Wabeno Sanitary District No. 1
Trump Lake Management Plan

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1 Executive Summary

A lake management plan is defined as a working document that describes the activities that have been undertaken and those that should be undertaken, which will result in the optimum use and enjoyment of the lake and surrounding land area without adverse impacts on that water body. This lake management plan was prepared at the request of the Wabeno Sanitary District No. 1, the Town of Wabeno, and the Trump Lake Association. The plan was developed in sequence, following the initial water quality study completed in 1999. The previous work was documented in the report Trump Lake Study Report, June 1999. This study and plan focused on Trump Lake's water quality and an evaluation to determine the potential impact that surrounding land uses may have on the lake's water quality. This initial report evaluated private sanitary systems and their potential impact on the regions water quality. As part of the earlier study report, a water quality sampling program was performed to determine the lake's trophic status (water quality indicator), a sanitary survey was distributed to all property owners within the Trump lake area to determine the potential impact of private sanitary systems on the water quality of the lake and soil borings were completed to determine the suitability of soils for conventional septic systems, and an analysis of the lake's watershed was completed. Since that report was completed, additional soil borings were taken, a shoreline survey was completed, and the groundwater flow path was determined from piezometer readings. The following highlight the conclusions of the studies and the recommendations to the Wabeno Sanitary District No. 1

Conclusions

- Trump Lake can be classified as a Mesotrophic lake based on the water quality sampling results.
- 59% (30 of 51) of the on-site conventional system within the Trump Lake area do not meet the 56" separation distance from groundwater code requirement.
- Based on the data collected from the sanitary survey, soil borings, and piezometer readings, it is possible that some on-site sanitary systems within the Trump Lake area are discharging wastewater to the groundwater which feeds into Trump Lake and is potentially contributing to the accelerated eutrophication of the lake.

  Also, based on the piezometer readings, much of the groundwater around Trump Lake is flowing away from the lake. Therefore, it is possible that on-site sanitary systems within the Trump Lake area, are discharging toward nearby private wells where they were once thought to be discharging towards the lake.
- The watershed model indicates that Trump Lake is not experiencing significant phosphorus or other pollutant loadings based on the current land use in the watershed, however, as increased development occurs there will likely be a greater negative impact on the lake's water quality if surface water runoff is not controlled.

It is recommended that the Wabeno Sanitary District No. 1 proceed with the following:

- Establish a long-term water quality testing program to accurately determine if the lake is experiencing significant changes in water quality and the rate of that change.
- Implement one or more water quality improvement alternatives, including:
  - Educate property owners in the District.
  - Upgrade on-site sanitary systems.
  - Consider the benefits of installing public sanitary sewer and potable water.

2 Introduction

Trump Lake is located in the northwest portion of the Town of Wabeno in southeast Forest County, Wisconsin. The lake covers an area of 172 acres, which is slightly higher than the average size of the named lakes in Forest County (110 acres). It has approximately 2.78 miles of shoreline (0.08 public), and a maximum depth of 20 feet. The lake is located in an area which is comprised primarily of Nicolet National Forest and USA Indian lands, however the immediate vicinity of Trump Lake consists of mostly private land holdings. Development has occurred on all developable lots around the lake, and these areas currently are not serviced by public sanitary sewer or water. All developments adjacent to Trump Lake have private, on-site septic systems which could potentially have a negative impact on the water quality of the lake and/or the local groundwater resources.

In 1995, 89 property owners of land adjacent to Trump Lake signed a petition requesting that the Wabeno Sanitary District study the feasibility of extending public sewer service to the properties located in the Trump Lake area. These property owners initiated the petition for sewer service as they were concerned about protecting the water quality of Trump Lake.

In response to the petition, the Wabeno Sanitary District decided that the first step in assessing the feasibility of extending its sewer service to the Trump lake area should be to complete an evaluation of the current conditions of the lake's water quality and the potential impact that surrounding private sanitary systems and land uses may have on the lake's water quality.

In May, 1998 the Wabeno Sanitary District No. 1 was awarded a Lake Management Planning Grant from the Wisconsin Department of Natural Resources (WDNR) to conduct a study of the water quality of Trump Lake. The study looked at existing conditions and potential impacts to the water quality of Trump Lake.

A study report was completed by the consulting firm Foth & Van Dyke in June of 1999 and that report detailed findings and recommendations of the Trump Lake area.

The next phase of work included applying for a subsequent grant from the WDNR to complete a Lake Management Plan. That grant was awarded to the Wabeno Sanitary District No. 1 in June of 2000 .

2.1 Authorization

The Wabeno Sanitary District No. 1 authorized Foth & Van Dyke to reevaluate the existing water quality and the potential impacts to lake water quality from private sanitary systems and surrounding land uses within the lake's watershed, and to prepare a lake management plan identifying the results and giving recommendations for improvements.

The local share of the lake management plan was to be funded equally by the Wabeno Sanitary District No. 1, the Town of Wabeno, and the Trump Lake Association. The local share was $6,075, while the Lake Planning Grant funded $10,000. In-kind contributions were anticipated to be approximately an additional $800.

2.2 Purpose

The purpose of the 1999 lake study was to evaluate the water quality of Trump Lake, and determine the potential impact of private on-site sanitary systems and surrounding land uses on the lake's water quality. This information was used to aid in assessing the feasibility of providing public sanitary sewer service to properties in the Trump Lake area. The study also included an exploration of alternatives to improve water quality. Recommendations, based on the 1999 data presented in the report were made to provide direction to the Sanitary District and Lake Association. This direction addressed the need for future technical studies, including the development of an overall lake management plan and an evaluation to determine the feasibility of installing public sewer service.

The 1999 study eventually lead to the development of this Lake Management Plan.

The development of this Lake Management Plan utilized data obtained from the 1999 study. The work completed for the 2000/2001 phase also contained a data collection component. Much of the data collected in this phase was used to confirm or add information to the 1999 data set. This process helped define recommendations for protection of the surface water and groundwater in and surrounding Trump Lake. The Lake Management Plan is intended to provide direction for both corrective steps and preventative measures that can be taken to improve and/or sustain the existing Trump Lake water quality.

2.3 Project Study Area

Map No. 1 illustrates Trump Lake and surrounding parcels, and also identifies the location from which water quality sampling, soil borings, and piezometer readings were performed for the study.

Map 1

3 Water Quality Protection

3.1 Introduction

The water quality of a lake is dependent upon a number of factors and lake characteristics. Every lake possesses a unique set of physical and chemical characteristics that may change over time. The chemical changes may occur on a daily basis, while physical changes (such as plant and algae growth) are more likely to be seen on a seasonal basis. Seasonal changes in the physical characteristics of a lake are common because factors such as surface runoff, groundwater inflow, precipitation, temperature and sunlight are variable. A lake's water quality will vary with these seasonal changes, therefore data must be gathered over a period of time to accurately determine if a lake is experiencing significant changes in water quality and to distinguish between natural variability and human activity impacts.

To determine the water quality and trophic status of Trump Lake, a sampling program was developed which included monitoring numerous characteristics of the lake. The following section explains the sampling program and its components and presents the results and analysis of the sampling conducted. First however, it is important to identify the source of the lake's water supply as this contributes to the factors which affect the quality of its water supply. In addition, identification of the water source allows for sound management practices to be selected which reflect the specific characteristics of the lake.

3.2 General Lake Characteristics

Trump Lake is classified as a drained lake which is the least-common lake type found in Wisconsin (WDNR, 1995): a drained lake has no inlet, but does have a continuously flowing outlet. This is also referred to as a groundwater drainage lake, although the groundwater component of this lake is not a major component in the overall water budget. The primary source of water is from precipitation and direct drainage from the surrounding land, as all of the groundwater is not a feeding source to Trump Lake. This was determined from the piezometer analysis on pages 35-37. Water levels in drained lakes frequently fluctuate depending upon the supply of water available. Due to the lake's source of water, the water quality of the lake is greatly affected by the land uses and sanitary systems surrounding the lake. For instance, runoff from various land applications and/or failing sanitary systems can cause problems in the lake, such as nuisance plant growth which results from excess phosphorus. Therefore, knowledge of these items is critical to making future decisions regarding the management of the lake.

A shoreline survey was performed for Trump Lake by Foth & Van Dyke in the fall of 2000. That survey concluded that the existing developed lots have homes built close to the lake and that most properties have rock riprap protection along the shoreline. Where no protection exists, there is visible erosion and erosion potential. Most locations have wooded lots that help to

reduce runoff potential and impacts. The southwest portion of Trump Lake consists mainly of wetland vegetation and has no development. From the shoreline, the land use gradually turns to tamarack swamp and then to upland deciduous. This area tends to act as a buffer for runoff impacts to the lake.

Along this same area there exists an outlet approximately 13 feet wide at the mouth and readings were taken in April 2001 that indicate that the outlet flow from Trump Lake to Eugene Lake to the south is approximately 0.007 cubic feet per second. This flow is very nominal, however it's existence does verify that Trump Lake is a drained lake or groundwater drainage lake. If not for the flow, Trump Lake would be classified as a seepage lake.

3.3 Watershed Characteristics

A watershed is an area of land in which water drains to a common point, such as a stream, lake or wetland. Managing the watershed to control nutrients and soil that enter the lake is essential to protecting water quality. Controlling the water that runs from the land's surface into the lake is especially important for drained lakes as their primary source of water is from direct drainage from the surrounding land (watershed) and precipitation. The watershed, or land area, which drains into Trump Lake was delineated by Foth & Van Dyke and is illustrated on Map No. 2, Existing Land Use, Trump Lake Watershed (1999 study report).

Trump Lake drains approximately 880 acres of land, while Trump Lake itself comprises approximately 172 acres of surface water. Therefore, the watershed to lake area ratio is about 5:1. The larger the ratio, the more the watershed will have an impact on the lake through nutrient, pesticide, and soil runoff. (Impoundment ratios usually average more than 100:1).
However, low ratio lakes (small watershed and large lake area) have high retention times, in which instance nutrients are more likely to remain in the water for a longer time period before exiting the lake. Trump Lake is a low-ratio lake. Reserve nutrients in lake sediments can continue to recirculate in lakes with high retention times, even after the source of the nutrients has been controlled. Therefore, effects of watershed protection may not be apparent for many years.

Map No. 2 illustrates the existing land use within the Trump Lake watershed. The map was prepared using LandSat imagery which is made available by the WDNR. Figure 3-1 summarizes the land use classifications within the watershed and the total acreage and percentage of land use each comprises.

Approximately three-fourths (674 acres) of the Trump Lake watershed is comprised of woodland/forested land which is dominated by mixed/other broad-leaved deciduous species. Most of this land is privately-held, however there is a small portion of the Nicolet National Forest within the watershed (northeast), and also a considerable portion of USA Indian land (east/southeast).

The shoreland areas have been converted to residential lots, except a portion along the southwest shoreline where a wetland complex consisting of emergent wet meadow and forested wetlands exists(verified through shoreline survey). Residential uses comprise approximately 10 percent of the land within the watershed (83 acres). Some agricultural land, in the form of forage crops, exists within the watershed and comprises approximately 57 acres or 6 percent of the total land use within the watershed.

Figure 3-1
Existing Land Use
Trump Lake Watershed

An estimation of sediment and nutrient (phosphorus) loading to Trump Lake was calculated based on the existing land uses illustrated in Map No. 2. The results of the calculation are identified in Table 3-1 (per 1999 study, page 33).

