

14 Pomona Lake

14.1 General Background

Pomona Lake was impounded in 1963 and reached full pool in 1965. The main water quality threats to Pomona Lake are sedimentation, nutrients and bacterial contamination. The lake is listed on the state's 2004 303(d) list for water quality impairment due to eutrophication and silt. Kansas State University (KSU) received a 319 grant to develop a Watershed Restoration and Protection Strategy (WRAPS) project within the Pomona Lake watershed. The WRAPS, chaired by Dr. Bill Hargrove (KSU), has initiated SWAT modeling efforts to help identify priority areas of concern. In addition, the Marais des Cygnes Basin Advisory Committee has begun efforts to develop a watershed management plan and protect the watershed for current and future water needs.

14.1.1 Location

Pomona Lake is located approximately 48 km (30 miles) south of Topeka, Kansas. The dam is located at river km 13.3 (river mile 8.3) on 101 Mile Creek, a tributary of the Marais des Cygnes River. The watershed includes portions of Osage and Wabaunsee counties. Historic water quality sample sites at Pomona Lake include 3 lake, 1 outflow, and 1 inflow (Figure 14.1).



Figure 14.1. Pomona Lake area map with sample site locations.

14.1.2 Authorized Purposes: Flood damage reduction, recreation, water quality improvement, and fish and wildlife management.

14.1.3 State Use Designations: Primary and secondary contact recreation, expected aquatic life support, food procurement, and drinking water supply.

14.1.4 Lake and Watershed Data

Pools	Surface Elevation (ft. above m.s.l.)	Current Capacity (1000 AF)	Surface Area (A)	Shoreline (miles)
Flood Control	1,003	176.1	8,522	
Multipurpose	974	64.2	3,871	52
Total		240.3		

Total watershed area: 322 sq miles (206,080 A)

Watershed ratio: 24.18 FC / 53.24 MP

Average Annual Inflow: 143,721 acre-feet

Average Annual outflow: 000 acre-feet

Average flushing rate: 0.42 years

Sediment inflow (measured): 7,045 acre-feet (1963 – 1989)

Water management Plan: Approved February 1973

Historic stage hydrograph: 1996 – 2006 (Figure 14.2)

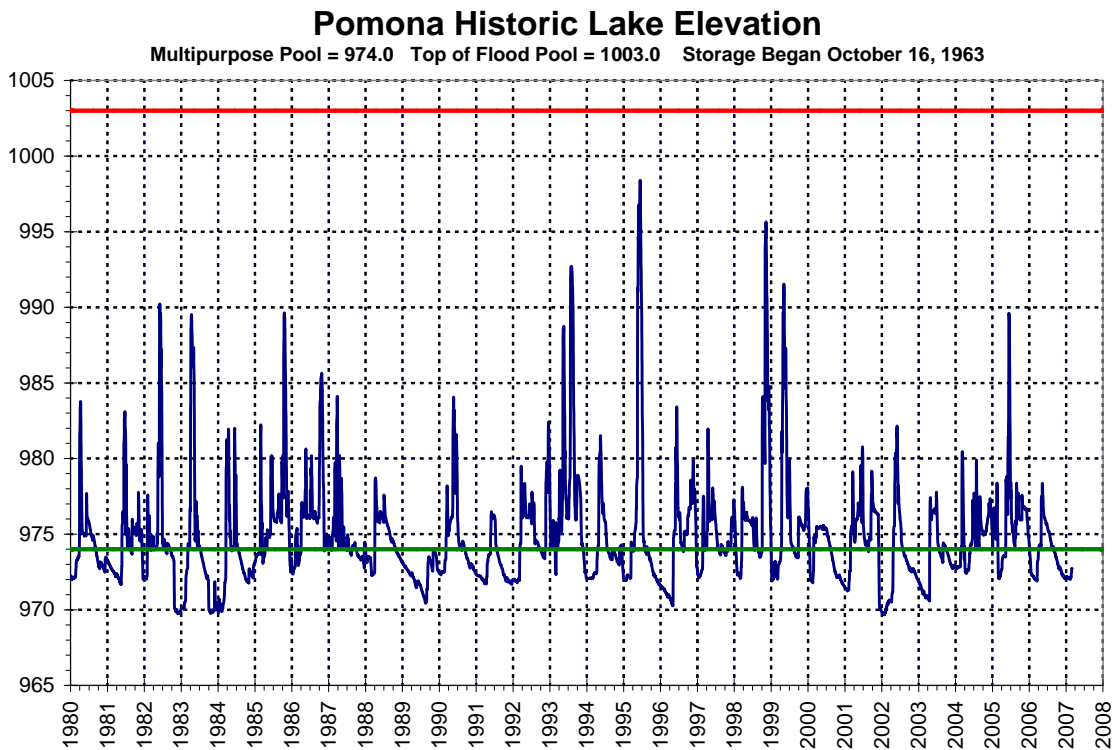


Figure 14.2. Pool elevation hydrograph from 1980 – 2006 (green line is multipurpose pool elevation level; 974.0 msl). Graph provided by Steve Spaulding (CENWK-EC-HC).

