2018 Watershed Management Bureau in Review: Program achievements and data quality report

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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EXECUTIVE SUMMARY

In 2018, the NHDES Watershed Management Bureau operated 22 programs to monitor, protect and restore the state's surface waters, including its lakes and ponds, rivers and streams, coast, wetlands, and public bathing facilities. The diverse nature of these programs is exemplified by their activities that range from water quality monitoring, exotic species management and regular sampling of beaches, to funding vessel waste disposal facilities, support of nonpoint source pollution control activities and inspection of pools and spas. In all cases, these programs are designed to promote the health of one of New Hampshire's most valuable natural resources: water.

A key element to the success of each of these programs is the availability of a modern laboratory. The Jody Connor Limnology Center (JCLC) serves as the primary hub of activity in preparation for field surveys, water sampling processing and tracking. In 2018, the JCLC processed nearly 15,000 water quality samples and approximately 2,500 identifications of biological organisms. The laboratory's capabilities range from simple tests of pH in water to the determination of mercury content in fish tissue. In addition, Colby-Sawyer College maintains a satellite laboratory that provides water analyses capabilities in cases where samples cannot be transported to Concord. Collectively, these laboratories are critical to the support of two valuable volunteer surface water quality monitoring programs that successfully monitored over 180 lakes and ponds and 3,000 river miles in 2018.

In 2018, well over 100,000 data records were collected from the state's surface waters by the Watershed Management Bureau. With such a high volume of data, maintaining and managing data quality is critical. Data quality is ensured through program specific Quality Assurance Project Plans (QAPP) or detailed standard operating procedure (SOPs). In both cases, these documents spell out specific procedures to confirm the acceptance of only high quality data. NHDES maintains a catalog of these documents and updates them as needed or required by EPA.

Data meeting the quality assurance standards are stored in NHDES' environmental monitoring database (EMD). The EMD houses millions of unique data points from over 39,000 monitoring stations and 800 individual projects. Data generated by the Watershed Management Bureau are entered through automated lab imports, batch uploads and manual entry. Applicable data are flowed directly to EPA's STORET/WQX. The EMD serves as a vital component in meeting the bureau's data management needs and responsibilities.

All this data is used for a variety of management purposes that are taken on by numerous Watershed Management Bureau programs. Activities include assessment reports, total maximum daily loads, watershed management and other ways of protecting and restoring water quality. While these programs are not strictly related to data gathering and quality assurance for water quality parameters, they each keep track of metrics to document program success and output.

The following report describes the various program activities within the Watershed Management Bureau that collected data, utilized the facilities of the JCLC in 2018, or provided services to the public. The report is organized into two primary sections; the first section provides individual program summaries in a standardized template for quick reference; the second section includes a more detailed account of the specific accomplishments of each program and, where applicable, data quality assessments.

I. WATERSHED AMBIENT MONITORING PROGRAM SUMMARIES

1.1 Jody Connor Limnology Center (JCLC)

Challenges Addressed: The JCLC practices rigorous science to ensure that water quality data can be used by communities and industry to make decisions about lake and river management. JCLC also has the capacity to respond to water quality emergencies such as toxic algal blooms and chemical spills. The JCLC provides the necessary equipment, expertise, and space to allow for the processing of thousands of water quality samples and field work associated with surface water assessments conducted throughout the state.

Data usage: Data processed through JCLC is used to complete surface water quality assessments, for issuance of public health advisories, completion of waterbody-specific reports, compliance with regulatory activities and general investigations of surface water quality.

Approach: JCLC provides equipment, analytical services and sampling services to support probability based, targeted and trend monitoring activities.

Parameters measured: JCLC and the Colby-Sawyer College satellite laboratory provide analysis for approximately 25 chemical and physical parameters as well as more than a half dozen biological parameters.

Method of data collection: Discrete samples are analyzed by JCLC. Continuous data records are generated by deployment of remote water quality sensors.

Achievements: In 2018, JCLC and the Colby-Sawyer College satellite laboratory created 18,358 chemical or physical data records. JCLC analyzed 428 biological samples and made 2455 species-specific identifications.

Quality Assurance Measures: JCLC and the Colby-Sawyer satellite laboratory each maintain a laboratory manual detailing quality assurance measures and procedures for each specific analysis. In-lab quality assurance measures include blanks, duplicate analyses, continuing calibration verification (CCV) samples and spikes where appropriate. All quality assurance measures are documented by parameter in individual bench logs as well as the JCLC database; over 2,700 quality assurance measures were performed in 2018.

Funding: General funds (1000 account) and federal funds (Account 7602).

Program needs: Vital roles within the JCLC are shared amongst Watershed Management Bureau monitoring staff. The Lab Safety Officer, QA/QC Officer and Data Administrator all have ambient monitoring programs responsibilities. The JCLC would benefit from a staff position that is dedicated to those roles.

1.2 Volunteer Lake Assessment Program (VLAP)

Challenges Addressed: VLAP works with lake associations to assess and protect the health of New Hampshire's lakes and ponds. Over 500 volunteers monitor summer water quality at over 170 lakes. These data allow for the identification of potential problems and to fix them before they impact recreation or fishing. VLAP reports are routinely requested by realtors and lakefront property buyers.

Data usage: Data generated through VLAP are utilized annually to create approximately 180 annual individual lake reports. VLAP is a primary source of lake and pond data utilized to complete surface water quality assessments for the federally required section 305(b) / 303(d) water quality report. VLAP data are also utilized by NHDES to complete Total Maximum Daily Loads (TMDLs), watershed management plans, and by lake associations and organizations to apply for grant funds.

Approach: Trend Monitoring - Repetitive visits to set of established sampling locations annually or on an established schedule for the purpose of tracking water quality parameters over time.

Parameters measured: VLAP measures a total of 13 chemical and biological parameters including: pH, conductivity, turbidity, apparent color, chloride, total phosphorus, alkalinity, *E. coli*, dissolved oxygen, temperature, transparency, chlorophyll-*a* and phytoplankton (including cyanobacteria).

Method of data collection: VLAP collects discrete samples at multiple in-lake and tributary stations.

Achievements: In 2018, VLAP, and its associated satellite laboratory Colby-Sawyer College, accomplished the following:

- 458 individual sampling events conducted by volunteers and VLAP biologists.
- 182 lake deep spots and 500 river/stream stations monitored.
- 15,561 individual chemical and biological sample results generated.
- Approximately 3,700 hours collecting water quality samples.
- Approximately $94,000 value of volunteer time collecting water quality samples.

Quality Assurance Measures: VLAP operates under an EPA-approved Quality Assurance Project Plan (QAPP), RFA# 14087, dated April 2019. VLAP is required to update the plan once every five years and submit to EPA for approval. VLAP is also required to complete an annual program audit detailing any deviations from the methods and data criteria stated in the QAPP and resolutions to those deviations.

Funding: General Fund (1000 Account).

Program needs: VLAP receives requests from lake associations and Watershed Management Bureau staff to add lakes or increase monitoring to supplement the development of water quality plans and to understand current lake conditions. VLAP is at its maximum capacity and can no longer accept new lakes. To provide expanded services requires additional staff in order to support operations in the Jody Connor Limnology Center and complete annual biologist visits to participating lakes.

1.3 Volunteer River Assessment Program (VRAP)

Challenges Addressed: VRAP was initiated in 1998 to promote awareness and education of the importance of maintaining water quality in New Hampshire's rivers and streams. VRAP volunteers monitor water quality from May through October in rivers and streams throughout the state, allowing NHDES to analyze water quality trends, identify potential problems and fix them before they cause degradation in water quality.

Data usage: VRAP is primarily a data procurement mechanism to determine whether rivers or streams are impaired or potentially impaired based on surface water quality standards and designated uses (e.g., swimming, fishing and aquatic life support). Data collected through VRAP are used to develop the federally required section 305(b) / 303(d) water quality report. Almost 40% percent of the surface water quality assessments of riverine assessment units included in the 2016 303(b) report was provided by VRAP. Currently this data contributed to the assessment of over 3,000 miles of rivers and streams.

Approach: VRAP conducts trend monitoring via repetitive visits to established sampling locations on an established schedule. Targeted monitoring is also conducted to investigate suspected sources of pollution or to measure the water quality impacts as they relate to changes in the landscape such as development.

Parameters measured: VRAP measures field parameters including dissolved oxygen, pH, turbidity, specific conductance, water temperature and flow. Laboratory parameters include *E.coli*, nutrients, chloride, and chlorophyll-*a*.

Method of data collection: VRAP collects discrete samples at multiple river and riverine impoundment stations.

Achievements: In 2018, data generated by VRAP volunteers are summarized as follows:

- 30 VRAP groups supported.
- 225 river/stream stations monitored across 3,000 miles of streams
- 5,775 individual chemical and biological sample results generated.
- Approximately 1,500 hours spent by individuals collecting water quality samples.
- Approximately $30,000 value of volunteer time collecting water quality samples.

Quality Assurance Measures: VRAP operates under an EPA-approved QAPP dated May 17, 2017. VRAP is required to update the plan once every five years and submit to EPA for approval. VRAP is in the process of updating the QAPP. VRAP is also required to complete an annual program audit detailing any deviations from the methods and data criteria stated in the QAPP and the resolutions to those deviations.

Funding: Federal funds (Account 7602)

Program needs: The day to day operations of VRAP are currently done by a part time staff member. If this position were to be made full time it would reduce the need for assistance from current ful-time staff, reduce turnover in the current part time position, and provide consistency in program operations.

1.4 River Trend Monitoring Program (RTMP)

Challenges Addressed: RTMP began in the early 1970s, and prior to 2012, it was known as the Ambient River Monitoring Program (ARMP). In 2013, NHDES updated its surface water monitoring strategy to include 40 river and stream stations that are visited three to five times per year. The revised monitoring network includes approximately 20 new stations that span a wide range of watershed sizes, levels of development, and geographic locations. Data collected since 1990 are maintained in NHDES' Environmental Monitoring Database (EMD). The RTMP is implemented directly by NHDES staff and measures water quality in rivers and streams throughout the state. Ultimately, it is used by many programs both within the bureau and outside.

Data usage: RTMP is primarily a data procurement mechanism to determine whether river or stream conditions are declining, improving or remaining stable over time. The data are also used to assess if river segments are impaired or potentially impaired, based on surface water quality standards and designated uses (e.g., swimming, fishing and aquatic life support). Data collected through RTMP are used to develop the federally required section 305(b) / 303(d) water quality report.

Approach: RTMP conducts trend monitoring via repetitive visits to established sampling locations with the purpose of tracking water quality parameters over time. RTMP also conducts confirmation monitoring to determine if waterbodies can be removed from the 303(d) list. Targeted monitoring of previously unsampled waterbodies is also be completed to gain additional information about the condition of New Hampshire surface water resources. Targeted sampling is done by sampling locations chosen from 10-digit hydrologic drainage units (HUC 10) using predetermined schedule.

Parameters measured: RTMP measures field parameters including dissolved oxygen, pH, turbidity, specific conductance, water temperature and flow. These parameters are collected via instantaneous measurements and deployable multi-parameter dataloggers. Laboratory parameters include *E.coli*, nutrients (nitrogen and phosphorus), chloride, chlorophyll-*a*, metals, cations and other parameters as needed.

Method of data collection: RTMP collects discrete and continuous samples at multiple river and riverine impoundment stations. In 2018, over 2,500 individual chemical and biological sample results were generated.

Quality Assurance Measures: RTMP operates under an EPA-approved QAPP that is required to be updated every five years and submit to EPA for approval. An updated QAPP received approval from EPA in 2015. The RTMP is also required to complete an annual program audit detailing any deviations from the methods and data criteria stated in the QAPP and resolutions to those deviations.

Funding: Federal funds (Account7602).

Program needs: The River Trend Monitoring Program requires continued financial support for laboratory and equipment costs. Annual costs to process water quality samples through this program are approximately $25,000. The equipment used by this program includes both handheld meters and multiparameter dataloggers that require regular maintenance and replacement. A recently identified limitation is the lack of funds for laboratory analyses of contaminants of emerging concern, such as PFAS, which tend to be very expensive.

1.5 Lake Trophic Survey Program (LTSP)

Challenges Addressed: LTSP was initiated in the mid-1970s to provide basic information on the hundreds of lakes and ponds in NH. It continued for over thirty years through 2008 when it was discontinued. The LTSP was revamped and reinitiated by the Watershed Management Bureau in 2013 in order to generate periodic data on a portion of New Hampshire lakes and ponds that are not part of a volunteer program. The purpose remains to determine a trophic rating for a lake or pond as well as gather basic lake data. Trophic rating helps determine to what level the water quality in a lake or pond needs to be regulated and, over the long term, the health trend of the waterbody.

Data usage: To establish a lake trophic rating and determine if waterbodies meet their designated uses as required by sections 305(b) / 303(d) report for the Federal Clean Water Act.

Approach: Lakes are selected from a schedule of targeted watersheds on a rotational basis (eight 10-digit hydrologic drainage units annually). The selection process is conducted by several biologists in the WMB and takes into consideration the age of available water quality data, public accessibility and recreational use.

Parameters measured: At the deep site of a lake, a dissolved oxygen/temperature profile is collected and the degree of stratification is assessed. Secchi depth is measured. A composite water sample from the mid-metalimnion is collected and analyzed for Chlorophyll-*a*, and a plankton haul is collected to mid-metalimnion depth. A discrete mid-epilimnion sample is collected and analyzed for alkalinity, pH, conductivity, apparent color, chloride, calcium, magnesium, NO_2 and NO_3 nitrogen, TKN nitrogen, total phosphorus, sodium, sulfate, silica and dissolved organic carbon. Shoreline habitat data is collected at 10 stations around each waterbody sampled beginning in 2016. The data are used characterize the condition of the shoreline and nearshore habitat.

Method of data collection: The LTSP collects discrete samples.

Achievements: In 2018, 30 lakes were sampled. Ten of the 30 were new for 2018 and sampling on the remaining 20 was initiated either in 2016 or 2017. Overall, a total of 651 chemical records were generated. Additionally, ten summary reports were finalized from the 2015 selection of lakes.

Quality Assurance Measures: LTSP's QAPP was approved by EPA in 2015. All analyses are performed in accordance with the JCLC laboratory manual or the Department of Health and Human Services (DHHS) water lab's NELAC certification.

Funding: General funds (1000 account)and federal funds (Account 7602).

Program needs: The LTSP requires continued financial support in order to maintain current staff, laboratory analysis, and field equipment costs. It is important to note, however, that there are often 50 or more candidates lakes with data that are 20 years or older. At the current level of support the program is only able to select 10 new lakes each year for sampling. At this pace the NHDES will not be able update the data on all lakes and ponds in New Hampshire without increased capacity for sampling.

1.6 Biomonitoring

Challenges Addressed: The biomonitoring program was established in 1995 to determine the ability of the state's surface waters to support a healthy community of aquatic organisms. Sampling is completed each in summer and fall and serves to satisfy federal water quality reporting requirements under sections 303(d) / 305(b) for the Clean Water Act. To date, sampling by the biomonitoring program has been primarily focused in rivers and streams.

Data usage: Data produced through the biomonitoring program are used to complete water quality assessments to determine whether rivers or streams are impaired or potentially impaired, based on surface water quality standards and designated uses (aquatic life support). Biological data are used in the development of water quality standards and in making regulatory decisions. Data collected through the biomonitoring program are used to develop the federally required section 305(b) / 303(d) water quality report. The data are also used to track site-specific trends in biological condition and characterize the variability associated with macroinvertebrate data.

