

Table 6. **Lake Las Vegas conductance profiles at station LLV-1A during March, June, September, and December 2004.**

Transparency

There was considerable seasonal and spatial variability in Lake transparency values during 2004 with values ranging between 1.25 and 7.75 meters of lake depth. With the great quantity of storm water discharge into the lake in 2004, transparency was high during the spring and fall and lower during the summer months. (Figure 8).

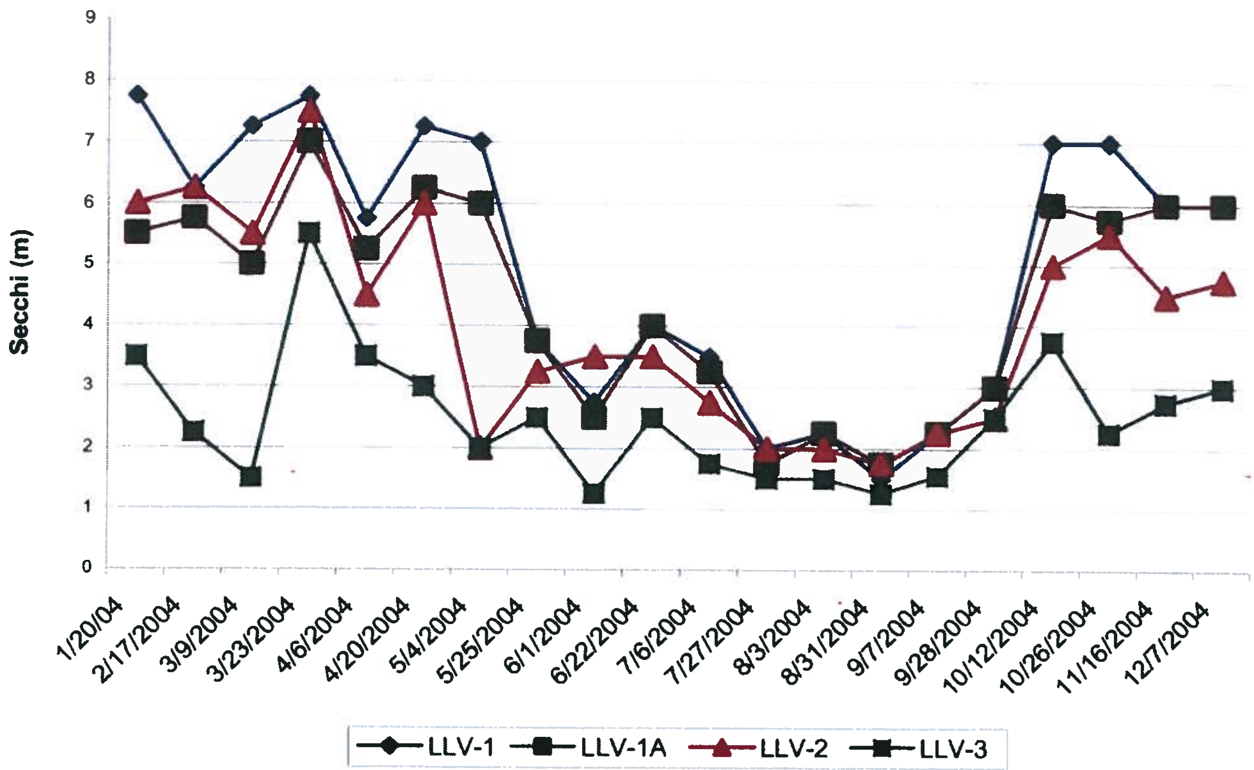


Figure 8. **Lake Las Vegas transparency measurements in surface water at Lake monitoring station during 2004.**

Turbidity

Monthly Turbidity values did not vary between the four sites with concentrations varying between 1.0 and 2 ppm at the surface (0-2.5m). There was no significant difference in turbidity concentrations between depths at site LLV-1A in 2004 ($p>0.05$) (Table 7).

***Table 7.* 2004 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 (m)	BOD5 (ppm)	TDS (ppm)	TSS (ppm)	TURB (ppm)	Chl-a (ppb)	Ortho Phos (ppb)	Total Phos (ppb)	Nitrite + Nitrate (ppb)	Ammon. (ppb)	TKN (ppb)	Total Nitro (ppb)	Ca (ppm)	Cl (ppm)	HCO3 (ppm)	SO4 (ppm)	Na (ppm)	K (ppm)	Mg (ppm)
3/23/04	0	2	2462	5	1	1	5	9	1820	130	970	2790	306	370	92	1270	302	37	99
3/23/04	5	2	2470	2	1	2	5	12	1770	130	1070	2840	286	370	92	1320	277	33	92
3/23/04	10	2	2758	4	1	1	5	14	1510	180	890	2400	312	440	96	1436	309	37	101
3/23/04	20	2	2770	4	1	1	5	23	1430	150	780	2210	325	410	92	1463	317	39	106
6/22/04	0	2	2516	3	1	4	5	8	2228	50	870	3098	348	384	80	1292	212	43	105
6/22/04	5	2	2516	3	1	3	5	8	2259	50	1010	3269	313	380	80	1297	190	36	94
6/22/04	10	3	2538	4	1	1	5	8	2139	120	870	3009	348	400	116	1329	206	41	103
6/22/04	20	2	2796	10	1	1	19	25	1755	80	700	2455	422	430	116	1443	258	51	123
9/21/04	0	4	2700	2	1	20	5	14	1320	80	860	2180	325	440	80	1349	294	40	99
9/21/04	5	4	2750	5	1	22	5	14	1329	50	1110	2439	316	419	88	1356	285	39	95
9/21/04	10	5	2758	4	1	59	5	12	1219	110	700	1919	338	400	88	1364	324	41	100
9/21/04	20	6	2312	4	2	11	35	72	1045	470	970	2015	379	440	140	1191	322	40	105
12/7/04	0	3	2292	2	1	1	19	39	1864	180	750	2614	262	400	88	1183	297	49	68
12/7/04	5	2	1866	2	1	1	20	45	1866	160	940	2806	283	325	88	1190	301	52	72
12/7/04	10	2	2045	2	1	1	22	39	2045	150	760	2805	279	350	92	1196	295	51	71
12/7/04	20	2	2268	1	1	1	22	42	1946	150	850	2796	284	350	88	1202	294	51	72

C. Chemical Analysis

Total Suspended Solids

Monthly total suspended solids concentrations varied between 1.0 and 11.0 ppm with no significant differences between the sites. ($p>0.05$). The highest concentrations occurred post November storm. (Figure 9).

There were no significant differences in total suspended solids concentrations between depths at site LLV-1A in 2004 ($p>0.05$) (Table 7).

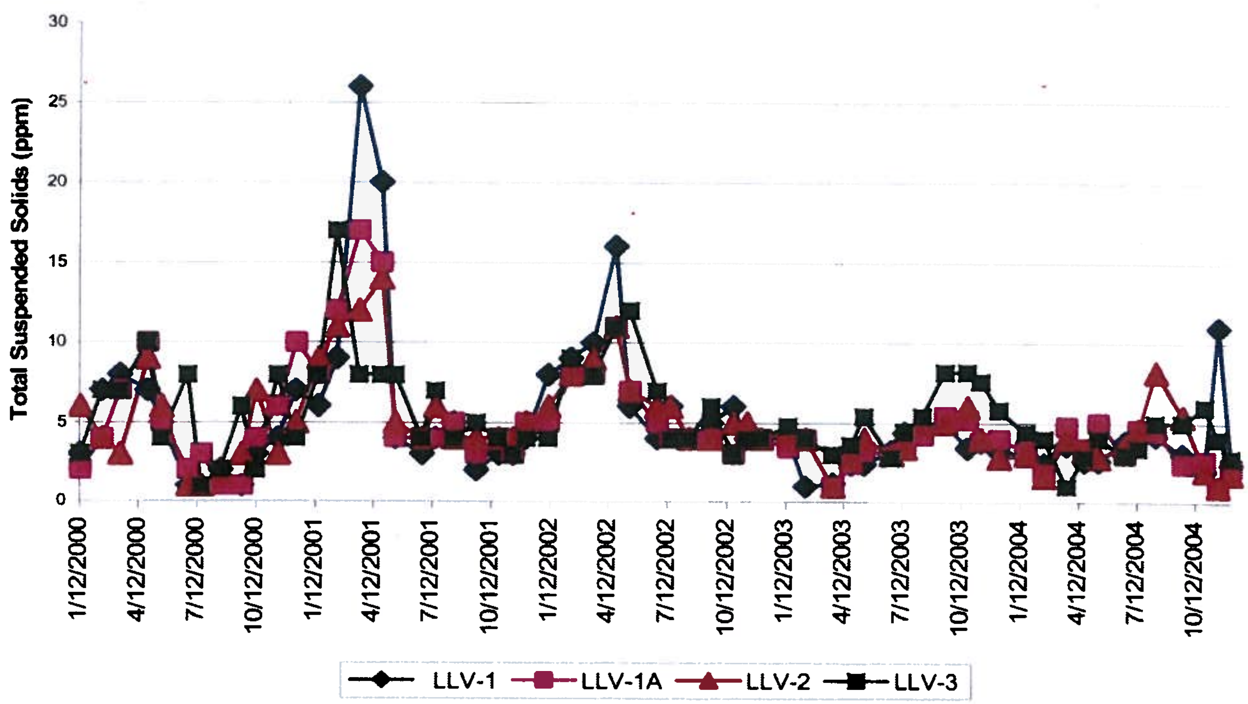


Figure 9. **Lake Las Vegas total suspended solids concentrations in surface waters at monitoring stations during 2000-2004.**

