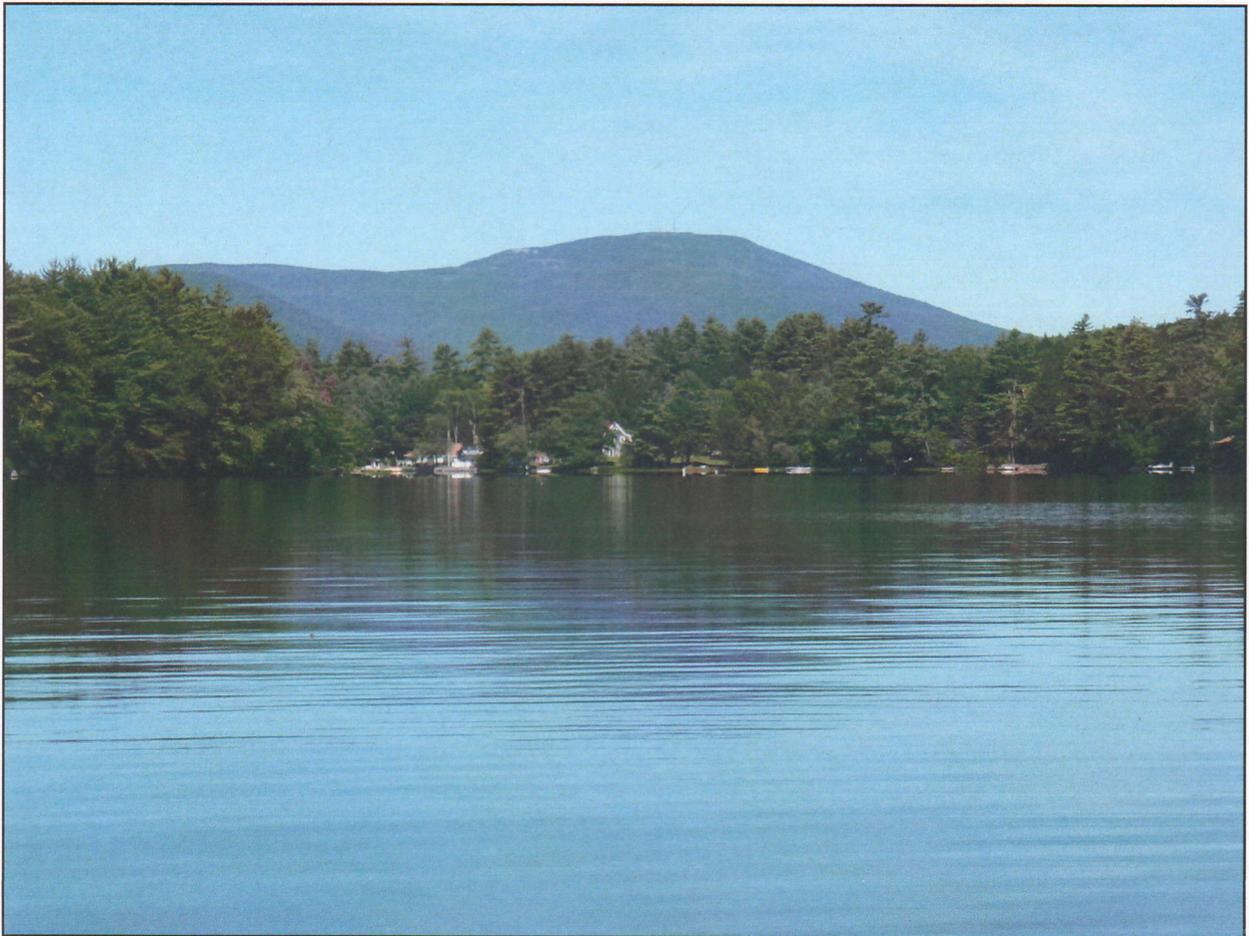


New Hampshire Volunteer Lake Assessment Program

2012 Lakes Region Regional Report



Winnepocket Lake, Webster, NH



Acknowledgements

The New Hampshire Department of Environmental Services Volunteer Lake Assessment Program (VLAP) is a collaborative effort that depends on the cooperation of many people. The continued help and support of these individuals and groups has contributed to the increased popularity of VLAP during its 27-year history.

The VLAP Coordinator extends their greatest thanks to each devoted volunteer monitor for spending countless hours sampling, and identifying potential watershed pollution. The wealth of water quality information collected by volunteers is overwhelming and the data is instrumental to the Environmental Protection Agency and the NHDES to commit resources to the production of Total Maximum Daily Loads (TMDLs) and watershed management planning that help protect our beautiful lakes. We also thank the volunteers for their continued support and enthusiasm for the program.

The VLAP Coordinator also extends a well deserved thank you to the following DES staff:

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- Melanie Titus, DES Watershed Management Bureau, for data management and database support.
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The VLAP Coordinator also recognizes the staff and interns of the Lake Sunapee Protective Association (LSPA) and Colby-Sawyer College (CSC) Satellite Laboratory in New London for supporting VLAP monitoring efforts in the Lake Sunapee region. The CSC-LSPA Satellite Laboratory, under the management of Bonnie Lewis, continued to distribute equipment to volunteer monitors and process samples in an extremely professional and timely manner.

The VLAP Coordinator also recognizes Aaron Johnson, Plymouth State University (PSU) Satellite Laboratory Manager, and the staff of PSU's Center for the Environment for supporting VLAP and VRAP monitoring efforts in the North Country and Lakes Region. The PSU Satellite Laboratory conducted annual biologist visit, provided equipment and processed samples for a number of lakes and rivers in Northern New Hampshire.

VLAP Lakes and Volunteer Monitors
2012 Sampling Season

Angle Pond, Sandown	Brant Sayre, Norm Baxter, Jim Henneman, Bill Fleischmann
Armington Lake, Piermont	Mike Poole, Grita Taylor, Kayla Horton, Dawn Horton
Ashuelot Pond, Washington	Don Damm, Rich Huniham
Ayers Pond, Barrington	Ron St. Jean, Diane St. Jean, Michael Cavanaugh
Baptist Pond, Springfield	Bob Ruel, Cynthia Hayes, John Trachy, Perry Hodges
Baxter Lake, Farmington	Rene Turgeon
Bearcamp Pond, Sandwich	Gail Colozzi, Bob Greene
Beaver Lake, Derry	Tim Pellegrino, Kevid Konstant, Laurel Powers
Beech Pond, Lower, Tuftonboro	Jim Minieri, Mark Evitts, Rex Hawley, Eedee Dopp, Jerry Wilson
Berry Bay, Ossipee	Susan Marks, Eric Senecal
Big Island Pond, Derry	Herb Lippold, Dick Jones, Noreen Mercier, Len Shell, Kelly Shell, Drennan Lowell
Blaisdell Lake, Sutton	Leon C. Malan, Vicki Willard
Bradley Lake, Andover	Larry & Susan Chase, Mike Vercellotti, Sooki Vercellotti, Stan Boyd-Robertson, Deb Brower
Broad Bay, Ossipee	Susan Marks, Eric Senecal
Canaan St. Lake, Canaan	John Bergeron, Carol Williams, Nathan Harris, Mike Paine, David Auerbach, Haver Markham, Dick Abington
Canobie Lake, Windham	Bill Schroeder, Scott Buttram, Betty Dunn
Captain's Pond, Salem	Jillian Mason, Aaron Provencal
Chalk Pond, Newbury	Dennis Varley, Daniel Varley
Chapman Pond, Sullivan	Cameron Barth, Cody Barth
Chestnut Pond, Epsom	Barry Arseneau, Martha Chase
Clarksville Pond, Clarksville	John and Kathleen Domanico
Clement Pond, Hopkinton	Dick McIntire, Pedro McIntire
Clough Pond, Loudon	Tom Edward, Debbie Lincoln
Cobbetts Pond, Windham	Derek Monson, T. Leclair, D. MacKenzie
Cole Pond, Andover	Chris Morse
Conner Pond, Ossipee	Lynne Hart, Anita Fahy, Carol Googins, Emily Robertson, Laura Robertson, Alex Robertson
Contention Pond, Hillsboro	Bob Taraskiewicz
Contoocook Lake, Jaffrey	Ted Covert, Carolyn West, Jim Noel
Crescent Lake, Acworth	Tim Perry, Stan Rastallis, Bob Kroupa, Sue & Bill Paton, Mark Wilson
Crystal Lake, Gilmanton	Jean Martin, Marty Martin
Crystal Lake, Manchester	Todd Connors, Stella Connors, Lela Connors
Danforth Pond, Lower, Freedom	Jim McElray, P. Ogren
Deering Lake, Deering	Bob Compton, Herb Huckins, K & M Terpstra
Dodge Pond, Lyman	Patti Slavtcheff, Donna Trudell
Dorrs Pond, Manchester	Jeff Marcoux, Jen Drociak
Dublin Lake, Dublin	Karen Bunch, Felicity Pool, Joan Griffin
Duck Pond, Freedom	Bill Clark
Dutchman Pond, Springfield	Tina Rivera

Eastman Pond, Grantham	Jackie & Bill Underhill, Ernie Mills, Gale Schmidt, Shelia Shulmon, Jan Evans, Mary O'Rourke, Ebba McArt, Maynard Wheeler, Karla Karash
Emerson Pond, Rindge	Tina Vaillancourt
Flints Pond, Hollis	Dave Connor, Erica Daly, Beth Flagler, Sarah McDougall, Bruce Moran
Forest Lake, Dalton/Whitefield	Neil Lupton, Claire Lupton, Rick Wight
Forest Lake, Winchester	Dave & Pat Johnson, Debra Tavares, Doug Sears
French Pond, Henniker	Mike French
Frost Pond, Jaffrey	Leslie Whone
Gardner Lake, Bath	Libby & Aarne Vesilind, Bruce Ricker, Ollie Brooks, Dave Smigiel
Gilmore Pond, Jaffrey	Michael Lichter
Goose Pond, Canaan	Mike & Allison Riese
Governors Lake, Raymond	Ken Pothier
Granite Lake, Nelson/Stoddard	Tom Newcombe, Ian Newcombe
Great Pond, Kingston	Dave Ingalls, Skip Clark, Bill Bixby, Larry Smith
Gregg Lake, Antrim	Bob Southall
Halfmoon Lake, Barnstead	Mike Fedorchak, Larry Holt, Bill Dugan, Frank Bramante, Ralph Guarino, Jim Rye
Halfmoon Pond, Washington	Carol Andrews
Harantis Lake, Chester	Jo Columbus
Harrisville Pond, Harrisville	Suzanne Coble, Tucker Cutler
Harvey Lake, Northwood	Karen Smith, Doris Entwisle
Hermit Lake, Sanbornton	Marie Westcott
Highland Lake, Andover	Earle Davis, Jenna Davis, Jim Frost
Highland Lake, Stoddard/Washington	Jeff Berry, William Bearce
Hills Pond, Alton	Carol & Bill Marcin, Maureen Burns
Howe Reservoir, Dublin	Nancy Markuson
Hunkins Pond, Sanbornton	Lisa Rixen
Island Pond, Stoddard	Don Flemming, Geof Molina, Charles Swan
Island Pond, Washington	Stephen Vinciguerra, Mike & Jean Kluk, Mark Morrissette
Jackman Reservoir (Franklin Pierce Lake)- Hillsboro	Cindy & Charles Riordan, Chuck Nystrom
Jeness Pond, Northwood	Hal Kreider, Irene Kreider, Cody McCarthy
Katherine Lake, Piermont	Joyce Tompkins
Kezar Lake, North Sutton	Keith Brooks
Kilton Pond, Grafton	John & Jan Bidwell, Tom Crouse, Maryanne
Kimball Pond, Canterbury	Robert Fife
Knowles Pond, Northfield	Alan Leach
Kolelemook Lake, Springfield	Gerald Cooper, Barbara Cooper
Laurel Lake, Fitzwilliam	Barbara Green, Perry and Roberta Nadeau, Phyllis Lurvey, Kathy Olson, Barbara Schecter
Leavitt Bay, Ossipee	Eric Senecal, Susan Marks
Ledge Pond, Sunapee	Bob & Ellen Kanerva
Lees Pond, Moultonboro	Bev Nelson, Jim Hoburg, Ed Lazdowski
Locke Lake, Barnstead	Judy & Ted Cropper, Teresa Bailey
Long Pond, Lempster	Al Grotheer, Nola Gerrits, Elisabeth Ashley
Long Pond, Pelham	Dave & Flo Parece
Loon Lake, Plymouth/Rumney	Dean Moss, Darryl Howes, Mike Sueltenfuss, Jim McBride, Judy McBride

Loon Pond, Gilmanton	Richard Hillsgrove, Sarah Hillsgrove
Lower Beech Pond, Tuftonboro	Jim Minieri, Eedee Dopp, Rex Hawley, Tom Kennedy, Mark Evitts
Martin Meadow Pond, Lancaster	James Whithed, John Ogle
Mascoma Lake, Enfield	Jim Martel, Jim Magnell, Jack Foster, Roger Barnes, Lee Hammond, Austin Flint, George Crowe
Lake Massasecum, Bradford	Dave Currier, Zac Currier, Robert Toppi, Aidan Dempsey
Lake Sunapee	Bonnie Lewis, R. Wood, Kai Eldridge, Elodie Reed, Caroline Watson, Jenisha Shrestha, Bill Hall, Dick Katy, Sue Venable, Gene Venable, Sheehan, BHGC, Steve Ansart, Robb, Bob & Glenda Cottrill, Taryn McIntire, Robert Kenerson, Clare Bensley, Joseph DiClerico, Shelby Blunt, Sue & Dick Eaton, Dave Beardsley, K. Begor, M. Begor, Chris & Tom McKee, Joe Goodnough, Kara Obey, Midge Eliassen, Joseph Grassi, Thomas Sankontz, J & P Fichter, Jane Erras, Joy Erras
May Pond, Washington	Mike Morrison
Messer Pond, New London	John Harris, John Doyle
Mill Pond, East Washington	Jed Schwartz
Millen Pond, Washington	Dennis O'Malley, Fred Douglas
Mirror Lake, Tuftonboro	Beth Urda
Monomonac Lake, Rindge	Lourdes Gray
Moores Pond, Tamworth	Carol M-L
Mountain Lake, North, Haverhill	Tom Eighthmy
Mountain Lake, South, Haverhill	Tom Eighthmy
Mountainview Lake, Sunapee	Eleanor Thompson, James Segalini, Ward Bennett, Michael McGuinness
New Pond, Canterbury	Mike Ryan
Northwood Lake, Northwood	Andrea Tomlinson, Brad Hall, Elijah Tomlinson-Burrell, Luanne Pigeon
Norway Pond, Hancock	Dick & Josephine Warner, Robert Williams
Nubanusit Lake, Nelson	Dave Birchenough, Maurice Lagace, Ed MacDonald
Nutts Pond, Manchester	Jen Drociak, Jeff Marcoux
Onway Lake, Raymond	Jonathan & Joyce Wood, Bob Banker
Lake Ossipee, Ossipee	Robert Reynolds, P. Ogren
Otter Pond, New London/Sunapee	Gerry Shelby, C. Currier
Otternick Pond, Hudson	Mike Cunningham
Partridge Lake, Littleton	Dayton Goudie, Mark Meau
Pawtuckaway Lake, Nottingham	Steve Donahue, Will Urban, Rick Morrissey, Jon Crowell, Merrill Lewis
Pea Porridge Pond, Big, Madison	Bob Borchers, Ralph Lutjen, Rich & Cathy Sholtanis, Paul Mattatall
Pea Porridge Pond, Mid, Madison	Bob Borchers, Ralph Lutjen, Rich & Cathy Sholtanis, Paul Mattatall, John Rocharoz
Pearly Pond, Rindge	Phil Folsom, Dick Isakson, Bob Scribner
Pemigewasset Lake, Meredith	Paul Flaherty
Perkins Pond, Sunapee	Gary Szalucka
Phillips Pond, Sandown	Al & Marion Lake, Nathan Lake, Gene & Deb Freeman
Pillsbury Lake, Webster	M.J. Turcotte, Pat Adams

Pine Island Pond, Manchester	Merrill Lewis, Steve Donahue, Roger Crosley
Pleasant Lake, Deerfield	Chuck Reese, Jim Creighton
Pleasant Lake, New London	Dick Kellom, Terry Dancy, Pete Dunning, John Wilson, Bruce Johnson
Pleasant Pond, Francestown	Anne Clark, Jaclyn Clark, Levi Clark
Pool Pond, Rindge	Steve Whitney, Nancy LaBonne
Post Pond, Lyme	Heather Toolman
Powwow Pond, Kingston	Judy Lewis, Paul Dearborn, Diane Coll
Pratt Pond, New Ipswich	Ralph Barker
Province Lake, Effingham	Steve & Mary Craig, John Wilkinson, Amy Sargent
Rand Pond, Goshen	Bernie Cutter, Richard Locke
Reservoir Pond, Lyme	Lee Larson
Robinson Pond, Hudson	Peter Heller, Mitch Albanese, Ed Duffett
Rock Pond, Windham	Sue & Frank Burgess
Rockwood Pond, Fitzwilliam	Dean Zirolli, Val Busler
Rockybound Pond, Croydon	Catherine Stroomer, Don Hanlon, Barry Wade, Liz Lee, Al Oliver
Round Pond, Little, Wakefield	Dave Giunta, Dave Robinson
Round Pond, Lyman	Patti Slavtcheff, Donna Trudell
Russell Reservoir, Harrisville	Bob Sturgis
Rust Pond, Wolfeboro	Keith Simpson, Christy Parker, Rich Coan
Sand Pond, Marlow	Mark & Pat Allen, Felicia Istel
Scobie Pond, Francestown	Chuck Rolph, Hugh Donaghey, John Magee
Sebbins Pond, Bedford	Louis Pinard, MacKenzie Turgeon
Showell Pond, Sandown	Fred Riley, Tina Buckley
Silver Lake, Harrisville	Roger & Sandy Williams, Panos Pitsas, Chet Hurd
Skatutakee Lake, Harrisville	Gordon Page, George Lowery, Charles Faucher
Snake River, New Hampton	Janan Hays
Spectacle Pond, Enfield	Kathy Gips
Spofford Lake, Chesterfield	Bayard Tracy, Pam Walton, Elliot Rowsey
Stevens Pond, Manchester	Jeff Marcoux, Jen Drociak
Stinson Lake, Rumney	Les Gilbert, Ken Soper, Bob & Janet Furey
Stocker Pond, Grantham	Pat Woolson, Thani Allan
Stone Pond, Marlborough	Marge Shepardson, Ira Garvin, Jesslyn Mullett, Jeanie Buttler
Sunapee Lake, Little, New London	Robert Scott, Peter Gunn, William Gunn, Jack Sheehan
Suncook Pond, Upper, Barnstead	Randy Roberts
Suncook Pond, Lower, Barnstead	Randy Roberts
Sunrise Lake, Middleton	John Mullen, Evelyn Campbell, Carol Vita
Sunset Lake, Alton	Carol & Bill Marcin, Maureen Burns
Swanzy Lake, Swanzy	Ronnie & Ann Bedaw
Tarleton Lake, Piermont	George & Joyce Tompkins, Helga Mueller
Thorndike Pond, Jaffrey	Jim Banghart
Todd Lake, Newbury	Norman Lehouiller, Bob Doherty, John Warren, Tim Rodd, Janet & Mark Lausten
Tom Pond, Warner	John Hamilton
Tucker Pond, Salisbury	Tom Duffy
Turee Pond, Bow	Kally Abrams, Quinn Abrams
Walker Pond, Boscawen	Steve Landry, Michele Tremblay
Warren Lake, Alstead	Kate Morgan, Rosemary Dowling, Joyce Curll, Karyn Kaminski, Tim Putnam, Russell Putnam, the Nelsons

Waukeena Lake, Danbury	Don & Barbara Hartford
Lake Waukewan, Meredith	Boo Gershun, Don Thompson, Robert Melchreit
Webster Lake, Franklin	Shelley Pellegrini, Brian Campbell
White Oak Pond, Holderness	Galen Beach, Nancy Voorhis, Roger Uhler
Wicwas Lake, Meredith	David and Marjorie Thorpe, Tom Crane
Willand Pond, Dover	Doug Knight, Helen Brock
Wilson Pond, Swanzey	Rebecca Madrigal, Jim Glemenakis, Tom Bouffard, Abbott Fletcher
Lake Winnepocket, Webster	Dennis Card, Maureen McCanty, Warren Emley
Lake Winnisquam, Laconia/Belmont	Dave McLaughlin, C. McLaughlin, E. McLaughlin, Dave Reinauer
Lake Winona, New Hampton	Linda & Mark Heminway, Donna Saia, Ted Saia

**New Hampshire
Volunteer Lake Assessment Program
2012 Lakes Region Regional Report**

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- Appendix A: Monitoring Parameters and Data Interpretation
- Appendix B: Pollution Control Resources
- Appendix C: Regional VLAP Lake Groupings
- Appendix D: Individual Lake Reports

INTRODUCTION AND HISTORY

New Hampshire is home to approximately 900 lakes and ponds, and thousands of river miles. Protecting our lakes and rivers is critical to sustaining New Hampshire's drinking water resources, aquatic and natural environments, recreational and tourism industries.

