- Polychlorinated biphenyls;
- Electrical transformers that may contain polychlorinated biphenyl dielectric oil;
- Mercury-containing fluorescent light bulbs;
- Mercury thermostats;
- Miscellaneous containers of oil or hazardous materials;
- Refrigerants (commonly found in such items as air conditioners, refrigerators, etc.);
- Hydraulic lifts;
- ASTs; and
- USTs.

The level of audit for each location would vary based on building type, age, and current use. Residential buildings would typically be limited to asbestos and lead paint reviews. Commercial buildings would include a more intensive review for all pertinent materials.

Any miscellaneous containers of oil and hazardous materials would be removed before each relevant building is demolished. In addition, tank closure assessments would be completed after each UST is removed. If contaminants are found with the tank closure assessments, remediation may be required.

Limited Reuse Soils

LRS excavated from within the operational ROW shall be addressed in accordance with applicable NHDES rules, waivers, and/or Soils Management Plans.

Per- and Polyfluoroalkyl Substances

NHDES identified PFAS as emerging contaminants and has developed Ambient Groundwater Quality Standards (AGQSs) for two PFAS compounds: perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). Groundwater that could have PFAS-impacted groundwater above AGQSs may be subject to management with a groundwater management plan.

4.11 Surface Waters and Water Quality

4.11.1 Affected Environment

The Project lies within the Upper Beaver Brook watershed (Level 12 Hydrologic Unit 010700061025) as mapped in USGS' Watershed Boundary Dataset (NHDES, 2017a). Beaver Brook, south of the Project, flows west under I-93 and then south into Massachusetts where it joins the Merrimack River in Lowell. Upper Beaver Brook has been subject to water quality investigations since 2003 in response to proposed development in the watershed, including widening and improvements to I-93 (NHDES, 2008a).

Surface waters of the state are classified as Class A or Class B, pursuant to NH RSA 485-A:8, I-III, Water Pollution and Waste Disposal. Class A waters have the highest quality designation and are required to stay below certain threshold values with regard to bacteria (*Escherichia coli*), and discharges of sewage or wastes are not allowed. Class A waters are considered potentially acceptable for use as water supply after adequate treatment. Class B waters are the second highest quality designation and are required to meet less stringent bacteriological criteria, as well as several other biological, physical, and chemical criteria. By default, all surface waters in New Hampshire are designated as Class B. New Hampshire's Administrative Rules Env-Wq 1700 provide thresholds for pollutants, dissolved oxygen (DO), color, temperature, and other criteria that must be met for Class A and Class B waters.

Regulatory Framework

Project developers are subject to a variety of state and federal regulations and associated programs that ensure surface water quality is preserved or restored in all waters of the U.S. Impacts on waterbodies near the Project alignment would necessitate involvement with these regulations as the Project proceeds through final design to construction.

Clean Water Act Sections 303(d) and 305(b)

Sections 303(d) and 305(b) of the Clean Water Act[11] (CWA) require each state to submit two reports (CWA 303(d) report and CWA 305(b) report) to EPA every two years, documenting the water quality status of surface waters within the state. New Hampshire's "305(b) Report" describes the quality of New Hampshire's surface waters and analyzes the extent to which all such waters provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife and allow recreational activities in and on the water.

The second report, required by Section 303(d) of the CWA, requires submittal of a list of waters that are:

- impaired or threatened by a pollutant or pollutant(s);
- not expected to meet water quality standards within a reasonable time even after application of best available technology standards for point sources or best management practices (BMPs) for nonpoint sources; and
- require development and implementation of a comprehensive water quality study (i.e., a TMDL study) designed to meet water quality standards.

New Hampshire Surface Water Assessment

New Hampshire's process for assessing surface water quality is detailed in the "Consolidated Assessment and Listing Methodology" that interprets New Hampshire's Surface Water Quality Regulations (Env-Wq 1702.17) and identifies "designated uses" for New Hampshire surface waters, defined as "the uses that a waterbody should support" (NHDES, 2017b). Table 4.11-1 lists designated uses.

[11] The Federal Water Pollution Control Act (PL 92-500) as last reauthorized by the Water Quality Act of 1987.