14.2 2006 Activities

Pomona Lake was categorized as an ‘ambient’ lake during 2006, with sample collection occurring from June through September. Surface samples were collected from three lake sites. Vertical profiles (temperature, DO) were recorded at the three lake sites during each monthly sampling trip. Pomona Lake staff (OF-PO) providing field assistance with the WQP during 2006 included David White and Brad Cox. David Green, OF-PO Operations Manager, provided technical insight and background knowledge on Pomona Lake and surrounding watershed.

14.3 2006 Data

Comparative historic data consists of monthly (April – September) data collected from 1996 - 1997, 1999 – 2005. Samples were collected at the three lake sites from June through September during 2006.

14.3.1 Inflow

No Inflow samples were collected during 2006. All data is discussed in context with lake samples below.

14.3.2 Lake

Based on total nitrogen (TN), total phosphorus (TP) and chlorophyll *a* concentrations, Pomona Lake is classified as eutrophic. Nitrogen is an essential nutrient to aquatic life. However, excessive concentrations can result in algal blooms, low DO levels, taste and odor issues in drinking water, and even fish kills. Monthly and annual variability in total nitrogen is evident at all sites (Figure 14.2 is an example from Site 3). Median concentrations range from 0.84 – 0.94 (Figure 14.3) for the three lake sites, which exceeds EPA’s proposed ecoregional nutrient criteria value of 0.36 mg/L total nitrogen.

Phosphorus is another essential nutrient for aquatic life, and it limits algal growth. Median TP concentrations ranged from 0.08 – 0.1 mg/L (Figure 14.4), which exceed EPA’s proposed nutrient criteria value of 0.02 mg/L TP. The measured values for TN and TP are typical for reservoirs within the district.

The ratio of TN:TP can be used as a surrogate to determine the dominant algal community within a waterbody. Ratios $\geq 20:1$ are indicative of desirable algal communities, whereas ratios $\leq 12:1$ are indicative of bloom-forming cyanobacteria (blue green algae). As would be expected, there is high monthly and annual variability in the TN:TP ratio at all sites; see Figure 14.5 as an example at Site 12. Median TN:TP ratios at all three lake sites are < 12 , indicating the lake is at risk for cyanobacteria blooms (Figure 14.6). Historically, bluegreen algae blooms have been detected at Pomona Lake.

No metal samples were collected from lakes sites during 2006. No chlorophyll *a* samples or secchi depth measurements were collected during 2006.

Mean atrazine concentrations in Pomona Lake, ranging from 1.67 – 2.03 ug/L, are less than EPA’s drinking water maximum contaminant level (MCL) of 3 ug/L (Figure 14.7). However, individual samples measured since 1996 have been significant enough to

