Shoreline Development

Chapter 9

Canandaigua Lake offers beautiful scenery, clear blue waters, good fishing, and is an excellent lake for water sports. These factors have proven to be an irresistible combination for thousands of homeowners and vacationers. Much of the lake front development occurred during the 1950s and 60s, a time period when there was less concern about the effects of development on the lake shore and water quality. Building along Canandaigua Lake has continued since then. Today there are around 1100 seasonal and year round residences on approximately 1400 lake shore parcels.

High building densities, building on marginal lands, greater numbers of septic systems,

View of development along the north end of the lake.

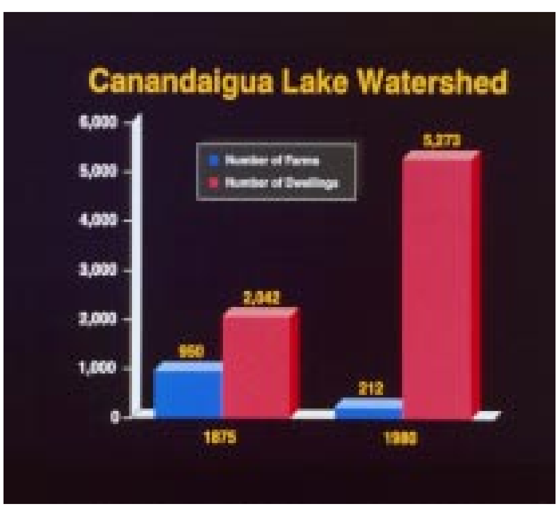


Table showing the increased residential development within the watershed.

and aging septic systems risk overwhelming Canandaigua Lake's natural ability to effectively dilute wastes and nutrients from runoff and seepage. In an effort to protect public health, safety, and to address potential environmental impacts that building and altering the landscape might have, most municipalities have adopted regulations that govern design and construction in and around the lake. Contained in the zoning ordinances, these regulations pertain to type and location of septic systems, home distance from shore, maximum building height, etc... . Ordinances vary from town to town, so it is important to check with your local zoning officials as to the particulars of your area. They will also know which other agencies it will be necessary to contact before building. Depending on a number of site factors, it may be necessary to obtain construction permits from the town, state, or even federal agencies.

Construction of a dock, mooring, boathouse, accessory structure and boat hoist is subject to the Canandaigua Lake Uniform Docking and Mooring Law enforced by the local Code Enforcement Officer (CEO). In addition, any excavation at or below mean high water level (MHWL), 689.4 ft above mean sea level (the lake level is printed daily in the local weather section of *The Daily Messenger* of Canandaigua), requires a permit from the New York State Department of Conservation (DEC). An example would be the construction a dock anchored to shore by a breakwall. A DEC and local permit would be required for the breakwall and possibly a separate local permit would be necessary for the dock. If you have any doubts about whether or not a permit is needed for a project, call your local CEO and/or the DEC. It is always better to discover a permit is not needed rather than being cited for a violation.

Ordinances, laws, rules and regulations were created to protect public health, safety, welfare and the environment. Protection of water quality of Canandaigua Lake is important to the 1,500 lake area residences and the 50,000 people from the City and Town of Canandaigua, Gorham, Farmington, Middlesex, Newark, Palmyra, Rushville, and other municipalities that drink water from Canandaigua Lake. These laws also help preserve the clarity of the water, scenic views, fisheries, and many of the other reasons people are drawn to the lake. Please remember that everyone on and around the lake is part of a community, and each individual has an impact.

The next three sections provide information on shoreline development: residences, docks, and beach erosion protection. The fourth section provides important information on lake levels and flooding that should be taken into account before any construction.

Sediment Control for Building and Property Improvements

The largest negative impact that construction can have on the lake is increased sedimentation due to increased runoff over disturbed soils. Sediments in the lake can muddy the water, smother fish eggs, increase cost of water filtration and bring in nutrients that cause undesirable algae blooms. Simple erosion control practices can reduce the amount of soil reaching the water by reducing the amount and velocity of water washing downhill.