Total Dissolved Solids

There was no significant difference in monthly total dissolved solids (TDS) concentrations between the four Lake sites ($p>0.05$) (Figure 10). Monthly concentrations ranged between 2034 and 2792 ppm at the surface (0-2.5m). There was no significant difference in total dissolved solids concentrations between depths at site LLV-1A in 2004 ($p>0.05$) (Table 7)

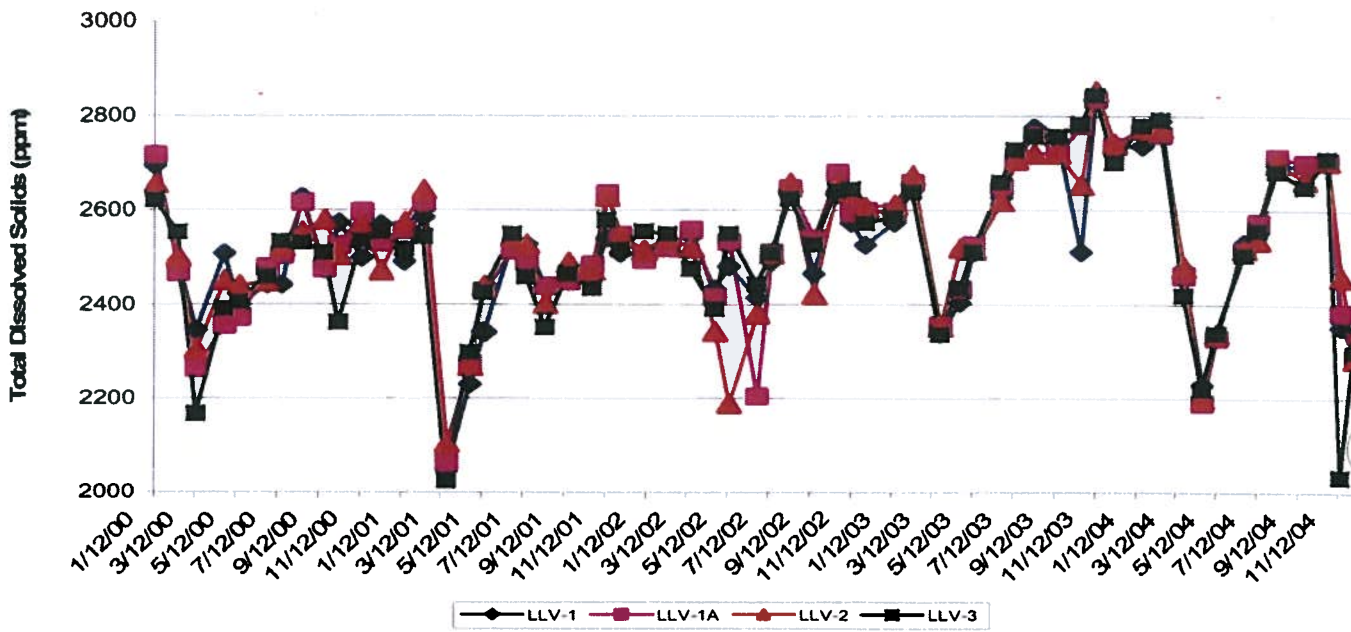


Figure 10. **Lake Las Vegas total dissolved solids concentrations at Lake monitoring station during 2000-2004.**

Major Ion Concentrations

Quarterly depth samples did not vary significantly at site LLV-1A for the ions of calcium, sodium, chloride, potassium, sulfate and magnesium ($p>0.05$) (Table 7). Calcium, Choride, Bicarbonate, Sodium, Potassium, and Magnesium concentrations did not vary with depth or time.

Total Phosphorus

Monthly concentrations ranged between 6 and 53 ppb at the surface (0-2.5m). This is compared to 5 and 80 ppb last year. In 2004 there was no significant difference between the sites ($p>0.005$) (Figure 11). Monthly total phosphorus concentrations varied slightly between depths at site LLV-1A, but were not significantly different ($p>0.05$) (Table 7). Storm events during 2004 caused short term elevations in total phosphorus concentrations and corresponding increases in chlorophyll "a" production. (Figure 11)

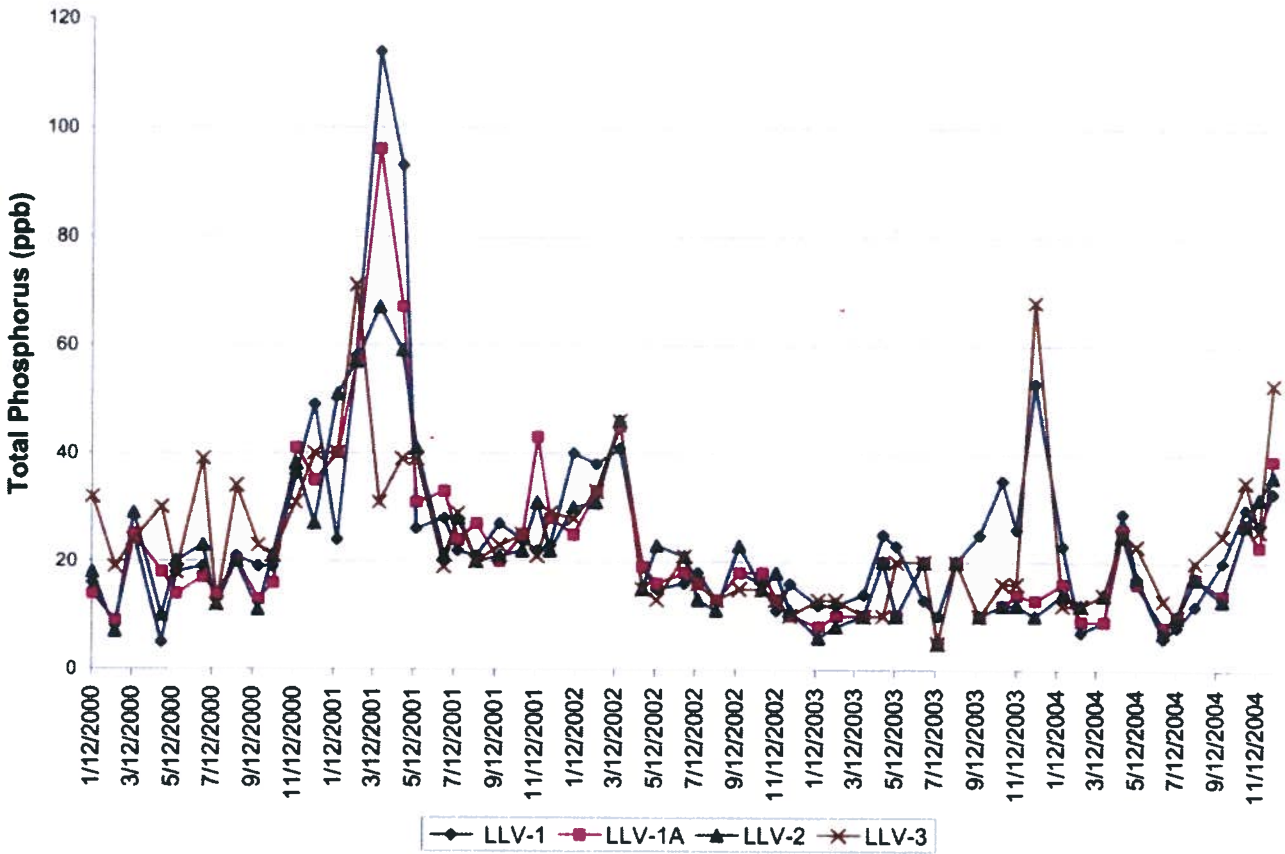


Figure 11. **Lake Las Vegas total phosphorus concentrations in surface waters at Lake monitoring sites during 2000-2004.**

Ortho-Phosphorus

Monthly Ortho-phosphorus concentrations did not vary significantly between sites and ranged between 5 and 23 ppb ($p>0.05$) (Figure 12). Monthly ortho-phosphorus concentrations did not show a significant difference between depths. ($p>0.05$) (Table 7). Seasonal peaks represent nutrient contributions from storm events.

