

## **Texas Stream Team Volunteer Water Quality Monitoring Program 2009 Lake Palestine Data Summary**

This data summary report includes general basin volunteer monitoring activity, general water quality descriptive statistics, tables and graphs, and comparisons to stream standards as related to “aquatic life use” criteria.

In alignment with Texas Stream Team’s core mission, monitors attempt to collect data that can be used in decision-making processes, to promote a healthier and safer environment for people and aquatic inhabitants. While many assume it is the responsibility of Texas Stream Team to serve as the main advocate for volunteer monitor data use, it has become increasingly important for monitors to be accountable for their monitoring information and how it can be infused into the decision-making process, from “backyard” concerns to state or regional issues. To assist with this effort, Texas Stream Team is coordinating with monitoring groups and government agencies to propagate numerous data use options.

Among these options, volunteer monitors can directly participate by communicating their data to various stakeholders. Some options include: participating in the Clean Rivers Program (CRP) Steering Committee Process (see box insert on this page); providing information during “public comment” periods; attending city council and advisory panel meetings; developing relations with local Texas Commission on Environmental Quality and river authority water specialists; and, if necessary, filing complaints with environmental agencies; contacting elected representatives and media; or starting organizing local efforts to address areas of concern.

***The Texas Clean Rivers Act established a way for the citizens of Texas to participate in building the foundation for effective statewide watershed planning activities. Each CRP partner agency has established a steering committee to set priorities within its basin. These committees bring together the diverse interests in each basin and watershed. Steering committee participants include representatives from the public, government, industry, business, agriculture, and environmental groups. The steering committee is designed to allow local concerns to be addressed and regional solutions are recommended. For more information about participating in these steering committee meetings and to contribute your views about water quality, contact the appropriate CRP partner agency for your river basin at: <http://www.tnrcc.state.tx.us/water/quality/data/wmt/contract.html>.***

Currently, Texas Stream Team is working with various public and private organizations to facilitate data and information sharing. One component of this process includes interacting with watershed stakeholders at CRP steering committee meetings. A major function of these meetings is to discuss water quality issues and to obtain input from the general public. While participation in this process may not bring about instantaneous results, it is a great place to begin making institutional connections and to learn how to “work” the assessment and protection system that Texas agencies use to keep water resources healthy and sustainable.

In general, Texas Stream Team efforts to use volunteer data may include the following:

1. Assist monitors with data analysis and interpretation
2. Analyze watershed-level or site-by-site data for monitors and partners
3. Screen all data annually for values outside expected ranges
4. Network with monitors and pertinent agencies to communicate data
5. Attend meetings and conferences to communicate data
6. Participate in CRP stakeholder meetings
7. Provide a data viewing forum via the Texas Stream Team Data Viewer
8. Participate in professional coordinated monitoring processes to raise awareness of areas of concern

Information collected by Texas Stream Team volunteers utilizes a TCEQ and EPA approved quality assurance project plan (QAPP) to ensure data are correct and accurately reflects the environmental conditions being monitored. All data are screened for completeness, precision and accuracy where applicable, and scrutinized with data quality objective and data validation techniques. Sample results are intended to be used for education and research, baseline, local decision making, problem identification, and others uses deemed appropriate by the data user. Graphs are compiled and situated to assist the data user in obtaining information from the collected data. Where applicable, “time” is located on the “x” or horizontal axis and is chronologically listed from oldest to most recent sampling. The “y1” or “y2” axes contain the constituent(s) of interest. Note: pH values were not transformed for graphing purposes or for developing mean statistics; data collection events may not be evenly distributed over time (through seasons and years); sampling events may occur at different times of the day; sample collection and results documentation may have been completed by different monitors over time at each site; data collected by school groups should undergo additional scrutiny before use; data summary information is subject to change.

## **Lake Palestine Description**

Lake Palestine is labeled TCEQ stream segment 0605 in the Neches River Basin. It impounds the Neches River (0606) and Kickapoo Creek (0605A) to create a 25,560 acre reservoir that is designated for: aquatic life, contact recreation, fish consumption, public water supply, and general use.

The Neches River and Kickapoo Creek have both been listed on the TCEQ's 303(d) List of Impaired Water Bodies for various reasons. The Neches River has had listings for zinc in the water since 1996, low pH since 2002, depressed dissolved oxygen since 2004, and bacteria as of 2008. Kickapoo Creek has had listings for bacteria since 2000 and depressed dissolved oxygen since 2006. Lake Palestine itself has been listed for low pH values since 2006. Lake Palestine has also been noted in the past to having eutrophic conditions that contributed to extensive algal growth.

The land cover around Lake Palestine is almost exclusively privately-owned residential uses, and the majority of activity on the lake is recreational, including fishing and boating.

## **DATA**

The following information summarizes water quality data collected at four sites on Lake Palestine in Henderson County and Smith County, Texas. Information presented in this report will be accompanied by corresponding charts and graphs.

For all graphs, site name or sample date is located on the "x" or horizontal axis. This axis represents the independent variable, location of site or time. The data points on the "x" axis progress from upstream to downstream or chronologically from oldest to most recent sampling. The "y1" or "y2" axes contain the constituent(s) of interest. There is also an "R" squared correlation coefficient equation accompanied by a trend line that indicates the strength and direction of a linear relationship between two variables. This coefficient is used to determine if an independent variable is related to a dependent variable. While correlation does not represent causation, there is sometimes a demonstrated cause and effect relationship.

Data collected by Texas Stream Team monitors include: pH, specific conductivity, water and air temperature, dissolved oxygen, total depth, Secchi depth, field observations, flow severity, days since last precipitation, and others.

There were 293 samples taken from Lake Palestine from April 18<sup>th</sup>, 2000 to December 18<sup>th</sup>, 2008. All monitoring was conducted by the Greater Lake Palestine Council in partnership with the Angelina-Neches River Authority. The samples were taken at four different sites across the lake: Wildwood Pier, Flat Creek, Malibu Bay, and Fish Bay. Sampling times ranged from 6:30 am to 6:30 pm.

### **Water Temperature Summary**

Water temperature affects many different aspects of water quality. It can effect feeding, reproduction, and the metabolism of aquatic animals as well as the rate of chemical reactions and solubility of compounds in the water.

In this data set, mean water temperature readings ranged from 20.6°C to 22.6°. The maximum reading of 38° was taken at both Wildwood Pier and Flat Creek in June of 2006 and 2005, respectively. The minimum of 5.5° was taken at Fish Bay on January 5<sup>th</sup>, 2001.

### **Specific Conductivity Summary**

Specific Conductivity (SC) levels measure the amount of Total Dissolved Solids (TDS) that are present in a water sample. These can be a wide variety of inorganic substances such as sodium, chloride, nitrates, and phosphates. Generally, high SC values indicate salt water, while lower values are usually observed in fresh water. SC is measured using micro Siemens per centimeter ( $\mu\text{S}/\text{cm}$ ).

In this data set, mean SC values ranged from 201.9 to 217.3  $\mu\text{S}/\text{cm}$ . The maximum value of 380  $\mu\text{S}/\text{cm}$  was observed at Wildwood Pier on December 15<sup>th</sup>, 2006 and the minimum value of 50  $\mu\text{S}/\text{cm}$  was observed at Flat Creek on January 16<sup>th</sup>, 2007.