Before the project begins - A little forethought and understanding of how erosion prevention works will make sediment control easier. In nature, plant roots hold soil in place during storms and heavy snow melts. Debris, grasses and underbrush slow overland flow, allowing the water more time to infiltrate into the soil and reducing the power of the water. This means that the less the natural landscape is disturbed when building, the less area for erosion to occur. Deflecting "clean" water away from the disturbed site will also help reduce erosion. Seeded and mulched swales (shallow diversion ditches) and dikes can be used for this purpose. Direct the flow into a stable area.

Temporary sediment barriers placed before construction can intercept and remove sediment from runoff once excavation begins. Straw bales solidly staked into the ground slows flow, allowing suspended particles to settle, and can act as a filter for water running through. A silt fence works like straw bales but can be used on steeper slopes. Both need to be checked periodically to make sure they are working properly. Swales and dikes can be used to divert sediment-laden water to settling ponds or other sediment trapping devices. These are usually used on larger construction projects in conjunction with bales and fences.

Once the erosion prevention and sediment control measures are in place, excavation and construction can begin.

During construction - Preserve as much of the topsoil as possible. Stockpile it out of the way and protect it by covering it or seeding it. Replacing a layer of topsoil after construction provides a good base for replanting, reduces irrigation needs, and reduces the need for fertilizer.

Check the sediment control devices and adjust as necessary. As grades change during construction, the direction and force of the runoff can change as well. This would make previous efforts for control ineffective.

Protect existing vegetation, including trees, from additional damage. Keep the area of impact contained in the smallest area reasonable. It often takes a year or more to re-establish vegetation on a disturbance, many years to replace a dead tree.

Inadequate stablization leads to erosion into the lake.

Afterwards - Stabilize the disturbed areas as soon as possible upon completion of the project. This can include replacing the topsoil saved, seeding or planting and finally mulching. Placing sod is another option. In selection of seeding mixture or plants consider whether the site is to be mowed, light and moisture conditions, and the steepness of the slope. Replanting native vegetation has the advantage that these plants have evolved in the area and are well suited for the conditions.

Mulch is used to stabilize the soil, provide moisture for the seedlings, and prevent seeds and seedlings from washing away. Some examples of different types of mulches are: sawdust, woodchips/bark mulch, compost, hay or straw, peat moss, gravel or stone, and plastic. Each has its advantages and drawbacks. A local nursery or contractor should have more information.

Once plants have established a sufficient root system to prevent erosion, the erosion prevention and sediment controls can be removed. Sediment accumulated in basins and traps to be removed should be carefully disposed of to prevent it from washing down into the lake. Sometimes it is desirable to leave the erosion prevention dikes and/or swales permanently.

Before beginning any project, remember to contact the local CEO about local zoning ordinances and permits. Also, discuss erosion and sediment control measures with your contractor to make sure control measures will be installed.

Docks

Many lake residents desire a dock for easy access to the water, docking for boats, fishing access, and other forms of recreation. They can be permanent - anchored to the lake bed and left in place year-round; or temporary - a seasonal structure. There are specific regulations regarding the size and location of the docks in the Canandaigua Lake Uniform Docking and Mooring Law. Some of the more important restrictions for residential properties are:

1. Structures have to be at least 10 ft from any property boundary unless it is to be shared by the respective owners.

2. The number of boat slips and/or moorings as well as the number of docks allowed by this law is determined by the lineal feet of lakeshore owned as follows:

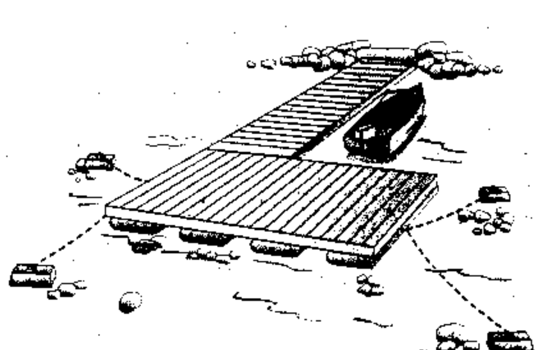
❶ 0 - 25ft: 1 boat slip, 1 dock
❷ 25.01 - 50 ft: 2 boat slips, 1 dock
❸ 50.01 - 100 ft: 3 boat slips, 1 dock
❹ 100.01 - 150 ft: 4 boat slips, 2 docks
❺ 150.01 - 200 ft: 5 boat slips, 2 docks

3. Docks cannot exceed 720 sq ft. The main body of the dock can be a maximum of 8 ft wide as measured parallel to the shoreline and can be a maximum of 60 ft long or as long as necessary to reach 3 ft of water depth as measured from the mean low water level. In this case the length maybe restricted if the dock is a hazard to safe navigation.

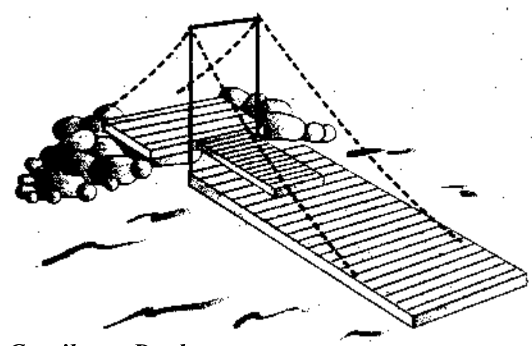
4. Mooring buoys are prohibited for properties with only 0 - 25 ft of shoreline. The moorings must be placed so that at no time could a moored vessel cross over an extended property line. Any moorings proposed to be placed over 100 ft from the shoreline require site plan approval.

Floating swimming platforms, ski jumps and other recreational platforms located in the lake are not regulated by the local municipalities. They are regulated by the New York State Office of Parks and Recreation.

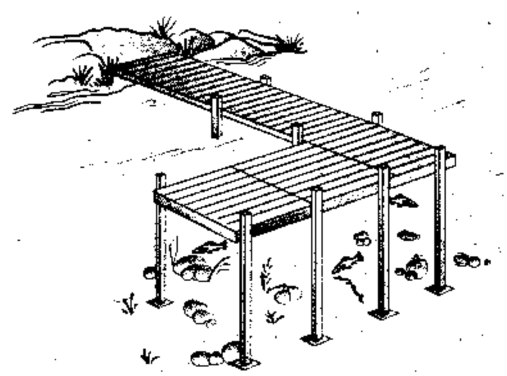
Three common dock designs are the floating, cantilever, and post-supported docks. *Floating docks* are decks supported by buoyant materials such as clean, sealed plastic drums or rigid, plastic foam. The dock should be kept in place by chains attached to weights in the lake bed. *Cantilever docks* have one end permanently fixed to the shore while the deck juts out over the water, the far end supported by floats, vertical posts or a combination of the two. These docks can be pulled straight up and back to shore, like a drawbridge. *Post-supported docks* are held in place by posts vertically sunk into the lake bed. The narrow posts allow natural wave action and fish and other wildlife to pass freely around it.



Floating Dock



Cantilever Dock



Post Supported Dock

All three of these structures tend to have minimal impact on the lake bottom in construction and once in place. In addition they can be designed to be temporary - removable for the winter. Removal prevents ice damage which reduces the need for repair each spring. It also allows the dock to be maintained on land, reducing the amount of paint or sealer entering the lake. In exposed areas, the design and materials need to be robust, able to withstand winds and heavy wave action.

Materials

Pressure-treated wood is the most common and initially most economical material used to build docks. Salt injected into the wood during the pressure-treatment preserves the wood from water damage, fungi, and insects. There are other types of pressure-treated wood impregnated with chemicals such as creosote, pentachlorophenol, or inorganic arsenical compounds that should not be used in the lake. These chemicals are toxic to humans as well as the lake environment.

