Valley Lake

Valley Lake is a 12-acre man-made lake constructed in 1952. It is located within the Des Plaines River watershed, in unincorporated Lake County, about one mile east of Illinois Route 45. Most of Valley Lake is owned and managed by the Wildwood Park District. A spillway at the northeast corner of the lake drains to an underground storm sewer network that eventually reaches the Des Plaines River. The Wildwood Park District has two access locations, Valley North, located on the north end of the lake, and Valley South, at the south end of the lake. A swimming beach is at Valley South. Both areas offer fishing from shore and a picnic area. Only non-motorized boating is allowed on the lake, and access is limited to park district residents.

In 2020, the Lake County Health Department–Ecological Services (LCHD-ES) monitored Valley Lake. Water samples were collected once a month from May through September. Sample location was at the deepest part of the lake (Appendix A). Samples were analyzed for nutrients, solid concentrations and other physical parameters. Additionally, an aquatic plant survey was conducted in September (2020) and a shoreline assessment surveyed in November (2020). This report summarizes the water quality sampling results, aquatic plant survey, and shoreline survey conducted on Valley Lake by the LCHD-ES.

EcoLOGical Services Water QualiTy Specialists

Gerard Urbanozo  
gurbanzo@lakecountyil.gov  
847-377-8020

Alana Bartolai  
abartolai2@lakecountyil.gov

Lake County, IL

2020 Valley Lake Summary Report

Lake County Health Department
Ecological Services
Following are highlights of the water quality sampling, shoreline survey and aquatic macrophyte surveys from the 2020 monitoring season. Historically, Valley Lake has had a variety of lake quality issues dating back to the 2000 sampling season. These problems include or have included excessive phosphorus, total suspended solids, severe algal blooms and nutrient enrichment. Many water quality parameters remain above the Lake County median. The complete data sets for water quality, aquatic plant sampling, and shoreline surveys conducted on Valley Lake can be found in Appendix A and B of this report, and discussed in further detail in the following sections.

- Average water clarity was 3.03 ft., which is 40% lower than 2007 (5.05 ft), and slightly better than the Lake County median Secchi depth of 3.02 ft.
- Water clarity is influenced by amount of particles in the water column; this is measured by total suspended solids. The average TSS concentrations on Valley Lake was 10.8 mg/L in 2020, which is significantly greater than the Lake County median of 7.7 mg/L. TSS concentrations increased by 30% since 2007 (8.3 mg/L).
- Nutrient availability indicated that the average TN:TP ratio was 13:1 meaning that Valley Lake was phosphorus and nitrogen limited. Most of the lakes in Lake County tend to be phosphorus limited, meaning addition of phosphorus to the lake ecosystem can affect change in the lake, such as increased algal populations. Ratios of less than 10:1 suggest a system limited by nitrogen, while lakes with ratios greater than 20:1 are limited by phosphorus. It is important to know if a lake is limited by nitrogen or phosphorus because any addition of the limiting nutrient to the lake will, likely, result in algae blooms or an increase in plant density.
- The 2020 average total phosphorus concentration was 0.144 mg/L, which exceeds the Illinois Environmental Protection Agency (IEPA) water quality standard of 0.050 mg/L. Valley Lake is impaired for phosphorus. While Valley Lake is still impaired for phosphorus, there was a 52% increase since 2007.
- Trophic State index (TSIp) for Valley Lake was 76; meaning Valley Lake is considered hypereutrophic. This means that the lake has high nutrients which can result in excess plant or algae growth.
- Surface dissolved oxygen (DO) concentration averaged 7.02 mg/L at Valley Lake and is considered adequate to support fisheries. However, the lake has a history of low DO during the summer. Fish can suffer oxygen stress when DO drops below 5 mg/L. The DO concentration at 3 ft below the surface ranged from 2.39 mg/L in September to a high of 9.72 mg/L in July.
- Dissolved oxygen concentrations reached anoxic conditions (<1 mg/L) near the bottom of the lake in August (8 ft) and September (7ft - 8ft) in the lake.
- The aquatic macrophyte survey showed that only 21% of all sampling sites had plant coverage. A total of 3 plant species were present which were: Coontail, Sago Pondweed, and Eurasian Watermilfoil (EWM). EWM is a non-native invasive aquatic plant.
- Valley Lake had 20% of its shoreline eroding with 20% classified as slight erosion.
- Although minimal shoreline erosion was occurring, 87% of Valley Lake’s lakeshore buffer condition was classified as poor based on the 2020 shoreline condition survey.
Watershed & Land Use

Valley Lake is in the Des Plaines River watershed and its lakeshed is 82.12 acres (Figure 1). The dominant land uses in the watershed are Single Family (59.4%), Transportation (5.94%), and Public and Water (12.15%). Overall, the watershed has 83.49% developed land. The size of the watershed feeding the lake relative to the size of the lake is also an important factor in determining the amount of pollutants in the lake. The watershed to lake surface area ratio is 8:1 and has a calculated retention time of 308 days. Retention time is the amount of time it takes for water entering the lake to flow out of it. It is important to properly manage the lands in a way that minimizes pollutants such as phosphorus, nitrogen, and chlorides from entering the lake.

Figure 1: Valley Lake Land Use and Watershed Boundary 2020

Based on the amount of impervious surfaces each land use contributes varied amounts of runoff. Because impervious surfaces (parking lots, roads, buildings, compacted soil) do not allow rain to infiltrate into the ground, more runoff is generated than in the undeveloped condition. The major sources of runoff for Valley Lake were Single Family (59.81%) and Transportation (5.94%). Runoff is referring to the amount of water making its way to the lake, however, each land use contributes different amount of pollutant loads associated with it’s runoff. The water land use does not have high pollutants associated with it since it refers to the rainfall falling directly on the lake. Pollutants in rainfall are mostly related to atmospheric deposition and while contribute contaminants do so at a lower quantity than other land uses in urbanized areas. For example, the transportation land use, and other impervious surfaces, contain higher pollutants that are carried to the lake by runoff. In Valley Lake most pollutants are likely a result of the runoff from transportation and single family homes land uses.

Table 1: Valley Lake 2020 Land Use and Estimated Runoff

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Acreage</th>
<th>Runoff Coeff.</th>
<th>Estimated Runoff, acft.</th>
<th>% Total of Estimated Runoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi Family</td>
<td>2.81</td>
<td>0.30</td>
<td>2.32</td>
<td>3.51%</td>
</tr>
<tr>
<td>Public and Private Open Space</td>
<td>1.40</td>
<td>0.15</td>
<td>0.58</td>
<td>0.87%</td>
</tr>
<tr>
<td>Single Family</td>
<td>59.81</td>
<td>0.30</td>
<td>49.34</td>
<td>74.62%</td>
</tr>
<tr>
<td>Transportation</td>
<td>5.94</td>
<td>0.85</td>
<td>13.89</td>
<td>21.00%</td>
</tr>
<tr>
<td>Water</td>
<td>12.15</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>82.12</td>
<td></td>
<td>66.13</td>
<td>100.00%</td>
</tr>
</tbody>
</table>
Water clarity is typically measured with a Secchi disk and is primarily used as an indicator of algal abundance and general lake productivity. Although it is only indicator, Secchi disk depth is the simplest and one of the most effective tools for estimating a lakes' productivity. It can also provide an indirect measurement of the amount of suspended materials in the water. A number of factors can interfere with light penetration and reduce water clarity. This includes: algae, water color, re-suspended bottom sediments, eroded soil, and invasive species.

The 2020 average water clarity in Valley Lake was 3.03 ft., which was similar to the 2007 sampling where the Secchi depth was 5.05 ft. Compared to other lakes in Lake County, Valley Lake remains slightly above the median Lake County Secchi depth of 3.02 ft. Secchi depth and total suspended solids are inversely related. As total suspended solids increase, there is a decrease in Secchi depth, and vice versa. Figure 3 depicts this inverse relationship between TSS and Secchi in Valley Lake during the 2020 monitoring season. Algae most likely played a big role in decreasing water clarity in Valley Lake which was observed frequently during the summer months.