The New Hampshire Department of Environmental Services (DES) recognizes the importance of these waterbodies in maintaining a healthy ecosystem for our current and future generations. Protecting high quality waters and restoring those that are impaired requires coordination and partnership between federal, state and local governments, non-profits, regional commissions, lake associations, and watershed residents.

To help citizens assess the health of New Hampshire's lakes and ponds, DES established the Volunteer Lake Assessment Program (VLAP) in 1985. The program is a volunteer-driven cooperative effort between the State and local governments, lake associations and lake residents. VLAP trains citizen volunteer monitors to collect water quality data at lakes and their associated tributaries on a monthly basis during the summer. VLAP compiles, interprets and reports the data back to state, federal and local governments, lake associations, and lake residents.

VLAP volunteer monitors are invaluable stewards for New Hampshire's lakes. Volunteer monitoring allows DES to establish a strong set of baseline chemical and biological data, determine long-term water quality trends and identify emerging water quality issues. DES acts on these findings through its funding and regulatory programs. Volunteers use this information to educate lake and watershed residents, businesses and local governments on best management practices to keep New Hampshire's lakes and ponds clean. They have been, and will continue to be, a key element in protecting the integrity of New Hampshire's lakes.

PROGRAM OVERVIEW

VLAP is a cooperative program between DES and lake residents and associations. Currently, approximately 500 volunteers monitor water quality at 180 lakes throughout New Hampshire. Interest in the program has grown drastically in the past ten years as citizens have become more aware of the connections between land use activities and water quality. Volunteer monitors continually collect high quality data on their local waterbodies and educate watershed residents.

Volunteer monitors are trained by DES to use monitoring equipment to collect lake water quality data, survey the surrounding watershed, and sample the streams and rivers that are tributaries to the lake. Each of the participating lakes must be visited by a DES biologist on a bi-annual basis. This visit is a valuable event in which the volunteer monitors have an opportunity to discuss water quality and watershed concerns and receive recommendations on potential remediation activities. Also, the event allows DES biologists to perform a field sampling techniques audit to evaluate

volunteer monitor's ability to collect quality data, and to collect information on additional water quality parameters as necessary. Volunteers then sample on their own for the remaining summer months.

To further encourage volunteer monitoring, DES, established partnerships with the Lake Sunapee Protective Association (LSPA), Colby Sawyer College (CSC) in New London, NH, and Plymouth State University (PSU) in Plymouth, NH to operate VLAP satellite laboratories. These satellite laboratories serve as a convenient location for volunteers to borrow sampling equipment and deliver water samples for analysis. These strategic locations serve the Dartmouth Lake Sunapee, North Country and White Mountain regions.

The data gathered by the volunteers are reviewed by DES Quality Assurance Officers and Satellite Laboratory Managers and imported into DES' Environmental Monitoring Database (EMD). During the winter, DES biologists review and interpret the water quality data, perform trend analyses, and compile the results into annual reports. The high quality data gathered through VLAP also helps DES to conduct statewide surface water quality assessments. Assessment results and methodology are published and submitted to the Environmental Protection Agency (EPA) by DES every two years as a requirement of the Clean Water Act.

Once the volunteer monitors receive the data and the annual report for their lake, DES encourages the volunteers to relay that information to their respective associations, organizations, businesses, and local governments. Volunteers are also kept informed of the latest in lake management and water quality issues through an annual newsletter, technical and educational materials, regional workshops, and information on important legislation. In addition, DES biologists give presentations at lake association meetings and participate in youth education events. Educational initiatives, such as those mentioned above, allow volunteers to recognize potential water quality or shoreland violations around the lake and report their findings to DES. Volunteer monitors are dedicated, proactive lake stewards who are concerned for the well-being of their lakes.

MONITORING AND PARAMETER SUMMARY

VLAP encourages the collection of comprehensive data sets on key water quality parameters from participating lakes to determine overall health of the system. The lake and tributaries are sampled several times each year over a period of years. This establishes baseline water quality data and allows for the discernment of long-term water quality trends. These trends depict lake health and provide invaluable information to DES' mission to protect New Hampshire's lakes. The sampling efforts of the volunteer monitors supplement the environmental monitoring efforts of DES. Only through the assistance of volunteer monitors can such a high volume of sampling be accomplished throughout the state.

DES recognizes the importance of collecting data sets that are representative of varying conditions. VLAP has an EPA approved Quality Assurance Project Plan (QAPP). The QAPP identifies specific responsibilities of DES and volunteers, sampling

rationale, training procedures, and data management and quality control. DES and volunteers adhere to the QAPP regime to ensure high quality and representative data sets are collected.

Volunteers collect samples once per month in June, July and August, with some lakes monitored more or less frequently. Samples are collected at approximately the same location each month at each deep spot thermal layer, major tributaries (those flowing year round) and seasonal tributaries during spring run-off. The samples are analyzed for a variety of chemical and biological parameters including: pH, alkalinity, conductivity, chloride, turbidity, total phosphorus, and *E. coli* (optional). Additional in-lake data are also collected at the deep spot including lake transparency (with and without a viewscope), chlorophyll-a, phytoplankton, and dissolved oxygen and temperature profiles. Volunteer monitors are also trained to identify and collect samples of suspicious aquatic plants and cyanobacteria.

Environmental outcomes are measured by making comparisons to established New Hampshire averages and ranges of lake water quality, and state water quality standards. If analytical results for a particular sampling station frequently exceed state water quality averages or standards, then additional sampling to identify potential pollution sources is necessary. Volunteers often conduct storm event sampling, tributary bracket sampling, and spring run-off sampling to better assess watershed health and provide additional data to guide lake management decisions.

Appendix A includes a summary of each monitoring parameter and Appendix B includes recommended best management practices to remediate pollution sources.

LAKES REGION REGIONAL SUMMARY

The Lakes region consists of towns in New Hampshire's Belknap County, southern parts of Carroll and Grafton Counties, and central parts of Merrimack County (Figure 1). The region is home to a large number of lakes and rivers, most notably Lake Winnepesaukee and Newfound Lake. The Pemigewasset and Winnepesaukee Rivers converge as the headwaters of the Merrimack River.

Freshwater resources in the Lakes region provide valuable drinking water and recreational opportunities and play an important role in the regional economy. Freshwater recreation, including boating, fishing and swimming, in the Lakes region generate approximately \$210 million dollars in sales, \$74 million in household income, and 3,313 jobs annually

(Nordstrom, 2007). A perceived decline in water quality as measured by water clarity, levels, flows, aesthetic beauty, or overuse could result in approximately \$64.2 million dollars in lost revenue, \$22.7 million in lost household income and 1,023 lost jobs. The Lakes Region generates the largest revenue from summer recreational activities and would stand to lose the most if water quality were perceived to decline (Nordstrom, 2007).

Similarly, a decline in water clarity alone can result in a decrease in New Hampshire lakefront property values. A one meter decrease in water clarity can lead to an average decrease in property values of between 0.9

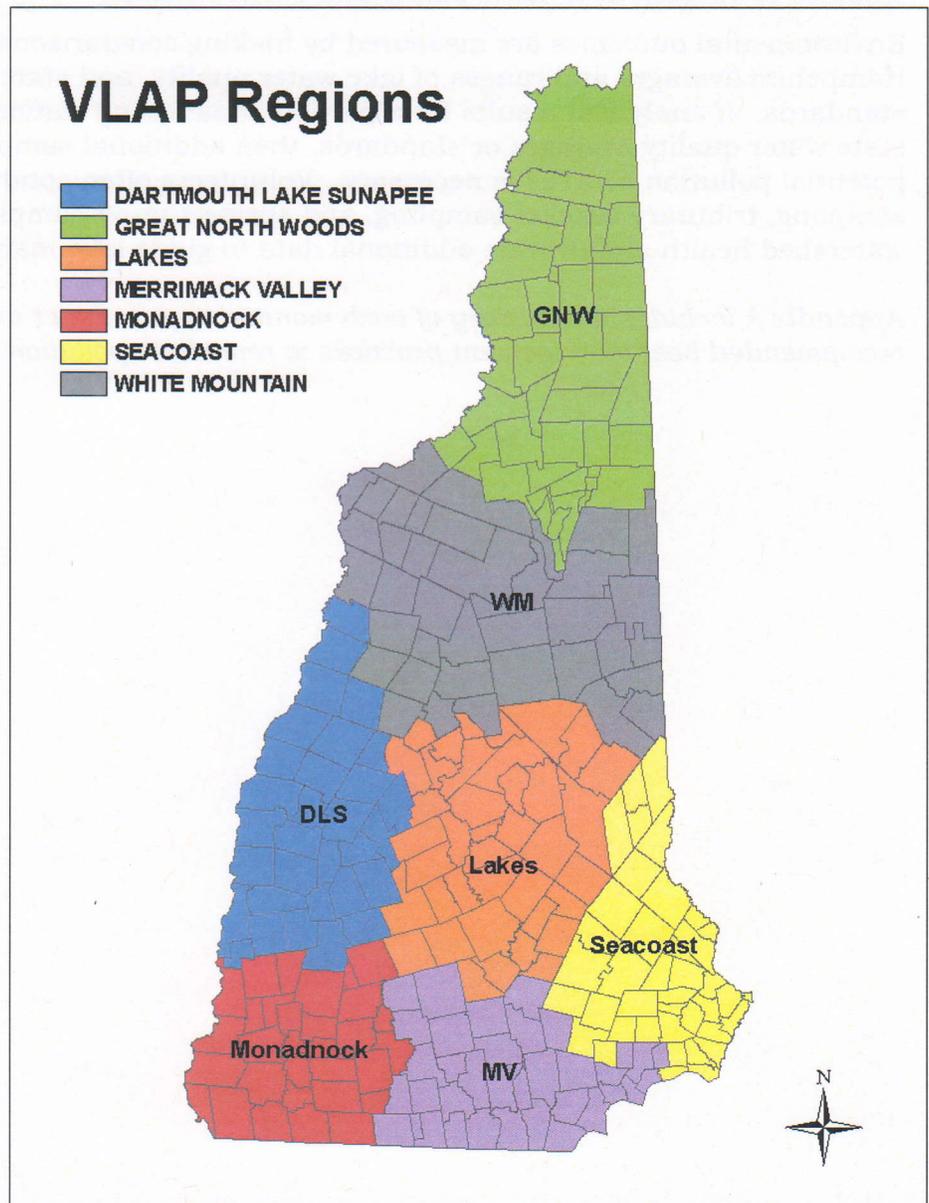


Figure 1. VLAP Regions

percent and 6.0 percent in New Hampshire (Gibbs, Halstead, Boyle & Huang, 2002). This may negatively impact property tax revenues, especially in a state where there are approximately 64,000 vacation homes concentrated around the Lakes region (lakes), Seacoast (ocean) and North Country (skiing) (Loder, 2011). According to a 1999 publication of the Society for the Protection of New Hampshire Forests, "The Economic Impact of Open Space in New Hampshire", vacation homes contribute approximately \$286 million to state and local tax revenues (note: open space includes lakes). For a town with a large number of lakefront homes (vacation or residential), a decline in water clarity can cause decreased property values and local tax revenue.

The Lakes region encompasses all or portions of the Level 8 Hydrologic Unit Code (HUC) Watersheds of the Pemigewasset, Winnepesaukee, Merrimack, and Contoocook Rivers. The HUC boundary defines a specific drainage basin of a major river or series of smaller rivers. There are 18 HUC 8 watersheds in New Hampshire. There are seven VLAP regions (Figure 1). The Lakes Region (Figure 2) consists of 35 VLAP lakes as follows. Individual reports for each lake can be found in Appendix D.

Lake Name	Town	Lake Name	Town
Hills Pond	Alton	Winnisquam, Pot Isl.	Laconia
Sunset Lake	Alton	Winnisquam, Three Isl.	Laconia
Bradley Lake	Andover	Clough Pond	Loudon
Cole Pond	Andover	Pemigewasset Lake	Meredith
Highland Lake	Andover	Waukewan Lake, Mayo	Meredith
Halfmoon Lake	Barnstead	Waukewan Lake, Winona	Meredith
Locke Lake	Barnstead	Wicwas Lake	Meredith
Suncook Pond, Lower	Barnstead	Lees Pond	Moultonborough
Suncook Pond, Upper	Barnstead	Winona Lake	New Hampton
Winnisquam, Mohawk Isl.	Belmont	Knowles Pond	Northfield
Walker Pond	Boscawen	Tucker Pond	Salisbury
Turee Pond	Bow	Hermit Lake	Sanbornton
Kimball Pond	Canterbury	Hunkins Pond	Sanbornton
New Pond	Canterbury	Lower Beech Pond	Tuftonboro
Chestnut Pond	Epsom	Mirror lake	Tuftonboro
Webster Lake	Franklin	Tom Pond	Warner
Crystal Lake	Gilmanton	Pillsbury Lake	Webster
Loon Pond	Gilmanton	Winnepocket Lake	Webster
French Pond	Henniker	Rust Pond	Wolfeboro
Clement Pond	Hopkinton		

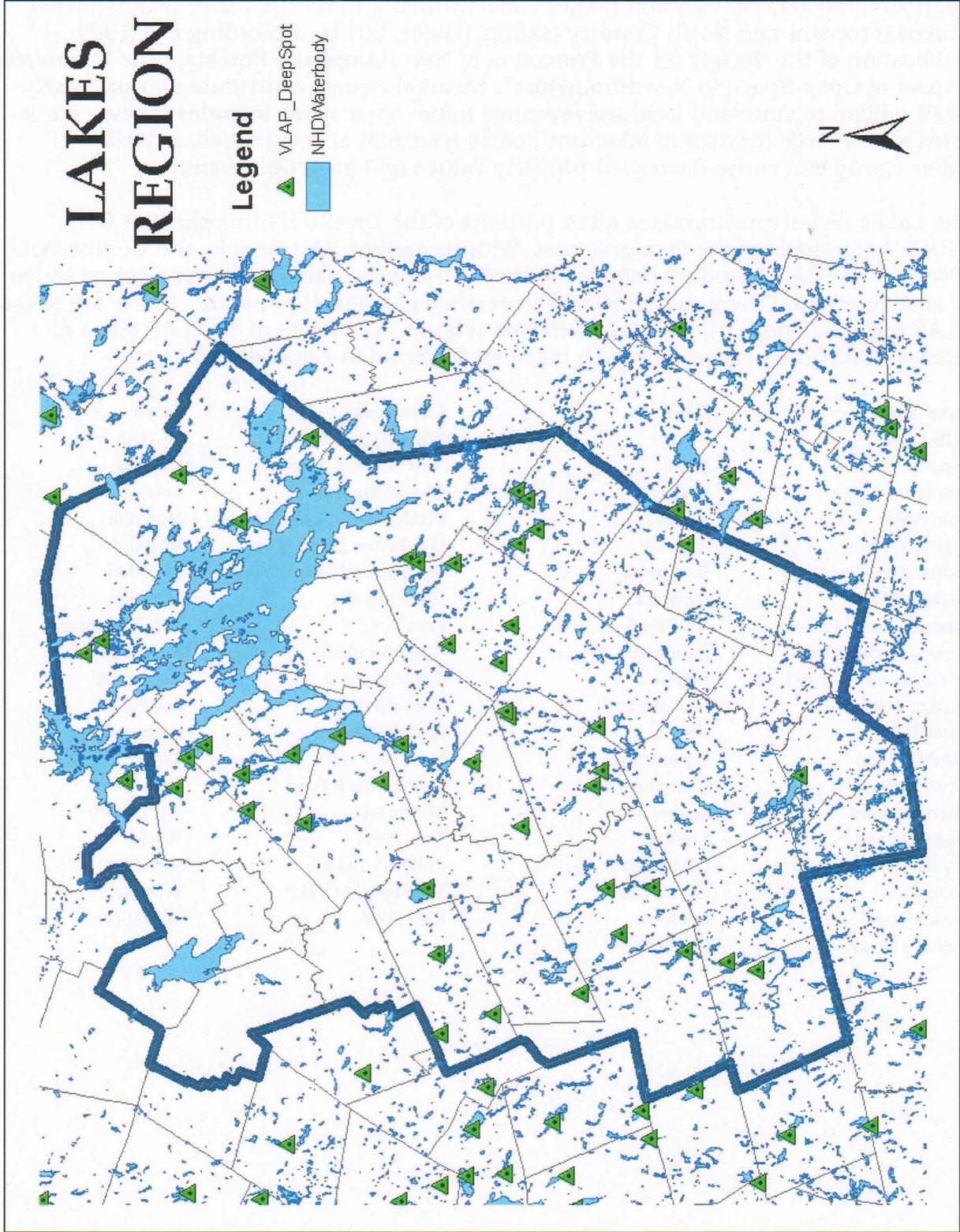


Figure 2. Lakes Region Lakes

LAND USE AND POPULATION GROWTH

According to the 2010 update of the Society for the Protection of New Hampshire Forests' publication "New Hampshire's Changing Landscape 2010", New Hampshire's population is expected to increase by 180,000 through 2030 (Figure 3). Almost 70 percent of that growth will occur in the Southeastern part of the state, particularly in Merrimack, Hillsborough and Rockingham counties.