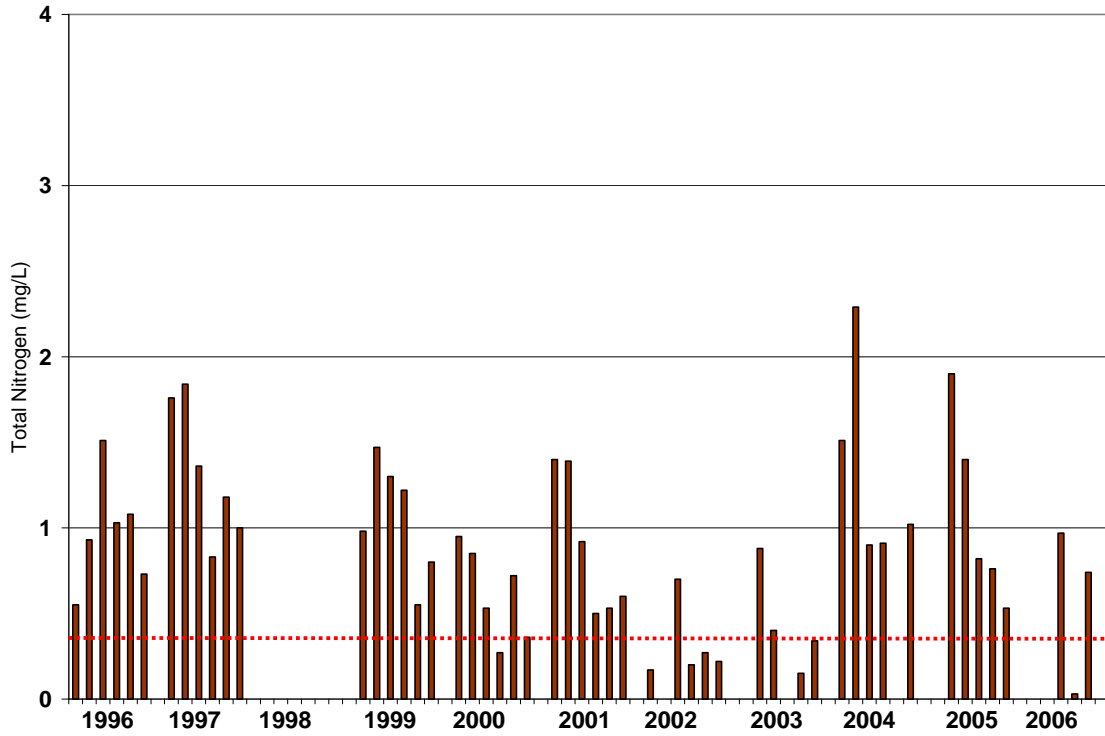


Figure 14.2. Total nitrogen concentrations by sample data collected at Site 3 (Tower) from 1996 through 2006 in Pomona Lake. Red line = proposed EPA ecoregional nutrient criteria value (0.36 mg/L).

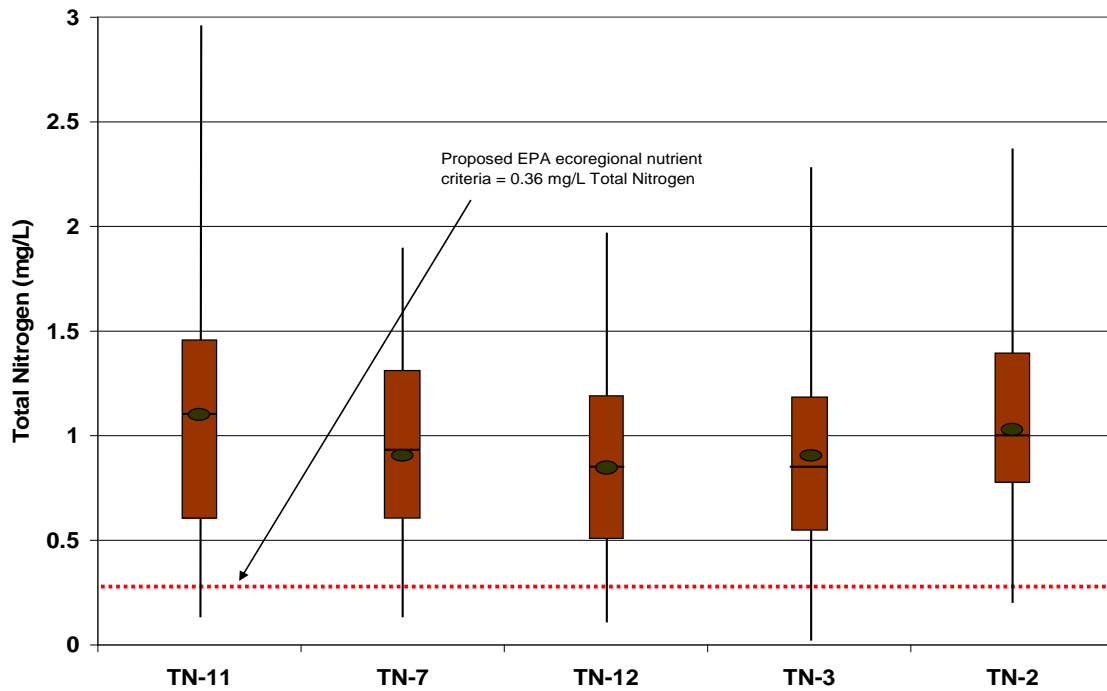


Figure 14.3. Box plots of surface water sample total nitrogen concentrations measured at inflow, lake, and outflow sites from 1996 through 2006 at Pomona Lake.

