LAKE COMO

State of the Lake Report
&
Watershed Management Plan

September 2007

Cayuga County Department of Planning and Economic Development,
Cayuga County Soil &Water Conservation District
&
The Lake Como Association

Acknowledgements

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Thanks to all landowners in the watershed who filled out surveys.

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Published by the Cayuga County Soil and Water Conservation District, James Hotaling, Executive Director.

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This document was prepared by funding provided by Congressman Walsh.

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Section 1: Watershed Characteristics

Geography of the Lake

Lake Como is a small lake that extends in a northwesterly direction and is located in southern Cayuga County, New York, in the Town of Summer Hill. It is located in the Oswego-Seneca-Oneida River Basin, south of the Seneca River.

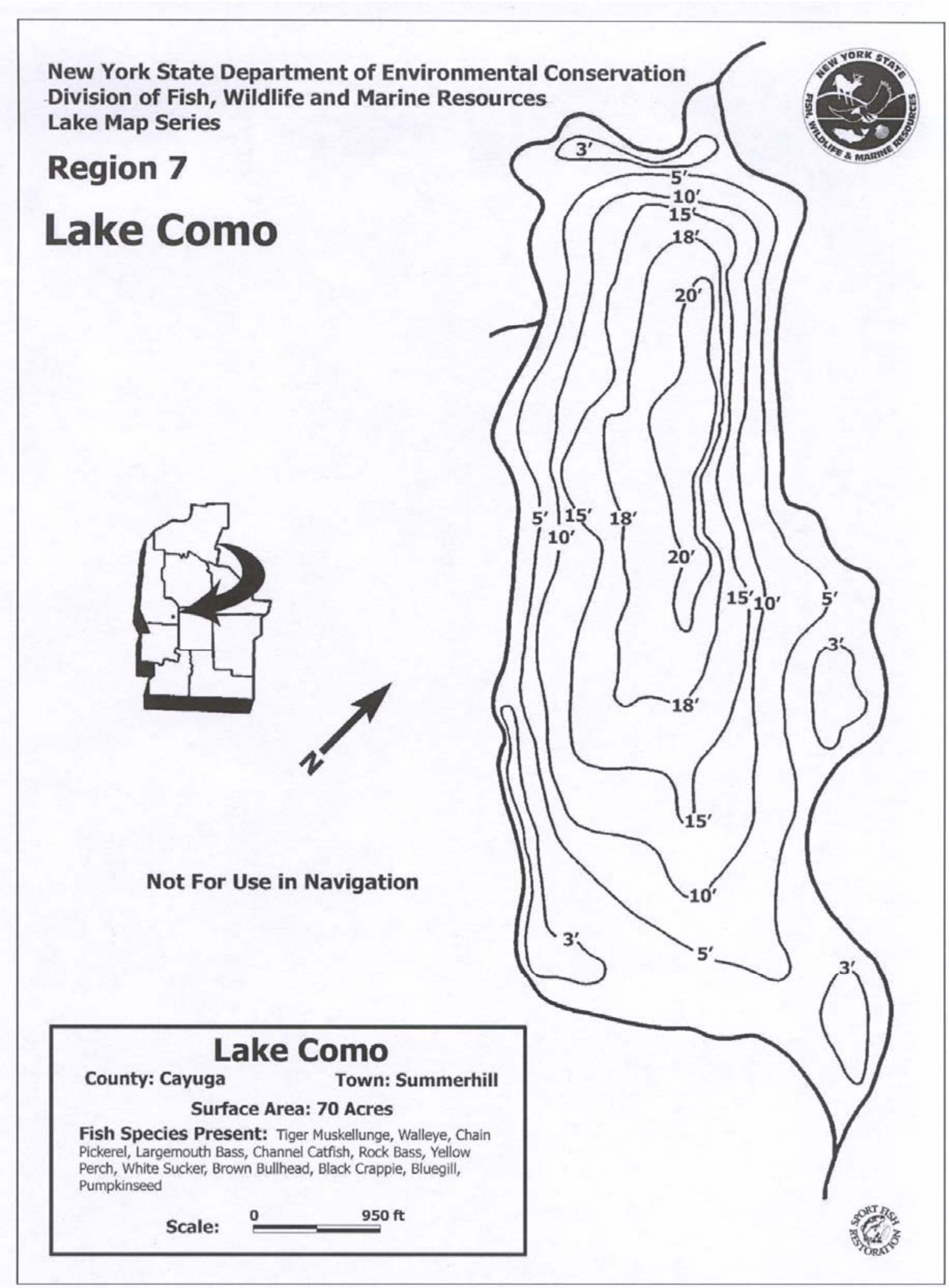
Lake Como is a relatively shallow lake with a mean depth of 10 feet (3 m) and a maximum depth of 22 feet (6.7 m) (Effler et al., 1988). The deepest water is found in the center of the lake (see Figure 1). Lake Como is a relatively small lake with a length of 0.62 miles (1 km), a maximum width of 0.25 miles (0.4 km) and a surface area of 64 acres (0.26 km^2). It has a mean elevation of 1309 feet above sea level (*Lake Como, USGS Sempronius (NY) Topo Map,* 2007). For more information, see Table 1.

Lake Como is an upland lake, which is a lake that is formed in the upper portions of a watershed and that tends to be part of extensive wetland systems (Hennigan, 1992). Both the north and south end of the lake contain wetlands and there is a steep ridge that extends northwesterly on the west side of Lake Como. There are homes and camps along most of the shoreline. Two unnamed tributaries enter Lake Como in the north and the Lake flows out the Lake Como Outlet in the south. The Lake Como Outlet enters Fall Creek, which flows into Cayuga Lake.

Table 1: Geographic and Morphometric Information on Lake Como, NY.

		Source
Latitude	42.677ºN	*Lake Como, USGS Sempronius (NY) Topo Map,* 2007
Longitude	76.303ºW	*Lake Como, USGS Sempronius (NY) Topo Map,* 2007
Preliminary Watershed County	Cayuga	Cayuga County GIS
Surface Area	64 acres (0.26 km^2)	NYSDEC and NYSFOLA, 2006
Length	0.62 miles (1 km)	Effler et al., 1988
Maximum Width	0.25 miles (0.4 km)	Hennigan, 1992
Shoreline	1.5 miles (2.4 km)	Hennigan, 1992
Mean Depth	10 feet (3 m)	Effler et al., 1988
Maximum Depth	22 feet (6.7 m)	Effler et al., 1988
Estimated Volume	221 Million gallons	Hennigan, 1992
Retention Time	0.36 years	NYSDEC and NYSFOLA, 2006
Preliminary Watershed Area	2793 acres (11.3 km^2)	Cayuga County GIS
Runoff	0.508 m/year	NYSDEC and NYSFOLA, 2006
Elevation	1309 ft.	*Lake Como, USGS Sempronius (NY) Topo Map,* 2007
NYSDEC Water Quality Class	B	NYSDEC

Figure 1: Depth Contour Map of Lake Como (*Lake Como (Summer Hill) Contour Map*, 2007)



Classification of the Lake

The New York State Department of Environmental Conservation (NYSDEC) classifies Lake Como as a Class B waterbody. The best usages of Class B waters are primary and secondary contact recreation and fishing; and these waters shall be suitable for fish propagation and survival (*6 NYCRR Part 701 Classifications-Surface Waters and Groundwaters*, 2007). Data from the 2005 New York State Citizens Statewide Lake Assessment Program (CSLAP) for Lake Como indicates that Lake Como could be classified as mesoeutrophic (moderately to highly productive) (NYSFOLA and NYSDEC, 2006).

Priority Waterbodies List

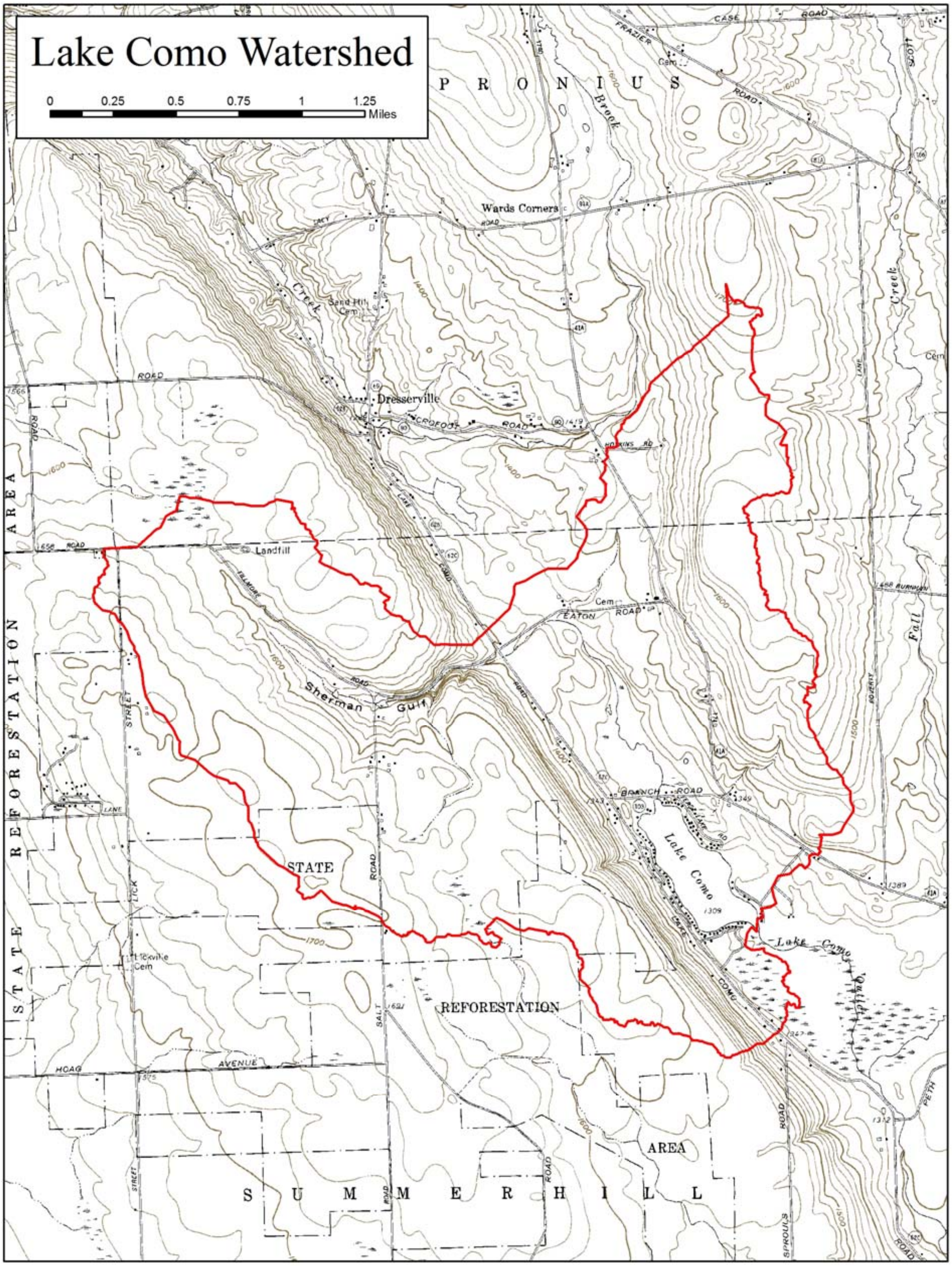
Lake Como is listed in the NYSDEC publication "The 1996 Priority Waterbodies List for the Oswego-Seneca-Oneida River Basin" with a primary use impairment of boating, a primary pollutant of nutrients and a primary source of on-site systems. Additional use impairments include bathing being stressed, fish survival being threatened, and fishing and aesthetics being impaired (NYSDEC, 1996). Additional pollutants are silt (sediment), oxygen demand, water level/flow, pathogens and aesthetics; and additional sources include streambank erosion, agriculture, and roadbank erosion (NYSDEC, 1996). Further details from this document state (NYSDEC, 1996) :

> *Use Impairment: Rooted aquatic vegetation covering 50% of the lake impairs boating, fishing and bathing use of the lake. Reduced or zero oxygen levels in the hypolimnion threatens fish survival.*
>
> *…It is considered eutrophic with the abundant weed and algae problems. Large accumulations of sediment exist on the lake bottom which provide ample rooting substrate for nuisance macrophytes. Aesthetics are impaired by algal blooms, dense weed beds, and garbage found in lake waters.*
>
> *Primary source of nutrients appears to be on-site systems from surrounding lake residences. Agricultural runoff from manure-spread fields, and cows in stream also contribute nutrients. Farm, streambank and roadbank erosion contribute sediment. Health department has measured high coliform levels at times. Changes in water level due to beaver dams on inlet and outlet have flooded some residences possibly causing more nutrient loading from leach fields. Flooding also results in floatables, garbage, trash entering lake from certain properties close to lake where these items are dumped.*

Watershed Description

A watershed is the area of land that drains into a river, stream or lake. The Lake Como Watershed is the area of land that drains into Lake Como. The Cayuga County GIS staff developed a preliminary watershed for Lake Como by utilizing digital elevation data for Cayuga County. The preliminary Lake Como watershed (hereafter referred to as the watershed), or area of land that serves as the drainage basin for the lake, is approximately 2793 acres (see Figure 2). The majority of the watershed is located within the Town of Summer Hill in Cayuga County. The upper reaches of the watershed are in the Town of Sempronius and a small portion of the Town of Locke. The ratio of land to lake surface area is 43.6 acres of watershed per acre of lake surface area.

Figure 2: Preliminary Lake Como Watershed. Cayuga County GIS.



Two unnamed tributaries enter the north end of Lake Como and the water flows southward and exits the Lake Como Outlet. However, Miller (1978) lists Lake Como as a spring fed lake, so the majority of the water entering the lake is probably groundwater.

Topography

Lake Como and its watershed are located in Plateau Country, which extends from the Catskills to the Western end of the State (Cayuga County EMC, 1979). This area was once a high plain that has been cut into hill and valley topography by erosion and glacial pressure (Cayuga County EMC, 1979). The highest elevations in the watershed occur in the western reach of the watershed (1720 feet above sea level) and northeastern reach (1700 feet above sea level). The lowest elevation is the lakeshore at 1309 feet above sea level.

Directly west of the lakeshore stretching northwest and southeast is a ridge that blocks prevailing winds which, along with elevation, makes the Lake Como area slightly colder than surrounding areas (Blake, 2002).

Geology

Bedrock Geology

The bedrock that underlies the Lake Como watershed is sedimentary and originated between the Upper Silurian Period (approximately 420 million years ago) and the Devonian Period (approximately 385 million years ago) (GFLRPC and Ecologic, 2000). Most of this bedrock was formed while the area was overlain by an inland sea and this area eventually underwent glaciation and erosion.

The bedrock in this area is part of the Portage Formation, which includes Sherbourne sandstone and Ithaca shales with some Enfield shales on the highest elevations (Cayuga County Planning Board, 1969). These rocks are thinly bedded shales and fine ground dense sandstones that are predominately grey in color, are non-calcareous and contribute most of the material in the glacial till in this portion of the County (Cayuga County Planning Board, 1969). The soils they form are mainly those of the Lordstown, Valois, Langford and Erie series which are generally low in lime and with medium potassium supplying power (Cayuga County Planning Board, 1969).

Surficial Geology

The surficial geology materials of the northern portion of Lake Como and its watershed are till of variable texture and thicknesses (GFLRPC and Ecologic, 2000). Along the southern portion of the lake and its watershed, the surficial geology materials are lacustrine sand deposits which are well sorted stratified arrangements of permeable quartz sand (GFLRPC and Ecologic, 2000).

Soils

Soil associations are intended to broadly describe the soil characteristics that are most dominant in an area. It gives a general idea of the soils in the area. The soil association that makes up most of Lake Como and its adjacent watershed is the Howard Langford Association. This association consists of approximately 40% Howard soils and 25% Langford soils (Cayuga County Planning Board, 1969). The topography is rolling to moderately steep and is subject to serious erosion only on the steepest slopes (Cayuga County Planning Board, 1969). These soils are good for agriculture, are favorable to irrigation and have slight limitations for septic systems or drainage fields (Cayuga County Planning Board, 1969). There are granular materials under the dominate soils and wells provide good water yields (Cayuga County Planning Board, 1969).