Approach: Prior to 2013, biological monitoring was either part of a probability-based or targeted sampling design. Starting in 2013, biological monitoring expanded to support three elements of the NHDES surface water quality monitoring strategy; trend, synoptic (targeted) and probability based monitoring. Trend monitoring is conducted in collaboration with River Trend Monitoring Program and encompasses approximately 28 long-term stations monitored annually. Synoptic monitoring selects eight to 10 of the 82 HUC10 watersheds within the state each year. Each watershed is evaluated once every 10 years. Probability-based monitoring of 50 sites includes 20 national and 30 state river and stream assessment sites. 2017 marked the last year of the current probability-based monitoring cycle that began in 2013. Assessing Aquatic Life and Primary Contact Recreation Designated Uses of New Hampshire's Rivers and Streams, 2013-2017 (R-WD-18-09), was published in July, 2018. 2018 started a new round of national probability-based monitoring limited to 20 national sites and will continue in 2019.

Parameters measured: Fish, macroinvertebrates, dissolved oxygen, pH, specific conductance, water temperature, flow, physical habitat characters and various laboratory generated water chemistry parameters.

Method of data collection: Data are collected using:
continuous measures, and surveys of water quality. Sample types, include:

- Discrete samples (chemical water quality parameters, stream flow).
- Continuous samples (physical water quality parameters).
- Surveys (macroinvertebrates, fish, algae, habitat, gradient, sediment/pebble).

Achievements: In 2018 the Biomonitoring Program collected the following data:

- Macroinvertebrate samples: 118 samples at 42 sample sites (>26,000 data points).
- Fish surveys: 40 sample sites (>7,500 data points).

Quality Assurance Measures: The Biomonitoring Program operates under the RTMP QAPP, an EPA-approved QAPP that is required to be updated every five years and approved by EPA. The QAPP was finalized in May, 2014 and received approval from EPA in 2015. The Biomonitoring Program is also required to complete a bi-annual program audit detailing any deviations from the methods and data criteria stated in the QAPP and resolutions to those deviations.

Funding: Federal funds (Account 7602).

Program needs: The biomonitoring program requires continued support for sample processing, supplies, and equipment on an annual basis. Although expensive, the program would be enhanced by microalgal sampling and toxological analysis.

1.7 Fish Tissue Mercury Monitoring Program

Challenges Addressed: To collect data on the mercury content in tissue of freshwater fish species within the State of New Hampshire. The source of mercury contamination is from airborne stack emissions regionally and from the west due to prevailing winds. This makes mercury contamination of fish a widespread problem in New Hampshire.

Data usage: The data are used to conduct risk assessments for mercury exposure from fish consumption. Risk assessments are used to update statewide and, if appropriate, waterbody-specific fish consumption advisories. The data are also used to track trends over time in the mercury content in fish tissue. A summary report was initiated in 2015 and was finalized in 2018. The report includes data from 1992 through 2017.

Approach: Trend and targeted monitoring. Most samples are supplied by volunteers who bring in fish from the lake where they live or often fish. Additional fish may be obtained through specific studies related to regulatory changes designed to reduce the deposition of atmospheric mercury. Additionally, certain waterbodies have been targeted for long-term collection to perform trend monitoring.

Parameters measured: Mercury content in fish tissue expressed as mg of elemental mercury/kg of fish, weight and length of the fish.

Method of data collection: Discrete.

Achievements: Typically, over 100 fish are analyzed annually. A report (R-WD-17-22) titled “Status and trends of mercury in fish tissue in New Hampshire waterbodies, 1992-2016” was released on 2018.

Quality Assurance Measures: The scale used for the weight is inspected and certified annually by a third party (contractor). Blanks, duplicates, continuing calibration verification (CCV) and spikes are performed in accordance with JCLC laboratory manual protocols.

Funding: General Fund (1000 Account).

Program needs: A revised sampling design is required in order to maintain consistency in the number of fish analyzed, waterbodies sampled, and fish species assessed. Implementation of the revised design requires collaboration from the Fish and Game Department.

1.8 Acid Rain Deposition Program

Challenges Addressed: To collect data on acid rain deposition and determine its effects on sensitive lakes and ponds. Acid deposition results from regional and westerly power plant stack emissions as well as automotive emission sources.

Data usage: Data are used to conduct trend analysis on the effects of acid rain deposition and the effectiveness of air pollution regulations. Data have been used by the New Hampshire Fish & Game Department to make stocking decisions on acid sensitive ponds and lakes. In 2015, a summary report was completed utilizing data collected from the mid-1980s through 2014.

Approach: Trend Monitoring. Lakes and ponds included in this monitoring program have been monitored consistently in excess of 30 years. Twenty ponds are sampled by Watershed Management Bureau staff and 10 remote ponds are sampled coorperatively by Fish & Game during helicopter stocking. Rain is also collected in Concord, N.H., and analyzed to verify source inputs to lakes and ponds.

Parameters measured:

- Lakes/Ponds **–** pH, acid neutralizing capacity, conductivity, color, , sulfate, nitrate and chloride.

- Rain – pH, nitrate, sulfate and total phosphorus.

Method of data collection: Discrete. Samples are collected from specified lake outlets in fall and spring. Rain event samples are collected at NHDES headquarters in Concord.

Achievements: Twenty lakes and ponds are sampled twice per year, 10 helicopter-stocked lakes are sampled once per year during stocking activities, and rain is sampled every time there is a rain event significant enough to yield the volume necessary for testing. In 2018, 350 chemical records were generated to support the lakes monitoring effort and, 67 rain events were sampled and 284 analyses performed.

Quality Assurance Measures: This program is included in the Lake Trophic Survey Program QAPP that was approved by EPA in 2015.

Funding: General funds (1000 account) and federal funds (Account 7602).

Program needs: Continued support for current staffing, laboratory analyses, and equipment needs.

1.9 Surface Water Quality Complaints

Challenges Addressed: Investigate concerns impacting surface water quality reported to the Watershed Management Bureau by staff and the public.

Data usage: Data are used to evaluate if an issue or water quality violation exists. If an issue exists, there may be administrative action taken by NHDES or a referral to another agency for action to be taken.

Approach: If investigator deems monitoring is warranted, targeted sampling is completed at strategically located stations. All complaints are logged into a complaint module of the Environmental Monitoring Database.

Parameters measured: Depends on the nature of the complaint.

Method of data collection: Continuous monitoring or discrete samples depending on the nature of the complaint.

Achievements: In 2018, 47 complaints were received, 31 were investigated. Samples were processed for 10 individual complaints in the JCLC.

Quality Assurance Measures: Parameter specific based on the JCLC Laboratory Manual or DHHS water lab protocols.

Funding: General funds (1000 account).

Program needs: This program is administered by one person who has other duties. In the summer when monitoring activities are at their maximum, resources for a field investigations and sampling are be limited. These resources include vehicles and sampling equipment.

1.10 Public Bathing Facility Program (PBFP)

Challenges Addressed: RSA 485A:26 requires NHDES to operate a year-round statewide PBFP program to ensure public health and safety when using bathing facilities such as pools and spas. The PBFP works to minimize health risks and safety concerns for New Hampshire residents and visitors who use public pool and spa facilities. Exposure to contaminated, poorly managed and maintained pool and spa water in New Hampshire has resulted in lung, skin, ear, and eye infections, as well as gastric illness caused by pool chemicals or airborne and waterborne pathogens such as Legionella, Cryptosporidium, Giardia, Staphylococcus, Norovirus and E. Coli. The program has established standards of design to ensure that water quality is regularly sampled and analyzed, that construction designs provide for safe use, and that scheduled maintenance is regularly performed.

Data usage: Data generated through PBFP are used to evaluate facility compliance with state and federal public health and safety laws, determine enforcement actions, prioritize seasonal/regional inspections, shape educational outreach efforts and make historical comparison to evaluate program effectiveness. The U.S. Center for Disease Control makes periodic requests for data in studying chlorinated aquatic venues.

Approach: Targeted monitoring – PBFP conducts periodic routine inspections to evaluate public health and safety and responds to illness complaints.

Parameters measured: PBFP measures a total of 10 chemical and biological parameters. In-situ analysis includes temperature, pH, free chlorine, total chlorine, combined chlorine, bromine, turbidity, total dissolved solids, cyanuric acid, hardness and alkalinity. Field samples are submitted to DHHS-PHL for *E. coli* and total coliform analysis.

Method of data collection: PBFP collects discrete samples at public bathing facilities statewide.

Achievements: In 2018, PBFP achieved the following:

- 251 facility inspections.
- Collected 431 samples for chemical and microbial analysis.
- Identified 143 water quality violations.
- Found 95 safety/facility violations.
- Issued 12 Letter of Deficiencies.
- Issued 42 Notice of Deficiencies.
- Issued 12 full design permits for new construction.

Quality Assurance Measures: Follows and updates the PBFP Field Inspection QA & SOP manual (last updated 5/23/2017). PBFP staff follows JCLC quality assurance measures for specific analysis. PBFP is also required to complete an annual program audit detailing any deviations from the methods and data criteria stated in the QA manual and resolutions to those deviations.

Funding: General funds (1000 account).

Program Needs: This program needs a dedicated account and higher inspection and design review fees to adequately staff the program. Long sought database updates and the incorporation of e-enterprise practices need to be realized for a significant boost in efficiency. The effectiveness of this program will be dictated by the ability to increase the inspection rate, effectively manage the data and a broad education/ outreach initiative directed at pool owner and operators.

1.11 Public Beach Inspection Program (PBIP)

Challenges Addressed: PBIP personnel collect water from coastal and freshwater beaches to test for fecal bacteria to protect the public health of swimmers. During the summer swim season, NHDES personnel monitor over 180 freshwater public bathing beaches on a monthly basis and 16 coastal beaches on a weekly or bi-weekly basis. When bacteria counts at designated public beaches are higher than the state criteria, an advisory is issued to notify the public approximately 24 hours after sampling. The program also responds to complaints about cyanobacteria blooms and posts closures during extreme bloom events.

Data usage: The main goal of the program is to use the data collected to protect public health and inform the public of potential health risks at public beaches. Over time, data from beach sampling are used to determine impairment for the 303(d) list of impaired waters. Cyanobacteria data also help to inform the safety of surface water supply public drinking water.

Approach: Targeted – samples are collected at individual beaches based on a predetermined schedule and used to make daily posting decisions regarding public health and safety. Follow up sampling at beaches with advisories is completed as necessary until fecal bacterial levels fall below state criteria.

Parameters measured: The main parameters measured are fecal bacteria (*E. coli* – freshwater beaches; enterococci – coastal beaches). Additionally, six other physical parameters are collected during visits to beaches.

Method of data collection: Discrete data points are collected during each beach visit.

Achievements: In 2018, a total of 2653 bacteria samples (not including duplicates) were collected from New Hampshire beaches. For freshwater beaches, 1853 bacteria samples were collected, with 89 fecal bacteria advisories. Additionally, there were 34 cyanobacteria lake warnings issued. There were 800 samples collected from coastal beaches resulting in eleven fecal bacteria advisories from eight of the beaches.

Quality Assurance Measures: An EPA-approved PBIP QAPP was updated in April 2017 (RFA# 17075).

Funding: Federal funds, Org. Code: 2065, Approximately $200,000 per year.

Program needs: There is an imminent need for dedicated staff to develop and implement advanced techniques to monitor harmful algal and cyanobacterial blooms in order to protect public health. An overall budget of $175,000 per year would sufficiently fund an advanced level staff position and laboratory activities.

1.12 Clean Vessel Act (CVA) Program

Challenges Addressed: The New Hampshire CVA program works to ensure that wastewater from boats is disposed of properly. Given the vast and growing number of boaters in New Hampshire, education is much more important than enforcement. The program works with marinas and the boating public to educate vessel owners about how to manage sewage and greywater in a way that protects New Hampshire's surface water quality. The program provides mobile and stationary pumpout facilities to ensure plenty of options for sewage offload are available.

Data usage: The locations, availability, and status of operation of stationary and mobile pumpout resources are tracked to provide this information to the public boating community and to identify potential CVA funding assistance opportunities. Additionally, data from the mobile pumpout services is collected and stored.There is also an Access database that houses boat inspection information.

Approach: Targeted information is collected annually from stationary and mobile pumpout resources through grantees, contractors, and communication between CVA staff and facility owners. The CVA program offers grants year-round to help keep pumpouts operational.

Parameters measured: Information collected may include the location of the pumpout resource, whether it is stationary or mobile, marina amenities, pumpout system mechanical information, system availability, usage fee collected (if any), participant contact information, vessel name, vessel type, and estimated wastewater gallons pumped. Information for the boat inspection database is collected from individual boat registrations and wastewater systems that include graywater and marine sanitation device (MSD) configurations. Details on location, dates of inspections and/or re-inspections, and compliance/non-compliance issues are documented by the boat inspector.

Method of data collection: Staff use data sheets for site visits of a stationary facility. Grantees are required to document boater information and wastewater estimates in logbooks in order to receive annual reimbursement for upkeep costs. The mobile pumpout services collect information using a physical receipt during each service. The boat inspection program collects data on physical forms or may enter directly onto a laptop in the field if one is available.

Achievements: In 2018, the program accomplished the following:

- The northern coast and Great Bay mobile pumpout boat documented about 750 captain hours, 338 serviced boats, and approximately 8,654 gallons of sewage pumped.
- The Hampton Harbor pumpout boat documented about 256 captain hours, 280 serviced boats, and approximately 5,211 gallons of sewage pumped.
- Since 2002, the mobile pumpout services have pumped off approximately 185,257 gallons of boater wastewater.

Quality Assurance Measures: Input from data sheets, logbooks and receipts are verified either by the seasonal intern or Clean Vessel Act program coordinator. Boat inspection database entries are reviewed by either the boat inspection program staff or Clean Vessel Act program coordinator.

Funding: Federal Funds, Org. Code 2061, SFY 2018 $305,090.

Program Needs: Currently the program funds 50% of a full-time staff position and a part-time boat inspector, with funding for a summer intern position. In 2018 the boat inspector position was vacant but typically the position works weekends, about 5 hours a week or less. The summer intern position was filled in 2018 after many years of vacancy. Future goals include reviewing staff needs and potentially increasing the percent of time for the full time staff position. The boat inspector position was difficult to fill due to its very limited hours and the limited hours also led the position to be less effective. It may be beneficial to the inspection program overall to increase the hours of that staff postion.

1.13 Exotic Species Program

Challenges Addressed: The primary purpose of New Hampshire's Exotic Aquatic Plant Program is to "prevent the introduction and further dispersal of exotic aquatic weeds and to manage or eradicate exotic aquatic weed infestations in the surface waters of the state" (RSA 487:17, II). Aquatic invasive species are a constant threat to the ecological, biological, recreational, and economic values of New Hampshire's waterbodies. Infestations lead to waterbody impairments and reduced values of the resource.

Data usage: Data generated through the Exotic Species Program are used to guide control activities on waterbodies. Data are also used to track concentrations of aquatic herbicides that may be used in various waterbodies and to determine the presence/absence of invasive aquatic plants in waterbodies.

Approach: Trend Monitoring. Repetitive visits are made to infested waterbodies to track infestations (size, density, distribution) over time. Targeted water quality monitoring may also be performed to document conditions before, during, and after implementation of the control practices

Parameters measured: Plant location, density and percent cover are surveyed annually on infested waters. Water depth, clarity, dissolved oxygen concentrations, herbicide concentrations, nutrient concentrations, temperature and turbidity may also be monitored.

Method of data collection: Discrete samples and observation at multiple stations in lakes and ponds for plant surveys or as needed for special studies. Data loggers are occasionally deployed for continuous data collection for parameters like dissolved oxygen.