### **Dissolved Oxygen Summary**

Dissolved Oxygen (DO) is the oxygen freely available to fish and other aquatic life. Traditionally, the level of DO has been accepted as the single most important indicator of a water body's ability to support desirable aquatic life. It is measured in milligrams per liter (mg/L). When DO levels drop below 6.0 mg/L, it is deemed in exceedance of safe DO levels, thus, dangerous for aquatic life. While DO values are only quality-assured with evidence of dual titrations, all values were kept intact in this dataset for purposes of data completeness. Each site's DO values were fully incorporated into statistical analysis, however, not denoted 100% complete when dual titrations are absent.

In this data set, mean DO values ranged from 7.5 to 8.4 mg/L. The maximum value of 12.2 mg/L was observed at Wildwood Pier on February 4<sup>th</sup>, 2001 and the minimum value of 3.1 mg/L was observed at Fish Bay on August 15<sup>th</sup>, 2005. In general, DO values fall within an exceptional range for aquatic life use. As shown in the graphs displaying the relationship between DO and water temperature, it can be said that these two parameters very often exhibit an inverse relationship. Therefore, DO values can be expected to fall in the summer and rise in the winter. At Fish Bay, DO values stayed within a range of 3.1 to 5.8 mg/L from May to November 2005. This is the longest stretch of exceedingly low values in the dataset.

### **pH Summary**

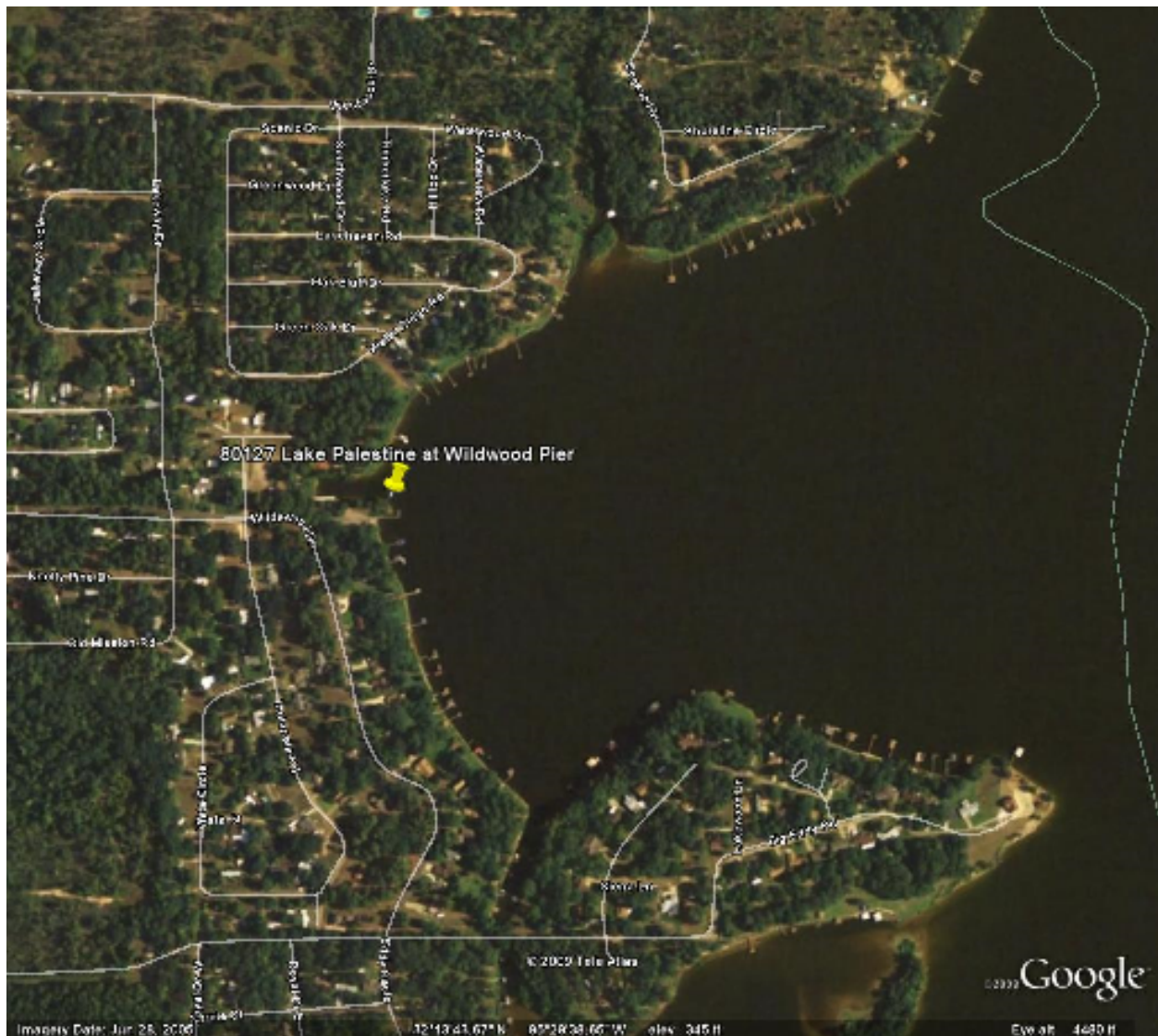
pH levels measure how acidic or alkaline the water sample is. A reading is taken on a 0 – 14 scale measured in standard units (su). When pH levels fall out of the 5 – 9 su range, it begins to become a problem for aquatic life.

In this dataset, mean pH values stay within a tight range of 7.6 to 7.8 su. The maximum value of 9.5 su was observed at Wildwood Pier on September 20<sup>th</sup>, 2004 and the minimum value of 5.5 su was observed at Malibu Bay on January 18<sup>th</sup>, 2005. From the data presented in this report, pH values look to stay consistently healthy.