The soil association that makes up the upper reaches of the watershed is the Langford Erie Association. This soil association consists of approximately 60% Langford soils and 20% Erie soils (Cayuga County Planning Board, 1969). These are poor crop soils that tend to have strongly expressed fragipans that interfere with roots and water movement (Cayuga County Planning Board, 1969). They provide a good supply of surface water, but the shale bedrock makes poor aquifers even though the wells tend to not go dry (Cayuga County Planning Board, 1969).

Figure 3: Soil Survey of the Lake Como Area (Hutton et al., 1971)

Soil series are the smallest levels of soil classification and the ones closest to Lake Como are shown in Figure 3. All of the following soils series information is from the United States Geological Survey's (USGS) document "Soil Survey: Cayuga County New York" (Hutton et al., 1971). Most residences in the Lake Como watershed are found on the shorelines of Lake Como. Therefore, the soil series along the shoreline can have an effect on these residences and their effect on the lake. The western shoreline consists of mainly Langford Howard gravelly loam with 8 to 15% slopes (LhC). These soils have severe limitations for septic tank effluent disposal due to variable permeability. The northeastern shoreline consists of mainly Howard gravelly loam with 3 to 8% slopes (HwB) with some Alton-Howard soils with 15 to 25% slopes (AoD). The Howard gravelly loam has slight limitations for septic system effluent while the Alton-Howard soils have severe limitations due to slope. The southeastern shoreline consists of mainly Howard gravelly loam with 8-15% slopes (HwC) and 0-3% slopes (HwA) and these soils have slight limitations for septic system effluent.

The southern shoreline of the lake consists of Langford Howard gravelly loam with 2 to 8% slopes (LhB), which has slight limitations for septic system effluent. There is also some Sloan silt loam (Sn) on the southern shoreline where houses have been built. This soil is poorly drained and flooded several times a year and has severe limitations for septic tank effluent due to flooding and prolonged wetness. There are also deep muck soils (Mr) at the northern and southern ends of the lake where water enters and exits the lake. On the central eastern side of the lake, there is also some alluvial land (Al), which is recent deposited soil and sediment adjacent to streams.

Lake Bottom

The lake bottom mainly consists of very deep loose organic and inorganic muck that generally exceeds 13 feet (4 m) in depth (Miller, 1978). The sediment composition of the bottom consists of muck and silt (20% sand, 74% silt and 6% clay), except for the northeast corner which consists of hard sand (77% sand, 20% silt and 3% clay) and a small cove with sand and cobbles (Miller, 1978). There was substantial human debris on the bottom when Miller did his aquatic vegetation survey in 1977, which included glass and steel containers, appliances, tires and toys.

Climate and Precipitation

The climate of the Lake Como watershed area is a humid continental type with warm summers and long cold winters (GFLRPC and Ecologic, 2000). The area lies near or on the major west to east track of cyclonic storms and is characterized by variety and frequent periods of stormy weather, especially in the winter (GFLRPC and Ecologic, 2000).

The weather station utilized for climatological data was a U.S. Climate Reference Network (USCRN) climate station developed as part of the National Oceanic and Atmospheric Administration (NOAA). This station is located approximately 14 miles south from Lake Como. Temperature and precipitation are from records dated 1971-2000.

Temperature

The normal annual average temperature is 46.1ºF (7.8ºC), with July having the warmest average temperature (68.7ºF/20.4ºC) and January having the coldest (22.6ºF/-5.2ºC).

Precipitation

Precipitation is well distributed throughout the year with an average rainfall of 36.71 inches per year. Monthly averages (water equivalent) range from 2.06 inches in February to 3.87 inches in June.

The late fall and winter have frequent snow squalls and the average snowfall is 67.3 inches per year. The maximum monthly average for snowfall occurs in January with 16.9 inches.

Hydrology

Runoff

As precipitation lands on a lake's watershed it can infiltrate the soil, percolate into groundwater, evaporate into the atmosphere, or runoff. Runoff occurs when precipitation flows over Earth's surface into streams or other surface waters. The amount of water running into Lake Como has not been quantified. The retention time, or how long water stays in the lake, has been stated to be 0.20 years (Hennigan, 1992) and 0.36 years (NYSDEC and NYSFOLA, 2006).

Groundwater

The hydrologic budget is not quantified but groundwater is believed to be significant to annual water budget for Lake Como (Effler et al., 1988). Miller (1978) also stated that Lake Como is a spring fed lake.

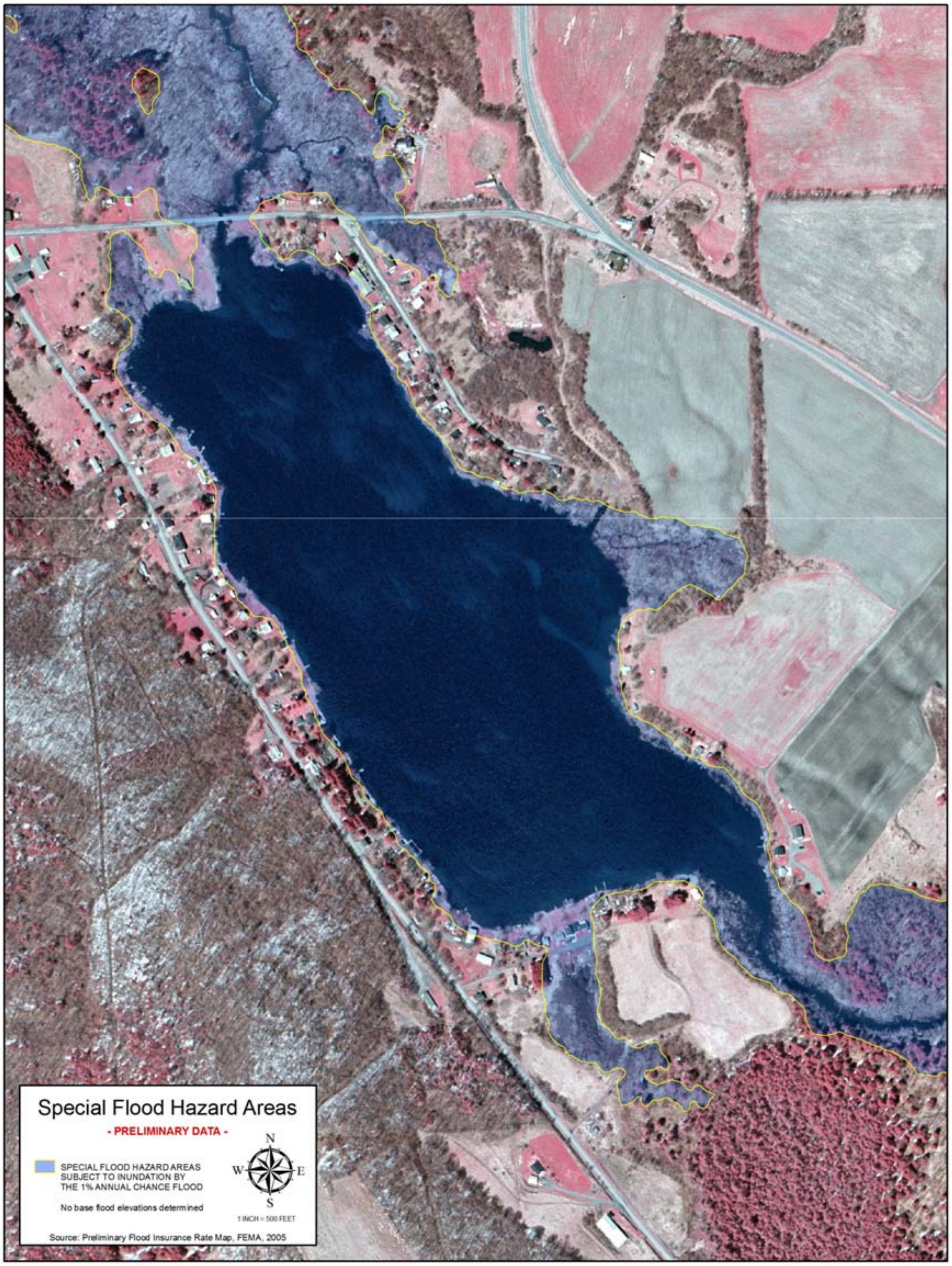
The area around Lake Como and its immediate watershed consists of the Howard Langford Soil Association, which tends to have wells with good water yield (Cayuga County Planning Board, 1969). The Langford Erie Soil Association, which makes up the upper portions of the Lake Como watershed, tends to not be a good aquifer due to the shale bedrock, but the wells do not usually go dry (Cayuga County Planning Board, 1969).

Lake Levels

There are no gauges on Lake Como to measure lake level and no studies were found on its levels. There has been public concern about the lake levels based on visual observations. Miller (1988) found that beaver dams in Fall Creek were causing lake level issues. Beaver dams in Fall Creek were a concern in 2006 and beaver baffles were installed to reduce the lake level.

The preliminary Flood Insurance Rate Map from FEMA (2005) shown in Figure 4 shows that that there are houses located in the special flood hazard areas that are subject to the 1% annual chance flood.

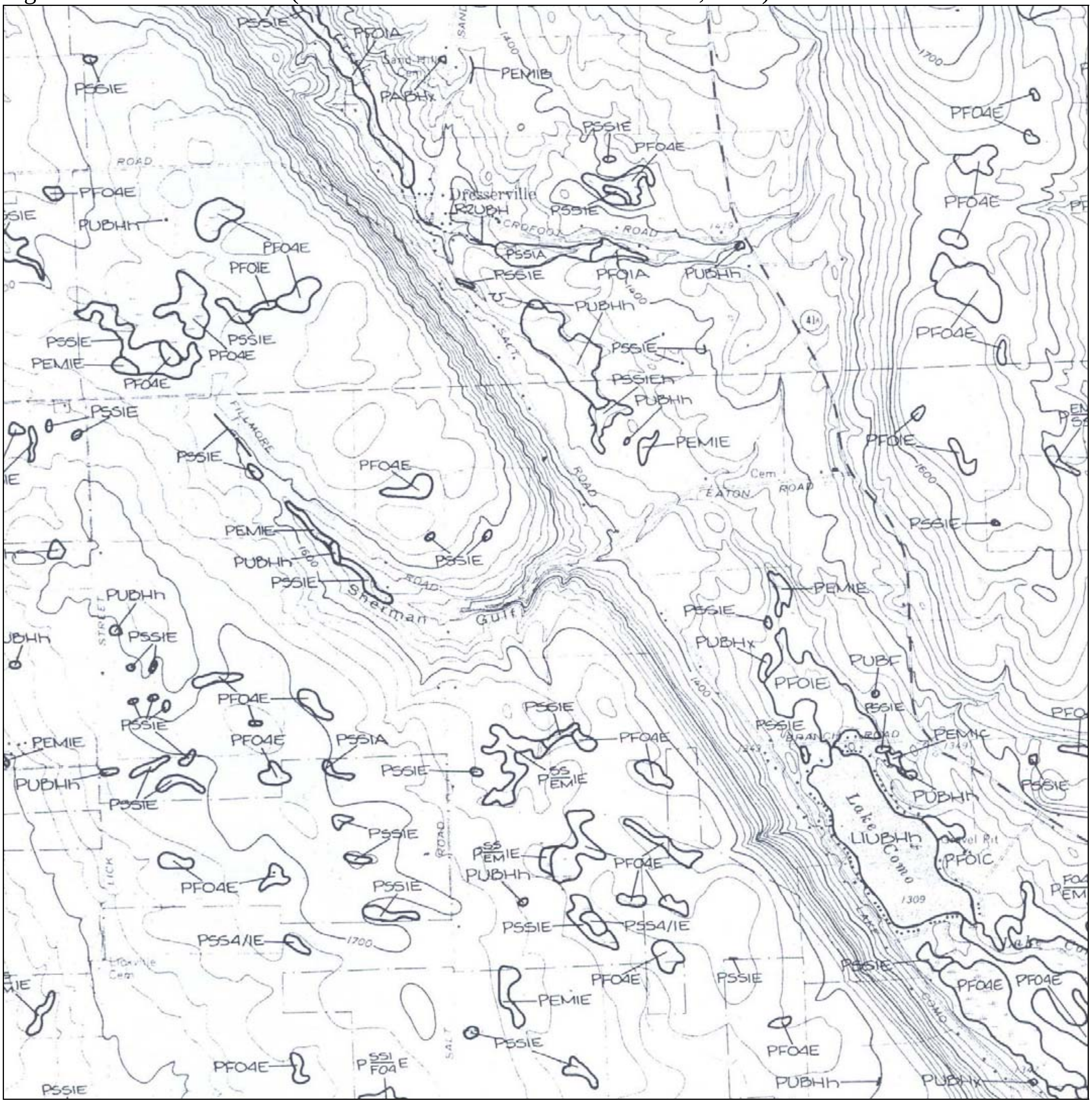
Figure 4: Special Flood Hazard Areas from the Preliminary Flood Insurance Rate Maps (FEMA, 2005)



Wetlands

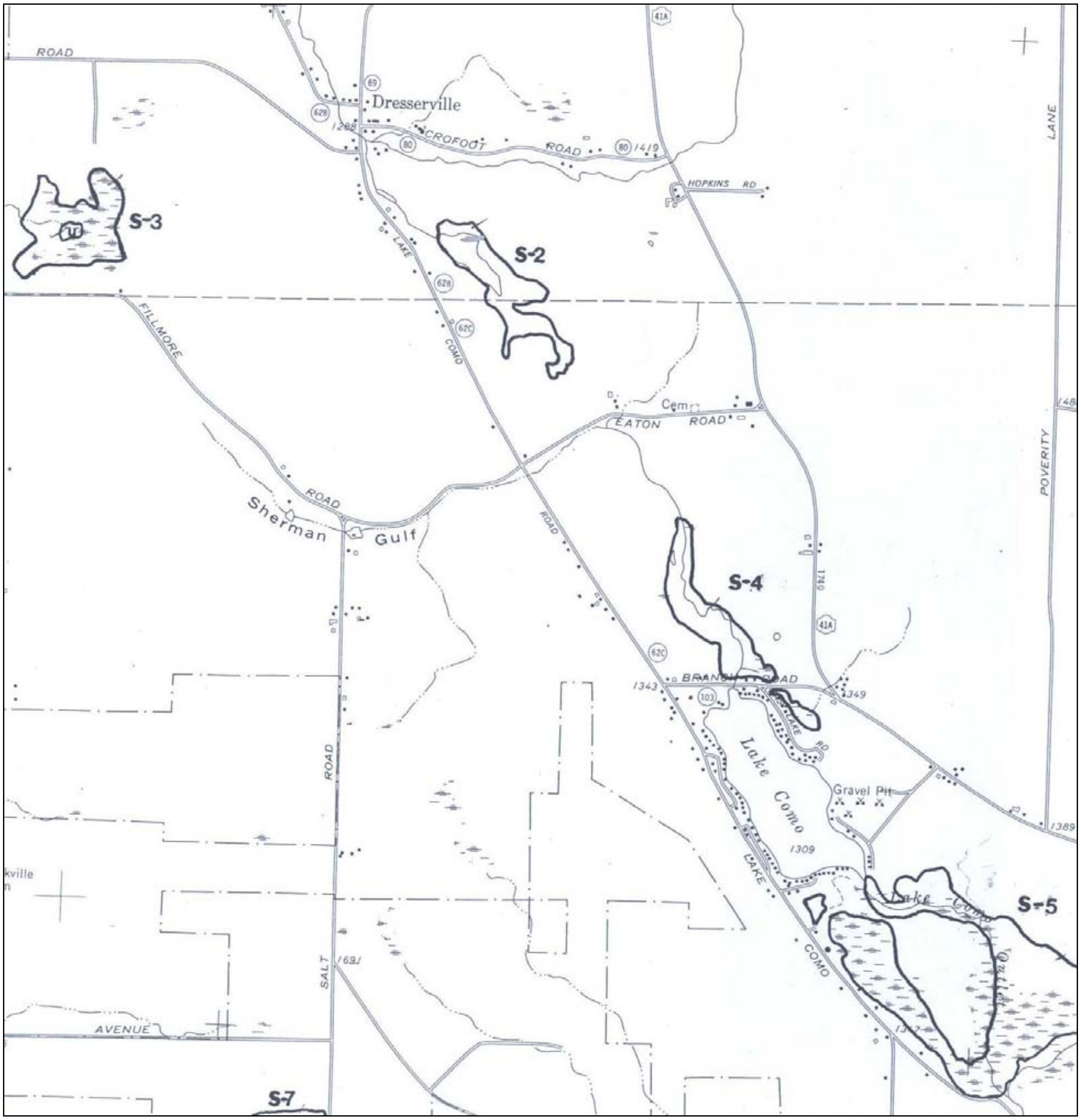
In the Lake Como watershed, one percent of the land area is woody wetlands and less than one percent is emergent herbaceous wetlands. The wetlands shown in Figure 5 are listed on the National Wetlands Inventory from the United States Fish and Wildlife Service (FWS). There are large federal wetlands at the north and south end of Lake Como as well as numerous small ones scattered throughout the watershed.