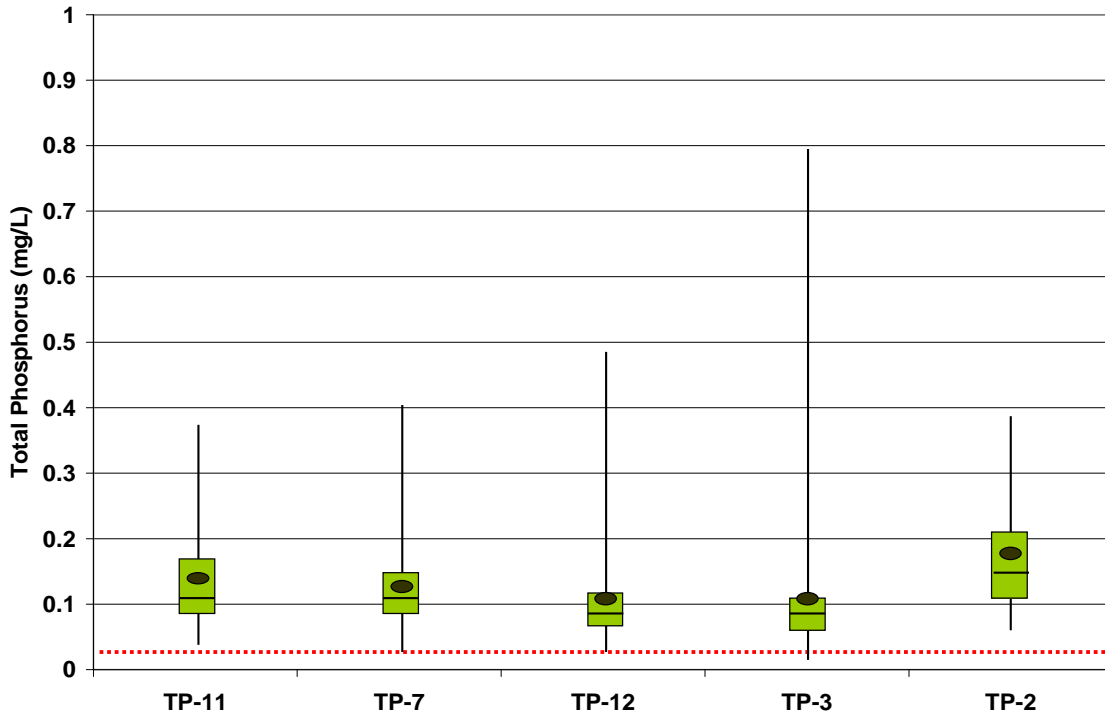


Figure 14.4. Box plots of surface water sample total phosphorus concentrations measured at inflow, lake and outflow sites from 1996 through 2006 at Pomona Lake.

