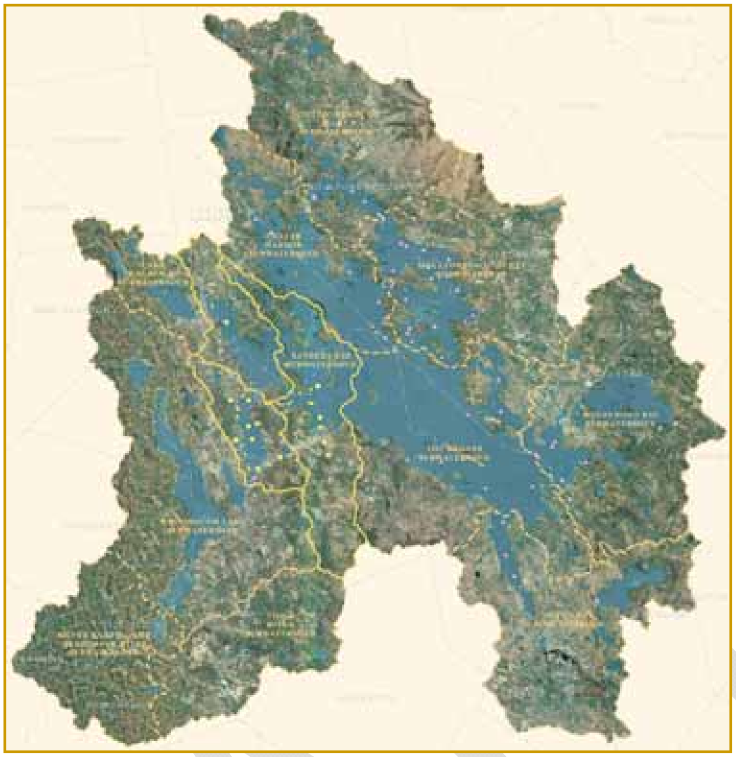


# A Watershed Management Plan for Lake Winnipesaukee

## *People in Partnership with Lake Winnipesaukee*

### Vision

Lake Winnipesaukee is a national and international scenic resource renowned for its remarkable setting, outstanding water clarity, and economic vitality within New England. Protecting Lake Winnipesaukee requires well-managed watersheds that include native forests and abundant wildlife, with an active and informed community of residents and visitors acting as stewards for the lake. In the future, communities and facilities will harmonize with the natural environment and provide a sustainable, vital economy for visitors and residents.

### The Challenge

Lake Winnipesaukee is the largest lake in New Hampshire and the third largest in New England. It is a significant asset for state tourism, and the primary economic force of the region; however, the watershed lacks a comprehensive management plan to protect the environmental quality and scenic beauty. The Winnipesaukee Watershed needs a strong, coordinated, and effective organizational voice committed to advocacy, outreach, and education. The need has never been greater or timelier.

## Approach

The Lake Winnipesaukee Watershed Association, Lakes Region Planning Commission, North Country Resource Conservation and Development Area Council, University of New Hampshire, Center for the Environment at Plymouth State University, Belknap County Conservation District, and watershed municipalities are partnering to forge a unique, subwatershed approach to create an effective, sustainable planning and implementation process using state-of-the-art information systems. We propose a user-friendly, web-based system that will integrate future subwatershed plans, and will provide 'one-stop shopping' for maps, environmental plans, water quality data, recreational opportunities, fishing regulations, land use and zoning, realtor information, and more. The Lake Winnipesaukee Watershed Association remains dedicated to fulfilling an advocacy, outreach, and education role, which will include a high-visibility public involvement process.

## An Update

Water quality analysis has been completed on four subwatersheds: Waukewan, Meredith Bay, Paugus Bay, and Saunders Bay. Several presentations have been made to raise awareness of the project and foster participation. Over 50 people attended the work session held on January 5, 2010 to share ideas, provide local insight and drive the watershed management process forward. We have begun working with the communities of Meredith, Laconia, and Gilford to develop recommendations and identify specific sites for restoration projects.

## Project Partners

The following partners have collaborated to collect water quality data, populate the models, and conduct data analysis to determine action steps to evaluate current conditions and determine trends in water quality:

Lake Winnipesaukee Watershed Association (LWWA)
Lakes Region Planning Commission (LRPC)
University of New Hampshire (UNH)
Belknap County Conservation District (BCCD)
North Country Resource Conservation & Development Area Council (NCRC&D)
NH Department of Environmental Services (NH DES)
City of Laconia
Town of Meredith
Town of Gilford
Plymouth State University (PSU)

Funding for the first phase of the Lake Winnipesaukee Watershed Management Plan (LWWMP) comes from several sources, including section 319 of the Clean Water Act, provided by the U.S. Environmental Protection Agency, and administered by the NH Department of Environmental Services.

# Phase I: Meredith, Paugus & Saunders Bays

## I. Goals:

- Protect the natural resources and water quality health of the Lake Winnipesaukee Watershed for the long term
- Protect the economic vitality of the Lakes Region
- Protect and preserve the natural beauty of the watershed, and quality of life for all.

### Objectives:

- Establish local water quality goals for phosphorus levels per Assessment Unit that either meet or exceed the State Standard for phosphorus
- Identify and implement best management practices or low impact development techniques that allow for continued economic development in the subwatersheds
- Establish and coordinate long term water quality monitoring program
- Develop outreach and education materials and information for the public

## II. Water Quality and Health of the Lake

### The Phosphorus Focus

Phosphorus (P) is a naturally occurring element and a major nutrient required for biological productivity. It is found in all living plants and animals, including people. It is present in soils, especially topsoil. Although its existence is widespread in nature, it may not be *naturally* abundant. Phosphorus is usually the limiting nutrient in most New Hampshire freshwater ecosystems and therefore a necessary nutrient for aquatic productivity. Algae and cyanobacteria are free-floating aquatic organisms whose growth is usually phosphorus limited.

**Increased P levels in freshwater, along with other environmental conditions may result in increased biological productivity, causing increased phytoplankton and cyanobacteria cell production in the water column. This can cause:**

- Decreased water clarity
- Increased Chlorophyll a levels
- Increased turbidity levels
- Accelerated lake eutrophication
- Decreased oxygen concentrations
- Undesirable shifts in relative abundance of aquatic species

**Increased levels of P in freshwater *may* result in:**

- Decline in property values
- Economic loss from decline in tourism due to decline in water clarity
- Public health risk due to potential of increased occurrence of cyanobacteria blooms
- Decline in swimming, fishing and boating use
- Increase in public expenditures to address water quality impairments

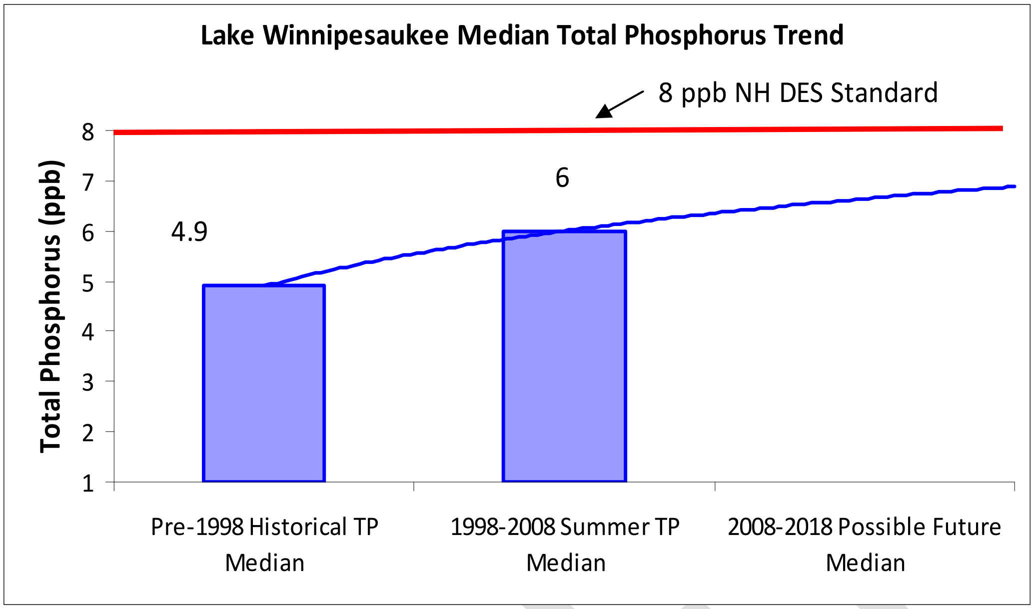
Human and animal waste, residential and agricultural fertilizers and atmospheric deposition are the major sources of P. P is found in organic and inorganic ("orthophosphate") compounds. It is bound in soil by adhering to the surface of soil particles. Erosion and sediment transport, including eroding streambanks, roadway runoff, and exposed soil on construction sites are all potential phosphorus sources. High intensity rain events result in untreated stormwater transported from the land and the road network to storm drains and catch basins which discharge directly and indirectly to surface waters.

## Current Water Quality Status

### Lake Winnipesaukee

Lake Winnipesaukee is currently categorized as Oligotrophic (low productivity) and listed as a high quality water per NH DES. The trophic status also takes into consideration dissolved oxygen concentration, chlorophyll-a (phytoplankton community abundance), submerged and emergent aquatic plant communities, and thermal stratification (Winnipesaukee stratifies during the early summer and typically mixes completely in spring and fall). Water quality monitoring for the lake has been taking place for approximately 25 years through UNH's NH Lakes Lay Monitoring Program (UNH LLMP). The LLMP program measures water clarity, temperature, phosphorus, chlorophyll-a, alkalinity, and dissolved color. However, not all areas of the lake have consistently been sampled, and therefore more monitoring needs to occur in the Meredith, Paugus, and Saunders Bay subwatersheds to assess current in-lake phosphorus concentrations.