Figure 5: Federal Wetlands (United States Fish and Wildlife Service, 1991)



The wetlands on the north and south ends of Lake Como are also classified as New York Department of Environmental Conservation freshwater wetlands (Figure 6). The wetland located at the end of Fillmore Glen Road is also a New York Department of Environmental Conservation wetland. Wetland S-2 is not within the Lake Como Watershed.

Figure 6: State Wetlands (NYSDEC 1985)



Forestry Resources

Forest makes up the largest land use in the Lake Como watershed (39%) along with mixed forest (22%) and evergreen forest (2%). According to the Cayuga County Planning

Board's *Master Plan Background Study: Natural Resources* (1969), the principal forest type along the western side of Lake Como, and a portion of the upper western and eastern watershed is predominately maple, beech and basswood. The majority of the southwestern watershed is a state reforestation area and the majority of the trees are softwood.

Wildlife

Lake Como and its watershed are located in the National Audubon Society's designated Greater Summer Hill Area Important Bird Area. This is an area recognized for its biological importance for birds and it stretches from the Summer Hill State Forest to the wetlands at the South end of Owasco Lake. The Finger Lakes Land Trust's Dorothy McIlroy Bird Sanctuary at the south end of Lake Como is also in this area. A wide variety of birds, including at risk species are found at Lake Como and its watershed.

Lake Como and its watershed provide habitat for a wide variety of animals including beaver, deer and other mammals. At times, beavers cause problems with Lake Como's level by building dams on the tributaries to Lake Como, as well as the Lake Como outlet and Fall Creek.

Chemical, Physical and Biological Data

Overview

By Secchi disk transparency and total phosphorus criteria, Lake Como is best classified as a mesotrophic (moderately productive) lake, however by chlorophyll *a* criteria, it is best classified as an eutrophic (highly productive) lake. Therefore, Lake Como is best classified as a mesoeutrophic (moderately to highly productive) lake. Phosphorus levels in Lake Como exceeded 0.020 mg/L, which is the state guidance value for total phosphorus (not a standard) for class B or higher waters, in about 25% of the samples taken during the 2005 Citizens Statewide Lake Assessment Program (CSLAP) season. Secchi disk transparency readings rarely fall to below the minimum recommended water transparency for siting new swimming beaches.

Lake Como has a small volume of water and is a relatively shallow lake, therefore it responds readily to meteorological conditions and may not develop continuous thermal stratification in the summer every year. This can allow continuous cycling of material released from the sediments, including nutrients, into the upper productive waters (Effler et al., 1988). Productivity is also shown by the overabundance of macrobethic vegetation that exists around the lake.

Lake Como's water is alkaline with pH readings that often exceed the upper limits of New York State water quality standards about 20% of the CSLAP sampling sessions. However, this is common to waterbodies in the Oswego River Basin and there is no evidence that this affects the ecological health of the lake. Nitrate and ammonia levels do not appear to threaten the health of humans or the water quality. A small portion of Lake Como may become anoxic (oxygen depleted) when thermal stratification develops in the summer.

Water Quality Sampling Efforts

Water quality sampling has been conducted on Lake Como by the Lake Como Association through the Citizens Statewide Lake Assessment Program (CSLAP) since 1988. Finger Lakes Lake Ontario Watershed Protection Alliance (FLLOWPA) funds have been dedicated to continue this sampling program in 2006 and 2007.

Trophic State

Trophic state is a measure of the level of primary productivity. A measure of a lake's health depends to a large extent on the amount of nutrients that enters it. The nutrient level, or trophic state, of a lake is generally determined by its level of phytoplankton production (algae). This method of measurement is used because the growth of phytoplankton directly corresponds to the amount of nutrients present in the lake.

The three trophic states that describe the levels of nutrients and amount of phytoplankton in a lake are oligotrophic, mesotrophic, and eutrophic. Oligotrophic means nutrient levels, particularly phosphate or nitrogen compounds, are low. When lakes are young, they are oligotrophic. Eutrophic means nutrient levels are high and mesotrophic means nutrient levels are between oligotrophic and eutrophic.

Eutrophication is the natural aging process by which lakes move from being oligotrophic to being eutrophic. If this process is accelerated by human activity, it is called cultural eutrophication. As the water of an oligotrophic lake becomes enriched with nutrients and phytoplankton production increases, numerous changes take place. Like all green plants, phytoplankton produce oxygen, causing the surface of the water to become supersaturated with oxygen. However, oxygen generated by phytoplankton does not replenish the dissolved oxygen levels of deeper water. Phytoplankton have remarkable high growth and reproductive rates. Eventually, a maximum population is reached and a die off occurs. Dead phytoplankton settle, resulting in heavy deposits of detritus on the bottom of the lake. The accumulation of detritus then supports abundance of decomposers, mainly bacteria which depletes the oxygen at the bottom of the lake. This depletion of dissolved oxygen results in the suffocation of higher organisms, such as fish.

Although trophic levels are generally measured by phytoplankton populations, phytoplankton themselves can be assessed by measuring chlorophyll *a* concentrations, transparency, phosphorus concentrations, and surface oxygen depletion. Eutrophic lakes, for example, would have high concentrations of chlorophyll *a*, low transparency, high concentrations of phosphorus, and low concentrations of oxygen near the lake bottom.

The 2005 CSLAP data indicate that Lake Como could be classified as mesoeutrophic or moderately to highly productive and this assessment is typical from the CSLAP data from Lake Como (NYSFOLA and NYSDEC, 2006). By Secchi disk transparency and total phosphorus criteria, Lake Como would be considered mesotrophic, while by the chlorophyll *a* criteria, it would be considered eutrophic (see Table 2). Therefore, the lake is most appropriately classified as mesoeuthrophic, or moderately to highly productive (NYSFOLA and NYSDEC, 2006). This is comparable to work by Effler et al. (1988) that found an intermediate level of biological production in the open waters; chlorophyll *a* and total phosphorus concentrations in the water column indicative of mesotrophy; and a large population of macrophytes that Effler et al. reported should rank Lake Como as eutrophic.

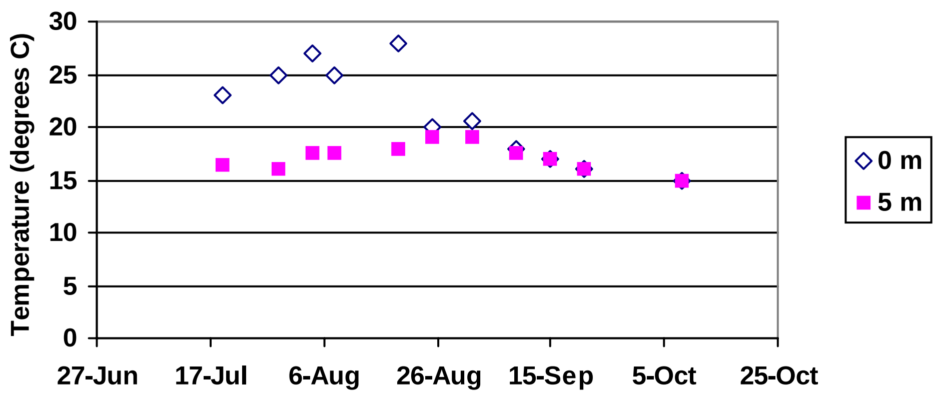
Table 2: Eutrophic Indicators and the Conditions in Lake Como (NYSFOLA and NYSDEC 2006).

	Eutrophic Indicators	Mesotrophic Indicators	Lake Como Average
Phosphorus (mg/L)	>0.020	0.10 - 0.020	0.019
Chlorophyll *a* (µg/L)	>8	2 – 8	11.7
Secchi Disk Clarity (m)	<2	2 – 5	2.5

Temperature

Effler et al (1988) examined the surface and near bottom temperatures of Lake Como in 1987 and the results are shown in Figure 7. The thermal stratification process and the importance of vertical mixing on the cycling of nutrients, oxygen concentrations, etc. will be discussed in respective sections of this report.

Figure 7: Temporal distributions of Surface and Near Bottom Temperatures of Lake Como (Effler et al, 1988).



Thermal Stratification/Turnover

When the surface waters of a lake begin to warm up in the spring, the heat takes a long time to penetrate the bottom of a lake. Eventually there is a marked difference in temperature between the upper layer of a lake and the water at lower depths. This means that there is also a difference in the density of the water; lighter water floats on top of denser cooler water. When a lake divides into an upper, warmer layer and a lower, colder layer, the lake is said to be thermally stratified (summer stratification). The layers, or strata, are known as the epilimnion (top layer) and the hypolimnion (lower layer). There is a layer between the two known as a thermocline. Stratification reduces or eliminates exchange of nutrients, oxygen, etc. between the epilimnion and the hypolimnion. As the air temperature declines during the autumn, so does the surface water temperature. Eventually there is much less difference in density between the waters of the epilimnion and that of the hypolimnion. This situation allows strong winds to mix the layers of the water so that the temperature of the top and bottom of the lake are essentially the same. When this process occurs, the lake is said to have experienced turnover (fall overturn). This mixing also allows bottom nutrients to mix with the surface waters, and surface oxygen to mix with the bottom waters. Thermal stratification can also occur in the winter, with mixing occurring in the spring (spring overturn). A lake that experiences this spring and fall mixing is known as a dimictic lake (twice-turning). Lake Como is considered a dimictic lake (Hennigan, 1992).

Lake Como displayed distinct thermal stratification, which means it was continuously stratified for several weeks, but only for a small portion of the lake (Effler et al., 1988). Lake Como has a small volume of water and is a relatively shallow lake, therefore it responds readily to meteorological conditions and may not develop continuous thermal stratification in the summer every year. The absence of continuous thermal stratification allows cycling of material released from the sediments, including nutrients, to the upper productive waters and oxygen to the lower waters. As is shown in Figure 7, the temperature of the surface water of Lake Como peaked in mid August in 1988 and then started to decline. In late August, elevated winds prompted the rapid turnover of Lake Como, which was early in comparison to the deeper, more strongly stratified lakes of the region (Effler et al., 1988).

Dissolved Oxygen

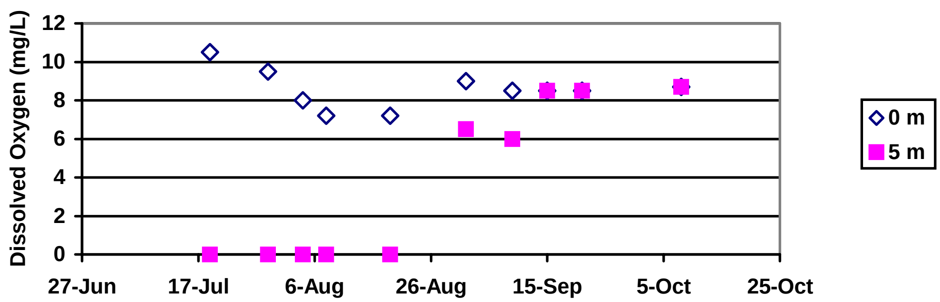
When determining overall water quality, the concentration of dissolved oxygen (DO) is an important chemical parameter to consider. Many forms of aquatic life, especially fish, require a certain concentration of DO to survive. Major sources of oxygen to Lake Como include the air and photosynthesis by aquatic plants and phytoplankton. The major oxygen depleting processes are cell respiration (from all organisms that live in the lake) and the decomposition of dead organic matter.

DO concentrations can vary throughout the water column. DO sources tend to be near the surface of the lake where mixing can occur and where light can penetrate, while in the deeper waters of the lake where light cannot penetrate, only respiration will occur and no photosynthesis. Also, when organisms die, they fall to the bottom of the lake, where decomposition occurs. Therefore, the deeper waters of the lake use oxygen without producing more. Once the lake stratifies in early summer, the hypolimnion (lower depths) becomes largely isolated from sources of oxygen. This can lead to low or no DO in the hypolimnion. The aquatic life that requires a certain amount of DO cannot survive in these conditions. Oxygen levels can also decline during the winter when the lake is covered with ice and snow, which does not allow oxygen to mix with the water or light to penetrate for photosynthesis. If oxygen levels get low enough, it can lead to a fish kill.

Effler et al. in 1988 found that the bottom waters of Lake Como became devoid of oxygen (anoxic) after summer stratification (see Figure 8). This condition reflects the high level of productivity in the lake as well as the small volume of epilimnion (Effler et al., 1988). In the end of August and beginning of September of 1987, elevated winds allowed the water layers in Lake Como to mix until the top and bottom layers of the lake were essentially the same.

Ambient DO levels can be affected by the growth of aquatic plants and phytoplankton. These provide a source of oxygen during daylight hours due to photosynthesis. DO concentrations decline at night due to respiration. In lakes with moderate nutrient levels, photosynthesis and respiration tend to compensate for each other with small overall impact. In lakes with higher enrichment levels, such as Lake Como, supersaturated conditions can occur due to elevated levels of photosynthesis and incomplete air-water surface exchange. The study by Effler et al. (1988) showed that Lake Como had oversaturated conditions from late July to September in 1987.   They presumed that the rather strong saturation dynamics were due to rooted macrophytes as the chlorophyll *a*, and thus phytoplankton population, remained comparatively low.

Figure 8: Temporal distribution of surface and near-bottom concentrations of dissolved oxygen in Lake Como (Effler et al., 1988).



Nutrients

In lakes, plant production increases as the supply of nutrients increases. The most important nutrients in regards to plant production are phosphorus and nitrogen.

Phosphorus:

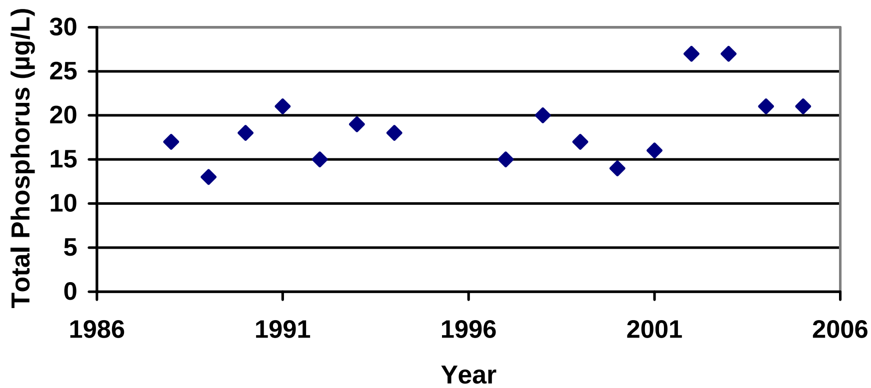
In a lake, phosphorus can be found in many different forms. The forms of phosphorus are technically defined according to laboratory extraction procedures rather than their functional role in the environment. Total phosphorus includes all forms of phosphorous (soluble, insoluble, organic, and inorganic). Soluble reactive phosphorous (SRP) is inorganic, soluble and is the form of phosphorus that is most readily available for aquatic plant and phytoplankton use.

Phosphorus is a major nutrient needed for plant and algae growth. It is often considered the limiting nutrient in lakes, which means that the amount of phosphorus in a lake controls the amount of plants and algae that can grow. This is the case in Lake Como, where the CSLAP data indicates that the mean nitrogen: phosphorus ratio from 2002-2005 is 57.46, which indicates phosphorus is the limiting nutrient for algae growth (NYSFOLA and NYSDEC, 2006).

Phosphorus can enter the lake from external loading sources, such as agricultural run-off, lawn fertilizers, animal waste, or faulty septic systems. Sources of phosphorus can also come from internal loads such as lake sediments. Lake sediments that are overlain with anoxic (no oxygen) water can release phosphorus to the water column.