Volunteer Lake Monitoring Program (VLMP)

The VLMP was established in 1981 by the Illinois Environmental Protection Agency (IEPA) to be able to collect information on Illinois inland lakes, and to provide an educational program for citizens. The volunteers are primarily lakeshore residents, lake owners/managers, members of environmental groups, and citizens with interest in a particular lake. The VLMP relies on volunteers to gather information on their chosen lake. The primary measurement by volunteers is Secchi depth (water clarity). The sampling season is May through October with measurements taken twice a month. IEPA suspended the program in 2019 but you can still participate through Lake County.

LCHD recommends that Valley Lake continue participating in the VLMP Program. This will provide valuable data for the lake as it provides annual data and can help look at long term trends.

For more information on the VLMP program

Contact: Alana Bartolai
abartolai2@lakecountyil.gov
847-377-8009
TOTAL SUSPENDED SOLIDS

Another measure of water clarity is turbidity and total suspended solids. Suspended particles dissipate light, which affects the depth at which plants can grow. The total suspended solid (TSS) parameter represents the concentration of all organic and inorganic materials suspended in the lake’s water column. Typical inorganic components of TSS are referred to as non-volatile suspended solids (NVSS). NVSS originate from weathering and erosion of rocks and soils in the lake’s watershed and re-suspension of lake sediments. The organic portion of TSS are called volatile suspended solids (TVS). TVS is mostly composed of algae and other organic matter such as decaying plant and animal matter.

2020 TSS concentrations in Valley Lake averaged 10.8 mg/L. 2020 concentrations were an increase of 30% in TSS since the 2007 sampling (8.3 mg/L). The 2020 TSS also remains significantly above the Lake County median TSS concentration of 7.7 mg/L. TSS ranged from 2.2 mg/L (June) to 31 mg/L (August) as seen in Figure 5. High TSS values are typically correlated with poor water clarity (Secchi disk depth) and can be detrimental to many aspects of lake ecosystem including the plant and fish communities. The runoff in Valley Lake contributes to high total suspended solid concentrations, as they resuspend bottom sediments. Algae blooms noted throughout the sampling season also contribute to these higher concentrations. Increasing the aquatic plants and reducing carp population can help stabilize lake bottom sediment from resuspension.

A lake can have a TSS impairment which is based on if the median surface NVSS is greater or equal to 12 mg/L for the monitoring season. Based on the 2020 sampling data, Valley Lake is not impaired for TSS with a median surface NVSS of 1.939 mg/L.

Figure 5: Total Suspended Solid Concentrations in Valley Lake, 2020.

<table>
<thead>
<tr>
<th>DATE</th>
<th>TSS</th>
<th>TSS</th>
<th>TS</th>
<th>TVS</th>
<th>NVSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/20/2020</td>
<td>476</td>
<td>5.1</td>
<td>456</td>
<td>66</td>
<td>31.54</td>
</tr>
<tr>
<td>6/18/2020</td>
<td>473</td>
<td>2.2</td>
<td>502</td>
<td>76</td>
<td>13.15</td>
</tr>
<tr>
<td>7/14/2020</td>
<td>440</td>
<td>11.0</td>
<td>460</td>
<td>72</td>
<td>62.96</td>
</tr>
<tr>
<td>8/12/2020</td>
<td>397</td>
<td>31.0</td>
<td>467</td>
<td>99</td>
<td>131.24</td>
</tr>
<tr>
<td>9/23/2020</td>
<td>419</td>
<td>4.6</td>
<td>442</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Average</td>
<td>48</td>
<td>10.8</td>
<td>465</td>
<td>78</td>
<td>59.72</td>
</tr>
<tr>
<td>Median</td>
<td>48</td>
<td>5.1</td>
<td>460</td>
<td>74</td>
<td>47.25</td>
</tr>
</tbody>
</table>
NUTRIENTS: PHOSPHORUS

Organisms take nutrients in from their environment. In a lake, the primary nutrients needed for aquatic plant and algal growth are phosphorus (P) and nitrogen (N). Phosphorus is a vital nutrient for converting sunlight into usable energy and essential for cellular growth and reproduction. Phosphorus occurs in dissolved organic and inorganic forms or attached to sediment particles. Phosphates, the inorganic form, are preferred for plant growth but other forms can be used. Phosphorus builds up in the bottom sediments of a lake.

The source of phosphorus to a lake can be external, internal, or both. Phosphorus originates from a variety of external sources, many of which are related to human activities including: human and animal waste, soil erosion, detergents, sewage treatment plants, septic systems, and runoff from lawn. Internal sources of phosphorus originate within the lake and are typically linked to the lake sediment. When it remains in the sediments it is generally not available for use by algae, however, various chemical and biological processes can allow phosphorus to be released from the sediment and be available in the water column. Sediment resuspension and subsequent phosphorus release can occur through wind/wave action.

Phosphorus has a direct effect on the amount of plant and algal growth in lakes. The 2020 average total phosphorus (TP) epilimnion (near surface sample) concentration in Valley Lake was 0.144 mg/L, this was a 51% increase from the 2007 concentration (0.095 mg/L). Lakes with concentrations exceeding 0.050 mg/L can support high densities of algae and aquatic plants, which can reduce water clarity and dissolved oxygen levels and are considered impaired by the IEPA. Since there was very little aquatic plants found in Valley Lake during the 2020 survey, algae blooms were frequent during the later part of the summer as TP concentration steadily increased. Internal loading of phosphorus occurs when the lake bottom becomes anoxic. Phosphorus bound in sediments are released during anoxic conditions and have a significant impact on the TP concentration in the lake. Anoxic conditions occurred in August and September.

Figure 6: Phosphorus Concentrations in Valley Lake monitored by LCHD

TROPHIC STATE INDEX

Total phosphorus is also used to calculate the Trophic State Index (TSI) value. Trophic states describe the overall productivity of a lake and refers to the amount of nutrient enrichment. This has implications for the biological, chemical and physical conditions of the lake. Lakes are classified into four main categories: oligotrophic, mesotrophic, eutrophic, and hypereutrophic. These range from nutrient poor and least productive (oligotrophic) to most nutrient rich and most productive (eutrophic). In 2020, Valley Lake had a TSIp value of 75.79, which categorizes the lake as hypereutrophic. A hypereutrophic lake has excessive nutrients, resulting in nuisance plant or algae growth. These lakes are often pea-soup green, with poor water clarity. Low dissolved oxygen may also be a problem, with fish kills occurring in shallow, hypereutrophic lakes more often than less enriched lakes. As a result, rough fish (tolerant of low dissolved oxygen levels) dominate the fish community of many hypereutrophic lakes. Based on the TSIp, Valley Lake was 145th out of 177 lakes surveyed by the LCHD-ES from 2000 – 2020 (Appendix B).
Alkalinity is the buffering capacity of a water body. It measures the ability of water bodies to neutralize acids and bases to maintain a stable pH. In a lake, alkalinity acts to buffer lakes from the effects of acid rain. Alkalinity comes from rocks, soils, salts, and certain plant activities. If a lake’s watershed contains large quantities of calcium carbonate (CaCO3, limestone), the surface waters tend to be more alkaline; while granite bedrock does not have high amounts of CaCO3 and therefore lacks alkaline materials to buffer acidic inputs.

pH is a measure of the hydrogen ion concentration of water. As the hydrogen ions are removed, pH increases. A well buffered lake also means that daily fluctuations of CO2 concentrations result in only minor changes in pH throughout the day. Aquatic organisms benefit from stable pH. Each organism has an ideal pH threshold, but most aquatic organisms prefer pH of 6.5—8.0. pH values <6.5 or >9.0 cause a water quality impairment.

In 2020, the average alkalinity (CaCO3) concentration in Valley Lake was 163 mg/L which equal to the Lake County median alkalinity concentration of 163 mg/L. The USEPA considers lakes with CaCO3 concentrations greater than 20 mg/L to not be sensitive to acidification. Valley Lake’s average pH in 2020 was 8.35, which is slightly above the Lake County median of 8.32. In August the pH was 9.14, which is outside the acceptable range <6 or >9 for aquatic organisms. It’s important to monitor pH and report and suspicious fish or macroinvertebrate problems. Valley Lake has a high density of algae that absorb CO2 for photosynthesis. The removal of CO2 reduces the concentration of carbonic acid, which causes the pH to rise. This can cause the water to become alkaline with pH levels greater than 9.0.