There are many alternatives to pressure-treated wood. Woods such as cedar and redwood are naturally resistant to the damaging effects of immersion. Aluminum is a strong light material that will last. Polyvinylchloride (PVC) and recycled plastic also offer light weight with plenty of strength. These and other alternative building materials may initially be more expensive than pressure-treated wood. However, plastics and metals will last years longer and require less maintenance than does wood, making them potentially more economical in the long term.

Floating docks and platforms are anchored to prevent them from blowing or washing away. Traditional anchors include concrete or stone filled steel drums. Even if they appear perfectly clean, the drums often contain residues of their past contents such as chemicals, gasoline, pesticides, or inks - all harmful to the living lake. The same is true for using empty drums and barrels as floats. If these types of containers are used, buy them new or make sure that the previous contents were not toxic.

Remember: before constructing a dock, mooring or other shoreline structure, consult the code enforcement officer and other potential regulating agencies to prevent future hassles. Also, talk to neighbors about what designs and materials work or do not work for that area. Their experience can help eliminate unforseen problems. The local lake associations and builders can also be good sources for information.

Shoreline Erosion

Shorelines are also susceptible to erosion. Erosion results from waves and ice. Waves, caused naturally or by boats, beat against the shore and eat away at the shoreline. Waves, wind, and expansion pressure grind ice along the shore. The size of the waves and the stability of the shore are the largest factors influencing the amount of erosion. The average size of the waves varies around the lake. Protected shores experience small waves while those shores exposed to prevailing northwest winds tend to be subject to the largest waves. The stability of the shore is a factor of the type and size of material making up the shore and the slope of the land. Soft or fractured stones such as the shale found around Canandaigua Lake are easily eroded by wave action, especially on steeper slopes. With low angle slope, the energy of the wave is quietly dissipated as it washes over the shore. Much more of the wave's energy impacts a steeper slope when the wave crashes against it.

A shoreline can be protected by increasing the shores resistance to wave action, reducing the wave impact, or a combination of the two. This protection can be achieved through structural and nonstructural modifications to the existing shore.

Nonstructural Controls

Beach sloping - The area near the lake shore can be made less susceptible to erosion by flattening the slope of the shore. A flatter slope allows waves to dissipate their erosive energy without damaging the shoreline. The ideal slope ratio is approximately 10:1. Essentially, the shore area from the mean high water level (689.4 ft) inland the distance that waves wash up would become a gravel beach without much vegetation. The gravel serves as additional protection.

Landscaping - Using plants to stabilize shorelines is a simple way of reducing erosion. The roots of plants help to hold soil in place and the plants themselves act as buffers, absorbing some of a wave's energy during storm events and flooding. This method works best in conjunction with other methods such as a low-angled slope. In sheltered areas, vegetation can be grown right to

Picture of flooding and erosion at a cottage along the lake.

the water's edge. However, plants and trees are not able to withstand constant battering by waves. Therefore, if the shore is exposed to continuous wave action, vegetation should be planted out of reach from normal waves. The root systems of these plants will extend down to the wave impact zone and support the soil in that way.

Trees are one of the most effective plants at reducing erosion. The roots are strong and far reaching, solidifying large areas. At times it is necessary to remove a dying or problematic tree. Leaving the stump will help hold the soil until other vegetation can grow or the tree replaced.

Structural Controls

Structure controls, otherwise known as revetments, protect shoreline by covering the area susceptible to erosion. The rocks, logs, metal and concrete that these structures are made of are able to withstand the force of the waves that the endangered shore could not.

In determining what type of structural control to use, a few criteria must be taken into consideration. The main concern is the average wave height at the mean high water level. In lakes, the height of waves, measured from the trough to the crest, is determined by wind speed and the distance the wind travels across the lake. Structures are usually designed to be higher than the expected height a wave will climb up the shore or structure, otherwise known as runup.