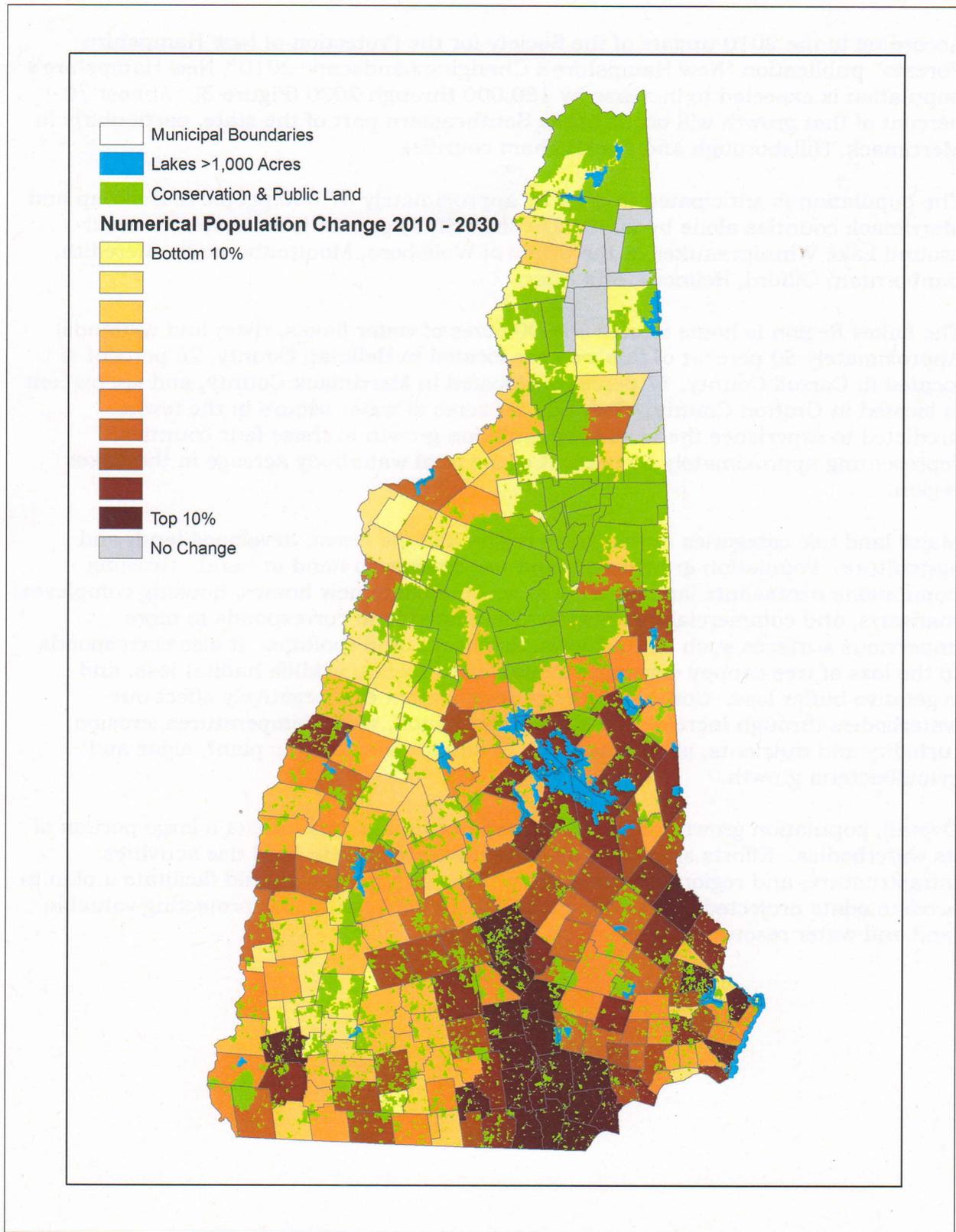
The population is anticipated to grow by approximately 37,000 people in Belknap and Merrimack counties alone by 2030. The majority of growth is estimated to occur around Lake Winnepesaukee in the towns of Wolfeboro, Moultonborough, Meredith, Sanbornton, Gilford, Belmont, and Alton.

The Lakes Region is home to over 86,000 acres of water (lakes, river, and wetlands). Approximately 50 percent of this water is located in Belknap County, 26 percent is located in Carroll County, 17 percent is located in Merrimack County, and six percent is located in Grafton County. Over 50,000 acres of water occurs in the towns predicted to experience the heaviest population growth in these four counties, representing approximately 60 percent of the total waterbody acreage in the Lakes region.

Major land use categories in the Lakes region include forest, developed land, and agriculture. Population growth and land use change go hand in hand. Growing populations necessitate land clearing to accommodate new homes, housing complexes, roadways, and commercial businesses. Developed land corresponds to more impervious surfaces such as roadways, driveways, and rooftops. It also corresponds to the loss of tree canopy coverage, unstable sediments, wildlife habitat loss, and vegetative buffer loss. Consequences of development can negatively affect our waterbodies through increases in stormwater runoff, water temperatures, erosion, turbidity and nutrients, as well as shifts in aquatic life, aquatic plant, algae and cyanobacteria growth.

Overall, population growth in the Lakes region could greatly impact a large portion of its waterbodies. Efforts should be made to evaluate current land use activities, infrastructure, and regional water quality. This information should facilitate a plan to accommodate projected population growth while conserving and protecting valuable land and water resources.

Figure 3. NH Population Growth per Town 2010-2030



EXOTIC SPECIES

Exotic aquatic species are those plants and animals not native to New Hampshire's waterbodies, such as Variable milfoil and Zebra mussels. Many of these species are invasive and quickly spread throughout the aquatic system, altering habitat and the ecology of the system, often to the detriment of native species. They are a serious threat to the health of New Hampshire's aquatic ecosystem, recreation and tourism industries.

New Hampshire has 87 exotic plant infestations in 78 waterbodies. Those include Variable milfoil, Eurasian milfoil, Brazilian Elodea, Water chestnut, Curly-leaf Pondweed, Fanwort, European Naiad, and Didymo ("Rock Snot"). Variable milfoil inhabits the majority of infested waterbodies, and Didymo, an invasive alga, has now infested 54 river miles in the North Country. Currently, 29 waterbodies in the Lakes Region are infested with an exotic species, which represents the largest number of infestations of any region in the state (Figure 4). All waterbodies have variable milfoil infestations.

The unique nature and invasive tendencies of these exotic species heighten the need to prevent new infestations, manage current infestations and engage watershed residents. The newest infestation of Eurasian milfoil occurred in 2010, and public education is integral in preventing further infestations. One program that educates the public and engages watershed residents is the DES Weed Watchers Program. The Weed Watchers program has approximately 750 volunteers dedicated to monitoring lakes and ponds for the presence of exotic aquatic plants. Volunteers are trained to survey their lake or pond once a month from May through September. To survey, volunteers slowly boat, or sometimes snorkel, around the perimeter of the waterbody and its islands looking for suspicious aquatic plant species. If a suspicious plant is found, the volunteers send a specimen to DES for identification, either in the form of a live specimen, or as a photograph emailed to the Exotic Species Program Coordinator. Upon positive identification, a biologist visits the site to determine the extent of infestation, initiates a rapid response management technique where possible, and formulates a long-term management plan to control the nuisance infestation.

Another program dedicated to public education and engaging watershed residents is the Lake Host™ program. The Lake Host™ Program is funded through DES and Federal grants. The program was developed in 2002 by NH LAKES and DES to educate and prevent boaters from spreading exotic aquatic plants to waterbodies in New Hampshire. Since then, the number of participating waterbodies, volunteers and number of "saves" (exotic plants discovered) has consistently increased. The program is invaluable in educating boaters, preventing recreational hazards, avoiding property value and aquatic ecosystem decline, addressing aesthetic issues, and saving costly remediation efforts.

GEOMORPHOLOGY AND CLIMATE

Chemical, physical and biological properties of lakes often reflect how they were formed. Lake formation can occur in a variety of ways. In New Hampshire, most lakes were formed during the last ice age as glaciers retreated. Lakes were also formed from rivers (oxbow), and were man and animal made (impoundments, dams and beavers). These formations create distinct lake morphology, such as length, width, area and volume that affect the lake's ability to adapt to shifts in climate and land use.

Along with morphological characteristics of lakes, the bedrock and sediment geology is also important in understanding lake properties. Underlying geological properties can affect the pH and acid neutralizing capacity (ANC) of our surface and groundwater. New Hampshire is typically referred to as the "Granite State" because the bedrock geology consists of variations of Igneous Rock high in granite content and typically contributes to a lower pH and less capacity to buffer acidic inputs such as acid rain. Metamorphic rocks make up the remainder of bedrock geology and consist of slate, schist, quartzite and carbonate rocks which tend to contribute to a more neutral pH and better buffering capacity.

Along with bedrock geology, climate also drives multiple processes in lake systems. Lakes respond to shifting weather conditions such as sunlight, rainfall, air temperature, and wind and wave action in various ways. This variability is reflected in the types and number of biological communities present, and chemical and physical properties of the lake system. It is essential that we understand how these factors influence water quality data collected at individual lake systems. Therefore, volunteers record pertinent weather data, rain and storm event totals on field data sheets while sampling.

To summarize the Lakes region climate conditions in 2012, the sampling season was warmer and slightly wetter than normal. These observations are based on air and rainfall data recorded in Concord, NH and surface water temperatures recorded by VLAP (Table 1). Average air temperatures in May, July and August were warmer than historical averages, while June and September were slightly below average. Overall, the 2012 average summer air temperature was 1.2° warmer than the historical average. Surface water temperatures in 2012 were well above average in July and August however the summer average was only 0.1° warmer than the historical regional average.

Table 1. Current Year and Historical Average Temperature and Precipitation Data for Lakes Region

	May	June	July	August	September	Summer
2012 Average Air Temperature (°F)	59.5	64.6	71.6	70.9	59.5	65.2
Annual Average Air Temperature (°F)	56.0	65.0	70.0	69.0	60.0	64.0
2012 Average Surface Water Temperature (°F)	-----	67.3	77.3	77.2	-----	73.9
Annual Average Surface Water Temperature (°F)	-----	71.1	75.3	74.9	-----	73.8
2012 Precipitation (in.)	4.76	4.01	3.29	6.35	4.04	4.49
Annual Average (in.)	3.66	3.69	3.74	3.18	3.38	3.53

The 2012 monthly summer rainfall amounts were slightly above average in May, June, August and September. However, July and August both experienced two weeks with dry conditions and the majority of rainfall in both months occurred during large volume single storm events.

Table 1. Current and Historical Average Temperature and Precipitation Data for Lake Region

Month	Year	Average Temperature (°F)	Average Precipitation (in)
May	2012	62	4.5
May	2011	61	4.2
May	2010	60	4.0
May	2009	59	3.8
May	2008	58	3.6
May	2007	57	3.4
May	2006	56	3.2
May	2005	55	3.0
May	2004	54	2.8
May	2003	53	2.6
May	2002	52	2.4
May	2001	51	2.2
May	2000	50	2.0
May	1999	49	1.8
May	1998	48	1.6
May	1997	47	1.4
May	1996	46	1.2
May	1995	45	1.0
May	1994	44	0.8
May	1993	43	0.6
May	1992	42	0.4
May	1991	41	0.2
May	1990	40	0.0

MONITORING AND ASSESSMENT

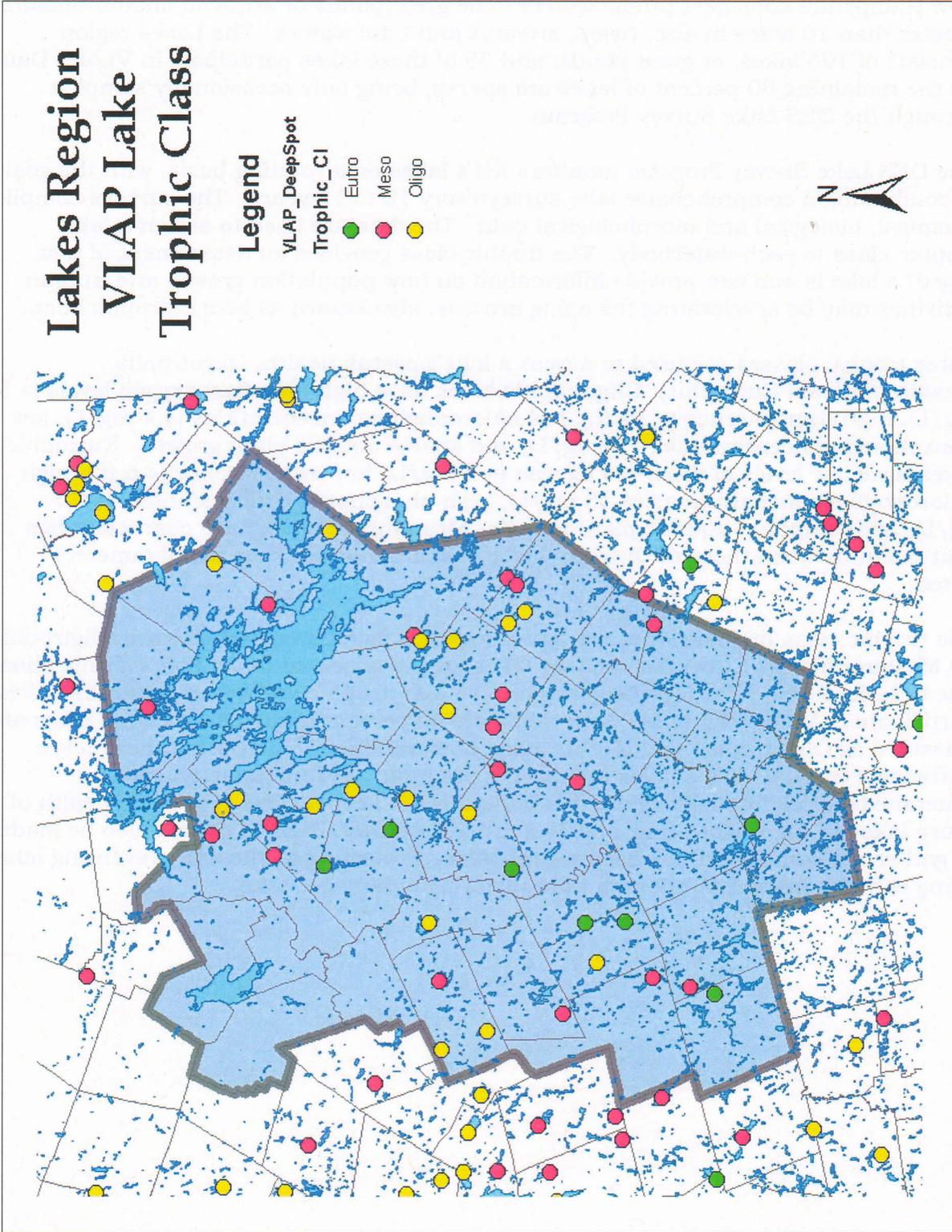
New Hampshire considers public waters to be great ponds or artificial impoundments greater than 10 acres in size, rivers, streams and tidal waters. The Lakes region consists of 196 lakes, or great ponds, and 35 of those lakes participate in VLAP. Data on the remaining 80 percent of lakes are sparse, being only occasionally sampled through the DES Lake Survey Program.

The DES Lake Survey Program monitors NH's lakes on a rotating basis, with the goal of conducting a comprehensive lake survey every 10 to 15 years. The surveys compile chemical, biological and morphological data. The data are used to assign a lake trophic class to each waterbody. The trophic class provides an assessment of how "aged" a lake is and can provide information on how population growth and human activities may be accelerating the aging process, also known as lake eutrophication.

Three trophic classes are used to assess a lake's overall health, Oligotrophic, Mesotrophic and Eutrophic. Oligotrophic lakes have high dissolved oxygen levels (> 5 mg/L), high transparency (> 12 ft.), low chlorophyll-a concentrations (< 4 mg/L), low phosphorus concentrations (< 10 ug/L), and sparse aquatic plant growth. Eutrophic lakes have low levels of dissolved oxygen (< 2 mg/L), low transparency (< 6 ft.), high chlorophyll-a concentrations (> 15 mg/L), high phosphorus concentrations (> 20 ug/L), and abundant aquatic plant growth. Mesotrophic lakes have characteristics that fall in between those of Oligotrophic and Eutrophic lakes for the parameters listed.

The trophic class breakdown of the Lakes region is as follows: 44 lakes are Oligotrophic, 69 Mesotrophic, 39 Eutrophic, and 44 lakes are un-assessed for trophic classification due to lack of data. Thirteen Oligotrophic, 15 Mesotrophic and seven Eutrophic lakes participate in VLAP (Figure 5). Approximately 60 percent of the Lakes region lakes are classified as Oligotrophic and Mesotrophic; however only 27 percent of those lakes participate in VLAP or a similar monitoring program. As human activities in watersheds accelerate lake aging, it is imperative to keep a close eye on the health of those lakes in the Oligotrophic and Mesotrophic classes. Efforts should also be made to gather data on the un-assessed waterbodies. Protecting a lake and preventing lake aging is much more cost-effective than restoring a damaged lake.

Figure 5. VLAP Lakes Trophic Class



VLAP WATER QUALITY DATA INTERPRETATION

The Lakes Region is home to 36 lakes and ponds that participate in VLAP. Volunteer monitors at each lake collect comprehensive data sets at the deepest spot of the lake and from streams entering or exiting the lake. Deep spot sample collection is representative of overall lake quality conditions and provides insight into how the lake responds to localized events such as stormwater and drought. Deep spot data are used to establish long term water quality trends and to provide information into the overall health of the waterbody. Stream sample collection is representative of what flows into the lake from the surrounding watershed. Stream data are used to identify potential watershed pollution problems so that remediation actions occur before they negatively impact the overall health of the waterbody.

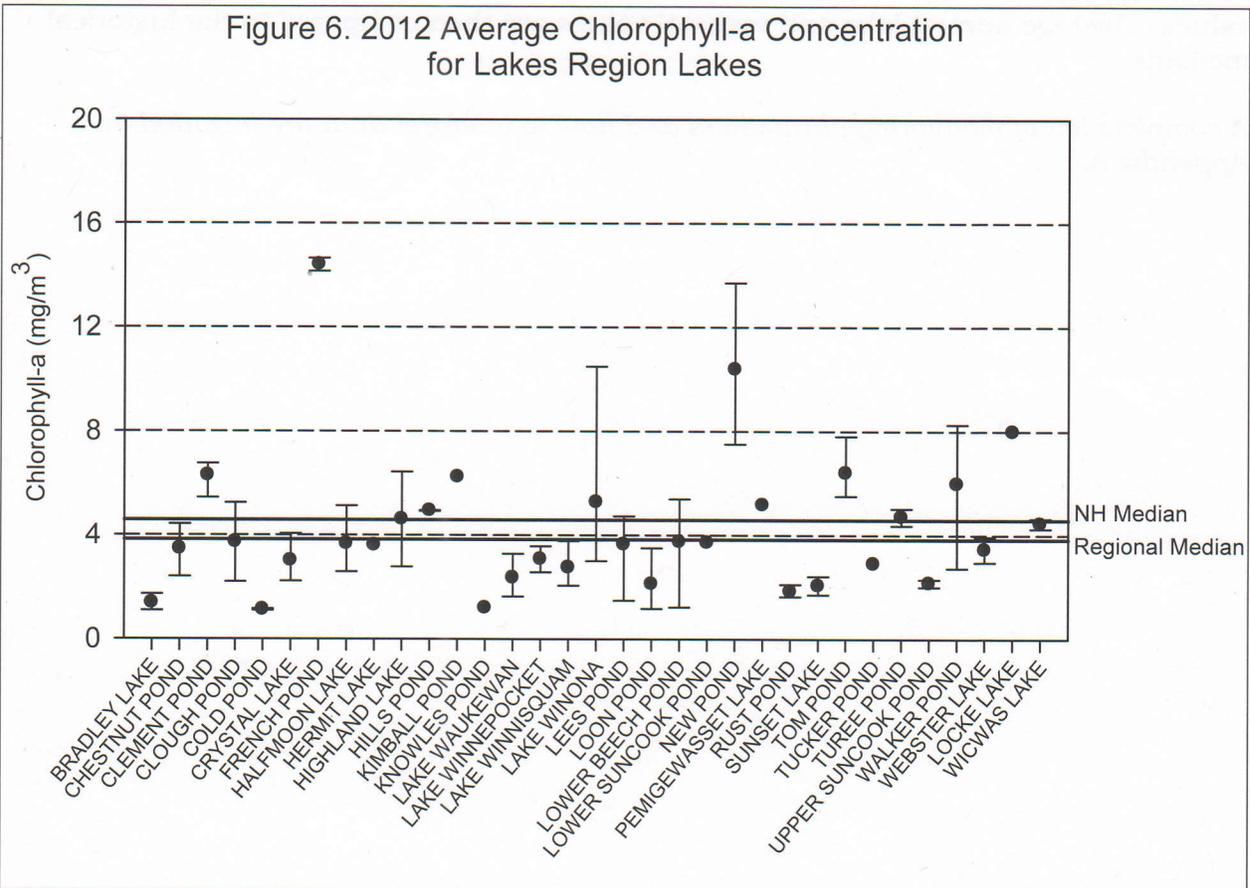
The following section provides a summary of the VLAP monitoring parameters, long-term water quality trends, and an analysis of the current year and historical data for the VLAP lakes and ponds in the Lakes region compared with regional and state medians. The deep spot data for the epilimnion, or surface water layer, is compared to the New Hampshire median to provide an understanding of how the quality of your lake deep spot compares to other New Hampshire lake deep spots. Similarly, the epilimnion data are compared to the regional median to provide an understanding of how the quality of your lake deep spot compares with other local lakes. Median values were utilized to represent historical state and regional conditions as the value tends to better represent the actual middle number while minimizing the effects of outlier values. Average annual lake and regional values are then compared to the historical medians.

A complete list of monitoring parameters and how to interpret data are included in Appendix A.