Table 4.11-1. Designated Uses for New Hampshire Non-Tidal Surface Waters

Designated Use	NHDES Definition	Applicable Surface Waters
Aquatic Life	Waters that provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms.	All surface waters
Fish Consumption	Waters that support fish free from contamination at levels that pose a human health risk to consumers.	All surface waters
Shellfish Consumption	Waters that support a population of shellfish free from toxicants and pathogens that could pose a human health risk to consumers	All tidal surface waters
Drinking Water Supply After Adequate Treatment	Waters that with adequate treatment will be suitable for human intake and meet state/federal drinking water regulations.	All surface waters
Primary Contact Recreation (i.e., swimming)	Waters that support recreational uses that involve minor contact with the water.	All surface waters
Secondary Contact Recreation	Waters that support recreational uses that involve minor contact with the water.	All surface waters
Wildlife	Waters that provide suitable physical and chemical conditions in the water and the riparian corridor to support wildlife as well as aquatic life.	All surface waters

Source: NHDES (2017b)

Designated uses are assessed in the Consolidated Assessment and Listing Methodology using a 1–5 TMDL Priority scale, with 1 indicating that all designated uses are attained, and 5 indicating that one or more uses is impaired and a TMDL is required. A score of 4 or 5 indicates that the Assessment Unit (AU, the waterbody or stream segment used for recording assessments) is impaired for one or more designated uses, as defined in the Consolidated Assessment and Listing Methodology:

- **AU Category 4A**: Impaired or threatened for one or more designated uses but does not require the development of a TMDL because a TMDL has been completed.
- **AU Category 4B**: Impaired or threatened for one or more designated uses but does not require the development of a TMDL because other pollution control requirements are reasonably expected to result in attainment of the water quality standard in the near future.
- **AU Category 4C**: Impaired or threatened for one or more designated uses but does not require the development of a TMDL because the impairment is not caused by a pollutant.

- **AU Category 5**: Impaired or threatened for one or more designated uses by a pollutant(s), and requires a TMDL (this is the 303(d) List) (NHDES, 2017b).

Parameters for assessing wildlife are under development, so no assessments for this designated use have been conducted to date.

Total Maximum Daily Load Program

Waterbodies designated in New Hampshire as AU Category 5 (updated every two years in the NHDES 303(d) list) are impaired or threatened waters for one or more designated uses by a pollutant or pollutants and require development of a TMDL for the pollutant(s) causing the threat(s) or impairment(s). The TMDL establishes the maximum amount of a pollutant that can be allowed in a waterbody to achieve water quality standards for all designated uses (NHDES, 2008a). A TMDL report also identifies the sources of the pollutant(s) of concern and the load allocations for each source that are allowed while achieving water quality standards. All TMDLs are subject to public review and comment, review, and approval by EPA (NHDES, 2008a). A TMDL is determined as:

$$TMDL = WLA + LA + MOS$$

Where “WLA” is the waste load allocation for point sources of a pollutant; “LA” is the load allocation for nonpoint sources of a pollutant; and “MOS” is the margin of safety to account for uncertainty and unknowns (NHDES, 2008a).

TMDL Implementation Plans

A TMDL establishes a target for reducing a pollutant(s) to achieve water quality standards in an impaired waterbody, and often a TMDL report is partnered with (although not required) an implementation plan for achieving the necessary load reductions to meet the TMDL. A TMDL implementation plan may identify a framework for achieving load reductions through existing or necessary controls that address the identified source(s) of pollutant(s). One example of pollution controls is BMPs that are structural (e.g., stormwater infiltration) and non-structural methods of achieving pollution reduction (e.g., public outreach and education). Developing and executing an implementation plan may be a permit condition for certain types of projects in TMDL watersheds (e.g., the 401 Water Quality Certification (WQC) for the I-93 widening project [NHDES, 2006]).

Clean Water Act Section 319 Nonpoint Source Pollution Management Program

Section 319 of the CWA was established to address nonpoint sources of polluted runoff. Under this program, the NHDES Watershed Assistance Bureau distributes grants to non-profit organizations, government entities, and watershed organizations to develop watershed management plans, implement BMPs, and assist with organization and outreach. The program also distributes grants annually to these organizations for restoration of impaired waterbodies. The program awarded $705,159 in 2017 for 18 projects throughout the state (http://www4.des.state.nh.us/OneStopOrig/Watershed_NPSGrants_Results).

National Pollutant Discharge Elimination System

The NPDES permit program addresses water pollution by regulating point sources that discharge pollutants to waters of the United States. The NPDES program was created in 1972 by the CWA and allows EPA to transfer authority to state governments to perform many permitting, administrative, and enforcement aspects of the program. Two permitting programs under NPDES are relevant to highway construction projects in the Exit 4A study area: the Construction General Permit (CGP) and the MS4 general permit.