Phosphorus water quality analyses (in-lake productivity) were conducted on data available from NH DES, UNH, PSU, LWWA, and town records. The data was divided into two categories – historical data (> 10 years old) and data collected within the last 10 years. Per those data, the phosphorus trend in Lake Winnipesaukee increased (worsened) 1.1ppb in ten years.




Phosphorus data analysis is from 25 years of water quality monitoring from UNH and other sources. This data represents the median value for all Lake Winnipesaukee sampling stations.

## State Standard for Phosphorus

The State of New Hampshire is in the process of setting water quality standards for nutrients based on the designated use of the waterbody. The total phosphorus and chlorophyll a criteria for supporting aquatic life designated use are:

**TP and Chl a Criteria for Aquatic Life Designated Use**

| Trophic State | TP (ug/L) | Chl a(ug/L) |
|---|---|---|
| Oligotrophic | < 8.0 | < 3.3 |
| Mesotrophic | <= 12.0 | <= 5.0 |
| Eutrophic | <= 28 | <= 11 |

As mentioned above, Lake Winnipesaukee is categorized as Oligotrophic. The new state standard for total phosphorus (TP) and chlorophyll-a (chl a) that would apply to determine if Lake Winnipesaukee is supporting the aquatic life designated use is < 8 ug/L TP and < 3.3 ug/L Chl a.

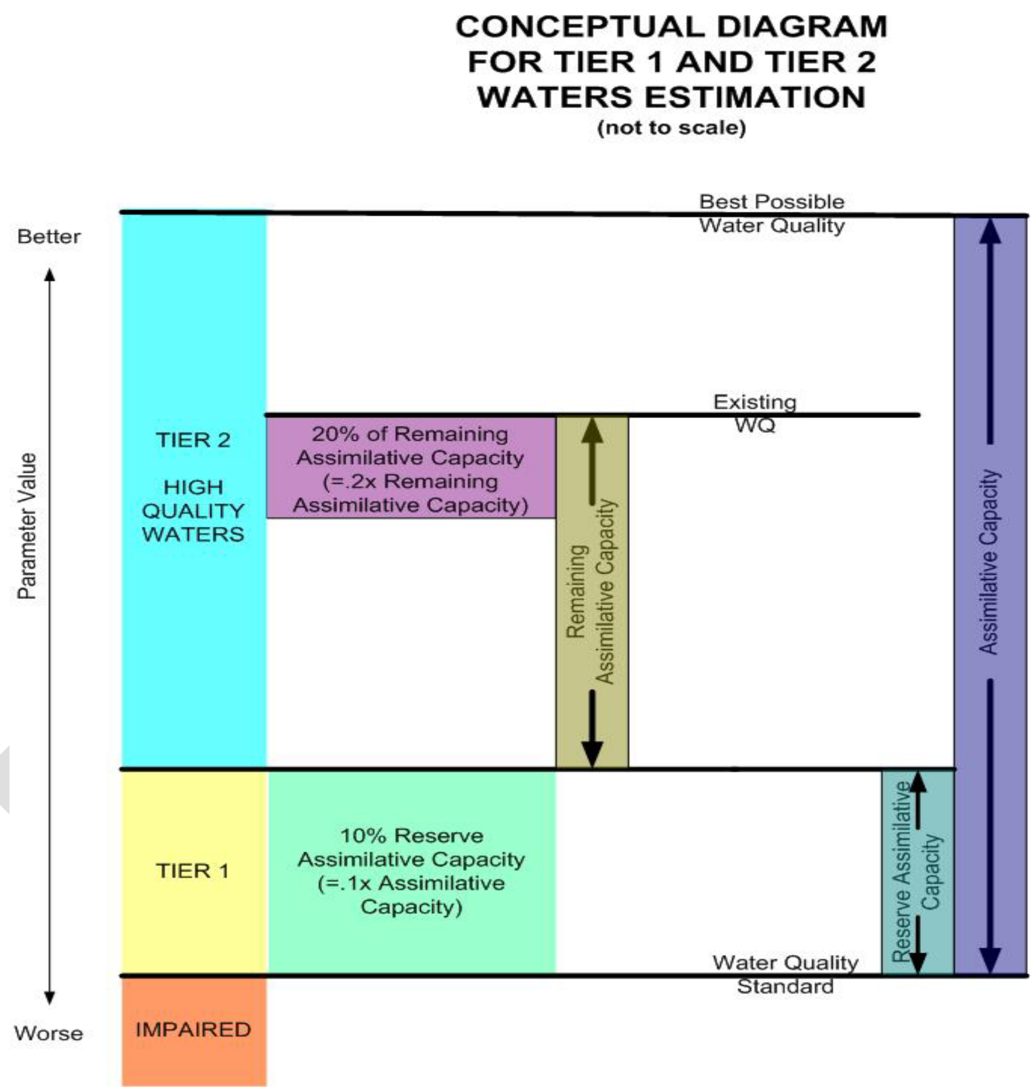
This standard means that if the lake median phosphorus level reaches above 8 ug/L, the lake would be considered impaired and must meet rigorous antidegradation requirements for any level of development to occur. The existing averaged in-lake phosphorus concentration for Lake Winnipesaukee places the lake within 2 ug/L of reaching that threshold.

As part of the management plan process, analysis was done on the existing water quality data available for the last ten years (1999-2009) for each of the three subwatersheds involved in Phase I to determine the median total phosphorus (P) and mean chlorophyll a values, and to determine the assimilative capacity of the subwatersheds as compared to the State Standard for P. Water quality data for Lake Waukewan was also included as it contributes a significant volume of water to Meredith Bay.

| | **Water Quality Analysis (1999-2009)** | | | |
|---|---|---|---|---|
| | **Waukewan** | **Meredith Bay** | **Paugus Bay** | **Saunders Bay** |
| **Total P (ug/L)** | 7.1 | 6.3 | 5 | 5.4 |
| **Chl a (ug/L)** | 2.5 | 1.9 | 2.1 | 1.5 |

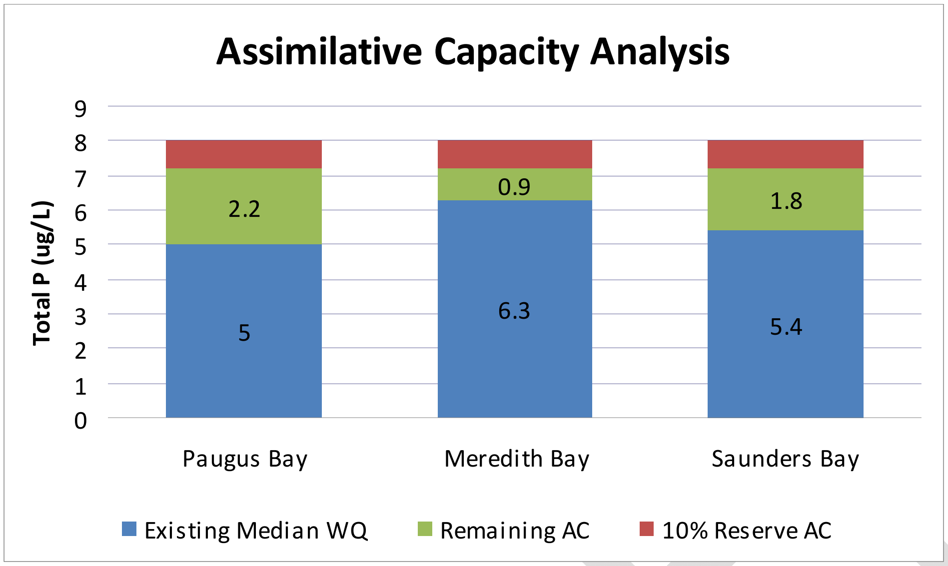
## Assimilative Capacity (AC) for Total Phosphorus (TP)

Total AC = (Water Quality Standard (8 ug/L TP) - Best Possible WQ (0 ug/L) = 8.0 ug/L TP
Reserve assimilative capacity = 0.10 x Total AC = 0.8 ug/L P
Remaining assimilative capacity = Existing WQ – Reserve AC




| | Median WQ | Remaining AC |
|---|---|---|
| ***Tier 2: High Quality Waters*** | **0.0 - 7.2 ug/L** | **>0** |
| ***Tier 1:*** | **7.2 - 8.0 ug/L** | **- 0.8 to 0** |
| ***Impaired:*** | **> 8.0 ug/L** | **< - 0.8** |