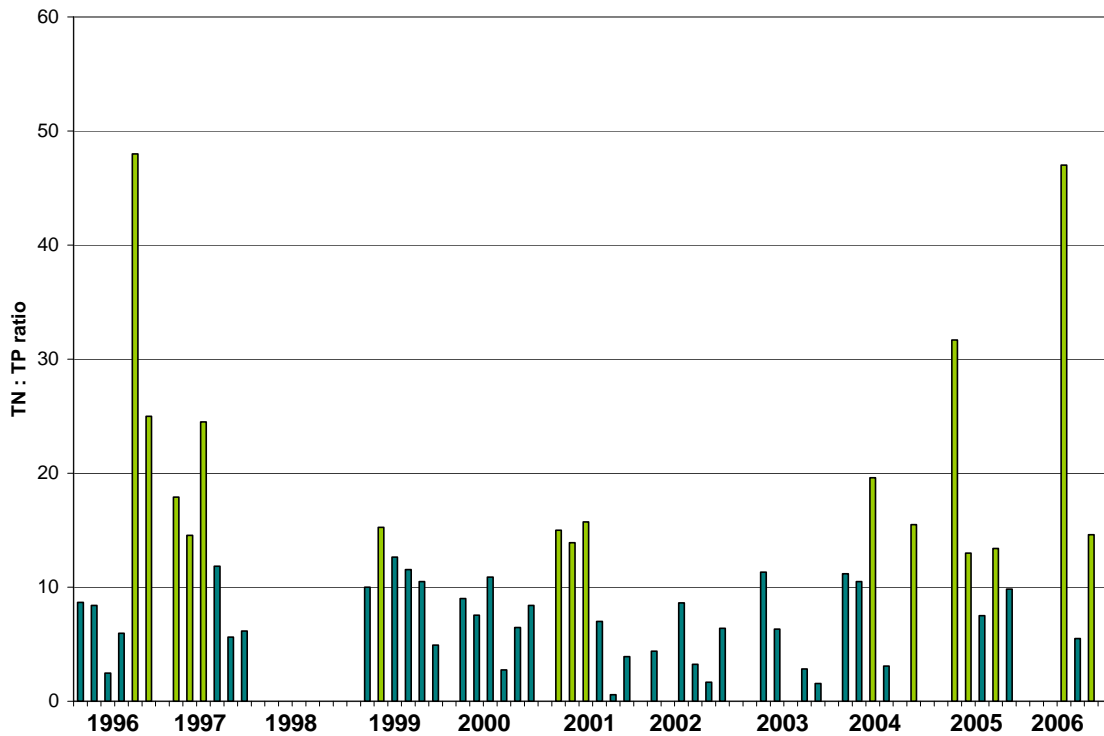


Figure 14.5. Graph of total nitrogen : total phosphorus (TN : TP) ratio by sample date at Site 12 in Pomona Lake from 1996 through 2005.

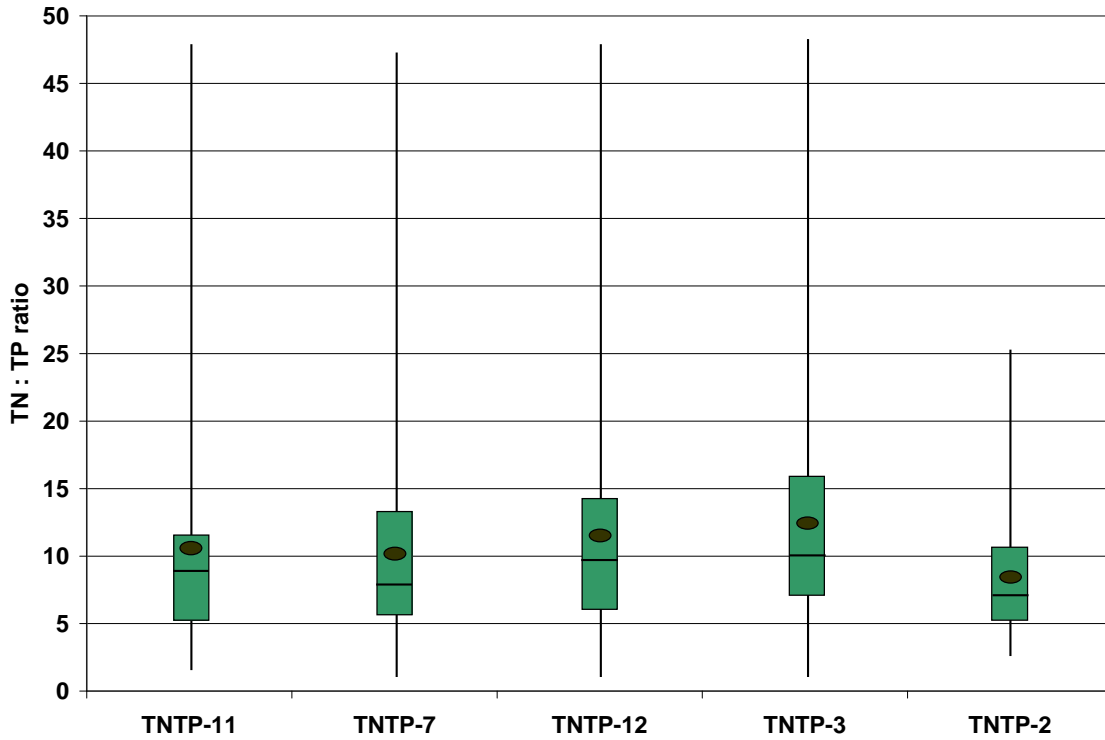


Figure 14.6. Box plots of total nitrogen : total phosphorus (TN : TP) by site from 1996 through 2005 at Pomona Lake.