Achievements: In 2018, the Exotic Species Program collected the following data:

- 87 waterbodies infested (dating back to 1970).
  - One new infestation of variable milfoil was confirmed in Angle Pond in Sandown. Divers visited the pond and hand removed growth as it was documented by local residents. The pond was not yet placed on the list of infested waters, due to low level growth that was routinely removed. A reassessment will be performed in 2019.
- 243 plant identifications.
- >80 field inspections (GPS).
- No pet store inspections this year due to early departure of season intern who usually does the inspections. Will resume in 2019.

Quality Assurance Measures: Activities performed by the Exotic Species Program are described in the Quality Assurance Project Plan for the program, which was approved in 2014 by EPA. It is currently under review and revision, in advance of a renewal of the plan.

Funding: State Fee Funds derived from boat registrations total approximately $893,000 annually.

Program Needs: Additional funding is needed to expand control efforts. Currently, just one third of the waterbodies with infestations are being managed. Grant awards for management are provided by the state, but local entities assume at least 60% of the cost of management on the municipal or non-profit level.

1.14 Chloride Reduction Efforts

Challenges Addressed: Chlorides are toxic to aquatic organisms, plants and to the infrastructure that supports our roads and bridges. NHDES has measured increasing chloride pollution in both lakes and rivers over the past 20 years. The primary source of those chlorides is road salt used for winter maintenance. NHDES has a number of programs to address this issue that include implementation monitoring for the Total Maximum Daily Loads (TMDL) for chloride for water bodies in the vicinity of the I-93 corridor from Massachusetts to Manchester, NH, and a voluntary commercial salt applicator certification program (Green SnowPro or GSP). Each of these programs has been successful in their respective efforts to reduce chloride contamination of the environment.

Data usage: The data is used to determine compliance with the TMDL and judge success of the commercial salt applicator program.

Approach:

- Continuous datasonde monitoring at four stations within the I-93 Corridor.
- Handheld measurement and grab samples at one site weekly and all sites every three weeks.
- Datasonde QA/QC checks, data download, and maintenance every six weeks.
- Number of approved certified applicators.

Parameters measured (TMDL): Temperature, specific conductance and chloride. The chloride samples are processed and tested at the Jody Connor Limnology Center**.**
Parameters measured (GSP): Applications received and meeting the approval criteria as specified in RSA 489-C.

- Method of data collection (TMDL): Continuous (datasonde) and discrete (chloride).
- Method of data collection (GSP): Electronic (PDF or Word attachments), facsimile, or direct mailing of hard copy applications.

Achievements:

- 34,000-35,000 data points per station per year.
- Over 1,200 certified salt applicator certificates issued since 2011.

Quality Assurance Measures (TMDL): A full description of all the data quality control measures are contained in a 2006 EPA-approved QAPP, the 2018 Ambient River Monitoring Program QAPP and updated field SOPs for the I93 Implementation monitoring.
Quality Assurance Measures (GSP): Certified Salt Applicators must apply for certification annually and meet the requirements listed in the RSA.

Funding (TMDL): NHDES has expended all the funding dedicated for the TMDL and monitoring by NHDOT as part of the I-93 study. Addition monitoring funds may become available as a result of the future Exit 4A project.

Funding (GSP): The Commercial Certified Salt Applicator Program became fee based as of June 2018. Application costs are tiered and written into the RSA. These funds support a part-time Salt Reduction Coordinator position within NHDES.

Program Needs (GSP): The Green SnowPro salt reduction coordinator position was filled in August 2018. The position is part time and tasked with processing hundreds of applications each year, planning for the annual Salt Symposium, organizing and hosting full and refresher training courses, assisting with database development, conducting outreach, education, and evaluating and implementing new marketing opportunities. The scope of work associated with this program merits a full-time coordinator.

1.15 NHDES Shellfish Program

Challenges Addressed: The mission of the Shellfish Program is to ensure that the shellfish harvested in New Hampshire are safe to eat. The program monitors coastal waters for bacteria, viruses, and algal blooms that produce biotoxins that can accumulate to potentially fatal levels in shellfish. The program creates the regulatory conditions that allow the commercial shellfish industry to legally harvest and engage in interstate commerce. Recently, the commercial shellfish industry has grown rapidly in New Hampshire, adding 2-3 commercial aquaculture farms per year since 2011. In 2018 there were 25 oyster farms, four oyster upwellers and six blue mussel farms. The program also ensures the safety of recreational shellfishing.

Data usage: Data generated by the Shellfish Program are used to prepare and update Sanitary Survey reports for the eight major shellfish growing areas in the state's jurisdiction. Data generated by the program are also used to make daily and weekly management decisions regarding which harvesting areas are open or closed based on current information on public health threats such as red tide levels, recent rainfall, boating and mooring surveys and others. These decisions are communicated to through a hotline message and internet-based tools.

Approach: The shellfish monitoring program implements a systematic random sampling program to maintain updated bacteria data on 70 monitoring stations in the state's tidal waters. Data from event-based seawater and shellfish tissue testing after pollution events such as heavy rainfall events are used to supplement the ambient program and to support management decisions. Additional monitoring programs include Harmful Algal Bloom Monitoring, Shoreline Survey Program, and new monitoring programs focused on Vibrio bacteria risk assessment and on viral indicators of sewage pollution.

Parameters measured: Seawater and shellfish tissue sampling programs document fecal coliform bacteria, water temperature, salinity and other observations; phytoplankton monitoring and biotoxin levels in blue mussels and other shellfish species; water temperatures near commercial oyster farms and Vibrio bacteria levels in oysters; and Male Specific Coliphage levels in municipal wastewater treatment facility effluent, as well as in oysters, softshell clamsblue mussels.

Achievements: In 2018, the Shellfish Program accomplished the following:

- 45 rounds of sampling on tidal waters.
- 1,107 seawater samples collected.
- 22 rounds of sampling in response to rainfall events.
- 46 red tide samples collected.
- 539 commercial harvesting decisions generated.
- 111 wastewater treatment facility calls evaluated.
- 64 harvesting hotline updates implemented.
- 1,985 properties surveyed and tracked for pollution.
- 22 marina/mooring field surveys performed.
- 881 pollution sources tracked.
- 22 rounds of pollution source sampling completed.

Quality Assurance Measures: The Shellfish Program operates under three EPA-approved Quality Assurance Project Plans (QAPPs), dated May 2013, addressing ambient monitoring, Red Tide monitoring and shoreline survey monitoring. All three are currently being redrafted for the five-year updates. The Shellfish Program is also required to complete a program audit every other year detailing any deviations from the methods and data criteria stated in the QAPPs and resolutions to those deviations.

Funding: General fund (1523) FY 19 $321,235.

Program Needs: Increased capacity for offshore/nearshore monitoring of Harmful Algal Blooms needs to be developed.

1.16 Special Studies

Challenges Addressed: Short-term monitoring to collect data for the purposes of evaluating the environmental impact of a temporary event such as construction, answer a specific scientific question, evaluate a data collection method, or solve a specific problem within a waterbody or watershed.

Data usage: The primary use of data will fulfill the goal of the study. Any ambient monitoring data will be available via the EMD for other programs to use.

Approach: Targeted monitoring approach.

Parameters measured: Determined by study design.

Method of data collection: Determined by study design.

Achievements: In 2018, four special studies were in progress involving the JCLC, including: 92 analyses for the Hothole Pond Special Study; 87 analyses for the Pawtuckaway Lake instream flow pilot; 10 analyses for the Newport waste water treatment plant; and, 42 analyses for the River Regional Monitoring Network.

Quality Assurance Measures: As determined by study design.

Funding: Various.

Program Needs: There are no specific needs at this time.

1.17 Wetland Monitoring Program

Challenges Addressed: Currently NHDES has no wetland-specific water quality criteria for completion of assessments under the Clean Water Act section 305(b). Wetland monitoring using the protocols described below began in 2014 and 2015 under an EPA Wetland Program Development Grant (WPDG) to identify tools and criteria for wetland condition assessment in New Hampshire. Included among the protocols and assessment methods applied were Maine Department of Environmental Protection's (MDEP) protocols for its predictive model for wetland assessment, based on macroinvertebrate sampling of lacustrine and other open freshwater wetlands. Sampling continued in 2016 and 2017 under a second Wetland Program Development Grant. A total of 44 wetland sampling surveys were completed. During 2016, NHDES also participated in the National Wetland Condition Assessment effort, sampling 12 additional wetlands using USEPA protocols.

Data usage: Data produced through the wetlands monitoring project are being used to evaluate the applicability of several tools for assessment of wetland condition in New Hampshire.

Approach: Lacustrine aquatic bed wetlands and palustrine emergent and aquatic bed wetlands representing a range of human disturbance were targeted for sampling, which was conducted between late June and mid-August in each field season.

Parameters measured: Aquatic macroinvertebrate community composition, vegetation community composition, the physical and chemical characteristics of water (including nutrients, chloride, pH, specific conductance, temperature, alkalinity), and landscape condition were measured/ observed. GIS tools were used to evaluate landscape condition.

Method of data collection: Discrete biological and water samples were collected as described below.

- Field analyses: Took instantaneous measurements of field parameters including dissolved oxygen, pH, turbidity, specific conductance and water temperature at three locations in each wetland.
- Water grab samples: Collected one grab sample in each wetland and analyzed for nutrients (nitrate-nitrite, total Kjeldahl nitrogen, total phosphorus), chloride, chlorophyll-a, dissolved organic carbon and alkalinity.
- Macroinvertebrate samples: Sampled benthic macroinvertebrates using a dip-net, from a canoe or by wading, at three locations in each wetland (three "replicate" samples).
- Landscape analysis: Collected information on physical habitat parameters (land use, terrain, dominant plant species, presence of invasive plant species, and substrate composition).
- Ecological Integrity Assessment (EIA): Applied the rapid assessment protocols developed by the New Hampshire Natural Heritage Bureau, which includes a GIS-based landscape analysis, stressor evaluation, as well as vegetation-based surveys that can support application of Floristic Quality Assessment methods (FQA).
- Wetland Human Disturbance Assessment (WHDA): A rapid survey of each wetland/surrounding landscape within 100 feet and within watershed of assessment area.
- Vegetation sampling: Sampled aquatic vegetation with a shrub rake at three locations within each wetland or surveyed vegetation at three locations, as well as shoreline areas present to support the application of FQA.

Achievements: For 2014-2017, the Wetlands Monitoring project collected data at 44 sampling visits (42 distinct wetlands). Two wetlands were visited twice to address the low total abundance or generic richness of the initial macroinvertebrate samples.

- NHDES developed detailed aquatic plant sampling protocol and provided training to MDEP biomonitoring staff for their use with biomonitoring.
- The MDEP predictive model assigned attainment cases to 32 of 44 sampled wetlands. Low abundance or low generic richness affected the ability to assign attainment classes to 12 wetlands.
- The application of two rapid assessments (EIA and WHDA) and floristic quality assessment metrics have provided useful information about indicators of disturbance that can continue to be used and perhaps refined in future work. The correlation between the EIA-Land Use Index scores and chloride levels provides strong support for the potential to use the Land Use Index alone as a screening level tool for targeted sampling.

- Analyses of the four years of sampling data may identify additional metrics or tools for wetland condition assessment and potential criteria.
- This study represents NHDES' initial efforts to collect macroinvertebrate and water quality data specifically in wetlands. The resulting data have started to fill a gap in our knowledge of New Hampshire's wetlands.

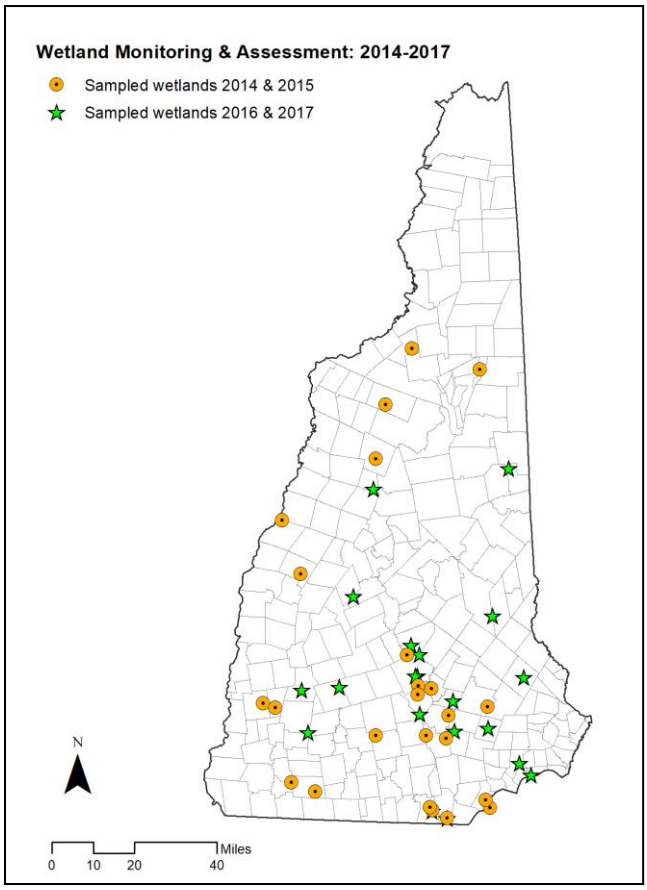
Quality Assurance Measures: The Wetland Monitoring project quality assurance protocols are described in the project-specific QAPP developed in 2014 and updated in 2016, covering physical, chemical, biological and landscape data collection used to evaluate wetland condition. All data were quality assured applying specific measures as specified in the EPA-approved QAPP.

Funding:

USEPA Wetland Program Development Grants funded the majority of this wetland monitoring and assessment work. Match resources were provided partially by a Wetlands Bureau staff person who participated on the sampling team.

Program Needs:

After completion of the 2017 field season and subsequent analysis and report, no funding was sought for additional monitoring and assessment work. Further work to develop wetland-specific water quality standards will require more funding (and match).



1.18 Surface Water Quality Assessments (305(b)/303(d))

Challenges Addressed: The water quality status of New Hampshire's surface waters are reported in accordance with Section 305(b) and 303(d) of the Clean Water Act (CWA), and New Hampshire Statutes Chapter 485-A:4.XIV. Per the Clean Water Act, assessments are to be completed biennially on even numbered years.

Data usage: Assessments are viewed and used by the general public, local, state and federal agencies, as well as non-governmental organizations. Assessment results are formally sent to EPA for transmital to Congress. All assessment results are made availiable to the public via the program website and a web-based data mapper.

Assessments determine if a waterbody meets its designated uses. Waters that do not meet one or more designated use are considered impaired. In cases where a waterbody meets one or more of its designated uses, protection measures may be an appropriate management action. The Surface Water Quality Assessment Program does not take any actions based upon the attainment determinations, but rather provides that information to other programs. Impaired waters become eligible for 319 restoration funds. Impairment status may influence certain permitting actions.

Method of data collection: The primary source of data for the assessments is the EMD. Every two years, as part of the assessment process, a snapshot of "recent" samples is imported to the Supplimental Assessment Database (SADB) for processing and tracking. The snapshot includes discrete and continuous data records.

Achievement:
For 2016 cycle, the Surface Water Quality Assessment Program reviewed the following to complete designated use support decisions:

- 197 different project sources of data.
- 8,819 monitored stations.
- 386,666 individual sampling events.
- 304,571 day/parameter combinations from datalogger record sets.
- 1,254,450 individual chemical and biological grab sample results.
- 3,220,224 individual water quality standard comparisons were made.

Quality Assurance Measures: In addition to the quality assurance methods of each of the data sources, the assessment is guided by set of standard procedures called the Consolidated Assessment and Listing Methodology (CALM). More information is available on CALM on the Surface Water Quality Assessment publications website.