## SITE BY SITE

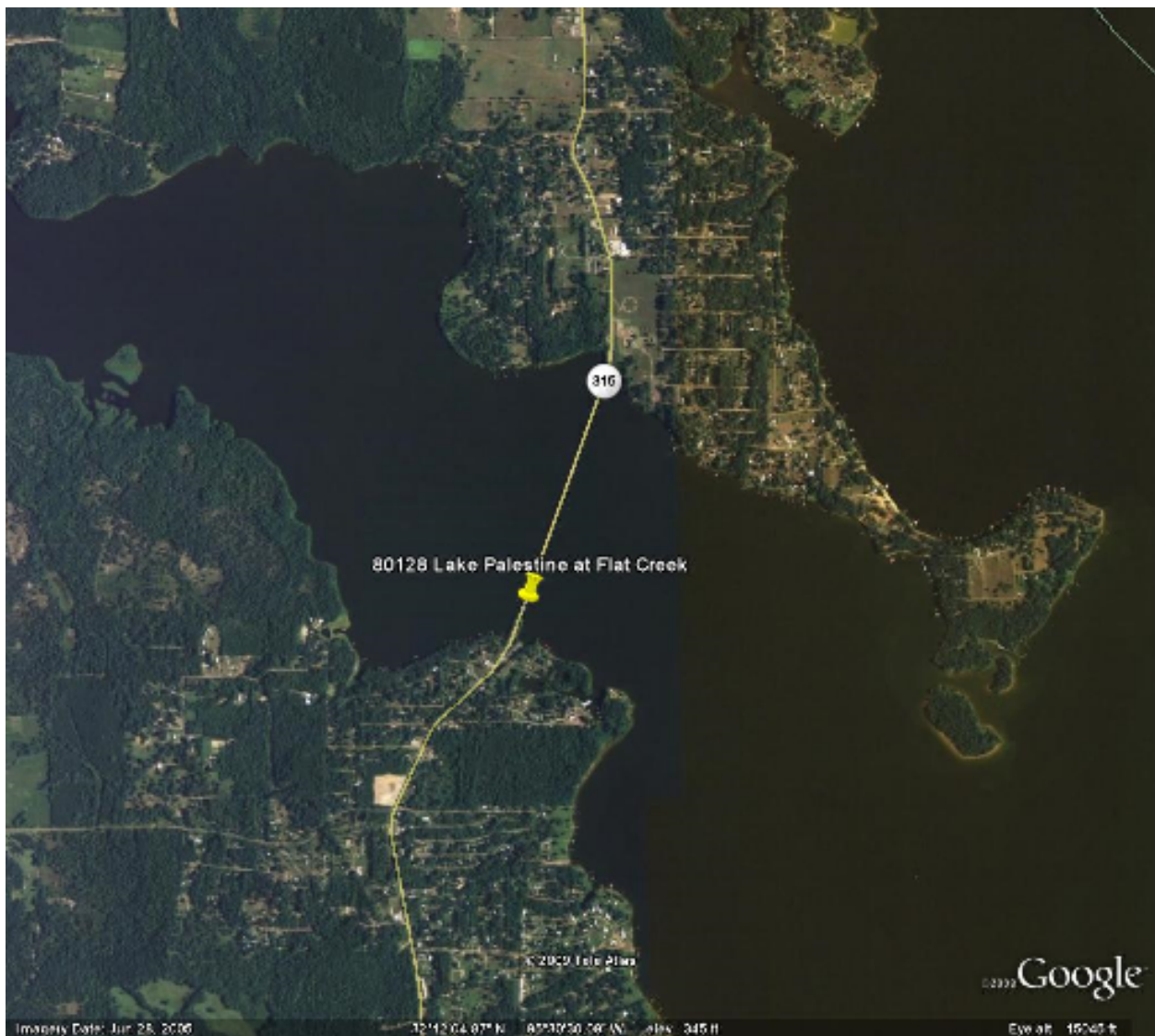
### Lake Palestine at Wildwood Pier

There were 70 samples taken from Wildwood Pier from June 3<sup>rd</sup>, 2000 to December 17<sup>th</sup>, 2008. Sampling times ranged from 9:15 am to 6:30 pm with the average sampling time occurring at 1:30 pm. All sampling at Wildwood Pier was conducted by Gene Gordon, Tom and Nancy Martin, Lynn Hendren, and John Vreeland. Total depth measurements ranged from 0.1 to 2.8 m with an average of 1.1 m. Secchi depth measurements ranged from 0.1 to 1.15 m with an average of 0.66 m. Water temperature readings ranged from 6°C to 38° with an average of 22.6°. SC values ranged from 80 to 380 µS/cm with an average value of 217.3 µS/cm. DO values ranged from 4.9 to 12.2 mg/L with an average value of 8.4 mg/L. Of all DO values, only 3 were less than the 6.0 mg/L standard, giving Wildwood Pier a 4% exceedance rate. pH values ranged from 6.5 to 9.5 su with an average value of 7.8 su.



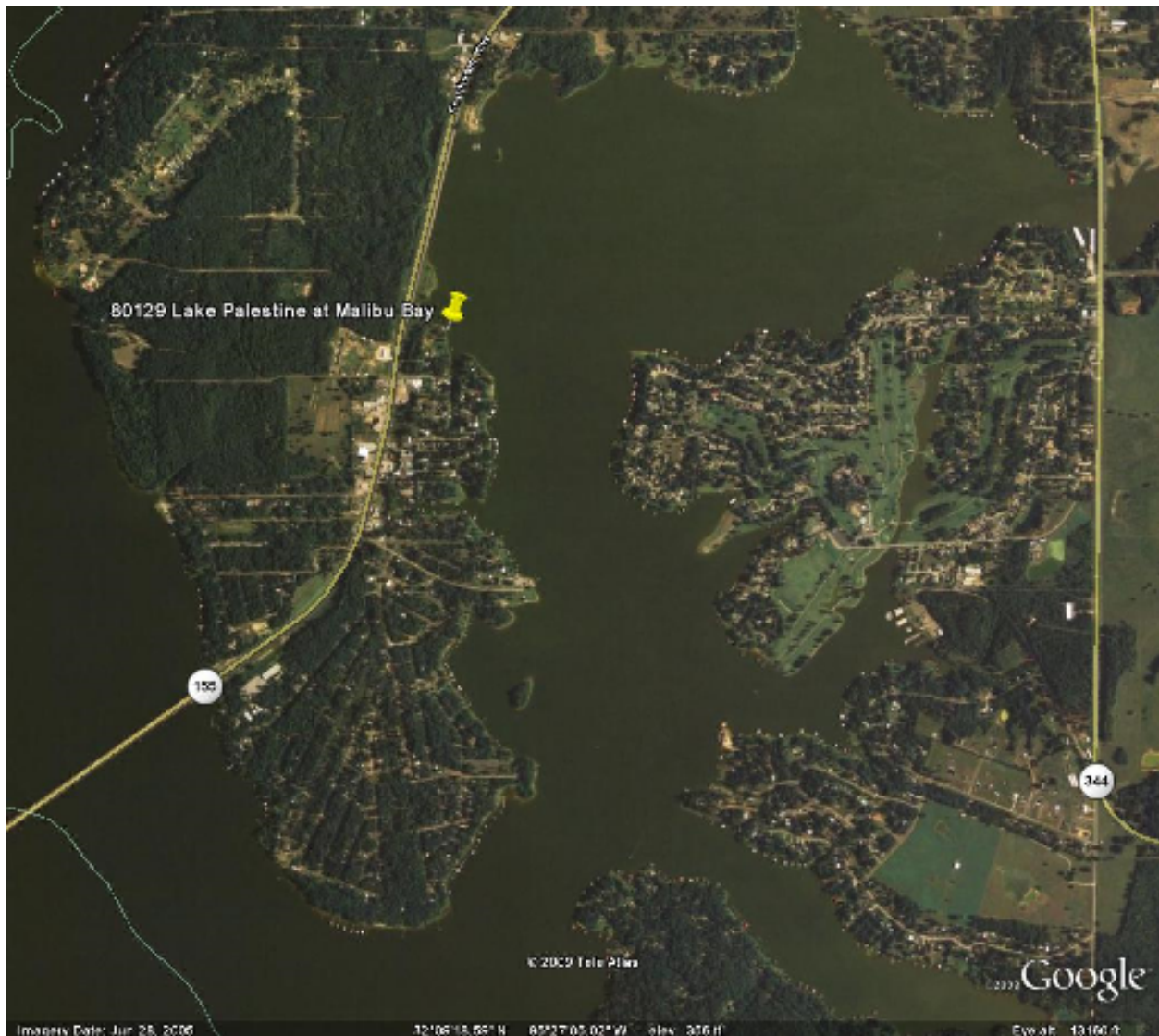
### Lake Palestine at Flat Creek

There were 72 samples taken from Flat Creek from June 8<sup>th</sup>, 2000 to December 18<sup>th</sup>, 2008. Sampling times ranged from 8:00 am to 6:30 pm with the average sampling time occurring at 1:14 pm. All sampling at Flat Creek was conducted by Patrick and Barbara Bowles, Tom and Nancy Martin, Gene Gordon, John Tierney, Richard Hensley, and Wayne and Mary Neff. Total depth measurements ranged from 0.2 to 2.05 m with an average of 1.18 m. Secchi depth measurements ranged from 0.27 to 1.25 m with an average of 0.74 m. Water temperature readings ranged from 6°C to 38° with an average of 22.6°. SC values ranged from 50 to 350  $\mu\text{S}/\text{cm}$  with an average value of 207.2  $\mu\text{S}/\text{cm}$ . DO values ranged from 4.25 to 12.1 mg/L with an average value of 7.8 mg/L. Of all DO values, 8 were less than the 6.0 mg/L standard, giving Flat Creek an 11% exceedance rate. pH values ranged from 6.5 to 9.3 su with an average value of 7.7 su.