### Nutrients: Nitrogen

Nitrogen in the form of nitrate (NO3-), nitrite (NO2-), or ammonium (NH4+) is a nutrient needed for plant and algal growth. Sources of nitrogen include septic systems, animal feed lots, agricultural fertilizers, manure, industrial wastewaters, sanitary landfills and atmospheric deposition. The average Nitrate/Nitrite concentrations in the epilimnion of Valley Lake were below detectable concentration from June to September 2020. Total Kjeldahl Nitrogen (TKN), an organically associated form of nitrogen 1.79 mg/L for Valley Lake which is above the Lake County Median of 1.15 mg/L.

Typically lakes are either phosphorus or nitrogen limited. This means that one of the nutrients is in shorter supply and any addition of that nutrient to the lake will result in an increase of plant/or algal growth. Most lakes in Lake County are phosphorus limited. To compare the availability of nitrogen and phosphorus, a ratio of total nitrogen to total phosphorus (TN:TP) is used. Valley Lake had an average TN:TP of 13:1 and considered a phosphorus limited system. Any additional inputs of phosphorus can increase algal/aquatic plant growth. However, low nitrogen levels do not guarantee limited algal growth the way low phosphorus levels do. Nitrogen gas in the air can dissolve in lake water and blue-green algae can “fix” atmospheric nitrogen, converting it into a usable form. Since other types of algae do not have the ability to do this, nuisance blue-green algae blooms are typically associated with lakes that are nitrogen limited (i.e., have low nitrogen levels).

**TN:TP Ratio**

- <10:1 = nitrogen limited
- >20:1 = phosphorus limited

**TN:TP Ratio on Valley Lake is 13:1**

Valley Lake is Phosphorus Limited

### pH

Alkalinity is the buffering capacity of a water body. It measures the ability of water bodies to neutralize acids and bases to maintain a stable pH. In a lake, alkalinity acts to buffer lakes from the effects of acid rain. Alkalinity comes from rocks, soils, salts, and certain plant activities. If a lake’s watershed contains large quantities of calcium carbonate (CaCO3, limestone), the surface waters tend to be more alkaline; while granite bedrock does not have high amounts of CaCO3 and therefore lacks alkaline materials to buffer acidic inputs.

pH is a measure of the hydrogen ion concentration of water. As the hydrogen ions are removed, pH increases. A well buffered lake also means that daily fluctuations of CO2 concentrations result in only minor changes in pH throughout the day. Aquatic organisms benefit from stable pH. Each organism has an ideal pH threshold, but most aquatic organisms prefer pH of 6.5—8.0. pH values <6.5 or >9.0 cause a water quality impairment.

In 2020, the average alkalinity (CaCO3) concentration in Valley Lake was 163 mg/L which equal to the Lake County median alkalinity concentration of 163 mg/L. The USEPA considers lakes with CaCO3 concentrations greater than 20 mg/L to not be sensitive to acidification. Valley Lake’s average pH in 2020 was 8.35, which is slightly above the Lake County median of 8.32. In August the pH was 9.14, which is outside the acceptable range <6 or >9 for aquatic organisms. It’s important to monitor pH and report and suspicious fish or macroinvertebrate problems. Valley Lake has a high density of algae that absorb CO2 for photosynthesis. The removal of CO2 reduces the concentration of carbonic acid, which causes the pH to rise. This can cause the water to become alkaline with pH levels greater than 9.0.

**Figure 7: Valley Lake Chloride Concentrations**

The pH scale ranges from 0 to 14. A pH of 7 is considered neutral. Substances with a pH of less than 7 are acidic, and greater than 7 are basic.
CONDUCTIVITY

Another parameter measured during the 2020 monitoring season that is important in comparing data from year to year is conductivity. Conductivity is the measure of different chemical ions in solution. As the concentration of these ions increases, conductivity increases. The conductivity of a lake is dependent on the lake and watershed geology, size of the watershed flowing into the lake, land use, evaporation, and bacterial activity.

In 2020, the average conductivity for Valley Lake was 0.7818 mS/cm which is higher than the Lake County median conductivity concentration of 0.7698 mS/cm. This value is a 51% decrease since the 2007 concentration of 1.5912 mS/cm (Figure 8). Since Valley Lake is a shallower lake it can easily flush out chloride. From 2000—2020 conductivity has been decreasing in Valley Lake, likely a result of improvements in de-icing practices.

CHLORIDES

One of the most common dissolved solids is road salt used in winter road deicing. Most road salt is sodium chloride, calcium chloride, potassium chloride, magnesium chloride or ferrocyanides salts. In 2020, Valley Lake’s chloride concentration averaged 154 mg/L which was above the Lake County median of 132 mg/L but much lower than the 2007 concentration of 375 mg/L (Figure 9). The United States Environmental Protection agency has determined that chloride concentrations higher than 230 mg/L can disrupt aquatic systems. While Valley Lake’s chloride concentrations are significantly below the aquatic life criteria, recent research has indicated organisms can get stressed at values lower than 230 mg/L. Chloride ions do not break down and can accumulate within a watershed. High chloride concentrations may make it difficult for many of our native plant species to survive while many of our invasive species such as Eurasian Watermilfoil, Cattail, and Common Reed are tolerant to high chloride levels.

The LCHD-ES and Lake County Stormwater Management Commission (LCSMC) have been holding annual trainings targeting deicing maintenance personnel for both public and private entities to hopefully reduce the amount of chloride being introduced into our environment while maintaining safe passageways. Almost all deicing products contain chloride so it is important to read an follow product labels for proper application. For instance, at 10°F Fahrenheit, rock salt is not at all effective in melting ice and will blow away before it melts anything. Additionally calling your local township office to ask them if they are taking actions to minimize deicers on their properties or supporting changes in their deicing policy to minimize salt usage is encouraged. It is important to follow best management practices in the watershed to protect and maintain the health of the lake.

ICE FACTS

- Deicers melt snow and ice. They provide no traction on top of snow and ice.
- Anti-icing prevents the bond from forming between pavement and ice.
- De-icing works best if you plow/shovel before applying material.
- Pick the right material for the pavement temperatures.
- Sand only works on top of snow as traction. It provides no melting.
- Anti-icing chemicals must be applied prior to snow fall.
- NaCl (Road Salt) does not work on cold days, less than 15°F.
- NaCl is more effective at warmer temperatures—when it is warmer out, you do not need to put as much road salt down to melt ice efficiently.
Lake stratification is a result of variations in density caused by temperature (or salinity) and can prevent warm and cold water from mixing. A lake's water quality and ability to support fish are affected by the extent to which the water mixes. Lakes that experience stratification have the water column divided into three zones: epilimnion (warm surface layer), thermocline (transition zone between warm and cold water) and hypolimnion (cold bottom water) (Figure 10). Stratification traps nutrients released from bottom sediments in the hypolimnion and prevents mixing. Lakes in Lake County are either dimictic or polymictic. Dimictic means there are only two lake turnovers (spring and fall), whereas polymictic means that the thermocline is never that strong so the lake can go mix multiple times throughout the season.

Monthly depth profiles of water temperature, dissolved oxygen, conductivity, and pH were taken every foot from the lake surface to the lake bottom on Valley Lake. The relative thermal resistance to mixing (RTRM) value can be calculated from this data and indicates if a lake stratifies, how strong the stratification is, and at what depth the thermocline occurs. Due to its shallow nature, Valley Lake did not stratify and can be easily mixed by wind activity.

Dissolved Oxygen

A dissolved oxygen (DO) concentration of 5.0 mg/L is considered adequate to support a fishery since fish can suffer oxygen stress below this concentration. Fish and other aquatic animals depend on dissolved oxygen gas that enters the water from plants and the atmosphere.