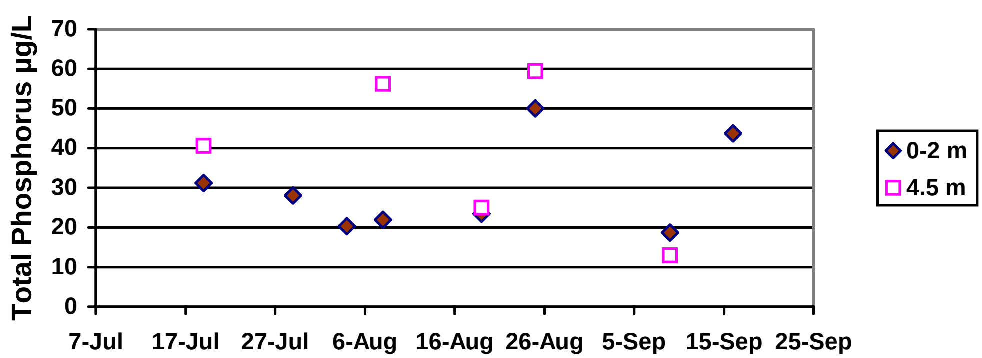
The average level of total phosphorus in Lake Como from 1988-2005 was 0.019 mg/L (19 µg/L), which ranks it as a moderately to highly productive (mesoeutrophic) lake. According to CSLAP data, Lake Como phosphorus levels have exceeded the phosphorus guidance for New York State lakes of 0.020 mg/L (20 µg/L), about 25% of the CSLAP sampling sessions (NYSFOLA and NYSDEC, 2006). High phosphorus levels can lead to high algae populations and water transparency readings which fail to meet the recommended water clarity for swimming beaches (1.2 m), but this has not generally occurred in Lake Como (NYSFOLA and NYSDEC, 2006). CSLAP sampling has shown that productivity increases somewhat over the course of the sampling season (NYFOLA and NYSDEC, 2006).

Figure 9: Average Total Phosphorus in µg/L by Year (NYFOLA and NYSDEC, 2006)



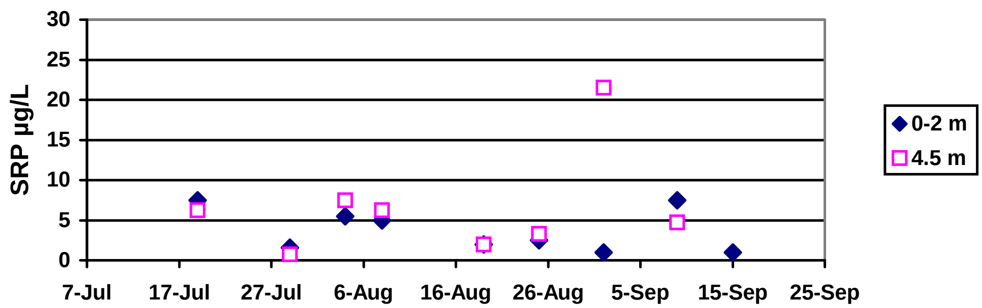
Effler et al. (1988) sampled total phosphorus and SRP at both the surface and near the bottom in 1987. The average total phosphorus was 0.0274 mg/L (27.4 µg/L) and the range was 0.018 – 0.050 mg/L (18 - 50 µg/L). Figure 10 shows that total phosphorus was enriched near the bottom of the lake until the end of August. The bottom of Lake Como was anoxic from mid July to mid September, and therefore the sediments could release nutrients such as phosphorus to the overlying waters.

Figure 10: Total Phosphorus in µg/L by Depth from in 1987 (Effler et al., 1988)



The higher phosphorus concentrations near the bottom appear to be particulate because as shown in Figure 11, the SRP concentrations did not differ greatly from the surface and bottom waters. This is important because SRP is the form of phosphorus most easily utilized by plants and phytoplankton. An increase in total phosphorus was observed in late August and this was a period in which elevated winds were experienced (Effler et al., 1988). After overturn, the total phosphorus concentration was similar for the surface and the bottom of the lake, and there was a secondary peak in total phosphorus.

Figure 11: Soluble Reactive Phosphorus (SRP) in μg/L by Depth from Effler et al., 1988.

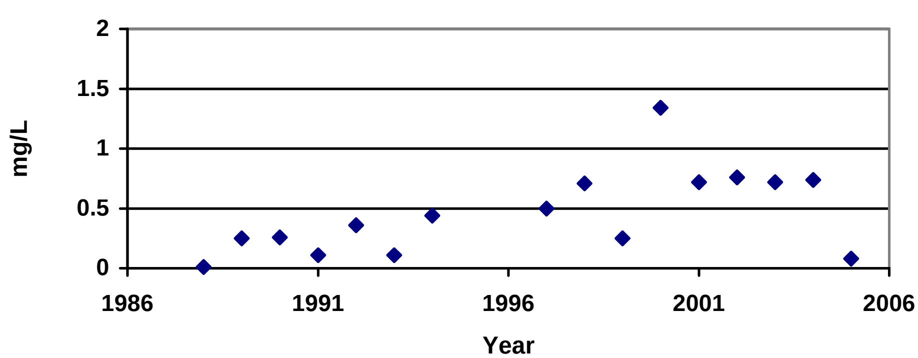


***Nitrogen**:*

Nitrogen is an essential plant macronutrient that exists in many forms. Fixed nitrogen (N_2), ammonia nitrogen (NH_4^+), nitrite nitrogen (NO_2^-), and nitrate nitrogen (NO_3^-) are all forms of nitrogen that exist in the environment.

Nitrate nitrogen (NO_3^-) is the form of nitrogen that plants most readily utilize and is the most common form entering most lakes. Lake Como has intermediate nitrate and ammonia levels (NYSFOLA and NYSDEC, 2006). The state ambient water quality standard for nitrate/nitrite nitrogen is 10 mg/L to protect human health. The average level found in Lake Como from 1988-2005 was 0.41 mg/L, which is far below this level (Figure 12) (NYSFOLA and NYSDEC, 2006). Nitrate levels were lower in 2005 than nearly all previous CSLAP sampling seasons, which may be due to drier weather conditions that year (NYSFOLA and NYSDEC, 2006).

Figure 12: Mean Nitrate + Nitrite Nitrogen as N in Lake Como from 1988-2005 (NYSFOLA and NYSDEC 2006)



Ammonia levels were lower than the nitrate levels, and as shown in Figure 13 were all below the human health standard of 2 mg/L in 2002-2005 (NYSFOLA and NYSDEC, 2006). The ammonia data from Effler et al. (1988) showed Lake Como had higher concentrations than other local lakes in 1987 and there was a major increase in ammonia in early September (Figure 14). However, the generally low levels of ammonia reflect a high rate of utilization by plants in productive systems (Effler et al., 1988).

Figure 13: Range of Ammonia as N in mg/L in Lake Como (NYSFOLA and NYSDEC, 2006).

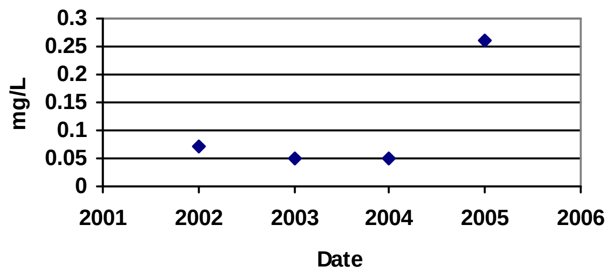
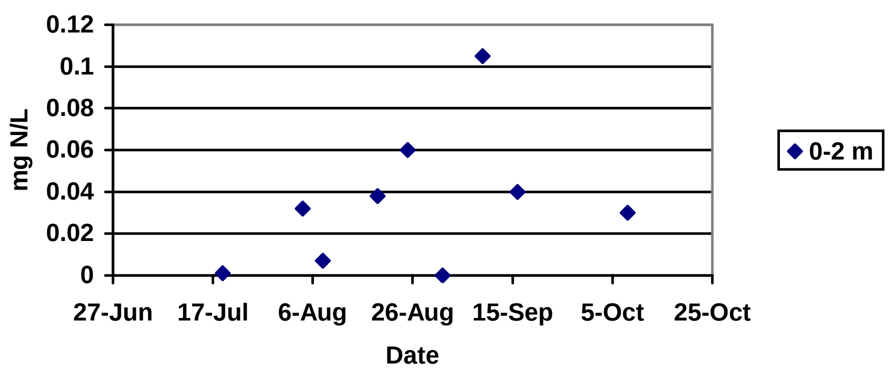


Figure 14: Range of Ammonia in mg N/L in the Surface Water of Lake Como in 1987 (Effler et al., 1988).

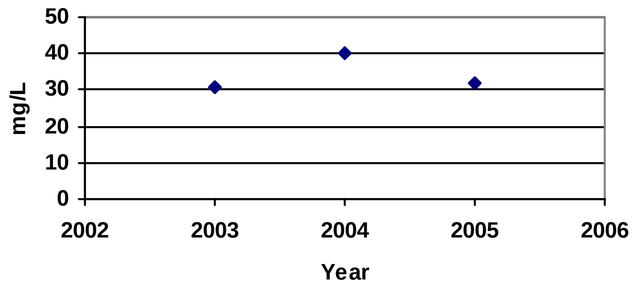


Major Ions

Ions are grouped into positively charged cations and negatively charged anions. Positively charged ions include calcium (Ca^{2+}), sodium (Na^{+}), and magnesium (Mg^{2+}). Negatively charged ions include carbonate (CO_3^{2-}), biocarbonate (HCO_3^{-}), sulfate (SO_4^{2-}), and chloride (Cl^{-}). The major sources of ions are from salts that have leached from mineral soils and rocks. Ions can also originate from anthropogenic sources, such as road salt, septic tanks, and agriculture run-off.

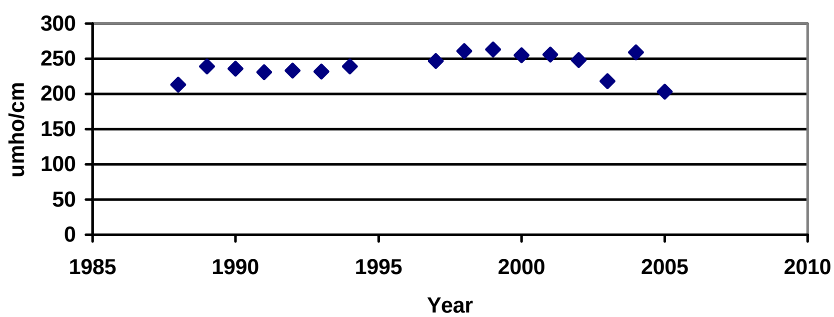
Calcium is a required nutrient for most aquatic organisms. Calcium is naturally contributed to lakes from limestone deposits and often strongly correlated with lake buffering capacity (NYSFOLA and NYSDEC, 2006). Zebra mussels require at least 8-10 mg/L for shell growth and the data from the 2005 CSLAP program shows an average level of 34.1 mg/L in Lake Como from 2003-2005 (Figure 15) (NYSFOLA and NYSDEC, 2006). Therefore calcium levels are high enough to support zebra mussels, but they are not believed to have been found in Lake Como at this time.

Figure 15: Average Calcium in mg/L in Lake Como (NYSFOLA and NYSDEC, 2006)



Conductivity which measures the electrical current passing through water can be used to estimate the number of ions in the water, is somewhat related to hardness and alkalinity, and may influence the degree to which nutrients remain in the water (NYSFOLA and NYSDEC, 2006). Lake Como had an average conductivity of 238 µmho/cm from 1988 to 2005 and these conductivity readings are typical of hard water lakes and are not believed to have caused water quality or ecological impacts (NYSFOLA and NYSDEC, 2006).

Figure 16: Average Specific Conductance Corrected to 25°C in umho/cm (NYSFOLA and NYSDEC, 2006)



pH and Alkalinity

The pH of a lake is a measure of its acidity or alkalinity. Natural waters exhibit wide variations in relative acidity and alkalinity, not only in actual pH values, but also in the amount of dissolved materials that impact pH. Alkalinity of waters refers to the quantity and kinds of compounds present, which collectively shift the pH to the alkaline side of the pH scale (above 7). The concentrations of these compounds and their ratio to one another determine the actual pH and buffering capacity of a lake.

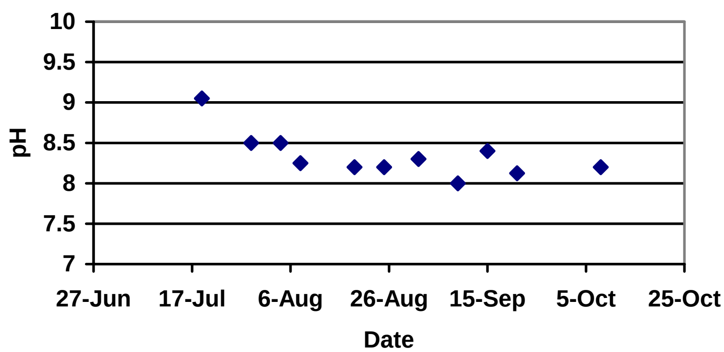
pH values for Lake Como are shown in Table 3. The average pH from 1988-2005 is 8.18, which indicates alkaline conditions (NYSFOLA and NYSDEC, 2006). This is typical of a hard water lake. The New York State water quality standard for pH to protect aquatic life is a pH higher or equal to 6.5 but less than 8.5. For Lake Como, pH readings have exceeded the New York State water quality standard during about 20% of the CSLAP sampling sessions, but it is not known if high pH represents an ecological problem because high pH is common to lakes in the Oswego River Basin (NYSFOLA and NYSDEC, 2006). This may warrant further investigation.

Table 3: Average pH values for Lake Como.

Year	Source	Average	Number of Samples
1988-2005	NYSFOLA and NYSDEC, 2006	8.18	107
2005	NYSFOLA and NYSDEC, 2006	7.77	8
2004	NYSFOLA and NYSDEC, 2006	7.82	8
2003	NYSFOLA and NYSDEC, 2006	8.53	6
2002	NYSFOLA and NYSDEC, 2006	8.02	8
2001	NYSFOLA and NYSDEC, 2006	8.55	6
2000	NYSFOLA and NYSDEC, 2006	7.88	4
1999	NYSFOLA and NYSDEC, 2006	8.13	8
1998	NYSFOLA and NYSDEC, 2006	8.05	8
1997	NYSFOLA and NYSDEC, 2006	8.44	4
1994	NYSFOLA and NYSDEC, 2006	8.17	8
1993	NYSFOLA and NYSDEC, 2006	8.36	6
1992	NYSFOLA and NYSDEC, 2006	8.36	3
1991	NYSFOLA and NYSDEC, 2006	8.26	6
1990	NYSFOLA and NYSDEC, 2006	8.27	7
1989	NYSFOLA and NYSDEC, 2006	8.36	5
1988	NYSFOLA and NYSDEC, 2006	8.30	12
1988	Effler et al., 1988	8.32	11

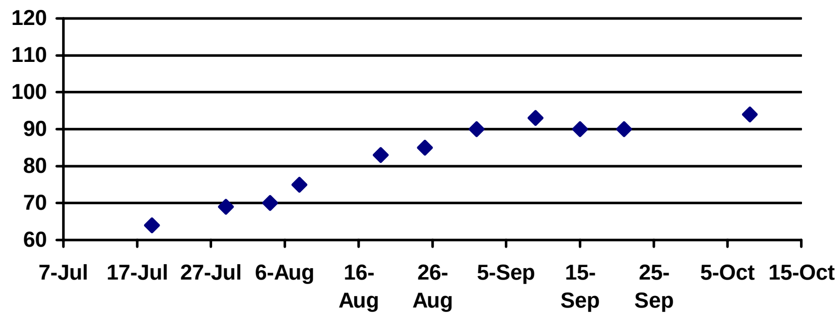
Data from Effler et al. (1988) shows that in 1987 pH values peaked in mid July, decreased in mid August and then remained in the range of 8.0 to 8.5 (Figure 17). As aquatic plants and phytoplankton grow and reproduce, they consume carbon dioxide, which becomes acidic when dissolved in water. Consequently, as carbon dioxide levels decrease, pH levels increase. Therefore, there are slightly higher basic pH values found in the summer, when phytoplankton growth peaks.