Asessments are conducted in a step wise fashion. First, the SADB manages all imported sample data and performs the initial sample level water quality standard comparisons. Next, each waterbody/parameter combination is summarized in bulk and those bulk assessments are quality assured by a second individual. Third, the detailed lists of waterbodies with significant changes and/or borderline assessments are subjected to detailed review using a tool that allows all samples to be paired up with weather and flow data. Finally, all new impairments and de-impairments are vetted through professional staff to confirm that the data are sufficient to support those decisions

Funding: Federal funds, Org. Code: 7602

Program Needs: The process of the biennial vetting of assessments through NHDES professional staff could be leaned. An upcoming challenge is the full integration of the new EPA web based Assessment and TMDL Tracking and Implementation System (ATTAINS) and full phase-out of the old Assessment Database (ADB) system. Due to those changes, NHDES will need to implement some of the pieces of the old EPA ADB into New Hampshire's SADB and revise the SADB code to continue functioning.

1.19 TMDL Program

Challenges Addressed: The TMDL Program develops pollution budgets for impaired waters. TMDLs have been developed for rivers/streams and lakes/ponds. In the past several years the focus of TMDL development has been on bacteria and nutrient impairments.

Data usage: The TMDL Program uses in the NHDES Environmental Database (EMD) to estimate nutrient loads and develop estimated reductions necessary to achieve water quality targets. Where needed, supplemental data is collected to develop, update and/or confirm existing data.

Approach: Data used in the development of TMDLs are targeted to the specific waterbody of interest or those draining into or out of the waterbody of interest.

Method of data collection: When necessary, the TMDL program collects discrete and continuous data in lakes, ponds, rivers and streams where applicable to develop each TMDL project. When samples are collected they are done so following the applicable EPA approved programmatic QAPP(s).

Achievement: Since 2000, EPA has approved 942 TMDLs in NH. In 2017 EPA approved the Northeast Regional Mercury TMDL which accounted for 5,124 additional TMDLs.

Quality Assurance Measures: The TMDL program uses data in the EMD that has been collected according to an EPA approved programmatic QAPP. The TMDL program is also required to complete an annual program audit detailing any deviations from the methods and data criteria and resolutions to those deviations.

Funding: Federal funds, Org. Code: 7602

Program Needs: The program would benefit from additional staff resources to develop TMDLs.

1.20 Rivers and Lakes Management and Protection Programs

Challenges Addressed: The Rivers and Lakes Management and Protection Programs provide a mechanism for public recognition and management of important state waterbodies. In addition, it participates in the development and implementation of statewide surface water management policies.

Data usage: The Instream Flow Program uses stream flow data to determine when management actions are needed, including water use restrictions and flow releases on designated rivers for which protected instream flows have been established. The Program also measures river stage and flow to develop rating curves for locations without stream gages.

Method of data collection: Continuous data records are obtained for stream flow and water temperature. Discrete field measurements of stream velocity, stream depth and width are collected to estimate streamflow when gages aren't available.

Achievements:

- 19 Designated Rivers; 1,010 total Designated River miles.
- 22 Local River Management Advisory Committees.
- 200+ active volunteers.
- Approximately 19,468 volunteer hours in 2017 valued at over $484,000 to the State.
- 224 permit applications reviewed by local citizens in 2018.
- 8 State-owned surplus land disposals reviewed in 2018 ensuring that public access to state waters is maintained.
- 35 Letters of testimony submitted during the 2018 New Hampshire legislative session by the state-wide Rivers and Lakes Management Advisory Committees.

In 2018 the New Hampshire legislature approved the designation of the Warner River into the Rivers Management and Protection Program. The addition of the Warner River added 20 miles to the number of river miles protected under the Program, and established a new local river management advisory committee to oversee the Warner River.

The rules administering the Instream Flow Program (Env-Wq 1900) were updated in 2018, allowing this program to expand beyond the pilot phase of the initial two designated river to encompass all 19 designated rivers.

Quality Assurance Measures: Stream flow measurements are assessed by repeated measurements to evaluate the variability of individual measurements and estimate the overall accuracy of the results.

Funding: General Funds: Org. Code 1518 (FY2018 $239,042); Federal Funds: Org. Code 7602 (FY2018 $128,265).

Program Needs: The Instream Flow Program needs two additional full-time staff and additional contract funds to expand the program to all 19 designated rivers in the state. Currently one river and one river segment have been largely completed and are being actively evaluated and managed to maintain protected flows. Continued management of these rivers and establishment of water management plans for the other rivers and segments will require two additional staff positions: an environmentalist to develop and coordinate water management plans and monitor stream flow conditions; and a biologist to evaluate fish, wildlife and riparian plant community health and to develop long-term monitoring for determining the effectiveness of Instream Flow Program implementation. Development of instream flows on additional designated rivers requires an additional $100,000 to $175,000 per year, depending on the length of the river under development, in contract funds for hiring consultants to develop protected instream flows at the rate of one river per year.

The Lakes Management and Protection Program requires funding for a Lakes Coordinator in order to provide support to the Lakes Management Advisory Committee and lake management efforts throughout the state. The Lakes Program is currently unfunded.

1.21 Coastal Program

Challenges Addressed: The Coastal Program protects clean water, restores coastal habitats, and helps make communities more resilient to flooding and other natural hazards through staff assistance and funding to 42 coastal towns and cities as well as other local and regional groups. Coastal areas are especially vulnerable to storm surge, flooding and sea level rise, putting coastal infrastructure, property and habitats at risk. The Coastal Program helps local decision-makers to minimize damage and increase preparedness for these natural hazards.

Achievement: Funded and provided staff support on a project for dune restoration that has engaged 43 community leaders and local community members in Hampton and Seabrook planting workshops. The resiliency of the dunes has been increased with fencing, planting 20,000 plants in two acres of remnant dunes, and collecting monitoring data. Initiated, funded and staffed the development of the New Hampshire Coastal Viewer, which houses 150 coastal resources and hazards-related spatial data sets for better decision making at the state and local level.

Funding: Federal Funds (The Coastal Program is funded by The National Oceanic and Atmospheric Administration). Org. Code 3642; Received $1,053,000 for FFY17.

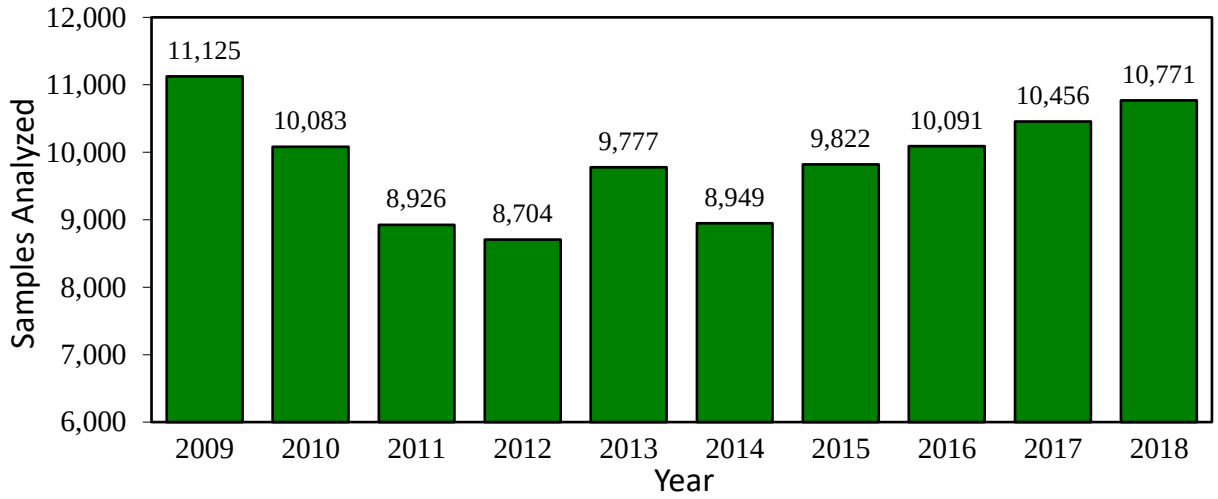
Program Needs: Funding and staff to help communities prepare for coastal hazards through grants, technical assistance, and outreach and training.

II. NHDES JODY CONNOR LIMNOLOGY CENTER AND SATELLITE LAB

2.1 Overall Workload

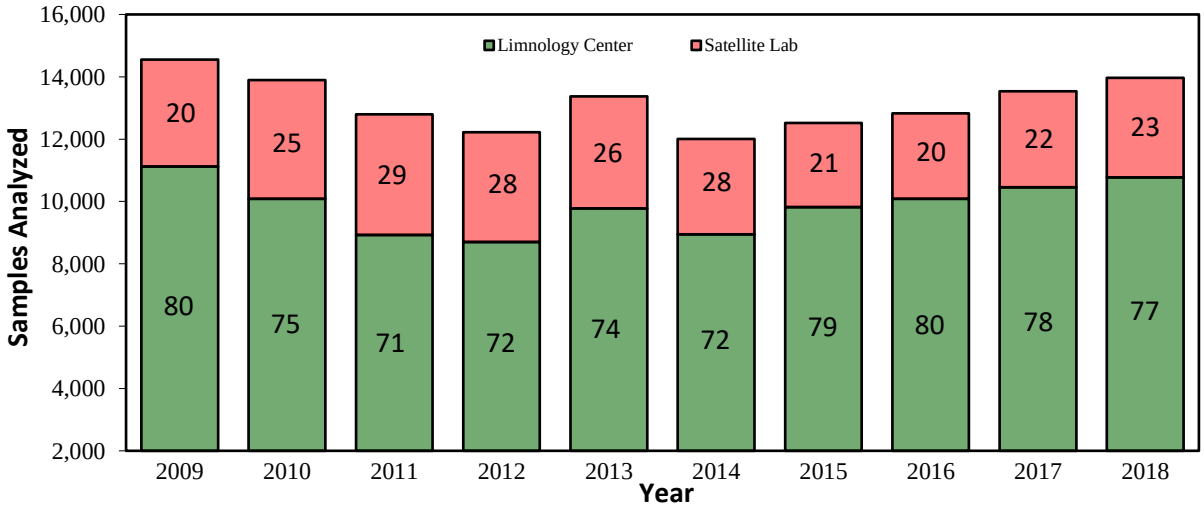
JCLC staff processed 10,771 chemical analyses in 2018 (Figure 1), which continues the modest increasing trend that has been on going for the last few years. Additionally, approximately 7,044 from 2018 were collected by JCLC programs but analyzed by DHHS-PHL which represents a increase of roughly 700 analyses from 2017.

Figure 1: Chemical analyses processed by NHDES JCLC, all programs combined.



JCLC strives to provide volunteer monitors better service by making avialable and providing oversight to a satellite laboratory at Colby-Sawyer College (CSC). The laboratory is a cooperative effort between CSC and the Lake Sunapee Protective Association (LSPA). In 2018, 3,195 chemical analyses were processed at the CSC satellite laboratory, a slight increase over 2017. The CSC-LSPA lab has mirrored the annual modest increasing trend seen in the JCLC and discussed above. The workload was split between the JCLC (77% of samples) and the CSC-LSPA lab (23% of samples).

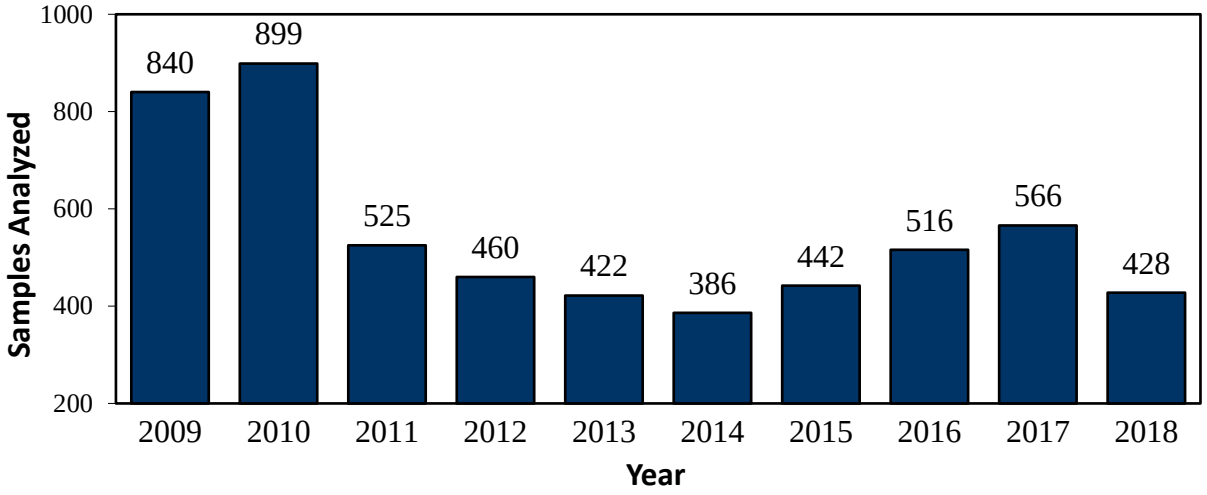
Figure 2: Satellite vs JCLC Analysis 2009-2018 (Numbers inside bars is the annual percentage of data).



Quality control (QC) is an important component in assuring the production of high quality data. At both JCLC and its satellite lab, QC samples are processed regularly. Over 2,700 QC sample analyses were conducted by the two laboratories in 2018.

The JCLC also analyses biological samples of phytoplankton, zooplankton, cyanobacteria, and macrophyte identifications. The number of annual biological analyses performed rose steadily until 2010 (Figure 3), but has been steadily around 500 since. In 2018, 428 biological samples were analyzed in JCLC which is a drop from the previous few years, but in line with the range seen since 2011 (Figure 3). These analyses are time consuming and most often performed through microscopic examinations by trained staff.

Figure 3: NHDES JCLC Total Annual Biological Analyses.



2.2 Data Quality Objectives

JCLC and the CSC satellite laboratory met their data quality objective (DQO) requirement of conducting replicate analyses on 10% of the processed samples. Since establishing the DQO objective in 1999, the cumulative laboratory replicate percentage has surpassed the 10% requirement each year. All laboratories also continued to follow both Continuing Calibration Verification (CCV) and Critical Range (CR) criteria. The CCV and CR processes verify that the laboratory equipment, standard operating procedures and personnel are all meeting established standards and confirming that high quality, reliable data are being produced. Further, during the 2016 NHDES QA Self-Audit, both labs were found to have excellent systems in place to ensure that quality data were being produced and no recommendation was made to improve those systems. The next self-audit for 2018 will be completed in early 2019.

2.2.1 JCLC Laboratory

As a result of requirements set forth in the NHDES Quality Management Plan (QMP), JCLC began to track new staff training in 2003. Tracking staff training is a critical component to verify competency on equipment use, DQO procedures, CR and CCV procedures. At the start of each sampling season, in addition to routine training, interns and new permanent staff are required to complete a training checklist prior to conducting analyses. This checklist serves to standardize training for new analysts and to document the proficiency of laboratory staff.

JCLC replicate split mean ranges (SMR) and Relative Percent Difference (RPD) also show consistency in data quality. The JCLC and CSC-LSPA lab analyze two aliquots (sub-samples) from the same sample as a QC for at least 10% of all samples run. Depending on analysis factors such as the range of the analytical instrument used either a SMR or RPD is calculated for each QC sample. The SMR is the value difference between QC and original sample and the RPD is the percent difference between the two samples. JCLC generates SMR/RPDs as a non-statistical method to review that replicate ranges are consistent with historical SMR/RPDs. In 2018, all parameters exhibited SMRs or RPDs within their historic levels (Table 1). Lastly, 99% of laboratory replicates met established critical range criteria for all parameters.