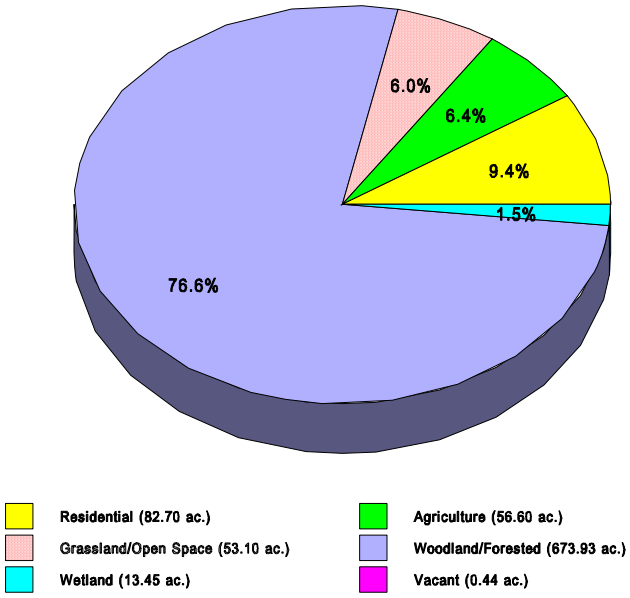


Table 3-1
Existing Sediment and Nutrient Loading (in lbs/yr)
Trump Lake Watershed

Land Use Class	Acreage	Sediment (lbs/yr)	Phosphorus (lbs/yr)	Zinc (lbs/yr)	Lead (lbs/yr)
Residential	82.70	4,135.0	4.1	3.3	0.8
Agriculture	56.60	1415.0	0.6	0.0	0.3
Grassland/Open Space	53.10	1,327.5	0.5	0.0	0.3
Woodland/Forested	673.93	16,848.3	6.7	0.0	3.4
Wetlands	13.45	336.3	0.1	0.0	0.1
Vacant	0.44	11.0	0.0	0.0	0.0
Total	**880.22**	**24,073.0**	**12.1**	**3.3**	**4.8**

Source: Foth & Van Dyke, 1999.

The table identifies the estimated existing pollutant loadings for the Trump Lake watershed. The level of the estimated pollutant loadings is very similar to that of a primarily undeveloped or open area. Therefore, if the land use within the Trump Lake watershed remains relatively unchanged, the level of pollutant loadings would not be a major concern in the future. If however, the area experiences more development there could potentially be a threat to the existing water quality of Trump Lake, and consideration should be given to managing the area to control runoff. If this is the case, there are some common "Best Management Practices" (BMP's) which can be used to help protect the lake's water quality from pollutants/nutrients. Such practices include wet and dry detention basins, wet ponds, porous pavement, swales and filter strips, and the many construction site BMP's available, as well as the general reduction in use, or protection from the use of pesticides, herbicides, illicit discharges and other public use controls.

Map No. 2

3.4 Water Quality Sampling Program

The June 1999 lake study report documented the sampling program for Trump Lake. The program was conducted over approximately a one year time period, beginning in June of 1998, and concluding in April, 1999. Samples were taken from the deepest point in the lake (illustrated on Map No. 1) on five separate occasions including:

- June 19, 1998
- July 15, 1998
- August 13, 1998
- February 12, 1999 (ice on)
- April 23, 1999 (ice off - spring turnover)

The samples were collected by staff from Foth & Van Dyke and the Wabeno Sanitary District No. 1, while sample testing was completed by Northern Lake Service, Inc. It was important to obtain samples with ice on, ice off, and in summer months to obtain data representative of the seasonal changes which affect water quality.

As mentioned previously, numerous factors were considered in the sampling program. On all the dates provided above, samples were collected and analyzed for Total Phosphorus and Chlorophyl-a, while field measurements for Dissolved Oxygen, Temperature, pH, Conductivity, Redox Potential, and Secchi Disc readings were also collected. These factors were sampled at various depths in the lake ranging from surface to subsurface.

During the spring turnover sampling (April 23, 1999), more extensive monitoring was conducted which included those items mentioned above, along with- Chloride, Calcium, Potassium, Sulfate, Iron, Color, Total Dissolved Solids, Total Suspended Solids, Alkalinity, Magnesium, Dissolved Phosphorus, Ammonium Nitrogen, Nitrate plus Nitrite Nitrogen, Total Kjeldahl Nitrogen (organic plus ammonium), Organic Nitrogen (calculation), Manganese, Turbidity, and Total Volatile Solids. Samples for these parameters were collected at two depths, a surface sample was collected and one from near the bottom of the lake.

In order to accomplish the objective of identifying the water quality of the lake, some of the sampling data was used to make a determination of the lake's current trophic state. The trophic state of a lake is an indicator of water quality. The factors which contribute to making the determination of the lake's trophic status were therefore sampled more frequently than most other factors. These factors include Total Phosphorus (Total P), Chlorophyll *a*, and Secchi Disc readings.

Other factors that may indicate any problems in the water quality of Trump Lake and their causes include analyzing for chlorides. Chlorides are found in septic tank effluents, animal waste, and road salts. High nitrogen concentrations may indicate that local land use impacts are greater

than they should be and therefore need to be addressed. These include the presence of human and pet waste, and the excessive use of lawn and agricultural fertilizers being applied along the shoreline.

The following section provides the results of the sampling program, highlighting the dissolved oxygen levels, temperature, and those factors which contribute to the determination of the lake's trophic state. The complete results of the sampling program conducted on Trump Lake are displayed in Appendix 3-1.

3.5 Water Quality Sampling Results and Analysis

The following section explains how a lake's trophic status is determined, and provides more detailed discussion of the sampling results of Dissolved Oxygen levels, temperature, Total Phosphorous concentrations, Chlorophyll *a* concentrations, and Secchi disc readings completed on Trump Lake, as part of the June 1999 study report.

3.5.1 Trophic Status Indicators

The trophic state of a water body is an indicator of the nutrient levels and water clarity in a lake. Lakes can be divided into three categories based on their trophic state which include Oligotrophic, Mesotrophic, and Eutrophic. The following provides a description of each trophic state:

Oligotrophic: Generally clear, cold lakes which are deep and free of weeds or large algae blooms. Oligotrophic lakes are low in nutrients (nutrient-poor) and therefore do not support plant growth or large fish populations, however are capable of sustaining a desirable fishery of large game fish.

Mesotrophic: These lakes are in an intermediate stage between the oligotrophic and eutrophic stages. They are moderately productive (contain excess nutrients), supporting a diverse community of native aquatic plants. The bottoms of Mesotrophic lakes lack oxygen in late summer months or winter periods which limits cold water fish and causes phosphorus cycling from sediments. Overall however, Mesotrophic lakes support good fisheries.

Eutrophic: Lakes which are high in nutrients (nutrient-rich), and support a large biomass are categorized as eutrophic. These lakes are usually weedy and/or frequently experience large algae blooms. Most often they support large fish populations, however they are also susceptible to oxygen depletion which limits fishery diversity. Rough fish are common in eutrophic lakes.

The process of eutrophication is a natural aging process which occurs in all lakes, however this process may be accelerated by allowing nutrients from soil erosion, lawn fertilizers, streets, septic systems, agriculture, and urban storm drains to enter lakes.

The trophic state of a lake can be determined by observing three lake characteristics including Total Phosphorus concentration (Total-P) which indicates the amount of nutrients present in the lake which are necessary for algae growth, Chlorophyll *a* concentration which is a measure of the amount of algae actually present, and Secchi disc readings which is an indicator of water clarity. As expected, low levels of Total P are related to low levels of Chlorophyll *a*, which are related to high Secchi disc readings.

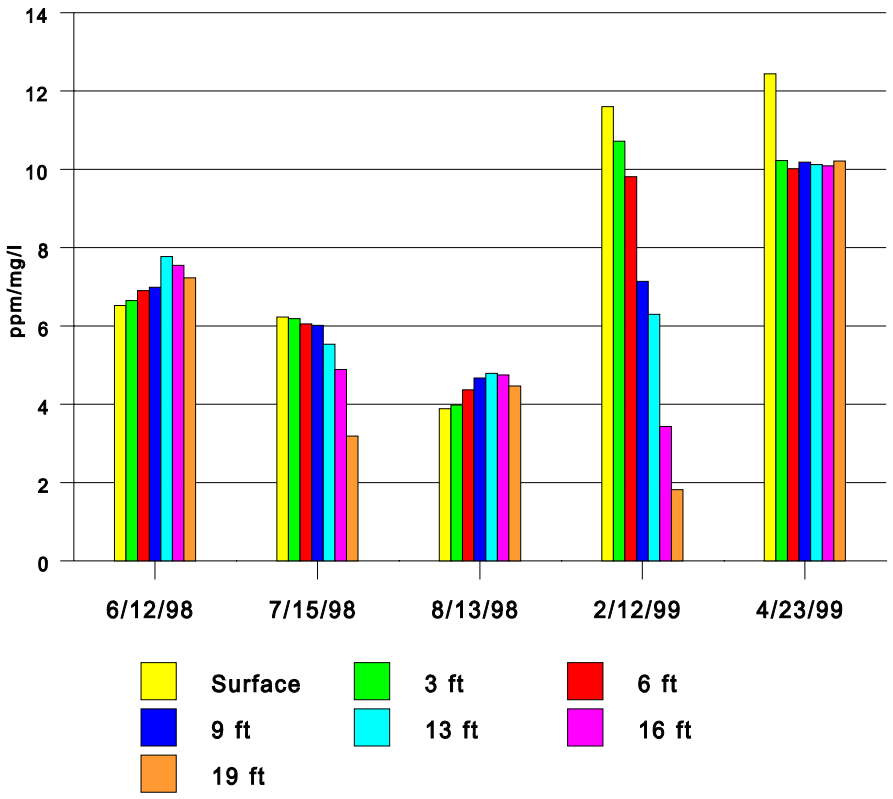
To determine the trophic state of the lake, the Wisconsin Trophic State Index (WTSI) can be applied to each of the above noted factors. The WTSI converts the actual measurement into a value which is representative of one of the trophic states. Values less than or equal to 39 indicate oligotrophic conditions, values from 40-49 indicate Mesotrophic conditions, and values equal to or greater than 50 represent eutrophic conditions.

3.5.2 Dissolved Oxygen (D.O.) Concentration

The concentration of Dissolved Oxygen present in a lake is important as it supports aquatic life. The solubility of oxygen depends on the temperature of the water - colder water holds more oxygen than warmer water. The amount of D.O. present in lakes at different times of the day, and at different depths, is largely determined by the processes of photosynthesis and respiration. Oxygen is produced when green plants grow (photosynthesis), and is consumed through respiration. Therefore, D.O. levels tend to be higher during daylight hours (when photosynthesis occurs), and lower at night/early morning. In addition, lake depths which are below the reach of sunlight may experience oxygen depletion. Oxygen depletion is especially apparent in winter months where snow cover prevents sunlight from penetrating the water, stopping photosynthesis and causing plants to die; this is termed "winterkill" and occurs in many eutrophic lakes.

The warm water sport fish water quality standard for D.O. is 5 mg/l, which represents the minimum amount of oxygen needed for the survival and growth of fish such as largemouth bass and perch. When a lake is very healthy, the D.O. levels will be near saturation. Saturated D.O. concentrations exist between 8.1 mg/l for an 80 F summer water temperature to greater than 14 mg/l when the water temperature approaches the freezing mark of 32 F. Figure 3-1 illustrates Dissolved Oxygen levels at varying depths in Trump Lake on five sampling dates.