Figure 17: Temporal distribution of pH in 0-2 m interval in Lake Como (Effler et al., 1988).



Lake Como can best be described as alkaline. Data from Effler et al. (1988) has the mean alkalinity in 1987 from late July to mid October at 82.3 mg/L. As shown in Figure 18 there was a progressive increase in alkalinity until late August when, after turnover, it stayed fairly uniform at 90 mg/L (Effler et al., 1988). Effler et al. (1988) stated that the initial increase could be due to the entrainment of lower enriched layers with the approach to turnover. Alkaline lakes such as Lake Como have good buffering capacity which means that they can readily neutralize acid rain inputs and maintain their high pH. This protects the lake's ecosystem and fishery from acid rain.

Figure 18: Alkalinity over the Course of a Summer (Effler et al., 1988)



Pesticides

Lake Como is not part of the Pesticide Monitoring Survey administered by the New York State Department of Health or the Statewide Pesticide Monitoring Program administered by the NYSDEC and assisted by the USGS.

Transparency (Clarity)

How well one can see an object in water is a measure of the water's transparency, or clarity. The ability of light to penetrate the water so that the object can be seen depends on the number and types of particles dissolved or suspended in the water. Sometimes we say that the water looks "murky" or "crystal clear." Examples of particles that can "cloud up" water include phytoplankton (algae), dissolved organic matter (detritus) and inorganic particulates (e.g. precipitants of minerals). Transparency is an aesthetic feature and controls plant growth by controlling how deep light can penetrate.

One method that measures transparency is the use of a Secchi disc. Typically, the Secchi disc is 20 cm in diameter, made of metal, and is attached to a rope to be lowered into the water. The depth at which the disc disappears from view is then recorded. The Secchi disc method is based on light penetration. Generally in the spring and autumn, when there is a lot of runoff or when mixing occurs after a storm, there are more particles that enter the water, resulting in lower transparency. On the other hand, in mid to late summer when there is less runoff, higher transparencies are often present.

CSLAP data suggests that water clarity in Lake Como is probably closely influenced by both algae and nutrients (NYSFOLA and NYSDEC, 2006). CSLAP data shows that from 1988-2005, the average Secchi Disk transparency was 2.48 m (8.1 feet) (Table 4). The New York

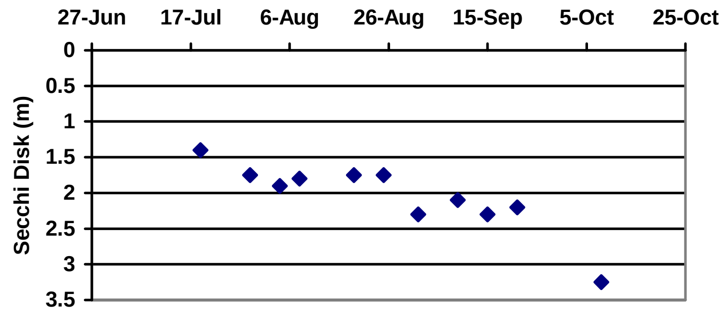
State guidance for Secchi disc transparency for swimming in a Class B or higher lake is greater than 1.2 m (4 feet) and this guidance is only applied to siting new bathing beaches. However, this guidance may be appropriate for all waterbodies used for contact recreation (e.g. swimming), like Lake Como. Lake Como very rarely fails this guidance standard.

Table 4: Yearly mean Secchi disc transparency of Lake Como in meters.

Year	Source	Average depth (m)	Number of samples
1988-2005	NYFOLA and NYSDEC, 2006	2.48	109
2005	NYFOLA and NYSDEC, 2006	2.36	8
2004	NYFOLA and NYSDEC, 2006	2.48	8
2003	NYFOLA and NYSDEC, 2006	1.33	6
2002	NYFOLA and NYSDEC, 2006	2.17	8
2001	NYFOLA and NYSDEC, 2006	2.58	6
2000	NYFOLA and NYSDEC, 2006	4.04	4
1999	NYFOLA and NYSDEC, 2006	3.03	8
1998	NYFOLA and NYSDEC, 2006	2.87	8
1997	NYFOLA and NYSDEC, 2006	2.78	4
1994	NYFOLA and NYSDEC, 2006	2.68	8
1993	NYFOLA and NYSDEC, 2006	2.26	6
1992	NYFOLA and NYSDEC, 2006	2.47	3
1991	NYFOLA and NYSDEC, 2006	1.95	6
1990	NYFOLA and NYSDEC, 2006	2.56	8
1989	NYFOLA and NYSDEC, 2006	3.35	5
1988	NYFOLA and NYSDEC, 2006	1.97	13
1988	NYFOLA and NYSDEC, 2006	2.1	11
1987	Miller, 1988	3.7	-
1977	Miller, 1978	2.3	-

According to Effler, et al. (1988), the Secchi disk transparency did not change much from 1977 to 1988 and the mean of samples was 2.1 m (6.9 feet). Transparency was at its minimum at the start of the study and during the peak of calcite turbidity (Effler, et al., 1988). In 1987, following a modest increase, the conditions remained relatively uniform through August, with additional increases in September to a major increase in October (Figure 19) (Effler, et al,. 1988). The major regulator of transparency appearing to be the calcite turbidity, not phytoplankton biomass, with the measured transparencies being consistent with turbidity (Effler, et al., 1988). Light penetration was adequate to support submerged rooted plant growth over almost the entire basin (Effler, et al., 1988).

Figure 19: Secchi disc transparency of Lake Como in meters in 1987 (Effler et al., 1988)



Lake Como's color has been recorded as dark brown in color by Miller and with a better clarity from 1977 to 1987 (Miller, 1988).   In 2005, CSLAP reported that the lake is weakly to moderately colored which is probably natural and the color is not high enough to affect transparency (NYSFOLA and NYSDEC, 2006).

Turbidity

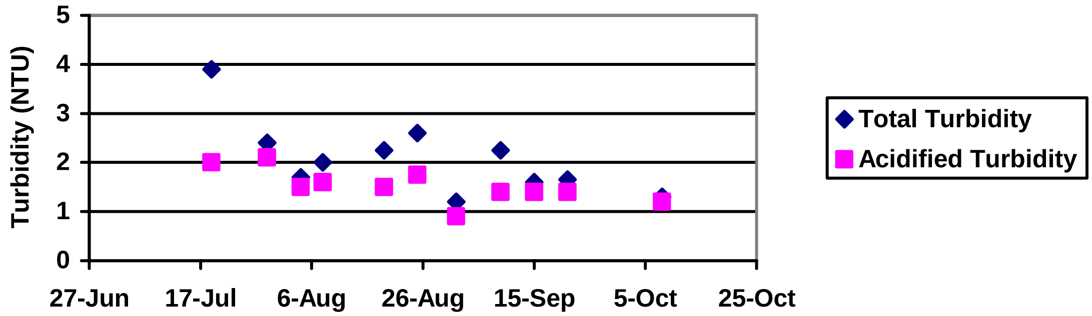
Turbidity refers to the amount of suspended particles in water. As turbidity increases, transparency decreases. In a lake, turbidity is typically caused by a mixture of suspended particles that include clay, silt, finely divided organic and inorganic matter, phytoplankton, and other microscopic organisms. These particles can come from tributaries that feed into the lake, they can be resuspended from lake sediment that has been disturbed or agitated (natural or human caused), or produced in the water column. Another source of turbidity is known as "whiting," which is when calcite precipitates into the water. "Whiting" events occur in lakes with very high concentrations of calcium carbonate (hard water lakes) and they tend to occur as the temperature and plant productivity increases. The turbidity caused by the calcite is determined by subtracting the acidified turbidity from the total turbidity.

Table 5 shows the summary statistics for turbidity in Lake Como in 1987. An average of 25% of the total turbidity in Lake Como in 1987 was due to calcite. As is shown in Figure 20, the highest calcite turbidity occurred at the beginning of the sampling. Calcite precipitation was apparently largely responsible for the elevated total turbidity in Lake Como at that time. Turbidity decreased initially in Lake Como, but varied little thereafter (Effler, et al., 1988).

Table 5: Summary statistics for turbidity, acidified turbidity, and calcite turbidity in the 0 to 2 m interval of Lake Como in 1987 (Effler et al. 1988).

Mean Turbidity (NTU)	Mean Turbidity Range (NTU)	Mean Acidified Turbidity (NTU)	Mean Acidified Turbidity Range (NTU)	Mean Calcite Turbidity (NTU)	Mean Calcite Turbidity Range (NTU)
2.0	1.1 – 3.9	1.5	0.9 – 2.1	0.5	0.1 – 1.9

Figure 20: Temporal distributions of turbidity and acidified turbidity in the 0 to 2 meter interval of Lake Como in 1987 (Effler et al, 1988).



Phytoplankton

Phytoplankton are microscopic plants that are common to most surface waters. Most often, phytoplankton consists of a large number of algal species, which need light, nutrients and warm temperatures to multiply.   Like all green plants that photosynthesize, phytoplankton absorb light and carbon dioxide during the day, which results in the production of oxygen and glucose. During the night, they consume oxygen and use glucose in a process called cell respiration. When phytoplankton die, they fall to the bottom of the lake and decompose. This event also consumes oxygen.

Phytoplankton are the principle regulators of water transparency, they effect oxygen concentrations in lower depths, and are indicators of phosphorus levels. Many researchers quantify phytoplankton by measuring the amount of chlorophyll *a* pigment found in a cubic meter of water. However, identifying specific species of phytoplankton can also be used as a method to determine the trophic conditions of a lake. There are no phytoplankton surveys for Lake Como (NYSFOLA and NYSDEC, 2006).

Chlorophyll a

Chlorophyll *a* is a photosynthetic pigment common to all phytoplankton. Thus, researchers typically measure the level of chlorophyll *a* in water to quantify the amount of phytoplankton. For example, high concentrations of chlorophyll *a* indicate high concentrations of phytoplankton. In turn, high phytoplankton may indicate high nutrient loading and lower transparencies.

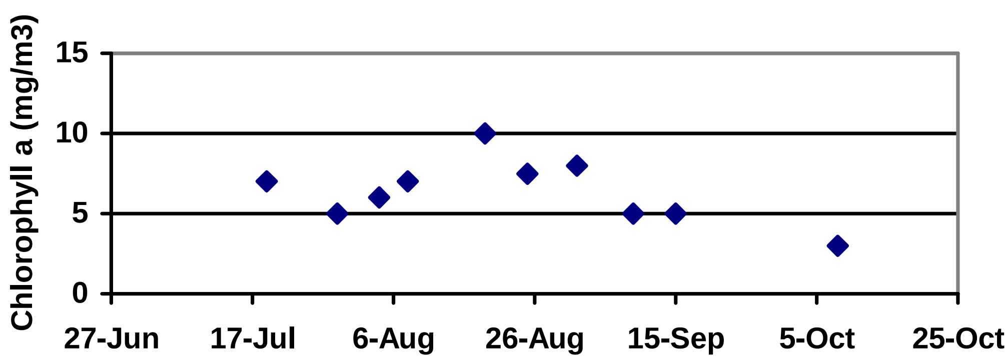
As shown in Table 6, chlorophyll *a* levels have varied since 1988. When Lake Como's chlorophyll *a* level is compared to neighboring lakes and other CSLAP lakes, Lake Como is more productive; however, Lake Como is about as productive as other Class B lakes (NYSFOLA and NYSDEC, 2006).   The readings for 2004 and 2005 were lower than normal, which may be caused by weather conditions (NYSFOLA and NYSDEC, 2006). Lakes with chlorophyll *a* levels greater than 8 µg/L are indicative of a eutrophic lake, and Lake Como's average from 1988 to 2005 was 11.59 µg/L.

Table 6: Average Yearly Chlorophyll *a* in µg/L

Year	Source	Average	Number of Samples
1988-2005	NYSFOLA and NYSDEC, 2006	11.59	99
2005	NYSFOLA and NYSDEC, 2006	6.31	7
2004	NYSFOLA and NYSDEC, 2006	5.16	7
2003	NYSFOLA and NYSDEC, 2006	10.03	6
2002	NYSFOLA and NYSDEC, 2006	6.71	7
2001	NYSFOLA and NYSDEC, 2006	6.16	5
2000	NYSFOLA and NYSDEC, 2006	9.47	4
1999	NYSFOLA and NYSDEC, 2006	14.59	5
1998	NYSFOLA and NYSDEC, 2006	28.01	8
1997	NYSFOLA and NYSDEC, 2006	22.15	4
1994	NYSFOLA and NYSDEC, 2006	7.65	7
1993	NYSFOLA and NYSDEC, 2006	12.31	6
1992	NYSFOLA and NYSDEC, 2006	9.34	3
1991	NYSFOLA and NYSDEC, 2006	16.19	6
1990	NYSFOLA and NYSDEC, 2006	19.70	7
1989	NYSFOLA and NYSDEC, 2006	6.43	5
1988	NYSFOLA and NYSDEC, 2006	6.91	12
1988	Effler et al., 1988	6.40	10

Data from Effler, et al (1988), showed that in 1987, the chlorophyll *a* levels reached a peak in August and then declined, most likely due to reduced primary production as temperature and solar radiation levels decreased (Figure 21).

Figure 21: Temporal distributions of the concentration of chlorophyll *a* in the 0 to 2 meter interval of Lake Como in 1987 (Effler et al., 1988).



Zooplankton

Zooplankton are microscopic animals and are largely made up of copepods, cladocera and rotifers that are generally less than 2 mm in length. Some zooplankton feed on plants (herbivores or planktivores), some feed on animals (carnivores) and some feed on plants and animals (omnivores). Zooplankton are considered a biologically important component of a "healthy" lake. They control algae and other phytoplankton, bacteria populations, and form an important food component for several fish species. As a result, zooplankton populations are valuable indicators of change in the conditions of the lake. There are no zooplankton surveys for Lake Como (NYSFOLA and NYSDEC, 2006).

Macrobentic vegetation

Aquatic vegetation growth in Lake Como, as in any body of water, is limited to the littoral zone. This zone is the area between the high water mark and where sunlight can no longer reach the bottom. Aquatic vegetation contributes to lake beauty as well as provides food and shelter for other life in the lake (NYSFOLA and NYSDEC, 2006).

The earliest information on aquatic vegetation in Lake Como is found in field notes from a 1927 New York State Conservation Department survey that stated that Lake Como is "shallow, warm…mud bottom and with large areas of vegetation both submerged and emergent types" (NYSFOLA and NYSDEC, 2006).

An aquatic plant survey of Lake Como conducted in 1977 by Gary Miller found a heterogeneous complex of plants of which eelgrass (*Vallisneria americana*) was the most important species, along with water naiad (*Najas flexilis*) and water stargrass (*Heteranthera dubia*). Aquatic plants formed a ring around the entire lake and the most obvious plants were white water lilies (*Nymphaea odorata*) and yellow water lilies (*Nuphar variegatum*) in shallow areas (1 m or 3.28 feet or less) (Miller, 1978). These exotic water lilies are believed to have been introduced to Lake Como by humans (Miller, 1978).

In his 1977 plant survey, Miller found that 54% of the littoral zone had aquatic plant growth and aquatic plants grew to a depth of 3 m (10 feet) (Miller 1978).   He found that 40% of the littoral zone exhibited weed densities sufficient to inhibit recreational use of the water column (Miller, 1978). He reported that homeowners coped by physically trying to remove the vegetation (Miller, 1978).

The year that the nuisance vegetation was perceived to be at its worst was 1981 as homeowners physically removed plants and limited cutting occurred with the County's aquatic management program (Miller, 1988). The Lake Como Lake Association was formed in 1982 in response to these conditions (Miller, 1988). The Lake Como Fish and Game Club used a County harvester to harvest in Lake Como in 1982 (Dross, 1984). The County applied chemical treatment (Diquat) to 16 acres in 1983 and 1984; and applied Diquat and pelletized 2,4D to 22 acres in 1985 that targeted milfoil (*Myrophyllum spp.*), pondweeds (*Potamogeton spp.*), elodea (*Elodea canadensis*), and coontail (*Ceratophyllum demersum*) (Miller, 1988). The NYSDEC denied permission for chemical treatment in 1986 and vegetation levels returned to previous conditions (Miller, 1988). Mechanical treatment of Lake Como continues to this day.