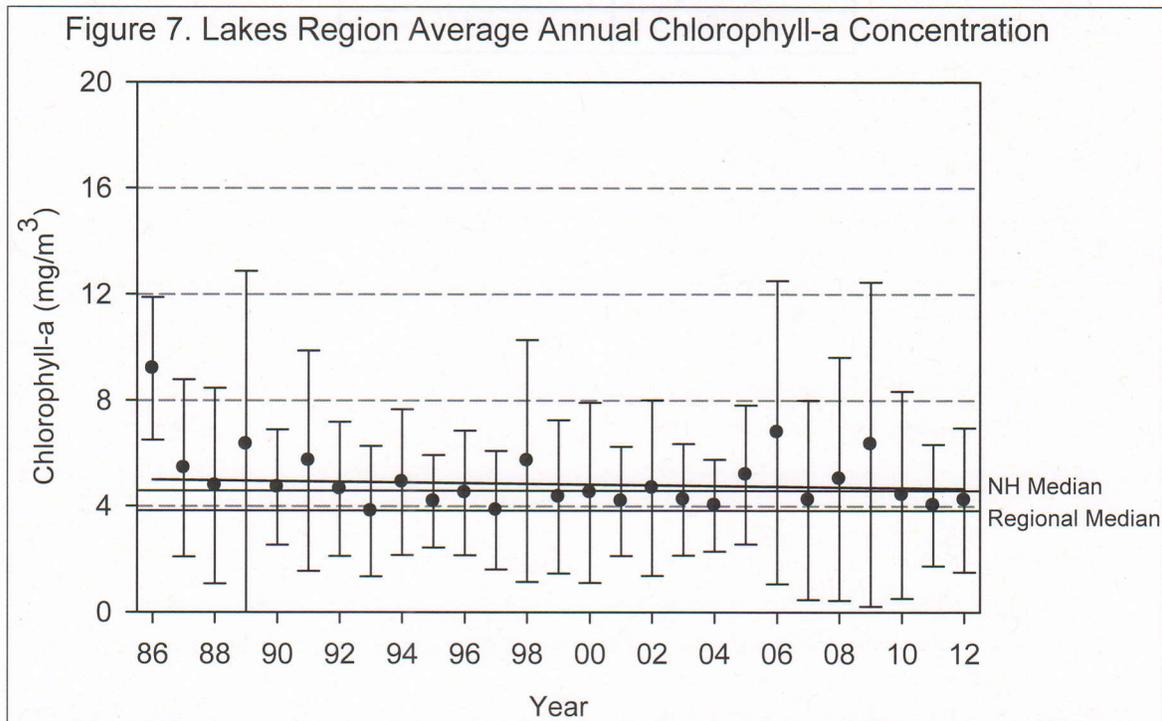
Annual and Historical Chlorophyll-a Results

Algae are microscopic plants that are naturally found in the lake ecosystem. Algae and cyanobacteria contain chlorophyll-a, a pigment used for photosynthesis. The measurement of chlorophyll-a in the water provides an estimation of the algal and/or cyanobacteria abundance or lake productivity. **The median summer chlorophyll-a concentration for New Hampshire's lakes and ponds is 4.58 mg/m³. The median chlorophyll-a concentration for the Lakes Region is 3.83 mg/m³.**

The 2012 average chlorophyll-a concentration for each lake in the Lakes region are represented in Figure 6. The regional and state medians are provided for reference. The average chlorophyll-a concentration at 20 lake deep spot stations are equal to or below the regional median and are typically representative of good water quality. One lake has average chlorophyll-a concentrations between the state and regional medians, and 12 lakes experienced average chlorophyll-a concentrations above the state median. Typically, chlorophyll-a concentrations that exceed 5.0 mg/m³ are considered higher than desirable. Eight lakes experienced average chlorophyll-a concentrations greater than 5.0 mg/m³. Two of those lakes are classified as Eutrophic and one typically experiences an annual cyanobacteria bloom. The average chlorophyll-a concentration at Hunkins Pond in Sanbornton reached 59.6 mg/m³, however that value was not included in Figure 6 to allow better graphical representation of all lakes. Overall, approximately 90 percent of the sampled deep spots have chlorophyll-a concentrations representative of Oligotrophic and Mesotrophic classifications.



The average annual chlorophyll-a concentrations for the Lakes region are represented in Figure 7. Average annual chlorophyll-a concentrations have generally remained between 4.0 and 5.0 mg/m³ since 1986. Please note that this does not include data from Hunkins Pond in Sanbornton. Hunkins Pond is a shallow farm pond which experiences annual cyanobacteria blooms and phosphorus loading several times higher than the regional lakes. Utilizing the data is not representative of the regional average and was removed to better represent regional characteristics. Visual observation of the trend line indicates regional chlorophyll-a concentrations, and therefore algal growth, are relatively stable over time.



Chlorophyll-a Trend Analysis

Lakes region lakes with 10 or more consecutive years of data were subject to statistical analyses to determine whether water quality trends were significantly improving, degrading, stable, or variable, meaning values fluctuate between years and there is no clear trend. Chlorophyll-a trends were assessed for approximately 27 deep spots at 26 lakes in the region. Nine lakes did not have 10 or more consecutive years of data, therefore, trend analyses were not conducted. Approximately 70 percent of the Lakes region lakes have 10 or more years of consecutive data collection on record.

Table 2 represents the percentage of Lakes region lakes with improving, degrading (worsening), stable, or variable chlorophyll-a trends. Note that improving trends reflect a decrease in chlorophyll levels, and vice-versa. Approximately 95 percent of lake deep spots have a stable or variable chlorophyll-a trend, meaning the chlorophyll-a concentrations have not significantly increased or decreased, while the remaining lakes have an improving chlorophyll-a trend. Chlorophyll-a concentrations are

typically related to phosphorus concentrations because as phosphorus increases, more algal growth occurs. The stable and improving chlorophyll-a trends are a positive sign for the region.

Table 2. Chlorophyll-a Trends in Lakes Region

Chlorophyll-a Trend	Percentage of Lakes
Improving	4
Stable	41
Degrading	0
Variable	55

Annual and Historical Transparency Results

Volunteer monitors use the Secchi disk, a 20 cm disk with alternating black and white quadrants, to measure how far a person can see into the water. Transparency, a measure of water clarity, can be affected by algae and sediment in the water, as well as the natural color of the water. Transparency may also be measured using a viewscope, a cylindrical tube, designed to decrease surface water properties that may cause difficulty in viewing the Secchi disk. A comparison of transparency readings collected with and without the use of a viewscope shows that the viewscope typically increases the depth to which the Secchi disk can be seen into the lake, particularly on sunny and windy days. **The median summer transparency for New Hampshire's lakes and ponds is 3.20 meters. The median transparency for the Lakes region is 4.30 meters.**

Figure 8 represents the 2012 average transparency for each lake in the Lakes region compared with state and regional medians. The average transparencies at eight lake deep spots are equal to or below the state median and are typically representative of poor water quality conditions. Ten lakes fall between the state and regional median, and 16 lakes are above the regional median and are typically representative of good water quality. Overall lake depth plays an important role when interpreting transparency data. Shallow lakes will typically report lower transparencies than deeper lakes, yet these waterbodies may be quite clear. A better representation would be to look at how transparency changes over time.

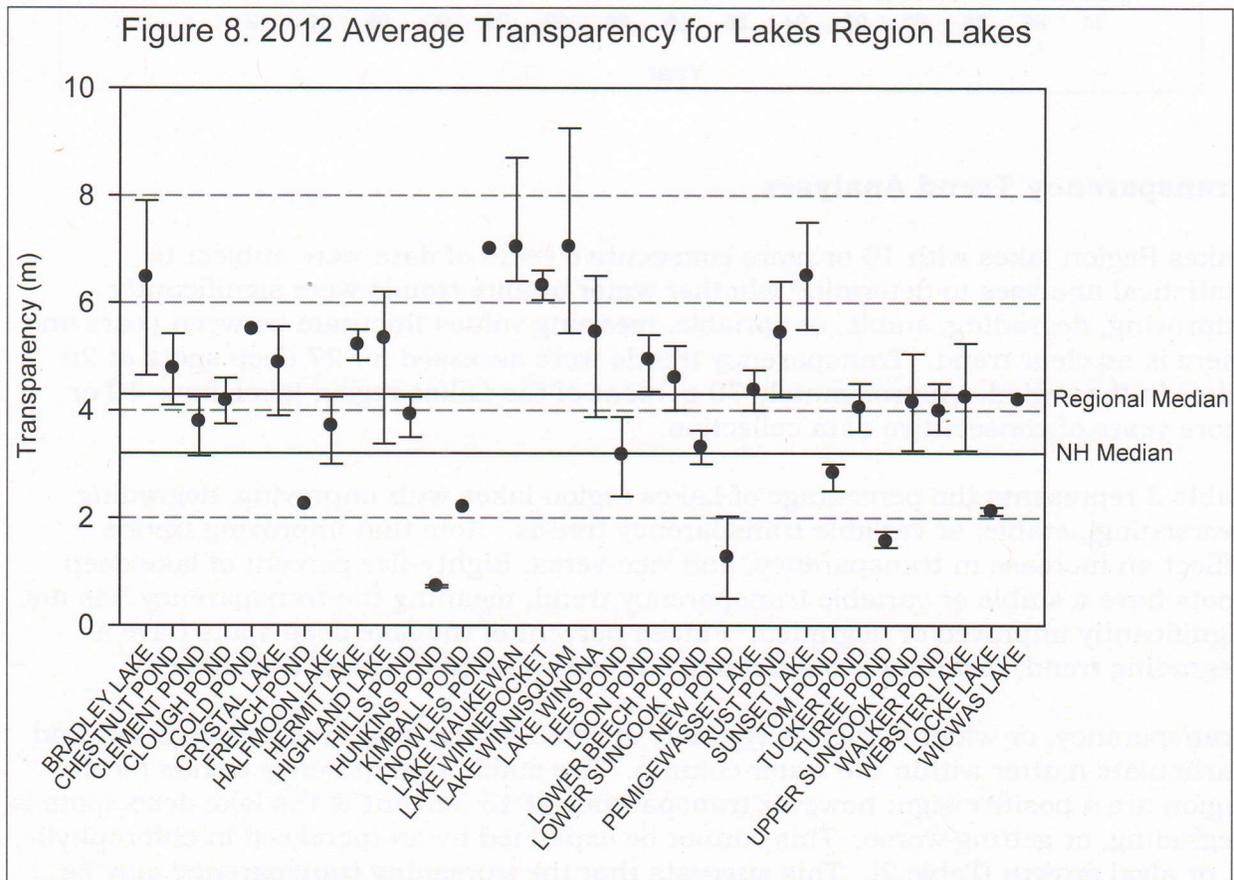
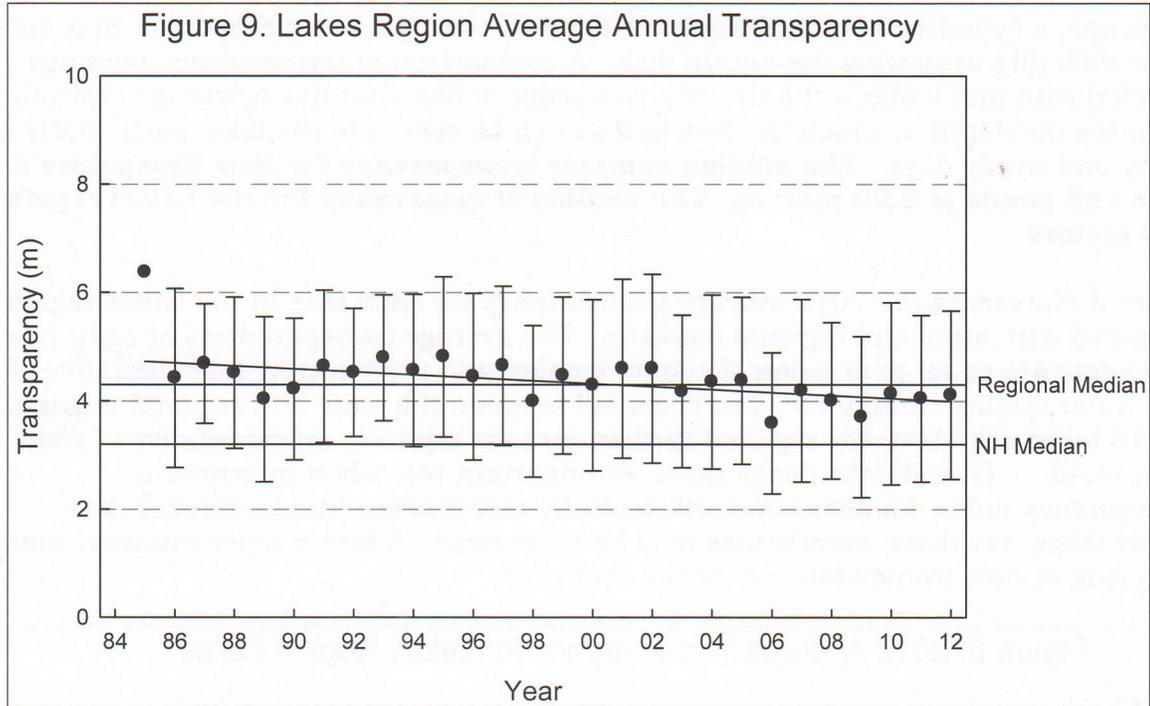


Figure 9 represents the average annual transparency for the Lakes region. Average transparencies for the region remained at or above the regional median from 1985 through 2002. Average transparencies have decreased from 2003 to the present and remain between the regional and state medians. Visual observation of the trend line indicates regional transparency has decreased over time.



Transparency Trend Analyses

Lakes Region lakes with 10 or more consecutive years of data were subject to statistical analyses to determine whether water quality trends were significantly improving, degrading, stable, or variable, meaning values fluctuate between years and there is no clear trend. Transparency trends were assessed for 27 deep spots at 26 lakes in the region. Approximately 70 percent of the Lakes region lakes have 10 or more years of consecutive data collection.

Table 3 represents the percentage of Lakes region lakes with improving, degrading (worsening), stable, or variable transparency trends. Note that improving trends reflect an increase in transparency, and vice-versa. Eighty-five percent of lake deep spots have a stable or variable transparency trend, meaning the transparency has not significantly improved or degraded. Fifteen percent of the lake deep spots have a degrading trend, meaning transparency has worsened (decreased) over time.

Transparency, or water clarity, is typically affected by the amount of algae, color, and particulate matter within the water column. The stable transparency trends for the region are a positive sign; however transparency at 15 percent of the lake deep spots is degrading, or getting worse. This cannot be explained by an increased in chlorophyll-a, or algal growth (Table 2). This suggests that the worsening transparency may be

explained by an increase in suspended sediments. Stormwater runoff can transport exposed and unstable sediments and other debris to lake systems. It is imperative to identify potential areas of concern in the watershed and utilize best management practices to control stormwater and erosion. Please refer to Appendix B for reference material on do-it-yourself stormwater best management practices.

Table 3. Transparency Trends in Lakes Region

Transparency Trend	Percentage of Lakes
Improving	0
Stable	63
Degrading	15
Variable	22

Annual and Historical Total Phosphorus Results

Phosphorus is typically the limiting nutrient for vascular plant and algal growth in New Hampshire's lakes and ponds. Excessive phosphorus in a pond can lead to increased plant and algal growth over time. **The median summer epilimnetic (upper layer) total phosphorus concentration of New Hampshire's lakes and ponds is 12 ug/L. The median epilimnetic total phosphorus concentration for the Lakes region is 8 ug/L.**

Figure 10 represents the 2012 average epilimnetic total phosphorus concentration for the Lakes region lakes. The regional and state medians are provided as reference. The regional median is considerably lower than the state median, and is considered to be representative of Oligotrophic conditions. Fourteen lakes experienced average phosphorus concentrations equal to or below the regional median. Fourteen lakes experienced average phosphorus concentrations between the regional and state medians, and six lakes experienced average phosphorus concentrations equal to or greater than the state median. Three of those lakes experienced average phosphorus concentrations above 20 ug/L representative of Eutrophic conditions. Overall, regional epilimnetic phosphorus concentrations are relatively low and representative of Oligotrophic and Mesotrophic conditions.

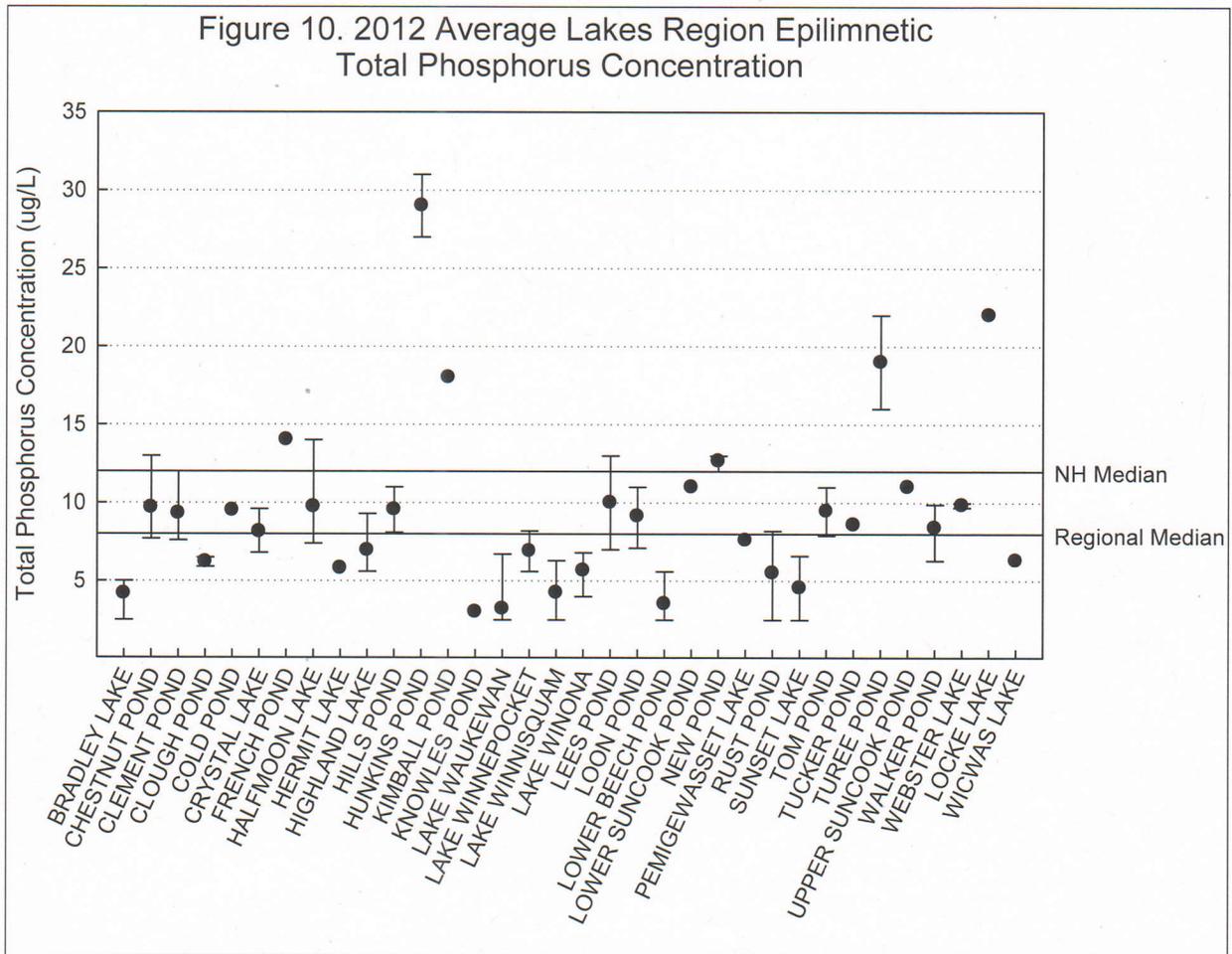
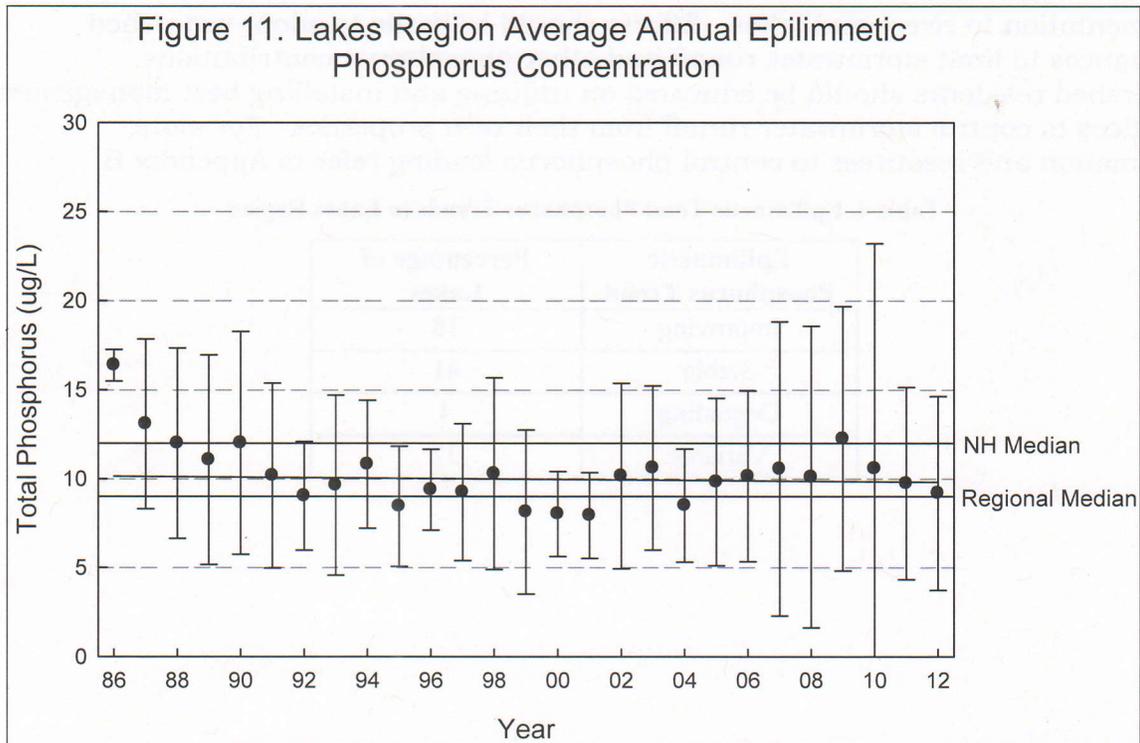


Figure 11 represents the average annual epilimnetic phosphorus concentration for the Lakes region. The average annual epilimnetic phosphorus concentrations have generally remained between the regional and state median since 1986. The annual average has fluctuated between 8 ug/L and 16 ug/L but tends to be around 10 ug/L, which is on the border of Oligotrophic/Mesotrophic conditions. Visual observation of the trend line indicates regional epilimnetic phosphorus has remained relatively stable over time.