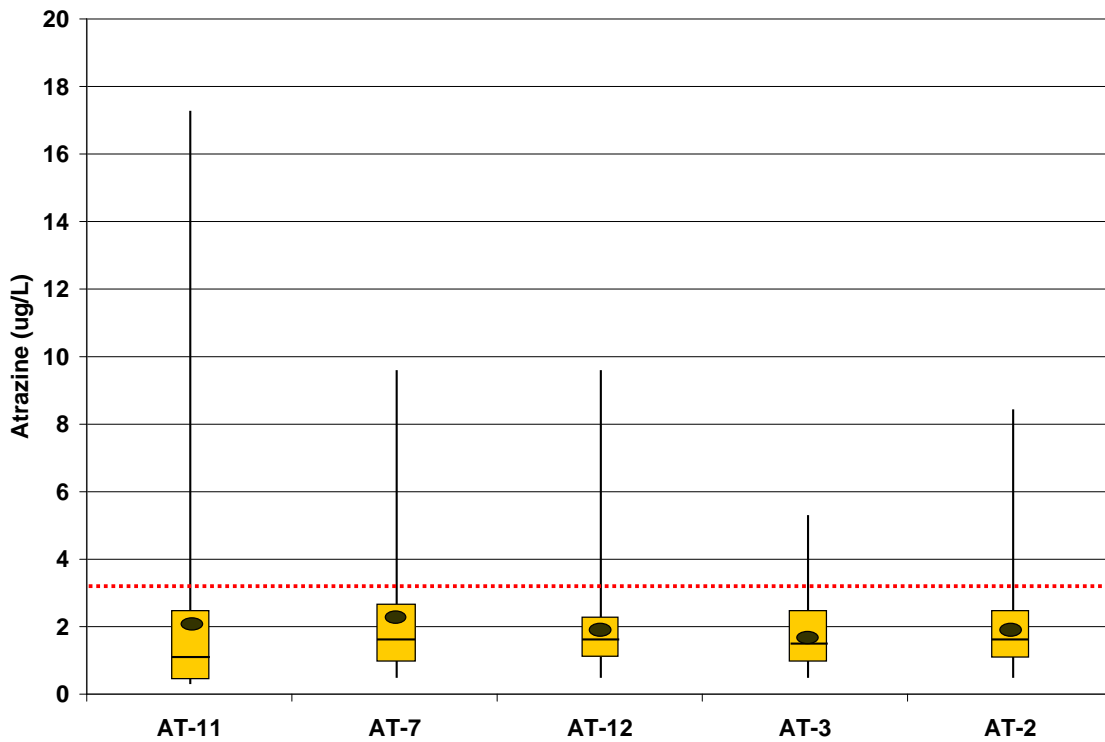


Figure 14.7. Box plots of surface water sample atrazine concentrations measured by site from 1996 through 2005 at Pomona Lake.

exceed the MCL – even exceeding 8 ug/L at Sites 12, 7 and 2 during 2005! Figure 14.8 depicts annual variability in atrazine concentration by sample date at Site 11 (inflow).

Vertical profiles were recorded during sample trips in June and August 2006. Parameters included temperature and dissolved oxygen. Based on these profiles, the lake was stratified both chemically and thermally during June but not during August. (Figure 14.9) Stratification occurred between 5 – 8 m at Site 3 during June 2006.

Fecal bacteria (*E. coli*) samples were collected from three locations at Michigan Valley beach prior to three major holidays (Memorial Day, July 4th, and Labor Day) during 2006. All samples collected were well within compliance limits of 732 colonies / 100 ml for a whole-body contact single sample maximum during the recreational season (Figure 14.10).