The oxygen (DO) concentrations in Valley Lake were adequate (>5.0 mg/L) from May through August and dropped below 5 mg/L in September. Average DO concentrations ranged from 2.39 (September) to 9.14 mg/L (August). High dissolved oxygen concentrations in August also correlate with algae blooms, where there is increased amounts of photosynthesis occurring. Hypoxic conditions (DO<1.0 mg/L) occurred near the bottom in August and September (Figure 11). When DO concentration drop below 1.0 mg/L, biological and chemical processes release nutrients into the water, which are sequestered in the hypolimnion due to stratification and can be released into the surface waters. This is important because the absence of oxygen (anoxia) near the lake bottom can have adverse effects in eutrophic lakes resulting in the chemical release of phosphorus from lake sediment and the production of hydrogen sulfide (rotten egg smell) and other gases in the bottom waters (Figure 12). Phosphorus release from anoxic sediments represents additional phosphorus load into the water column. The low DO in September can be attributed to decaying algae and the introduction of beneficial bacteria into the lake on September 16, 2020.

Oxygen levels at certain depths can be used as a guide when placing artificial fish structures in the lake. These artificial structures should be located in depths where the DO levels are 5.0 mg/L or better.
BATHYMETRIC MAP

Bathymetric maps are also known as depth contour maps and display the shape and depth of a lake. They are valuable tools for lake managers because they provide information about the surface area and volume of the lake at certain depths. This information can then be used to determine the volume of lake that goes anoxic, how much of the lake bottom can be inhabited by plants, and is essential in the application of whole-lake herbicide treatments, harvesting activities and alum treatments of your lake. Other common uses for the map include sedimentation control, fish stocking, and habitat management.

In May 2016, field data was collected by LCHD-ES using a Lowrance HDS Gen2; Lowrance cites accuracy measures of approximately 5m however actual accuracy is typically better than this conservative estimate and has been discovered to be sub-meter (CIBiobase, 2013). Once collected, the data was analyzed and imported into ArcGIS 10.2 for further analysis. In ArcGIS 10.2, the contours and volumes were generated from the triangular irregular network (TIN) (Figure 14).

Table 6: Valley Lake Morphometric Table

<table>
<thead>
<tr>
<th>Contour (Feet)</th>
<th>Area Enclosed (Acres)</th>
<th>Percent of total acres</th>
<th>Volume (Acre-feet)</th>
<th>Depth Zone (Feet)</th>
<th>Area (Acres)</th>
<th>Percent (Depth zone to total acres)</th>
<th>Percent (Acre-feet to Total Volume)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>12.02</td>
<td>100%</td>
<td>11.68</td>
<td>0 - 1</td>
<td>0.67</td>
<td>5.6%</td>
<td>18.3%</td>
</tr>
<tr>
<td>1</td>
<td>11.34</td>
<td>94.9%</td>
<td>10.96</td>
<td>1 - 2</td>
<td>0.75</td>
<td>6.2%</td>
<td>17.2%</td>
</tr>
<tr>
<td>2</td>
<td>10.59</td>
<td>88.2%</td>
<td>10.16</td>
<td>2 - 3</td>
<td>0.87</td>
<td>7.2%</td>
<td>15.9%</td>
</tr>
<tr>
<td>3</td>
<td>9.73</td>
<td>80.9%</td>
<td>9.17</td>
<td>3 - 4</td>
<td>1.10</td>
<td>9.2%</td>
<td>14.4%</td>
</tr>
<tr>
<td>4</td>
<td>8.62</td>
<td>71.8%</td>
<td>8.01</td>
<td>4 - 5</td>
<td>1.21</td>
<td>10.1%</td>
<td>12.5%</td>
</tr>
<tr>
<td>5</td>
<td>7.41</td>
<td>61.7%</td>
<td>6.66</td>
<td>5 - 6</td>
<td>1.47</td>
<td>12.3%</td>
<td>10.4%</td>
</tr>
<tr>
<td>6</td>
<td>5.94</td>
<td>49.4%</td>
<td>4.61</td>
<td>6 - 7</td>
<td>2.55</td>
<td>21.2%</td>
<td>7.2%</td>
</tr>
<tr>
<td>7</td>
<td>3.39</td>
<td>28.2%</td>
<td>2.06</td>
<td>7 - 8</td>
<td>2.42</td>
<td>20.1%</td>
<td>3.2%</td>
</tr>
<tr>
<td>8</td>
<td>0.97</td>
<td>8.1%</td>
<td>0.44</td>
<td>8 - 9</td>
<td>0.90</td>
<td>7.5%</td>
<td>0.7%</td>
</tr>
<tr>
<td>9</td>
<td>0.07</td>
<td>0.6%</td>
<td>0.11</td>
<td>9 - 10</td>
<td>0.07</td>
<td>0.6%</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

63.85 12.02 100% 100%

WATER LEVEL

Lakes with stable water levels potentially have less shoreline erosion problems. The lake level in Valley Lake was measured from the top of the top of a boat dock to the water level. The lake level decreased from May to September by 0.52 ft. The highest water level recorded occurred in May (0.98 ft) and the lowest level in August (1.51 ft). The rain events in late June and July caused the most significant water level fluctuation with an increase of 2.4 inches. A spillway at the northeast corner of the lake drains to an underground storm sewer network that eventually reaches the Des Plaines River. In order to accurately monitor water levels it is recommended that a staff gauge be installed and levels measured and recorded frequently (daily or weekly). The data provides lake managers a much better idea of lake level fluctuations relative to rainfall events and can aid in future decisions regarding lake level. Staff gauge is a great tool for measuring water level in lakes, rivers, reservoirs. The data collected can be compiled to help understand the natural fluctuations of the lake. Lakes with fluctuating water levels potentially have poorer water quality and have more shoreline erosion problems.

Table 7: 2020 Lake Level on Valley Lake

<table>
<thead>
<tr>
<th>2020</th>
<th>Level (in)</th>
<th>Seasonal Change (in)</th>
<th>Monthly Change (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
<td>0.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>1.49</td>
<td>-0.51</td>
<td>-0.51</td>
</tr>
<tr>
<td>July</td>
<td>1.29</td>
<td>-0.31</td>
<td>0.20</td>
</tr>
<tr>
<td>August</td>
<td>1.51</td>
<td>-0.53</td>
<td>-0.22</td>
</tr>
<tr>
<td>September</td>
<td>1.50</td>
<td>-0.52</td>
<td>0.01</td>
</tr>
</tbody>
</table>
SHORELINE EROSION

Erosion is a natural process along lake shorelines primarily caused by wind and wave action resulting in the loss of material from the shoreline. Disturbed shorelines caused by human activity such as clearing of vegetation and beach rocks and increasing runoff will accelerate erosion. Eroded materials cause turbidity, sedimentation, nutrients, and pollutants to enter a lake. Excess nutrients are the primary cause of algal blooms and increased aquatic plant growth. Once in the lake, sediments, nutrients and pollutants are harder and more expensive to remove.

A shoreline erosion assessment was conducted on Valley Lake (Figure 15). The shoreline evaluated for none, slight, moderate and severe erosion based on exposed soil and tree/plant roots, failing infrastructure and undercut banks. Based on the 2020 data, 20% of the shoreline had slight. A majority (80%) of the shoreline had no erosion as a result of the seawalls, riprap and emergent vegetation that protects the shoreline against erosion. Frequent increase or decrease of the water level can negatively influence a variety of the lake parameters including: nutrients, suspended solids, lake volume, and aquatic plants by increasing shoreline erosion.

Emergent plants absorb wind and wave energy preventing soil erosion. Native plants adds habitat for wildlife and can also help filter pollutants and nutrients from the near shore areas.

To see the complete dataset of shoreline erosion, refer to the shoreline condition assessment tables in Appendix B.

Table 8: Valley Lake 2020 Shoreline Erosion Condition

<table>
<thead>
<tr>
<th>Erosion</th>
<th>None</th>
<th>Slight</th>
<th>Moderate</th>
<th>Severe</th>
<th>Total</th>
<th>Lateral Recession Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Linear Ft</td>
<td>%</td>
<td>Linear Ft</td>
<td>%</td>
<td>Linear Ft</td>
<td>%</td>
</tr>
<tr>
<td>Valley Lake</td>
<td>3114.2</td>
<td>80%</td>
<td>772.6</td>
<td>20%</td>
<td>0.0</td>
<td>0%</td>
</tr>
</tbody>
</table>

Figure 15: Shoreline Erosion Condition Valley Lake, 2020
SHORELINE EROSION

Figure 16: Good Shoreline Condition

Figure 17: Moderate Shoreline Erosion Condition

SHORELAND BUFFERS

A shoreland buffer helps stabilize the sediment near the lakes edge which prevents soil erosion. The buffer will also filter out pollutants and unwanted nutrients from entering the lake. Buffer strips should be at least 25 feet wide and can include native wildflowers, native grasses, and native wetland plants. Wider buffers may be needed for areas with a greater slope or additional runoff issues. Areas that are already severely or moderately eroding, a buffer strip of native plants may need to be bolstered for additional stability.