## Water Quality Analysis



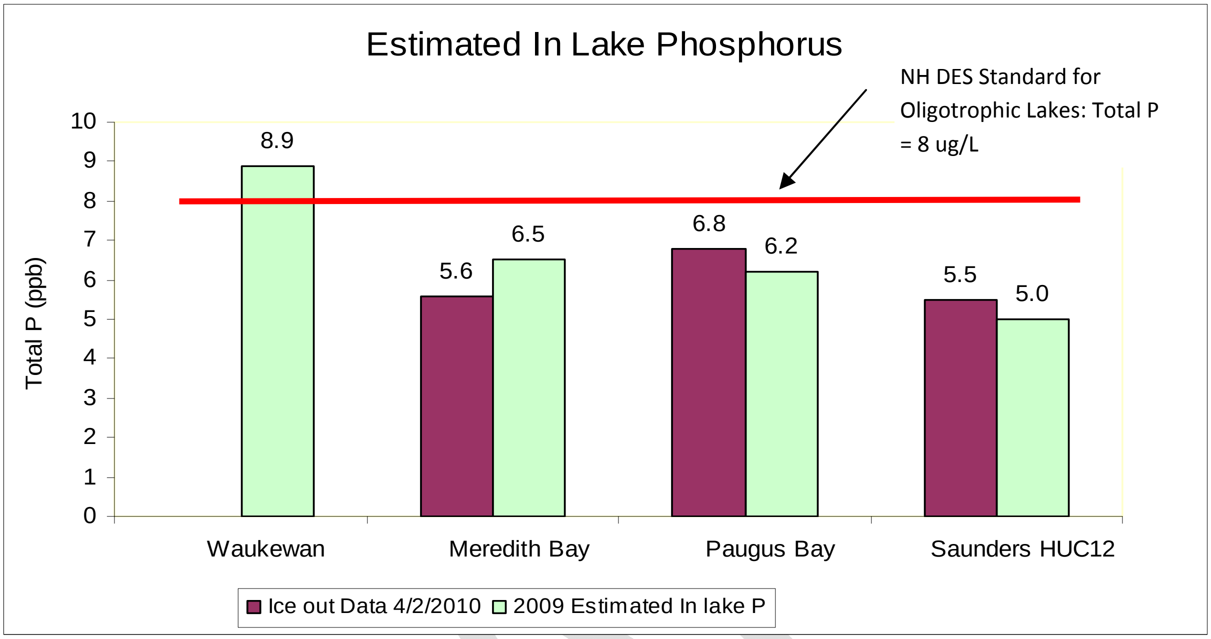

The water quality data and assimilative capacity analysis support Lake Winnipesaukee's designation as a high quality water and oligotrophic classification.

## III. Land Use and P load (STEPL)

The following pages summarize the characteristics of each subwatershed, or bay, within the Phase I study area. The associated data and graphs were developed using predictive models for phosphorus that depend on land use characteristics, rainfall and runoff data, hydrologic soil type, and a range of lake characteristics such as volume, depth, and flushing rate.

On April 2, 2010 a group of volunteers, DES, UNH, and PSU scientists collected over 150 water samples from Lake Winnipesaukee at twelve (12) designated deep spots to determine phosphorus levels at spring overturn. The chart below compares the spring overturn data results to the predicted in-lake P from the models.

To estimate in-lake phosphorus values for each subwatershed, the phosphorus load coming from the land in the watershed needs to be determined. The estimated loads are based on land use, and the overall estimated phosphorus load is then input into a model that predicts in-lake P at spring overturn.

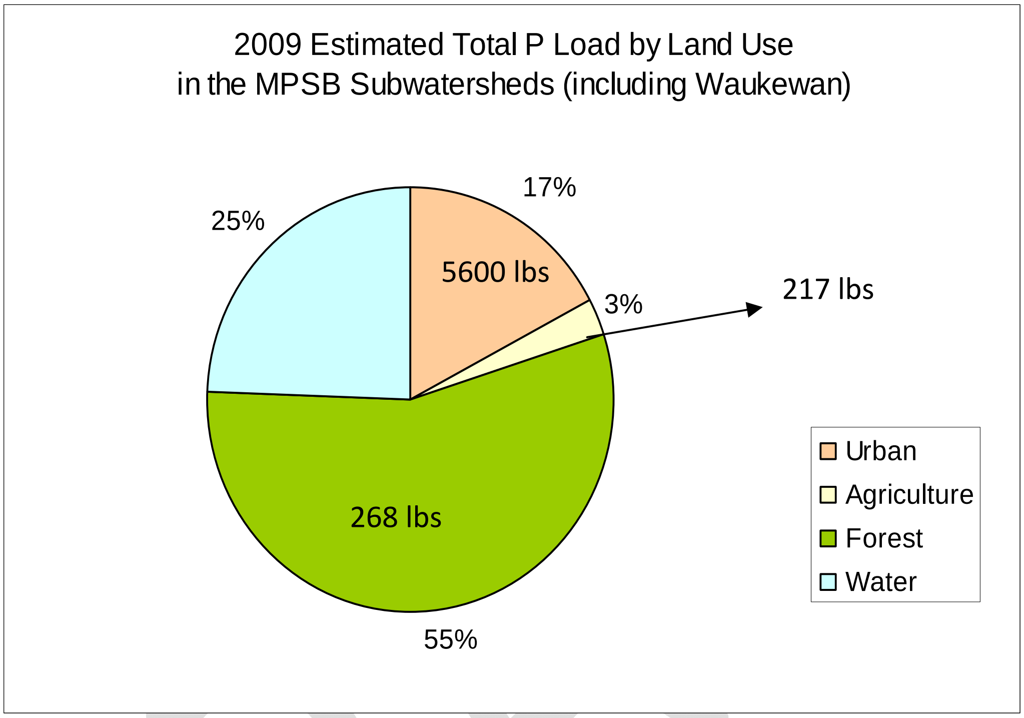



The Waukewan watershed was included in the analyses since it flows into Meredith Bay; however, ice out data was not collected for Lake Waukewan.

The phosphorus loading for each subwatershed was estimated using EPA's STEPL model (Spreadsheet Tool for Estimating Pollutants Loads) based on land use data. The following table shows the 2009 Land Use-Land Cover based on 2006 and 2008 aerial photography. *A detailed overview of how the analysis was done is in the Notes section.*

| | **Land Use per Subwatershed (in total acres)** | | | | |
|---|---|---|---|---|---|
| | | | | **Saunders Bay** | |
| **2009 Land Use-Land Cover** | **Waukewan** | **Meredith Bay** | **Paugus Bay** | **North** | **South** |
| Urban | 951.1 | 1,799.0 | 1,858.0 | 524.0 | 2229.0 |
| Agriculture | 196.3 | 204.7 | 276.9 | 51.2 | 476.0 |
| Forested | 6014.0 | 4,180.0 | 4096.5 | 2431.0 | 6663.0 |
| Water | 1,247.9 | 2,618.6 | 1,293.4 | 1777.0 | 3336.0 |

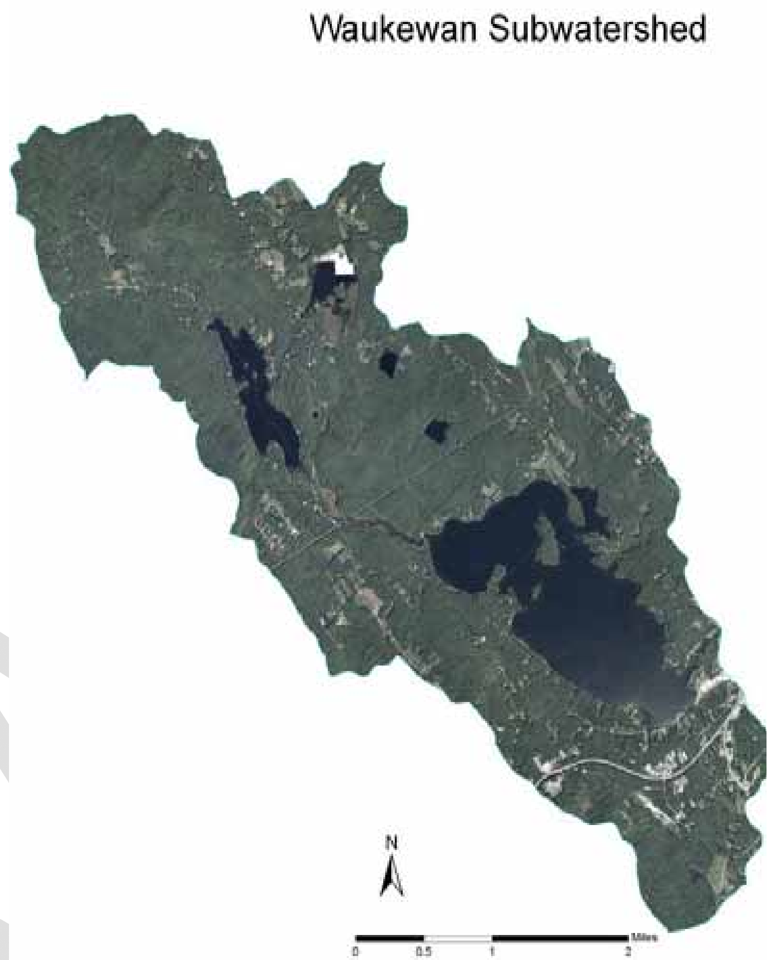
The following pie chart illustrates the percentage of phosphorus load for the entire study area based on 2009 land use data using the STEPL model. *Note: The water category is not included in the calculation of pollutant load.*




In the Waukewan, Meredith, Paugus, and Saunders Bays subwatersheds, 17% of the land use is urban, but contributes 92% of the phosphorus load, compared to 55% forested land use contributing 4% of the phosphorus load. The land use and phosphorus load breakdown by each individual subwatershed is shown on the following pages.

The results of the models indicate that in order to prevent increasing phosphorus levels in the lake, measures and actions should focus on limiting the phosphorus load coming from urban areas. Land use categories included within urban land use are: commercial, industrial, institutional, transportation, multi and single family residential, urban cultivated, vacant land, and open space. Within the urban land use, the transportation category (road network) and single family residential were the main sources of phosphorus. The transportation category is a large source of P due to the fact that it represents impervious areas and carries **untreated** stormwater from land surfaces to storm drains and catch basins that empty directly into associated waterbodies.