Construction General Permit

EPA's CGP program is designed to ensure that proper stormwater controls are used to protect water resources and the surrounding environment while allowing construction activities to proceed as planned. EPA issued a new CGP on January 11, 2017 (EPA, 2017b) that covers:

- Large construction sites larger than 5 acres,
- Construction sites 1 to 5 acres, and
- Construction sites smaller than 1 acre if they are part of a larger common plan of development.

The 2017 CGP requires the owner and operator of the construction site to develop and implement a Stormwater Pollution Prevention Plan (SWPPP), and includes requirements for oversight and inspection of construction sites. A Notice of Intent (NOI) is submitted electronically to EPA.

Municipal Separate Storm Sewer System General Permit

In addition to notification requirements for construction, the NPDES program requires that municipalities that operate MS4s obtain a permit for stormwater discharge from these systems. Owners and operators in 61 New Hampshire municipalities, including Derry and Londonderry, are required to apply for coverage under the MS4 permit program. In January 2017, EPA released the General Permits for New Hampshire MS4s, which became effective July 1, 2018 (EPA, 2017c). The MS4 general permit has special requirements for discharges to impaired waterbodies and water bodies with an approved TMDL as discussed further in *Chloride Mitigation* in Section 4.11.2.

Clean Water Act Section 401

Section 401 of the CWA requires that owners or operators of projects that seek a federal license or permit for a project that may result in a discharge obtain a certification that state water quality standards will be met. NHDES administers this federal requirement. Projects that require a WQC include those that require:

- CWA Section 404 permits from USACE
- Federal Energy Regulatory Commission licenses
- NPDES permits

USACE, which administers the Section 404 permits, issued Programmatic General Permits for certain activities (USACE, 2017). Under these permits, the WQC is also programmatic and requires no separate filing. For larger projects, requiring an individual Section 404 permit, a separate 401 WQC application must be filed. The application must demonstrate that the project as proposed will not cause exceedances of NH Water Quality Standards (Env-Wq 1700).

Alteration of Terrain Program

The NH Alteration of Terrain (AoT) Bureau is also charged with oversight of the NH Water Quality Standards (NHDES, n.d.). The AoT Bureau issues permits for projects that disturb:

- 100,000 square feet or more,
- 50,000 square feet or more for projects within 250 feet of surface waters under the jurisdiction of RSA 483, the New Hampshire Water Quality Protection Act, or
- Projects of any size that disturb areas with a grade of 25 percent or greater within 50 feet of any surface water.

NHDOT has been granted an exemption from the AoT permit and fee by NHDES as detailed in an agreement signed by NHDOT and NHDES titled "Department of Transportation Terrain Alteration Permit Exemption" (NHDES, 2011b). The agreement recognizes that NHDOT projects are designed, constructed and maintained to comply with all provisions of state water quality standards under a number of state and federal regulations, standards, guidance documents, and contract provisions. These standards are listed in the agreement and are updated by NHDOT as needed:

- DOT Standard Specifications for Road and Bridge Construction, specifically Sections 107 and 645 (approved August 17, 2010)
- AASHTO Highway Drainage Guidelines, 4th Edition, 2007
- EPA's Developing Your Stormwater Pollution Prevention Plan-A Guide for Construction Sites, May 2007
- DOT, Best Management Practices for Erosion and Sediment Control, June 1995
- NHDES New Hampshire Stormwater Management Manual, Volumes 1, 2 & 3, December 2008
- NHDOT Guidelines for Temporary Erosion Control and Stormwater Management, 2002
- NHDOT Best Management Practices for Routine Roadway Maintenance Activities in New Hampshire, August 2001
- NHDOT *Construction Manual*; June 1, 2006
- FHWA's Guidance Manual for Monitoring Highway Runoff Water Quality, March 2001
- FHWA's Urban Drainage Design Manual, August 2001
- FHWA's Hydraulic Design of Highway Culverts, September 2001
- All applicable Federal Aviation Administration Advisory Circulars and Orders
- AREMA's Manual for American Railway Engineering and Maintenance-of Way Association, April 2009

Surface Waters in the Exit 4A Project Area

Several lakes, ponds, and streams in the Project area may be affected by the construction and maintenance of any of the alternatives. The surface waters described below are depicted in Figure 4.11-1.

Lakes in the Exit 4A Project Area

- Beaver Lake, the largest waterbody in the study area, which has a surface area of 134 acres and a maximum depth of 46 feet. Beaver Lake is an important recreational resource for the Town of Derry.