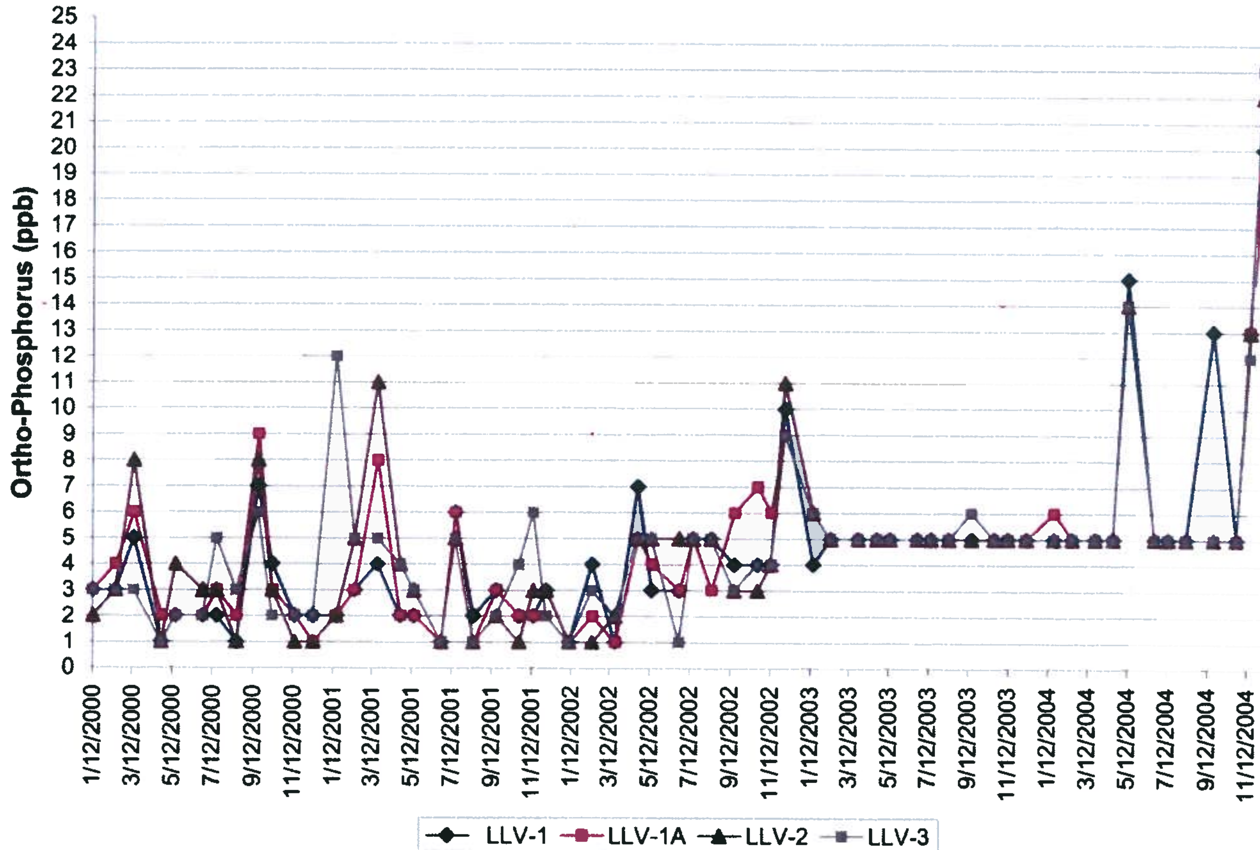


Figure 12. **Lake Las Vegas ortho-phosphorus concentrations in surface waters at Lake monitoring stations during 2000-2004.**

(Nitrite + Nitrate) – Nitrogen

Monthly nitrite plus nitrate surface water concentrations ranged between 459 and 2370 ppb at the four Lake sites in 2004 with no significant difference ($p>0.05$) (Figure 13). A large decrease in nitrogen plus nitrate was observed during the summer months. At this time a reasonable explanation is not available for this observance. Monthly nitrite plus nitrate concentrations were not significantly different by site or depth ($p>0.05$) (Table 7).

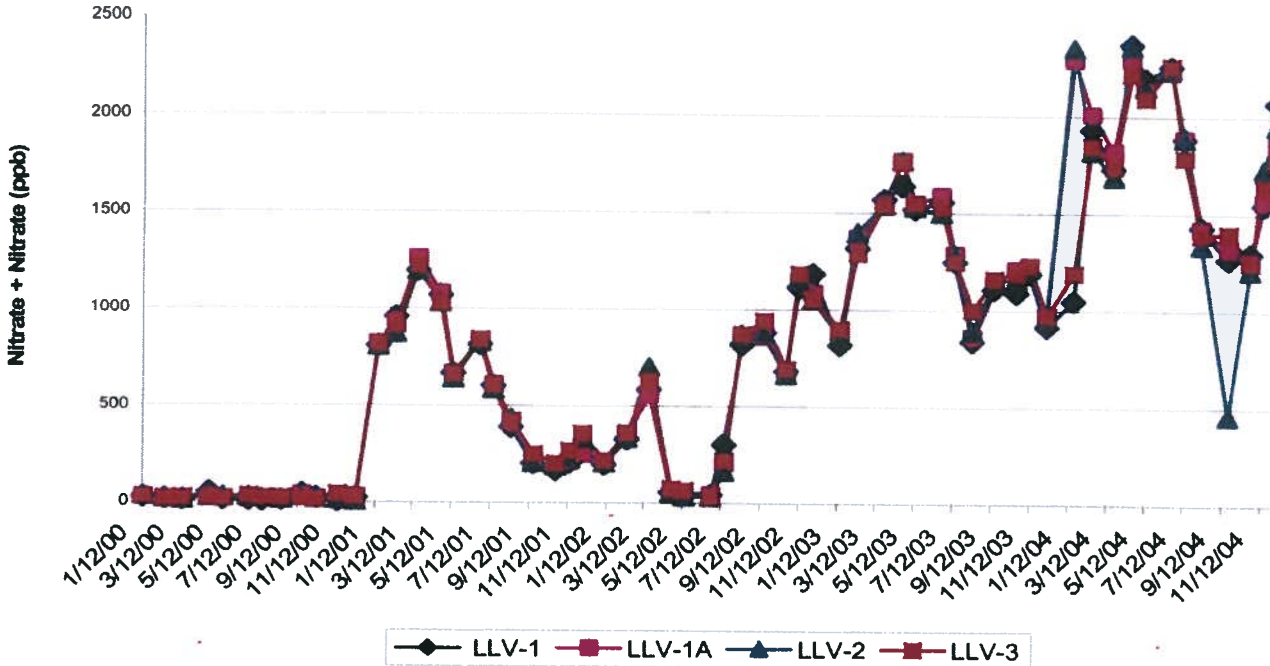


Figure 13. **Lake Las Vegas nitrite + nitrate concentrations in surface waters at Lake monitoring stations during 2000-2004.**

Ammonia - Nitrogen

Monthly ammonia surface water concentrations ranged between 50 to 310 ppb during 2004, with no significant difference between the four Lake sites ($p>0.05$) (Figure 14). Variability in concentrations between depths was not found significant for ammonia during 2004 at site LLV-1A ($p>0.05$) (Table 7).