## Lake Waukewan




**Towns:** Center Harbor, Meredith, Ashland, Holderness, New Hampton

**HUC Number:** 010700020109

**Perimeter (m):** 34,044

**Mean Depth (m):** 6.7

**Max Depth (m):** 21.4

**Watershed Area (acres):** 8409

**Watershed Area ($m^2$):** 34,038,514

**Lake Area ($m^2$):** 3,693,600

**Volume ($m^3$):** 24,809,000

**Watershed Area/Lake Area:** 9.22

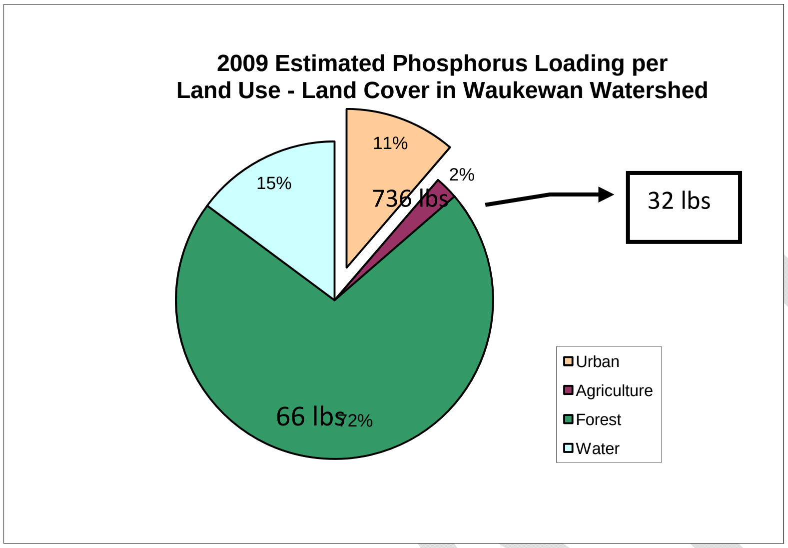
**Areal Water Load (m/yr):** 3.87

**Flushing rate ($yr^{-1}$):** 0.60

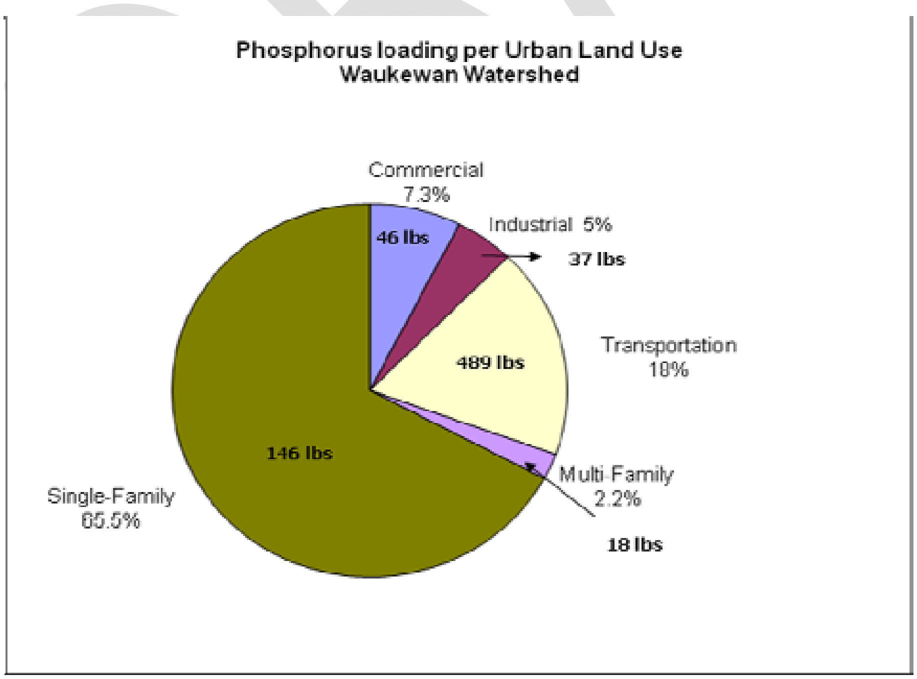
**Watershed:** Winnipesaukee River

**Downstream Waterbody:** Meredith Bay

Total estimated phosphorus load for the Waukewan watershed is 834 lbs per year. The major source for the phosphorus is from the Urban land use category. Although urban land accounts for only 11% of the total watershed acreage, it contributes 88% of the phosphorus load.




The chart below breaks down the Urban Land Use category by the distribution of classes that make up the category. Within Urban Land Use, Transportation (road network), followed by Single Family Residential are the largest sources of phosphorus.



## Meredith Bay

**Towns:** Center Harbor, Meredith, Laconia, Gilford


**HUC Number:** 010700020110

**Perimeter (m):** 35,128.5

**Mean Depth (m):** 12.9

**Max Depth (m):** 30.5

**Watershed Area (acres):** 8791

**Watershed Area ($m^2$):** 35,705,041

**Lake Area ($m^2$):** 10,346,649

**Volume ($m^3$):** 133,240,188

**Watershed Area/Lake Area:** 3.44

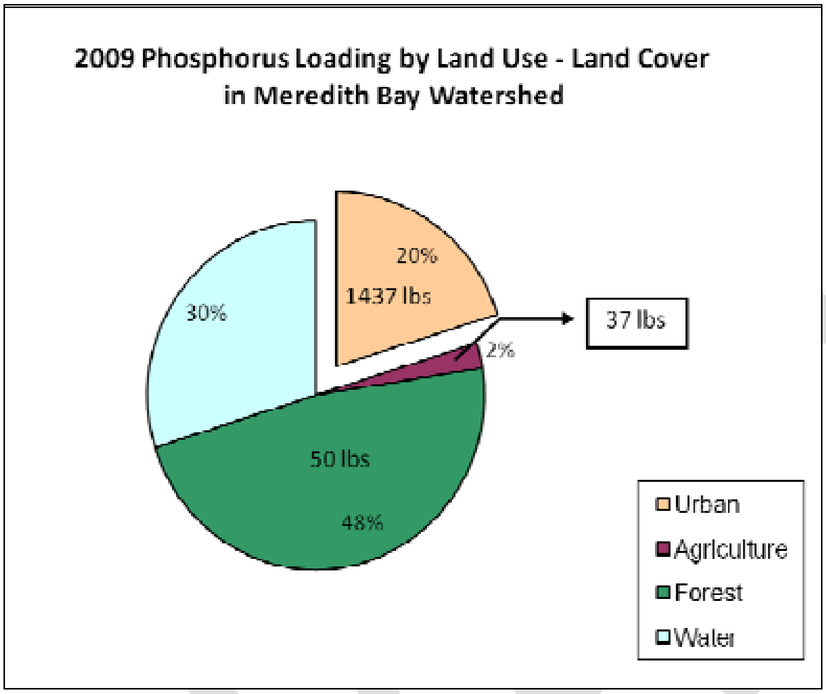
**Areal Water Load (m/yr):** 3.50

**Flushing rate ($yr^{-1}$):** 0.258

**Watershed:** Winnipesaukee River

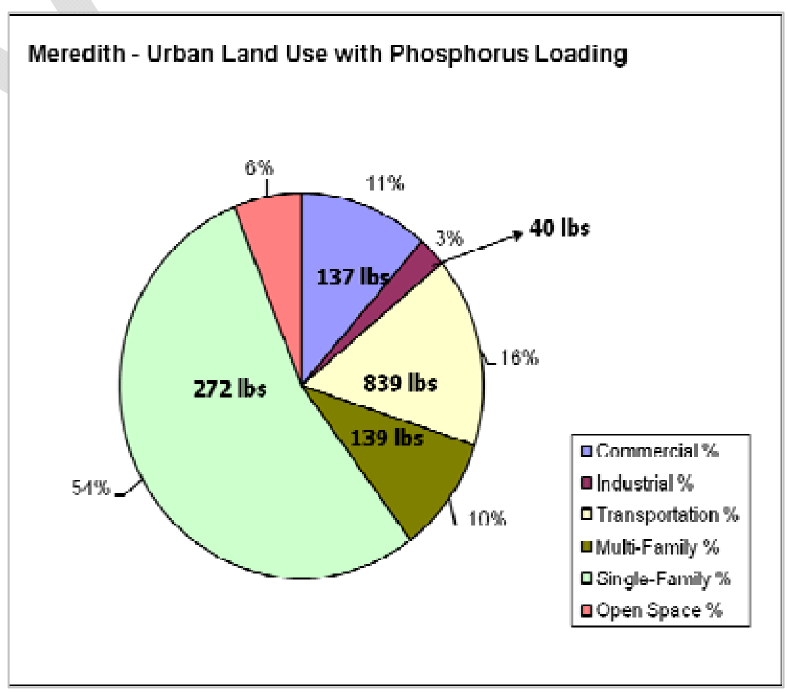
**Downstream Waterbody:** Paugus Bay

The estimated phosphorus loading for the Meredith Bay watershed is 1524 lbs per year. The Urban land use category is the major source of the phosphorus loading with an estimated 1437 lbs. Although the Urban land use category only makes up 20% of the total land use, it accounts for 94% of the phosphorus load.