Epilimnetic Phosphorus Trend Analyses

Lakes region lakes with 10 or more consecutive years of data were subject to statistical analyses to determine whether water quality trends were significantly improving, degrading, stable, or variable, meaning values fluctuate between years and there is no clear trend. Epilimnetic total phosphorus trends were assessed for approximately 27 deep spots at 26 lakes in the region. Approximately 70 percent of the Lakes region lakes have 10 or more years of consecutive data collection. This allows a more accurate picture of regional water quality trends.

Table 4 represents the percentage of Lakes region lakes with improving, degrading (worsening), stable, or variable epilimnetic total phosphorus trends. Note that improving trends reflect a decrease in phosphorus levels, and vice-versa.

Approximately 80 percent of lake deep spots in the region have a stable or variable epilimnetic phosphorus trend, meaning the phosphorus concentrations have not significantly improved or degraded since monitoring began. Eighteen percent of the lake deep spots have an improving total phosphorus trend, meaning phosphorus concentrations have significantly decreased, which is a positive sign. A more positive

sign is that only four percent, or one lake, has a significantly degrading (increasing) phosphorus trend; however efforts should be made to identify and remediate sources of phosphorus at this lake.

Increasing epilimnetic phosphorus trends are often a result of phosphorus-enriched stormwater runoff related to increased watershed development. An increase in watershed development often results in an increase in impervious surfaces and unstable sediments. This contributes to an increase in stormwater runoff and sedimentation to rivers and lakes. Efforts should be made to adopt watershed ordinances to limit stormwater runoff and other phosphorus contributions. Watershed residents should be educated on utilizing and installing best management practices to control stormwater runoff from their own properties. For more information and resources to control phosphorus loading refer to Appendix B.

Table 4. Epilimnetic Total Phosphorus Trends in Lakes Region

Epilimnetic Phosphorus Trend	Percentage of Lakes
Improving	18
Stable	41
Degrading	4
Variable	37

Dissolved Oxygen Data Analysis

The presence of dissolved oxygen is vital to bottom-dwelling organisms as well as fish and amphibians. If the concentration of dissolved oxygen is low, typically less than 5 mg/L, species intolerant, meaning sensitive, to this situation, such as trout, will be forced to migrate closer to the surface where there is more dissolved oxygen but the water is generally warmer, and the species may not survive. Temperature and time of day also play a role in the amount of dissolved oxygen in the water column. Water can hold more oxygen at colder temperatures than at warmer temperatures. Therefore, a lake will typically have a higher concentration of dissolved oxygen during the winter, spring, and fall than during the summer. Oxygen concentrations are typically lower overnight than during the day. Plants and algae respire (use oxygen) at night and photosynthesize (produce oxygen) during the day. Dissolved oxygen levels may shift depending on the abundance of aquatic plants and algae in the littoral (near shore) and pelagic (deep water) zones.

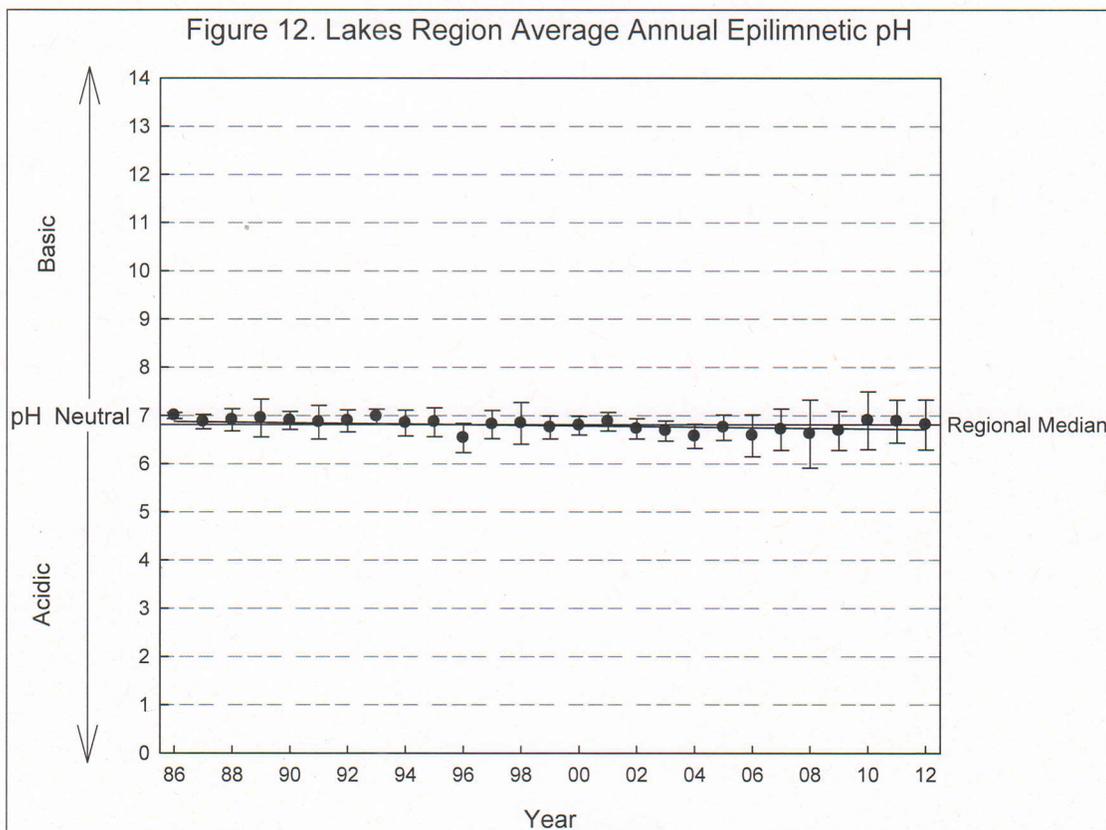
Dissolved oxygen and temperature profiles are collected at VLAP lakes on an annual or bi-annual basis. The 2012 average dissolved oxygen level for the Lakes region is 5.32 mg/L, which is lower than desirable and may cause stress for certain aquatic life. For additional information regarding dissolved oxygen please refer to Appendix A.

Annual and Historical Deep Spot pH Data Analysis

pH is measured on a logarithmic scale of 0 (acidic) to 14 (basic). pH is important to the survival and reproduction of fish and other aquatic life. A pH below 6.0 typically limits the growth and reproduction of fish. A waterbody is considered impaired for aquatic life when the pH falls below 6.5 or above 8.0. **The median epilimnetic pH for New Hampshire's lakes is 6.6, which indicates that the state surface waters are slightly acidic. The median epilimnetic pH for the Lakes Region is 6.81.**

Figure 12 represents the average annual pH value for the Lakes region compared with the regional median. The 2012 average epilimnetic pH value of the Lakes region was 6.82, which means that the water is approximately neutral. The lowest, most acidic, average pH value was 5.33 measured at Bradley Lake in Andover whereas; the highest, most basic, pH value was 9.11 measured at Hunkins Pond in Sanbornton. This extremely basic value is not normally measured in New Hampshire surface waters and is caused by photosynthetic by-products released during algal and cyanobacteria blooms. Although a large fluctuation in regional pH is not noticeable, visual inspection of the trend line indicates pH is becoming slightly more acidic.

Variations in pH values between lakes and between different geographical regions may depend on the composition and weathering of underlying bedrock and the lake water chemistry. Another contributing factor to pH is acid deposition received as a result of emissions from power plants and vehicles. This increases levels of atmospheric carbon, nitrogen and sulfur which fall back to the earth in the form of acidic precipitation.

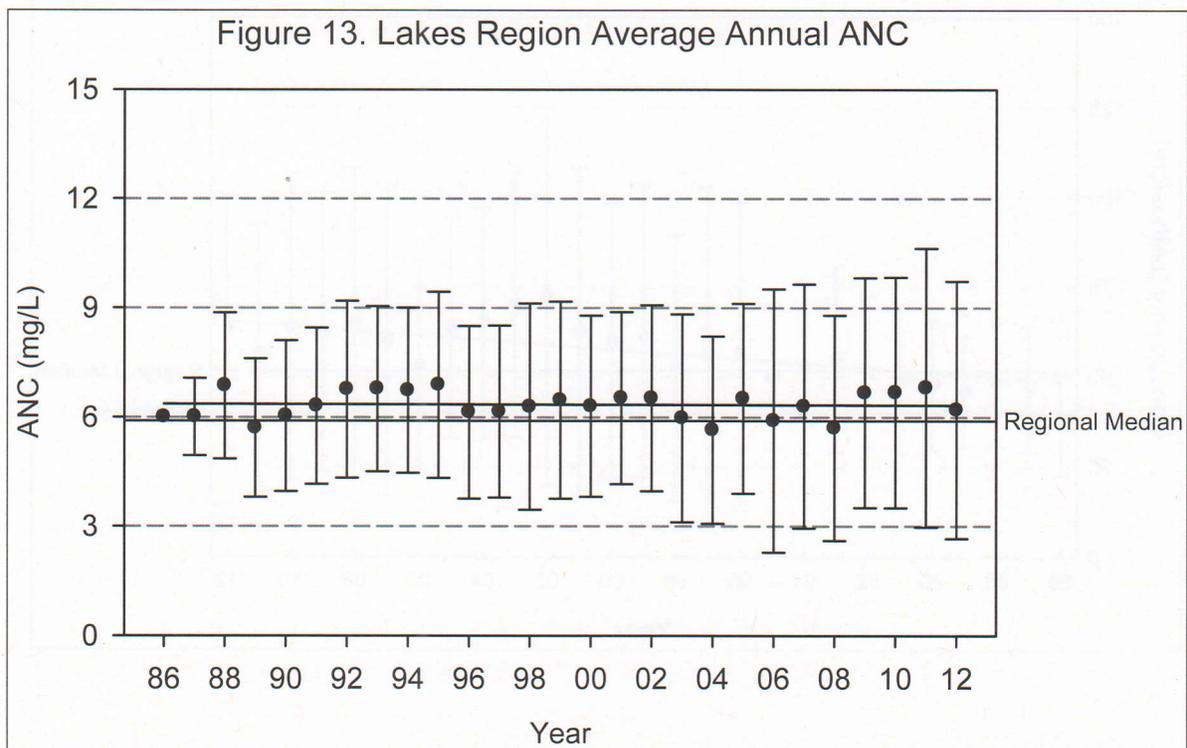


Annual and Historical Acid Neutralizing Capacity (ANC) Data Analysis

The acid neutralizing capacity (ANC) measures the buffering capacity of a water body, or its ability to resist changes in pH by neutralizing acidic inputs. These “buffers” are typically bases such as bicarbonate and carbonate. Geology can play an important part in a water body’s buffering capacity. Lakes located in areas with predominantly limestone (calcium carbonate), sedimentary rocks and carbonate rich soils often have a higher ANC, while lakes located in areas with predominantly granite and carbon poor soils often have a lower ANC.

The higher the ANC, the more readily a waterbody can resist change in pH. In NH, lakes with ANC values greater than 25.0 mg/L are considered not vulnerable to acidic inputs, and lakes with an ANC between 10.1 and 25.0 mg/L have a low vulnerability. Moderately vulnerable lakes have an ANC between 2.1 and 10.0 mg/L, and extremely vulnerable lakes between 0 and 2.0 mg/L. The median ANC value for New Hampshire’s lakes and ponds is **4.8 mg/L**, and the median ANC value for the Lakes region is **5.9 mg/L**, which indicates that many lakes and ponds in the state are at least “moderately vulnerable” to acidic inputs.

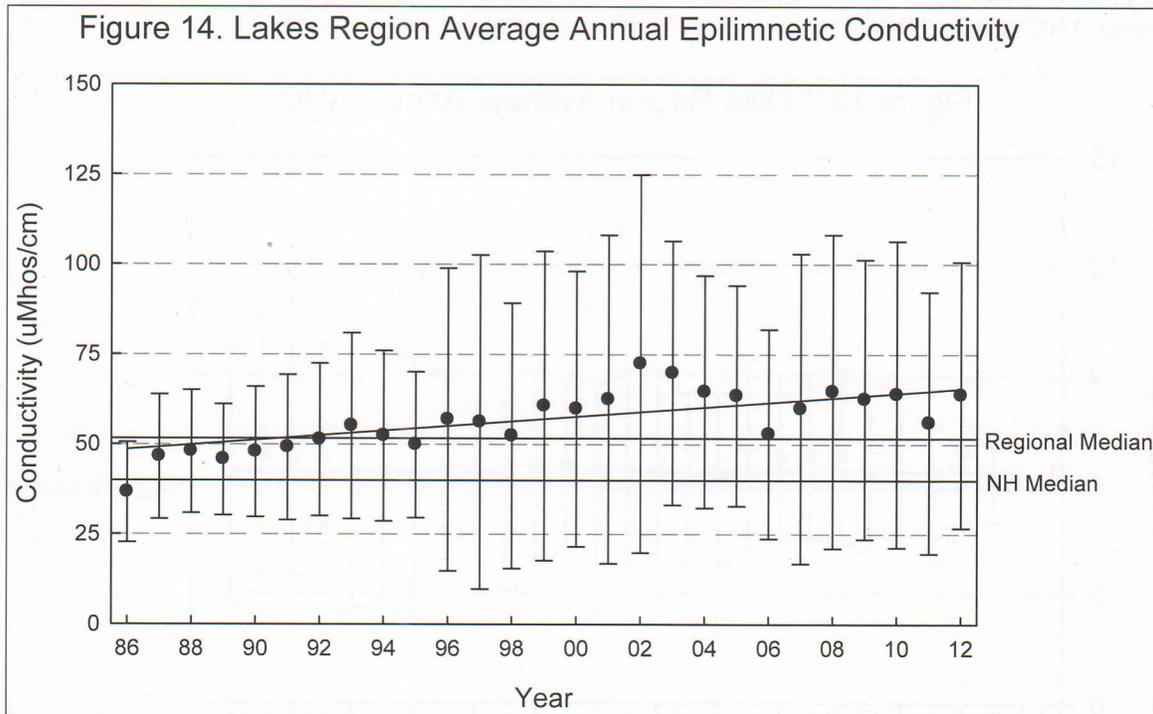
Figure 13 represents the average annual ANC for the Lakes region. The average annual ANC has generally remained between 5.0 and 7.0 mg/L since 1986. The lowest ANC was 1.40 mg/L measure at Bradley Lake in Andover and the highest ANC was 23.3 mg/L measured at Rust Pond in Wolfeboro. ANC values do not fluctuate greatly from year to year and visual inspection of the trend line indicates a relatively stable regional ANC since 1986.



Annual and Historical Deep Spot Conductivity and Chloride Data Analysis

Conductivity is the numerical expression of the ability of water to carry an electric current, which is determined by the number of negatively charged ions from metals, salts, and minerals in the water column. The soft waters of New Hampshire have traditionally low conductivity values, generally less than 50 uMhos/cm. However, specific categories of good and bad levels cannot be constructed for conductivity because variations in watershed geology can result in natural fluctuations. **The median conductivity value for New Hampshire's lakes and ponds is 40.0 uMhos/cm. The median epilimnetic conductivity value for the Lakes region is 51.6 uMhos/cm.**

Figure 14 represents the 2012 average annual epilimnetic conductivity value at Lakes region lakes compared with the regional and state medians. The 2012 average epilimnetic conductivity value of the Lakes region was 63.7 uMhos/cm, which is slightly greater than the state median. Conductivity values fluctuate widely among the region's lakes. The lowest value of 12.5 uMhos/cm was measured at Bradley Lake in Andover whereas the highest value of 174.3 uMhos/cm was measured at Turee Pond in Bow. A wide range of watershed types and degrees of development exists in the region. Bradley Lake experiences relatively little developmental pressures, whereas Turee Pond in Bow, although partially surrounded by forested land, receives stormwater runoff from residential development, paved roadways, parking lots and athletic fields. Overall, visual observation of the trend line indicates regional conductivity has increased over time.



Generally, conductivity values in New Hampshire lakes exceeding **100 uMhos/cm** indicate cultural, meaning human, disturbances. An elevated conductivity trend typically indicates point source and/or non-point sources of pollution are occurring within the watershed. These sources include failed or marginally functioning septic systems, agricultural runoff, and road runoff, and groundwater inputs. New development in the watershed can alter runoff patterns and expose new soil and bedrock areas, which could also contribute to increasing conductivity. In addition, natural sources, such as the mineral composition of bedrock, can influence conductivity.