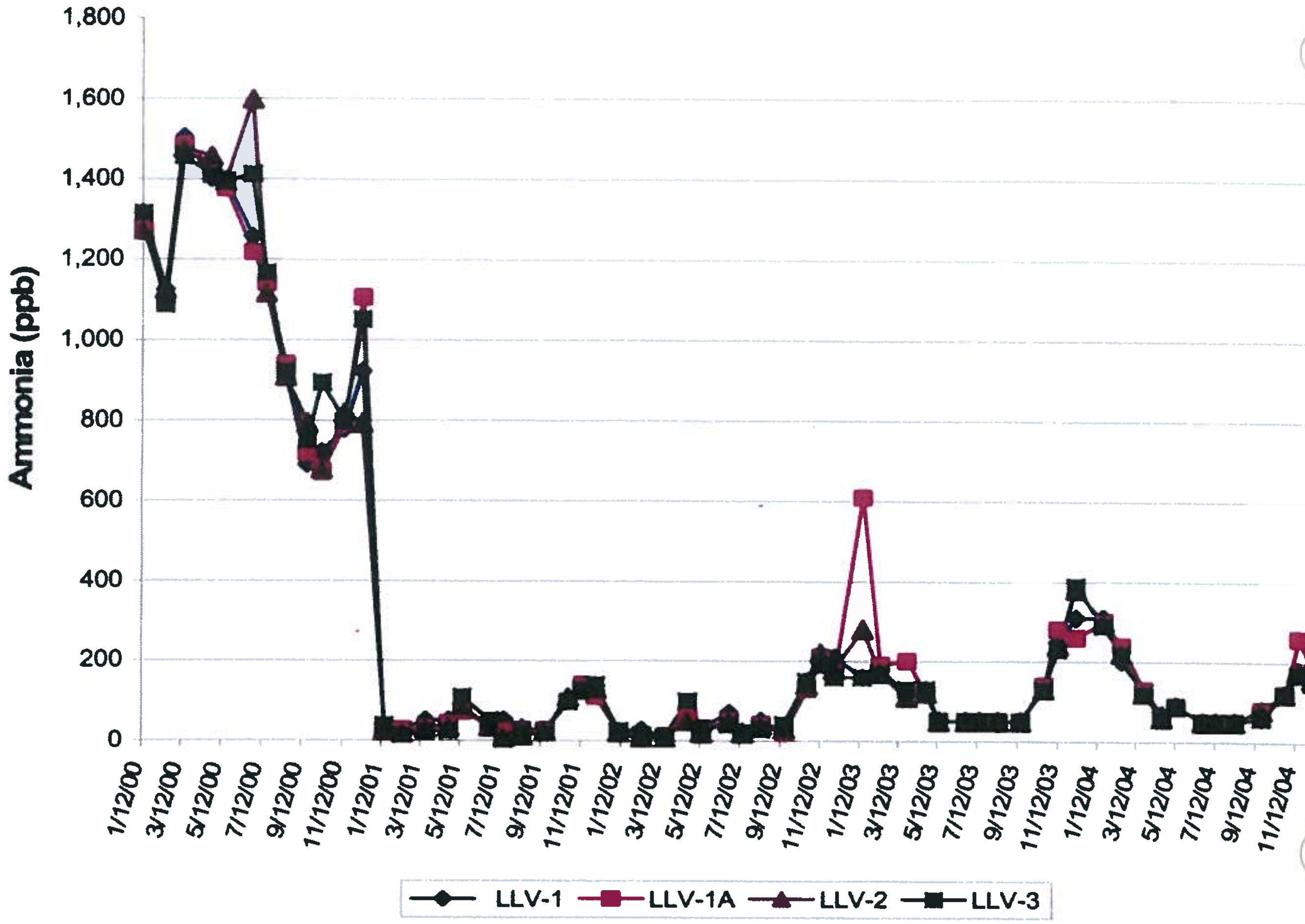


Figure 14. **Lake Las Vegas ammonia-N concentrations in surface waters at Lake monitoring stations during 2000-2004.**

Total Nitrogen

Monthly total nitrogen concentrations ranged between 1249 and 3170 ppb and were not significantly different between sites ($p>0.05$) (Figure 15). No significant difference was found between depths at site LLV-1A during 2004 ($p>0.05$) (Table 7).

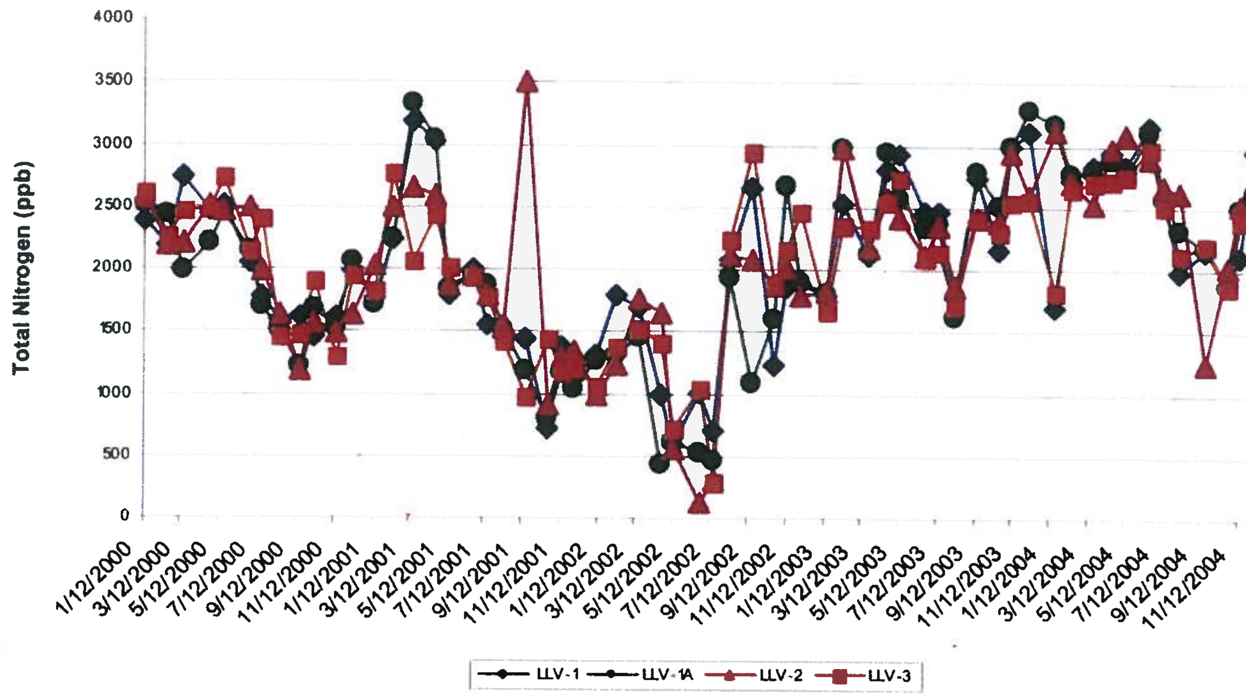


Figure 15. **Lake Las Vegas Total Nitrogen concentrations in surface waters at Lake monitoring stations during 2000-2004.**

D. Biological Analysis

Zooplankton Species Composition and Abundance

Numerous species of zooplankton have been identified in 0 – 15 m vertical plankton tows at station LLV-1 in 2004 (Table 8). Rotifers dominated the population with a frequency of (74%), followed by Cladocerans (16%) and Copepods (10%) during 2004.

Brachiounus caudatus exhibited the greatest average annual average density in 2004 of 501,251 No./cu.m (Table 8). Of the Cladoceran family, *Daphnia pulex* and juvenile copepods dominated with average densities totaling 206,958. This genus is well known for their ability to control Phytoplankton populations in pelagic zones.

DIVISION	GENUS/SECIES	No./cu.m Total
Copepods	*Copepods*	168,473
Copepods	*Cyclops vernalis*	51,912
Copepods	*Diacyclops bicuspidatus*	26,632
Copepods	*Diaptomus sp.*	165,890
Copepods	*Mesocyclops edax*	42,151
Copepods	*Nauplii*	968,420
	Total Copepods	**142,348**
	Frequency	**10%**
Cladocerans	*Alona sp.*	11,052
Cladocerans	*Daphnia juveniles*	69,525
Cladocerans	*Daphnia pulex*	137,433
Cladocerans	*Juvenile Cladocerans*	5,541
	Total Cladocerans	**223,551**
	Frequency	**16%**
Rotifers	*Brachionus caudatus*	501,251
Rotifers	*Brachionus havanaensis*	289,442
Rotifers	*Hexarthra sp*	12,943
Rotifers	*Keratella quadrata*	199,940
Rotifers	*Notholca sp.*	1,464
Rotifers	*Polyarthra remata*	1,515
Rotifers	*Synchaeta sp.*	2,713
	Total Rotifers	**1,009,268**
	Frequency	**74%**

Table 8. **Lake Las Vegas zooplankton species identified in the 0 – 15 m vertical plankton tows at station LLV-1 during 2004.**

Chlorophyll-a

Chlorophyll-a concentrations ranged from 1 to 26 ppb in surface water during 2004. Concentrations were not significantly different between sites ($p>0.05$) (Table 7).

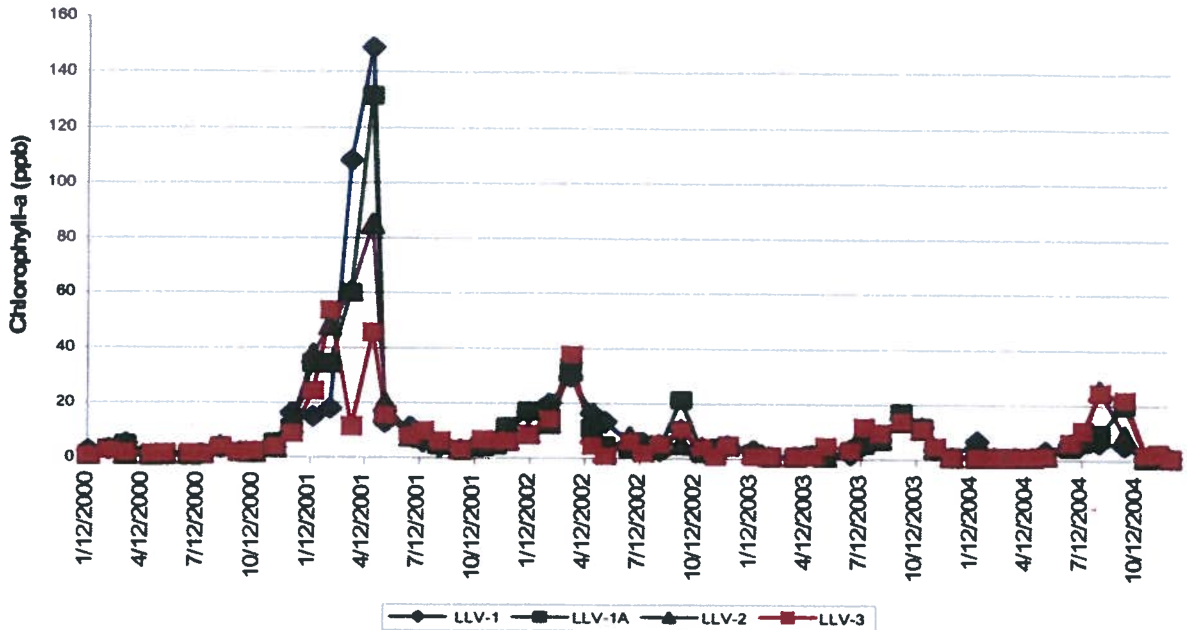


Figure 16. **Lake Las Vegas chlorophyll "a" concentrations in surface waters at Lake monitoring stations during 2004.**

Phytoplankton

Seven (7) taxonomic divisions of phytoplankton were found at LLV-1 during 2004 (Table 9), compared to Eight (8) in 2003. By abundance the most frequently observed division was *Pyrrhophyta* in 2004 (51%) (Figure17). The remaining seven (7) divisions, *Bacillariophyta (13%), Cryptophyta (3%), Cyanophyta (16%), Chlorophyta (9%), Chrysophyta (1%), Haptophyta (6%)*, were distributed in relation to *Chlorophyta* during the year. (Table 9).