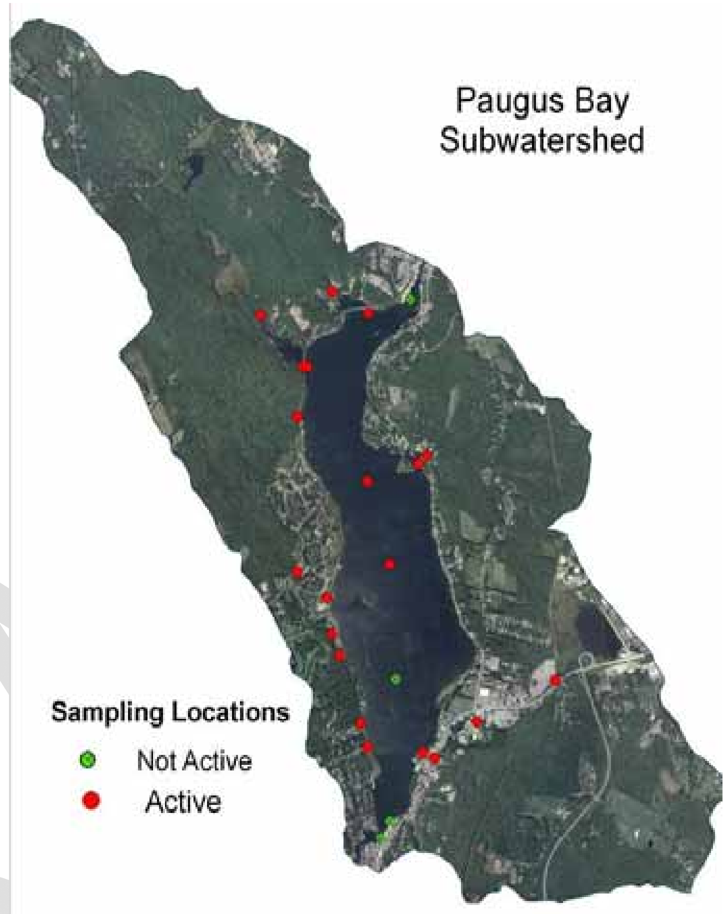



The Urban Land use category can be further characterized by the land use distribution that make up the category.

The chart at the right shows the classes that comprise the Urban land use category. The largest class of Urban land use is Single Family residential at 54%, followed by Transportation at 16%. Transportation accounts for 58% of the total Urban phosphorus load.



## Paugus Bay




**Towns:** Meredith, Laconia, Gilford,

**HUC Number:** 010700020201

**Perimeter (m):** 29,247

**Mean Depth (m):** 9.3

**Max Depth (m):** 24.4

**Watershed Area (acres):** 7525

**Watershed Area ($m^2$):** 30,471,642

**Lake Area ($m^2$):** 4,871,464

**Volume ($m^3$):** 45,410,433

**Watershed Area/Lake Area:** 6.24

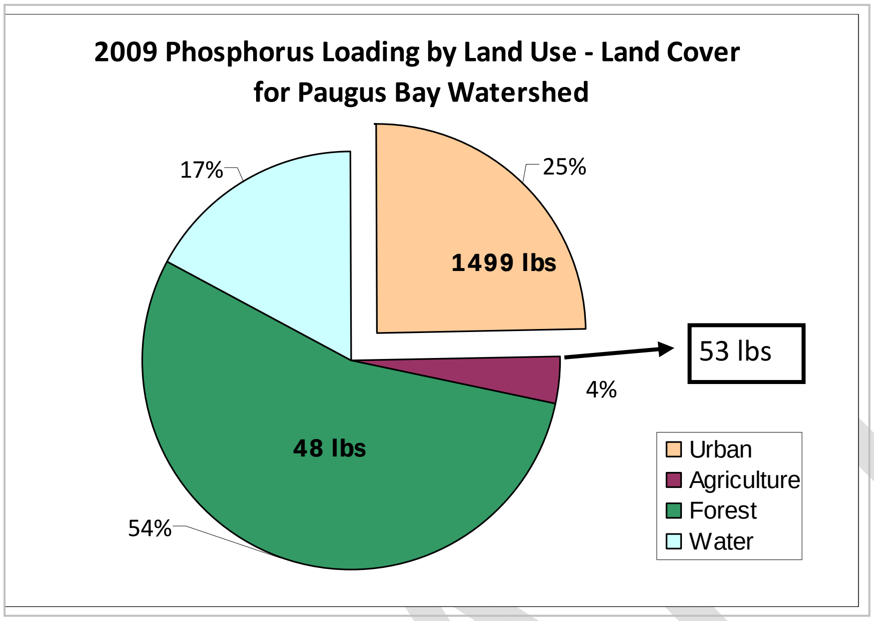
**Areal Water Load (m/yr):** 97.76

**Flushing rate ($yr^{-1}$):** 10.63

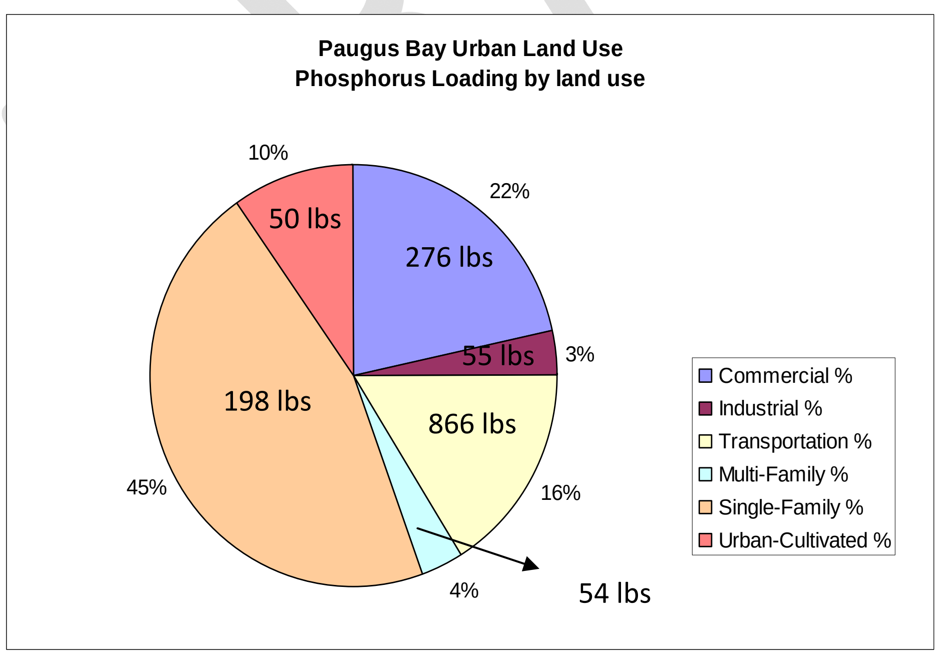
**Watershed:** Winnipesaukee River

**Downstream Waterbody:** Opechee Bay

As was shown in the previous subwatersheds, urban land use is the major source or contributor of phosphorus in the watershed.




In the Paugus Bay subwatershed, the transportation land use makes up 16% of the urban land use category, but contributes 58% of the phosphorus. Out of the four subwatershed areas, Paugus Bay has the most commercial, industrial, and urban cultivated land, accounting for 35% of the urban category.