Lake Managers are encouraged to establish buffers or not mow to lakes edge to allow native grasses to grow. Buffers composed of tall grass along the shoreline will discourage geese from coming ashore. Geese have a natural fear of predators lurking in the bushes.

A shoreland buffer condition of Valley Lake was assessed by looking at the land within 25 feet of the lake’s edge on aerial images in ArcGIS. Shoreland buffer’s were classified into three categories; poor, fair or good based on the amount of un-mowed grasses, forbs, tree trunks and shrubs, and impervious surfaces within that 25 foot range. In 2020, Valley Lake had 4.2% of the shoreline with good, 8.9% fair, and 86.9% poor buffer conditions (Table 9). For a complete list of buffer condition by lake, refer to Appendix B.

Figure 18: Shoreline Buffer Condition

Table 9: Valley Lake Shoreline Buffer Condition 2020

<table>
<thead>
<tr>
<th>Buffer</th>
<th>Good Condition</th>
<th>Fair Condition</th>
<th>Poor Condition</th>
<th>Shoreline Length Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Linear ft.</td>
<td>%</td>
<td>Linear ft.</td>
<td>%</td>
</tr>
<tr>
<td>Valley Lake</td>
<td>163.2</td>
<td>4.2</td>
<td>346.8</td>
<td>8.9</td>
</tr>
</tbody>
</table>
**AQUATIC PLANTS AND BIOVOLUME**

Aquatic plants play an important role in the lakes ecosystem by providing habitat for fish and shelter for aquatic organism. Their presence is natural and normal in lakes. Aquatic plants provide oxygen, reduce nutrients such as phosphorus to prevent algae bloom, and help stabilize sediment.

An aquatic macrophyte survey provides information based on the species, density and distribution of plant communities in a particular lake. An aquatic macrophyte survey was conducted on Valley Lake in September 2020. Valley Lake had 29 points generated based on a computer grid system with points 60 meters apart randomly overlaid on an aerial photo. Aquatic plants in Valley Lake occurred at 6 of the 29 sites (21% total lake coverage). This included 2 native aquatic plant and one non-native invasive aquatic plant species.

In 2020, the most commonly occurring species for Valley Lake were American Pondweed (10%) and Flatstem Pondweed (10%). Monitoring for invasive plants such as Eurasian Watermilfoil, Curlyleaf Pondweed, and Brittle Naiad should continue every year in order to manage these non-native and invasive aquatic plants if before they become a problem.

Figure 19 shows the aquatic plant biovolume on Valley Lake for 2020. Biovolume refers to the volume of the water column taken up by plants. The extent of plant populations can be influenced by a variety of factors. Water clarity and depth are the major limiting factors in determining the maximum depth at which aquatic plants will grow. When light level in the water column falls below 1% of the surface light level, plants can no longer grow. The extent of the 1% light can be obtained by doubling the Secchi disk reading. Since 2007 the average Secchi disk reading decreased for Valley Lake from 5.05 feet to 3.03 feet in 2020. The maximum depth that aquatic plants were found was 4.2 feet.

Plants provide oxygen, reduce nutrients such as phosphorus to prevent algae bloom, and help stabilize sediment. Create an Aquatic Plant Management Plan (APMP) that targets the reduction of invasive species and promotes native plant diversity. A native plant community tends to be diverse and usually does not impede lake activities such as boating, swimming and fishing. APMP can also include developing requests for proposals (RFPs) for herbicide application; which can better help associations properly manage their lake. To maintain a healthy fishery, the Illinois Department of Natural Resources (IDNR) suggests that aquatic plants cover approximately 20% to 40% of the lake bottom.

Valley Lake lacks both diversity and density of native aquatic plants. Aquatic plants can reduce the occurrence algae blooms late in the summer by competing with algae for phosphorus that is available in the water. Creating buffer strips, and planting emergent vegetation should help reduce some of the total suspended solids in the lake.
AQUATIC PLANTS

The most common native aquatic plants found in Valley Lake were American Pondweed and Flatstem Pondweed. The diversity and extent of plant populations can be influenced by a variety of factors. Water clarity and depth are the major limiting factors in determining the maximum depth at which aquatic plants can be found. A healthy aquatic plant population is critical to good lake health. Aquatic vegetation provides important wildlife habitat and food sources. Additionally, aquatic plants provide many water quality benefits such as sediment stabilization and competition with algae for available resources.

**AMERICAN PONDWEED** (*Potamogeton nodosus*)

Description

American pondweed is a perennial plant that has both floating and a few submerged leaves in an alternate pattern. The floating leaves are elliptical to oval 4 to 7 inches long and to inches wide on long petioles. Submerged leaves are not abundant and are blade-like, somewhat transparent and smaller than floating leaves. Rhizomes are white. Fruits are on spikes that often stand above the water’s surface and are brownish to reddish 1 to 2 inches wide.

**FLATSTEM PONDWEED** (*Potamogeton zosteriformis*)

Description

It grows annually from turions and seed, producing bushy plants branching near the surface with long, rather grass-like leaves that are 85–240 mm long and 3–6 mm wide and olive-green or dark green, sometimes with a reddish tinge near the surface. The leaves have a rather opaque appearance compared to the transparent leaves of most pondweeds. Distinguished from most other pondweeds by its combination of strongly flattened stems

*Figure 20: Carp Exclosure at St. Mary’s Lake*

In 2007 the Lake County Health Department placed several carp exclosures in St. Mary’s Lake to see if aquatic plants would grow and expand if they were protected from carp. There were no aquatic plants observed in the lake since 2002. The first carp exclosure installed and planted in 2017 and after one year the native aquatic plants expanded. There were 5 native aquatic plants species selected for planting based upon their tolerance for turbid water conditions. These aquatic plants are Sago Pondweed, Elodea, White Water Lily, American Pondweed and Vallisneria.
Invasive Species: Eurasian Watermilfoil

Eurasian Watermilfoil (EWM) is a feathery submerged aquatic plant that can quickly form thick mats in shallow areas of lakes and rivers in North America. These mats can interfere with swimming and entangle propellers, which hinders boating, fishing, and waterfowl hunting. Matted milfoil can displace native aquatic plants, impacting fish and wildlife. Since it was discovered in North America in the 1940’s, EWM has invaded nearly every US state and at least three Canadian Provinces. Milfoil spreads when plant pieces break off and float on water currents. It can cross land to new waters by clinging to sailboats, personal watercraft, powerboats, motors, trailers, and fishing gear.

EWM was not previously observed in Valley Lake since the first aquatic plant survey was performed by the Lake County Health Department in 2000. EWM was found at 7% of the sites sampled in 2020. An aquatic plant management plan is critical to maintaining the health of the lake and a balanced aquatic plant community. The plan should be based on the management goals of the lake and involve usage issues, habitat maintenance/restoration, and limitations of the lake. The primary focus of the plan must include the control of EWM. Follow up monitoring and removal is critical to achieve long-term success. A good aquatic plant management plan considers both the short and long-term needs of the lake. At this time native aquatic plants that should be protected and allowed to flourish to keep the Eurasian water milfoil from expanding in the lake. Native aquatic plants tend to grow later than the EWM. Chemical treatment of EWM should be done early in the season to avoid the treatment of native aquatic plants.

Figure 17: Valley Lake EWM Rake Density 2020

Myriophyllum spicatum Exotic

Common Names:
Eurasian Watermilfoil

Origin: Exotic
Europe and Asia. Found throughout Lake County and Illinois

Importance:
This invasive plant spreads rapidly, crowding out native species, clogging waterways, and blocking sunlight and oxygen from underlying waters.

Look Alikes:
Northern Watermilfoil which has fewer than 12 leaflet pairs per leaf, and generally has stouter stems.

Key Features:

Stem: Long, often abundantly branched stems form a reddish or olive-green surface mat in summer.