Figure 3-2
Dissolved Oxygen Levels
Trump Lake 6/19/98 - 4/23/99



As indicated by Figure 3-2, D.O. levels in Trump Lake have met or exceeded the water quality standard of 5 mg/l at varying depths on most sample dates. However, the lake does experience a lack of summertime oxygen. In June oxygen levels were sufficient, exceeding the water quality standard (though not at the point of saturation). However by July, oxygen levels had declined and even dropped below 5 mg/l in the lower depths of the lake (below 16 feet). The D.O. levels in August clearly indicate the gradual decline in oxygen experienced in the lake during summer months; D.O. levels were at or slightly below the water quality standard in August ranging from approximately 4 mg/l - 5 mg/l - a marginal amount of oxygen in terms of supporting the lake's fishery. This lack of summertime oxygen, especially in the lower depths of the lake, is a critical indicator that water quality gradually deteriorated over throughout the summer.

In late winter, oxygen becomes depleted below approximately 16 feet. The low D.O. experienced on 2/12/99 is a symptom of the lake's aging process and is consistent with the Mesotrophic status of the lake's water chemistry. Despite oxygen depletion in this depth of the lake, fish are still able to survive by moving to more shallow areas where D.O. levels are high enough to support them.

As oxygen levels continue to decrease, phosphorus (an important nutrient for algae growth) in the sediments will become available for algae blooms in the fall. When sufficient oxygen is present in water, phosphorus is less soluble and remains in the sediment rather than being released into the lake.

3.5.3 Temperature

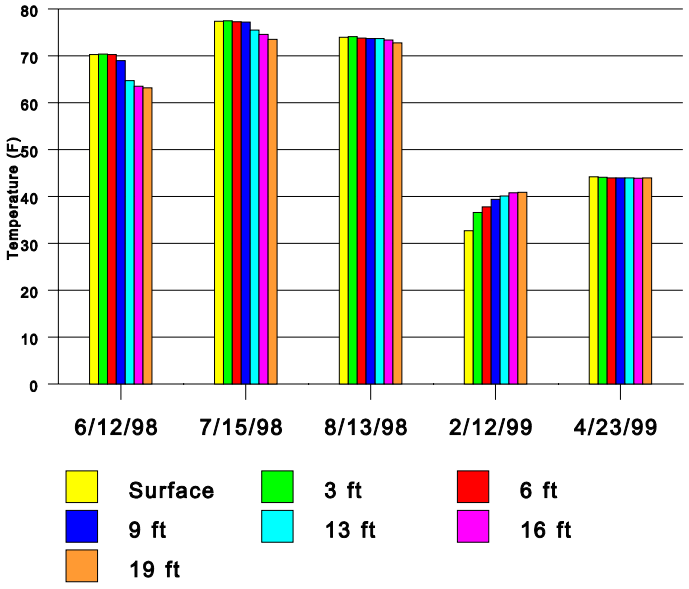
Temperature profiles at different depths were taken in Trump Lake. Figure 3-3 shows that the lake did not stratify into thermal layers during the summer months, as was expected since the lake's maximum depth is only 20 feet. The water remained "mixed", or at approximately the same temperature from top to bottom, throughout the summer months.

Trump Lake experienced the greatest variability in temperature during the winter with a temperature difference of approximately 7° (39° on the lake bottom versus 32° right below the ice). This is termed winter stratification, even though the temperature remains rather stable as the ice prevents the wind from mixing the water.

As expected, the lake had the same temperature from top to bottom as it completely mixed in mid-April when the ice melted.

Overall, the water in Trump Lake remains mixed year-round, therefore distributing oxygen throughout the lake, which is consistent with the D.O. levels that do not experience much variation from the top of the lake to the bottom of the lake, except during the winter months.

Figure 3-3
Temperature Profile
Trump Lake
6/19/98 - 4/23/99



3.5.4 Total Phosphorus Concentration (Total P)

Phosphorus is the key nutrient which influences plant growth in over 80% of the lakes throughout Wisconsin, and promotes excessive aquatic plant growth. This chemical is generated from a number of sources including many human-related activities such as human and animal wastes, soil erosion, detergents, septic systems, and runoff from farms and/or lawns. Two types of phosphorus analyses can be conducted which include soluble reactive phosphorus and total phosphorus; total phosphorus is a better indicator of the nutrient status of a lake because its levels remain more stable. The concentrations of Total P detected at the surface (approximately 1 foot), and near the lake bottom (approximately 19 feet), in Trump Lake are presented in Figures 3-4 and 3-5, respectively, while the corresponding WTSI values are presented in Figures 3-6 and 3-7.

Figure 3-4
Total P Concentrations - Surface Samples
Trump Lake
6/19/98 - 4/23/99

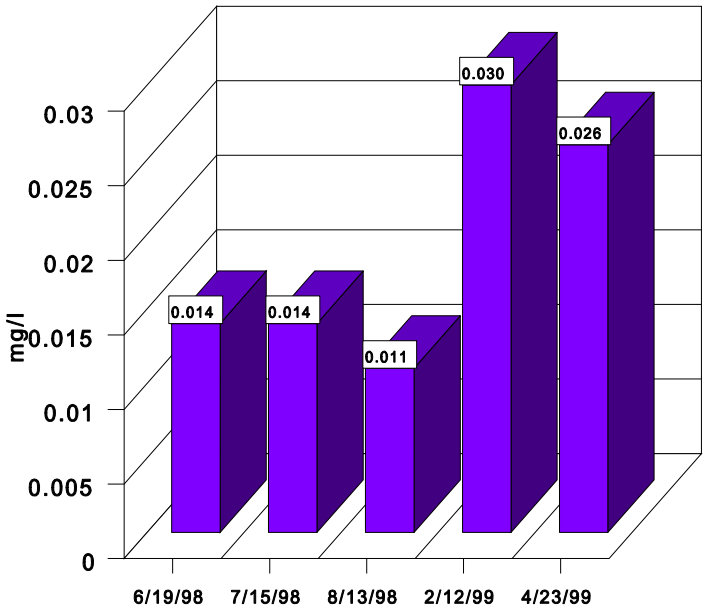
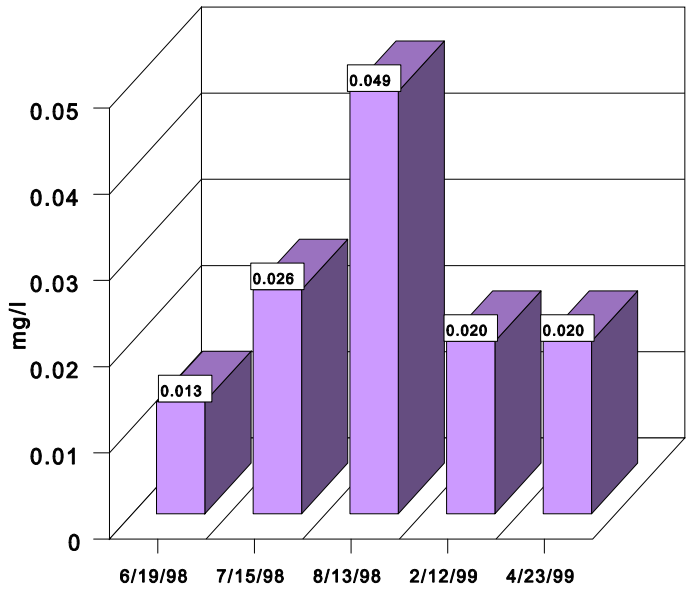


Figure 3-5
Total P Concentrations - Bottom Samples
Trump Lake

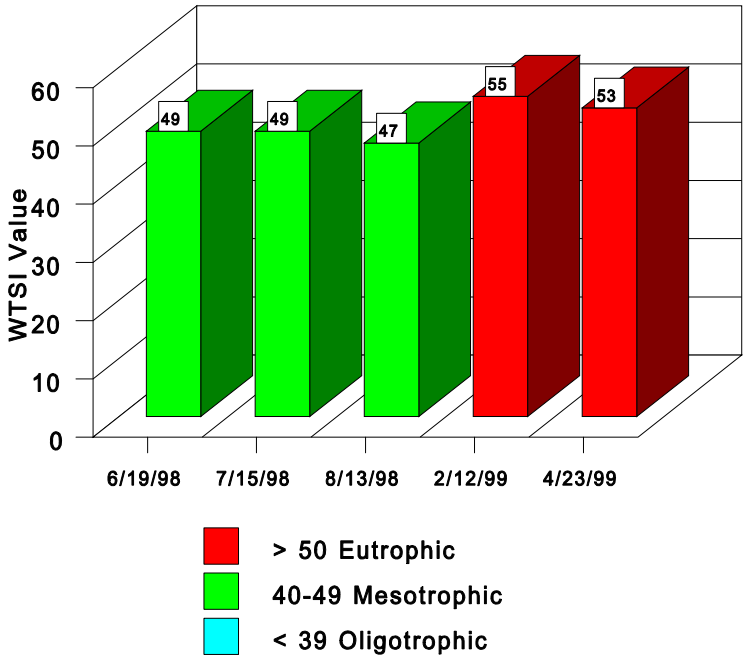


6/19/98 - 4/23/99

Total P concentrations should be maintained below 0.02 mg/l for natural lakes in order to prevent nuisance algae blooms (Understanding Lake Data). As indicated in Figure 3-4, the surface sample Total P concentrations in Trump Lake remained below 0.02 mg/l throughout the summer, however exceeded this amount in the February and April samples.

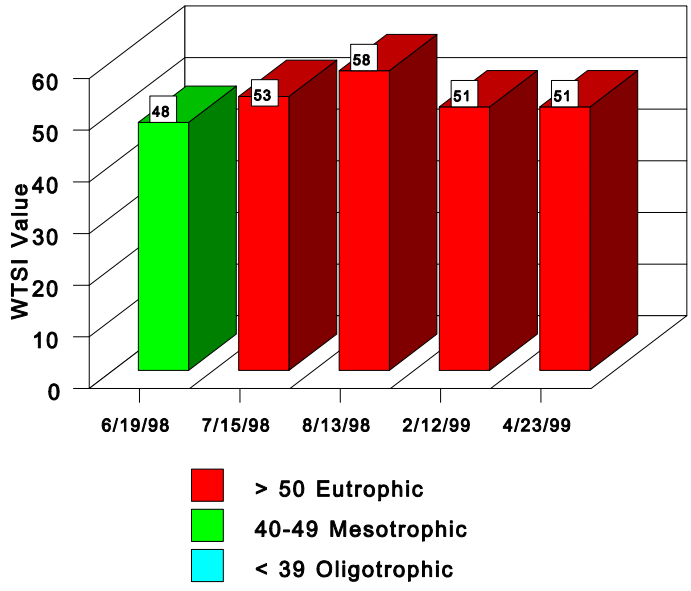
Total P concentrations near the lake bottom (Figure 3-5) were higher overall than those detected near the surface, being at or above 0.02 mg/l on four of the five sample dates. The increase in Total P concentrations near the lake bottom throughout the summer months indicates that depleting summertime oxygen levels are allowing sediments to release more phosphorus, under which conditions fall algae blooms can be expected to increase.