## Saunders Bay

**Towns:** Laconia, Gilford

**HUC Number:** 010700020109

**Perimeter (m):** 62,005

**Mean Depth (m):** 12.43

**Max Depth (m):** 36.6

**Watershed Area (acres):** 17,855

**Watershed Area ($m^2$):** 72,256,685

**Lake Area ($m^2$):** 20,689,173

**Volume ($m^3$):** 257,121,869

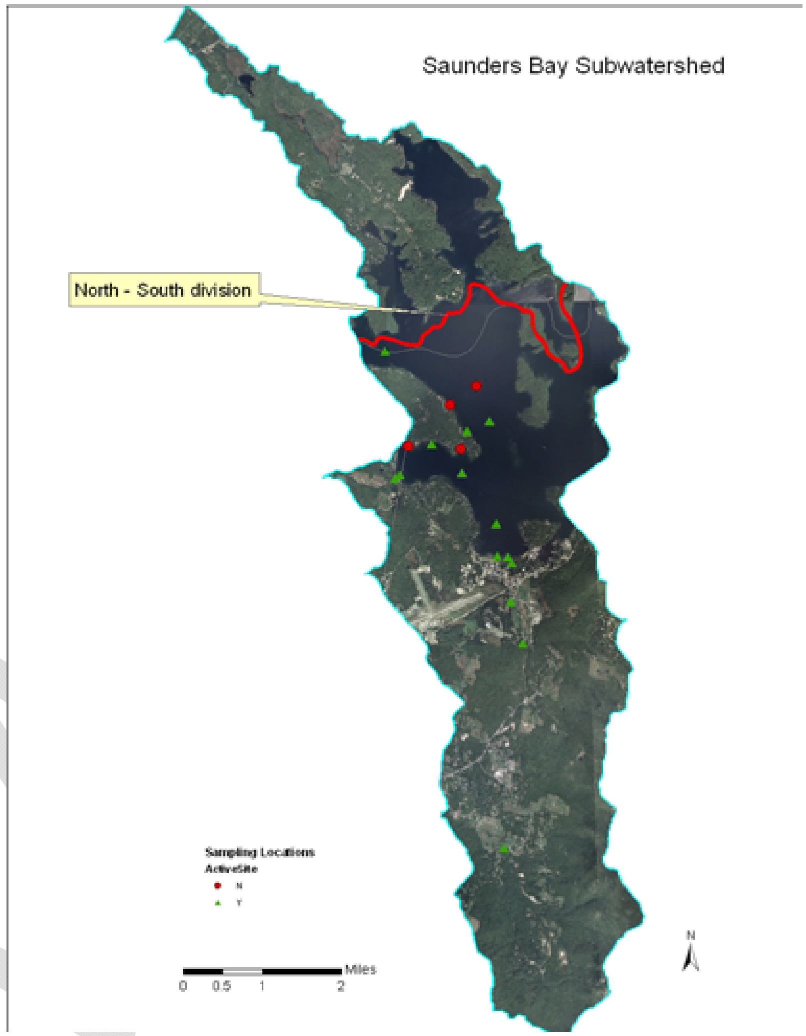
**Watershed Area/Lake Area:** 3.49

**Areal Water Load (m/yr):** 22.21

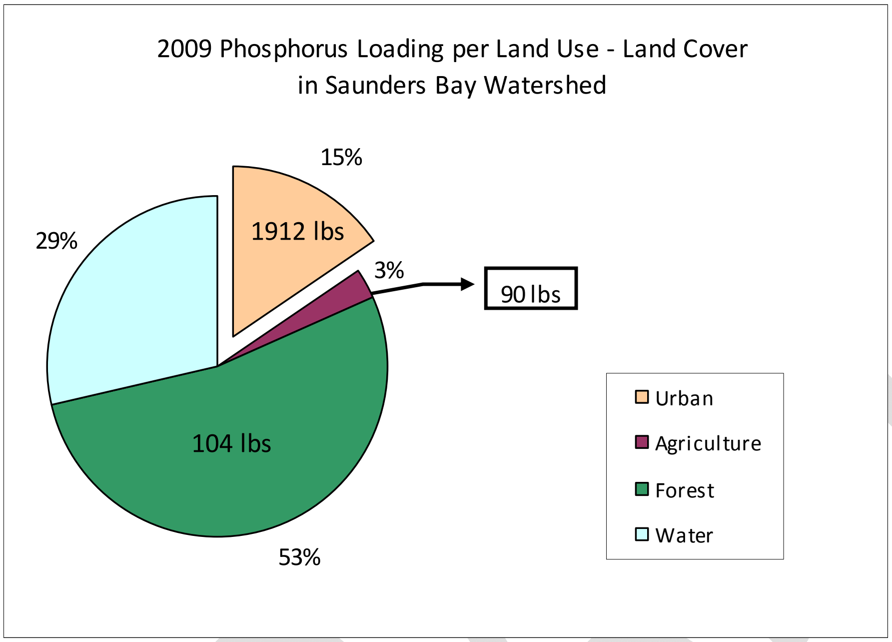
**Flushing rate ($yr^{-1}$):** 1.79

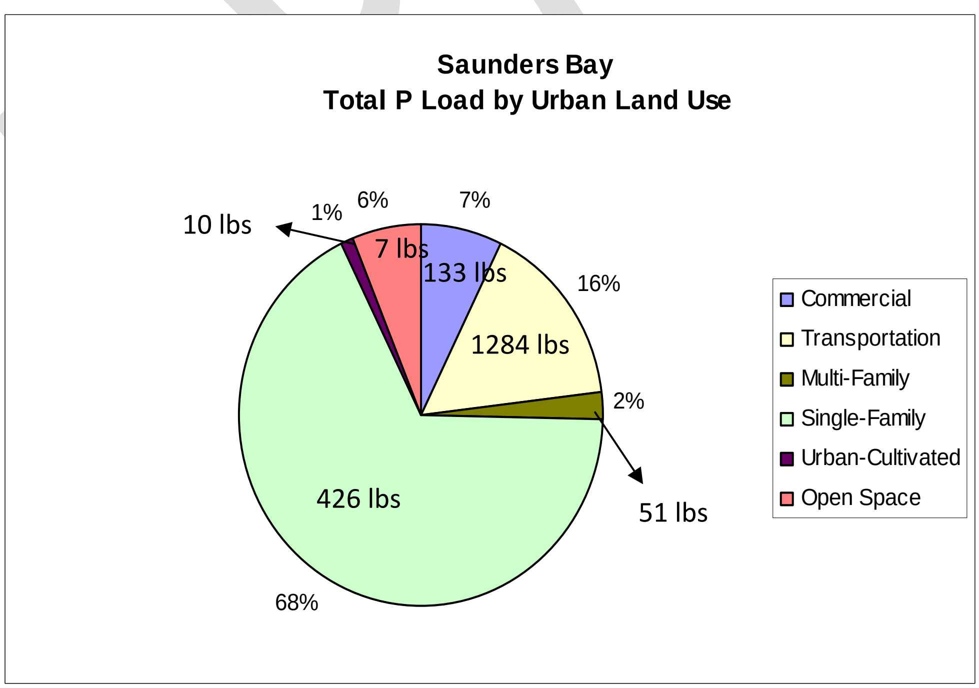
**Watershed:** Winnipesaukee River

**Downstream Waterbody:** Meredith Bay



The Saunders Bay subwatershed was first evaluated as a whole to determine the phosphorus loading by land use. The watershed was then split into two sections based on GIS digitizing and estimated flow paths. These delineations are somewhat arbitrary as unlike land topography, lines cannot be drawn through water to separate basin areas.