Table 1: 2018 calendar year JCLC chemical analyses quality assurance summary.

Parameter	Replicate Analyses	Sample Analyses	Replicate Percent	Mean Relative Percent Difference or Split Mean Range					
				2013	2014	2015	2016	2017	2018
Alkalinity (ANC) mg/L	57	533	10.69	0.29	0.42	0.58	0.56	0.49	0.27
Apparent Color (Visual) cpu	14	129	10.85	1.07	0.78	1.05	0.53	0.69	0.71
Color in Water (Hanna)	55	488	11.27					4.32	5.09
Chloride mg/L	234	2019	11.50	1.02	0.55	0.88	1.55	1.53	1.89
Chlorophyll-a mg/L	70	609	11.59	0.35	0.29	0.60	0.46	0.38	0.54
Conductivity µmhos/cm	267	2375	11.24	0.74	1.41	1.03	1.33	1.38	1.78
Mercury mg/L	5	40	12.50	0.03	0.04	0.02	0.03	0.01	0.05
pH units	269	2435	11.05	0.37	0.25	0.40	0.12	0.27	0.07
Turbidity NTU	234	2120	11.04	0.09	0.13	0.14	0.16	0.13	0.14

2.2.2 Satellite Laboratory

The CSC-LSPA Satellite Laboratory continues to be well operated and serves as a model for producing high quality data in support of NHDES' volunteer water quality monitoring programs. In 2018 the lab gained the ability to analyze for chloride and color. Chloride is an increasing problem in NH due to road salt treatment of roads during the winter, and color is considered to be a sentinel parameter which has shown increases due to lake warming in recent years. It will take a few years to establish a split mean range for the new parameters. The CSC-LSPA lab has consistently met or exceeded the replicate DQO for all historic VLAP parameters since 2008. In addition, the 2018 split mean remained consistent with previous years (Table 2). Lastly, 98% of CSC-LSPA laboratory replicates met established critical range criteria for all parameters.

Table 2: 2018 calendar year CSC-LSPA Laboratory chemical analyses quality assurance summary.

Parameter	Replicate Analyses	Sample Analyses	Replicate Percent	Mean Relative Percent Difference or Split Mean Range					
				2013	2014	2015	2016	2017	2018
Alkalinity (ANC) mg/L	13	87	16.67	0.29	0.42	0.70	0.36	0.28	0.63
Color in Water (Hanna)	8	62	12.90						1.25
Chloride	22	140	15.71						1.82
Chlorophyll-a mg/L	19	123	15.45	0.27	0.42	0.32	0.11	0.37	0.53
Conductivity µmhos/cm	112	687	16.30	0.10	0.17	0.20	0.87	1.54	1.37
pH units	110	668	16.47	0.39	0.11	0.19	0.04	0.07	0.05
Turbidity NTU	110	669	16.44	0.18	0.18	0.19	.07	0.23	0.28
E. coli counts/100ml	13	75	17.33	0.00	0.47	0.00	0.00	.33	1.62
Total Phosphorus µg/L	100	632	14.66	2.0	2.8	3.5	1.5	1.0	0.8

III. ANNUAL PROGRAM REPORTS

3.1 Assessment-Based Programs

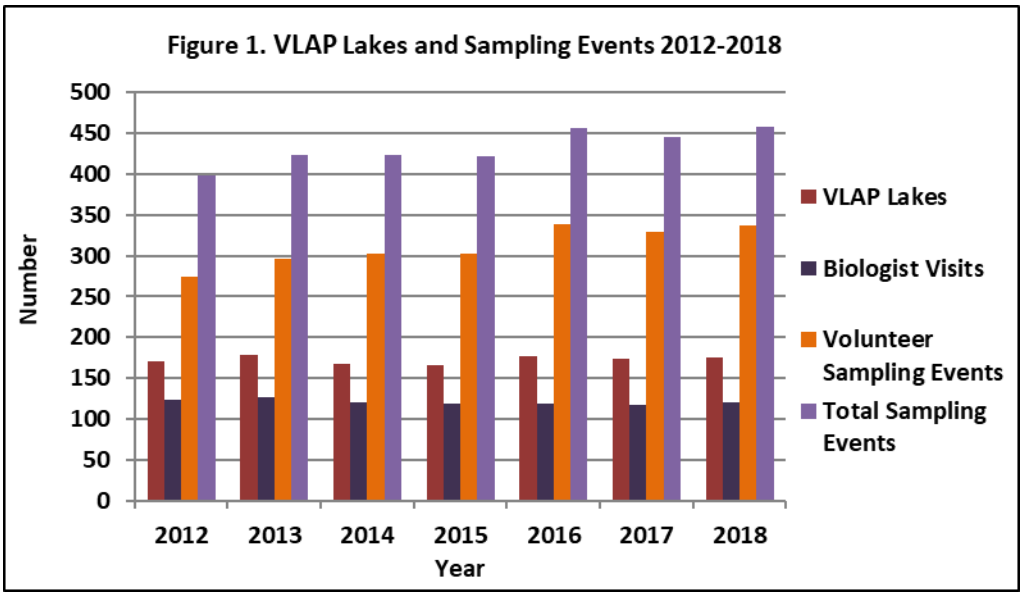
3.1.1 JCLC support summary

The JCLC provided analytical services for over a dozen programs in the Watershed Management Bureau in 2018. In addition, the JCLC provides bench space where field equipment can be maintained, calibrated and prepared for use. Equipment from the JCLC is also loaned to volunteers and other state agencies for the purpose of surface water quality monitoring. The following sections summarize the activities of the programs supported by and operating within the JCLC.

3.1.2 Volunteer Lake Assessment Program (VLAP)

VLAP was established in 1985 and trained volunteers collect monthly in-lake and tributary water quality samples during the summer. In 2018, 175 lakes were sampled through the program. This number has remained relatively consistent since 2007. Since its inception, VLAP has regularly enrolled new lakes into the program, with the exception of 2011-2012 and moving forward from 2018, where VLAP no longer will accept additional lakes due to staffing resource limitations. However, this has not deterred interest in volunteer monitoring (Figure 4) and the continued dedication of volunteers from nearly 200 lakes statewide clearly demonstrates the program's popularity and reflects the public's devotion to watershed management, water quality improvement and lake protection for future generations.

Figure 4: VLAP Monitoring Interest 2012-2018



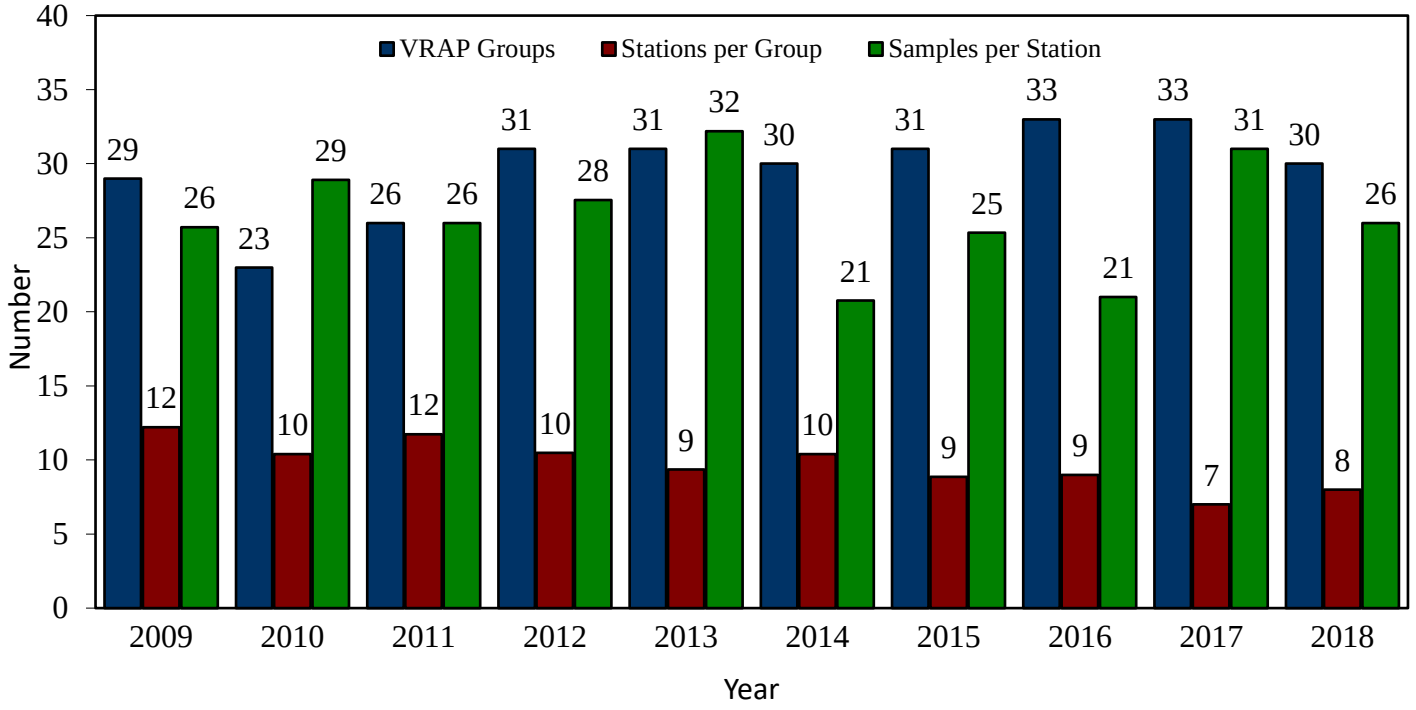
The VLAP coordinator provides the necessary guidance (training, field inspections, equipment loans and maintenance) to volunteers in order to produce quality data under the auspices of an EPA-approved QAPP. Sample collection and data quality control is extremely important as the data are used to prepare the State's Section 305(b) water quality report and list of impaired waters [303(d) list]. In addition, VLAP data are utilized to complete Total Maximum Daily Load (TMDL) studies, water quality criteria development and watershed planning efforts. Lake associations are educated on the importance of practicing quality control measures during sampling events and sample preservation during the delivery of samples to JCLC. In addition, volunteer monitor sample techniques are audited by collecting field duplicate samples during biennial NHDES staff visits to each participating lake and pond. If data are suspect, the VLAP coordinator assesses sample collection techniques and if necessary, provides quality control recommendations to the on-site volunteer monitors.

3.1.3 Volunteer River Assessment Program (VRAP)

In 1998, NHDES established VRAP to promote awareness and education of the importance of maintaining water quality in New Hampshire's rivers and streams. VRAP aims to educate people about river and stream water quality and ecology, and to improve water quality monitoring coverage for the protection of water resources. Today, VRAP loans water quality monitoring equipment, provides technical support, and facilitates educational programs. In 2018, VRAP supported 30 volunteer groups (Figure 5) on numerous rivers and watersheds throughout the state.

VRAP is a cooperative program between NHDES, river groups, local river advisory committees, watershed associations and individuals working to protect New Hampshire's rivers and streams. VRAP volunteers are trained by NHDES staff in the use of water quality monitoring equipment at an annual training workshop. NHDES staff works with VRAP groups to establish monitoring stations and develop a sampling plan. During each sampling season, NHDES receives water quality data from trained volunteers. The data are reviewed for quality assurance, and are entered into the EMD. During the off-season, NHDES staff interprets the data and compiles the results into an annual data report for each river. VRAP volunteers can use the data as a means of understanding the details of water quality, as well as to guide future sampling efforts. Data collected through VRAP is used to develop the 305(b) / 303(d) report, from which impaired or potentially impaired waters are targeted for additional detailed studies if necessary.

Figure 5: VRAP Group, Station and Sample Count from 2009-2018

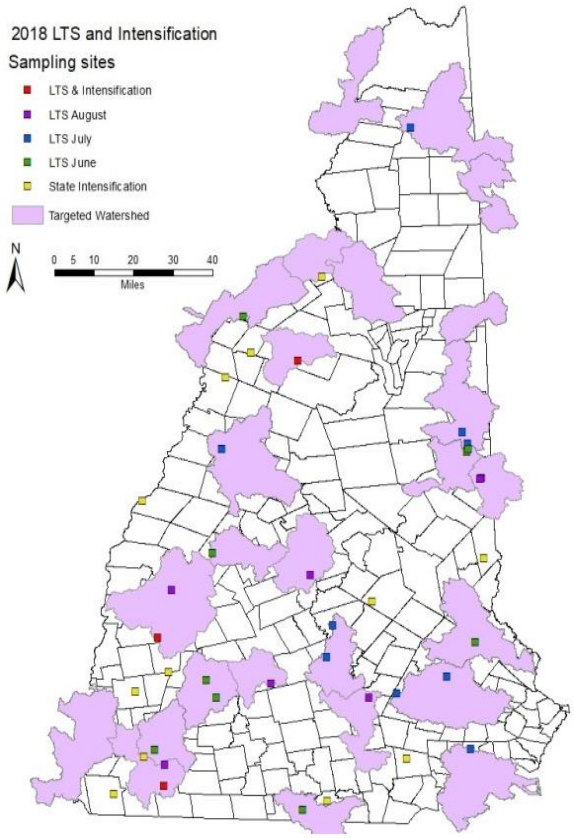


3.1.4 Lake Trophic Survey Program (LTSP)

For 2018, a total of 30 lakes were sampled (10 from those selected in 2018; 10 from the 2017 selection; 10 from the 2016 selection (Figure 6). In 2018 the LTSP reported on lakes that were selected in 2015. The reports have been made available on both the NHDES website and the new Lake Information Mapper. The data for 2016 selected lakes includes shoreline habitat data that was collected for the first time during those surveys. The LTSP will begin to integrate these data to future trophic reports once a summary index is developed.

Additionally in 2018 LTSP continued statewide probabilistic sampling effort. Thus far 35 of 50 have been sampled. The final 15 are scheduled to be sampled in 2019. The goal of the probabilistic survey is to produce a characterization of lake condition that represents all of New Hampshire's lake and ponds.

Figure 6: Lake Trophic Survey Program Lakes Sampled in 2018



3.1.5 Biomonitoring Program

The NHDES biomonitoring program was established in the mid-1990s in response to an EPA directive for states to develop the capacity to characterize the condition of its aquatic communities. Since that time, the program has focused on the development and implementation of biological condition indices for rivers and streams. The program also collects chemical and habitat data, which is used in conjunction with biological data to complete comprehensive water quality assessments of river and stream segments.

In 2018, the biomonitoring program assisted other WMB staff with deployment and retrieval of 19 water temperature loggers and completing water quality monitoring at 40 trend monitoring sites and 28 synoptic monitoring sites between May and October. At 38 of these locations (28 trend, 10 synoptic), biomonitoring staff were responsible for coordinating the collection of macroinvertebrate data. With assistance from WMB staff, rock baskets were deployed and retrieved approximately 8 weeks later. Collection of fish data occurred for 42 events (5 trend, 25 synoptic, 12 probability) at 40 different locations.

For the fifth consecutive year, NHDES and the New Hampshire Fish and Game Department worked cooperatively to complete fish surveys at several trend monitoring sites. The biomonitoring program also assisted NHFG with Eastern Brook Trout surveys.

The biomonitoring program finalized the statewide probability based report assessing of the state's wadeable rivers and streams for aquatic life use and primary contact recreation. The final report will be included with New Hampshire's 2018 305(b) water quality assessment report to USEPA.