DIVISION	GENUS/SPECIES	BIOMAS (mg/m3)
Cyanophyta	Anabaena aphanizemenoide	3201
Cyanophyta	Anabaena affins	109
Cyanophyta	Aphanocapsa delicatissima	63
Cyanophyta	Aphanocapsa sp.	34
Cyanophyta	Aphanothece clathrata	46
Cyanophyta	Chroococcus dispersus	267
Cyanophyta	Dactylococcopsis acicularis	1
Cyanophyta	Lyngbya Birgei	39
Cyanophyta	Merismopedia punctata	1
Cyanophyta	Merismopedia tenuissima	16
Cyanophyta	Merismopedia hyalina	9
Cyanophyta	Planktolyngbya contorta	34
Cyanophyta	Planktolyngbya subtilis	3
Cyanophyta	Planktothrix rubescens	61
Cyanophyta	Pseudanabaena Galeata	84
Cyanophyta	Pseudanabaena limnetica	38
Cyanophyta	Spirulina labryinthiformis	1
Cyanophyta	Synechocystis sp.	47
	TOTAL	**4052**
	%Freq	**16**

DIVISION	GENUS/SPECIES	BIOMAS (mg/m3)
Chlorophyta	Actinastrum Hantzschii	2
Chlorophyta	Ankistrodesmus falcatus	1
Chlorophyta	Ankyra judayi	3
Chlorophyta	Chlamydomonas sp.	8
Chlorophyta	Chlorogonium sp.	1
Chlorophyta	Coelastrum microporum	22
Chlorophyta	Elakatohrix gelatinosa	1
Chlorophyta	Gloeocystis gigas	174
Chlorophyta	Gloeocystis planctonica	23
Chlorophyta	Monoraphidium capricornu	5
Chlorophyta	Oocystis borgei	1305
Chlorophyta	Oocystis gigas v. incrassata	152
Chlorophyta	Oocystis Pusilla	2
Chlorophyta	Oocystis sp.	2
Chlorophyta	Pediastrum boryanum	10
Chlorophyta	Pyramichlamys dissecta	513
Chlorophyta	pryamichlamys restings	131
Chlorophyta	Chlamydomonas sp.	3
Chlorophyta	Quadrigula chodatii	2
Chlorophyta	Scenedesmus quadricauda	7
Chlorophyta	Sphaerocystis schroeteri	57
Chlorophyta	Tetraedon minimum	20
Chlorophyta	Trochischia aspers	1
	TOTAL	**2444**
	%Freq	**9**

DIVISION	GENUS/SPECIES	BIOMAS (mg/m3)
Crytophyta	Cryptomonas erosa	162
Crytophyta	Cryptomonas erosa v reflexa	3
Crytophyta	Cryptomonas marssonii	71
Crytophyta	Cryptomonas ovata	3
Crytophyta	Cryptomonas rostratiformis	6
Crytophyta	Cryptomonas sp.	35
Crytophyta	Katablepharis ovalis	19
Crytophyta	Rhodomonas lens	1
Crytophyta	Rhodomonas minuta	450
	TOTAL	**749**
	%Freq	**3**

DIVISION	GENUS/SPECIES	BIOMAS (mg/m3)
Bacillariophyceae	Achnanthes sp.	3
Bacillariophyceae	Anomoeoneis vitrea	56
Bacillariophyceae	Chaetoceros sp.	25
Bacillariophyceae	Cyclotella 10 uM	124
Bacillariophyceae	Cyclotella maneghiniana	1505
Bacillariophyceae	Cyclotella Atomus	25
Bacillariophyceae	Cyclotella Glomerta	1411
Bacillariophyceae	Cyclotella sp.	181
Bacillariophyceae	Cymbella sp.	5
Bacillariophyceae	Nitzschia palea	37
Bacillariophyceae	Nitzschia sp.	3
Bacillariophyceae	Synedra acus	2
Bacillariophyceae	Synedra sp.	2
	TOTAL	**3378**
	%Freq	**13**

DIVISION	GENUS/SPECIES	BIOMAS (mg/m3)
Haptophyta	Chrysochoromulina parva	1634
	TOTAL	**1634**
	%Freq	**6**

DIVISION	GENUS/SPECIES	BIOMAS (mg/m3)
Pyrrhophyta	Glenodinium armatum	7
Pyrrhophyta	Glenodinium sp.	16
Pyrrhophyta	Gymnodinium ordinatum	39
Pyrrhophyta	Gymnodinium sp.	15
Pyrrhophyta	Peridinium Pusillum	79
Pyrrhophyta	Peridinium penardiforme	12978
Pyrrhophyta	Peridinium quadridens	1
	TOTAL	**13135**
	%Freq	**51**

DIVISION	GENUS/SPECIES	BIOMAS (mg/m3)
Crysophyta	chrysocapsa planktonica	78
Crysophyta	Ochromonas sp.	188
	TOTAL	**265**
	%Freq	**1**

Table 9. **Lake Las Vegas phytoplankton species identified in the 0 – 15 m vertical plankton tows at station LLV-1 during 2004.**

In 2004 Bio-chemical oxygen demands (BOD_5) concentrations ranged between 2 and 7 ppm. Concentrations fluctuate the greatest during the year, coinciding with algal cycles observed. These increases often occur with lake turn over in the fall and storm events.

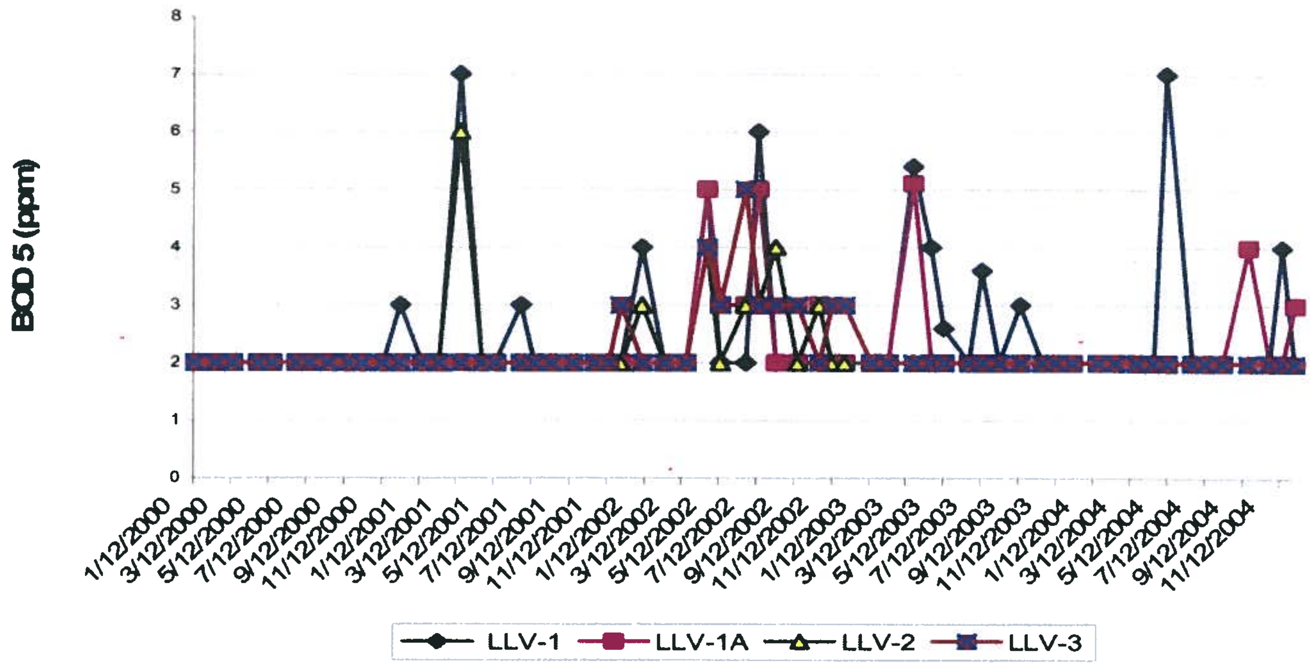


Figure 17. **Lake Las Vegas Biochemical Oxygen Demand concentrations (ppm) in surface waters at Lake Monitoring Station (LLV-3) during 2000-2004.**

Bacteria

Fecal coliform monitoring was completed on a monthly basis at Lake site LLV-3 in 2004. In 2004, bacteria sampling frequency was completed weekly during the months of April through October due to increased recreational use. Fecal coliform counts in surface waters were below body contact limits in 2004. A slight increase was observed during the full turnover of the lake, but was still within the guideline. (Figure18). As observed in figure 18, increase in fecal concentrations increases occurred with the November storm event.