The chloride ion (Cl^-) is found naturally in some surface and ground waters and in high concentrations in seawater. Research has shown that elevated chloride levels can be toxic to freshwater aquatic life. In order to protect freshwater aquatic life in New Hampshire, the state has adopted **acute and chronic** chloride criteria of **860 and 230 mg/L** respectively. The chloride content in New Hampshire lakes is naturally low in surface waters located in remote areas away from habitation. Higher values are generally associated with salted highways and, to a lesser extent, with septic inputs. **The median chloride value for New Hampshire's lakes is 4 mg/L. The median epilimnetic chloride value for the Lakes region is 12 mg/L.**

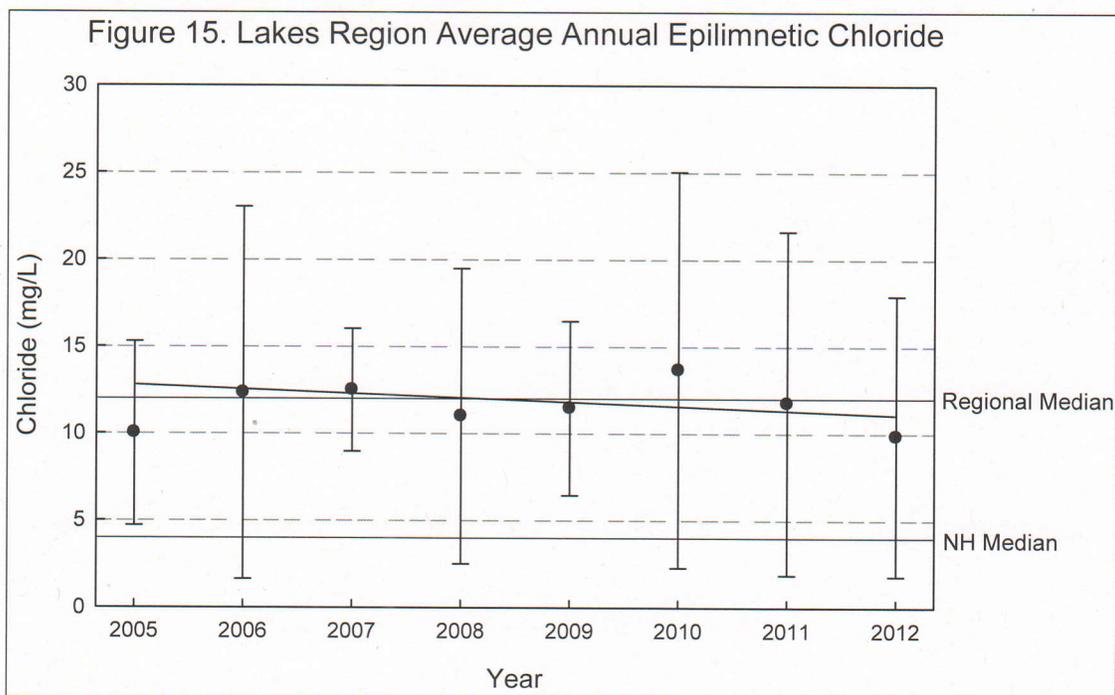
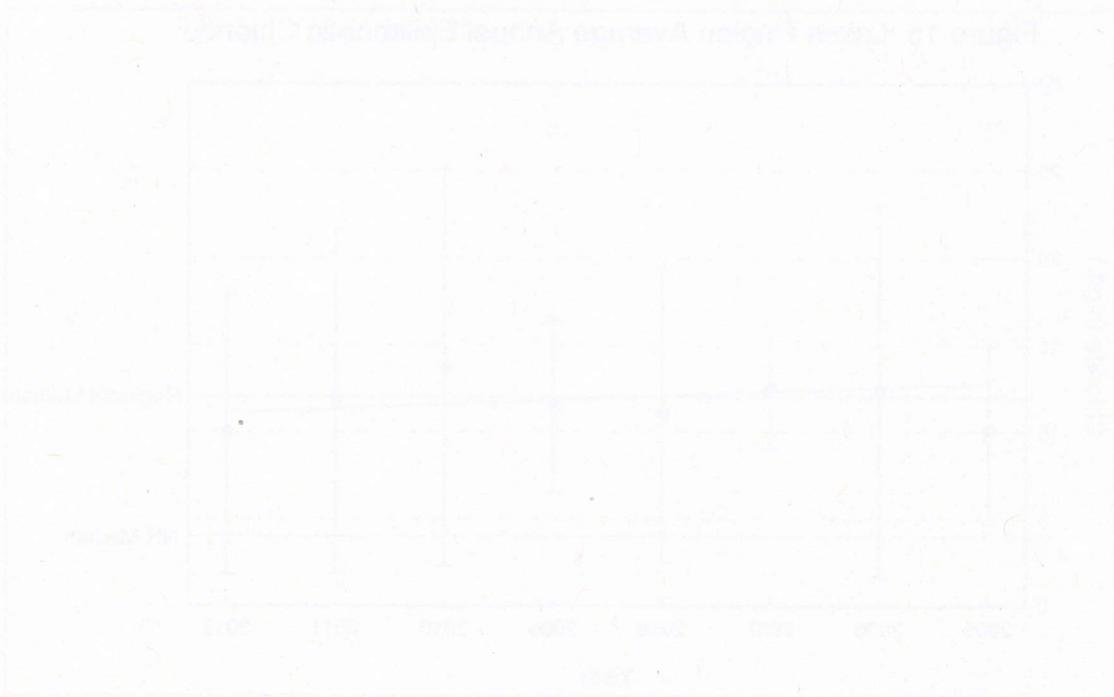


Figure 15 depicts average annual epilimnetic chloride levels for select regional lakes. The chloride measurement is relatively new for VLAP and is an optional analyte for participating lakes. Lakes that serve as water supplies or where conductivity levels may be influenced by chloride are analyzed annually. Average regional epilimnetic chloride levels generally range between 10 and 15 mg/L. Regional chloride levels are much less than the acute and chronic chloride criteria; however, they are greater than what we would typically measure in undisturbed NH surface waters.

Watershed management efforts to control un-natural sources of conductivity and

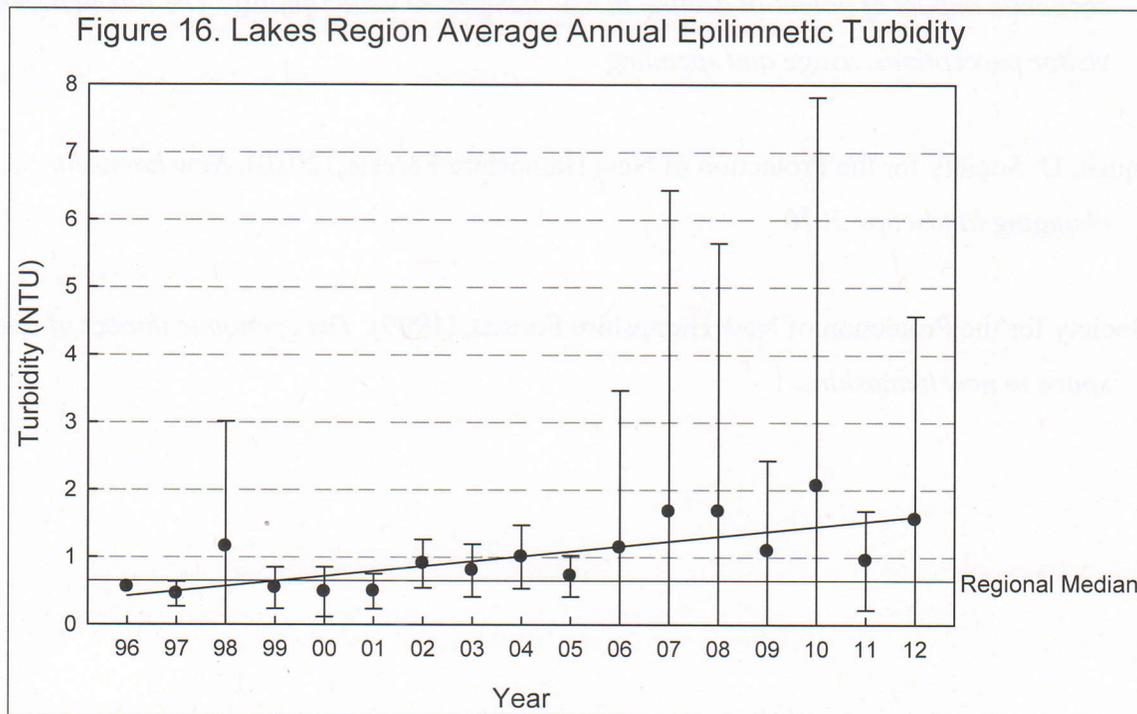
chloride in waterbodies should employ a combination of best management practices in regards to winter salting practices. State and local governments and private homeowners should evaluate the use of road salt and alternatives to reduce the amount of material applied while maintaining public safety. *For additional information on the relationship between conductivity and chloride, please refer to Appendix A. For additional information on best management practices please refer to Appendix B.*



Annual and Historical Deep Spot Turbidity Data Analysis

Turbidity in the water is caused by suspended matter (such as clay, silt, and algae) that cause light to be scattered and absorbed, not transmitted in straight lines through water. Water clarity is strongly influenced by turbidity. **The Class B surface water quality standard for turbidity is no greater than 10 NTUs over the lake background level. The median epilimnetic turbidity of the Lakes region is 0.65 NTU.**

Figure 16 represents the average annual epilimnetic turbidity for the Lakes region. The 2012 average epilimnetic turbidity at Lakes region lakes was 1.59 NTU. Regional epilimnetic turbidity saw large spikes from 2006 through 2010 and 2012 due to recurring cyanobacteria problems at French Pond in Henniker and Hunkins Pond in Sanbornton. Also, New Hampshire has experienced more significant rainfall events in recent years which may also be contributing to an increase in stormwater runoff and turbidity in the region's lakes.



Elevated deep spot turbidity levels are typically the result of stormwater runoff, algal or cyanobacteria blooms, and/or disturbance of lake bottom sediments. Stormwater BMPs should be implemented when possible to reduce the amount of suspended sediments and debris transported to surface water. Boating activity in shallow areas should adhere to rules specified by the NH Marine Patrol in regards to speed and no wake zones. If an algal or cyanobacteria bloom is observed, please contact DES immediately. *For additional information on stormwater BMPs, boating, algae, and cyanobacteria please refer to Appendices A and B.*

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APPENDIX A

**MONITORING PARAMETERS AND DATA
INTERPRETATION**

PARAMETER SUMMARY

Upon receiving the regional report, please read the *VLAP Water Quality Data Interpretation* section carefully. Current and historical water quality trends are described on an individual and regional basis. This Appendix serves to supplement the report by providing detailed descriptions of the chemical and biological data collected through VLAP, as well as helps understand the data interpretation section.

In the *VLAP Water Quality Data Interpretation* section, the epilimnetic deep spot data are compared to the respective New Hampshire median to provide an understanding of how the quality of your lake deep spot compares to other New Hampshire lake deep spots. Table 1 summarizes key biological, chemical, and physical parameters for all the state's lakes surveyed since 1976.

Table 1. Summer Epilimnetic Values of New Hampshire Lakes

Parameter	#*	Minimum	Maximum	Mean	Median
pH (units)	780	4.3	9.3	6.5**	6.6
Alkalinity (mg/L)	781	-3.0	85.9	6.6	4.9
Total Phosphorus (ug/L)	772	< 1	121	-	12
Conductivity (uMhos/cm)	768	13.1	696.0	59.4	40.0
Chloride (mg/L)	742	< 2	198	-	4
Chlorophyll-a (mg/m ³)	776	0.19	143.8	7.16	4.58
Transparency (m)***	663	0.40	13.0	3.7	3.2

* = the number of lake stations sampled

** = average pH reading; not average of hydrogen ion concentration

*** = does not include "visible on bottom" readings

Chlorophyll-a

Algae, also referred to as phytoplankton, are photosynthetic plants that contain chlorophyll but do not have true roots, stems, or leaves. They do, however, grow in many forms such as aggregates of cells (colonies), in strands (filaments), or as microscopic single cells. They may also be found growing on objects, such as rocks or vascular plants, on the lake bottom or free-floating in the water column. Regardless of their form, these primitive plants carry out photosynthesis and accomplish two very important roles in the process. First, they convert non-living compounds into organic, living, matter. These tiny plants form the base of a lake food chain. Microscopic animals, also known as zooplankton, graze upon algae like cows graze on grass in a field. Fish also feed on algae. Second, the water is oxygenated, aiding the chemical balance and biological health of the lake system.

Algae require sunlight, nutrients, and certain temperatures to thrive. All of these factors are constantly changing in a lake on a daily, seasonal, and yearly basis. Therefore, algal populations and the abundance of individual algal species naturally change in composition and distribution with changes in weather or lake quality. VLAP uses the measure of chlorophyll-a as an indicator of algal abundance. Algae are microscopic plants that contain the green pigment chlorophyll; the concentration of chlorophyll measured in the water gives an estimation of the algal concentration. If the chlorophyll concentration increases, this indicates an increase in the algal population.

Generally, a chlorophyll-a concentration of less than 5 mg/m³ typically indicates water quality conditions that are representative of oligotrophic lakes, while a chlorophyll-a concentration greater than 15 mg/m³ indicates eutrophic lakes. A chlorophyll concentration greater than 10 mg/m³ generally indicates an undesirable reproduction of algae, or what is generally referred to as an algal bloom, is occurring.

Table 2. Guidance Levels for NH Lake Chlorophyll-a Concentrations

Category	Chlorophyll-a (mg/m³)
Good 0 - 5	0.0 - 5.1
More than desirable	5.1 - 15.0
Nuisance amounts	> 15.0

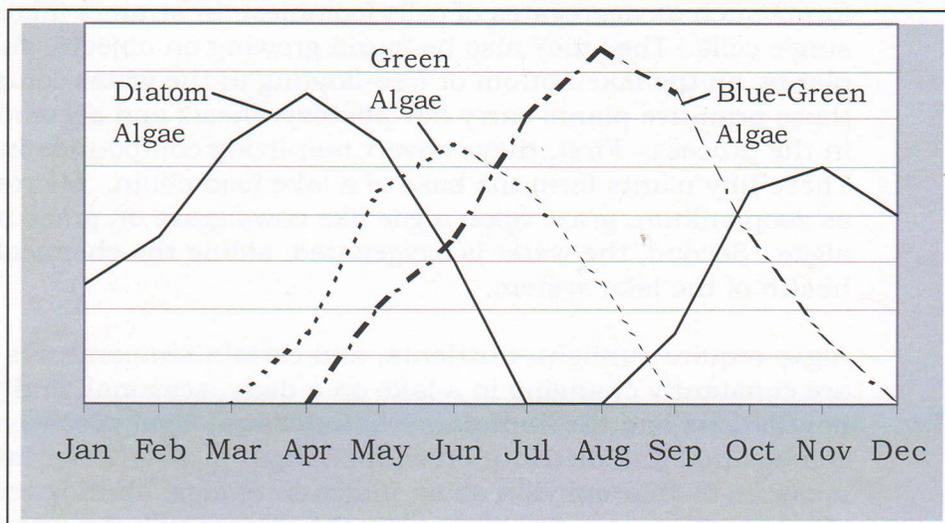
Phytoplankton

The type of phytoplankton (algae) and/or cyanobacteria present in a lake can be used as an indicator of general lake quality. The most direct way to obtain this information is to collect a plankton sample at the deep spot using a plankton net, count the quantity of phytoplankton and cyanobacteria contained in the sample, and identify the genera present in the sample using a microscope. An abundance of cyanobacteria (blue-green algae), such as *Anabaena*, *Aphanizomenon*, *Oscillatoria*, or *Microcystis* may indicate an excessive phosphorus concentration or that the lake ecology is out of balance. On the other hand, diatoms such as *Asterionella*, *Synedra*, and *Tabellaria* or golden-brown algae such as *Dinobryon* or *Chrysosphaerella*, are typical phytoplankton found in New Hampshire's less productive lakes. In shallow warm waters with minimal wave action

such as a cove, filamentous green algae may grow and form what looks like a mass of green cotton candy.

Phytoplankton populations undergo a natural **succession** during the growing season. Many factors influence this succession: amount of sunlight, availability of nutrients, temperature of the water, and the amount of zooplankton grazing. As shown in the diagram on the next page, it is natural for diatoms to be the dominant phytoplankton in the spring and then green algae in the early summer, while cyanobacteria may dominate in mid to late summer. The phytoplankton samples collected will show different dominant species, depending on when the samples were collected.

Figure 1. A Typical Seasonal Succession of Lake Algae



As shown in the diagram on the next page, it is natural for diatoms to be the dominant phytoplankton in the spring and then green algae in the early summer, while cyanobacteria may dominate in mid to late summer. The phytoplankton samples collected will show different dominant species, depending on when the samples were collected.

Phytoplankton Groups and Genera Common to New Hampshire Lakes and Ponds

Greens (Chlorophyta)

<i>Ankistrodesmus</i>	<i>Eudorina</i>	<i>Pandorina</i>	<i>Spirogyra</i>
<i>Arthrodesmus</i>	<i>Kirchneriella</i>	<i>Pediastrum</i>	<i>Staurastrum</i>
<i>Cosmarium</i>	<i>Dictyosphaerium</i>	<i>Quadrigula</i>	<i>Scenedesmus</i>
<i>Elakotothrix</i>	<i>Mougeotia</i>	<i>Sphaerocystis</i>	<i>Ulothrix</i>

Diatoms (Bacillariophyta)

<i>Asterionella</i>	<i>Melosira</i>	<i>Rhizosolenia</i>	<i>Synedra</i>
<i>Cyclotella</i>	<i>Fragilaria</i>	<i>Surirella</i>	<i>Tabellaria</i>

Dinoflagellates (Pyrrophyta)

<i>Ceratium</i>	<i>Peridinium</i>	<i>Gymnodinium</i>
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Cyanobacteria (Cyanophyta)

<i>Anabaena</i>	<i>Chroococcus</i>	<i>Gloeotrichia</i>	<i>Microcystis</i>
<i>Aphanizomenon</i>	<i>Coelosphaerium</i>	<i>Lyngbya</i>	<i>Oscillatoria</i>

Golden-Browns (Chrysochyta)

<i>Chrysosphaerella</i>	<i>Dinobryon</i>	<i>Mallomonas</i>	<i>Synura</i>	<i>Uroglenopsis</i>
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Cyanobacteria

Cyanobacteria are bacterial microorganisms that photosynthesize. Cyanobacteria may accumulate to form surface water scums. They produce a blue-green pigment but may impart a green, blue, or pink color to the water. Cyanobacteria are some of the earliest inhabitants of our waters, and they are naturally occurring in New Hampshire lakes. They are part of the aquatic food web and can be eaten by various grazers in the lake ecosystem, such as zooplankton and mussels. Research indicates that cell abundance increases as in-lake phosphorus levels increase.

Although they are most often seen when floating near the lake surface, many cyanobacteria spend a portion of their life cycle on the lake bottom during the winter months as akinetes. As spring provides longer periods of sunlight and warmer temperatures, cyanobacteria move up the water column and eventually rise toward the surface where they can form dense scums, often seen in mid to late summer and, weather permitting, sometimes well into the fall.

Certain cyanobacteria species produce toxins that adversely affect livestock, domestic animals, and humans. According to the World Health Organization (WHO), toxic cyanobacteria are found worldwide in both inland and coastal waters. The first reports of toxic cyanobacteria in New Hampshire occurred in the 1960s and 1970s. During the summer of 1999, several dogs died after ingesting toxic cyanobacteria from Lake Champlain in Vermont. The WHO has documented acute impacts to humans from cyanobacteria from the U.S. and around the world as far back as 1931. While most human health impacts have resulted from ingestion of contaminated drinking water, cases of illnesses have also been attributed to swimming in cyanobacteria infested waters.

The possible effects of cyanobacteria on the "health" of New Hampshire lakes and their natural inhabitants, such as fish and other aquatic life, are under study at this time. The Center for Freshwater Biology (CFB) at the University of New Hampshire (UNH) is currently examining the potential impacts of these toxins upon the lake food web. The potential human health hazards via exposure through drinking water and/or during recreational water activities are also a concern to toxicologists throughout the world.

Cyanobacteria occur in all lakes, everywhere. In New Hampshire, there are several common cyanobacteria that include: *Gleotrichia*, *Merismopedia*, *Anabaena*, *Aphanizomenon*, *Oscillatoria*, *Coelosphaerium*, *Lyngbya*, and *Microcystis*. *Anabaena* and *Aphanizomenon* produce **neurotoxins** that interfere with nerve function and have almost immediate effects when ingested. *Microcystis* and *Oscillatoria* are best known for producing **hepatotoxins** known as microcystins, which affect liver function. *Oscillatoria* and *Lyngbya* produce **dermatotoxins** which cause skin rashes.