Miller (1988) conducted a follow-up aquatic plant survey in 1987 which found that plants still formed heterogeneous population mixtures and the most obvious plants were still water lilies. Eelgrass dropped in importance, while water naiad, elodea and a new exotic plant, Eurasian watermilfoil (*Myriophyllum spicatum*) increased (Miller, 1988). This shift was most likely due to harvesting conducted in 1987, which favors lower growing plants (Miller, 1988). Miller (1988) found 58% of the littoral area had plant growth, plants were growing to a depth of

4 m (13.1 feet) due to increased light penetration, and 35% of the lake had weed densities sufficient to inhibit recreational use.

A Lake Como plant and user perception survey from 2000 suggests that the plant communities are dominated by exotic plants such as Eurasian watermilfoil and curly-leafed pondweed (*Potamogeton crispus*) or native plants such as large leaf pondweed (*Potamogeton amplifolius*) that can become a nuisance (NYSFOLA and NYSDEC, 2006). These plants are the ones most likely to contribute to the frequent observations that recreational uses are impacted (NYSFOLA and NYSDEC, 2006).

Exotic invasive plants such as Eurasian watermilfoil, curly-leafed pondweed, fanwort (*Cabomba caroliniana*) and waterchestnut (*Trapa natans*) are not native to this area and they can reproduce so rapidly that they can displace native species and disrupt natural ecosystems. These plants can also interfere with recreational activities. Fanwort and waterchestnut are not present in Lake Como at this time, but efforts should be made to keep them out.

Bacteria

Water supplies and public bathing beaches are routinely monitored for the presence of fecal contamination by testing for the presence of indicator microorganisms. Indicator microorganisms are chosen because they are present in relatively high numbers in feces and are easily cultured in the laboratory. Their presence in the water indicates that there may be fecal matter in the water and therefore a potential for disease causing pathogens. When determining the quality of bathing beaches, the New York State Department of Health (NYSDOH) uses fecal coliform as an indicator organism. The NYSDOH Standard for fecal coliform levels for bathing beaches is an instantaneous count of 1000 or greater colonies/100 mL or a logarithmic average of 200 or greater colonies/100 mL. There is no coliform data for Lake Como.

Fish

Fish species present in Lake Como include tiger muskellunge, walleye, chain pickerel, largemouth bass, channel catfish, rock bass, yellow perch, white sucker, brown bullhead, black crappie, bluegill and pumpkinseed (*Lake Como (Summer Hill) Contour Map, 2007).* The NYSDEC stocked tiger muskellunge and the Lake Como Lake Association stocked walleye in 1989 (Hennigan, 1992). In 2005, Lake Como was stocked with 200 9.5 inch tiger muskellunge in 2005 (*2005 Fish Stocking List for Cayuga County*, 2007).

Wildlife

The mixture of habitats within the Lake Como watershed, especially with the large amounts of forest, mixed forest, and hay/pasture lands, support a wide variety of species.

Lake Como is located within the Greater Summer Hill Important Bird Area of New York. These areas are determined by the Audubon of New York and provide essential habitat for one or more species of birds (*Important Bird Areas of New York*, 2007).   This Important Bird Area covers 29,000 acres and extends from the Summer Hill State Forest to Owasco Flats and includes the Finger Lake Land Trust’s Dorothy McIllroy Bird Sanctuary located at the south end of Lake Como (Ramanujan, 2005). Birds found in this area include 22 species of warblers and at risk

Table 7: Aquatic plant surveys conducted through CSLAP (NYSFOLA and NYSDEC, 2006):

Species	CommonName	Subm/ Emer?	Exotic?	Date	Location	%cover	Abundance
C.demersum	coontail	subm	no	8/15/1990	site 1-Eside/50f from Homan's dock	98	abundant
E.nuttallii	waterweed	subm	no	8/15/1990	site 1-Eside/50f from Homan's dock	1	abundant
P.crispus	curlyleaf pondweed	subm	yes	8/15/1990	site 1-Eside/50f from Homan's dock	1	abundant
C.demersum	coontail	subm	no	8/15/1990	site 2-Eside/50f from Homan's dock	50	abundant
Najas spp.	bushy pondweed	subm	no	8/15/1990	site 2-Eside/50f from Homan's dock	48	abundant
P.strictifolius	pondweed	subm	no	8/15/1990	site 2-Eside/50f from Homan's dock	1	abundant
V.americanum	eel grass	subm	no	8/15/1990	site 2-Eside/50f from Homan's dock	1	abundant
N. flexilis	bushy pondweed	subm	no	8/15/1990	site 3-Eside/50f from Homan's dock	99	abundant
V.americanum	eel grass	subm	no	8/15/1990	site 3-Eside/50f from Homan's dock	1	abundant
C.demersum	coontail	subm	no	8/15/1990	site 1-Wside/100f from Towsles dock	55	abundant
E.canadensis	waterweed	subm	no	8/15/1990	site 1-Wside/100f from Towsles dock	45	abundant
C.demersum	coontail	subm	no	8/15/1990	site 2-Wside/100f from Towsles dock	40	moderate
P.strictifolius/filiformis	pondweed	subm	no	8/15/1990	site 2-Wside/100f from Towsles dock	35	moderate
E.nuttallii	waterweed	subm	no	8/15/1990	site 2-Wside/100f from Towsles dock	25	moderate
C.demersum	coontail	subm	no	8/15/1990	site 3-Wside/100f from Towsles dock	80	moderate
E.canadensis	waterweed	subm	no	8/15/1990	site 3-Wside/100f from Towsles dock	15	moderate
V.americanum	eel grass	subm	no	8/15/1990	site 3-Wside/100f from Towsles dock	5	moderate
M.spicatum	Eurasian watermilfoil	subm	yes	6/19/2000	not identified	na	na
P.crispus	curlyleaf pondweed	subm	yes	6/19/2000	not identified	na	na
P.amplifolius	bassweed, largeleaf pondweed	subm	no	6/19/2000	not identified	na	na
B.beckii	water marigold	submergent	no	7/25/1931	not identified		
C.palustris	water starwort	submergent	no	6/15/1919	not identified		
N.flexilis	bushy pondweed	submergent	no	7/25/1931	not identified		
N.lutea	spatterdock	floating	no	6/15/1919	not identified		
N.odorata	fragrant white water lily	floating	no	7/5/1927	not identified		
P.virginica	arrow arum	emergent	no	8/1/1882	not identified		
P.amplifolius	large leaf pondweed	submergent	no	7/25/1931	not identified		
P.foliosus	ribbon leaf pondweed	submergent	no	7/25/1931	not identified		
P.gramineus	variable leaf pondweed	submergent	no	7/25/1931	east side		
P.illinoensis	Illinois pondweed	submergent	no	7/25/1931	not identified		
P.natans	floating brownleaf pondweed	submergent	no	7/25/1931	not identified		
P.obtusifolius	blunt-leaf pondweed	submergent	no	7/25/1931	south end		
P.praelongus	clasping-leaf pondweed	submergent	no	7/25/1931	south end		
P.zosteriformis	flat-stem pondweed	submergent	no	7/25/1931	not identified		
Potentilla palustris	marsh cinqefoil	emergent	no	6/1879	not identified		

species such as American black ducks, wood thrushes and American woodcock (Ramanujan, 2005).

Tributaries-Water Quality

The preliminary watershed map shows two unnamed tributaries directly entering Lake Como. Tributary 1 flows under Route 41A and Branch Road to enter Lake Como from a southwesterly direction 0.4 miles northwest of the head of the lake and 2.1 miles south of Dresserville (*6 NYCRR Part 898 Finger Lakes Drainage Basin*, 2007). This tributary is a class C stream which means the best use of its waters is fishing and fish propagation (*6 NYCRR Part 898 Finger Lakes Drainage Basin*, 2007). Tributary 2 stretches from the most northern tip of Lake Como Lake to Tributary 5 which is one mile upstream near Eaton Road (*6 NYCRR Part 898 Finger Lakes Drainage Basin*, 2007). This section of Tributary 2 is classified as C(T) which means this section supports trout (*6 NYCRR Part 898 Finger Lakes Drainage Basin*, 2007). Tributary 5, which flows under Eaton Road and enters Tributary 2, and the rest of the tributaries to Tributary 2 (including water from Sherman Gulf), are class C (*6 NYCRR Part 898 Finger Lakes Drainage Basin*, 2007). There is no sampling data for these tributaries.

Section 2: Watershed Land Use, Economy and Cultural Resources

History

Lake Como was originally known as Locke Pond or Summer Hill Lake (Reed, 2000). It is located in the Town of Summer Hill and its watershed is mainly in Summer Hill, with small portions in the Towns of Locke and Sempronius. The area around Summer Hill was formerly a hunting and fishing area for the Onondaga Nation (Reed, 2000). The upper northeastern portion of the watershed is in an archeological sensitive area as designated by the State Historic Preservation Office. After the passage of the Hewitt Reforestation Bill of 1929, New York State purchased farms in this area and planted them with trees with the efforts of the Civilian Conservation Corps and currently approximately one third of the Town of Summer Hill is in reforestation (Reed, 2000).

Human Population

In the Lake Como watershed, the majority of the housing units are located along the shoreline of Lake Como. In 1991, 66% of the 1.66 miles of Lake Como shoreline had dwellings (Hennigan, 1992). There were approximately 80 dwellings units along the shoreline with an estimated population of 240 people (Hennigan, 1992). Cayuga County Real Property Tax Services reports that currently there are 77 lakefront parcels and of these, 27 (35%) are seasonal.

According to the 2000 Census, the Lake Como shoreline contains parts of four census blocks (please note that the classification by the 2000 Census may differ from the classification by the town assessor). Census blocks are the smallest entities for which the Census Bureau collects and tabulates decennial census information. Census blocks are bounded on all sides by roads, streams, railroad tracks, or other features shown on Census Bureau maps. Census block data for census blocks 2026, 2027, 2036 and 2999 for the year 2000 are shown in Table 8. Within these four census blocks, 37% of the homes were seasonal. There is a population of 112 for those houses occupied year round, but the population of Lake Como could increase greatly during the summer months when most seasonal residents would be present. Please note that Census blocks 2027 and 2036 extend below the lake shoreline and its watershed and the data in Table 8 includes some housing units that are not on the lake or in its watershed.

Table 8: 2000 Census Data (United States Census Bureau).

Census Block	# Housing Units	# Occupied	Population Occupied	# Vacant (Total)	# Vacant (Seasonal, recreational or occasional)	# Vacant (rent, sale or other)
2999 (lake)	0	0	0	0	0	0
2026 (E. side of lake)	30	17	34	13	10	3
2036 (W. side of lake)	55	31	66	24	21	2
2027 (SE. side of lake)	15	11	12	11	6	5
Total	100	59	112	48	37	10

Existing Land Use

The Lake Como watershed covers approximately 2793 acres of land area. The majority of the acreage in the watershed lies within the Town of Summer Hill with small portions in the Towns of Sempronius and Locke. The largest portion of land use within the watershed is deciduous forest (39%), followed by pasture/hay (25%), mixed forest lands (22%), row crops (7%), woody wetlands (1%), evergreen forest (2%), open water (2%) and finally, emergent herbaceous wetlands, high residential use, low residential use, urban recreational grasses and quarries (<1% for these) (see Figure 22).

Agricultural Resources

Agriculture plays a role in the Lake Como watershed. Part of the Lake Como watershed on the east and west sides of Lake Como are located within Agriculture District #6, along with a portion of the southeast shoreline area of Lake Como. An agriculture district is created to protect and preserve agricultural lands from loss to non-agricultural development.

Roads/Highways

Major roads in the Lake Como watershed are Lake Como Road and Branch Road, which are Cayuga County roads, and State Route 41A, which is a State road. There are also numerous town roads and fire lanes.

Recreation

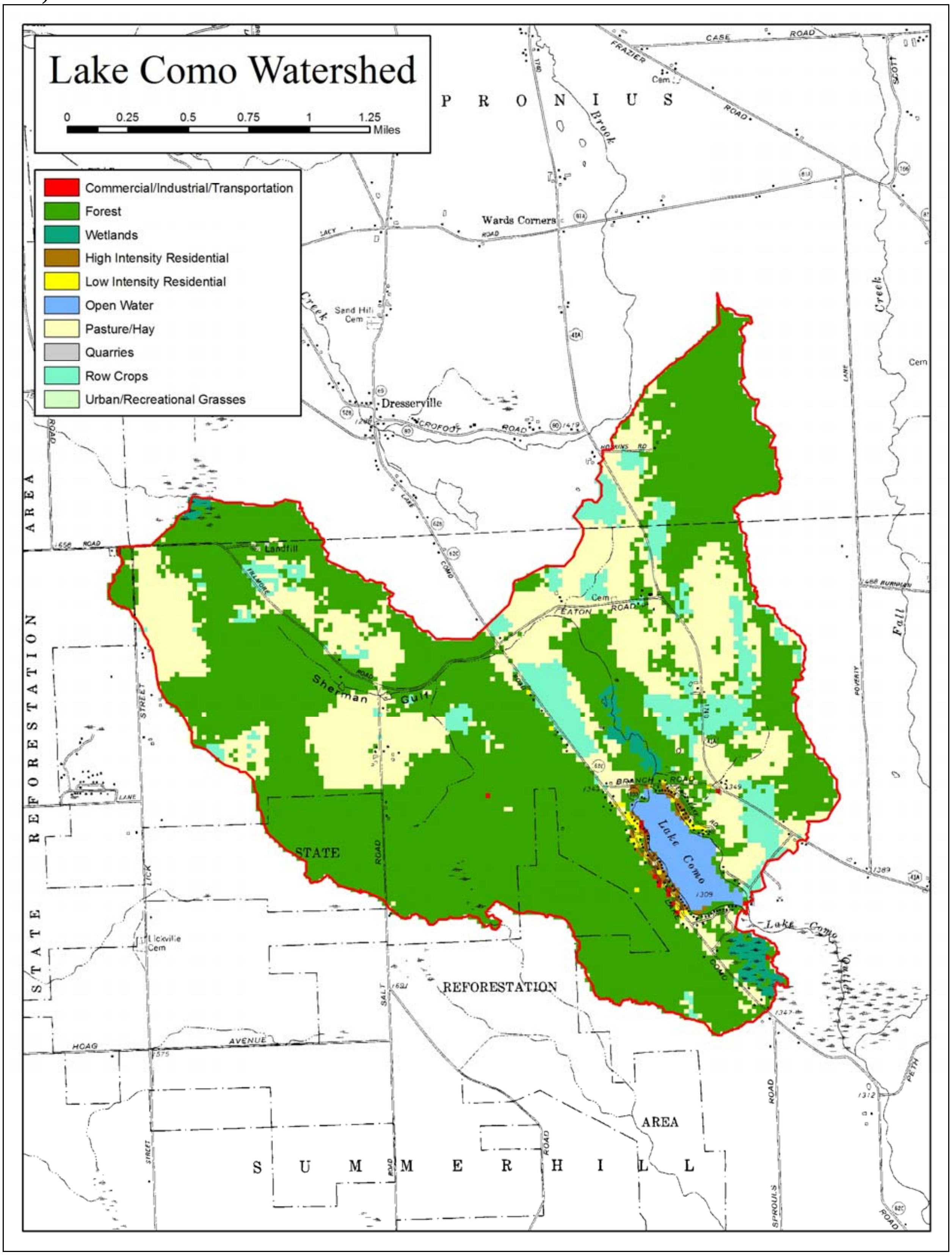
Lake Como and its watershed offer a number of recreational opportunities to its residents, especially during the summer months. About a third of the residences on the Lake Como shoreline are seasonal, so the highest concentrations of outdoor recreational use occur during the summer. The lake itself offers swimming, boating and fishing for lakeshore residents. At the south end of the lake is the Dorothy McIlroy Bird Sanctuary, which provides hiking and bird watching. The Summer Hill State Forest is also in the watershed and it has hiking and hunting.

A recreational survey conducted during the 2005 CSLAP season found that the recreational suitability of Lake Como was described less favorably by residents over the last several years (NYSFOLA and NYSDEC, 2006).   This is consistent with excessive weed growth, although water quality did not change in a similar fashion (NYSFOLA and NYSDEC, 2006). It is considered “slightly impaired” for most uses and having “definite algae greenness” (NYSFOLA and NYSDEC, 2006). This report stated that the ranking does not change as the season changes.