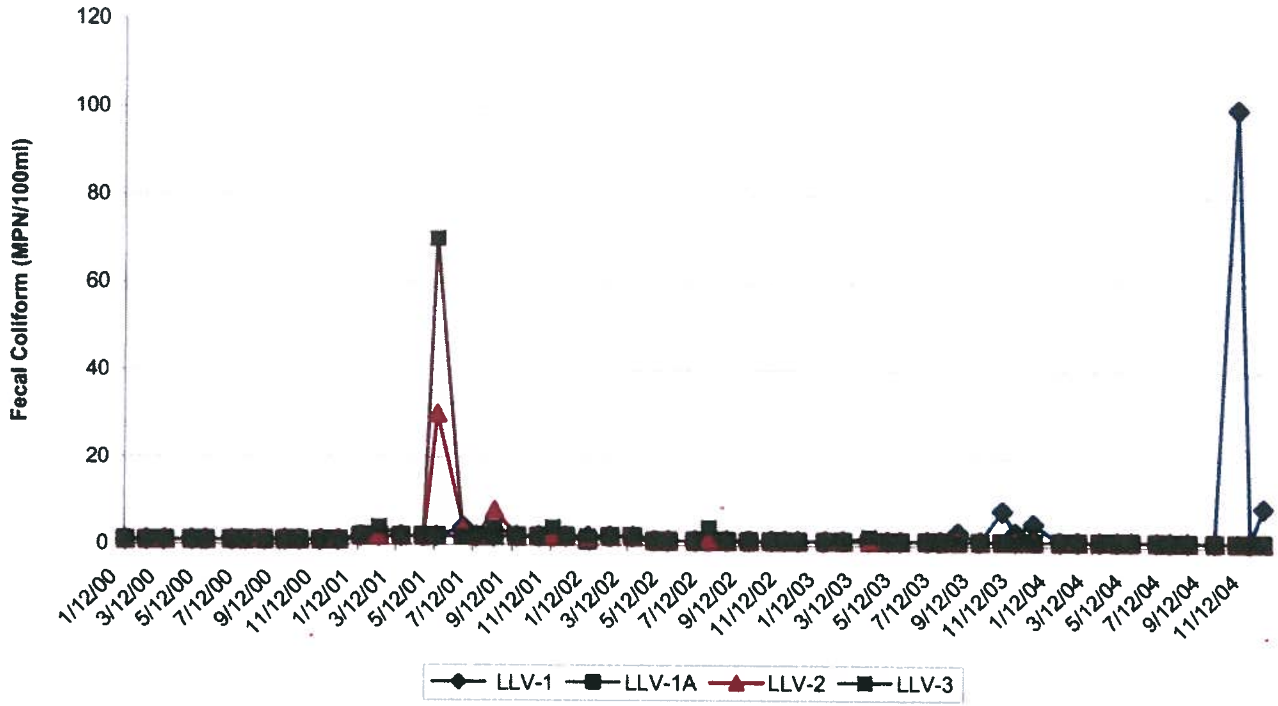


Figure 18. **Lake Las Vegas fecal coliform counts (MPN/100ml) in surface waters at Lake monitoring station (LLV-3) during 2003.**

Toxic Substances

Water samples for toxic analysis were collected from the surface (0m) and bottom (1m from bottom) of station LLV-1 during December 2004, 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 below levels of detection. (Appendix C).

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 during the April – September growing season. The chlorophyll-a guideline is applied at that time of year to protect water quality during the peak recreation period. Fecal coliform bacteria were at, or below, the limits of detection, as were concentrations of toxic metals, pesticides, herbicides and other toxic organic compounds. Except for total dissolved solids and its related ions, water quality in Lake Las Vegas continues to be very good. The Total dissolved solids guideline was established to keep salinity in the Lake at levels acceptable for irrigation. The project was designed so lake water can be withdrawn for on-site irrigation. Evaporation will continue to increase total dissolved solids until ions reach saturation and precipitate, or are diluted by inflows from Lake Mead. It will take several years for development to reach the point where irrigation demands are sufficient to keep total dissolved solids in the Lake at acceptable levels. Currently, water drawn from the Lake for irrigation is blended with Lake Mead water to dilute the total dissolved solids concentrations for Lake Las Vegas current three golf courses.

V. REFERENCES

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VI. APPENDIX

Annual Toxicity Analysis

Silver State Analytical Laboratories

5070 South Arville Street, Suite 6
Las Vegas, Nevada 89118

Telephone: (702) 873-4478
Fax: (702) 873-7967

LABORATORY REPORT

DATE: December 14, 2004

REPORT NUMBER: 04-3768

CLIENT: Lake Las Vegas Resort
1605 Lake Las Vegas Parkway
Henderson, Nevada 89011

CLIENT PROJECT:

CLIENT PO #:

Sampled By: Client .
Date Sampled: 12/07/04
Time Sampled: Refer to COC

Submitted by: Client
Date Received: 12/07/04
Time Received: 1305

Report Attention: Steven Weber

Sample ID	Parameter	Result	Unit	Detection Limit	Method	Date Analyzed	Analyst
LLV-1A	Nitrite	15	µg/L	5	EPA 354.1	12/08/04	RA
0 m	Turbidity	ND	NTU	1.0	EPA 180.1	12/07/04	RA
LLV-1A	Nitrite	18	µg/L	5	EPA 354.1	12/08/04	RA
20 m	Turbidity	ND	NTU	1.0	EPA 180.1	12/07/04	RA

ND: non-detect
EPA Flags: none
Note: 608, 8151, and 8270 subcontracted to Anatek, Moscow, ID (see attached laboratory reports).

REVIEWED BY:

Ronald W. Winter
Laboratory Manager

Silver State Analytical Laboratories
5070 South Arville, Suite 6, Las Vegas, Nevada 89118
Phone: (702) 873-4478 Fax: (702) 873-7967

CHAIN-OF-CUSTODY RECORD

Page ____ of ____
Date ____

Project Job #:
Payment Method/PO #:

SEND INVOICE TO
Name:
Company:
Mailing Address:
City, State, Zip:

REPORT RESULTS TO
Name: STEVE WEBER Title:
Company: LLV RESORT
Mailing Address: 1600 LLV PKWY
City, State, Zip: HENDERSON NV 89011
Phone: 564-1600 Fax:

Sampled By:
Report Attention:
On-Site pH/Temperature:

Turnaround (Specify Below with an X)
Standard 7-10 Business Days ☐
Rush: 24h | 48h | 72h | Other
NOTE: A surcharge is applied for rush samples

Other Pertinent Info:

Date Sampled	Time Sampled	Sample Location/ Sample ID	Silver State Lab ID	Comp/ Grab	Matrix*	Preservative	Number/Type of Containers**	608 (Pcb/Pcb)	VOC	HERBICIDE	SVOC	NO2, TURBID.						
7 Dec 04	1020	LLV	04-3768-1					X	X	X	X	X						
7 Dec 04	1125	LLV	-2					X	X	X	X	X						

ANALYSES REQUESTED

Reporting requirements:
Use RL / MDL / PQL
Report Level ⊕: I II III IV
⊕ Level III and IV will be surcharged for the level of effort

Circle Applicable Program: SDWA, CWA, RCRA, Other

*Metals: ANNUAL TOXIC SCREEN

Relinquished by Signature/Print	Time/Date	Received by Signature/Print	Time/Date
[signature]	1305 7 DEC 04	[signature]	1305 12/7/04
[signature]	16:30 12/7/04	[signature]	1630 12/7/04

Method of Delivery:
Receiving Laboratory:
Tamper Seal (Y/N):
Condition of Samples:

Special Instructions:

Authorization is required to process samples. This obligates your organization for fees pertaining to services rendered. If collections or legal services are required to recover said fees, your organization will be responsible for all fees and costs in addition to service fees. Date ______

NOTE: Samples are discarded 30 days after results are reported. This report for the analysis of the above samples is applicable only to those samples received by the laboratory. *Hazardous samples are returned to the client upon completion of analysis.*

* Key: AQ - Aqueous S - Soil W - Waste OT - Other
Distribution: White - Lab Yellow - Client Pink - Client on site
** Key: P - Plastic G - Glass V - VOA Vial T - Teflon OT - Other

Silver State Analytical Laboratories
Report Number: 04-3768
December 14, 2004

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

Analyzed by: AF
Date Analyzed: 12/09/04

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	Xylenes, total	ND	5

ND: non-detect
EPA Flag: none

Silver State Analytical Laboratories
Report Number: 04-3768
December 14, 2004

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

Analyzed by: AF
Date Analyzed: 12/09/04

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	Xylenes, total	ND	5

ND: non-detect
EPA Flag: none

Anatek Labs, Inc.