Both DES and UNH have extensive lake monitoring programs. Generally, the water quality of New Hampshire's lakes is very good. However, DES strongly advises against using lake water for consumption, since neither in-home water treatment systems nor boiling the water will eliminate cyanobacteria toxins if they are present. If you observe a well-established potential cyanobacteria bloom or scum in the water, please adhere to the following:

- Do not wade or swim in the water!
- Do not drink the water or let children drink the water!
- Do not let pets or livestock into the water!

Exposure to toxic cyanobacteria may cause various symptoms, including nausea, vomiting, diarrhea, mild fever, skin rashes, eye and nose irritations, and general malaise. If anyone comes in contact with a dense cyanobacteria scum, they should rinse off with fresh water as soon as possible.

If you observe a Cyanobacteria scum, please call the cyanobacteria hotline at 419-9229. DES will sample the scum and determine if it contains cyanobacteria that are associated with toxin production. An advisory or warning will be issued indicating that the area may not be suitable for swimming. DES will issue a press release and will notify the town health officer, beach manager, and/or property owner, and the New Hampshire Department of Health and Human Services. DES will continue to monitor the water and will notify the appropriate parties regarding the results of the testing. When monitoring indicates that cyanobacteria are no longer present at levels that could harm humans or animals, the advisory will be removed.

Transparency

The Secchi Disk is a 20 centimeter disk with alternating black and white quadrants. It has been used since the mid-1800s to measure the transparency, or clarity, of water. The Secchi Disk is named after the Italian professor P.A. Secchi whose early studies established the experimental procedures for using the disk. Transparency, a measure of the water clarity, is affected by the amount of algae, color, and particulate matter within a lake. In addition, the transparency reading may be affected by wave action, sunlight, and the eyesight of the volunteer monitor.

Therefore, it is recommend that two or three monitors view the Secchi Disk while sampling, and then average all the measurements. DES recommends that all volunteer groups collect transparency readings with and without the use of a viewscope. A comparison of the transparency readings taken with and without the use of a viewscope indicates that the use of a viewscope typically increases the depth to which the Secchi Disk can be seen, particularly on sunny and windy days. The use of the viewscope results in less variability in transparency readings between monitors and between sampling events.

In general, a transparency greater than 4.5 meters indicates oligotrophic conditions, while a transparency of less than 2 meters is indicative of eutrophic conditions. The median transparency for New Hampshire lakes is 3.2 meters and the mean transparency is 3.7 meters.

Table 3. Guidance Levels for NH Lake Transparency

Category	Transparency (m)
Poor	< 2.0
Good	2.0 – 4.5
Exceptional	> 4.5

Total Phosphorus

Like every living organism, lakes age over time. Lake aging is the natural process by which a lake fills-in over thousands of years. Lakes fill-in with erosional materials carried in by rivers and streams, with materials deposited directly through the air, and with materials produced in the lake itself. From the time a lake is created, the aging process begins. Although many New Hampshire lakes have the same chronological age, they fill-in at different rates due to differences in lake depth and size and individual watershed characteristics.

Eutrophication is the term used to describe lake aging that is accelerated by the process of increased nutrient input to a lake. Lakes can age more quickly than they would naturally due to human impacts, a process called cultural eutrophication. This accelerated aging results from watershed activities that increase nutrient loading and/or the deposition of other debris, such as fertilizing lawns, converting forest or pasture to cropland, and creating new impervious areas such as rooftops, parking lots, and driveways. Studies in New Hampshire have shown that phosphorus exports from agricultural lands is at least five times greater than from forested lands, and in urban areas may be more than 10 times greater than from forested lands.

The key nutrient in the eutrophication process is phosphorus. Phosphorus is the limiting nutrient in New Hampshire lakes; the greater the phosphorus concentration in a lake, the greater the biological production. Phosphorus sources within a lake's watershed include septic system effluent, animal waste, lawn fertilizer, eroding roadways and construction sites, natural wetlands, and atmospheric deposition. Reducing the amount of phosphorus in a lake will typically result in reduced algal concentrations.

A deep spot epilimnetic (upper layer) phosphorus concentration of less than 10 ug/L typically indicates oligotrophic conditions, while an epilimnetic concentration greater than 20 ug/L is indicative of eutrophic conditions. The median phosphorus concentration in the epilimnion of New Hampshire lakes is 12 ug/L. The median phosphorus concentration in the hypolimnion is 14 ug/L.

Table 4. Guidance Levels for Epilimnetic Total Phosphorus Concentrations

Category	Total Phosphorus (ug/L)
Ideal	< 10
Average	10.1 – 20
More than desirable	20.1 – 40
Excessive	> 40

Dissolved Oxygen and Temperature

The presence of dissolved oxygen is vital to bottom-dwelling organisms as well as fish and amphibians. If the concentration of dissolved oxygen is low, typically less than 5 mg/L, species intolerant, meaning sensitive, to low oxygen levels, such as trout, will be forced to move up closer to the surface where there may be more dissolved oxygen but the water temperature is generally warmer, creating additional stress on the species.

Water temperature is also a factor in the dissolved oxygen concentration. Water can hold more oxygen at colder temperatures than at warmer temperatures. Therefore, a lake will typically have a higher concentration of dissolved oxygen during the winter, spring, and fall than during the summer. At least once during each summer, a DES biologist measures the dissolved oxygen and temperature at set intervals from the bottom of the lake to the surface. These measurements allow us to determine the extent of thermal stratification as well as the lake oxygen content.

Lakes that are thermally stratified and are more productive tend to experience a decrease in dissolved oxygen in the deep hypolimnion layer as summer progresses. This process is driven by bacteria in the lake sediments. The bacteria decompose the dead, organic matter that settles out of the water column. The decomposition process utilizes oxygen and results in oxygen depleted bottom waters. More productive lakes tend to have organic-rich sediments leading to greater decomposition and potentially creating a severe dissolved oxygen deficit of less than 1 mg/L.

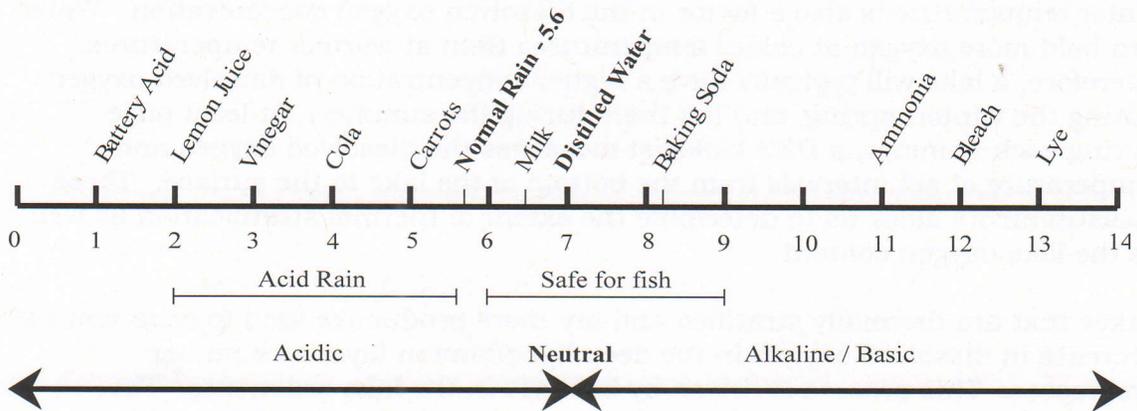
Low oxygen conditions can then trigger phosphorus that is normally bound to the sediment to be released back into the water column, a process called internal phosphorus loading. Internal phosphorus loading can be reflected in elevated phosphorus concentrations in hypolimnetic waters. Once lake mixing occurs (fall), phosphorus-rich hypolimnetic waters are re-distributed throughout the water column and can stimulate additional algal and/or cyanobacteria growth.

The dissolved oxygen percent saturation shows the percentage of oxygen that is dissolved in the water at a particular temperature and depth. Typically, during the summer, the percent saturation is lower in the deep hypolimnion layer due decomposition occurring at the lake bottom. A high reading at or slightly above the thermocline may be due to a layer of algae or cyanobacteria, producing oxygen during photosynthesis. Colder water is generally able to hold more dissolved oxygen than warmer water and generally, the deeper the water, the colder the temperature. As a result, a reading of 9 mg/L of oxygen at the warm lake surface will yield a higher percent saturation than a reading of 9 mg/L of oxygen at 25 meters where the water is much cooler.

pH

pH is measured on a logarithmic scale of 0 to 14. The lower the pH the more acidic the solution, due to higher concentrations of hydrogen ions. Acid rain typically has a pH of 3.5 to 5.5 due to pollutants added from the air. In contrast, the median pH for New Hampshire lakes is 6.6.

pH Scale



Lake pH is important to the survival and reproduction of fish and other aquatic life. A pH below 5.0 severely limits the growth and reproduction of fish. A pH between 6.0 and 7.0 is ideal. Many lakes exhibit lower pH values in the deeper waters than nearer the surface. This effect is greatest in the bottom waters of a thermally stratified lake. Decomposition carried out by bacteria in the lake bottom causes the pH to drop, while photosynthesis by phytoplankton in the upper layers causes the pH to increase. Tannic and humic acids released into the water by decaying plants can create more acidic waters particularly in areas influenced by wetlands. After the spring-time snow melt or a significant rain event, surface waters may have a lower pH than deeper waters and may take several weeks to recover, since snowmelt and rainfall typically have pH values of 5 or lower.

Table 5. Guidelines levels for NH Lake pH

Category	pH (units)
Critical (toxic to most fish)	< 5.0
Endangered (toxic to some aquatic organisms)	5.1 – 6.0
Satisfactory	> 6.0

Acid Neutralizing Capacity

Buffering capacity or acid neutralizing capacity (ANC) describes the ability of the lake to resist changes in pH by neutralizing acidic inputs. The higher the ANC, the greater ability the lake has to neutralize acidic inputs. This concept can be compared to a person taking an antacid to neutralize stomach acid indigestion. Low ANC lakes are not well-buffered. These lakes are often adversely affected by acidic inputs. Historically, New Hampshire has had naturally low ANC waters because of the prevalence of granite bedrock. Granite contains only a small amount of buffering elements such as calcium.

The median ANC for New Hampshire lakes is 4.9 mg/L while the mean ANC is 6.6 mg/L. This relatively low value makes surface waters vulnerable to the effects of acid precipitation.

Table 6. Guidelines for NH Lake Acid Neutralizing Capacity

Category	ANC (mg/L)
Acidified	< 0.0
Extremely Vulnerable	0.1 – 2.0
Moderately Vulnerable	2.1 – 10.0
Low Vulnerability	10.1 – 25.0
Not Vulnerable	> 25.0

Conductivity

Conductivity is the numerical expression of the ability of water to carry an electrical current. It is determined primarily by the number of ionic particles present. The soft waters of New Hampshire have traditionally low conductivity values, generally less than 50.0 uMhos/cm. However, specific categories of good and bad levels cannot be constructed for conductivity because variations in watershed geology can result in natural fluctuations in conductivity.

Generally, values in New Hampshire lakes exceeding 100 uMhos/cm indicate cultural, meaning human, disturbances. An increasing conductivity trend typically indicates the presence of point source and/or non-point sources of pollution in the watershed. The median conductivity for New Hampshire lakes is 40.0 uMhos/cm while the mean conductivity is 59.4 uMhos/cm.

Chloride

The chloride ion (Cl⁻) is found naturally in some surface and ground waters and in high concentrations in seawater. Higher-than normal chloride concentrations in freshwater, typically sodium chloride, that is used on foods and present in body wastes, can indicate sewage pollution. The use of highway deicing salts can also introduce chlorides to surface or ground waters.

Although chloride can originate from natural sources, most of the chloride that enters the environment in New Hampshire is associated with the storage and application of road salt. Road salt, which is most often sodium chloride, readily dissolves and enters aquatic environments in ionic forms. As such, chloride-containing compounds commonly enter surface water, soil, and ground water during late-spring snowmelt since the ground is frozen during much of the late winter and early spring.

Chloride ions are conservative, which means that they are not degraded in the environment and tend to remain in solution, once dissolved. Chloride ions that enter ground water can ultimately be expected to reach surface water and, therefore, influence aquatic environments and humans. Research has shown that elevated chloride levels can be toxic to freshwater aquatic life. Among the species tested, freshwater aquatic plants and invertebrates tend to be the most sensitive to chloride. In order to protect freshwater aquatic life in New Hampshire, the state has adopted acute and chronic chloride water quality standards of 860 and 230 mg/L, respectively, for surface waters. The chloride content in New Hampshire lakes is naturally low (median = 4 mg/L) in surface waters located in remote areas away from habitation. Higher values are generally associated with salted roadways and, to a lesser extent, with septic inputs.

Turbidity

Turbidity in water is caused by suspended matter, such as clay, silt, and algae that cause light to be scattered and absorbed, not transmitted in straight lines through the water. Secchi Disk transparency, and therefore water clarity, is strongly influenced by turbidity. High turbidity readings are often found in water adjacent to construction sites; during rain events unstable soil erodes and causes turbid water downstream. Also, improper sampling techniques, such as hitting the bottom of the lake with the Kemmerer bottle or stirring up the stream bottom when collecting tributary samples, may also cause high turbidity readings. The New Hampshire median for lake turbidity is 1.0 NTU.

Table 7. Statistical Summary Levels for NH Lake Turbidity

Category	Value (NTU)
Minimum	< 0.1
Maximum	22.0
Median	1.0

Bacteria

Surface waters contain a variety of microorganisms including bacteria, fungi, protozoa, and algae. Most of these occur naturally and have little or no impact on human health. Health risks associated with water contact occur generally when there is contamination from human sources or other warm blooded animals. Contamination arises most commonly from sources of fecal waste such as failing or poorly designed septic systems, leaky sewage pipes, nonpoint source runoff from wildlife habitat areas, or large congregations of waterfowl.

Swim beaches with heavy use, shallow swim areas, and/or poor water circulation also have commonly reported bacteria problems. Therefore, water used for swimming should be monitored for indicators of possible fecal contamination. Contamination is typically short-lived since most bacteria cannot survive long in surface waters as their natural environment is the gut of warm blooded animals. However, a recent study has shown that *E. coli* can survive fairly long periods of time in the sediments.

Specific types of bacteria, called indicator organisms, are the basis of bacteriological monitoring, because their presence indicates that sources of fecal contamination exist. Indicators estimate the presence and quantity of things that cannot easily be measured individually. We measure these sewage or fecal indicators rather than the pathogens themselves to estimate sewage or fecal contamination and, therefore, the possible risk of disease associated with using the water.

New Hampshire closely follows the bacteria standards recommended by the U.S. Environmental Protection Agency (EPA). Following a 1988 EPA report recommending the use of *Escherichia coli* (*E. coli*) as a standard for public water supplies and human contact, DES followed suit by adopting *E. coli* as the indicator organism. The standards for Class B waters specify that no more than 406 *E. coli* counts/100 mL, or a geometric mean based on at least three samples obtained over a 60 day period, be greater than 126 *E. coli* counts/100 mL. Designated public beach areas and other Class A waters, have more stringent standards: 88 *E. coli* counts/100 mL in any one sample, or a geometric mean of three samples over 60 days of 47 *E. coli* counts/100 mL.

APPENDIX B

BEST MANAGEMENT PRACTICES AND RESOURCES FOR POLLUTION CONTROL

BEST MANAGEMENT PRACTICES TO REDUCE ALGAL AND CYANOBACTERIA GROWTH

♣ FERTILIZERS

- DO NOT APPLY FERTILIZER WITHIN 25 FT. OF THE SHORELINE.
- USE ONLY LOW PHOSPHORUS, OR NO PHOSPHORUS, SLOW RELEASE NITROGEN FERTILIZERS BEYOND 25 FT. OF THE SHORELINE.
- TEST YOUR SOIL: YOU MAY NOT NEED FERTILIZER!
- RECOMMENDED: DON'T USE FERTILIZERS IF YOU OWN WATERFRONT PROPERTY!
 - *WD-SP-2 Proper Lawn Care in the Protected Shoreland*
<http://des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-2.pdf>
 - *Green Grass and Blue Water: Water Friendly Lawn Care Recommendations*
<http://des.nh.gov/organization/commissioner/pip/newsletters/greenworks/documents/201003grnworks.pdf>
 - *New England Regional Nitrogen and Phosphorus Fertilizer and Associated Management Practice Recommendations For Lawns Based on Water Quality Considerations* http://www.lawntolake.org/PDFs/NE_WQ_Fert_Rec.pdf

♣ STORMWATER

- MANAGE AND REDUCE STORMWATER RUNOFF FROM YOUR WATERFRONT PROPERTY (obtain permits if necessary).
- PLANT RAIN GARDENS AND WATERFRONT BUFFERS
- INSTALL RAIN BARRELS
- CONSTRUCT VEGETATED SWALES AND INFILTRATION TRENCHES
- USE PERVIOUS PAVEMENT OR PAVERS
- *Homeowners Guide to Stormwater Management: Do-It-Yourself Stormwater Solutions for Your Home*
<http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-11.pdf>
- *A Shoreland Homeowner's Guide to Stormwater Management*
<http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/nhdes-wd-10-8.pdf>
- *Best Management Practices to Control Nonpoint Source Pollution A Guide for Citizens and Town Officials*
<http://des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-03-42.pdf>

Rain Garden



BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL

◆ STABILIZE SHORELINES

- LEAVE TREES AND SHRUBS IN PLACE
- PLANT VEGETATED BUFFERS
 - *Landscaping at the Water's Edge: An Ecological Approach*
<http://extension.unh.edu/resources/>
 - *WD-SP-5 Vegetation Maintenance within the Protected Shoreland*
<http://des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-5.pdf>

Vegetated Buffer



◆ MANAGE STEEP SLOPES

- PLANNING AND DEVELOPMENT
- ORDINANCES
 - *Innovative Land Use Planning Techniques*
http://des.nh.gov/organization/divisions/water/wmb/repp/innovative_land_use.htm
 - *WD-WMB-16 Watershed Districts and Ordinances*
<http://des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-16.pdf>
 - *EPA New England*

◆ REDUCE IMPERVIOUS COVER

- LOW-IMPACT DEVELOPMENT
- ORDINANCES
 - *Innovative Land Use Planning Techniques*
http://des.nh.gov/organization/divisions/water/wmb/repp/innovative_land_use.htm
 - *New Hampshire Stormwater Manual Volumes I, II and III*
<http://des.nh.gov/organization/divisions/water/stormwater/manual.htm>
 - *UNH Stormwater Center*
<http://www.unh.edu/unhsc/>
 - *EPA Low Impact Development*
<http://water.epa.gov/polwaste/green/>

Pervious Pavement



◆ **MANAGE ROADWAYS**

- CONSTRUCTION
- ON-SITE STORMWATER TREATMENT
- CULVERT INSTALLATION AND MAINTENANCE

- *New Hampshire Stormwater Manual Volumes I, II and III*
<http://des.nh.gov/organization/divisions/water/stormwater/manual.htm>

Vegetated Swale



BEST MANAGEMENT PRACTICES TO MINIMIZE PHOSPHORUS LOADING

♣ FERTILIZERS

- DO NOT APPLY FERTILIZER WITHIN 25 FT. OF THE SHORELINE.
- USE ONLY LOW PHOSPHORUS, OR NO PHOSPHORUS, SLOW RELEASE NITROGEN FERTILIZERS BEYOND 25 FT. OF THE SHORELINE.
- TEST YOUR SOIL: YOU MAY NOT NEED FERTILIZER!
- RECOMMENDED: DON'T USE FERTILIZERS IF YOU OWN WATERFRONT PROPERTY!
 - *WD-SP-2 Proper Lawn Care in the Protected Shoreland*
<http://des.nh.gov/organization/commissioner/pip/factsheets/sp/documents/sp-2.pdf>
 - *Green Grass and Blue Water: Water Friendly Lawn Care Recommendations*
<http://des.nh.gov/organization/commissioner/pip/newsletters/greenworks/documents/201003grnworks.pdf>
 - *New England Regional Nitrogen and Phosphorus Fertilizer and Associated Management Practice Recommendations For Lawns Based on Water Quality Considerations*
http://www.lawntolake.org/PDFs/NE_WQ_Fert_Rec.pdf