Tourism

The Dorothy McIlroy Bird Sanctuary and the Summer Hill State Forest provide an attraction for tourism at Lake Como. At this time there is only one public access point to the lake. The inn on the eastern side of Lake Como allows boats to launch for a fee.

Figure 22: Land Use Map of the Preliminary Lake Como Watershed (Cayuga County GIS)



Real Estate

In New York State, "the waters of the state are part of the commons, owned by all and held in trust by the State for the use and good of all," which means that the state owns the water (Hennigan, 1992). Ownership of the underwater land and adjacent land can belong to private owners and if so, "the owner of the lake bed has the authority to regulate, control, or deny use of the overlying waters to others" (Hennigan, 1992). Hennigan (1992) reviewed real property records which indicated that the title to the lake bed of Lake Como is owned by the State. Since the lake bed of Lake Como rests with the State, then the State and local governments may enact appropriate laws and ordinances relative to surface activities on these lakes (Hennigan, 1992).

Cayuga County Real Property Tax Services has Lake Como lakefront properties assessed for a total of 3.5 million (Feb. 2007).

Landfills

Currently there are no active landfills located in the Lake Como watershed. There is an inactive solid waste disposal site located on Filmore Road in the upper northwestern corner of the watershed. This was a municipal landfill that was estimated to have opened in 1963 and closed in 1982 according to standard methods at the time of its closure.

There is no list of current illegal roadside dumping sites in the watershed.

Quarries

There is a quarry located on the east side of the lake. It is named Branch Pit and is located at Branch Road at State Route 41 A. This four acre mine is used by the Town of Summer Hill for sand and gravel.

Section 3: Watershed Laws/Ordinances/Regulations

Land Use and Zoning Laws

The majority of the preliminary watershed of Lake Como is located within the Town of Summer Hill. There is a smaller portion in the Town of Sempronius and an even smaller portion in the Town of Locke. The Towns of Summer Hill and Sempronius have no comprehensive or master plan, no zoning, no subdivision regulations or laws. They do have a setback and lot law, and site plan review. The Town of Locke has a master plan, a setback and lot law, and subdivision regulations. It has neither zoning nor site plan review.

Agricultural District Law

Part of the preliminary watershed on the east and west side of Lake Como is located within Agriculture District #6 along with a portion of the southeast shoreline of Lake Como. Agricultural districts were created to protect and preserve agricultural lands from loss to non-agricultural development. Article 25AA- Agricultural Districts of the Agriculture and Markets Law states that:

> *The socio-economic vitality of agriculture in this state is essential to the economic stability and growth of many local communities and the state as a whole. It is, therefore, the declared policy of the state to conserve, protect and encourage the development and improvement of its agricultural land for production of food and other agricultural products. It is also the declared policy of the state to conserve and protect agricultural lands as valued natural and ecological resources which provide needed open spaces for clean air sheds, as well as for aesthetic purposes.*

The law provides for the establishment of a county agricultural and farmland protection board and provides for placement of unique and irreplaceable agricultural lands in district by local owner proposal. Advantages include: agricultural tax assessment based on soil classification; limits on local regulation that might unreasonably restrict or regulate farms; limitation on exercise of eminent domain and other public acquisitions; coordination of local planning and comprehensive plans with the policy and goals of agricultural district law; and a “right to farm” clause, stating that a sound agricultural practice shall not constitute a private nuisance.

The Cayuga County Agricultural and Farmland Protection Board was formed in 1994. Included in the duties to be performed by this board was the creation of the Agriculture and Farmland Protection Plan for Cayuga County. This plan identifies and evaluates land use patterns, regulatory factors, and economic circumstances that encourage the conversion of agricultural land to non-farm purposes. Based on this evaluation, a program was developed to minimize, prevent or reverse the factors identified as contributing to conversion. The plan suggests ways to minimize the negative impacts of any unavoidable agricultural land use conversions.

Cayuga County Sanitary Code

In 1994, Article V of the Cayuga County Sanitary Code was revised as a result of increased public concern for water quality and an increased number of beach closings at Emerson Park on Owasco Lake during the early 1990's. The revisions called for individual residential wastewater treatment systems (septic systems) within the County to be periodically inspected and repaired if found to be failing. Development of the septic system inspection schedule was based on the system's location relative to Owasco Lake or Little Sodus Bay as outlined in Table 9. The Towns of Summer Hill and Sempronius were last inspected in 2000. The portion of the Town of Locke in the Lake Como watershed was inspected in 2003.

Table 90: Cayuga County Septic System Inspection Schedule

Septic System Location	Routine Inspection (years)
Bordering Owasco Lake or Little Sodus Bay	2
Within 500 feet of Owasco Lake or Little Sodus Bay	3
Within the watersheds of Owasco Lake or Little Sodus Bay and within Sterling, Fleming, Owasco, Niles, Scipio and Moravia	5
Outside the watersheds of Owasco Lake or Little Sodus Bay	7

Inspection Procedure

Through the County's privatized inspection program, homeowners must contract with a certified Cayuga County Wastewater Inspector for septic system assessments. Inspection includes a review of Division of Environmental Health records, an interview with the homeowner, inspection of plumbing and system components, and a dye test. Typically the dye test involves adding a florescent dye and a volume of water (depending on the number of bedrooms) to a wastewater receptacle and observing if the dye surfaces. Lastly, a sketch of system components, such as septic tank, distribution box, and leach field, is drawn in relationship to wells and waterbodies, such as lakes and streams.

Homeowners who are transferring property are required to have an inspector perform a property transfer inspection. A property transfer inspection is more stringent than a regular inspection. More water is added per bedroom and the septic tank must be pumped out by a certified waste hauler. All information relating to a homeowner's septic system is entered onto a six-page inspection form. The information is then logged into a database software package at the Cayuga County Environmental Health Division.

Section 4: Watershed Management Programs

Agricultural Environmental Management Program

Agricultural Environmental Management (AEM) is a voluntary, locally-led and implemented initiative that provides one-on-one help to farmers who want to identify environmental concerns on their farms and implement appropriate solutions. AEM provides a framework for existing agricultural agencies and private sector organizations to coordinate the delivery of their services to farmers. AEM utilizes a tiered approach to whole farm plan development.

Services provided through AEM include aid in identifying environmental concerns, planning and design of needed environmental practices, and the opportunity to apply for financial assistance. The farmer's business needs are a key consideration throughout the AEM process.

Cayuga County Nutrient Management Program

A voluntary agricultural nutrient management program was developed for Cayuga County and approved by the County Legislature in February of 1995. The Cayuga County Soil and Water Conservation District is the lead agency for the implementation of this program.

Cayuga County GRAZE NY Program

One of the goals of the Cayuga County Graze NY Program is to improve water quality by reducing the inflow of sediments, pathogens and nutrients into waterbodies via nonpoint source pollution, through the implementation of rotational grazing systems. The practice of intensive rotational grazing is an environmentally sound management practice that, where implemented, improves water quality. Unlike annual tillage crops that expose the soils, rotational grazing stabilizes the soil by providing permanent vegetative cover. As a result of this cover, rotational grazing provides reduced soil erosion and animal waste runoff. In addition to pasture establishment, maintenance practices also encouraged by this program (such as no-till and broadcast seedings, forage tests, soil tests, and proper fertilization techniques) greatly reduce soil erosion as well. Another component of rotational grazing is to physically exclude the animals from entering streams and/or other bodies of water. This practice further reduces erosion and improves water quality.

A second goal is to hold regular workshops, informational meetings, farm visits, and farm tours to educate farmers about the environmental benefits related to rotational grazing. Through the use of regular workshops, meetings, visits, and tours, agricultural producers will have an opportunity to share their experiences with, as well as gain information from, peers, grassland specialists, grazing technicians, and dairy nutritionists. Such grazing could be used in agricultural areas of the watershed, which are generally west of the lake.

Cayuga County Aquatic Vegetation Management Program

The principal objective of the Cayuga County Aquatic Vegetation Control Program, which was initiated in the early 1970's, is to sustain a balance of aquatic plants and algae in order to maintain the biological structure of our lakes. The program is not an attempt to eradicate or eliminate aquatic weeds, but rather to control them. The program seeks balance among recreational, economical, and ecological concerns, which includes integration of both short- and long-term goals. Partial funding for this program comes from the Finger Lakes Lake Ontario Watershed Protection Alliance (FLLOWPA).

Long term controls

Long term controls address the causes of nutrient and sediment loading to the lake. Since all aquatic plants require nutrients for growth, reducing and controlling their growth requires limiting the amounts of nutrients entering the lake from its watershed.

Short term Controls

Short-term controls address the immediate effects of nutrient and sediment loading which are excessive weed and algae growth. With the exception of harvesting, many of the methods do not significantly affect the nutrient levels and are therefore considered cosmetic or temporary. Short-term controls are, however, necessary to keep excessive plant growth at a manageable level, while long-term prevention methods are implemented. Lake Como has such extensive weed growth that short-term controls are, at times, necessary to maintain the recreational and economic interest in the lake.

Mechanical Harvesting

Involves the use of mechanical equipment to cut and remove nuisance plant growth from the lake. Mechanical harvesting is strictly a temporary measure and must be repeated two or more times each year in an area for best control. The equipment is expensive and relatively slow. Cut and unharvested plants can float to “clean” areas and begin infestations. Maintenance of the equipment is expensive.

Chemical treatment

Involves the application of herbicides or algaecides to retard or kill aquatic plants and algae. Although these chemicals are relatively easy to apply and provide relatively fast results, permits are required, monitoring costs are high, and environmental effects are not always known or easily monitored. Also, the chemicals can be hazardous to the applicator if not handled properly. Repeated applications are required annually. For the reasons stated above, chemical treatments by County agencies ended in the 1970's for lakes within the County.

Finger Lakes Lake Ontario Watershed Protection Alliance (FLLOWPA)

Cayuga County is a member of the Finger Lakes Lake Ontario Watershed Protection Alliance (FLLOWPA) and this group receives an annual appropriation from the New York State. Cayuga County receives funds from FLLOWPA annually. In recent years funds have been allocated to the Cayuga County Soil and Water Conservation District to conduct aquatic vegetation management and streambank stabilization; to the Cayuga County Department of Environmental Health to conduct septic system inspections; to the Cayuga County Planning Department to conduct inflow monitoring into Owasco Lake, roadside erosion surveys for Owasco Lake, and stormwater education; and to the Lake Como Association, Duck Lake Association and Cayuga Lake Watershed Network to fund their CSLAPs (Citizen Statewide Lake Assessment Program).

Section 5: Issues of Concern

The following issues of concern for Lake Como were identified at the public informational meeting held July 21, 2006 at the Lake Como Association Meeting. Participants were given five stickers to place on the issue or issues they felt were of the most importance. The number in parentheses next to the issue is the number of stickers the issue received.

1. Aquatic Weeds (41)
2. Lake Level (Beavers) (16)
3. Geese (15)
4. E. Coli (15)
5. Speed Limit Enforcement (14)
6. Septics (8)
7. Drainage (Creeks, W. side of Lake, Quality) (5)
8. Fishing (Abundance, Quality) (5)
9. Boating (Wakes, Speed) (4)
10. Invasive Species (4)
11. Public Access (4)
12. Lake Association (Power and Rights) (4)
13. Dogs (2)
14. Soil Erosion (2)
15. Floodlights (2)
16. Nutrients (1)
17. Garbage (1)
18. Public or Private Lake (Implications) (1)

Issues that were brought up at the meeting but received no votes.

1. Fireworks
2. Weed Identification Program
3. Burning Garbage
4. Mercury
5. Metals
6. Landfill
7. Agriculture
8. Noise Levels
9. Chemicals/Petroleum
10. Terrestrial Invasives
11. Yard Waste

Part 1: Lake Como State of the Lake Report

Members of the Lake Como Association who were unable to attend the meeting were given the opportunity to complete a survey developed by the Lake Como Association to identify their issues of concern. They were also given five votes to place on the issue or issues that they felt were of most importance. The results are as follows:

1. Aquatic Weeds (51)
2. Lake Level (22)
3. Boating (9)
4. Geese (6)
5. E-Coli (6)
6. Septic Contamination (6)
7. Dogs (6)
8. Draining Creeks (4)
9. Fishing (3)
10. Soil Erosion (3)
11. Agriculture (2)
12. Lake Association (power and rights) (2)
13. Fireworks (2)
14. Invasive Species (1)
15. Public Access (1)
16. Nutrients (1)
17. Public or Private Lake (1)
18. Burning Garbage (1)
19. Mercury Contamination (1)

Issues that were brought up at the meeting but received no votes in the survey.

1. Floodlights
2. Garbage
3. Weed Identification
4. Metals Contamination
5. Landfill
6. Noise Levels
7. Chemical/Petroleum
8. Terrestrial Invasives
9. Yard Waste
10. Speed Limit Enforcement

Top Issues from Survey and Public Meeting

The following ranking are based on the results from the public meeting held on July 21, 2006 and the Lake Como Association Survey. Numbers in parenthesis are the number of votes that issue received.

1. Aquatic Weeds (92)
2. Lake Level (38)
3. Geese (21)
4. E-Coli (21)
5. Speed Limit Enforcement (14)
6. Septic Contamination (14)
7. Boating (13)
8. Drainage **(**Creeks, W. side of Lake, Quality) (9)
9. Fishing (Abundance, Quality) (8)
10. Dogs (8)
11. Lake Association Power (6)
12. Invasive Species (5)
13. Public Access (5)
14. Soil Erosion (5)
15. Nutrients (2)
16. Agriculture (2)
17. Floodlights (2)
18. Public or Private Lake (2)
19. Fireworks (2)
20. Garbage (1)
21. Burning Garbage (1)
22. Mercury Contamination (1)

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LIST OF ACRONYMS

AEM – Agricultural Environmental Management

DO – Dissolved oxygen

FEMA – Federal Emergency Management Agency

FLLOWPA – Finger Lakes-Lake Ontario Watershed Protection Alliance

FWS – United States Fish and Wildlife Service

NOAA – National Oceanic and Atmospheric Administration

NYSDEC – New York State Department of Environmental Conservation

NYSDOH – New York State Department of Health

SRP – Soluble Reactive Phosphorus

USGS – United States Geological Survey

GLOSSARY OF TERMS

Anoxic - Water that does not contain oxygen.

Coliform organism - microorganisms found in the intestinal tract of humans and animals. The presence of fecal coliform in water indicates pollution by bird or mammal waste and potentially dangerous bacterial contamination by disease causing microorganisms.

Dimictic - A lake characterized by two turnover periods in between which the water layers stratify.

Dissolved oxygen (DO)- The oxygen freely available in water. DO is vital to fish and other aquatic life and for the prevention of odors.

Eutrophic – Lake that is rich in phosphorus, nitrates, and other nutrients that promote the growth of algae, which deplete the water of oxygen.

Effluent - Wastewater--treated or untreated--that flows out of a treatment plant, sewer, septic tank, or industrial outfall.

Epilimnion – The upper, warmer water of a lake, above the thermocline.

Erosion - The wearing away of land surface by wind or water. Erosion occurs naturally from weather or runoff but can be intensified by human practices.

Hypoliminion - The lower, cooler water of a lake, below the thermocline.

Lacustrine - Lake associated.

Littoral Zone - The zone close to the water's edge where one finds rooted aquatic plants.

Mesoeutrophic - Lake that contains moderate to high quantities of nutrients and is moderately to highly productive in terms of aquatic animal and plant life.

Mesotrophic - Lake that contains moderate quantities of nutrients and is moderately productive in terms of aquatic animal and plant life.

Nitrate -A compound containing nitrogen which can exist dissolved in water and which can have harmful effects on humans and animals.

Oligotrophic - Lakes with low nutrient supplies. They contain little organic matter and have a high dissolved-oxygen level.

Pesticides -Any substance or mixture intended for preventing, destroying, repelling, or mitigating any pest. Includes insecticides, herbicides, fungicides, and rodenticides. Pesticides can accumulate in the food chain and/or contaminate the environment if misused.

Runoff - The part of precipitation, snowmelt, or irrigation water that flows over the land into streams or other surface water. It can carry pollutants from the air and land into the receiving waters.

Thermocline – Layer of water between the epilimnion and hypolimnion, or an area of rapid temperature change between upper warmer waters and lower cooler waters in a thermally stratified lake.