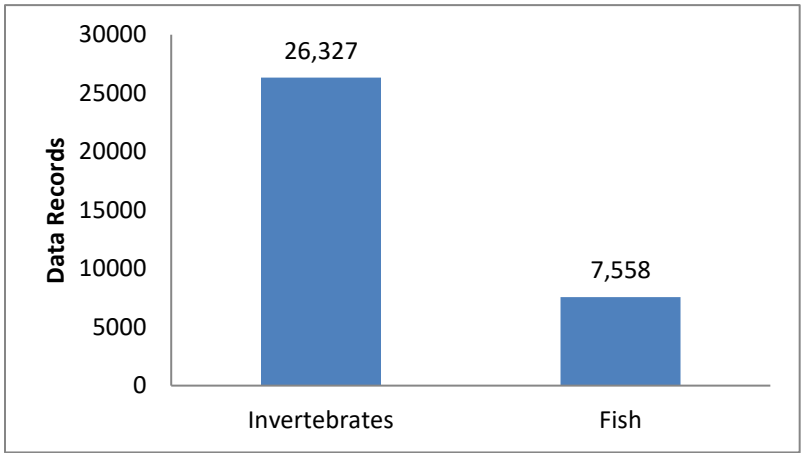
Biomonitoring program efforts include the collection macroinvertebrate and fish data satisfying trend, synoptic and probability-based monitoring efforts. In 2018, biological monitoring included 118 macroinvertebrate samples (42 sample sites) and 40 fish samples resulting in the generation of almost 34,000 combined data points (Figure 7). The number of

macroinvertebrate data records is an estimate based on the average number of macroinvertebrates per sample collected from 2000-2013. Actual data will be available in mid-2019.

Fish identification data quality control measures relied on having an expert fish taxonomist on site during sampling. Any unknown species were documented with photos or retained for laboratory analysis and further consultation with other state agencies and partners. Several samples were preserved for laboratory identification in 2018, including American shad, fallfish, spottail shiners and common shiners from several sites.

All field data are reviewed for quality assurance and entered into the biomonitoring program's Ecological Data Application System (EDAS) database. Additional data checks for completeness and accuracy are performed prior to uploading data to the NHDES Environmental Monitoring Database and later to the Environmental Protection Agency's Water Quality Exchange Database.

Figure 7: 2018 biological data summary



3.1.6 I-93 Chloride TMDL

In 2018 data collection continued for the I-93 TMDL development and implementation. The data quality objective for data completeness is to obtain continuous data for 80% of the fiscal year at each station. The 80% data completeness criterion was met for the datasonde records for North Tributary, Beaver Brook, Policy Brook and Dinsmore Brook (Table 3).

Table 3: Data completeness for in-situ specific conductance datasonde readings from 7/1/15 - 6/30/16

The actual number of chloride grab samples (104) was higher than the expected number (72) (Table 4). This result met

Station ID	Valid Specific Conductance Data Points	15 Minute Intervals in Reporting Period	Portion of Reporting Period with Valid Conductance Data
10A-BVR	35,000	35,040	99.9%
I93-DIN-01	35,010	35,040	99.9%
I93-NTC-01	29,553	35,040	84.3%
I93-POL-01V	34,572	35,040	98.7%

the data completeness quality objective of 80% of the planned measurements. There were 8 pairs of routine and field duplicate samples for chloride, which was one less than the expected number. The RPD between the routine and

duplicate samples was less than 15% in over 100% of the pairs. Therefore, the quality control samples do not indicate any systematic problems with the chloride samples collected for this study.

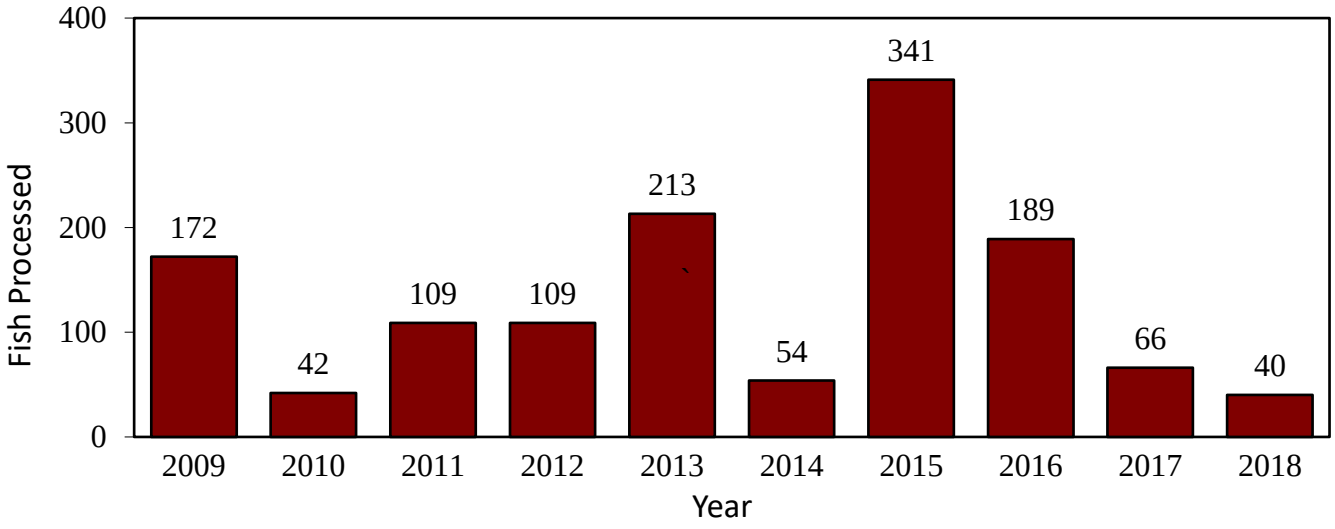
Table 4: Data completeness for grab samples and field meter measurements for 7/1/17 - 6/30/18

Parameter	Actual Number	Expected Number	Percent Complete
Temperature	104	72	>100%
Specific Conductance	104	72	>100%
Chloride	104	72	>100%
Temperature Duplicates	7	9	78%
Specific Conductance Duplicates	8	9	89%
Chloride Duplicates	8	9	89%

3.1.7 Mercury in Fish Tissue Program

The JCLC plays a critical role in the state's mercury in fish tissue study program. NHDES is responsible for organizing the collection of fish specimens for state fish tissue studies. All data collected in this program is used to support both state-wide advisories as well as individual lake and fish species advisories for human fish consumption. Fish are collected by volunteers using traditional fishing methods. The number of fish collected and processed by JCLC for 2018 was an unusually low 40 (Figure 8).

Figure 8: Number of Fish Processed for Mercury Analyses

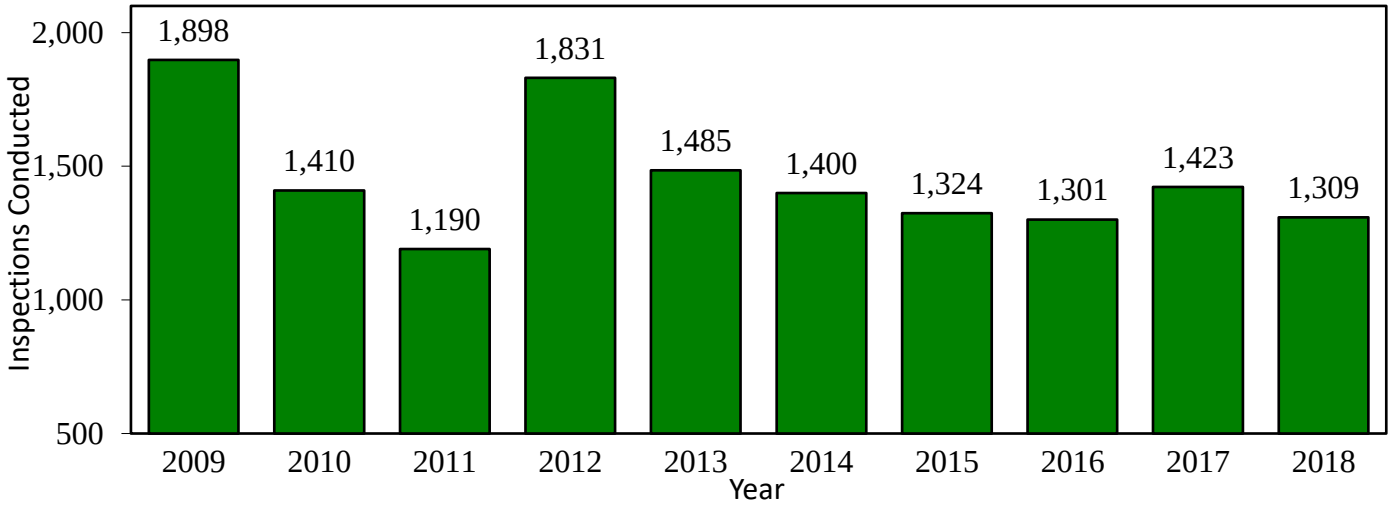


3.2 Inspection-Based Programs

3.2.1 JCLC Support Summary

Several programs are responsible for conducting field inspections. These include inspections of public bathing facilities, coastal and freshwater public beaches, recreational boats, and pet and plant suppliers. In 2018, these inspections totaled 1,309 (Figure 9), which was a modest decrease over the previous year. Fewer bathing facility inspections accounted for most of the difference. Program inspections may be either routine or a result of complaints. These programs protect public health and welfare and require a significant investment of JCLC staff time and resources.

Figure 9: Inspections Conducted by NHDES JCLC for All Programs

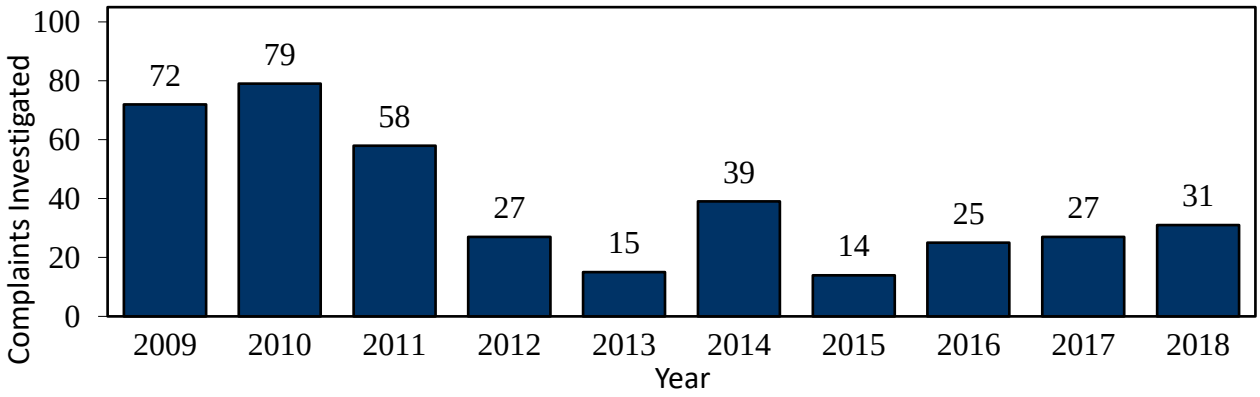


3.2.2 Complaints

Fourty seven new complaints were added to the EMD during the 2018 calendar year. Watershed Management Bureau staff conducted site visits for 31 (66%) of the complaints received (Figure 10). Most others were resolved with a phone call to the responsible party or referral of issues to another agency.

The EMD complaint module is used department wide to track complaints. The integration of all complaints into the EMD not only has an advantage with tracking, but also facilitates the process of referral of complaints received by one bureau to another bureau which has jurisdiction in the issue involved in the complaint.

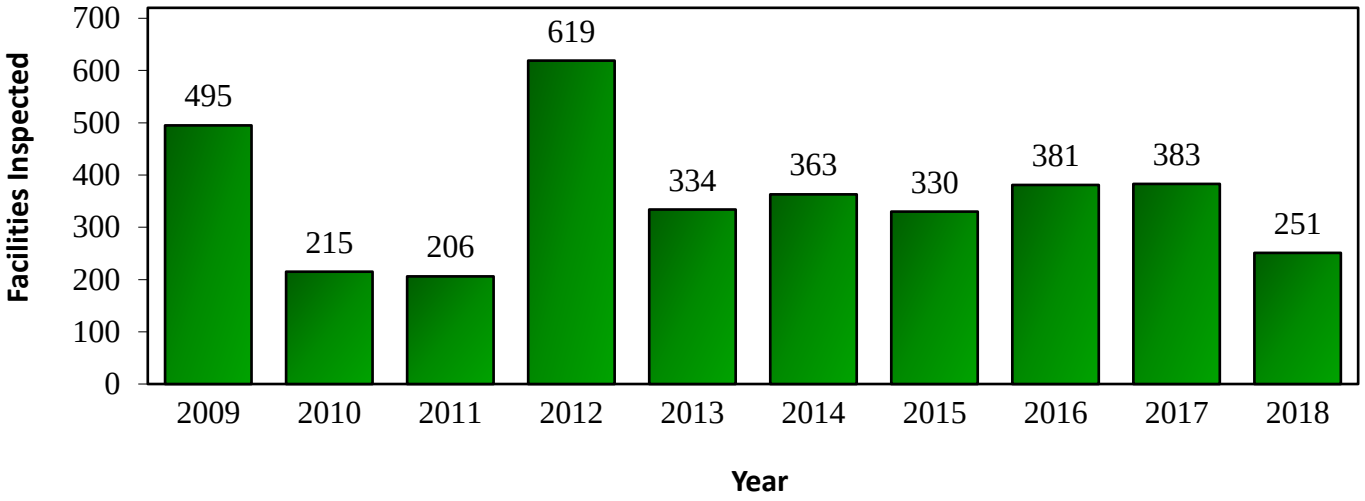
Figure 10: NHDES biology section complaint summary



3.2.3 Public Bathing Facility Inspection Program

The Public Pool and Spa Program oversees approximately 1,300 active facilities. In 2018, 251 facility inspections were conducted, including 226 routine/follow-up and re-test inspections, 10 complaint inspections and 14 pre-opening inspections (Figure 11). Inspection totals can vary from year to year depending on funding levels and the amount of time spent on additional program activities other than field work. Currently, inspections are carried out by the program coordinator and two summer interns. Historically (Pre-2004) the pool program received significant inspection assistance from the subsurface bureau, specifically in the North Country. That additional support began to significantly decrease in 2005 and ended completely in 2009. The loss of that assistance made the goal of inspecting all indoor facilities no longer possible.

Figure 11: Public bathing facility inspections



Water quality violations: Over the last 10 years, 60% of all inspections conducted revealed water quality violations. Fifty-six percent of all inspections in 2018 had one or more deficiency. Of the 251 inspections conducted, specific water quality violations were as follows: Bacteria = 37; pH = 62; disinfection = 62; turbidity = 18; Cyanuric Acid = 46. Although there are many factors that impact the ability of water to sanitize, free chlorine and bromine levels are the primary sanitizing component. There were 30 facilities that had low disinfection levels this year. The number of overall water quality violations varies from year to year with several factors contributing. Those factors include, but are not limited to, inadequate or improper water testing, equipment failure, insufficient owner/operator education, poor construction and weather. Weather impacts pool operation in several ways. Hot, humid weather patterns during the summer tend to drive larger crowds of people to cool off in pools and waterparks. This overcrowding in a body of water leads to a larger demand on the circulation and disinfection systems making it difficult to keep up. The intense UV rays of the hot summer sun will itself also degrade chlorine levels in pool water much more quickly. While rain tends to keep people out of the water, intense rain events often wash contamination directly into pools. Rain water itself can also make it difficult to regulate pool chemical levels.

Safety and Facility violations: When reporting violations in this category, the total number of deficiencies identified during a single inspection, are combined as a count of one. This is to give a general sense of how many inspections overall had safety and facility concerns. This could mean that the inspection revealed only one deficiency or 3 or 4 individual deficiencies.