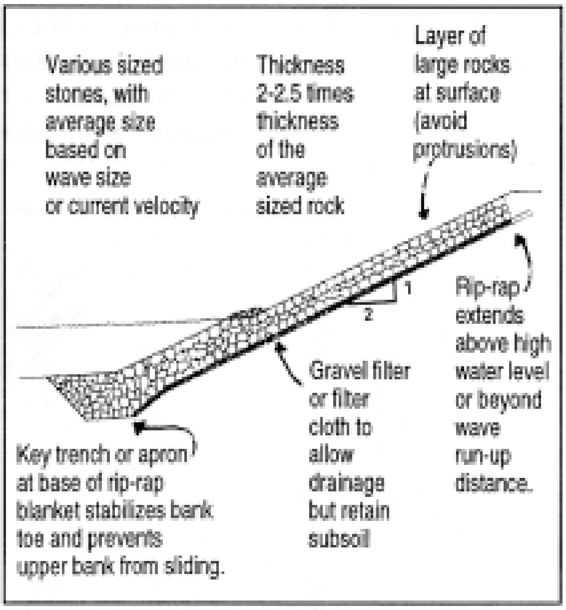
Other factors that need to be taken into consideration before construction is the mean high water level (MHWL), the stability of the shoreline, and steepness of slope. If the shoreline contains fairly loose soil, compaction of the soil is necessary before construction. Many revetments perform better and last longer if placed on lower angled slopes. Do not forget to check with the local code enforcement officer (CEO) and the NYS DEC about ordinances and permits needed.

When designing a revetment, there are several critical areas of the structure. These include:

- Protect the toe (or base) from scouring due to waves. An undercut structure will eventually fail and need replacement.
- Protect the revetment from overtopping under normal lake conditions by mak ing sure it is tall enough. Water splash ing on unprotected ground can cause erosion behind the protection, creating the potential for failure.
- Protect the flanks from erosion to pre vent failure.
- Allow for seepage from behind the structure by using filter cloth or a sand filter behind the revetment. Most shore line protection structures are not built to withstand major storms and water will get behind the structure. When that does happen, there needs to be a mechanism for the water to leave without undermin-

ing the revetment.

Types of Structural Controls



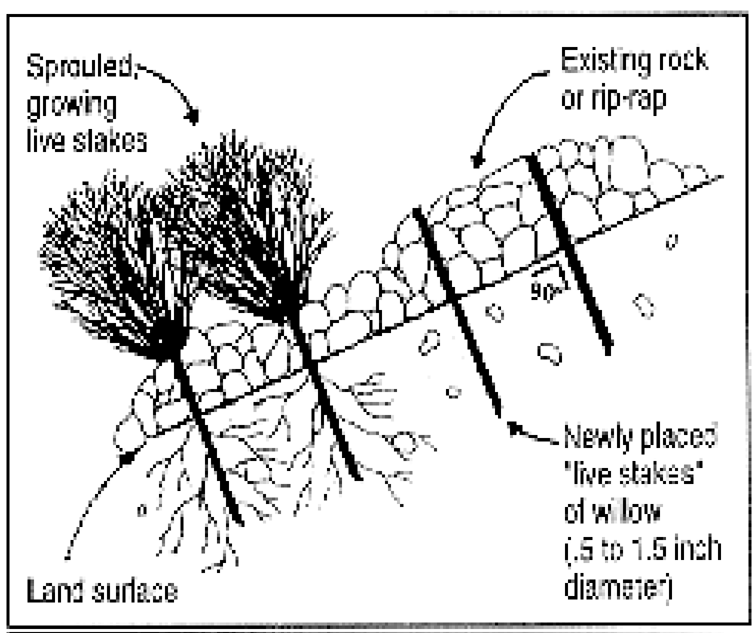
Typical cross section of rock revetment.