Leaf: Leaves are rectangular with ≥12 pairs of leaflets per leaf and are dissected giving a feathery appearance, arranged in a whorl, whorls are 1 inch apart.

Flower: Small pinkish male flowers that occur on reddish spikes, female flowers lack petals and sepals and 4 lobed pistil.
HARMFUL ALGAL BLOOMS

Valley Lake experienced harmful algal blooms during the 2020 monitoring season. Blooms were noticed in July and August by the LCHD. Samples were collected during bloom events and a qualitative test was preformed at LCHD to determine presence of microcystin toxins. Six samples were sent to the Illinois Environmental Protection Agency (IEPA) for quantitative testing and the samples were non-detect for Microcystin. The IEPA has established recommended recreational water concentrations to be safe at or below 8 micrograms per liter. The algae bloom at Valley Lake was mostly comprised of Anabaena. Anabaena may produce a few different toxins, including anatoxin and microcystin. The Wildwood Park District was notified during these occurrences.

Algae can grow quickly in water and is often associated with increased concentrations of nutrients such as nitrogen and phosphorus. Blue-green algae, or “cyanobacteria” are a type of algae that can bloom and produce toxins, which are similar to bacteria in structure but utilize photosynthesis to grow. Certain species of blue-green algae can produce toxins that could pose a health risk to people and animals when they are exposed to them in large enough quantities, and are identified as harmful algal blooms.

Blooms can last for an extended period of time and can deplete the oxygen and block sunlight in the water that other organisms needs to live. The water can appear blue-green, bright green, brown, or red and may look like paint floating on the water (Figure 13). Not all blue-green algae produce harmful toxins. The three types of cyanobacteria that are often associated with a harmful algal bloom (HAB) are Anabaena, Aphanizomenon, and Microcystis. The presence of these cyanobacteria does not always mean there are toxins present in the water. The presence of toxins can only be verified through a sample analyzed in the lab. During a bloom, the toxins are contained within the algae cells. If these cells are ingested, they break open in the stomach and the toxins are released. Poisoning from harmful toxins in blue-green algae have caused the death of cows, dogs, and other animals. Most human cases occurred when people swim or ski in affected recreational water bodies during a bloom. If you suspect that you are experiencing symptoms related to exposure to blue-green algae such as stomach cramps, diarrhea, vomiting, headache, fever, muscle weakness, or difficulty breathing contact your doctor or the poison control center.

Table 5: WHO Microcystin Toxin Guidelines

<table>
<thead>
<tr>
<th>Relative Probability of Acute Health Effects</th>
<th>Microcystin-LR (ug/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>&lt;10</td>
</tr>
<tr>
<td>Moderate</td>
<td>10 – 20</td>
</tr>
<tr>
<td>High</td>
<td>20 - 2,000</td>
</tr>
<tr>
<td>Very High</td>
<td>&gt;2,000</td>
</tr>
</tbody>
</table>

Figure 13: Valley HAB - Anabaena

For More Information On Blue-green algae: www.epa.state.il.us/water/surface-water/blue-green-algae.html

To Report Blue-green Algae Bloom: Lake County Health Department 847-377-8020
Swimming Beach Monitoring

All licensed inland beaches are tested bi-weekly from May to September by the Lake County Health Department’s Ecological Services Department. The water samples are tested for E. coli bacteria, which are found in the intestines of almost all warm-blooded animals. E. coli is used as an indicator organism, meaning that high concentrations of E. coli might suggest the presence of harmful pathogens such as, Salmonella, Giardia, etc. While not all strains of E. coli are the same, certain strains can make humans sick if ingested in high enough concentrations. If water samples come back high for E. coli (>235 E. coli/100 ml), LCHD informs the management body for the bathing beach that the beach is closed and a sign is posted indicating the beach closure. Licensed beaches will also be monitored for blue-green algae and samples may be taken for testing when blooms occur. During the summer of 2020, E. coli counts at Valley Lake South Beach had three samples that exceed the maximum allowable limit. When the August 4, 2020 sample registered 2419 FC colonies/100 ml. the beach was resampled on August 5th and August 6th with both samples exceeding 235 FC / 100ml. Light rain on August 3rd may have contributed to a high FC at Valley Lake Beach due to its proximity to an inlet. If you have any questions, feel free to contact the Lake County Health Department at 847-377-8030.

How to prevent illness and beach closure:

- If you are sick, do NOT swim.
- Don’t swim when you have diarrhea. You can spread germs in the water.
- Take a shower prior to entering the beach area.
- Children who are not toilet trained should wear tight fitting rubber or plastic pants.
- Pick up garbage around the beach area.
- Avoid swimming during algae blooms.
- Do not ingest the water while swimming.
- Keep pets, ducks and geese out of the beach area.
- Identify sources of pollution (ex: failing septic systems, stagnant standing water near the beaches, creeks and storm drains).
AQUATIC PLANT MANAGEMENT

Aquatic plants are essential for maintaining a balanced, healthy lake, but sometimes plants can create a nuisance for recreation, lake aesthetics, and invasive plant species can outcompete native plant species. Aquatic plant management is both controlling undesirable species while encouraging desirable species in important habitat areas. For Valley Lake, it is important to monitor the invasive species to determine if future control will be needed. A whole lake plant survey is recommended in order to fully understand the extent or lack of aquatic invasive species.

The main types of plant control include: mechanical harvesting, manual harvesting, and herbicides. Mechanical harvesting involves the use of specially designed machines that cut and remove plant material from a lake. Harvesting only reduces the height of aquatic plants in the water column. Manual or hand harvesting is the most environmentally friendly is best for small scale operations. The most common control tool in aquatic plant management is the use of herbicides registered by the U.S. Environmental Protection Agency. Below is a table that briefly summarizes some pros and cons of the different aquatic plant management techniques. This is not a comprehensive list and should only be used as a guide to understanding different management options available. Lake Managers should keep a yearly record of all aquatic plant herbicide treatments.

<table>
<thead>
<tr>
<th>Management Options</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost competitive with chemical controls</td>
<td>Undesirable plants may fragment, spread and colonize new areas</td>
<td></td>
</tr>
<tr>
<td>Removes nutrients from the lake but may be minimal compared with input</td>
<td>Desirable plants such as pondweeds may be suppressed</td>
<td></td>
</tr>
<tr>
<td>Removes organic material from the lake</td>
<td>Limited operation in shallow water and around docks and rafts</td>
<td></td>
</tr>
<tr>
<td>May provide some selective control</td>
<td>Machine breakdowns can disrupt operations</td>
<td></td>
</tr>
<tr>
<td><strong>Hand Harvesting</strong></td>
<td>Low Cost</td>
<td>Labor intensive</td>
</tr>
<tr>
<td>Excellent control in small areas</td>
<td>Not suitable for large areas</td>
<td></td>
</tr>
<tr>
<td>Low environmental impact</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Herbicides</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs are reasonable in many situations</td>
<td>Involves the introduction of pesticides into shared water resources</td>
<td></td>
</tr>
<tr>
<td>Range of products and combinations available provides flexibility in management options</td>
<td>Potential for misuse</td>
<td></td>
</tr>
<tr>
<td>Some products are highly selective for nuisance species</td>
<td>May contribute to the buildup of organic material</td>
<td></td>
</tr>
<tr>
<td>Can provide complete control of plants for swimming beaches</td>
<td>Algal blooms are possible following large herbicide treatments</td>
<td></td>
</tr>
<tr>
<td>Fish kills may occur with misuse of certain products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large treatments may encourage shifts in plant communities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water use restrictions may be need to be imposed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does not address the cause of cultural eutrophication</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FLORISTIC QUALITY INDEX

Floristic quality index (FQI) is an assessment tool designed to evaluate how close the flora of an area is compared to one of undisturbed conditions. It can be used to: 1) identify natural areas, 2) compare the quality of different sites or different locations within a single site 3) monitor long-term floristic trends and 4) monitor habitat restoration efforts. Each aquatic plant in a lake is assigned a number between 1 and 10 (10 indicating the plant species most sensitive to disturbance). This is done for every floating and submerged plant species found in the lake. The FQI is calculated by multiplying the average of these numbers by the square root of the number of these plant species found in the lake. A high FQI number indicates that a large number of sensitive, high quality plant species are present in the lake. Non-native species were also included in the FQI calculations for Lake County lakes.