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SILVER STATE ANALYTICAL LABS
RON WINTER
5070 S. ARVILLE STE. 6
LAS VEGAS, NV 89118

Project 3768
Report Date 21-Dec-04

Certificate of Analysis

EPA Method 608 - Organochlorine Pesticides/PCB's

Sample Name: LLV-1A 0M
Sample Location: 3768-1
Sampling Date: 12/7/2004
Sampling Time: 10:20
Date Received: 12/9/2004

Lab #: 04X3278-01
Matrix: WASTE WATER
Analyst: SAT
Extract Date: 12/13/2004
Analysis Date: 12/14/2004

Analyte	Result	Units	PQL
alpha-BHC:	ND	µg/L	0.01
gamma-BHC (Lindane):	ND	µg/L	0.01
Heptachlor:	ND	µg/L	0.01
Aldrin:	ND	µg/L	0.01
beta-BHC:	ND	µg/L	0.01
delta-BHC:	ND	µg/L	0.01
Heptachlor Epoxide:	ND	µg/L	0.01
Endosulfan I:	ND	µg/L	0.01
4,4'-DDE:	ND	µg/L	0.01
Dieldrin:	ND	µg/L	0.01
Endrin:	ND	µg/L	0.01
Endosulfan II:	ND	µg/L	0.01
4,4'-DDD:	ND	µg/L	0.01
4,4'-DDT:	ND	µg/L	0.01
Endrin Aldehyde:	ND	µg/L	0.01
Endosulfan Sulfate:	ND	µg/L	0.01
Methoxychlor:	ND	µg/L	0.01
Endrin Ketone:	ND	µg/L	0.01
Chlordane:	ND	µg/L	0.1
Toxaphene:	ND	µg/L	0.1
Arochlor 1016:	ND	µg/L	0.1
Arochlor 1221:	ND	µg/L	0.1
Arochlor 1232:	ND	µg/L	0.1
Arochlor 1242:	ND	µg/L	0.1
Arochlor 1248:	ND	µg/L	0.1
Arochlor 1254:	ND	µg/L	0.1
Arochlor 1260:	ND	µg/L	0.1

Surrogate Standard	% Recovery
TCX %R	103

ND Not Detected PQL Practical Quantitation Limit

Anatek Labs, Inc.

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SILVER STATE ANALYTICAL LABS
RON WINTER
5070 S. ARVILLE STE 6
LAS VEGAS, NV 89118

Project: 3768
Report Date: 21-Dec-04

Certificate of Analysis

EPA Method 608 - Organochlorine Pesticides/PCB's

Sample Name: LLV-1A 20M
Sample Location: 3768-2
Sampling Date: 12/7/2004
Sampling Time: 11:25
Date Received: 12/9/2004

Lab #: 04X3278-02
Matrix: WASTE WATER
Analyst: SAT
Extract Date: 12/13/2004
Analysis Date: 12/14/2004

Analyte	Result	Units	PQL
alpha-BHC:	ND	µg/L	0.01
gamma-BHC (Lindane):	ND	µg/L	0.01
Heptachlor:	ND	µg/L	0.01
Aldrin:	ND	µg/L	0.01
beta-BHC:	ND	µg/L	0.01
delta-BHC:	ND	µg/L	0.01
Heptachlor Epoxide:	ND	µg/L	0.01
Endosulfan I:	ND	µg/L	0.01
4,4'-DDE:	ND	µg/L	0.01
Dieldrin:	ND	µg/L	0.01
Endrin:	ND	µg/L	0.01
Endosulfan II:	ND	µg/L	0.01
4,4'-DDD:	ND	µg/L	0.01
4,4'-DDT:	ND	µg/L	0.01
Endrin Aldehyde:	ND	µg/L	0.01
Endosulfan Sulfate:	ND	µg/L	0.01
Methoxychlor:	ND	µg/L	0.01
Endrin Ketone:	ND	µg/L	0.01
Chlordane:	ND	µg/L	0.1
Toxaphene:	ND	µg/L	0.1
Arochlor 1016:	ND	µg/L	0.1
Arochlor 1221:	ND	µg/L	0.1
Arochlor 1232:	ND	µg/L	0.1
Arochlor 1242:	ND	µg/L	0.1
Arochlor 1248:	ND	µg/L	0.1
Arochlor 1254:	ND	µg/L	0.1
Arochlor 1260:	ND	µg/L	0.1

Surrogate Standard	% Recovery
TCX %R	103

Approved by: John W. Coddington

ND Not Detected   PQL Practical Quantitation Limit

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SILVER STATE ANALYTICAL LABS
RON WINTER
5070 S. ARVILLE STE 6
LAS VEGAS, NV 89118

Project 3768
Report Date 21-Dec-04

Certificate of Analysis

EPA Method 8151A/615 - Phenoxy Acid Herbicides

Sample Name: LLV-1A 0M
Sample Location: 3768-1
Sampling Date: 12/7/2004
Sampling Time: 10:20
Date Received: 12/9/2004
Lab #: 04X3278-01
Matrix: WASTE WATER
Analyst: SAT
Extract Date: 12/14/2004
Analysis Date: 12/15/2004

Analyte	Result	Units	PQL
Dalapon:	ND	ug/L	0.5
Dicamba:	ND	ug/L	0.5
Dichlorprop:	ND	ug/L	0.5
2,4-D:	ND	ug/L	1.0
Pentachlorophenol:	ND	ug/L	0.5
Silvex:	ND	ug/L	0.5
2,4,5-T:	ND	ug/L	0.5
2,4-DB:	ND	ug/L	1.0
Dinoseb:	ND	ug/L	1.0
Dacthal:	ND	ug/L	0.5
Picloram:	ND	ug/L	0.5

Surrogate Standard	% Recovery
DCPA %R	96.7

Sample Name: LLV-1A 20M
Sample Location: 3768-2
Sampling Date: 12/7/2004
Sampling Time: 11:25
Date Received: 12/9/2004
Lab #: 04X3278-02
Matrix: WASTE WATER
Analyst: SAT
Extract Date: 12/14/2004
Analysis Date: 12/15/2004

Analyte	Result	Units	PQL
Dalapon:	ND	ug/L	0.5
Dicamba:	ND	ug/L	0.5
Dichlorprop:	1.0	ug/L	0.5
2,4-D:	ND	ug/L	1.0
Pentachlorophenol:	ND	ug/L	0.5
Silvex:	ND	ug/L	0.5
2,4,5-T:	ND	ug/L	0.5
2,4-DB:	ND	ug/L	1.0
Dinoseb:	ND	ug/L	1.0
Dacthal:	ND	ug/L	0.5
Picloram:	ND	ug/L	0.5

Surrogate Standard	% Recovery
DCPA %R	99.9

Approved by: John Coddington

ND Not Detected PQL Practical Quantitation Limit

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SILVER STATE ANALYTICAL LABS
RON WINTER
5070 S. ARVILLE STE 6
LAS VEGAS, NV 89118

Sample Name: LLV-1A 0M
Sample Location 3768-1
Sampling Date 12/7/2004
Sampling Time 10 20
Date Received 12/9/2004
Report Date 21-Dec-04

Certificate of Analysis

EPA Method 8270/625 - GC/MS Semivolatile Organics

Analyte	Result	Units	PQL
Acenaphthene	ND	ug/L	0.5
Acenaphthylene	ND	ug/L	0.5
Anthracene	ND	ug/L	0.5
Benzidine	ND	ug/L	0.5
Benzo(k)fluoranthene	ND	ug/L	0.5
Benzo(b)fluoranthene	ND	ug/L	0.5
Benzo(ghi)perylene	ND	ug/L	0.5
Benzo(a)anthracene	ND	ug/L	0.5
Benzo(a)pyrene	ND	ug/L	0.5
Benzyl alcohol	ND	ug/L	0.5
Bis(2-chlorethoxy)methane	ND	ug/L	0.5
Bis(2-chloroisopropyl)ether	ND	ug/L	0.5
Bis(2-chloroethyl)ether	ND	ug/L	0.5
Bis(2-ethylhexyl)phthalate	ND	ug/L	0.5
4-Bromophenyl phenyl ether	ND	ug/L	0.5
Butylbenzylphthalate	ND	ug/L	0.5
4-Chloroaniline	ND	ug/L	0.5
2-Chloronaphthalene	ND	ug/L	0.5
4-Chloro-3-methylphenol	ND	ug/L	0.5
2-Chlorophenol	ND	ug/L	0.5
4-Chlorophenyl phenyl ether	ND	ug/L	0.5
Chrysene	ND	ug/L	0.5
Dibenz(ah)anthracene	ND	ug/L	0.5
Dibenzofuran	ND	ug/L	0.5
Di-n-butyl phthalate	ND	ug/L	0.5
1,3-Dichlorobenzene	ND	ug/L	0.5
1,2-Dichlorobenzene	ND	ug/L	0.5
1,4-Dichlorobenzene	ND	ug/L	0.5
3,3-Dichlorobenzidine	ND	ug/L	0.5
2,4-Dichlorophenol	ND	ug/L	0.5
2,6-Dichlorophenol	ND	ug/L	0.5
Diethyl phthalate	ND	ug/L	0.5
2,4-Dimethylphenol	ND	ug/L	0.5
Dimethyl phthalate	ND	ug/L	0.5
4,6-Dinitro-2-methylphenol	ND	ug/L	0.5
2,4-Dinitrophenol	ND	ug/L	0.5
2,4-Dinitrotoluene	ND	ug/L	0.5
2,6-Dinitrotoluene	ND	ug/L	0.5
Di-n-octyl phthalate	ND	ug/L	0.5
1,2-Diphenylhydrazine	ND	ug/L	0.5