Riprap and rootrap - Riprap is constructed with large stone or gravel that is placed on the natural or artificially graded shoreline slope. Often, the larger stones are "chinked" with smaller stones to fill crevices and enhance coverage and stability. Rootrap is constructed just like riprap, but topsoil is placed over the rocks, and vegetation is planted. The roots from the plants hold the soil in place and stabilize the movement of the riprap. Specific criteria for the design of riprap structures include:

- Extend riprap up the shore at least 0.5 feet above the height the average wave travels up the shore at MHWL.
- Place riprap at least the same distance below the MHWL.
- The median size of the riprap stone is determined according to the wave heights and the slope of the shore line. Consult the Natural Resource Conservation Service (used to be the Soil Conservation Service) or your local Soil and Water Conservation District for help with this.
- A minimum thickness of 2.5 times the median rock size.
- Bedding material, such as gravel, should be at least 6 inches thick, or use filter fabric.
- Anchor the riprap if the shore has slopes of 6:1 or steeper.

Gabions - Gabions are rectangular or square wire baskets that are filled with stones 4 to 8 inches in diameter. Once the shoreline is prepared, the baskets are put in place and filled with stones. A typical basket is three feet wide and are available in lengths of six, nine, or twelve feet. The height or thickness ranges from nine inches to three feet.

Individual baskets are wired together, filled with stone and wired shut. Gabions are ideal in



Live stakes installed through rip rap.

areas where they won't be used as a foot path. The baskets might require some occasional maintenance. It is vital that the stones are packed inside the baskets in order to make the structure rigid.

Interlocking blocks - Interlocking blocks are simply pre-made blocks that lock together. There are several styles available that local contractors or landscaping supply companies can provide more information about. In building an interlocking block structure, usually one layer of blocks is sufficient to do the trick. The interlocking mechanism gives the structure stability but allows the structure to move and settle without breaking. Depending on the conditions of the site, the blocks weigh anywhere from 30 to over 100 pounds. In many cases, the blocks can be put into place by hand.

Retaining walls - Retaining walls, also known as sea walls, bulkheads, or breakwalls are rigid structures that are placed vertically or at a slight angle inland to form a barrier between the shore and water. Retaining walls are either cantilevered or anchored. A cantilevered retaining wall is a sheet pile supported entirely by the ground. Sheet piles are typically sheets of steel bent like a stretched out "Z" and are driven into the ground. They also can be wooded planks set on end. An anchored wall is similar to the cantilevered wall, but there are anchors holding the upper portions of the wall.

The following list gives some of the design criteria for retaining walls that the Natural Resource Conservation Service recommends:

- Steel sheet piles can be driven into hard soil and soft rock. Aluminum and tim ber sheet piles can be driven into softer soil.
- For cantilevered retaining walls, the sheet piling should be driven deep enough to resist overturning, which usually requires a depth of two to three times the free standing height, depend ing on the foundation characteristics at the site.
- For an anchored retaining wall, sheet piling should be embedded to a depth one and a half to two times the freestanding height. Again, the foun dation characteristics may indicate shal lower or deeper penetration.
- The top of the retaining wall should be at least one foot above the height a wave reaches when it breaks against such a structure.
- Wing walls should be used to prevent flanking (erosion at the end of the wall). If the ends are not protected, erosion could produce a retreating shoreline at each end of the wall.
- The suggested minimum thickness for metal sheets is 0.109 inches; for wood planks, 2 inches; for wood poles, 4 inches.

Many of the shoreline properties around Canandaigua Lake also have streams that run through or enter the lake on the property. Stream erosion control structures are subject to different standard than lake structures. Running water can be even more destructive than wave action and the measures used to prevent erosion need to reflect that. Contact the Soil and Water Conserva tion District Office for more information.