In 2018, 82 inspections revealed safety or facility violations with a total of 359 individual safety facility violations (Table 5). Safety violations present a direct threat to bathers and include problems such as inadequate entrapment avoidance measures, turbid water, or the bottom of a pool not being visible. Other facility violations may exist that are not an immediate hazard but indicate a lack of basic pool operation, testing and maintenance knowledge.

Of the 251 inspections conducted, the major inspection safety and facility violations numbered as follows: 13 water clarity violations where the bottom of a pool or spa was not visible from the deck; 9 significant bather entrapment avoidance violations; 26 broken gates; 36 pools/spas without water depth markers; 78 occurrences of inadequate water testing; and 84 broken or missing flow meters. In the Safety/Facility violation category, pool water clarity, unapproved, broken or missing drain covers, faulty SVRS devices and others will result in immediate closure of the facility until the violation is corrected and re-inspected.

Table 5. Pool and spa safety violations in 2018.

Specific Safety/Facility Violations	# of Inspections
Poor Water Clarity/Bottom not visible	13
Broken pool fence/access gates	26
Unapproved suction outlet cover	3
Anti-Entrapment device/system (SVRS)	6
Missing skimmer equalizer covers	26
No water test kit available	23
Poor or no water testing recorded	78
Water depth markers missing	36
No breakpoint safety float lines	14
Missing/broken flow meters	84
Body Shepard's crook	11
Rescue flotation device	8
No patron safety rules posted	5
No emergency phone or phone signage	20
No Clock and/or timer for spa	6
Total of individual violations	**359**

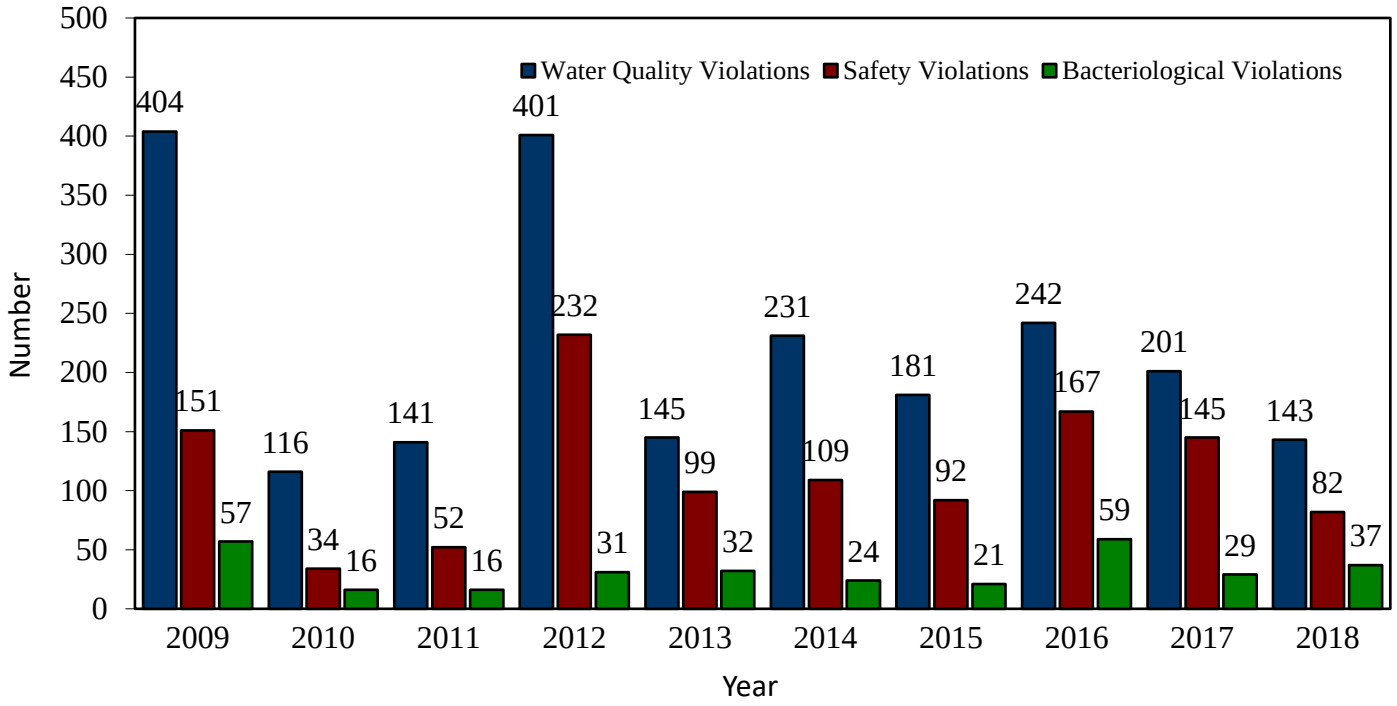
Enforcement activity: 2018 resulted in 12 Letters of Deficiency (LOD) and 42 Notices of Deficiency (NOD) being issued. Eighteen facilities were closed on site due to significant water quality or safety violations where a threat to public health and safety was imminent. Typically, immediate closures involve bottom drain cover problems; extremely low disinfection levels; severe water clarity issues and equipment failures. Responses to closures are typically rapid with many operators, to the extent possible, taking action during the inspections to correct deficiencies. Staff worked closely with local code officials where in 2018 four public pools were constructed without any permit applications being submitted to the NHDES.

Permits: Seventeen permit applications were submitted and issued in 2018. Over the last 15 years, 339 new pools received NHDES permits for construction. 2006 witnessed the highest number of permits issued in one year at 44. The economic downturn of 2008 resulted in a rapid decrease in construction activity, with the fewest number of submitted applications (10) in 2010. Pool construction in 2018 came from several pool categories including hotels, condos, campgrounds, health clubs, assisted living facilities and additions to several waterparks. There were 4 pools discovered that had been constructed without having received prior approvals.

Rulemaking activity: 2014 was the last year that the program's administrative rules were revised. Significant changes in design and operation requirements were made to increase public health and safety. The codification of federal anti-entrapment laws and incorporation of current national model code helped to bring our rules up-to-date. In July of 2018 the 3rd edition of the Model Aquatic Health Code, (US CDC) was published which provides important scientific rationale for future revisions of our rules.

Legislative activity: Late in 2018 the Watershed Management Bureau was given the green light to propose legislation for program improvement and expansion. The impetus for the legislation was precipitated by a Legionnaires disease outbreak in the summer of 2018. This new proposed legislation would increase design review fees, establish a registration and self-certification process, impose training requirements for public pool owners or their designees, and create a dedicated fund account for the program.

Figure 12: New Hampshire public bathing facility violations



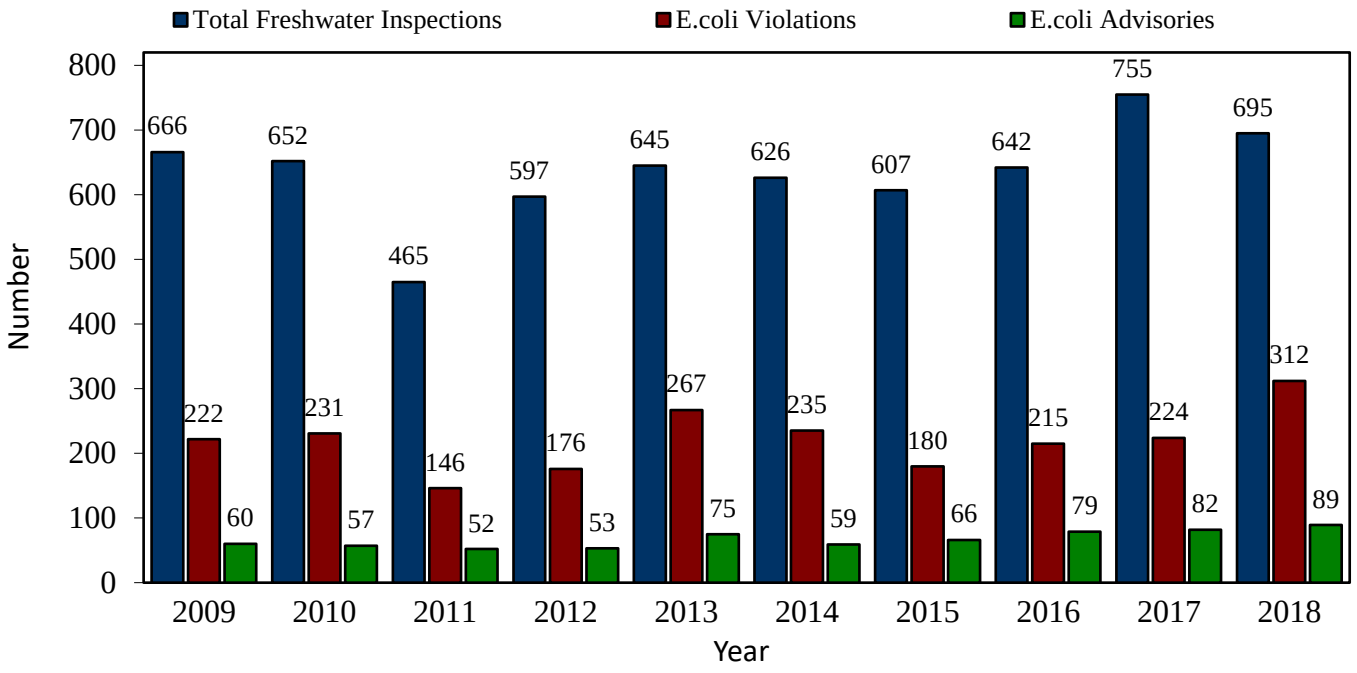
3.2.4 Freshwater Beach Program

The goal of the Public Bathing Beach Inspection Program is to better understand the relative frequency of elevated bacteria at public swimming beaches in New Hampshire. Most freshwater beaches in the program are inspected three times between Memorial Day and Labor Day. Over time, most notably since 2003, we have gained awareness which beaches are typically "clean" and which have recurring bacterial issues. The Freshwater Beach Program inspects and reports *E.coli* bacteria results from over 200 freshwater (town, state, federal and private association beaches). Some beaches are sampled by other agencies and municipalities, some monitoring weekly, and results are reported to NHDES. In 2018, freshwater beaches were inspected by the beach program from June 4 to August 27. During 2018, there were 695 inspections of freshwater beaches for *E.coli* bacteria. A total of 1,853 *E. coli* samples (plus 110 field duplicates) were collected. Samples were analyzed by the State Health and Human Services Department Public Health Laboratory as well as outside labs which were reported to NHDES. In 2018, 312 *E. coli* samples exceeded the state standards, resulting in the issuance of 89 freshwater beach advisories. This is an increase of 7 advisories from the summer of 2017, with the highest number of bacteria advisories issued during the swim season since 2003. Most advisories only lasted 2 days. In total, there were 576 freshwater beach advisory-days in 2018. One beach was preemptively posted for the entire season due to bacterial exceedances in the past. To see result details for each beach in 2018, there are 202 short beach reports available on the NHDES OneStop database for freshwater beaches monitored. .

The Beach Program also implements visual surveillance for cyanobacteria blooms during the roughly 600 cyanobacterial beach inspections made in 2018. Since 2003, NHDES has issued cyanobacteria lake warnings (or beach advisories) when cyanobacteria concentrations exceeded 70,000 cells/ml. Initially, the decision to issue a lake warning or beach advisory was dependent on the location, severity and distribution of the bloom. Since 2017, NHDES has issued cyanobacteria lake warnings regardless of its first reported location (whether a bloom occurs at a beach, far away from a beach, or on a lake without a public beach). The purpose of a cyanobacteria lake warning is to inform the entire lake of these cyanobacterial bloom events. This reasoning is due to the dispersal nature of a bloom, as it can move with wind, currents, and cycle between growth and decay. Bloom accumulations also occur on private shorelines and inaccessible locations. We also rely on public notification of bloom sightings. In 2018, 313 samples were observed in the laboratory for cyanobacteria by NHDES due to public complaints. NHDES issued 34 cyanobacteria related advisories/warnings at 30 different

waterbodies in 2018. Two beaches affected by cyanobacteria blooms were at state parks; Silver Lake SP in Hollis and Jericho SP in Berlin. Elm Brook Park (Hopkinton), Silver Lake (Hollis), Long Pond (Pelham) and Middle Danforth Pond (Ossipee) each experienced two separate advisories in the summer of 2018. The separate events were likely related but surfaced at different times. Two separate bloom events (entirely different locations and species) occurred on or near Lake Winnipesaukee; Weirs Channel and Winter Harbor. Three public water systems experienced cyanobacteria blooms (though no advisories were necessary at the time); Massabesic Lake, Lake Waukewan and Arlington Mill Pond. Additionally, one combined advisory affected two waterbodies; White Oak Pond and Pipers Cove- Squam Lake, as it appeared to be a connected bloom through the outlet stream of White oak Pond to Squam Lake. Over 70% of samples submitted the the JCLC were confirmed to contain cyanobacteria in both 2017 and 2018. In 2017, there were 19 cyanobacteria advisories and lake warnings between May 30 and October 6 of 2017. These events increased in 2018 to 34 advisories, but with increased sample effort (175 samples in 2017, 313 in 2018). The 2018 season had the highest number of reported blooms (exceeding the 70,000 cells/ml threshold) on record probably due to increased public awareness and sampling effort. The earliest reported bloom was May 23, 2018 and the latest reported bloom was November 2, 2018. The total number of cyanobacteria advisory or warning days was 884 (up from 285 days in 2017). The average length of an advisory was 26 days, with 3 days as the shortest and 89 days as the longest number of days for the lake warnings. *Anabaena circinalis* (*Dolichospermum*) was the most common type of cyanobacteria observed by NHDES. Other common taxa included *Microcystis*, *Oscillatoria*, *Woronichinia* and *Gloeotrichia*. Cyanobacteria and harmful algal bloom monitoring efforts continue to develop with the NHDES Public Beach Inspection Program.

Figure 13: Water quality violations and advisories at freshwater beaches



3.2.5 Coastal Beach Program

The Coastal Beach Program of the NHDES Public Beach Inspection Program is a federally funded program that provides resources for coastal beach research and monitoring. NHDES inspected 16 coastal public swimming beaches in 2018. During the swim season, Memorial Day through Labor Day, six beaches were inspected twice weekly, four were inspected weekly, and six beaches were sampled twice a month according to a tiered monitoring assessment. In 2015, the summer sampling frequency was reduced from weekly to twice a month at both Sawyer Beach and Seabrook Town Beach because both had been removed from the 303(d) impaired waters list in the most recent NHDES report to EPA.

The tiered monitoring assessment remained unchanged in 2018. Staff members conducted 245 inspections and collected 800 samples plus 82 field duplicates for a total of 882 Enterococci analysis during the 2018 swim season. The 2018 swim season in New Hampshire was 102 days long, translating into 1,632 beach days collectively for all 16 beaches. There was an increase in the number of samples exceeding the state standard of 104 MPN/100ml for Enterococci. Bacteria results from coastal beach inspections resulted in one or more advisories from eight of the 16 coastal beaches with a total of eleven coastal beach advisories (Hampton Harbor, Seabrook Harbor, Jenness Beach at Cable Rd., Sawyer Beach, Northside Beach (Plaice Cove), North Hampton State Beach, Wallis Sands Beach at Wallis Rd (Pirates Cove), and New Castle Town Beach). There were 37 total advisory days in 2018 compared to 21 total advisory days in 2017. In 2017, there were nine total coastal beach advisories issued at seven coastal beaches (Bass Beach, Foss Beach, North Beach, North Hampton State Beach, Wallis Sands State Park, Wallis Sands Beach at Wallis Rd. and New Castle Town Beach). The mean length of advisory days in 2018 was 3.5 days (up from 2.3 days in 2017). Additionally, the NHDES Beach Program sampled the culvert north of North Hampton State Beach and an outlet (twice weekly during the swim season or 26 scheduled visits) from a creek to the popular swimming beach, Wallis Sands (aka Pirates Cove), in order to better understand the source of bacteria for these particular beaches. Despite the apparent increase in advisories, over 98% of coastal beach samples are considered “clean” (> 96% of samples collected in 2018 were “clean”). There are 16 short reports available on the NHDES OneStop database for each coastal beach monitored in 2018..