Figure 3-6
Total P - Surface Sample WTSI Values
Trump Lake



6/19/98 - 4/23/99

Figure 3-7
Total P - Bottom Sample WTSI Values
Trump Lake
6/19/98 - 4/23/99

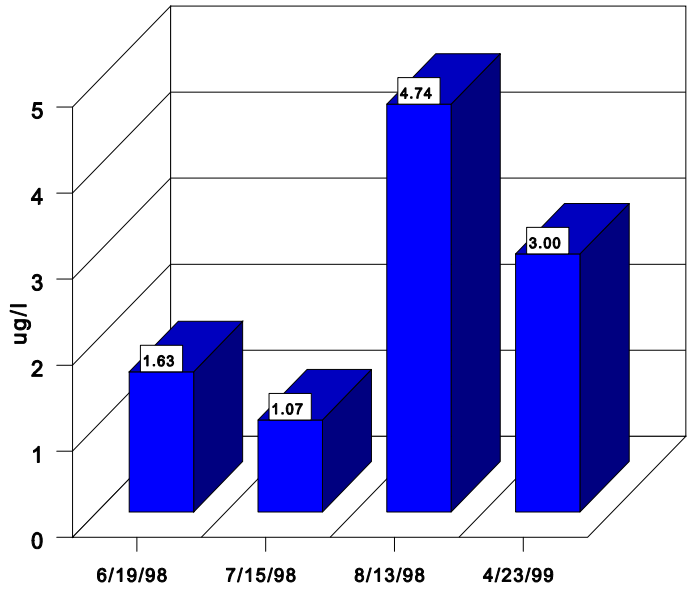


In terms of trophic status, the Total P concentrations found in Trump Lake indicate that the lake's trophic status ranges from late Mesotrophic to Eutrophic at the surface (Figure 3-6), and is primarily in a eutrophic state in the sub-surface (Figure 3-7). Eutrophic status was detected near the surface on two sample dates with WTSI values of 53 and 55, and was detected in the sub-surface on four of five sample dates with WTSI values ranging from 51 to 58. Based on the results of the Total P samples, Trump Lake may be classified as being in the early stages of a eutrophic lake.

3.5.5 Chlorophyll a Concentration

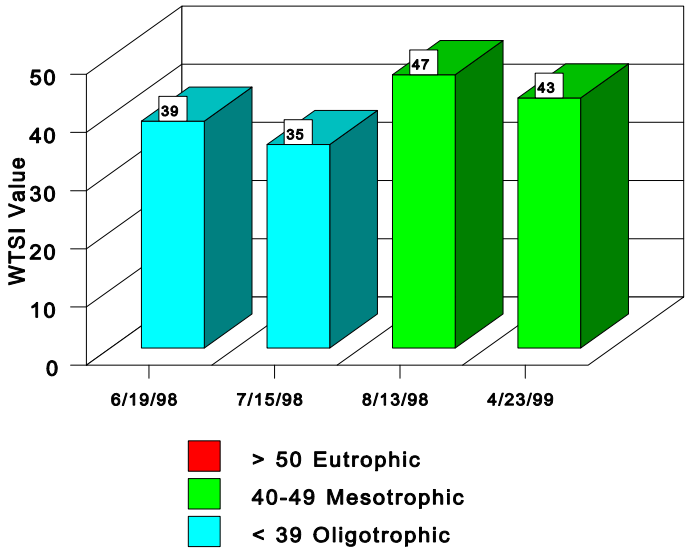
Chlorophyll *a* is a green pigment which is present in all plant life and is necessary for photosynthesis. The amount of chlorophyll *a* present in a lake is dependent upon the amount of algae present, and is therefore used as a common indicator of water quality. It is also one of three characteristics used to determine the trophic state of a lake. Figure 3-8 identifies the concentration of Chlorophyll *a* detected in Trump Lake, while Figure 3-9 illustrates the corresponding WTSI values.

Figure 3-8
Chlorophyll a Concentrations - ug/l
Trump Lake



6/19/98 - 4/23/99

Figure 3-9
Chlorophyll a Concentrations - WTSI Value
Trump Lake



6/19/98 - 4/23/99

Chlorophyll *a* concentrations were sampled on four dates, including the summer months and during spring turnover. Based on the results of the Chlorophyll *a* samples, the trophic status of Trump Lake was identified as being near the high end of Oligotrophic in early summer and gradually changed to the high end of Mesotrophic status near the end of summer, indicating an increase in the amount of algae in Trump Lake throughout the summer months. The spring turnover chlorophyll a sample was also indicative of Mesotrophic conditions.

3.5.6 Secchi Disc Reading

A Secchi disc reading is a measure of water clarity; it is not a direct measure of water quality related to chemical and physical properties. However, water clarity is often indicative of a lake's overall water quality, especially the amount of algae present. Secchi disc readings are taken by lowering an 8 inch disc into the water, and taking the average of the depth where the disc disappears from sight and where it becomes visible again when raised. The Secchi disc reading can be used to determine the trophic state of a lake. Figure 3-10 provides the Secchi disc readings from Trump Lake on five sampling dates, and Figure 3-11 displays the representative WTSI values for these readings.

Figure 3-10
Secchi Disk Readings
Trump Lake

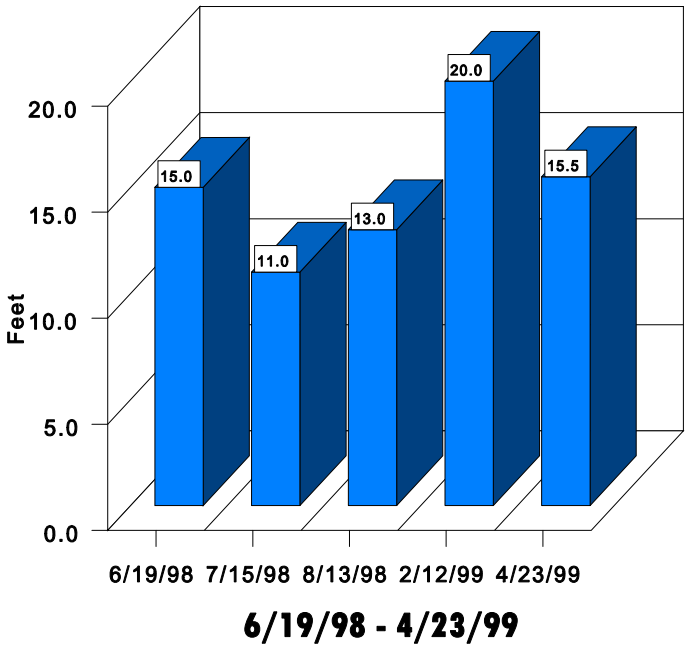
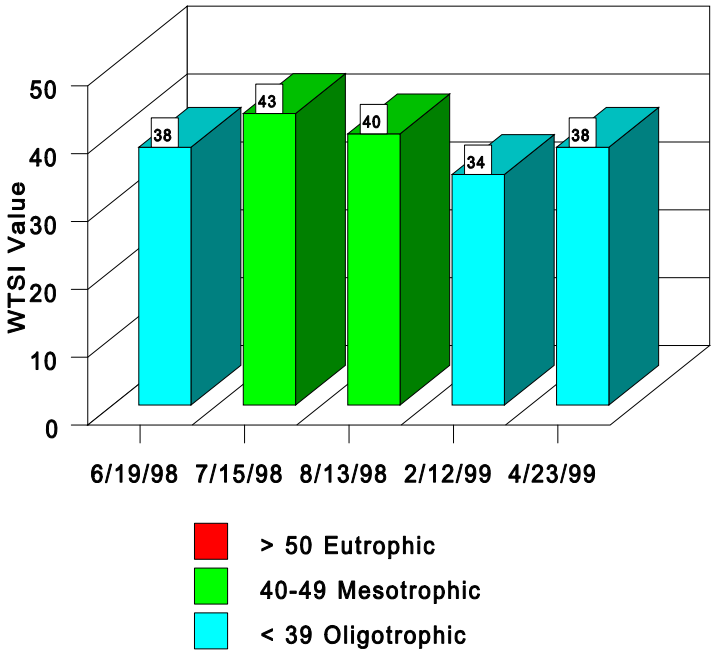


Figure 3-11
Secchi Disk - WTSI Values
Trump Lake



6/19/98 - 4/23/99

Figure 3-10 depicts that the water clarity of Trump Lake experienced a slight decrease during the late summer months, however remained relatively stable overall during the sampling period. These readings indicate the lake's water quality ranges from good to very good.

The trophic status of Trump Lake, as illustrated in Figure 3-11, ranged from late Oligotrophic to early Mesotrophic during the sampling period which indicates the presence of algae in the lake, however it is highly unlikely that nuisance algae blooms are experienced in the lake as the water is rather clear.

4 Existing Private Sanitary System Evaluation

An evaluation of the potential for existing private sanitary systems to negatively affect the water quality of Trump Lake was conducted for the 1999 study report through a collaborative effort by the Wabeno Sanitary District No. 1, Trump Lake Association, and Foth & Van Dyke staff. The evaluation included conducting a sanitary system survey, a review of County records pertaining to private sanitary systems, and an analysis of the capability of soils in the Trump Lake area to support private on-site systems which is based on soil borings from the area. From this information, it was deemed necessary to conduct more soil boring data to get a better representation of the Trump Lake area. The additional data is presented in Table 4-1 (pages 33-35).

4.1 Sanitary Sewer

A sanitary survey was distributed to all property owners within the Wabeno Sanitary District No. 1 in May, 1998. The purpose of the survey was to collect input regarding private wastewater and water supply systems to aid in evaluating the potential impact of private sanitary systems on the water quality of Trump Lake.

Currently, all residences are equipped with private, on-site septic systems, including septic tanks and fields, holding tanks, mound systems and other systems. Private septic systems can potentially have a negative impact on the water quality of the lake if they are improperly installed (including poor location selection) or maintained. The waste products of these systems contain nutrients which promote nuisance plant and algae growth. If these waste products enter the lake, the process of eutrophication can be accelerated and water quality may decrease.

4.2 Survey Results and Analysis (June 1999 Study)

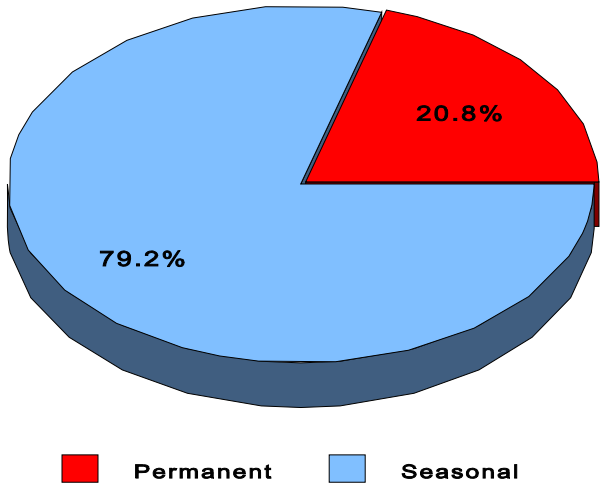
The following identifies the results of the survey responses which were received from 96 of the 140 property owners along Trump Lake for a response rate of 68.6 percent. The survey results are categorized into data concerning occupancy status, wastewater disposal systems, and water supply systems. The complete results of the Sanitary Survey are included in Appendix 4-1.

Occupancy Status

Figure 4-1 displays the occupancy status of the dwellings along Trump Lake, including Permanent and Seasonal residency. The majority of respondents, 79.2%, indicated that their dwellings are for seasonal use, while the remaining 20.8% of the respondents use their dwelling as a permanent residence. Of the respondents who indicated their dwelling is for seasonal use, approximately 30% indicated that they plan to convert the dwelling to permanent use within 8.4 years (average). This indicates that in the near future approximately one-half of the properties in the Trump Lake area will be used as permanent, year-round residences.