The median FQI for Lake County lakes from 2000-2020 is 14. Valley Lake had an FQI value of 7.1 ranking it 149th out of 173 lakes in Lake County (Appendix A). The FQI has decreased since the 2007 sampling when the FQI value for Valley Lake was 8.3. LCHD recommends the an Aquatic Plant Management Plan (APMP) should be taken into consideration to improve the diversity and density of native plants.

2020 LAKE COUNTY
AVERAGE
FQI = 14

VALLEY LAKE
FQI = 8.7
RANK = 130/173
AQUATIC PLANTS
SPECIES: 3
NATIVE PLANT SPECIES: 2

AQUATIC PLANTS: WHERE DO THEY GROW?

- **Littoral Zone**— the area that aquatic plants grow in a lake.
- **Algae**— have no true roots, stems, or leaves and range in size from tiny, one-celled organisms to large, multicelled plant-like organisms.
- **Submerged Plants**— have stems and leaves that grow entirely underwater, although some may also have floating leaves.
- **Floating-leaf Plants**— are often rooted in the lake bottom, but their leaves and flowers lay flat on the water surface.
- **Emergent Plants**— are rooted in the lake bottom, but their leaves and stems extend out of the water.

IN MANY LAKES MACROPHYTES CONTRIBUTE TO THE AESTHETICALLY PLEASING APPEARANCE OF THE SETTING AND ARE ENJOYABLE IN THEIR OWN RIGHT. BUT EVEN MORE IMPORTANT, THEY ARE AN ESSENTIAL ELEMENT IN THE LIFE SYSTEMS OF MOST LAKES.

- Macrophyte leaves and stems provide a habitat or home for small attached plants and animals. Some are microscopic in size and some are larger. These attached organisms are valuable as food for animals higher in the food chain, such as fish and birds.
- Many types of small organisms live in the sediment. There are insects that spend the immature stages of life in the sediments, leaving when they become adults. Decomposing plant life provides part of the food supply for these sediment-dwelling organisms and the emerging insects, in turn, are food for fish.
- The submerged portions of macrophytes provide shelter and cover for small or young fish from larger fish that would feed on them.
- Types of plants that extend above the water can provide cover for waterfowl and their young, and many plants can serve directly as food for certain types of waterfowl.
- Aquatic plants provide many water quality benefits such as sediment stabilization and competition with algae for available nutrients.
A National Pesticide Discharge Elimination System (NPDES) permit is required when pesticides are applied to, over or near the waters of the State. This permit applies to all public waters that have an outflow to the State waters. A Notice of Intent (NOI) must be filled and submitted electronically to the Illinois Environmental Protection Agency (IEPA) at least 14 days prior to any application of pesticides. In order to obtain the permit an application needs to be filed with the IDNR requesting a permit for pesticide application, the application can be filled out by the applicant or their representative (which is usually the pesticide consultant).

Copper Sulfate Application

Chemical applications for algae is a temporary solution that often requires multiple applications. As the treated algae sink to the bottom to decompose (use oxygen) they release nutrients that the surviving algae uses to rebound.

A pretreatment survey of your lake’s aquatic plants is necessary prior to sending out Request for Proposal (RFP) in order to assess the location and the amount of invasive plants.

FOR FULL DETAILS OF THE RULE SEE:
HTTP://WWW.EPA.STATE.IL.US/WATER/PERMITS/PESTICIDE/INDEX.HTML
Aquatic Herbicides - Copper Sulfate

Copper salts are one of the earliest known herbicides for terrestrial and aquatic weed control. Copper sulfate, which is used strictly for algae control, was first used in 1904. The use of copper sulfate is appealing because it generally has minimal effect on flowering plants at normal use rates and there are no restrictions on the use of water following a treatment. Environmental Aquatic Management applied copper sulfate on 15 occasions during the season. The efficiency of copper sulfate is greatly affected by the carbonate alkalinity (CaCO₃) concentrations in the water. The copper will combine with the carbonates and precipitate out of the water preventing the copper from entering the algal cells. Lake’s average alkalinity concentration in 2020 was 135 mg/L. Alkalinity concentrations 50 to 250 mg/L provide effective treatment and protect fish from lethal doses of copper. Copper sulfate is a contact herbicide. Therefore, direct exposure of the algae to the compound is required. Copper sulfate has a fairly short active period, and is quickly absorbed into the sediment. Over time a build-up of copper can occur in the sediment. Copper is toxic to invertebrates, which are aquatic bugs that live in the sediment. This can cause a disruption in the food chain from the bottom up resulting in a reduction in growth rates in the fish community. Herbicide treatments is one of the many tools available to lake managers when used alone they provide a quick fix, that does not address the source of the problem, high nutrient levels.

Aquatic Invasive Species Prevention

Helping to prevent the introduction and spread of invasive aquatic plants and animals are the most effective way of protecting healthy, non-infested ecosystems. Listed below are some of the simple steps you can take to prevent invasion.

- Remove all plants, mud, fish, or animals before transporting equipment.
- Eliminate all water from equipment before transporting equipment.
- Dry anything that comes in contact with water (boat, trailers, equipment, clothing, etc.).
- Remove all mud and dirt since it might contain aquatic hitchhikers.
- Never release plants, fish or animals into a body of water unless they came out of that body of water.
- Do not release bait into the waters you are fishing.
- Do not release aquarium fish or aquatic pets into the lake.

Chemical applications for algae is a temporary solution that often requires multiple applications. As the treated algae sink to the bottom to decompose (use oxygen) they release nutrients that the surviving algae uses to rebound.
AQUATIC PLANTS AND FISH

Fish depend on aquatic plants to provide habitat and forage for food. Most freshwater fish rely on aquatic plants at some point during their life stage. The plant composition and density can play an important role in the nesting, growth, and foraging success of these fish. While many fish require some aquatic vegetation for growth, excessive amounts of aquatic vegetation can negatively impact growth by reducing foraging success. The parameters of an ideal fish habitat can change based on the size and species of fish, the type of lake, structures present in the lake and many other factors. A fish survey can reveal the size distribution and population of the fish in your lake.

How do plants impact fish?

- Plants provide critical structure to aquatic habitats.
- Plants influence growth of fish by enhancing fish diversity, feeding, growth, and reproduction.
- Plants influence spawning. The structure provided by plant beds are important to fish reproduction.
- Plants influence the physical environment. Aquatic plants can change water temperatures and available oxygen in habitats.

Table 10. Common fish and their plant affinity during various life stages and their relationship with plants

<table>
<thead>
<tr>
<th>Fish</th>
<th>Plant Affinity</th>
<th>Larvae</th>
<th>Juvenile</th>
<th>Adult</th>
<th>Spawn</th>
<th>Forage</th>
<th>Predator avoidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluegill sunfish</td>
<td>High</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Common carp</td>
<td>High</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Largemouth bass</td>
<td>High</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Musky</td>
<td>High</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Northern Pike</td>
<td>High</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Black crappie</td>
<td>Moderate</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Smallmouth bass</td>
<td>Moderate</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Yellow perch</td>
<td>Moderate</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>White crappie</td>
<td>Low</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Salmon, trout</td>
<td>Low</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Shad</td>
<td>Low</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Walleye</td>
<td>Low</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**FISH**

A fish survey was conducted in 2016 by the Illinois Department of Natural Resources (IDNR). The survey consisted of 30 minutes of daytime electrofishing. The fishery in Valley Lake lacked diversity. A total of 6 species of fish were collected (Table 11). Fish sampling occurred around the shallow perimeter of the lake. The effective range of the electrofishing boat is around 5 ft. Some fish species may not be represented in a survey depending on the season. A fish survey should be conducted every five years in order to properly manage the fishery. No common carp or grass carp were collected or observed during this survey but they may be present in low numbers and so difficult to collect. During the 2004, both common carp and grass carp were collected.