3.2.7 Clean Vessel Act Program

The New Hampshire Clean Vessel Act (CVA) program is a result of a cooperative effort between NHDES and the U.S. Fish and Wildlife Service. The Federal Clean Vessel Act of 1992 was established to support adequate facilities for recreational boaters to dispose of waste from marine sanitation devices as well as educate the boating community about wastewater disposal. Through grants from the U.S. Fish and Wildlife Service Sport Fish Restoration program, the CVA program has funding available to construct, operate, maintain and repair stationary pumpout facilities and mobile pumpout services. These federal funds can be used to account for 75% of all approved projects with a minimum of 25% supplemented by the applicant, including state and local government, and private businesses or associations.

New Hampshire funding has been applied to the operation of a mobile pumpout service along the coast since 2002. Beginning in 2006, these grants were also used to implement an Operation and Maintenance Funding program that continues to assist marinas in seasonal upkeep costs to ensure existing pumpout resources remain in proper working condition. Eligible state activities include general program administration and educational outreach to marina owners, boat dealers, and the boating community.

Pumpout options are a key factor in maintaining No Discharge Areas (NDA) throughout New Hampshire waters. All fresh waters of the state are part of the freshwater NDA and prohibit the dumping of any wastewater from boat plumbing, including greywater from sinks and showers. All waters within three miles of the New Hampshire shoreline and the Isles of Shoals are part of the coastal NDA where treated or untreated boat sewage is prohibited. Tidal and estuarine waters, including all bays and rivers to the tidal dams, are also incorporated into the coastal NDA. Important goals of the CVA program continue to include educating the boating community of their environmental responsibilities and encouraging public awareness of sources of pollution and pumpout resources.

Coastal Waters – Currently there are three stationary pumpout locations and two mobile pumpout boats are available to the recreational boating public along New Hampshire’s coast. Every stationary facility has taken part in CVA funds at one point either for initial installation or seasonal repairs. One of the three marina locations was awarded 2017 CVA operation and maintenance funding for their stationary pumpout units. Under this grant, Great Bay Marine in Newington continued routine operation and maintenance. One stationary facility that was out of order for the 2017 season applied for and was approved for grant funds to repair the factilty. This facility was operational at the end of the 2017 season.

The mobile pumpout service receives CVA funding annually through a multi-year contract. Since 2002, approximately 185,257 gallons of sewage have been removed from recreational boats through the use of the mobile pumpout service. During 2018, a mobile pumpout vessel operated in Hampton Harbor from June through September. A state-owned mobile pumpout vessel operated in all other coastal waters from June through October. The two services documented about 1,000 captain hours, 618 serviced boats, and the disposal of an estimated 13,865 gallons of sewage (Figure 15). The popularity and effectiveness of the mobile resource has been evident in the consistency in boater user numbers and sewage pumped since program implementation. Seasonal activity within the recreational boating community varies from year to year depending on economic and weather conditions.

Inland Waters – New Hampshire has approximately 18 pump/dump facilities with 16 (12 of which are public access) devoted to Lake Winnipesaukee and one public facility on Lake Winnisquam. A public dump station is also located within Sunapee Harbor on Lake Sunapee. Approximately 50% of the available pump/dump facilities have taken part in CVA funding at one point or another either for initial installation or seasonal repairs. Three marinas on Lake Winnipesaukee were awarded 2018 CVA operation and maintenance funding for their stationary pumpout units. One additional marina expressed interest in repair funds for the 2019 season and that grant paperwork is currently in progress.

Boat marine sanitation devices (MSDs) were not inspected in 2018 due to the vacancy of the boat inspector position. While this is largely an educational inspection program, it also handles any complaints. No marine toilet, sink, or shower on any boat operated upon fresh waters of the state shall be so constructed or operated as to discharge graywater or sewage per RSA 487:2-3. The boat inspector is authorized under RSA 487 with enforcement if the regulations in RSA 487 are broken. Past season's boat inspections done on Lake Winnipesaukee can be viewed in Figure 14.

The CVA program anticipates funding construction, renovation and maintenance of systems as necessary in 2019. Currently there is one marina on Lake Winnipesaukee with repair grant paperwork pending and a few others interested in future grants. Education and outreach to marinas, pumpout/dump stations, and the boater community in general will continue both for inland waterbodies and coastal waters.

Figure 14: NHDES biology section boat inspection summary, 2008-2018.

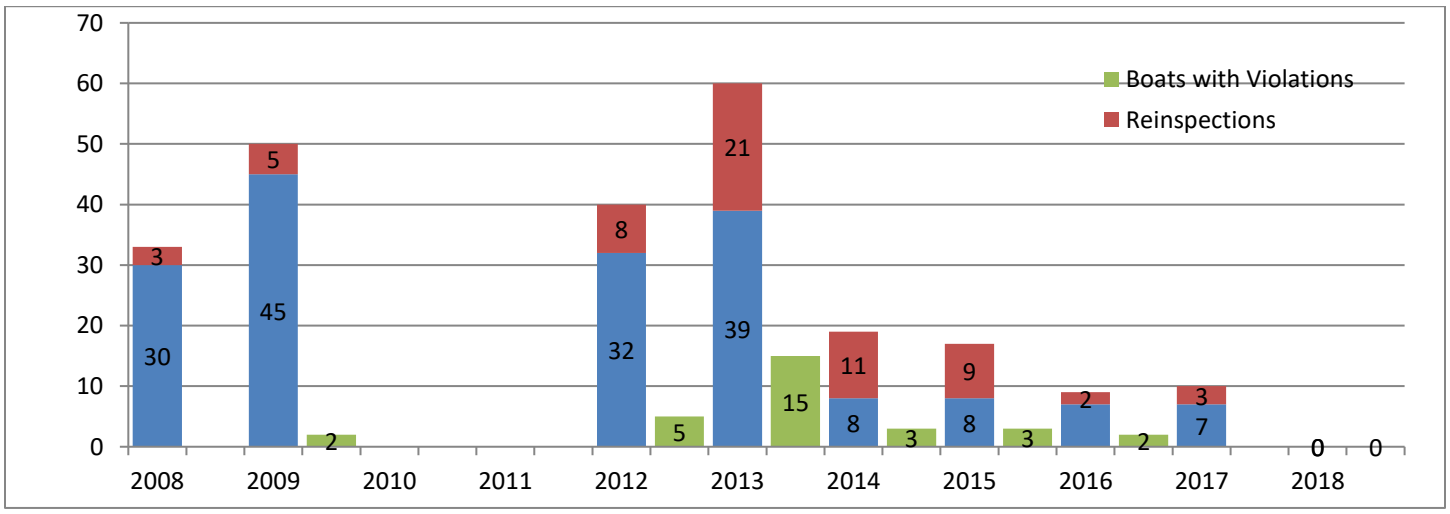
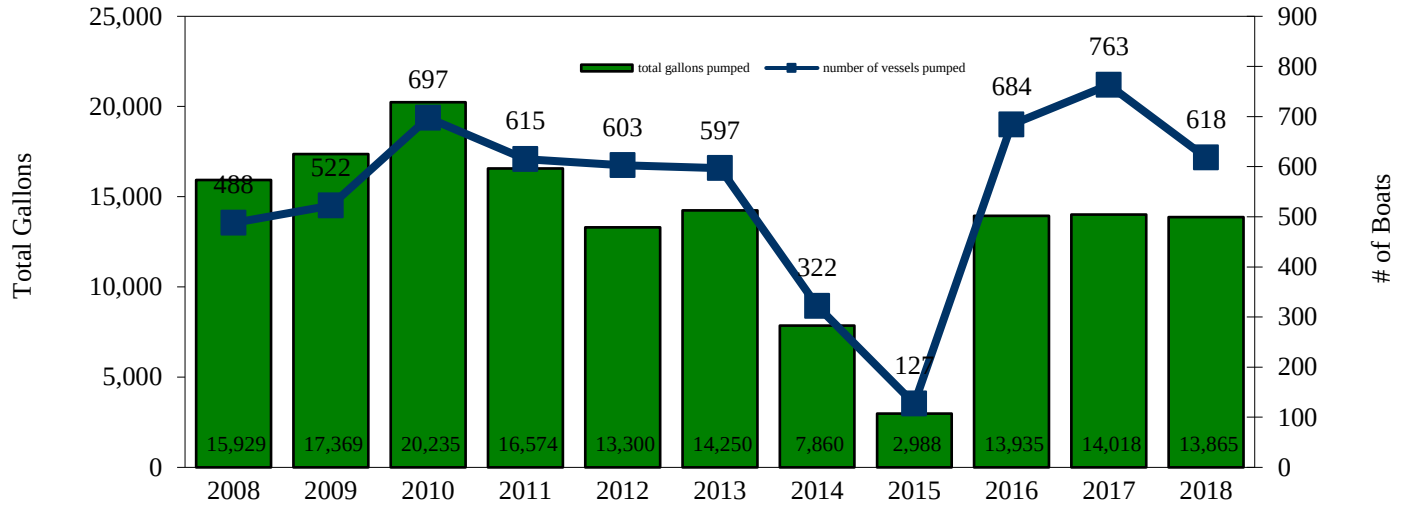


Figure 15: NHDES Clean Vessel Act Pumpout Service



3.2.8 Exotic Aquatic Species Program

The primary purpose of the exotic aquatic species program is to "prevent the introduction and further dispersal of exotic aquatic weeds and to manage or eradicate exotic aquatic weed infestations in the surface waters of the state" (RSA 487:17, II). The program has five focal areas: 1) Prevention of new infestations; 2) Early detection of new infestations; 3) Control of established infestations; 4) Research towards new control methods with the goal of reducing or eliminating infested areas; and 5) Regional and national cooperation.

One new infestation of variable milfoil was confirmed in Angle Pond in Sandown. Divers visited the pond and hand removed growth as it was documented by local residents. The pond was not yet placed on the list of infested waters, due to low level growth that was routinely removed. A reassessment will be performed in 2019.

The exotic aquatic species program inspected 87 waterbodies in 2018 for exotic plant species infestations (Figure 16). It anticipates conducting at least the same number of lake inspections in 2019. The total number of management actions for exotic plant control in 2018 is shown in Figure 17. Non-chemical means of control are increasing and use of herbicides has been decreasing over time.

Figure 16: Exotic species program lake inspections

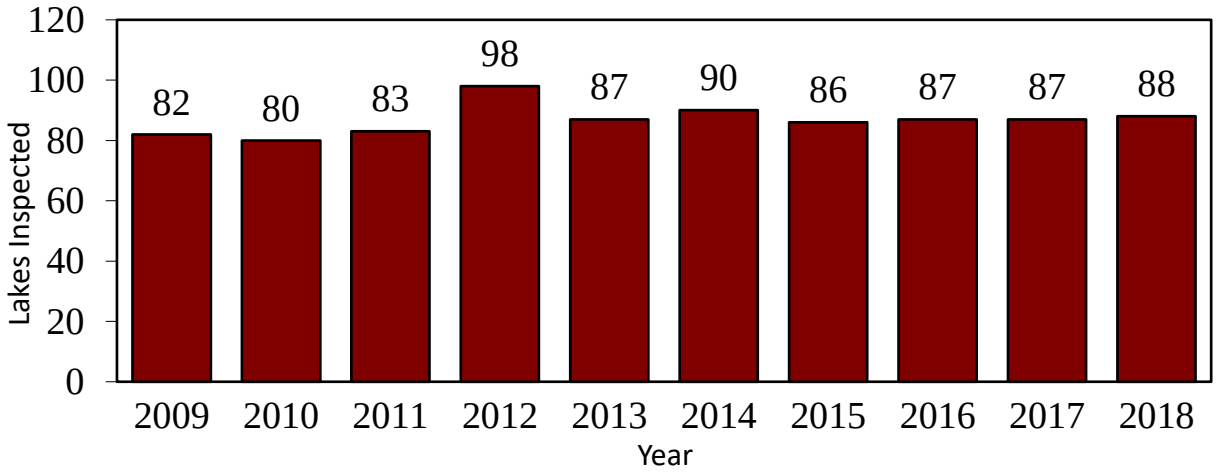
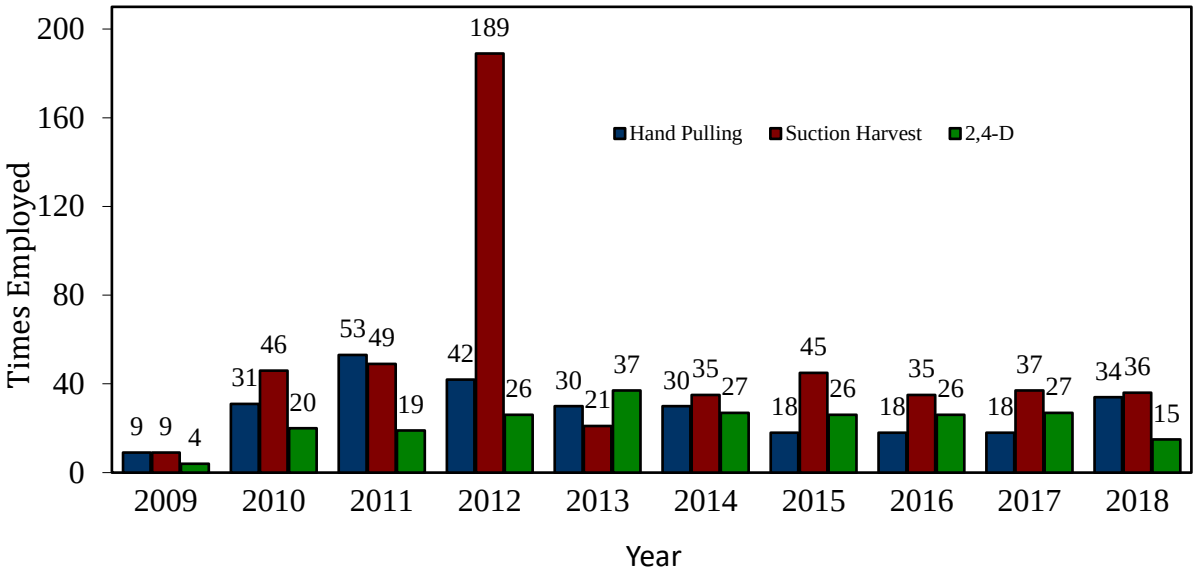


Figure 17: Exotic Species Program Control Practices



4. Summary

In summary, the NHDES WMB operated 26 programs dedicated to monitoring, protecting, and restoring the state's surface waters. Collectively, these programs provide critical information regarding the status and trends of the condition of our lakes, ponds, rivers, streams, estuaries and oceans. Many of these programs also supply valuable data used to estimate public health risks. The JCLC serves as a vital component in the operation of each of these programs, not only through the facilities and equipment it supplies, but also the consistency maintained in data quality control and data management. In 2018, over 13,000 data points were processed in the JCLC. The data quality control measures for all the data were adequately maintained. In total, surface water quality programs operating within the JCLC are covered under seven EPA QAPPs that have been approved or are pending approval. Programs without a formal QAPP have a dedicated SOP included in the JCLC laboratory manual, which is updated annually.