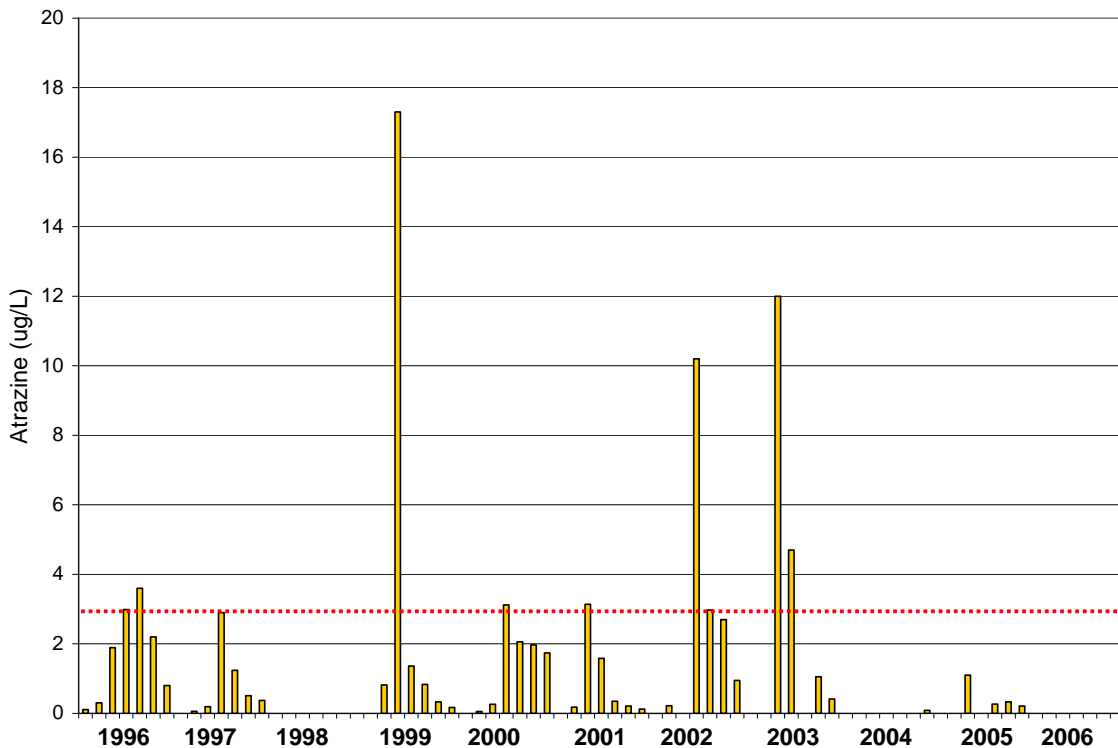


Figure 14.8. Atrazine concentrations by sample date from surface water samples collected at Site 11 (inflow) of Pomona Lake between 1996 and 2005.