## Saunders Bay - North

**Towns:** Meredith, Gilford

**HUC Number:** 010700020109

**Perimeter (m):**

**Mean Depth (m):** 9.58

**Max Depth (m):**

**Watershed Area (acres):** 4783

**Watershed Area ($m^2$):** 19,355,844

**Lake Area ($m^2$):** 7,189,655

**Volume ($m^3$):** 68,902,842

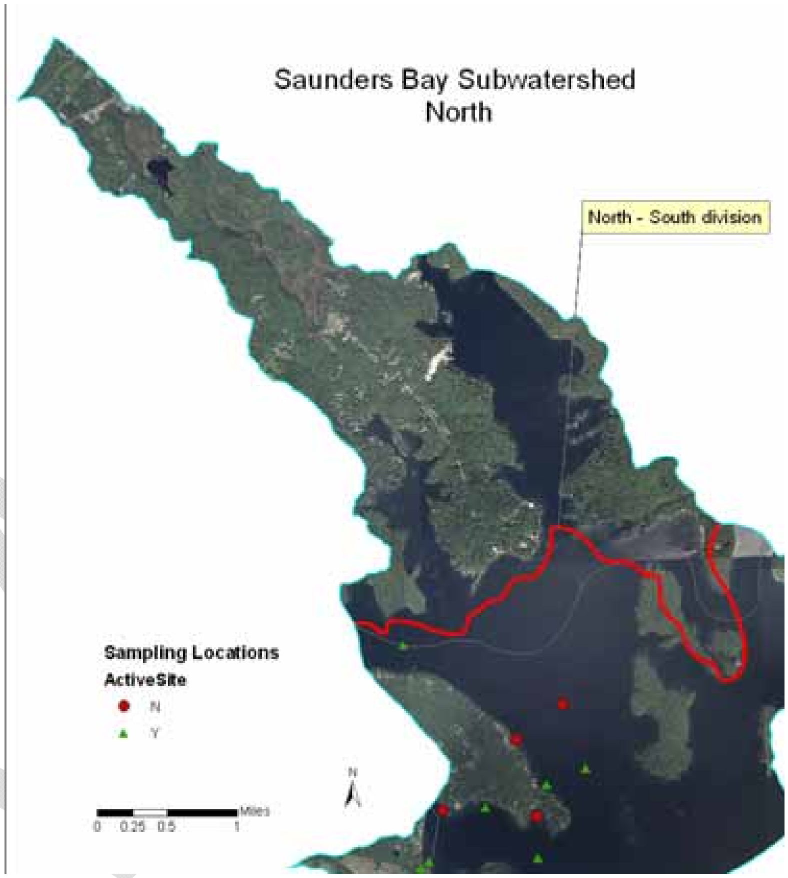
**Watershed Area/Lake Area:** 2.69

**Areal Water Load (m/yr):** 4.56

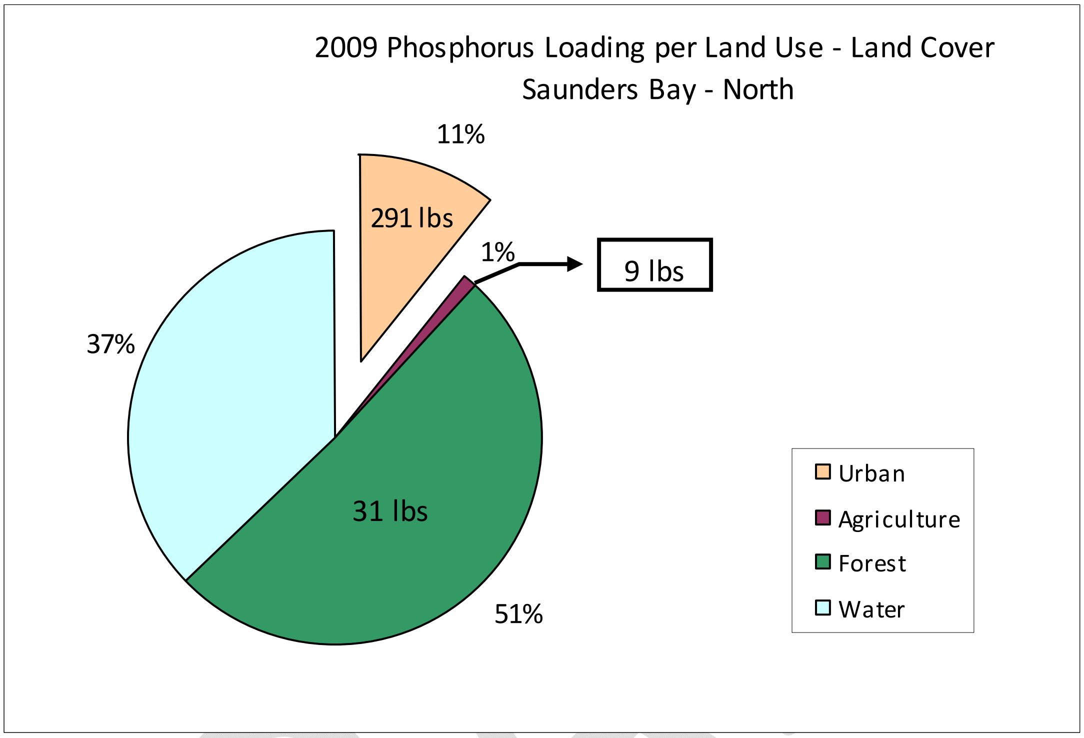
**Flushing rate ($yr^{-1}$):** 0.48

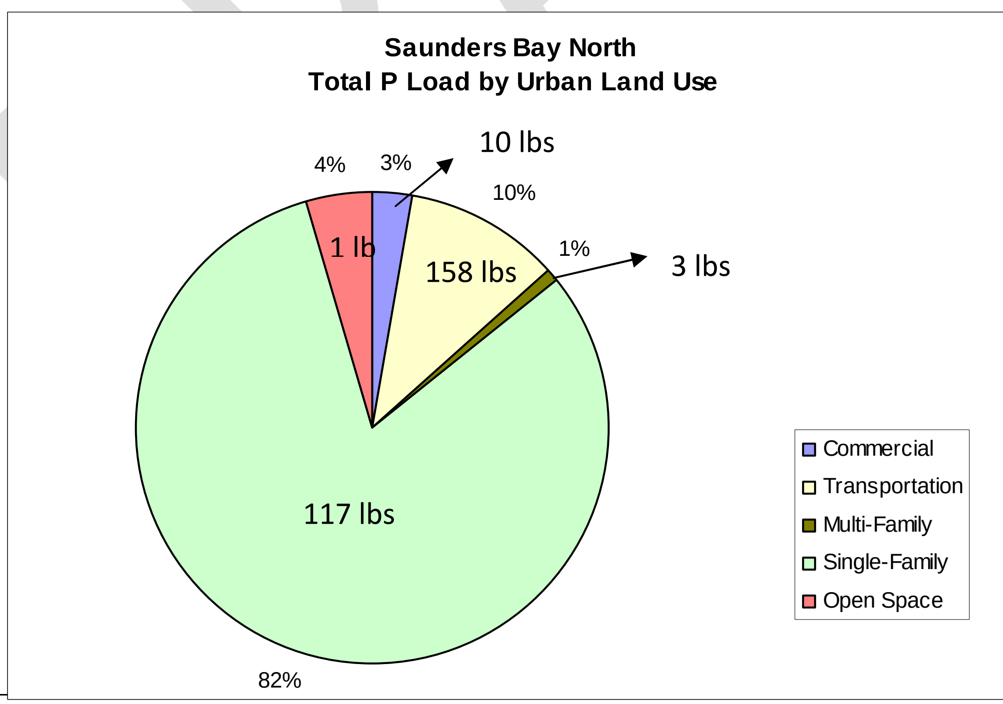
**Watershed:** Winnipesaukee River

**Downstream Waterbody:**
Saunders Bay South



The total estimated phosphorus load for Saunders Bay North was 331 lbs per year, the lowest loading of the subwatersheds; however it represents a small subwatershed area.



## Saunders Bay - South

**Towns:** Laconia, Gilford

**HUC Number:** 010700020109

**Perimeter (m):**

**Mean Depth (m):** 13.94

**Max Depth (m):**

**Watershed Area (acres):** 13,072

**Watershed Area ($m^2$):** 52,899,770

**Lake Area ($m^2$):** 13,499,518

**Volume ($m^3$):** 257,121,869

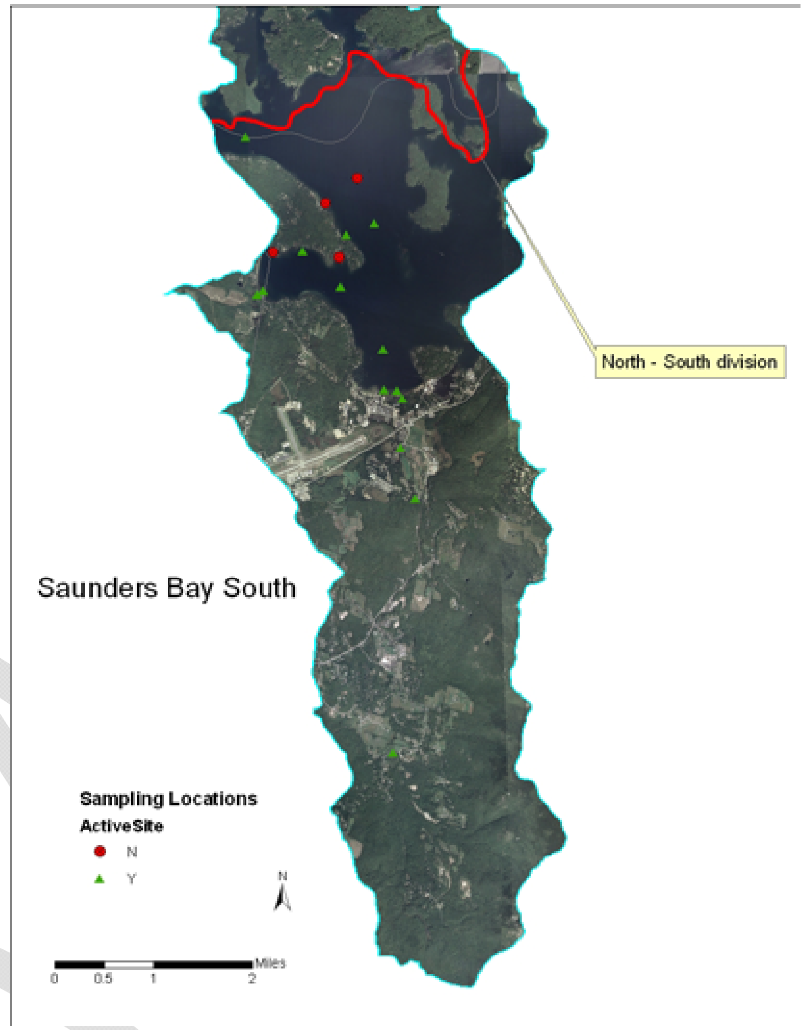
**Watershed Area/Lake Area:** 3.92

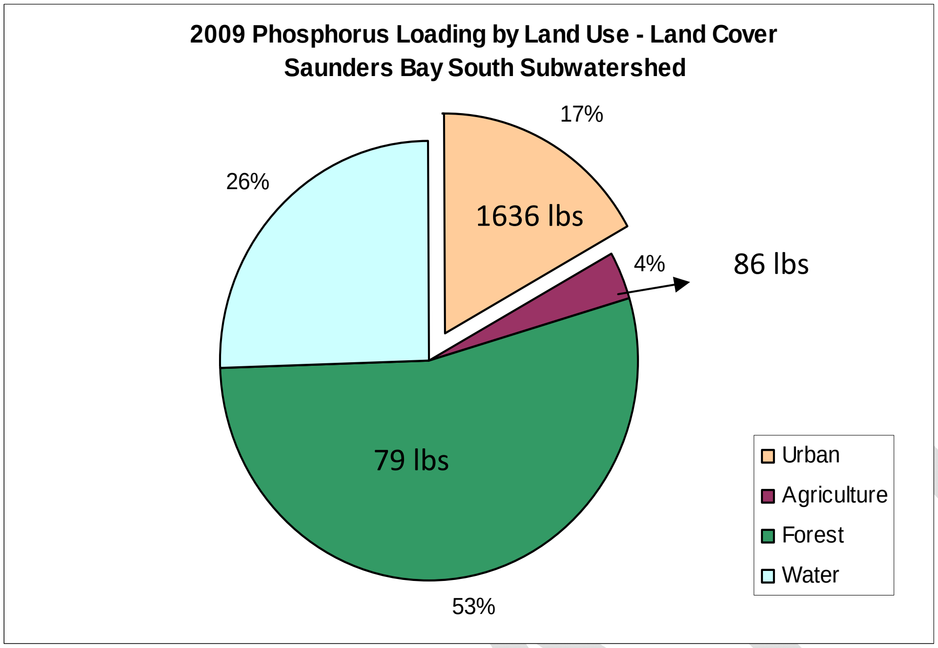
**Areal Water Load (m/yr):** 31.61

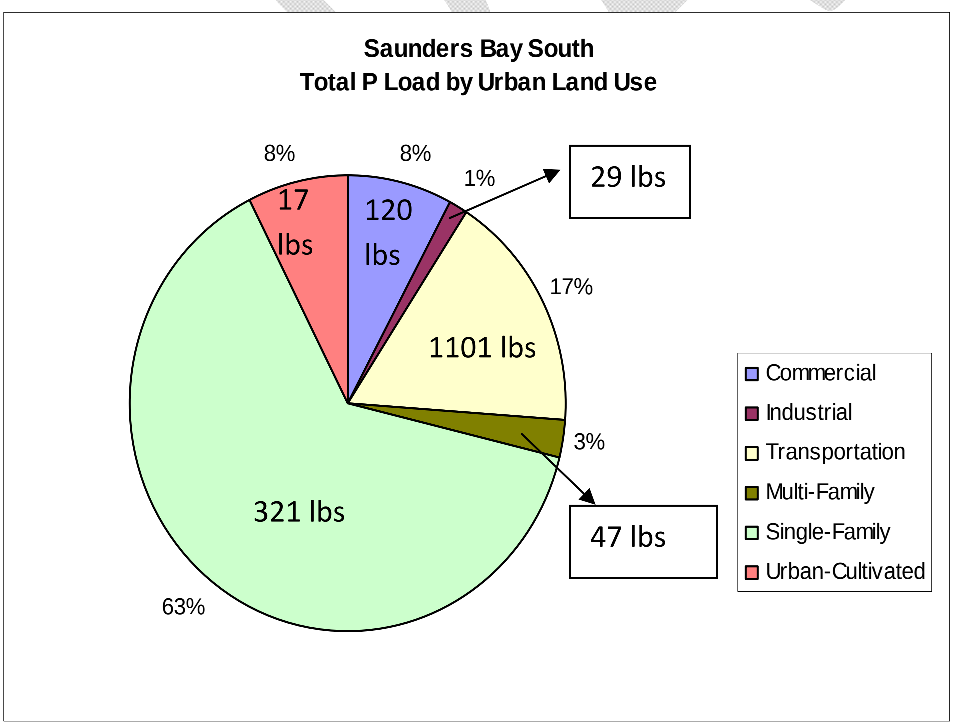
**Flushing rate ($yr^{-1}$):** 2.27

**Watershed:** Winnipesaukee River

**Downstream Waterbody:** Meredith and Paugus Bay




2009 Phosphorus Loading by Land Use - Land Cover
Saunders Bay South Subwatershed
17%
1636 lbs
26%
4%
86 lbs
79 lbs
53%
Urban
Agriculture
Forest
Water