Ponds in the Exit 4A Project Area

- Hoods Pond, an impoundment of Shields Brook located in Derry near the center of the study area. Hoods Pond is approximately 5 acres, with a maximum depth of 6 feet and an average reported depth of approximately 2 feet (NHDES, 1998; 2017a). The estimated watershed area is 6.13 square miles. NHDES classifies the pond as mesotrophic, although noted that it was highly biologically productive and close to being classified as eutrophic (NHDES, 1998).
- Horns Pond, also an impoundment of Shields Brook located in Derry near the center of the study area. Horns Pond is not listed as a Public Water, and no further data were found regarding Horns Pond.
- Scobie Pond, a natural pond located in Londonderry along the town line with Derry, near the northern limits of the study area. This pond covers a surface area of just under 27 acres and has a maximum depth of nearly 26 feet (NHDES, 2017c). The pond has an average depth of approximately 12 feet and is classified as mesotrophic by NHDES (NHDES, 2017c). Scobie Pond is listed on the NHDES *Official List of Public Waters* (NHDES, 2016b).
- Wheeler Pond is located in Londonderry just east of I-93 Exit 4, and it is less than 10 acres (NHDOT, 2004). The surrounding watershed is highly developed. Sampling of basic biological and water quality parameters was attempted by NHDES in August 1997 but at that time it was determined that this waterbody was a wetland rather than a pond (NHDES, 1997). Consequently, data collection was not completed. Wheeler Pond is less than 10 acres in area and is thus not listed on the NHDES *Official List of Public Waters*.
- Lower Shields Pond is located in Derry near the northern limits of the study area. This waterbody forms part of the headwaters of Shields Brook. Because it is less than 10 acres in size, it is not listed on the NHDES *Official List of Public Waters*. Therefore, physical and biological data were not available for Lower Shields Pond.

Streams and Brooks in the Exit 4A Project Area

- Beaver Brook is a perennial stream, the largest stream in the study area. It flows from Beaver Lake in the northeastern corner of the study area in Derry to the south and west through adjacent portions of Derry and Londonderry. It is listed as a public water, and its watershed upstream of I-93 is slightly less than 24 square miles (NHDES, 2007). Much of the watershed area for Beaver Brook is highly developed with commercial, industrial, and residential properties, as well as supporting transportation and utility infrastructure.

- Shields Brook[12] is a perennial stream that starts at the northern limits of the study area where it flows out of Lower Shields Pond, and flows in a generally southerly direction through Hoods Pond and Horns Pond to Beaver Brook. Scobie Pond also flows into Shields Brook just north of NH 28. Between NH 28 and its confluence with Beaver Brook, Shields Brook flows through very highly developed areas associated with the commercial and industrial development along NH Routes 28 and 102, as well as mixed use and residential areas. The stream has a watershed area upstream of NH 102 in Derry of just over 7.3 square miles. Shields Brook discharges into Beaver Brook just upstream of Fordway Street in Derry.
- West Running Brook a perennial stream located within the eastern portion of the study area and flows in a southerly direction. It drains residential and commercial areas to the east of NH 102 and NH 28.

Other Streams in the Exit 4A Project Area

Numerous additional unnamed streams and tributaries are within the study area, including a perennial stream that originates along I-93 near Trolley Car Lane (Unnamed Stream 1). This tributary flows along I-93 and drains into Wheeler Pond near Exit 4. Below Wheeler Pond, the stream flows under NH 102 before draining into a large wetland system associated with Beaver Brook near Transfer Lane in Derry. Upstream of NH 102 (immediately downstream of Wheeler Pond), the contributing watershed of this Beaver Brook tributary is about 1.2 square miles.

Another small perennial stream originates in a large wetland complex located on the west side of I-93 to the south of Stonehenge Road (Unnamed Stream 2). This stream flows to the north and east under I-93, then under NH 28 into a large wetland system (Peat Bog) before flowing to the east and south into Shields Brook. The watershed area for this tributary upstream of NH 28 near its confluence with Shields Brook is approximately 2.4 square miles.