Turbidity - Cloudiness in water caused by the presence of particles (suspended silt or organic matter) and pollutants.

Tributaries - River or stream flowing into a larger river or lake.

Watershed - Land area that surrounds and drains into a lake, river, stream or pond.

Wetland - An area that is regularly saturated by surface or ground water and subsequently is characterized by a prevalence of vegetation that is adapted for life in saturated soil conditions. Examples include swamps, bogs, fens, and marshes. Some wetlands are known for their ability to filter both chemical and biological pollutants from surface and ground water.

Part 2:

Lake Como

Watershed Management Plan

September 2007

Lake Como Watershed Management Plan

Aquatic Vegetation Management

Goal:

Prevent the introduction of exotic and invasive aquatic plant species and properly manage the aquatic vegetation that is present in Lake Como.

Issues:

- Excessive aquatic vegetation growth can complicate or restrict certain uses of the lake.
- A plant and user perception survey suggests that plant communities in Lake Como are dominated by exotic invasive plants such as Eurasian watermilfoil and curly leafed pondweed and native plants such as large leafed pondweed that can become a nuisance.
- Other exotic and invasive aquatic plant species such as water chestnut and fanwort have not spread into Lake Como, but are a threat.
- Excessive nutrients can lead to excessive vegetation growth.
- Different control methods have different benefits and concerns.

Suggested Actions:

1. Education:

a. Utilize the materials from the Weeds Watch Out! (W2O!) Program to inform lake users and homeowners about the spread and characteristics of invasive aquatic species, how to prevent the spread of invasive aquatic species, and teach volunteers to identify aquatic plant species and map them.

b. Educate the public on how to reduce nutrient loading to the lake utilizing materials from the P-Project.

c. Display information/bulletins on invasive aquatic plant species at the Summer Hill Town Hall and Lake Como Inn/Store.

d. Learn about life cycles to recommend harvesting times for harvesting efforts.

2. Assessment:

a. Extend the Weeds Watch Out! (W2O!) Program to Lake Como.

b. Inventory and map aquatic vegetation in Lake Como, compare to historical data and determine management needs. Publish findings as an educational tool.

c. Conduct annual surveys to monitor aquatic plant species in Lake Como.

d. Create a map to document the extent of aquatic plant growth based on annual plant surveys and sightings from lake users.

e. Examine alternative methods for aquatic vegetation control besides harvesting.

f. Research history of past controls and their success on aquatic vegetation.

g. Sample sediments to pinpoint high phosphorus sediment areas.

3. Funding:

a. Continue to utilize the funding from the Finger Lakes Lake Ontario Watershed Protection Alliance (FLLOWPA) program to continue the Citizens Statewide Lake Assessment Program (CSLAP).

b. Search for funding to inventory and map aquatic vegetation in Lake Como, compare to historic data and determine management needs.

c. Search for funding for education including expanding the Weeds Watch Out! (W2O!) Program and P-Project to Lake Como.

d. Search for funding to take sediment samples to pinpoint high phosphorus sediment areas.

e. Search for funding for the Lake Como Association to purchase equipment for aquatic vegetation management.

4. Regulation:

a. Propose and support state legislation to strictly enforce restrictions on the sale of invasive plant species especially website, plant nurseries and aquatic stores.

5. Miscellaneous:

a. Continue mechanical harvesting of Lake Como.

b. Examine dredging and explore funding opportunities to dredge high nutrient areas of Lake Como.

c. Examine chemical and other treatment options for aquatic vegetation management.

Lake Level

Goal:

Determine and attempt to maintain a preferred lake level that protects Lake Como and its shoreline.

Issues:

- High and low water levels can impact fisheries, wildlife habitat, aquatic vegetation growth, navigation, and recreation as well as lakeshore residences including their shorelines and septic tanks.

- Beavers, especially in the Lake Como Outlet, have caused lake level issues.

Suggested Actions:

1. **Education:**

   a. Educate realtors, builders, homeowners, architects and code enforcement officers on building code requirements or techniques specifically designed to protect structures in flood prone areas.

   b. Educate watershed residents on what to expect in regards to lake level and the effect it has on septic systems, aquatic weed growth, etc.

2. **Assessment:**

   a. Survey lakeshore residents on what the preferred lake level would be.

   b. Conduct a hydrologic study of Lake Como.

   c. Research obtaining an official lake level gauge for Lake Como.

   d. Study the effect of lake level on wildlife, revenue, silt deposition, aquatic vegetation, erosion, loss of beachfront, and effect of wave action.

3. **Funding:**

   a. Search for funding to conduct education on lake level and flooding issues.

   b. Search for funding for the hydrologic study.

   c. Search for funding to install an official lake gauge.

d. Search for funding to study the effect of lake level on wildlife, revenue, silt deposition, aquatic vegetation, erosion, loss of beachfront and effect of wave action.

4. Miscellaneous:

a. Examine dredging and explore funding opportunities to dredges areas in Lake Como.

b. Continue to work with the Finger Lakes Land Trust and the New York State Department of Environmental Conservation on beaver control projects.

Waterborne Bacteria

Goal:

Reduce waterborne bacteria levels in Lake Como in order to protect human health.

Issues:

- Waterborne bacteria can have potential health effects on humans.
- Geese, wildlife and domestic animals can affect bacteria levels in Lake Como.
- Loose dogs and improper disposal of pet waste can impact water quality.

Suggested Actions:

1. **Education:**
    a. Educate people how to reduce geese population on the lake and their property.
    b. Educate residents on the need to properly dispose of pet waste.
    c. Provide educational materials through Cayuga County Cornell Cooperative Extension and the Cayuga County Health Department.
2. **Assessment:**
    a. Conduct coliform testing of Lake Como.
    b. Implement a continuous monitoring program of Lake Como.
3. **Funding:**
    a. Explore funding for coliform testing.
    b. Explore funding to conduct a continuous monitoring program of Lake Como.
4. **Miscellaneous:**
    a. Provide incentives and programs for farmers and landowners to install, maintain, and manage buffers adjacent to lakeshore and other sensitive areas.

Septic Systems

Goal:

Protect public health and reduce nutrients and pathogen impacts of septic systems on surface and groundwater.

Issues:

- Inadequate and malfunctioning septic systems have the potential to introduce nutrients and pathogens to ground and surface waters.
- Shoreline residences can present special challenges to the proper operation of septic systems due to soils, slopes and small lot sizes.
- Conversion of homes from seasonal to year round without upgrading septic systems can lead to system failure.

Suggested Actions:

1. **Education:**
    a. Promote regular maintenance of septic tanks.
    b. Distribute educational literature that provides examples of good septic system and holding tank use and maintenance practices as well as other issues such as water conservation to homeowners and at Lake Como Association meetings.
    c. Distribute a septic maintenance log sheet for homeowners.
    d. Provide educational workshops on septic systems for residents.
2. **Assessment:**
    a. Perform a community dye test for residents using septic systems.
    b. Explore DNA testing to determine coliform sources.
3. **Funding:**
    a. Explore federal or state assistance to replace or upgrade septic systems of people with limited incomes.
    b. Explore what grants and loans are available for water and waste disposal systems for rural communities.

c. Seek funding to conduct dye testing.

d. Research funding options for the construction of alternative wastewater systems in high priority areas.

e. Seek funding to conduct DNA testing to determine coliform sources.

Boating/Jet Skis/Wave Runners

Goal:

Reduce boat and personal watercraft impacts on Lake Como.

Issues:

- Boating and the use of personal watercraft are popular past times, but there are a number of safety, environmental and quality of life issues that are of concern such as excessive speed and noise, lack of boating courtesy, water quality impacts and importing of exotic species.

Suggested Actions:

1. **Education:**

    a. Develop a coordinated appreciation/education program on boating that could include information such as perceived problems of boaters, speed limit and boating setbacks, safe and proper fuel storage of boats including what to do with a spill, boating safety and invasive species.

    b. Distribute New York State Boaters Guide to lakeshore owners and guests at the Lake Como Inn/Store.

    c. Develop and place a sign at the Lake Como Inn/Store with information from the New York State Boater Guide.

2. **Assessment:**

    a. Explore options and public opinion of motorized watercraft.

    b. Research the impact of excessive wave action.

    c. Study speed and noise of boats on Lake Como.

3. **Funding:**

    a. Search for funding to conduct education for boaters.

    b. Search for funding to conduct research on boating.

4. **Regulation:**

    a. Identify enforcement authority around the lake.

b. Work with law enforcement to increase enforcement of existing navigation laws locally.

c. Work with law enforcement agencies and local government to develop an effective strategy to enforce boating regulations.

d. Examine a nighttime speed limit.

Stormwater and Soil Erosion Management

Goal:

Reduce the potential impacts of soil erosion and stormwater on Lake Como and its watershed.

Issues:

- As water flows over the land it can erode soil as well as pick up pollutants such as litter, sediment, nutrients, pesticides and pathogens and deliver it to Lake Como.
- These pollutants can cause problems with the quality of the water in Lake Como and may cause human health impacts, floating debris, excess aquatic weed growth and other issues.
- Construction, roadways, agriculture and residential neighborhoods can all be sources of soil erosion and stormwater.

Suggested Actions:

1. **Education:**

   a. Provide education and training of local officials on erosion control and stormwater management including the Phase II Stormwater Rules and Regulations, the benefits of adopting a local law on stormwater erosion and erosion control that guides the local community through the process in order to protect, maintain, and enhance water quality in the Lake Como Watershed; and best management practices to protect water quality.

   b. Educate homeowners and residents through workshops and literature on how to reduce the amount of nutrients that enter Lake Como. Topics could include proper lawn maintenance, pet waste, yard waste management, erosion, landscaping, and shoreline erosion.

   c. Educate residents utilizing materials from the P-Project Program.

2. **Assessment:**

   a. Assess the streams entering Lake Como and restore severely eroded streambank segments.

   b. Conduct an assessment of shoreline erosion and related problems.

   c. Continue monitoring Lake Como through the Citizens Statewide Lake Assessment Program (CSLAP). Examine expanding this monitoring program.

d. Conduct testing on sediments to pinpoint high phosphorus sediment areas.

e. Research project to dredge mucky sediment areas to remove phosphorus source.

f. Monitor streams above and below farms.

g. Determine the impact of deicing materials including sand and salt on Lake Como.

3. Funding:

a. Identify funding sources for comprehensive streambank restoration and management programs.

b. Search for funding for education on nutrients.

c. Search for funding to expand the P-Project to Lake Como.

d. Search for funding to continue and possibly expand the monitoring of Lake Como.

e. Search for funding to test sediment samples to pinpoint high phosphorus sediment areas.

f. Encourage farmer participation in state and federal programs that relate to water quality and issues in the Lake Como Watershed and pursue forms of assistance such as continued federal and state grants and cost share programs.

4. Regulation:

a. Encourage the enforcement of near-shore boating speed limits to reduce shoreline erosion.

5. Miscellaneous:

a. Hydroseed and mulch roadside ditches and swales to reduce delivery of sediment and other pollutants from roadways.

b. Encourage use of structural controls of sediments on steep roads, roadbanks and in high flow areas.

c. Encourage use of and provide information on structural measures to control sediments and other pollutants from stormwater runoff.

d. Encourage use of and provide information on best management practices to reduce roadbank erosion.

e. Encourage use of filter strips or maintenance of vegetative filter strips to protect stream corridor and shorelines.

f. Provide assistance to design and implement preventative measures for shoreline erosion.

g. Provide incentives and programs for farmers and landowners to install, maintain and manage buffers adjacent to lakeshore and sensitive areas.

h. Encourage use of Agricultural Environmental Management (AEM) plans for farms in the Lake Como Watershed. Identify best management practices (BMPs) from AEM plans, look for assistance to implement these BMPs and measure the effectiveness of these BMPs.

i. Encourage use of whole farm plans.

j. Towns could encourage alternative agricultural uses of land such as rotational grazing, organic farming, etc.

k. Provide signs for lake friendly farms or watershed friendly farms.

Fisheries

Goal:

Maintain a healthy and diverse fishery in Lake Como.

Issue:

- It is important to maintain a healthy and diverse fishery in Lake Como for recreation, biodiversity and quality of life.

Suggested Actions:

1. **Education:**

   a. Educate the public on fisheries on such topics as viral hemorrhagic septicemia (VHS) and effects of invasive species on native fish populations.

2. **Assessment:**

   a. Determine water quality, including phosphorus level, dissolved oxygen and chlorophyll α in Lake Como and the effect it has on aquatic vegetation and fish.

3. **Miscellaneous:**

   a. Request that the New York State Department of Environmental Conservation contact the Lake Como Association before any stocking is conducted to discuss why stocking is being conducted and get their input.

   b. Promote watershed management strategies that will strengthen fish population.

   c. Continue aquatic plant management strategies to reduce impact on fish.

Invasive Species

Goal:

Contain or reduce current populations of invasive species and prevent the introduction of new invasive species in the watershed.

Issues:

- Invasive species have been found in Lake Como and its watershed.
- Many invasive species such as zebra mussels, quagga mussels and water chestnut threaten Lake Como and its watershed.
- Invasive species can have an economic, ecologic and aesthetic impact on Lake Como and its watershed.

Suggested Actions:

1. **Education:**

   a. Continue educational programs to prevent the spread of invasive species into Lake Como and its watershed.

   b. Utilize the materials from the Weeds Watch Out! (W2O!) Program to inform lake users and homeowners about the spread and characteristics of invasive aquatic species, how to prevent the spread of invasive aquatic species, and teach volunteers to identify aquatic plant species and map them.

   c. Display information/bulletins on invasive species at the Summer Hill Town Hall and Lake Como Inn/Store.

   d. Start a watch card program by creating and distributing cards focused on potential invaders to make people aware before infestations occur.

2. **Assessment:**

   a. Initiate a regular inventory and monitoring program for exotic, introduced and invasive species in the lake and watershed.

   b. Extend the Weeds Watch Out! (W2O!) Program to Lake Como.

3. **Funding:**

   a. Search for funding to conduct inventory, monitoring and control programs for invasive exotic species.

b. Search for funding to conduct education on invasive exotic species.

4. Regulation:

a. Propose and support state legislation to strictly enforce restrictions on the sale of invasive plant species especially website, plant nurseries and aquatic stores.

5. Miscellaneous:

a. Utilize expertise to monitor and control invasive species before they become established.

b. With Cayuga County Water Quality Management Agency (WQMA) or other agency, develop watchlist and list of infestations of nearby water bodies so boat, jet ski, canoe, etc. owners know what to look for.

Public Access

Goal:

To encourage public access while minimizing its environmental impact within Lake Como watershed.

Issues:

- There is limited public access because all of the shoreline around the lake is privately owned.
- Protect the lake from the negative impacts of public access such as introduction of invasive exotic species.

Suggested Actions:

1. **Education:**

   a. Encourage low impact use such as hiking, canoeing and fishing instead of motorized use.

   b. Develop and continue education to prevent spread of invasive exotic species from public access points into Lake Como.

2. **Funding:**

   a. Search for funding to conduct education on the spread of invasive exotic species into Lake Como.

Monitoring

Goal:

Continue and expand monitoring of Lake Como.

Issues:

- Reliable long term information on water quality, problem areas, and use impairment is needed to manage Lake Como and its surrounding watershed.
- Data can be used to gain insight into the present condition of Lake Como compared to historic data, and can be used to determine whether water quality conditions are improving, degrading, or stable.
- Data can also serve as a baseline for comparing future trends and examining the effect of changing land and lake use patterns and watershed activities.
- Data from monitoring can identify or confirm areas of concern within the watershed and set priorities for implementing best management practices (BMPs).

Suggested Actions:

1. **Assessment:**

   a. Continue monitoring Lake Como through the Citizens Statewide Lake Assessment Program (CSLAP). Examine expanding this monitoring program.

   b. Conduct other water quality testing including coliform testing, etc.

   c. Conduct testing on sediment samples to pinpoint high phosphorus sediment areas.

   d. Conduct water testing of tributaries and outlet.

   e. Conduct water testing of spring quality.

2. **Funding:**

   a. Continue to utilize the funding from the Finger Lakes Lake Ontario Watershed Protection Alliance (FL LOWPA) program to continue the Citizens Statewide Lake Assessment Program (CSLAP).

   b. Seek funding for other water quality testing.

   c. Search for funding to test sediment samples to pinpoint high phosphorus sediment areas.