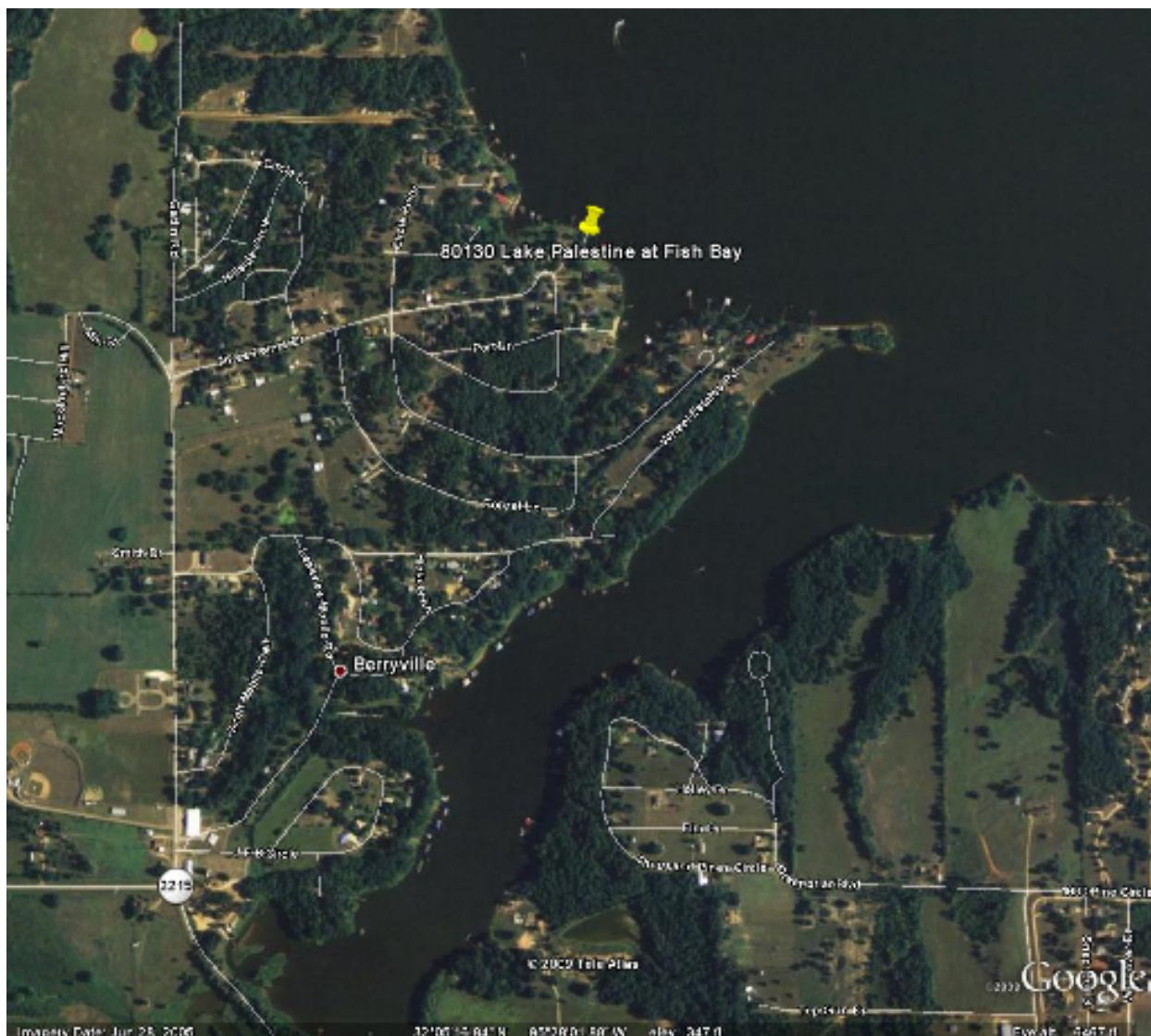
### Lake Palestine at Malibu Bay

There were 77 samples taken from Malibu Bay from April 18<sup>th</sup>, 2000 to December 17<sup>th</sup>, 2008. Sampling times ranged from 6:30 am to 6:30 pm with the average sampling time occurring at 11:25 am. All sampling at Malibu Bay was conducted by David Bowers, Floyd Wiggins, Don Walker, and Sam Houston. Total depth measurements ranged from 0.91 to 3.6 m with an average of 2.3 m. Secchi depth measurements ranged from 0.3 to 1.06 m with an average of 0.6 m. Water temperature readings ranged from 7°C to 33° with an average of 21.4°. SC values ranged from 120 to 360  $\mu\text{S}/\text{cm}$  with an average value of 212.9  $\mu\text{S}/\text{cm}$ . DO values ranged from 5 to 11.2 mg/L with an average value of 8.2 mg/L. Of all DO values, 5 were less than the 6.0 mg/L standard, giving Malibu Bay a 6% exceedance rate. pH values ranged from 5.5 to 9 su with an average value of 7.6 su.



### Lake Palestine at Fish Bay

There were 74 samples taken from Fish Bay from April 18<sup>th</sup>, 2000 to December 18<sup>th</sup>, 2008. Sampling times ranged from 8:00 am to 4:40 pm with the average sampling time occurring at 11:04 am. All sampling at Fish Bay was conducted by Tom Lynn, Edgar Scudder, Wayne Milner, and John Sawyer. Total depth measurements ranged from 0.17 to 2.03 m with an average of 1.24 m. Secchi depth measurements ranged from 0.295 to 1.15 m with an average of 0.8 m. Water temperature readings ranged from 5.5°C to 35° with an average of 20.6°. SC values ranged from 90 to 310  $\mu\text{S}/\text{cm}$  with an average value of 201.9  $\mu\text{S}/\text{cm}$ . DO values ranged from 3.1 to 11.1 mg/L with an average value of 7.5 mg/L. Of all DO values, 14 were less than the 6.0 mg/L standard, giving Fish Bay a 19% exceedance rate. pH values ranged from 7 to 8.8 su with an average value of 7.6 su.