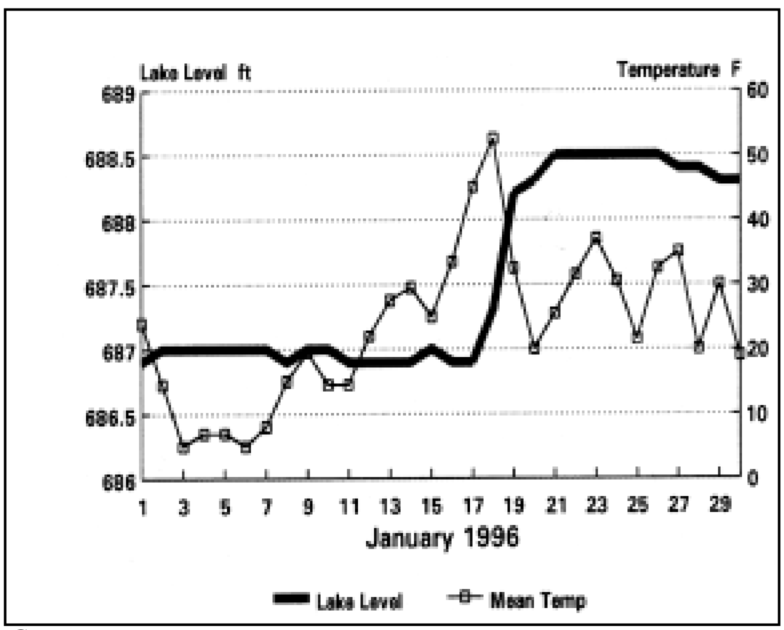
Lake Levels and Flooding

The water level in all lakes is determined by the amount of water entering into the lake and the amount leaving. The Canandaigua Lake watershed, approximately 174 square miles, feeds a lake of only 16.57 square miles. The watershed to lake area ratio is about 11:1. Under ideal conditions, an inch of rain falling on the entire watershed would result in an 11 inch rise in lake levels. Most of Canandaigua Lake's water leaves through the Feeder Canal or through the gates at Muar Dam, both in the City of Canandaigua. The gates function to help regulate the lake level and to force a minimum flow of 35 cubic feet per second (cfs) to properly dilute effluent from the waste water treatment plant through the Feeder Canal.

Low lying houses are suspect to periodic flooding.

Currently, the gates are regulated by the City of Canandaigua. The City strives to raise or lower the lake level to match the level recommended by a guide curve formulated to optimize the lake water levels throughout the year. The curve ranges from a desired water level of 686.9 msl in the winter to 688.5 msl in the summer. Canandaigua Lake's natural fluctuations are greater than the 1.6 ft indicated by the guide curve. Some of the interests and concerns addressed during the creation of the guide curve were: the New York State Department of Environmental Conservation, which mandates the minimum flow of 35 cfs through the Feeder Canal and preserves minimum water levels in the Hi Tor Wildlife Management Area marshes; cottage owners, worried about flooding and frozen pipes; boaters, concerned with lake access from stationary docks and ramps; municipalities, withdrawing water from the lake; and New York State, in maintaining water levels to preserve fish and wildlife needs.

For large storm events such as 1972's Hurricane Agnes, the largest storm of this century, the two outlets cannot remove the water fast enough to prevent the lake levels from rising. The amount of flooding from these storms depends on the lake level before the event, the amount of rain or snow melt, and the condition of the ground in the watershed. Frozen or saturated soil allows most of the water to run off into the streams and the lake. The largest increase of lake level each year normally occurs during spring runoff. In January 1996, combined rain and snow melt caused the lake level to rise precipitously. For the low lying land around the lake, flooding of property begins at 689.2 ft above mean sea level (msl). It is recommended that all buildings be built above the ten year flood level, 690.0 msl, to help prevent flooding. Septic sytems are required to have 4 ft of useable soils which puts the top of the septic systems at 694.0 msl.



Graph of lake level and average temperature for the month of January, 1996. Lake levels increased around the 19th of January due to snow-melt and precipitation.