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SILVER STATE ANALYTICAL LABS
RON WINTER
5070 S. ARVILLE STE. 6
LAS VEGAS, NV 89118

Sample Name:	LLV-1A 0M
Sample Location	3768-1
Sampling Date	12/7/2004
Sampling Time	10 20
Date Received	12/9/2004
Report Date	21-Dec-04

Certificate of Analysis (Continued)

EPA Method 8270/625 - GC/MS Semivolatile Organics

Analyte	Result	Units	PQL
Fluoranthene	ND	ug/L	0.5
Fluorene	ND	ug/L	0.5
Hexachlorobenzene	ND	ug/L	0.5
Hexachlorobutadiene	ND	ug/L	0.5
Hexachlorocyclopentadiene	ND	ug/L	0.5
Hexachloroethane	ND	ug/L	0.5
Indeno(123,cd)pyrene	ND	ug/L	0.5
Isophorone	ND	ug/L	0.5
2-Methylnaphthalene	ND	ug/L	0.5
2-Methylphenol	ND	ug/L	0.5
4-Methylphenol	ND	ug/L	0.5
Naphthalene	ND	ug/L	0.5
2-Nitroaniline	ND	ug/L	0.5
3-Nitroaniline	ND	ug/L	0.5
4-Nitroaniline	ND	ug/L	0.5
Nitrobenzene	ND	ug/L	0.5
2-Nitrophenol	ND	ug/L	0.5
4-Nitrophenol	ND	ug/L	0.5
N-nitrosodibutylamine	ND	ug/L	0.5
N-Nitrosodimethylamine	ND	ug/L	0.5
N-nitrosodiphenylamine	ND	ug/L	0.5
N-nitrosodipropylamine	ND	ug/L	0.5
Pentachlorophenol	ND	ug/L	0.5
Phenanthrene	ND	ug/L	0.5
Phenol	ND	ug/L	0.5
Pyrene	ND	ug/L	0.5
1,2,4-Trichlorobenzene	ND	ug/L	0.5
2,4,5-Trichlorophenol	ND	ug/L	0.5
2,4,6-Trichlorophenol	ND	ug/L	0.5

Surrogate Standard	% Recovery	QC Limits
2-Fluorophenol %R	57.9	21-110
Phenol-d5 %R	61.6	10-110
Nitrobenzene-d5 %R	51.7	25-130
2-Fluorobiphenyl %R	49.7	19-130
2,4,6-Tribromophenol %R	82.6	10-123
Terphenyl-d14 %R	80.8	10-125

Lab #:	04X3278-01
Matrix:	WASTE WATER
Analyst:	EMP
Extract Date:	12/13/2004
Analysis Date:	12/15/2004

ND Not Detected   PQL Practical Quantitation Limit   Project: 3768

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SILVER STATE ANALYTICAL LABS
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LAS VEGAS, NV 89118

Sample Name: LLV-1A 20M
Sample Location 3768 2
Sampling Date 12/7/2004
Sampling Time 11 25
Date Received 12/9/2004
Report Date 21-Dec-04

Certificate of Analysis

EPA Method 8270/625 - GC/MS Semivolatile Organics

Analyte	Result	Units	PQL
Acenaphthene	ND	ug/L	0.5
Acenaphthylene	ND	ug/L	0.5
Anthracene	ND	ug/L	0.5
Benzidine	ND	ug/L	0.5
Benzo(k)fluoranthene	ND	ug/L	0.5
Benzo(b)fluoranthene	ND	ug/L	0.5
Benzo(ghi)perylene	ND	ug/L	0.5
Benzo(a)anthracene	ND	ug/L	0.5
Benzo(a)pyrene	ND	ug/L	0.5
Benzyl alcohol	ND	ug/L	0.5
Bis(2-chlorethoxy)methane	ND	ug/L	0.5
Bis(2-chloroisopropyl)ether	ND	ug/L	0.5
Bis(2-chloroethyl)ether	ND	ug/L	0.5
Bis(2-ethylhexyl)phthalate	ND	ug/L	0.5
4-Bromophenyl phenyl ether	ND	ug/L	0.5
Butylbenzylphthalate	ND	ug/L	0.5
4-Chloroaniline	ND	ug/L	0.5
2-Chloronaphthalene	ND	ug/L	0.5
4-Chloro-3-methylphenol	ND	ug/L	0.5
2-Chlorophenol	ND	ug/L	0.5
4-Chlorophenyl phenyl ether	ND	ug/L	0.5
Chrysene	ND	ug/L	0.5
Dibenz(ah)anthracene	ND	ug/L	0.5
Dibenzofuran	ND	ug/L	0.5
Di-n-butyl phthalate	ND	ug/L	0.5
1,3-Dichlorobenzene	ND	ug/L	0.5
1,2-Dichlorobenzene	ND	ug/L	0.5
1,4-Dichlorobenzene	ND	ug/L	0.5
3,3-Dichlorobenzidine	ND	ug/L	0.5
2,4-Dichlorophenol	ND	ug/L	0.5
2,6-Dichlorophenol	ND	ug/L	0.5
Diethyl phthalate	ND	ug/L	0.5
2,4-Dimethylphenol	ND	ug/L	0.5
Dimethyl phthalate	ND	ug/L	0.5
4,6-Dinitro-2-methylphenol	ND	ug/L	0.5
2,4-Dinitrophenol	ND	ug/L	0.5
2,4-Dinitrotoluene	ND	ug/L	0.5
2,6-Dinitrotoluene	ND	ug/L	0.5
Di-n-octyl phthalate	ND	ug/L	0.5
1,2-Diphenylhydrazine	ND	ug/L	0.5

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Sample Name: LLV-1A 20M
Sample Location 3768-2
Sampling Date 12/7/2004
Sampling Time 11:25
Date Received 12/9/2004
Report Date 21-Dec-04

Certificate of Analysis (Continued)

EPA Method 8270/625 - GC/MS Semivolatile Organics

Analyte	Result	Units	PQL
Fluoranthene	ND	ug/L	0.5
Fluorene	ND	ug/L	0.5
Hexachlorobenzene	ND	ug/L	0.5
Hexachlorobutadiene	ND	ug/L	0.5
Hexachlorocyclopentadiene	ND	ug/L	0.5
Hexachloroethane	ND	ug/L	0.5
Indeno(123,cd)pyrene	ND	ug/L	0.5
Isophorone	ND	ug/L	0.5
2-Methylnaphthalene	ND	ug/L	0.5
2-Methylphenol	ND	ug/L	0.5
4-Methylphenol	ND	ug/L	0.5
Naphthalene	ND	ug/L	0.5
2-Nitroaniline	ND	ug/L	0.5
3-Nitroaniline	ND	ug/L	0.5
4-Nitroaniline	ND	ug/L	0.5
Nitrobenzene	ND	ug/L	0.5
2-Nitrophenol	ND	ug/L	0.5
4-Nitrophenol	ND	ug/L	0.5
N-nitrosodibutylamine	ND	ug/L	0.5
N-Nitrosodimethylamine	ND	ug/L	0.5
N-nitrosodiphenylamine	ND	ug/L	0.5
N-nitrosodipropylamine	ND	ug/L	0.5
Pentachlorophenol	ND	ug/L	0.5
Phenanthrene	ND	ug/L	0.5
Phenol	ND	ug/L	0.5
Pyrene	ND	ug/L	0.5
1,2,4-Trichlorobenzene	ND	ug/L	0.5
2,4,5-Trichlorophenol	ND	ug/L	0.5
2,4,6-Trichlorophenol	ND	ug/L	0.5

Surrogate Standard	% Recovery	QC Limits
2-Fluorophenol %R	71.4	21-110
Phenol-d5 %R	71.9	10-110
Nitrobenzene-d5 %R	69.5	25-130
2-Fluorobiphenyl %R	69.8	19-130
2,4,6-Tribromophenol %R	88.4	10-123
Terphenyl-d14 %R	87.2	10-125

Lab #: 04X3278-02
Matrix: WASTE WATER
Analyst: EMP
Extract Date: 12/13/2004
Analysis Date: 12/15/2004

Approved by: John W. Coddington

ND Not Detected PQL Practical Quantitation Limit Project: 3768