Saunders Bay South
Total P Load by Urban Land Use
8%
8%
1%
29 lbs
17 lbs
120 lbs
17%
1101 lbs
3%
47 lbs
321 lbs
63%
Commercial
Industrial
Transportation
Multi-Family
Single-Family
Urban-Cultivated

## Notes

## Comparison of Land Use / Land Cover: 2000 & 2009

**Data notes:**

This table compares land use/land cover data developed in 2000 and 2009 by Lakes Region Planning Commission. The year 2000 classification was primarily based on 1998 black & white aerial photography, while the year 2009 classification was primarily based on 2006 color photography. The earlier project used a simpler classification scheme of only 14 classes, while the 2009 project used a classification scheme of 58 classes. To help with the comparison of these somewhat different data sets, some intermediate subtotals have been calculated (e.g., Residential Sum, Commercial Sum).

Land use data were developed based on town boundaries; as a result, a watershed-based analysis like this contains data sets developed at different times. In this case, data sources include:

**2009 Land Use/Land Cover**

| Town | Date of data development | Data Sources |
|---|---|---|
| Meredith | 2009 | 2006 color photos, 2008 color photos, town parcel data, zoning, sewers, local knowledge |
| Laconia | 2009 | 2006 color photos, 2008 color photos, town parcel data, zoning, local knowledge |
| Gilford | 2009 | 2006 color photos, 2008 color photos, town parcel data, zoning, sewers, local knowledge |
| Center Harbor | 2009 | 2006 color photos, 2008 color photos, parcel data (where available), zoning, local knowledge |
| Holderness | 2006 | 2003 color photos, local knowledge |
| Ashland | 2000 | 1998 black and white photos |
| New Hampton | 2000 | 1998 black and white photos |

**2000 Land Use/Land Cover**

| Town | Date of data development | Data Sources |
|---|---|---|
| Meredith | 2000 | 1998 black and white photos |
| Laconia | 2000 | 1998 black and white photos |
| Gilford | 2000 | 1998 black and white photos |
| Center Harbor | 2000 | 1998 black and white photos |
| Holderness | 2000 | 1998 black and white photos |
| Ashland | 2000 | 1998 black and white photos |
| New Hampton | 2000 | 1998 black and white photos |

## Data Limitations

In some places, the differences between 2000 & 2009 classifications are the result of land use conversion (for example, a new residential development in what had been forest or agricultural land). However, a different methodology was also used to develop the 2000 classification: at that time, building footprints were digitized, whereas now, the entire visual extent of a land use is digitized. An effect of this change is to greatly increase the estimated acreage in some of the developed categories. For example, in the past a single house on an acre of mown lawn might have been calculated as 0.05 acres of residential; today, the entire acre of lawn would be digitized and calculated as 1.0 acre of residential land use. Finally, the 1998 black and white aerial photography used as the basis for the 2000 classification has much lower resolution than the 2006 1-foot color photography used for most of the 2009 data. As a result, the analyst developing the 2009 data was more likely to be able to see and capture scattered residential development such as individual houses.

## Models for phosphorus loading

**Dillon-Rigler Model** – an empirical model that predicts average summer chlorophyll-*a* concentrations in temperate lakes from total phosphorus concentrations at spring overturn (phosphorus concentrations are near-constant from surface to bottom during spring mixing). In general, average summer chlorophyll-*a* concentrations in temperate lakes increases with increasing spring overturn phosphorus concentration. The model has been well documented and widely used by lake managers, limnologists and researchers to set phosphorus loading guidelines for lakes and to set lake restoration objectives.

**Vollenweider Model** – examines phosphorus load and response characteristics for the relative general acceptability of the water for recreational use (Vollenweider, 1975). The model was developed by Vollenweider, working on the Organization for Economic Cooperation and Development (OECD) Eutrophication Study. Vollenweider found that when the annual phosphorus load to a lake is plotted as a function of the quotient of the mean depth and hydraulic residence time, lakes which were eutrophic tended to cluster in one area and oligotrophic lakes in another. Vollenweider developed a statistical relationship between areal annual phosphorus loading to a lake normalized by mean depth and hydraulic residence time, to predict lake phosphorus concentration. More information on the model can be found in: Vollenweider, R.A. 976, Advances in defining critical loading levels for phosphorus in lake eutrophication. Mem. Ist. Ital. Idrobiol., 33: 53-83.

**Spreadsheet Tool for Estimating Pollutant Load (STEPL) –** "Spreadsheet Tool for Estimating Pollutant Load (STEPL) employs simple algorithms to calculate nutrient and sediment loads from different land uses and the load reductions that would result from the implementation of various best management practices (BMPs). STEPL provides a user-friendly Visual Basic (VB) interface to create a customized spreadsheet-based model in Microsoft (MS) Excel. It computes watershed surface runoff; nutrient loads, including nitrogen, phosphorus, and 5-day biological oxygen demand (BOD5); and sediment delivery based on various land uses and management practices" (STEPL 4.0 User's Guide, 2006). STEPL Version 4.1, 12/13/07, developed by Tetra Tech, Inc. for the Grants Reporting and Tracking System of the U.S. Environmental Protection Agency (EPA).

## STEPL Assumptions:

| Livestock | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cattle | Pig farm | Sheep farm | Horse | Chicken farm | Turkey | Duck | Camelid farm | Goat farm | Game bird farm |
| Gilford | 236 | 1 | 1 | | | | | 1 | | |
| Laconia | 24 | 1 | 1 | | | | | | 1 | |
| Meredith | 12 | 2 | | | 2 | | | 1 | | 1 |
| **Total** | **272** | | | **20** | | | | | | |
| **Total, assuming 10 animals/farm** | | **40** | **20** | **0** | **20** | **0** | **0** | **20** | **10** | **10** |

Source: NH Dept. Ag.

Figures are by community, not watershed. Number of cattle were available, all others were by farm.

Assumed 10 animals per farm and assumed that all farms are within the watersheds and that they are equally distributed.

Added specifics depending on some familiarity with watersheds - i.e. bison farm in Gilford



**Estimated count of septic systems within 250' of shoreline in the Meredith Bay, Paugus Bay, Saunders Bay, and Waukewan subwatersheds:**

| | Subwatershed | | | | | |
|---|---|---|---|---|---|---|
| **Town** | **Lake Waukewan** | **Meredith Bay** | **Paugus Bay** | **Saunders Bay-North** | **Saunders Bay-South** | **Grand Total** |
| **Ashland** | 1 | | | | | 1 |
| **Center Harbor** | 65 | 8 | | | | 73 |
| **Gilford** | | 36 | 6 | 125 | 147 | 314 |
| **Laconia** | | 2 | 31 | | 1 | 34 |
| **Meredith** | 113 | 392 | 9 | 352 | | 866 |
| **New Hampton** | 132 | | | | | 132 |
| **Grand Total** | 311 | 438 | 46 | 477 | 148 | 1420 |

**Methodology:**

First, a 250’ buffer was applied to the shoreline of all waterbodies in the NH Hydrography Dataset – lakes, ponds, and streams, but not wetlands – within the 4-subwatershed study area (“BufferArea_Septic”). A point shapefile was created to represent estimated septic locations within this buffer (“Septic_points_250buf”). The points were developed differently for each town, depending on the presence of town sewer, parcel data, etc.

Ashland: Points were manually located by examining 2006 1-foot aerial photography.

Center Harbor: Points were manually located by examining 2006 1-foot aerial photography.

Gilford: To try to identify which parcels are not served by town sewer, sewer lines were buffered by 250’, and any parcels that did not intersect with the buffer were considered septic parcels. Parcels that had text PID values (“ROAD”, “ROW”, or “CEMETERY”) were excluded. A point shapefile representing the centroid of each septic parcel polygon was created, and any points that fell within BufferArea_Septic were appended to Septic_points_250buf.

Laconia: To try to identify which parcels are not served by town sewer, sewer lines were buffered by 250’, and any parcels that did not intersect with the buffer were considered septic parcels. Parcels with a STYLE_DESC of “Vacant Land” were excluded. A point shapefile representing the centroid of each septic parcel polygon was created, and any points that fell within BufferArea_Septic were appended to Septic_points_250buf.

Meredith: Parcels were considered septic users if their UTIL_DESC did not include the word “Sewer” and if their USE_DESC did not include the word “VACANT.” A point shapefile representing the centroid of each septic parcel polygon was created, and any points that fell within BufferArea_Septic were appended to Septic_points_250buf.

New Hampton: A point shapefile representing the centroid of each septic parcel polygon was created. Points representing roads were removed, and any remaining points that fell within BufferArea_Septic were appended to Septic_points_250buf. Because the original parcel shapefile did not align well with the boundaries of waterbodies from aerial photographs and the NH Hydrography Dataset, some points were manually adjusted (i.e., if their source parcel was within 250’ of the waterbody as drawn in the parcel layer itself, its associated point was added or moved to fall within BufferArea_Septic.)