**DESCRIPTIVE STATISTICS TABLES**

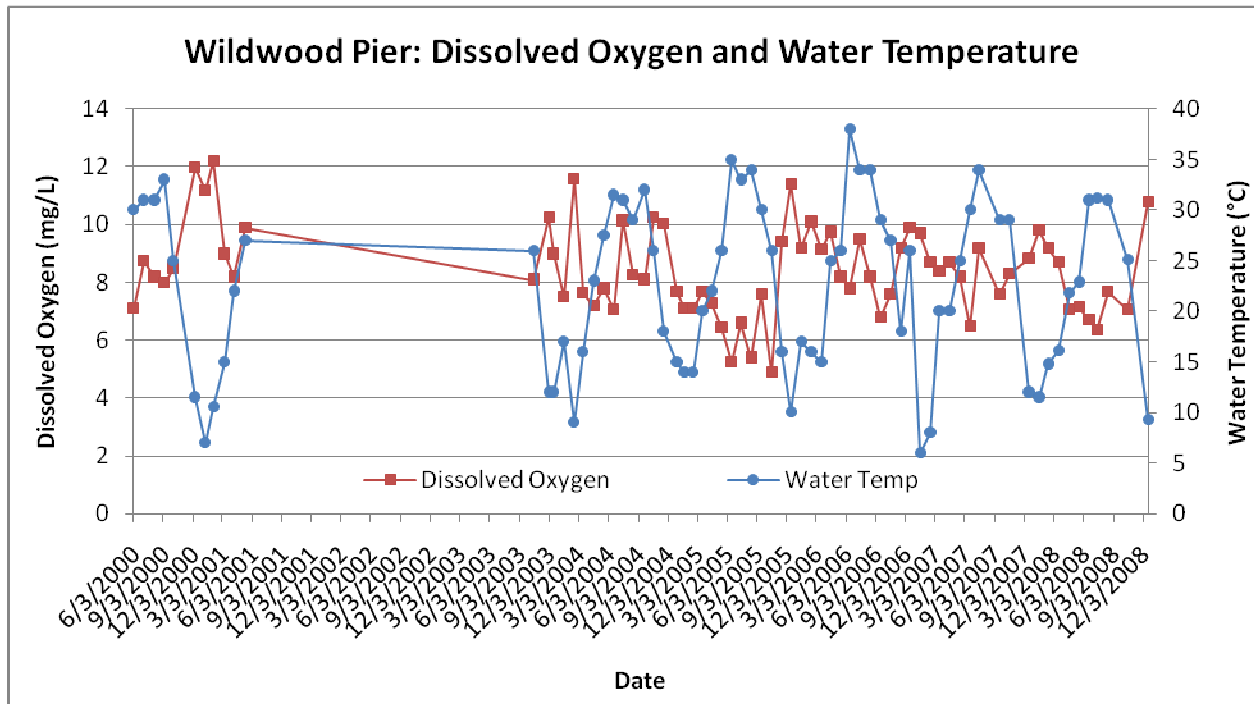
<b>Wildwood Pier (Site # 80127)</b>						
<b>Parameter</b>	<b>N</b>	<b>% complete</b>	<b>Min</b>	<b>Mean</b>	<b>Max</b>	<b>Std. Dev.</b>
Sample Time	69	99	9:15	13:30	18:30	2:16
Total Depth (m)	66	94	0.1	1.1	2.8	0.49
Secchi Depth (m)	62	89	0.1	0.66	1.15	0.19
Air Temperature (°C)	70	100	1	23.3	36	8.85
Water Temperature (°C)	70	100	6	22.6	38	8.4
Specific Conductivity (µS/cm)	69	99	80	217.3	380	66.2
Dissolved Oxygen (mg/L)	59	84	4.9	8.4	12.2	1.54
pH (su)	70	100	6.5	7.8	9.5	0.57
DO exceedance [< 6.0 mg/L]						
		3 of 70	4%			

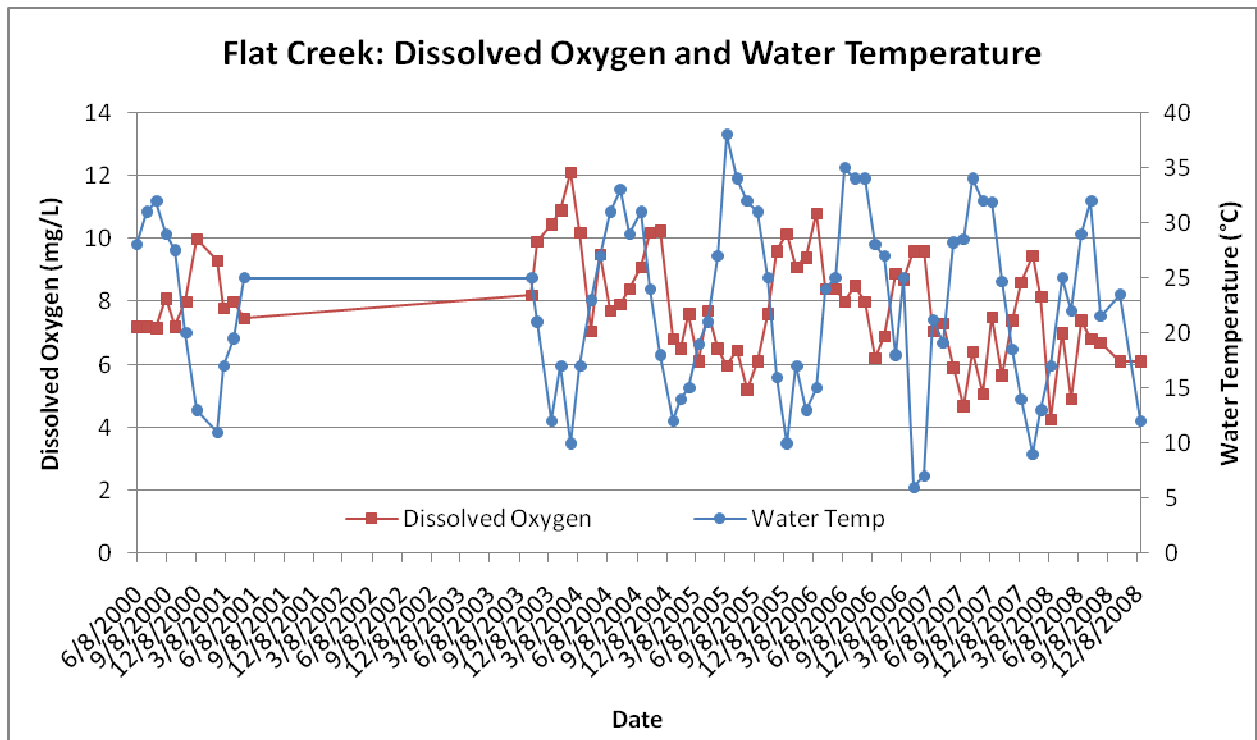
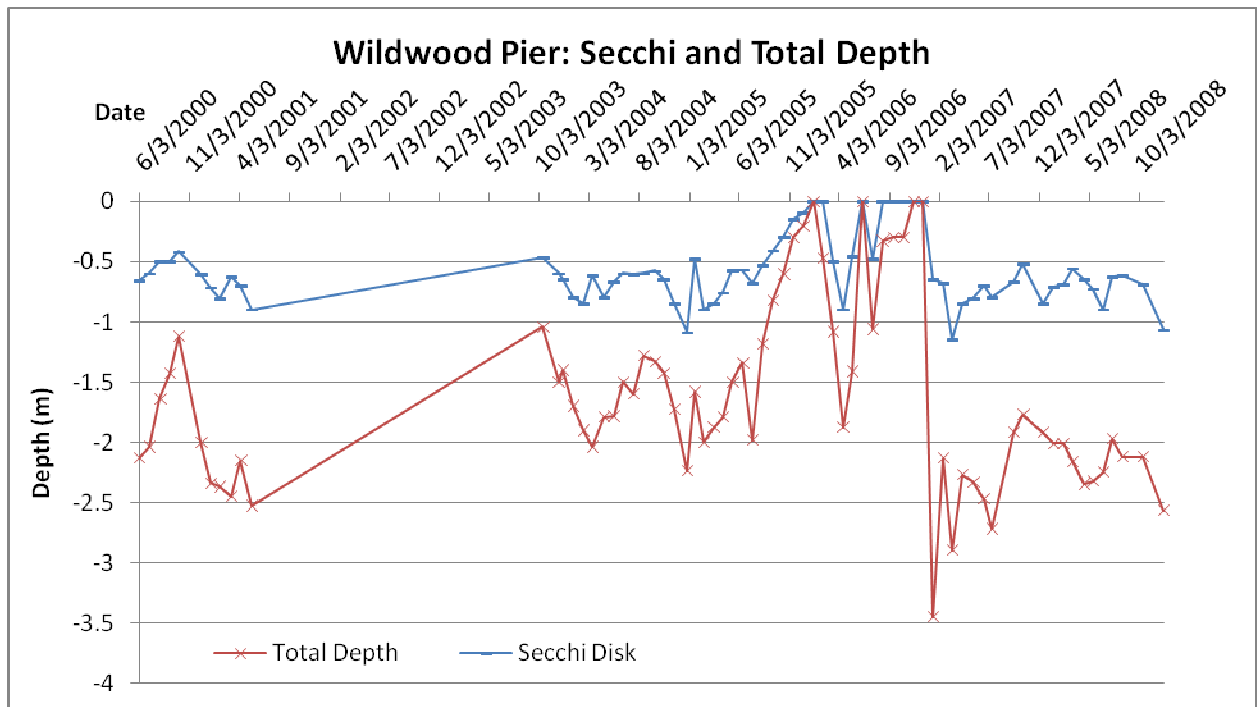
<b>Flat Creek (Site # 80128)</b>						
<b>Parameter</b>	<b>N</b>	<b>% complete</b>	<b>Min</b>	<b>Mean</b>	<b>Max</b>	<b>Std. Dev.</b>
Sample Time	71	99	8:00	13:14	18:30	2:32
Total Depth (m)	67	93	0.2	1.18	2.05	0.44
Secchi Depth (m)	64	89	0.27	0.74	1.25	0.22
Air Temperature (°C)	72	100	1	23.2	37	8.51
Water Temperature (°C)	72	100	6	22.6	38	7.92
Specific Conductivity (µS/cm)	72	100	50	207.2	350	61.2
Dissolved Oxygen (mg/L)	61	85	4.25	7.8	12.1	1.64
pH (su)	72	100	6.5	7.7	9.3	0.58
DO exceedance [< 6.0 mg/L]						
		8 of 72	11%			