The President of the Trump Lake Association indicated in 1999 that he would estimate the existing permanent resident status to be slightly higher than that indicated by the survey results.

Figure 4-1
Occupancy Status
Trump Lake Area



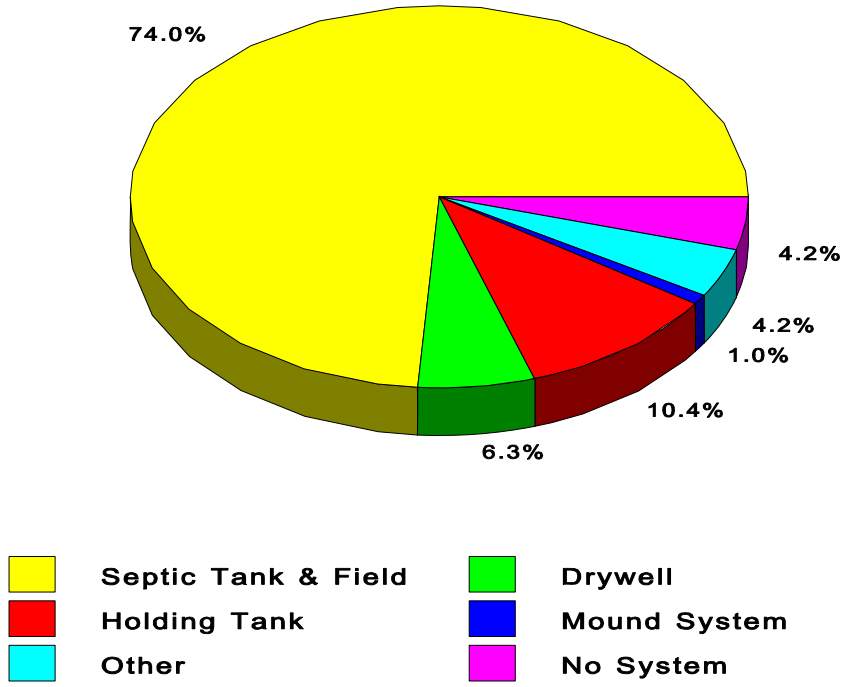
Wastewater Disposal Systems

The following identifies the characteristics of the wastewater disposal systems along Trump Lake, including type of system, age of system, time from last maintenance, location of system from Trump Lake, and problems experienced with the systems.

4.3 Type of System

The distribution of the various types of wastewater disposal systems along Trump Lake is presented in Figure 4-2. Approximately three-fourths of the respondents (74.0 %) have a septic tank and field for their sanitary system. Holding tanks comprised 10.4 percent of the systems, while the remaining approximately 15 percent of sanitary systems are distributed among mound systems, drywells, other systems and no systems.

Figure 4-2
Type of Wastewater Disposal Systems

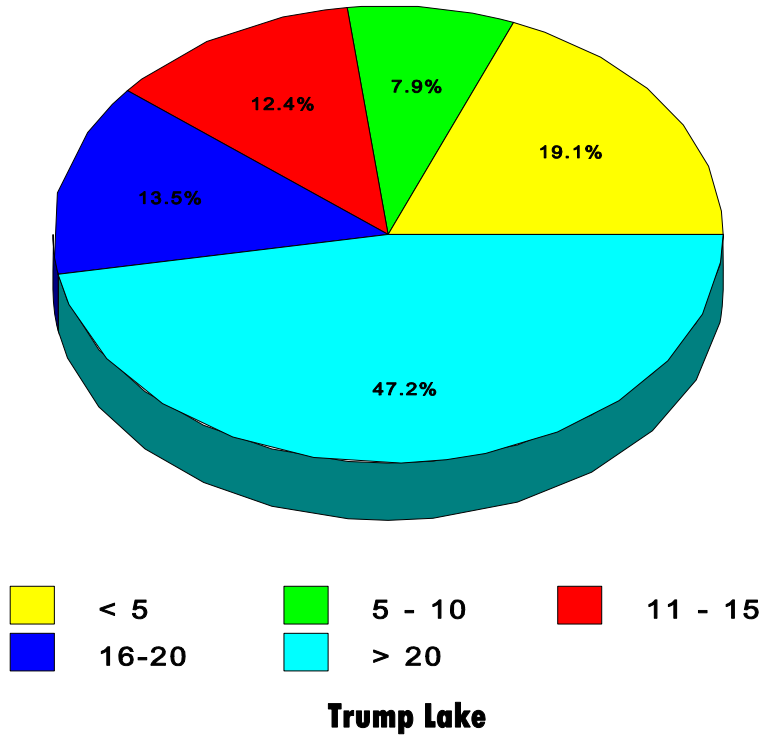


Trump Lake Area

4.4 Age of System

Figure 4-3 displays the ages of the private sanitary systems as indicated by survey respondents. The majority of these systems (47.2%) are more than 20 years old, and another 13.5 percent are 16 - 20 years of age, resulting in approximately 61 percent of the sanitary systems in the Trump Lake area being over 15 years old. Approximately 20 percent of sanitary systems are less than five years old, which indicates that either a number of old systems have been replaced or that new development has occurred during this time period. The remaining systems, those from five to 15 years of age, comprised approximately 20 percent of all sanitary systems. The majority of systems are older, and therefore are more susceptible to experience failure if not replaced or properly maintained which indicates a rather high potential exists for these systems to leak nutrients into Trump Lake, thus negatively impacting the water quality of the lake.

Figure 4-3
Age of Wastewater Disposal Systems



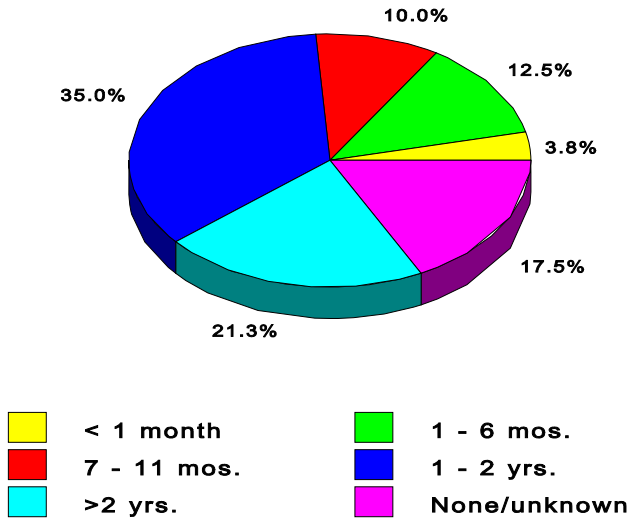
Trump Lake

4.5 Time from Last Maintenance

The time period since the last maintenance was performed on the wastewater disposal systems along Trump Lake is presented in Figure 4-4. Approximately 21 percent of respondents indicated it has been longer than two years since the last time their sanitary system was maintained (majority 3-5 years since last maintained), while another 17.5 percent did not know when the last maintenance was performed on their system. Approximately 35 percent responded that their systems had been maintained within the past two years, including 26 percent who indicated they have had their systems maintained within the past year.

Maintenance (pumping) should be performed at least once every year or every other year for conventional and mound systems, and should occur frequently (upon alarm) for holding tanks. Pumping conventional and mound system septic tanks will prevent clogging of the drain field; it does not, however, impact the nutrient discharge to the groundwater. The data collected indicates that while the majority of property owners appear to be maintaining their systems properly (at least every two years), a significant portion (approx. 40%) are not practicing proper maintenance. It should be noted that seasonal residents will likely have a lower loading of solids to the septic tank, and therefore would require less frequent maintenance.

Figure 4-4
Time From Last Maintenance

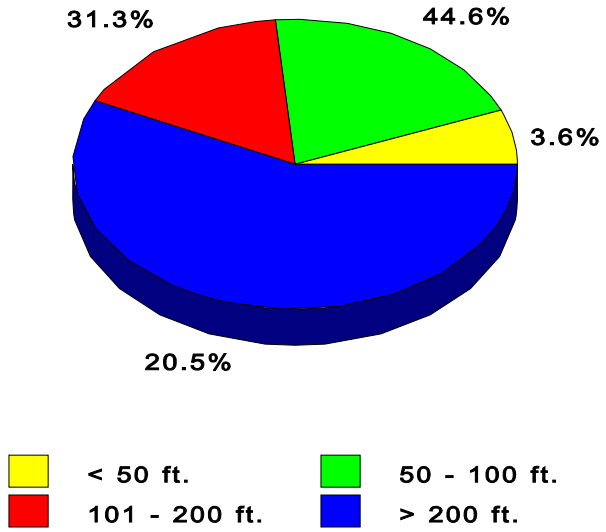


Trump Lake Area

4.6 Location of Wastewater Disposal System

The distance of wastewater disposal systems from the lake is an important factor in determining the likelihood of failing systems discharging to the lake. The closer the system is to the lake, the greater the chance of discharge entering the lake. Figure 4-5 shows the location (distance) of wastewater disposal systems in relation to Trump Lake.

Figure 4-5
Distance From Trump Lake
Trump Lake Area

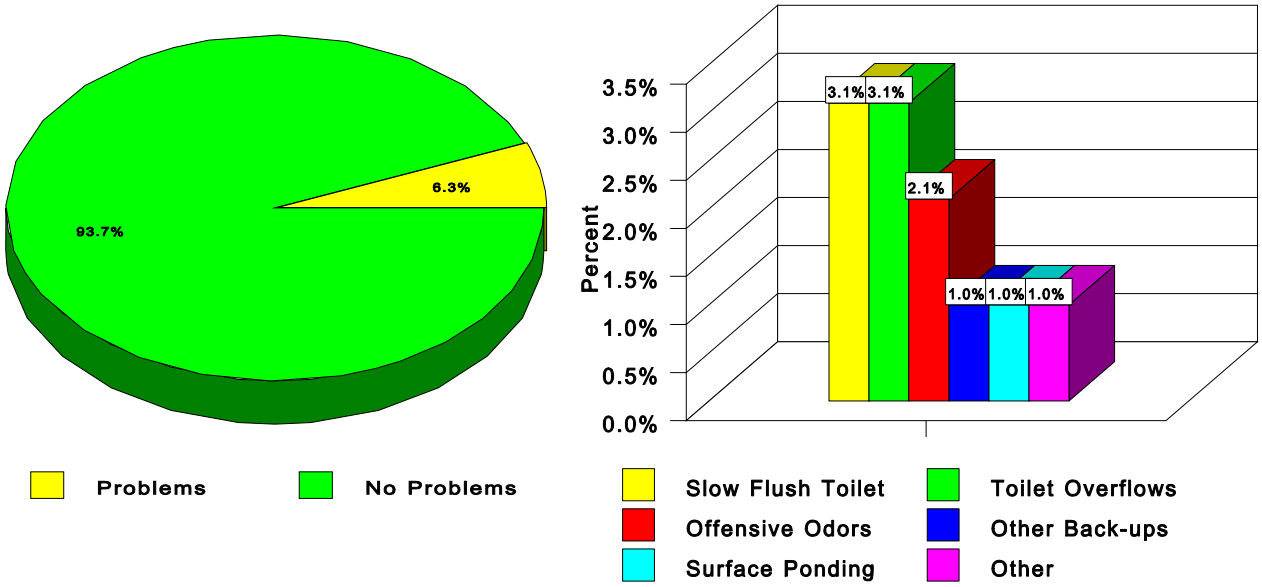


Approximately 44.6 percent of the sanitary systems are located within 50 feet - 100 feet of Trump Lake, while 51.8 percent are greater than 100 feet from the lake. Only 3.6 percent of the systems are located within 50 feet of the lake. Systems located within 100 feet of the lake generally will have a greater potential impact on lake water quality. The results of the sanitary survey indicate that nearly 50 percent of sanitary systems in the Trump Lake area are located within 100 feet of Trump Lake.