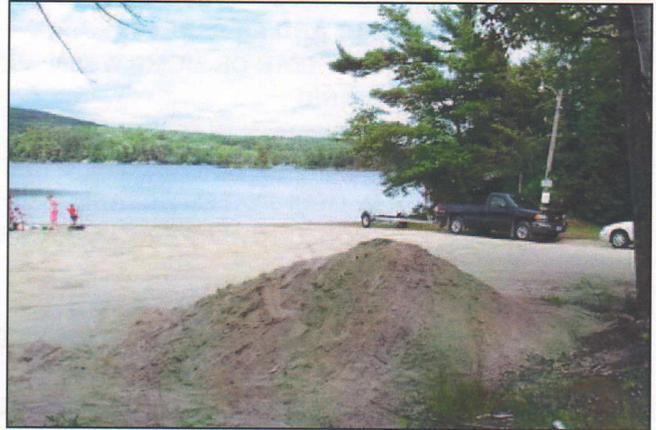
♣ SEPTIC SYSTEMS

- KNOW THE BASICS! TYPE, AGE, SIZE, AND LOCATION!
- INSPECT YOUR SEPTIC TANK ANNUALLY AND PUMP AT LEAST EVERY TWO TO THREE YEARS.
- REPLACE ANTIQUATED/FAILED SYSTEMS!
- SEPTIC SITE ASSESSMENT REQUIRED WHEN SELLING WATERFRONT PROPERTY.
 - *WD-SSB-2 Care and Maintenance of Your Septic System*
<http://des.nh.gov/organization/commissioner/pip/factsheets/ssb/index.htm>
 - *WD-SSB-10 Selling Developed Waterfront Property Site Assessment Required*
<http://des.nh.gov/organization/commissioner/pip/factsheets/ssb/documents/ssb-10.pdf>
 - *WD-SSB-13 You and Your Septic System*
<http://des.nh.gov/organization/commissioner/pip/factsheets/ssb/documents/ssb-13.pdf>
 - EPA Fact Sheet: Preventing Septic System Failure
[http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=rowse&Rbutton=detail&bmp=25](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=25)

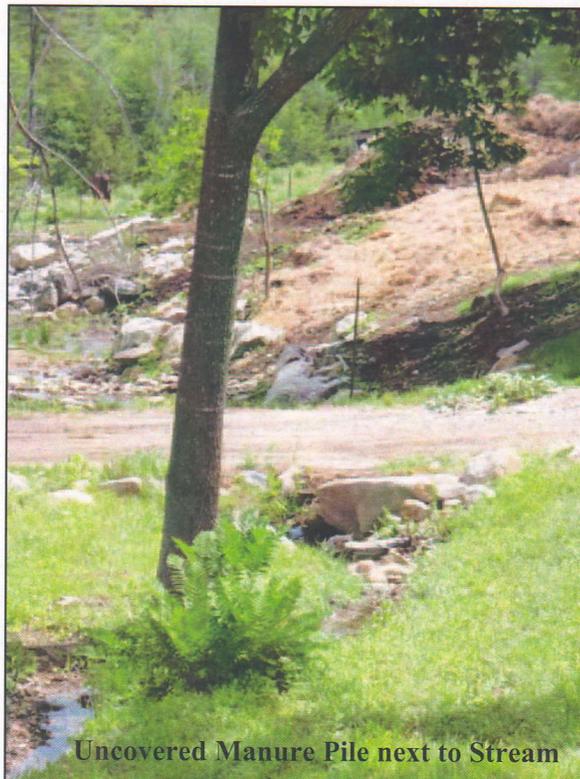
♣ SAND DUMPING

- PERMITS REQUIRED FOR BEACH CONSTRUCTION!
- CONSTRUCT PERCHED BEACHES IF POSSIBLE.
- PERMITS REQUIRED FOR BEACH REPLENISHMENT IF MORE FREQUENT THAN ONCE EVERY SIX YEARS!
 - Administrative Rules
<http://des.nh.gov/organization/commissioner/legal/rules/documents/env-wt100-900.pdf>
 - *WD-BB-15 Beach Construction-Water Quality Impacts of Dumping Sand*
<http://des.nh.gov/organization/commissioner/pip/factsheets/bb/documents/bb-15.pdf>

Sand Pile near Water

**♣ AGRICULTURE**

- PROPERLY STORE AND MANAGE MANURE PILES!
- CONTROL RUNOFF FROM FIELDS, PASTURES AND ROOFS!
- LIMIT AND RESTRICT ACCESS OF LIVESTOCK TO SURFACE WATERS!
- LIMIT AND CONTROL FERTILIZER USE!
- MANAGE DOMESTIC PET WASTE!
 - NH Department of Agriculture Best Management Practices
<http://www.nh.gov/agric/divisions/markets/documents/bmp.pdf>



Uncovered Manure Pile next to Stream

BEST MANAGEMENT PRACTICES FOR BOAT OWNERS AND MARINAS

♣ BOAT WASHING AND CLEANING

- DON'T WASH NEAR OR DUMP WASH WATER IN STORM DRAINS!
- DON'T WASH BOATS IN THE WATER!
- WASH BOATS FAR FROM SURFACE WATERS AND/OR IN DESIGNATED AREAS!
- USE ENVIRONMENTALLY FRIENDLY CLEANER IF NECESSARY.
- USE A BUCKET AND SPONGE TO WASH THE INTERIOR AND DISCHARGE WASH WATER APPROPRIATELY!
- DO NOT DISCHARGE BILGE WATER OVERBOARD!
- USE BILGE SOCKS TO SOAK UP PETROLEUM WASTE.
- USE NON-TOXIC, ENVIRONMENTALLY SAFE BILGE CLEANERS.

- *WD-BB-58 Boat Washing and Engine Winterization for Boat Owners*

<http://des.nh.gov/organization/commissioner/pip/factsheets/bb/documents/bb-58.pdf>

- *WD-WMB-12 Management of Bilge Water for Marinas*

<http://des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-12.pdf>



♣ SEWAGE AND GREY WATER DISPOSAL

- IT IS ILLEGAL TO DISCHARGE SEWAGE AND/OR GREY WATER TO SURFACE WATERS OF THE STATE!
- USE DESIGNATED SEWAGE PUMPOUT STATIONS LOCATED AT MARINAS!
- CALL A MOBILE SEWAGE PUMPOUT BOAT!
- *WD-WMB-2 Marine Sanitation Devices-Equipping Your Boat to Comply with the Law*
<http://des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-2.pdf>
- *WD-WMB-22 No Discharge Areas in New Hampshire*
<http://des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-22.pdf>

♣ ENGINE MAINTENANCE

- PERFORM MAINTENANCE ACTIVITIES ON IMPERVIOUS SURFACES.
- DO NOT WASH ENGINE OVER BARE GROUND OR WATER!
- USE BILGE SOCKS ROUTINELY TO ABSORB OIL AND PETROLEUM PRODUCTS.
- ANTIFREEZE IS NOT NECESSARY TO WINTERIZE ENGINES!
- USE PROPYLENE GLYCOL TO WINTERIZE ENGINE, IF YOU MUST!
- *Best Management Practices for New Hampshire Marinas*
<http://des.nh.gov/organization/commissioner/pip/publications/co/documents/co-06-2.pdf>

BEST MANAGEMENT PRACTICES FOR ROAD SALT

ROAD SALT

- REMOVE SNOW FIRST; DON'T USE SALT TO DO THE JOB.
- CALIBRATE EQUIPMENT FOR AN ACCURATE SALT APPLICATION RATE.
- CHOOSE THE RIGHT DE-ICING MATERIAL FOR THE JOB!
 - *WD-WMB-4 Road Salt and Water Quality*
<http://des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-4.pdf>
 - *Technology and BMPs for Salt Reduction*
<http://des.nh.gov/organization/divisions/water/wmb/was/salt-reduction-initiative/tech-assist-bmp-practices.htm>

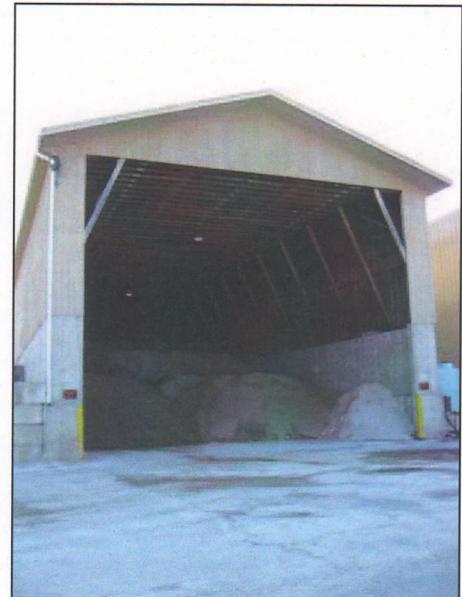
SNOW DUMPING

- STORE SNOW 25 FT. FROM HIGH WATER MARK NEAR FLOWING SURFACE WATERS.
- DON'T STORE WITHIN CERTAIN DISTANCES OF PRIVATE WELLS, COMMUNITY WATER SUPPLY WELLS AND MUNICIPAL WELLS.
- INSTALL A SILT FENCE BETWEEN STORAGE AND SURFACE WATER.
- CLEAR ANY DEBRIS BEFORE AND AFTER USE OF STORAGE SITE.
 - *WD-WMB-3 Snow Disposal Guidelines*
<http://des.nh.gov/organization/commissioner/pip/factsheets/wmb/documents/wmb-3.pdf>

SALT STORAGE

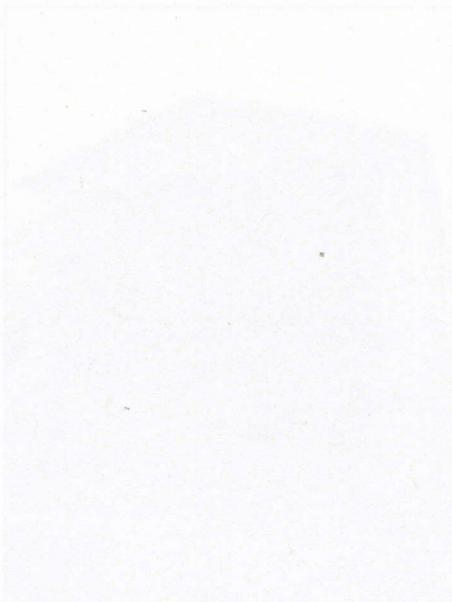
- STORE SALT PILES ON AN IMPERVIOUS SURFACE!
- LOADING AREAS SHOULD HAVE IMPERVIOUS SURFACES AND SHOULD BE SLOPED AWAY TO PREVENT STORMWATER FROM ENTERING THE STRUCTURE.
- ALL SALT STORAGE AREAS SHOULD BE COMPLETELY ENCLOSED BUT AT A MINIMUM MUST BE COVERED!
- STORAGE AREAS SHOULD BE LOCATED AWAY FROM SURFACE WATERS, WELLS, RESERVOIRS, AND STRATIFIED DRIFT AQUIFERS.
- INSPECT STORAGE STRUCTURES ANNUALLY FOR MAINTENANCE.
- BRINE HOLDING TANKS SHOULD BE MAINTAINED TO PREVENT RELEASE TO DRAINS, GROUNDWATER AND SURFACE WATER.
- BRINE COLLECTION BASINS MUST BE LINED AND MAY NEED TO BE COVERED.
 - *WD-DWGB-22-30 Storage and Management of Deicing Materials*
<http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/documents/dwgb-22-30.pdf>
 - *WD-DWGB-22-10 Wastewater Discharged from Vehicle Washing*
<http://des.nh.gov/organization/commissioner/pip/factsheets/dwgb/documents/dwgb-22-10.pdf>

Salt Storage Facility



Appendix C

Regional VLAP Lake Groupings



Dartmouth Lake Sunapee Region

Lake	Town	County
Armington Lake	Piermont	Grafton
Ashuelot Pond	Washington	Sullivan
Baptist Pond	Springfield	Sullivan
Blaisdell Lake	Sutton	Merrimack
Canaan St. Lake	Canaan	Grafton
Chalk Pond	Newbury	Merrimack
Chase Pond	Wilmot	Merrimack
Crescent Lake	Acworth	Sullivan
Dutchman Pond	Springfield	Sullivan
Eastman Pond	Grantham	Sullivan
Goose Pond	Canaan	Grafton
Halfmoon Pond	Washington	Sullivan
Island Pond	Washington	Sullivan
Katherine Lake	Piermont	Grafton
Kezar Lake	North Sutton	Merrimack
Kilton Pond	Grafton	Grafton
Kolelemook Lake	Springfield	Sullivan
Lake Sunapee	Sunapee	Sullivan
Ledge Pond	Sunapee	Sullivan
Little Lake Sunapee	New London	Merrimack
Long Pond	Lempster	Sullivan
Mascoma Lake	Enfield	Grafton
Massasecum Lake	Bradford	Merrimack
May Pond	Washington	Sullivan
Messer Pond	New London	Merrimack
Mill Pond	East Washington	Sullivan
Millen Pond	Washington	Sullivan
Mountainview Lake	Sunapee	Sullivan
Otter Pond	Sunapee	Sullivan
Perkins Pond	Sunapee	Sullivan
Pleasant Lake	New London	Merrimack
Post Pond	Lyme	Grafton
Rand Pond	Goshen	Sullivan
Reservoir Pond	Lyme	Grafton
Rockybound Pond	Croydon	Sullivan
Spectacle Pond	Enfield	Grafton
Stocker Pond	Grantham	Sullivan
Tarleton Lake	Piermont	Grafton
Todd Lake	Newbury	Merrimack
Waukeena Lake	Danbury	Merrimack

Great North Woods Region

Lake	Town	County
Burns Pond	Whitefield	Coos
Clarksville Pond	Clarksville	Coos
Forest Lake	Whitefield	Coos
Martin Meadow Pond	Lancaster	Coos

Lakes Region

Lake	Town	County
Bradley Lake	Andover	Merrimack
Chestnut Pond	Epsom	Merrimack
Clement Pond	Hopkinton	Merrimack
Clough Pond	Loudon	Merrimack
Cole Pond	Andover	Merrimack
Crystal Lake	Gilmanton	Belknap
French Pond	Henniker	Merrimack
Halfmoon Pond	Barnstead	Belknap
Hermit Pond	Sanbornton	Belknap
Highland Lake	Andover	Merrimack
Hills Pond	Alton	Belknap
Hunkins Pond	Sanbornton	Belknap
Kimball Pond	Canterbury	Merrimack
Knowles Pond	Northfield	Merrimack
Lees Pond	Moultonborough	Carroll
Locke Lake	Barnstead	Belknap
Loon Pond	Gilmanton	Belknap
Lower Beech Pond	Tuftonboro	Carroll
Mirror lake	Tuftonboro	Carroll
New Pond	Canterbury	Merrimack
Pemigewasset Lake	Meredith	Belknap
Pillsbury Lake	Webster	Merrimack
Rust Pond	Wolfeboro	Carroll
Suncook Pond, Lower	Barnstead	Belknap
Suncook Pond, Upper	Barnstead	Belknap
Sunset Pond	Alton	Belknap
Tom Pond	Warner	Merrimack
Tucker Pond	Salisbury	Merrimack
Turee Pond	Bow	Merrimack
Walker Pond	Boscawen	Merrimack
Waukewan Lake, Mayo	Meredith	Belknap
Waukewan Lake, Winona	Meredith	Belknap
Webster Lake	Franklin	Merrimack
Wicwas Lake	Meredith	Belknap
Winnepocket Lake	Webster	Merrimack
Winnisquam, Mohawk Isl.	Belmont	Belknap
Winnisquam, Pot Isl.	Laconia	Belknap
Winnisquam, Three Isl.	Laconia	Belknap
Winona, Lake	New Hampton	Belknap

Merrimack Valley Region

Lake	Town	County
Angle Pond	Hampstead	Rockingham
Beaver Lake	Derry	Rockingham
Big Island Pond	Derry	Rockingham
Canobie Lake	Windham	Rockingham
Captains Pond	Salem	Rockingham
Cobbetts Pond	Windham	Rockingham
Crystal Lake	Manchester	Hillsborough
Deering Lake	Deering	Hillsborough
Dorrs Pond	Manchester	Hillsborough
Flints Pond	Hollis	Hillsborough
Great Pond	Kingston	Rockingham
Long Pond	Pelham	Hillsborough
Nutts Pond	Manchester	Hillsborough
Otternick Pond	Hudson	Hillsborough
Pine Island Pond	Manchester	Hillsborough
Pleasant Pond	Francestown	Hillsborough
Powwow Pond	East Kingston	Rockingham
Pratt Pond	New Ipswich	Hillsborough
Robinson Pond	Hudson	Hillsborough
Rock Pond	Windham	Rockingham
Scobie Pond	Francestown	Hillsborough
Sebbins Pond	Bedford	Hillsborough
Stevens Pond	Manchester	Hillsborough

Monadnock Region

Lake	Town	County
Chapman Pond	Sullivan	Cheshire
Contention Pond	Hillsborough	Hillsborough
Contoocook Lake	Jaffrey	Cheshire
Dublin Lake	Dublin	Cheshire
Emerson Pond	Rindge	Cheshire
Forest Lake	Winchester	Cheshire
Franklin Pierce Lake (Jackman Reservoir)	Hillsborough	Hillsborough
Frost Pond	Jaffrey	Cheshire
Gilmore Pond	Jaffrey	Cheshire
Granite Lake	Stoddard	Cheshire
Gregg Lake	Antrim	Hillsborough
Harrisville Pond	Harrisville	Cheshire
Highland Lake	Stoddard	Cheshire
Howe Reservoir	Dublin	Cheshire
Island Pond	Stoddard	Cheshire
Laurel Lake	Fitzwilliam	Cheshire
Monomonac Lake	Rindge	Cheshire
Norway Pond	Hancock	Hillsborough
Nubanusit Pond	Nelson	Cheshire
Pearly Pond	Rindge	Cheshire
Pool Pond	Rindge	Cheshire
Rockwood Pond	Fitzwilliam	Cheshire
Russell Reservoir	Harrisville	Cheshire
Sand Pond	Marlow	Cheshire
Silver Lake	Harrisville	Cheshire
Skatutakee, Lake	Harrisville	Cheshire
Spofford Lake	Chesterfield	Cheshire
Stone Pond	Marlborough	Cheshire
Swanzey Lake	Swanzey	Cheshire
Thorndike Pond	Jaffrey	Cheshire
Warren Lake	Alstead	Cheshire
Wilson Pond	Swanzey	Cheshire

Seacoast Region

Lake	Town	County
Ayers Pond	Barrington	Strafford
Baxter Lake	Farmington	Strafford
Governor's Lake	Raymond	Rockingham
Harantis Lake	Chester	Rockingham
Harvey Lake	Northwood	Rockingham
Jeness Pond	Northwood	Rockingham
Little Round Pond (Lake Ivanhoe)	Wakefield	Carroll
Northwood Lake	Northwood	Rockingham
Onway Lake	Raymond	Rockingham
Pawtuckaway Lake	Nottingham	Rockingham
Phillips Pond	Sandown	Rockingham
Pleasant Lake	Deerfield	Rockingham
Showell Pond	Sandown	Rockingham
Sunrise Lake	Middleton	Strafford
Willand Pond	Dover	Strafford

White Mountains Region

Lake	Town	County
Bearcamp Pond	Sandwich	Carroll
Berry Bay	Freedom	Carroll
Broad Bay	Ossipee	Carroll
Conner Pond	Ossipee	Carroll
Danforth Pond, Lower	Freedom	Carroll
Dodge Pond	Lyman	Grafton
Gardner Lake	Bath	Grafton
Lake Ossipee	Ossipee	Carroll
Leavitt Bay	Ossipee	Carroll
Loon Lake	Plymouth	Grafton
Moores Pond	Tamworth	Carroll
Mountain Lake, North	Haverhill	Grafton
Mountain Lake, South	Haverhill	Grafton
Partridge Pond	Littleton	Grafton
Pea Porridge Pond, Big	Madison	Carroll
Pea Porridge Pond, Middle	Madison	Carroll
Province Lake	Effingham	Carroll
Round Pond	Lyman	Grafton
Stinson Lake	Rumney	Grafton
White Oak Pond	Holderness	Grafton