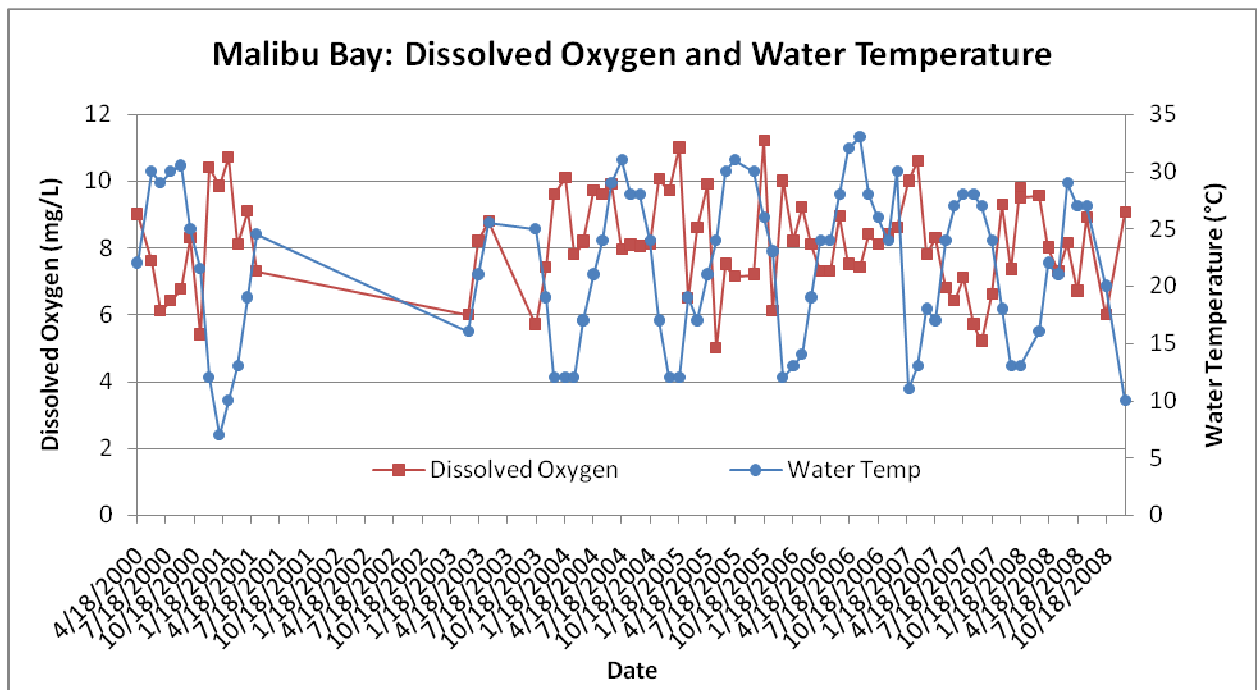
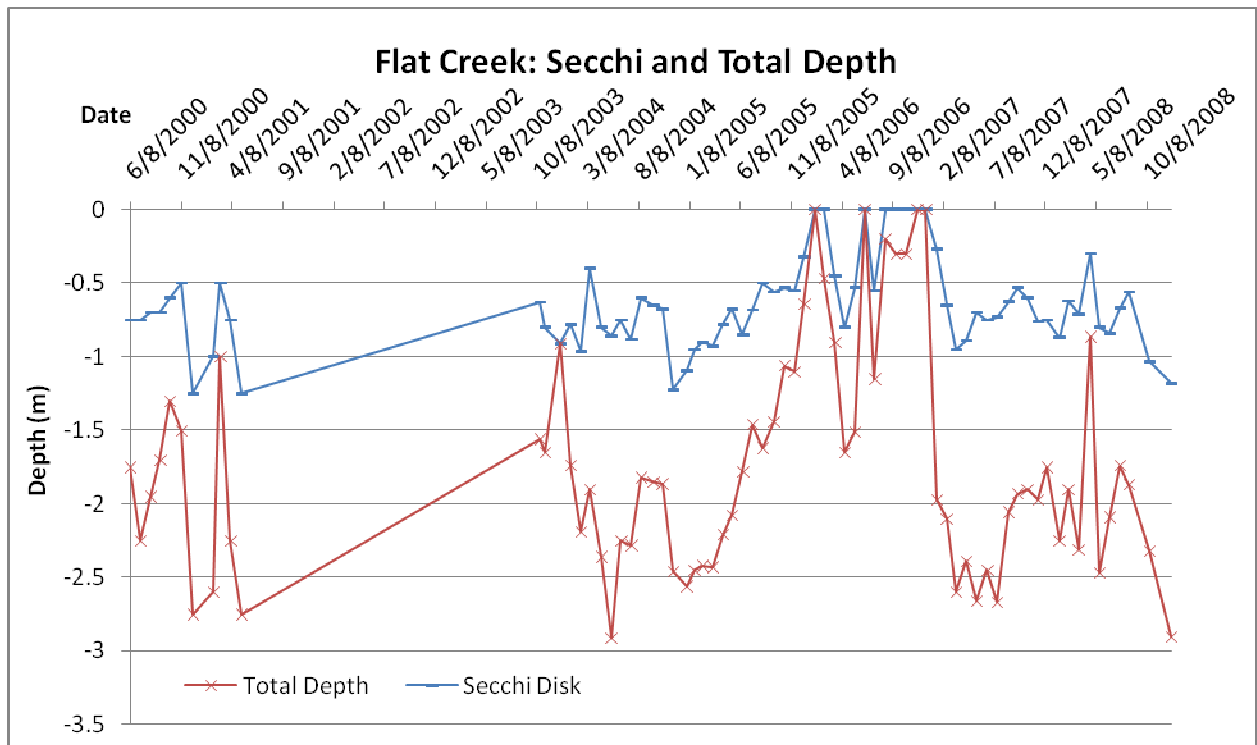
<b>Malibu Bay (Site # 80129)</b>						
<b>Parameter</b>	<b>N</b>	<b>% complete</b>	<b>Min</b>	<b>Mean</b>	<b>Max</b>	<b>Std. Dev.</b>
Sample Time	76	99	6:30	11:25	18:30	2:38
Total Depth (m)	77	100	0.91	2.3	3.6	0.53
Secchi Depth (m)	76	99	0.3	0.6	1.06	0.16
Air Temperature (°C)	77	100	6	21.8	35	6.8
Water Temperature (°C)	77	100	7	21.4	33	6.8
Specific Conductivity (µS/cm)	75	97	120	212.9	360	45.73
Dissolved Oxygen (mg/L)	63	82	5	8.2	11.2	1.46
pH (su)	77	100	5.5	7.6	9	0.6
DO exceedance [< 6.0 mg/L]						
		5 of 77	6%			