**Table 11: IDNR Fish Survey for Valley Lake 2016**

<table>
<thead>
<tr>
<th>Species</th>
<th>Number</th>
<th>Minimum</th>
<th>Average</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Largemouth Bass</td>
<td>36</td>
<td>1.7</td>
<td>12.3</td>
<td>15.7</td>
</tr>
<tr>
<td>Bluegill</td>
<td>57</td>
<td>2.3</td>
<td>3.8</td>
<td>7.4</td>
</tr>
<tr>
<td>Channel Catfish</td>
<td>30</td>
<td>17.2</td>
<td>19.8</td>
<td>23.3</td>
</tr>
<tr>
<td>Redear Sunfish</td>
<td>2</td>
<td>2.4</td>
<td>4.9</td>
<td>7.4</td>
</tr>
<tr>
<td>Black Crappie</td>
<td>2</td>
<td>7.5</td>
<td>8</td>
<td>8.5</td>
</tr>
<tr>
<td>Blackstripe Minnow</td>
<td>1</td>
<td></td>
<td>2.6</td>
<td></td>
</tr>
</tbody>
</table>

**Coarse Woody Habitat**

Downed trees are often removed from the lake as an eyesore or a hazard for navigation. This results in the lack of coarse woody habitat (CWH) that is important to a lake’s ecosystems. CWH often happens naturally as trees or large branches fall into the lake become material is critical habitat for tiny aquatic organisms that feed fish, turtles, birds, and other wildlife. Adding CWH in the north and south bays where it is away from the main boating traffic, can provide excellent cover for fish.

Bluegills and young of the year game fish often seek shelter in and around CWH. Larger logs with branching limbs provide shade and protection for the smaller fish. Black Bass species (smallmouth and largemouth) often build spawning nests in proximity to CWH, particularly large logs (Hunt and Annett 2002; Lawson et al. 2011; Weis and Sass 2011).

Adding CWH in the littoral or near-shore zone serves many functions within a lake ecosystem including erosion control, as a carbon source, and as a surface for algal growth which is an important food base for aquatic macroinvertebrates (Engel and Pederson 1998; Sass 2009). Macroinvertebrates provide food for panfish and young of the year game fish. Logs and branches that are out of the water are used by turtles, birds and other wildlife.
Although no common carp were collected or observed during the 2016 survey, they may be present in low numbers and difficult to collect. During the survey in 2004, both common carp and grass carp were collected.

Carp are considered to be one of the most damaging invasive fish species. Originally introduced to the Midwest waters in the 1800’s as a food fish, carp can now be found in 48 States. In the U.S., the common carp is more abundant in manmade impoundments, lakes, and turbid sluggish streams and less abundant in clear waters or streams with a high gradient (Pflieger 1975; Trautman 1981; Ross 2001; Boschung and Mayden 2004). They are also highly tolerant of poor water quality. Participation in the Clean Waters Clean Boats program will help prevent other invasive species from entering the lake. Never release plants, fish or animals into a body of water unless they came out of that body of water.

The common carp has a dark copper-gold back with sides that are lighter, a yellowish belly and olive fins. They have 2 pairs of short barbells on their upper lip and their dorsal and anal fins have a leading spine that are serrated. They spawn from early spring to late summer in water ranging from 15 – 28 C and prefer freshly flooded vegetation as spawning substrate. They prefer to spawn in shallow weedy areas in groups consisting of one female and several males. A single female can produce up to 100,000-500,000 which hatch in 5-8 days. The spawning ritual involves a lot of thrashing in shallow water contributing to turbidity problems (Fig. 22). Carp are omnivorous and feed over soft bottom substrate where they suck up silt and filter out crustaceans, insect larvae and other desirable food items. Carp are very active when feeding and can be observed around shallow areas where they uproot plants which increases turbidity and nutrient concentrations. Increase in nutrients causes algal blooms and reduction in light penetration that impacts aquatic plants.

There are several ways to control the carp population in a lake. Rotenone (piscicide) may be used to eradicate carp from a lake. However, it may be expensive because the entire lake and feeder creek needs to be treated to prevent carp from repopulating the lake. Rotenone is approved for use as a piscicide by the USEPA and has been used in the U.S. since the 1930’s. This piscicide can only be applied by an IDNR fisheries biologist. It is also biodegradable and there is no bioaccumulation. Warm-blooded mammals have low toxicity because they have natural enzymes that would break down the toxin.

Assess current fish population to ensure that there are enough native predator fish such as bass, catfish and northern pike to help control the carp population. Bluegills are also effective on helping control carp populations by feeding on carp eggs and fry.

**Figure 21:** Carp Spawning activity resuspends sediments in the lake.

**Family:**
Cyprinidae  
(Minnows or carps)

**Order:**
Cypriniformes  
(carps)

**Class:** Actinopterygii (ray-finned fishes)
LAKE MANAGEMENT PLANS

It is recommended that a long term Lake Management Plans be developed to effectively manage lake issues. All stakeholders should participate in the development of the plan and include homeowners, recreational users, lake management associations, park districts, townships or any other entity involved in managing Valley Lake. Lake Management plans should educate the public about specific lake issues, provide a concise assessment of the problem, outline methods and techniques that will be employed to control the problems and clearly define the goals of the program. Mechanisms for monitoring and evaluation should be developed as well and information gathered during these efforts should be used to implement management efforts (Biology and Control of Aquatic Plants, Gettys et al., 2009).

What are the steps in creating a Lake Management Plan?

1. **Getting Started**: Identify lake stakeholders and communication pathways

2. **Setting Goals**: Getting the effort organized, identifying problems to be addressed, and agreeing on the goals

3. **Problem Assessment & Analysis**: collecting baseline information to define the past and existing conditions. Synthesize the information, quantifying and comparing the current conditions to desired conditions, researching opportunities and constraints and setting direction to achieve goals.

4. **Alternatives**: List all possible management alternatives and evaluate their strengths, weakness, and general feasibility.

5. **Recommendations**: Prioritize management options, setting objectives and drafting the plan

6. **Project Management**: Management of assets, detailed records of expenses and time

7. **Implementation**: adopting the plan, lining up funding, and scheduling activities for taking action to achieve goals.

8. **Monitor & Modify**: Develop a mechanism for tracking activities and adjusting the plan as it evolves.

Follow these steps when getting started with writing Lake Management Plans. While each step is necessary, the level of effort and detail for each step will vary depending on the project’s goals, size of the lake, and number of stakeholders.
**LAKE RECOMMENDATIONS**

To improve the overall quality of Valley Lake, the LCHD-ES has the following recommendations:

- LCHD encourages the home owners to participate in the Volunteer Lake Monitoring Program.
- Chloride, while the trend is declining since 2007, it is recommended to follow best management practices for salt and de-icing of roads, sidewalks, and driveways in the watershed. Consider the benefit of attending one of Lake County’s De-icing workshops held annually to learn about these best management practices.
- Develop a Lake Management Plan that incorporates aquatic plant management. It is recommended to have a strategic plan related to lakes and lake management that can include their rules and regulations on how they manage the lakes.
- Become familiar with the appearance of harmful algal blooms and report any blooms to the LCHD-ES by calling 847-837-8030. Also, educate lake users about the appearance of harmful algal blooms so that blooms can be reported to LCHD.
- Establish a communication plan to alert homeowners through signs or postings when an algae bloom has been reported.
- Add Coarse Woody Habitat to increase fish habitat.
- Monitor Eurasian Water Milfoil and create an action plan to control the spread or remove the invasive plants.
- Consider trying to promote aquatic plant growth in Valley Lake. The littoral area around the island would be a good place to try and get aquatic plant growth. Carp impact aquatic plant growth since they can make water too turbid for a healthy plant community.
- Mitigate shoreline exhibiting erosion and improve shoreline buffer.
- Investigate drainage areas in the watershed that might contribute high nutrient loads to see if any best management practices can be implemented to reduce nutrient loads.

Protecting the quality of our lakes is an increasing concern of Lake County residents. Each lake is a valuable resource that must be properly managed if it is to be enjoyed by future generations. To assist with this endeavor, Population Health Environmental Services provides technical expertise essential to the management and protection of Lake County surface waters.

Environmental Service’s goal is to monitor the quality of the county’s surface water in order to:

- Maintain or improve water quality and alleviate nuisance conditions
- Promote healthy and safe lake conditions
- Protect and improve ecological diversity

Services provided are either of a technical or educational nature and are provided by a professional staff of scientists to government agencies (county, township and municipal), lake property owners’ associations and private individuals on all bodies of water within Lake County.