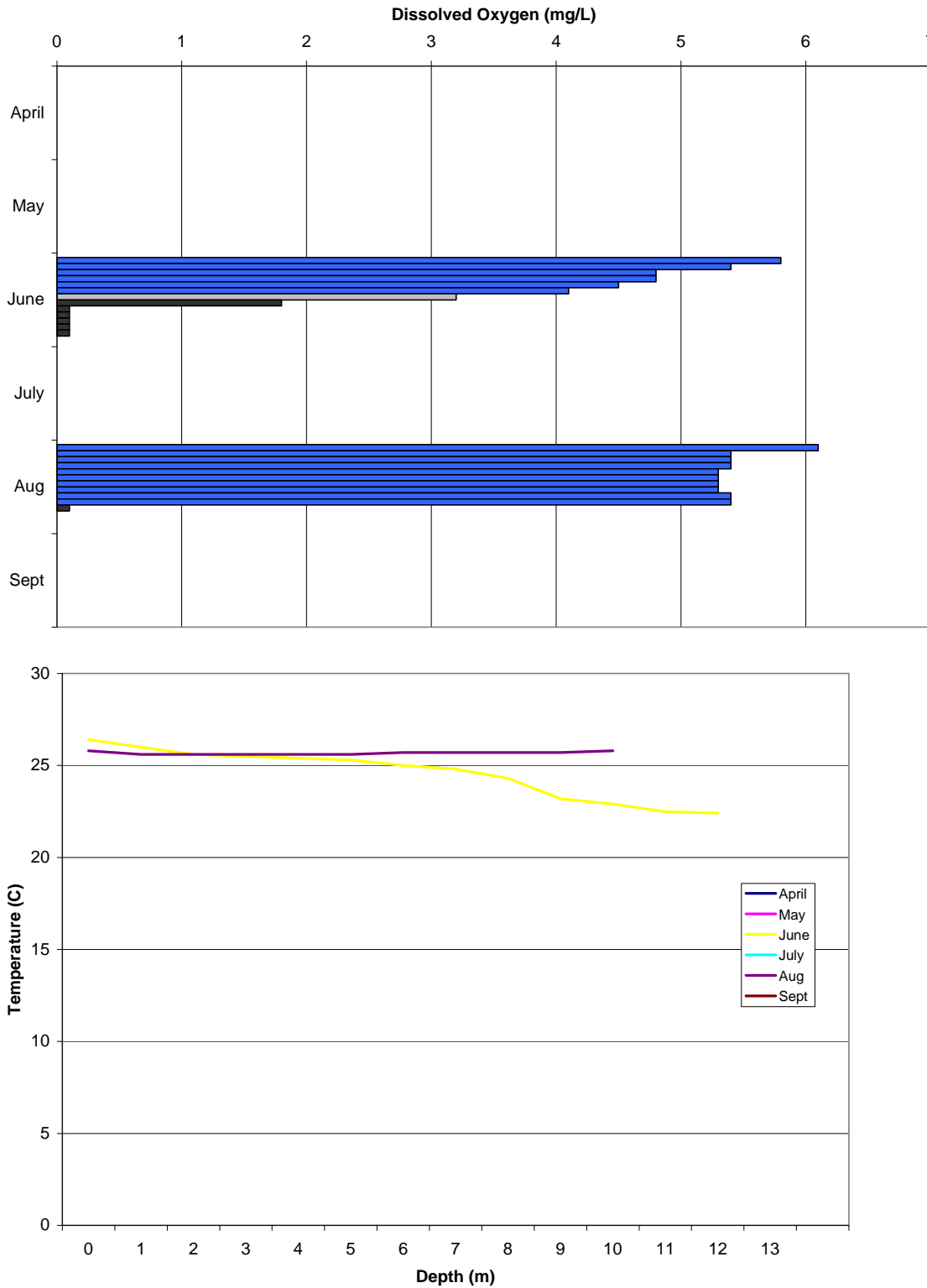


Figure 14.9. Dissolved oxygen concentration (mg/L) histogram and temperature (°C) Plot from vertical profiles recorded at Site 3 (Tower) during June and August 2006.

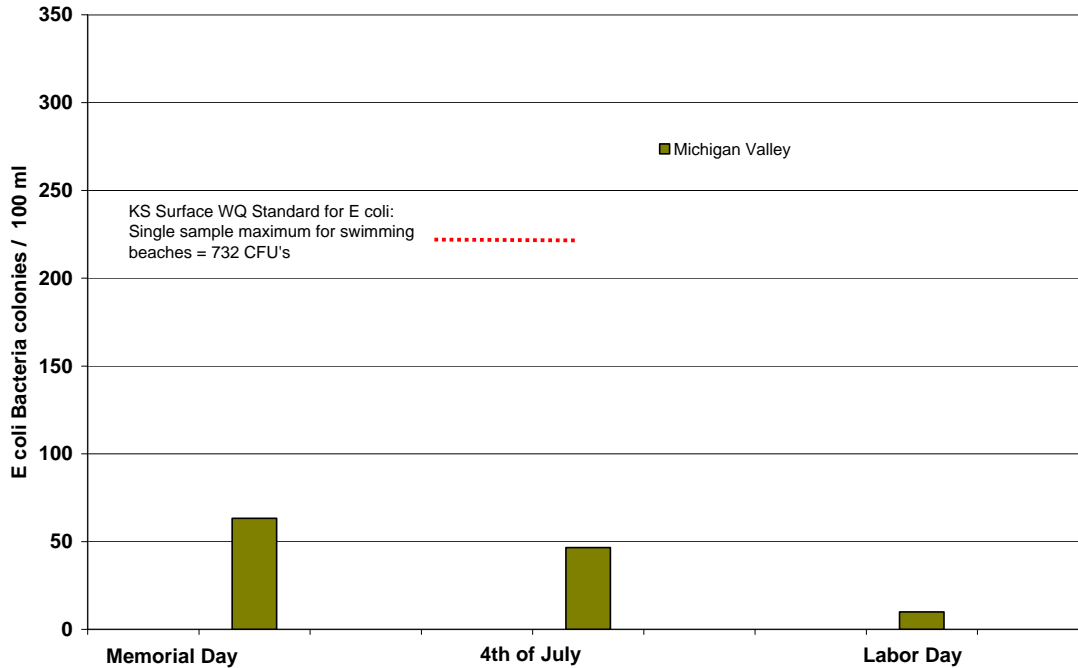


Figure 14.10. Fecal bacteria colonies per 100 ml samples from beach samples collected prior to major holidays at Harry S Truman Lake during 2006.

14.3.3 Outflow

Outfall samples were not collected from Pomona Lake during 2006. All historic data is discussed in context with the lake samples above.

14.4 Future Activities and Recommendations

Sampling activities for 2007 will include continuation of 'ambient' monitoring from May through September, as well as conducting at least one summer vertical profile at each of the three lake sites. To more completely assess specific sub-watershed impacts on Pomona Lake, an additional lake site will be added in 2007. This site (Site 14) will be located in the northeast cove near the confluence of Wolf and Valley Brook Creeks. Due to concerns of potentially toxic bluegreen algae, phycocyanin concentrations will be monitored for the cyanotoxin microcystin during August and September. Geosmin, associated with taste and odor issues in drinking water, will be examined from samples collected near the tower from July through September. Caffeine will be measured at several sites around the lake as a surrogate for human impacts resulting from failing septic systems, WWTP's, illicit dumping from boats, etc. Participation and data sharing efforts will continue with the Pomona WRAPS group.