4.7 Problems with Wastewater Disposal Systems

Respondents were asked to identify any problems which were experienced from their wastewater disposal systems. Problems include direct discharge to the surface, indirect discharge (seepage), back-up into the house, other problems, and no problems experienced. The vast majority of respondents (93.7%) indicated they had not experienced any problems with their wastewater disposal systems, while approximately 6 percent responded that they had experienced some problems (Figure 4-6). The most frequent problems experienced included slow-flushing toilets and toilet overflows.

Figure 4-6
Problems with Wastewater Disposal Systems
Trump Lake Area



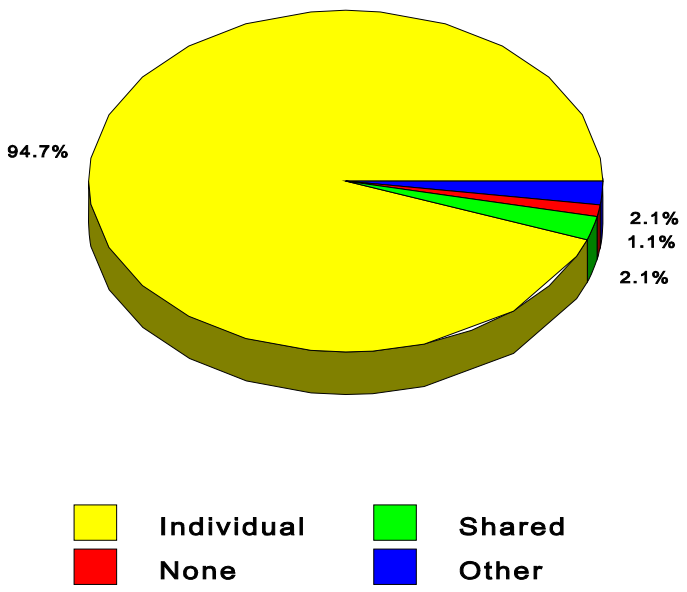
Water Supply Systems

The following identifies the characteristics of the water supply systems along Trump Lake, including the types of wells, ages of wells, location of wells (in relation to sanitary systems), and problems experienced with these systems.

4.8 Types of Wells

Figure 4-7 displays the types of wells (i.e. individual, shared, none) in operation along Trump Lake. Based on the survey responses, approximately 95 percent of the wells in the Trump Lake area are individual wells, while the remaining 5 percent of respondents indicated they had shared wells, no well or a different type of water supply system.

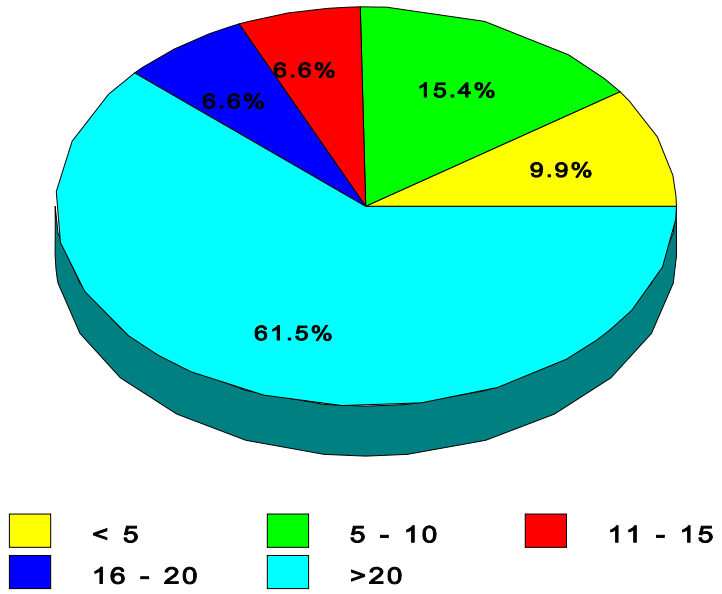
Figure 4-7
Well Types
Trump Lake Area



4.9 Age of Wells

The ages of the wells in the Trump Lake area are illustrated in Figure 4-8. According to the results of the survey, nearly two-thirds (61.5%) of the wells in the area are more than 20 years old, and another 6.6 percent are less than 16-20 years old. Approximately 25 percent of wells are ten years old or less.

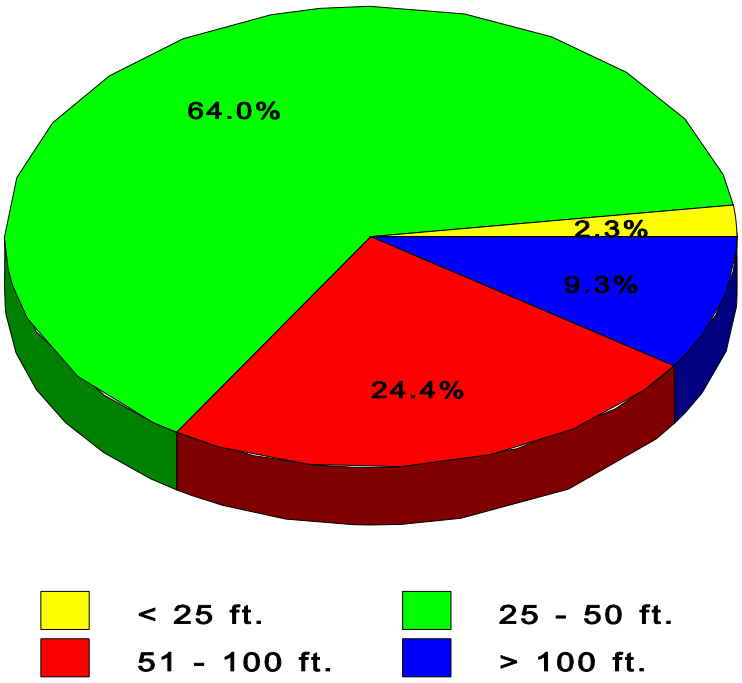
Figure 4-8
Ages of Wells
Trump Lake Area



4.10 Location of Wells

The location of water supply systems from the on-site wastewater disposal systems is important, as groundwater from wells located too close to wastewater disposal systems may become contaminated if the wastewater system is failing. Figure 4-9 indicates the locational relationship of water supply to wastewater disposal systems in the Trump Lake Area. The majority of water supply systems (66.3%) are located less than 50 feet from the on-site wastewater disposal system, while 33.7% are located more than 50 feet of an on-site disposal system. Only 2.3% of water supply systems are located within 25 feet of the on-site wastewater disposal system.

Figure 4-9
Location of Wells

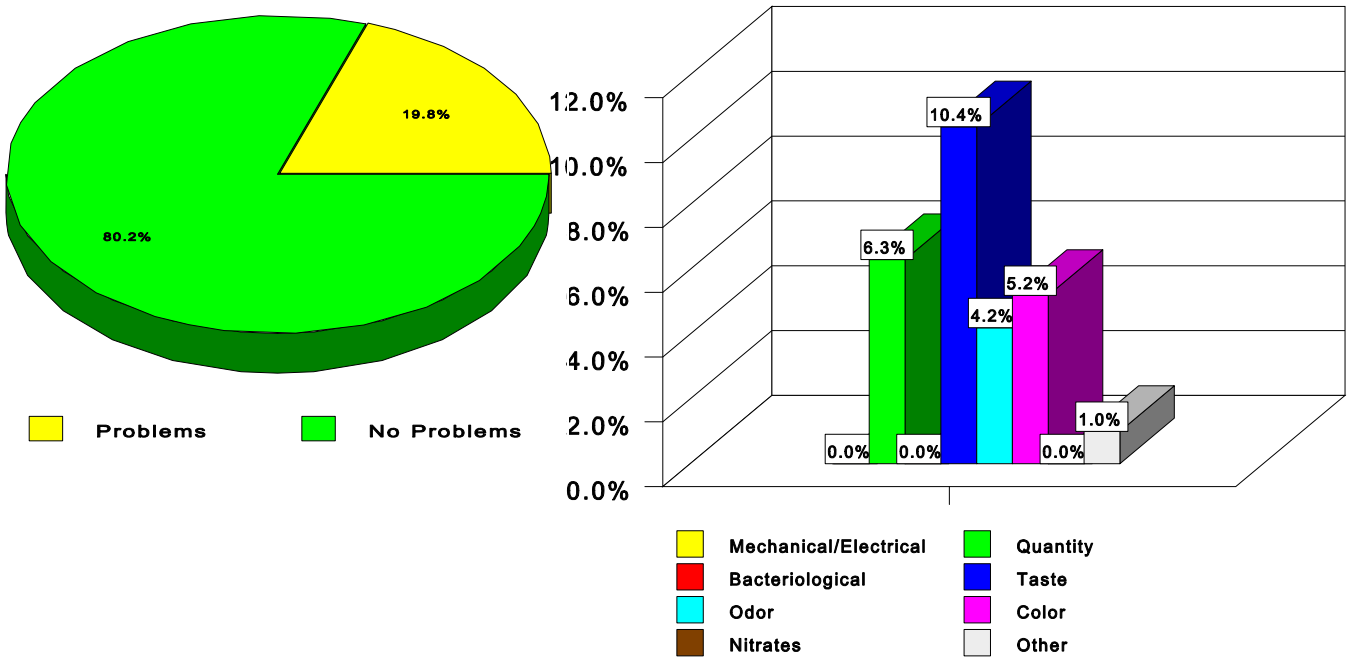


Trump Lake Area

4.11 Problems Experienced with Wells

Survey respondents were asked to identify any problems experienced with their water supply systems, including mechanical/electrical, quantity (volume/pressure), and quality such as bacteriological, taste, odor, color, nitrates, or other, or to indicate if no problems were experienced. Figure 4-10 displays that approximately 80 percent of all respondents do not have any problems with their wells. The remaining 20 percent, however, did indicate some problems. Approximately 20 percent experienced problems with well water quality, including 10 percent having taste problems, while odor and color problems were each experienced by approximately 5 percent of respondents. Problems with well water quantity were indicated by approximately 6.3 percent of respondents, while mechanical/electrical, bacteriological, and nitrate problems were not experienced at all.

Figure 4-10
Problems with Water Supply Systems



Trump Lake Area

4.12 Review of County Sanitary Records

A volunteer from the Trump Lake Association completed a review of Forest County's records of private sanitary systems around Trump Lake. However, County records of private sanitary systems were not required to be kept until 1980, therefore information pertaining to any systems installed prior to this year was not available in the majority of instances. Therefore, the review of County records of sanitary systems in the Trump Lake area was very limited. In addition, the County indicated that their filing is several years (up to four) behind, therefore even if information was recorded, it may not be readily available.

Unfortunately, due to the circumstances identified above, the information that was obtained from the County records with regards to private sanitary systems was not useful in the study report. For this lake management plan, future consideration should be given to bring the records up to date.