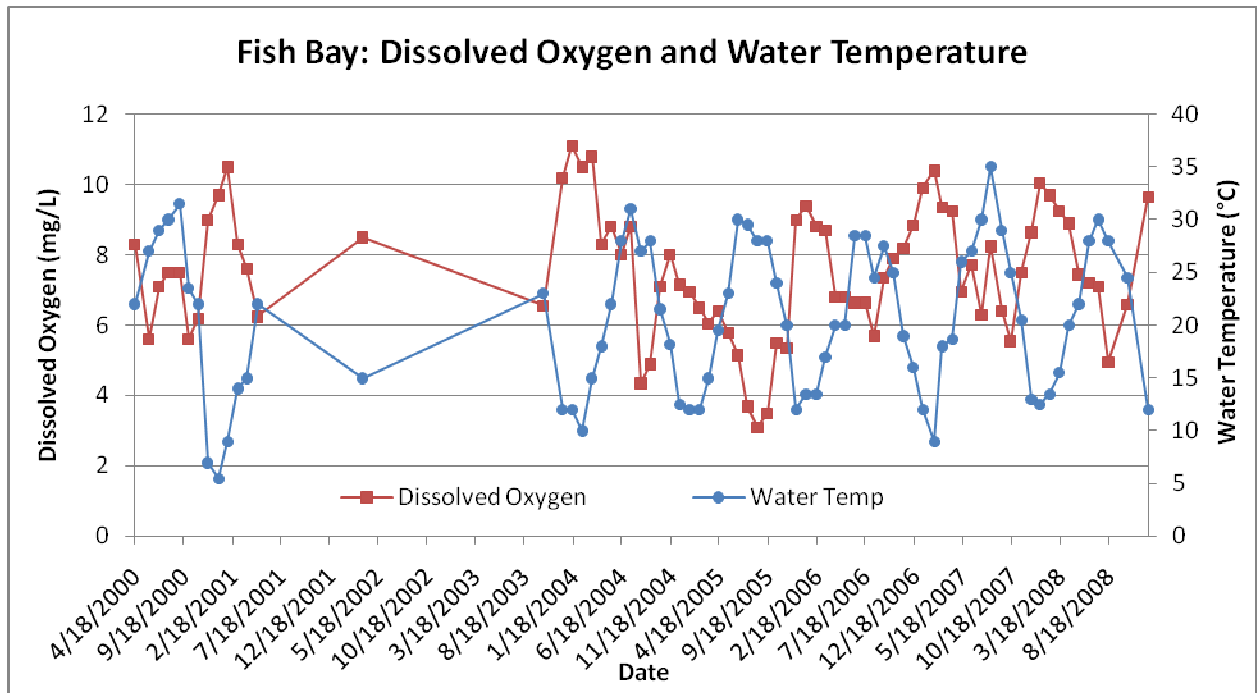
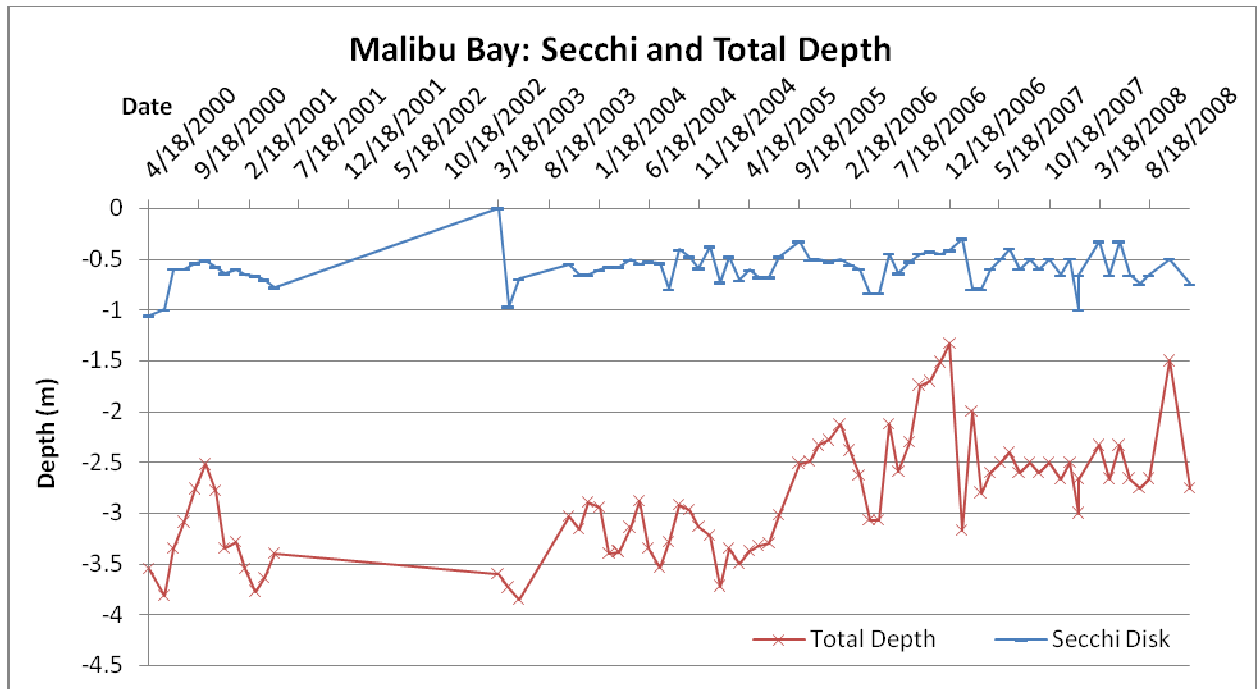
Fish Bay (Site # 80130)						
Parameter	N	% complete	Min	Mean	Max	Std. Dev.
Sample Time	74	100	8:00	11:04	16:40	2:09
Total Depth (m)	68	92	0.17	1.24	2.03	0.44
Secchi Depth (m)	65	88	0.295	0.8	1.15	0.17
Air Temperature (°C)	74	100	4.5	20.3	34	6.8
Water Temperature (°C)	74	100	5.5	20.6	35	7.1
Specific Conductivity (µS/cm)	74	100	90	201.9	310	60
Dissolved Oxygen (mg/L)	64	86	3.1	7.5	11.1	1.8
pH (su)	74	100	7	7.6	8.8	0.3
DO exceedance [ $< 6.0$ mg/L]		14 of 74	19%			