4.13 Soil Boring Analysis

Soil borings were completed at 51 of the 140 lots around Trump Lake at locations which would provide a representative sample of the soil conditions around the lakeshore from May 1999 until November 2000. Ten sample areas were from the 1999 study (A-1 through A-10) and an additional 41 sites were sampled in 2000 (B-1 through B-43 excluding B-31 and B-34). Map No. 1 identifies the locations from which soil borings were completed. The soil borings were conducted primarily to determine the soil suitability for on-site septic systems based on the depth to groundwater, though also included an evaluation of soil type, estimated elevation of system above lake level, and distance of sanitary systems from Trump Lake.

All soil borings were completed with a hand auger by Hess Engineering, a certified soil tester. The Soil and Site Evaluation Reports for each site where a soil boring was completed are attached in Appendix 4-2 and Appendix 4-3.

Soils are not mapped for Forest County, so the general capability of the soils around Trump Lake to accommodate septic systems is not known. However, the best soils for septic systems are those of a moderate texture that retain the wastewater long enough for good treatment. In addition, the soils must be at least 56 inches above the groundwater to provide treatment before the wastewater reaches the groundwater and meet code requirements.

The soil borings were conducted adjacent to the sanitary system vent pipes/drain fields where conventional septic systems existed on site. If a conventional septic system was not on the site, the boring was completed in an area on the site which was representative of approximately the same location as that of the sanitary system vent pipes of adjacent properties.

The results of the soil borings with regards to depth to groundwater and associated suitability for conventional sanitary systems are shown in Table 4-1. The soil boring numbers in the table correspond to the location numbers shown in Map No. 1.

Table 4-1
Soil Suitability for Conventional Systems
Trump Lake Area

Boring #	Fire Lot #	Depth to Groundwater (in.)	Suitable for Conventional System*
A-1	4671	30"	No
A-2	4615	16"	No
A-3	4501	32"	No
A-4	4481	18"	No
A-5	"Boat Landing"	24"	No

Boring #	Fire Lot #	Depth to Groundwater (in.)	Suitable for Conventional System*
A-6	2887	40"	No
A-7	"Swimming Beach"	18"	No
A-8	2669	>36[(2)]*	Yes
A-9	2615	>36[(2)]*	Yes
A-10	2595	14"	No
B-1	2581	>72	Yes
B-2	2623	>48[(2)]	No
B-3	2643	HT[(3)]	No
B-4	2651	HT[(3)]	No
B-5	2714	38	No
B-6	2731	30	No
B-7	2761	30	No
B-8	2787	HT[(3)]	No
B-9	2801	MD[(4)]	No
B-10	2843	>72	Yes
B-11	2851	>72	Yes
B-12	2865	HT[(3)]	No
B-13	2864	SL[(4)]	No
B-14	2875	>72	Yes
B-15	2887	>72	Yes
B-16	2931	SL[(4)]	No
B-17	2938	42	No
B-18	2954	>36[(2)]	Yes
B-19	2957	>65	Yes
B-20	2973	>65	Yes
B-21	2977	SL[(4)]	No
B-22	2983	SL[(4)]	No
B-23	2992	44	No
B-24	2999	52	No
B-25	3011	46	No
B-26	4361	53	No
B-27	4379	66	Yes

Boring #	Fire Lot #	Depth to Groundwater (in.)	Suitable for Conventional System*
B-28	4385	>53[2]	Yes
B-29	4423	SL[4]	No
B-30	4445	48	No
B-31	4501	Previous A-3	
B-32	4511	53	No
B-33	4531	56	Yes
B-34	No Test Data		
B-35	4571	68	Yes
B-36	4581	68	Yes
B-37	4609	>56	Yes
B-38	4635	>60	Yes
B-39	4647	>72	Yes
B-40	4659	66	Yes
B-41	4683	>36[2]	Yes
B-42	4707	>40[2]	Yes
B-43	4715	44	No

Source: Soil and Site Evaluation Reports for identified properties in Trump Lake area, Hess Engineering .

[1]Where depth is shown, limiting condition indicated by presence of groundwater or mottling.

[2]Depth of hand auger boring limited to indicated depth by presence of boulders/stones/gravel. Suitability based on soil tester notes concerning soil types, presence or absence or groundwater, and elevation above lake surface.

[3]Lot includes existing holding tank. Soil boring was not done. All sites with holding tanks were considered not to be suitable for a conventional system.

[4]Site limitations including insufficient area and/or steep grades. These sites were considered to not be suitable for a conventional system.

In summary, of the 51 sites tested, 30 were found unsuitable for conventional on-site systems. This means that 59% of the systems checked would not meet the minimum depth to groundwater requirement of 56".

The soil borings indicate that most of the lake area has soil that would not be suitable for conventional, on-site sanitary systems due to high groundwater. Even though the soil type found (silt/clay) does filter wastewater better than sandy soil would, enough soil does not exist to properly treat the wastewater before entering the groundwater. Therefore, existing on-site systems are likely to provide inadequate treatment prior to discharge to groundwater. This condition will contribute nutrients and other pollutants to Trump Lake and allow untreated wastewater to migrate toward private wells.

4.13.1 Piezometer Analysis

Map No. 1 indicates where piezometers were installed around the lake in the spring of 2000. A piezometer measures the height of the groundwater in relation to nearby water bodies. In this case, the piezometers were used to indicate the direction of groundwater flow. With the help of several local residents, groundwater data from piezometers was obtained. Table 4-2 documents the differences in height from the top of the piezometer to the water level inside the piezometer and from the top of the piezometer to the top of the lake level. Where the top of pipe to inside water level exceeds the top of pipe to lake level, groundwater is flowing away from the lake. In most instances, this is the case.

In a small area of the lake, water flows toward the lake carrying pollutants from failing on-site systems. In most cases where the water flows away from the lake, the concern is for contaminating of private wells, where about half of the wells are located closer than 50 feet to the septic system.

Table 4-2
Location of Groundwater to Lake Water Levels

5 Conclusions

Results from the sampling program indicate that D.O. concentrations in Trump Lake were below saturation during the summer months, indicating a lack of summertime oxygen. This low amount/lack of oxygen in the summer months allows phosphorus to be released from the sediments which could cause algae blooms in the fall. In addition, oxygen depletion was experienced in the winter at depths of approximately 16 feet or greater.

The lake remains mixed year-round, meaning that the temperature of the water remains stable from the top to the bottom of the lake. This is expected as the maximum depth of the lake is approximately 20 feet. Because the lake remains mixed, oxygen is distributed rather evenly throughout the lake, as concluded from the D.O. concentrations.

During the sampling period, the overall water quality of Trump Lake as indicated by WTSI values is of good quality. In general, Trump Lake can be classified as a Mesotrophic lake based on a combination of Total P concentrations, Chlorophyll *a* concentrations, and Secchi disc readings which were collected from June, 1998 through April, 1999.

In terms of trophic status indicators, it was mentioned that levels of Total P are related to levels of Chlorophyll *a*, which are in turn related to Secchi disc readings. The sample results for Trump Lake were somewhat inconsistent with this, whereby the lake experienced relatively high Total P concentrations which should be associated with higher levels of algae and therefore low Secchi disc readings. However, Chlorophyll *a* concentrations were not as high as would be expected based on the Total P levels, and Secchi disc readings were indicative of very good water clarity and quality. However, there was consistency when relating these readings to the trophic status of the lake. The majority of the data indicated a mesotrophic status for Trump Lake. This data may indicate that there is another limiting nutrient in Trump Lake, keeping the algae production in check. This may be a macro-nutrient, such as nitrogen or it could be a micro-nutrient such as zinc or copper.

The data presented here, however, does not completely reflect the health of Trump Lake. A lake's aging process naturally transitions from Oligotrophic through Mesotrophic to Eutrophic. However, it is the rate of this aging process that is very important. Data from several years is needed to accurately show whether a lake is experiencing significant changes in water quality as year-to-year changes in lakes are an indication of the rate of change. As a Mesotrophic lake, Trump Lake's aging process *is* progressing towards a Eutrophic condition. Human activity can accelerate this aging process. Therefore, continued water quality monitoring will be needed to follow and better predict the aging process of Trump Lake. The sampling conducted for this study provides a baseline for future water quality monitoring efforts to be compared with to gauge the rate of change experienced by Trump Lake through this aging process.

Based on the data collected from the sanitary survey, review of County records, and the soil borings, the following conclusions can be drawn:

- Approximately three-fourths of the on-site sanitary systems within the Trump Lake area are conventional septic systems.

- Over 60 percent of sanitary systems in the Trump Lake area are more than 15 years old. Codes may have been more lenient at the time these systems were constructed, therefore they may not be ideally located or constructed by today's standards.

- Approximately 90% of the sanitary systems in the Trump Lake area are located within 100 feet of Trump Lake which results in a greater potential impact on lake water quality.

- The vast majority of survey respondents (97%) indicated that no problems were experienced with their sanitary systems, however they may not be educated on how to detect wastewater discharging to the surface or discharging indirectly.

- Soil borings were taken on 51 of the 140 lots surrounding Trump Lake. The soil borings indicate that approximately 59 percent of the lots sampled would not adequately support conventional septic systems due to high or seasonally high groundwater. Therefore, it is likely that other lots, where soil borings were not taken, would exhibit similar soil conditions. Adequate soil conditions are not prevalent around Trump Lake to support conventional systems, though approximately three-fourths of the lots currently have these systems installed.

Based on the data received from the installation of the piezometers around the lake, there is good indication that the groundwater flows away from the lake. If the above mentioned sanitary systems do not discharge to the lake, they may still pose a human health threat. The threat being contamination of the private wells used for supplying drinking water to the residents. Nearly all wells are located away from the lake in comparison to the sanitary systems. Because of the unsuitable soils that may not be filtering the systems properly, the Trump Lake area may be in danger of well contamination. Close proximity of the wells to the sanitary system only heightens that risk as more than half of the wells lie within 50 feet of the septic system.

6 Alternatives for Water Quality Improvements

The following presents some alternatives which may be implemented to improve the water quality of Trump Lake, and to slow the process of eutrophication. Alternatives include educating Trump Lake area landowners, and improving the sanitary systems. Additional materials are attached in Appendix 6-1.

6.1 Education

There are numerous ways individual landowners can contribute to maintaining or improving the water quality of Trump Lake through various land practices. Landowners should continue to be provided with educational material explaining proper land practices and the benefits of them.

A number of human activities add nutrients to the water which promote excessive plant growth. The best long-term solution to control/prevent excessive plant and algae growth and improve water quality then is to prevent surplus nutrients and sediments from entering the water. Surface water runoff is a major source of nutrients and sediments in lakes. It should be noted, however, that variations in the natural environment (i.e. temperature, weather conditions, etc..) can also cause excessive plant growth.

This section identifies the ways in which private landowners can help to improve the lake's water quality by reducing surface water runoff and controlling soil erosion:

Landscaping Along the Waterfront

Landscaping along the shoreline is best kept in its natural state and provides several benefits which include:

- Protecting the water quality of the lake by filtering nutrients and pollutants from runoff before reaching the lake.
- Preserving the beauty of the shoreline by preserving the natural appearance and screening development from view.
- Providing wildlife habitat.
- Protecting the shoreline from erosion.
- Shading lakeshore water minimizing aquatic plant growth near shore
- low-maintenance care.

These benefits can be achieved by doing the following:

- Preserve Natural Shoreline Buffers: Leave the shoreline in a natural state if it has not yet been altered. In areas where the land slopes to the water, construct a berm back from the shore to detain runoff, allowing time for infiltration and evaporation of water.(local zoning regulations restrict shoreline vegetation removal).

- Restore Shoreline Buffer Areas: Leave a strip of unmowed grass, preferably 20 feet wide or more, along the shoreline; native flowers, shrubs and grasses will naturally grow in this area. Native species, including trees, may also be planted in these areas to add variety and provide more immediate results without requiring the use of fertilizers. The wider the buffer area, the greater the benefits.

- Shoreline Paths: Create pathways to the shoreline which follow natural contours rather than descend straight downslope to minimize erosion. Use wood chips or gravel for paving so runoff is not directed into the lake.

- Limit paved or impermeable areas. Dominating the landscape with driveways, patios, decks, and roofs increases the amount and velocity of runoff, carrying sediments and nutrients which cause nuisance plant growth, damage aquatic habitat, hinder recreational activities, and speed the eutrophication of the lake. Reduce the amount of runoff from driveways and patios by constructing them with porous paving bricks, and diverting water to areas where it can evaporate or soak into the soil.

- Minimize land slopes. Keeping the land as flat as possible reduces erosion. Terracing should be used to flatten areas of steep slope, such as those along the east shore of Trump Lake.

Lawn/Garden Care

It was observed during the field study that much of the lake is surrounded by well-kept lawns. The fertilizers and pesticides frequently used to maintain these laws and gardens can reach the water and negatively affect the water quality of the lake. A minimal amount of lawn area is recommended to maintain good water quality; ideally, native, low-maintenance ground covers should be planted in place of lawn. There are ways however, to care for lawns and gardens which will preserve the water quality of the lake, including:

- Proper use of fertilizers and pesticides, including the use of no- or low-phosphorus containing fertilizers. Use fertilizer only if there is a nutrient deficiency present as shown by a soil test. For pesticides, avoid application 1) if rain is likely, 2) near the shoreline, and 3) near a well, do not dispose of them down a toilet or drain, do not mix different pesticides, and carefully follow the directions on the label.

- Choose a grass type or groundcover that is appropriate for your site and soils which requires minimal maintenance, fertilizer and pesticide application.

- Leave grass clippings on the lawn. This will provide up to one-half of the nitrogen the lawn needs. Do not burn grass clippings and leaves near the shore or rake them into the water.

- Do not mow more than _ of the height of grass blades. Set the mower blade to 2 - 2 ½".

- Locate gardens away from the shoreline.

- Control garden pests by using natural controls and pest predators rather than pesticides.

- Add nutrients to gardens by composting aquatic weeds.

- Divert runoff from waterways. Downspouts should be directed to areas where infiltration can occur and not to areas of steep slope. Planting beds are a good location to direct downspout runoff.

- During construction, minimize soil disturbance and revegetate bare areas as soon as possible.

Other ways that Trump Lake area users can help protect the water quality of the lake are to abide by all local regulations. These regulations are in-place to help everyone live in harmony with the environment and to protect the environment from careless misuse. The Trump Lake Association in conjunction with the Wisconsin Department of Natural Resources and town and county representatives have established some regulations. Among them include shoreland zoning regulations and boating regulations. Boating regulations relate to wake and no-wake time periods on the water. No-wake periods occur from 4 o'clock p.m. until 10 o'clock a.m., with Wednesdays' having a no-wake period from dusk until 10 o'clock a.m. These boating regulations prevent undue stress upon the lake shore from wave action and prevents excessive turbidity from propeller spin.

6.2 Sanitary System Improvements

Properly functioning sanitary systems are designed to remove the majority of disease-causing organisms and some nutrients and chemicals from household water and wastewater, keeping them from entering surface water and groundwater. However, these systems are not designed to treat many water-soluble pollutants. It is necessary, therefore, to take extra care in the maintenance of private sanitary systems, especially those located near surface waters or where groundwater is close to the surface. Malfunctioning, unmaintained, or improperly installed sanitary systems can result in the release of nutrients such as phosphorus which encourage nuisance weed and algae growth in the lake.

The following provides improvements that can be made to upgrade malfunctioning or improperly installed/located sanitary systems, and also identifies ways in which property owners can reduce the risk of a malfunctioning sanitary system through proper maintenance and waste reduction practices.

Based on the sanitary survey and soil boring results presented in Section 4, there are sanitary system improvements which can and should be made to failing systems, to reduce the risk of malfunctioning systems discharging wastewater into Trump Lake. These improvements include:

- Relocate drainage fields on sites away from the lake and private wells, especially in areas of steep slope (i.e. uphill/across street from property if possible).

- Construct a cluster system with a number of other residents whereby one sanitary system has the capacity to be shared by multiple households. This is especially encouraged in areas where many small lots are grouped together and sufficient room is not available for individual systems.

- Change from conventional septic systems to holding tanks in areas of steep slope, where small lots are grouped together, and in low areas. Holding tanks can be successful if properly maintained.

- The Lake Association could develop ordinances allowing them to keep records of septic, mound and holding tank pumping frequencies for all systems in the area. This would encourage proper system maintenance.

In addition to sanitary system improvements, several recommendations are identified for properly maintaining private sanitary systems, whereby increasing the life of the system, reducing the chances of system malfunction, and more importantly reducing the incidence of allowing pollutants and nutrients to enter the lake (and groundwater):

- Decrease the amount of water used. There are several ways this can be achieved including using water-efficient appliances and flow restrictors, not letting faucets run unnecessarily, do dishes/laundry only when needed (full loads), etc.

- Use no- or low-phosphate laundry detergents and minimize the use of fabric softeners and water additives which contain phosphates. Detergents with less than 0.5% phosphate are considered low phosphate; usually liquid detergents are free of phosphates. Do not use detergents which contain fillers.

- Do not dump/pour products which contain contaminants, including pesticides, household chemicals, and solvents, or oil or grease down drains, on the ground, or down the driveway. Try to use products that are non-hazardous or less-hazardous.

- Divert discharge from wash water and water softeners from the lake; direct this water to the sanitary system.

- Avoid the use of garbage disposals.

- Don't drain sump pump water into the sanitary system, as this could increase the chance of a system overload.

- Have conventional and mound system tanks pumped at least once every year or every other year. Have holding tanks pumped upon alarm.

Malfunctioning sanitary systems can be detected by the following:

- Backup of sewage in drains or basement.
- Wet areas or ponded water over the drain field.
- Grass over the drain field is bright green (indicates effluent at the surface).
- An increase in aquatic plant growth along property's shoreline.
- Drains or toilets drain slowly.
- Sewage odors.
- Bacteria or nitrates detected in a nearby well water test.
- Biodegradable dye flushed through the system is detectable in the lake.

7 Recommendations

This section provides recommendations which the Trump Lake Association in conjunction with the Wabeno Sanitary District No. 1 and the Town of Wabeno, should implement to maintain and protect the water quality of Trump Lake. This plan concludes that if nothing is done to protect the lake, it will continue to progress to a eutrophic condition at a faster rate than would naturally be expected, as human activity will continue to impact the lake's water quality. Specifically, it is anticipated that there will be an increase in the permanent residence population around the lake in the near future, resulting in increased loading to conventional sanitary systems which are not suitable for use in the soil conditions (high groundwater) present around the lake. This may allow more nutrients to enter the lake or contaminate the drinking water supplies, which, when combined, will lead to a continued decrease in the water quality of Trump Lake and the quality of life in the area. The groundwater flow being generally away from the lake puts private wells at risk to contamination from failing septic systems.

7.1 Future Water Quality Testing

Water quality testing is recommended to be continued in the future. The testing completed as part of the report and this plan provides only a snapshot of Trump Lake's water quality. In order to accurately determine if the lake is experiencing significant changes in water quality, and the rate of that change, data from several years needs to be collected and analyzed.

A long-term sampling program should be established, specifically including the testing of the trophic status indicators - Total P, Chlorophyll *a*, and Secchi disc readings. Testing should be completed on a quarterly basis and include samples from both spring and fall overturn. Secchi disc readings should be taken on a weekly or bi-weekly basis from April through November. Other critical parameters that should also be monitored include D.O., pH, and the nitrogen compounds; Ammonia, Nitrate plus Nitrite and Total Kjeldahl Nitrogen.

In addition to water quality testing, it is recommended that the flow rate of water leaving the lake be continually monitored with the staff gauge to obtain a better understanding of the rate at which the lake discharges.

Also, as part of this additional testing, a Lake Management Planning Grant may be applied for that will help defray the costs associated with such an effort. As part of that grant application, additional testing should be included that will look for chlorides and sulfates that may indicate pollution causing agents exist from the private sanitary systems.

All private wells should be tested for the presence of fecal coliform and nitrate on a regular basis due to the threat of contamination from failed and at risk on-site systems.

7.2 Water Quality Improvements

It is recommended that alternatives for water quality improvement be implemented. Alternatives may include educating the public, upgrading on-site sanitary sewer systems, and/or the installation of a public sanitary sewer system and possibly a water system.

The installation of a public sanitary sewer system should be considered for the long term maintenance and protection of Trump Lake's water quality and the local groundwater. Trump Lake is very sensitive to pollution due to its low watershed to lake area ratio, therefore pollutants which enter the lake remain in the lake for a longer period of time before exiting. In addition, the lake's primary source of water is from the surrounding land uses in the watershed which, if significant development occurs, may have a tremendous impact on the lake's water quality. Both of these may cause the lake to progress to eutrophic status more rapidly. It would be more feasible to spend less money now to ensure protection of the lake's water quality rather than spend more money later to clean up the lake and then ensure protection. The installation of public sanitary sewer and water system for the Trump Lake area could be serviced from the Wabeno Sanitary District No. 1.

There are numerous advantages to proceeding with the installation of a public sanitary sewer system, including:

- Eliminates contamination of lake waters.
- Improves drinking water quality.
- Eliminates waste trucks in the area.
- Improves the value of properties.
- Eliminates the need for replacement systems.
- Improves overall environmental impact.
- Eliminates maintenance of on-site systems.

There are however, a few disadvantages to installing public sanitary sewer. The first disadvantage is the cost and associated unit assessments per RUE. Second is the inconvenience created due to construction of the system, however this occurs only initially for a limited time. Third, the installation of public sanitary sewer may promote growth within the district.

As part of looking into the feasibility of installing public sanitary sewer and the fact that private wells are at risk of being contaminated, the Wabeno Sanitary District No. 1, the Trump Lake Association, and the Town of Wabeno should also look at the need and feasibility for public water via the installation of water main. Installing water main at the same time as sewer saves time and dollars that would otherwise occur down the road. At a minimum, it is recommended that a public sewer system be evaluated to protect the on-site wells from contamination.

8 Implementation

The Wabeno Sanitary District No. 1, together with the Trump Lake Association and the Town of Wabeno, can begin the process of implementing the recommendations provided in Section 7 by applying for grants from Rural Development and others to fund a public project and sending out educational flyers to the property owners throughout the area.

The development of local regulations and ordinances, and lake improvement activities may be funded through these Lake Management Grants. Applications are accepted on May 1 of every year.

Educational flyers should be distributed to all property owners within the Trump Lake area, identifying ways they can contribute to the protection of Trump Lake's water quality.

The Wabeno Sanitary District No. 1 with the Trump Lake Association and the Town of Wabeno should investigate the feasibility of extending public sewer and water service to the Trump Lake area in the future to ensure the protection of the groundwater and the water quality of Trump Lake. On-site systems, even if upgraded, still pose the threat of nutrients and contaminants discharging into the lake and nearby wells.