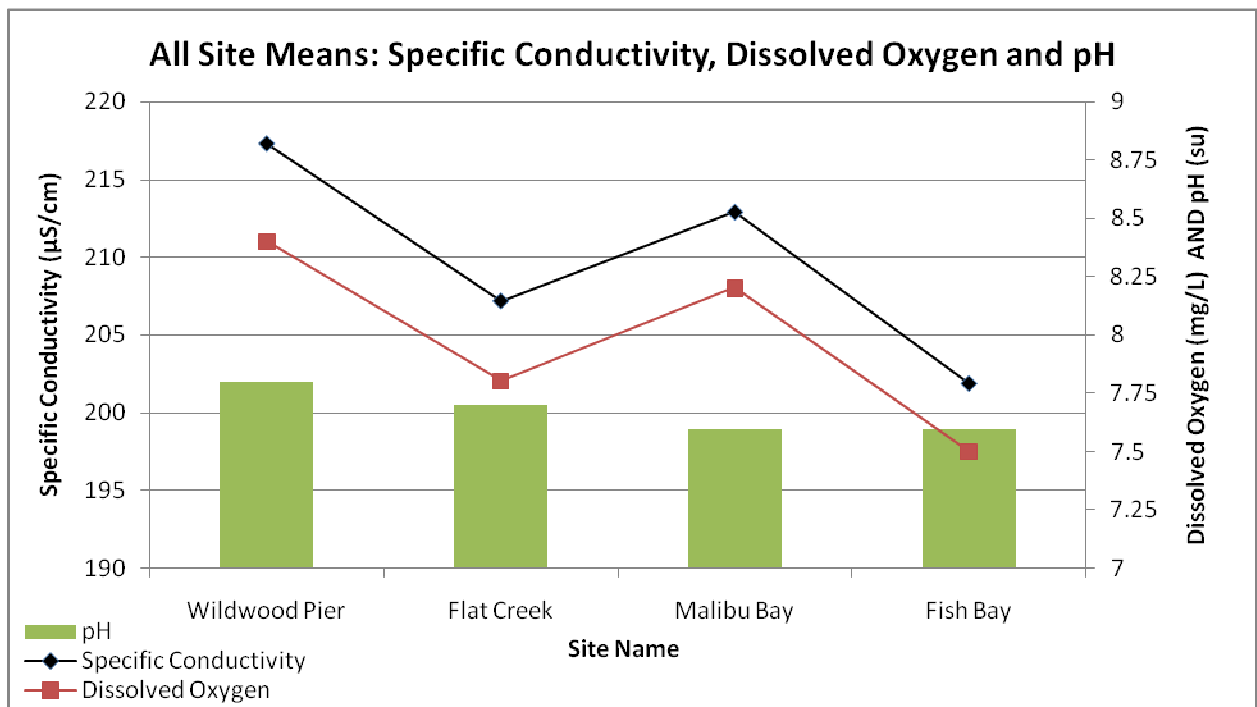
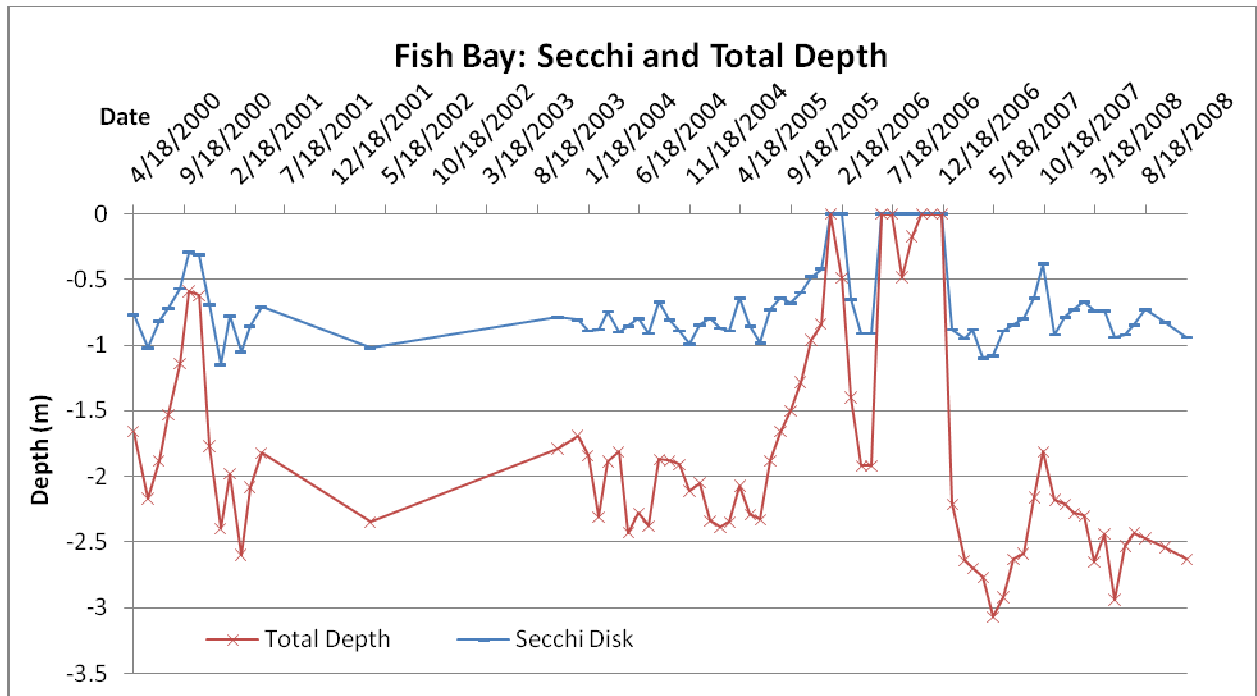
### GRAPHS











## **CONCLUSIONS**

The dataset presented in this report, collected by the Greater Lake Palestine Council, stays fairly consistent in terms of months monitored. Except for one sampling event at Fish Bay on March 31<sup>st</sup>, 2002; sampling events break in May 2001 until March 2003. However, once activity resumes again in 2003, sampling events go essentially uninterrupted until the end of 2008. This is a sign of a committed team of volunteers. With consistent data, it becomes easier to recognize trends in the water quality.

This dataset does not support Lake Palestine's 303(d) listing for low pH levels. As can be seen in the graph with all site means for Specific Conductivity, Dissolved Oxygen, and pH; pH levels stay on par with each other throughout the lake. While the lowest pH value in the dataset, a 5.5, is toward the lower end of a desirable pH balance, the next lowest value in the entire dataset is a 6.5. Therefore, the value of 5.5 could be considered an outlier and not representative of ambient conditions.

Of all 293 samples taken from Lake Palestine that are referenced in this report, only 30 recorded a value lower than the 6.0 mg/L standard for "exceptional" aquatic life use criteria. This represents 10% of all DO values in the dataset. The lowest DO exceedance rate of 4% is at the most upstream site, Wildwood Pier. The highest DO exceedance rate of 19% is at the most downstream site, Fish Bay. With almost one fifth of sampling events yielding an exceedance at Fish Bay, this site should be noted for repeatedly low DO levels.

As shown in the graphs for DO and Water Temperature, there tends to be an inverse relationship between these two parameters. The higher DO readings usually occur in the winter and the lower in the summer. As noted under the DO summary section, a streak of low values occurred at Fish Bay from May to November 2005 that stayed within a range of 3.1 to 5.8 mg/L. The recorded value of 3.1 mg/L is the lowest DO value observed in the dataset.