Also, there are several unnamed tributaries located in the northeastern corner of the study area that flow under Tsienneto Road in Derry. This includes a small intermittent stream that originates just east of the NH 28 Bypass and drains through residential areas to the south before crossing under NH 102 and discharging into Beaver Brook near Hoodkroft Country Club. Three other tributary streams associated with Beaver Lake cross under Tsienneto Road near its extreme east end. Two of these streams have relatively small watershed areas (i.e., less than 0.25 square mile). However, the most substantial stream in this portion of the study area drains through a large wetland complex, identified as Prime Wetland B-12, before flowing under Tsienneto Road near NH 102 (see Figure 4.12-2 in Section 4.12). This perennial stream drains a watershed area of just over 1.3 square miles.

[12] Shields Brook is identified in some sources as Beaver Brook. To minimize confusion, for the purpose of the SDEIS, Shields Brook is as described above.

Impaired Waters in the Exit 4A Project Area

As described in Section 4.11.1, New Hampshire is required by Sections 303(d) and 305(b) of the CWA to identify impaired surface waters (i.e., waters that have designated uses that score a 4 or 5) and report them every two years (referred to as the CWA 303(d) list). Impaired waters are also identified in published TMDL reports which designate pollutant reduction goals in impaired waters where a TMDL has been completed. The most recent 303(d) list was produced in 2016 and a summary of impaired waterbodies is presented in Table 4.11-2. These impaired reaches are shown on Figure 4.11-2. Fish consumption in all surface waters in New Hampshire is impaired by elevated mercury caused by atmospheric deposition. EPA approved a regional TMDL for all surface waters for mercury in 2007 (NEIWPCC, 2007). This regional impairment is not listed in Table 4.11-2.

Table 4.11-2. NHDES Listed Impaired Waters in the Study Area

Assessment Unit ID	Town	Surface Water	Year of Listing	Impaired Use	TMDL PC[a]	Reason for Impairment Listing
Lakes and Ponds						
NHLAK700061203-02-01/02/03/04	Derry	Beaver Lake	Statewide Bacteria TMDL approved in 2010. (NHDES, 2010)			
			2016	Aquatic Life	5	Chlorophyll *a*[b], DO saturation, pH, phosphorous (total)[b]
NHLAK700061203-03-01/02	Derry	Hoods Pond	Hoods Pond Phosphorous TMDL approved in 2012 (AECOM, 2012)			
Rivers and Streams						
NHRIV700061203-09	Derry	Beaver Brook, West Running Brook	Statewide Bacteria TMDL approved in 2010. (NHDES, 2010)			
			2016	Aquatic Life	5	Benthic-macroinvertebrate bioassessments,[b] chloride,[b] pH
NHRIV700061203-11	London-derry/ Derry	Beaver Brook	2016	Aquatic Life	5	Chloride[b]
NHRIV700061203-16	London-derry	Beaver Brook	Beaver Brook Chloride TMDL approved by EPA in 2008 (for AU NHRIV700061203-16)			
			2016	Aquatic Life	5	pH

Source: NHDES (2017d)

[a] TMDL Priority Scale.

[b] Identified by NHDES as development impairments (NHDOT, 2017c).

TMDLs in the Exit 4A Project Area

The Exit 4A Project area encompasses waterbodies with approved TMDLs including the Beaver Brook Chloride TMDL, the Statewide Bacteria TMDL and the Regional Mercury TMDL. This section describes the current TMDLs in the Project area and any subsequent actions related to the TMDL process including implementation plans and compliance actions.

Beaver Brook Chloride TMDL

Elevated chloride levels in Beaver Brook were documented close to I-93 as part of the EIS for the Salem to Manchester I-93 widening project. As a nontidal Class B waterbody, Beaver Brook is subject to water quality criteria defined in Env-Ws 1703.21 which states that chloride concentrations should not exceed 860 milligrams/liter (mg/L) for acute exposures or 230 mg/L for chronic exposures. Data collected in 2002 and 2003 from locations in Beaver Brook upstream and downstream of I-93 documented average chloride levels between 98 and 99 mg/L[13] (NHDOT, 2003; 2004). Numerically higher chloride concentrations were observed downstream of the I-93 crossing. However, the relatively high chloride levels observed upstream of the I-93 crossing of Beaver Brook suggested substantial sources upstream of the highway (NHDOT, 2004). Water quality violations of the chronic standard for chloride were detected at two monitoring stations, 10-BVR (below I-93) and 10A-BVR (upstream of I-93 and just downstream of the confluence of Beaver and Shields Brooks) in February 2004 and again in January 2005 at station 10A-BVR (NHDES, 2008a). The documented water quality violations prompted NHDES and NHDOT to conduct a comprehensive water quality monitoring program in the Upper Beaver Brook watershed in 2006 and 2007 and the subsequent data, which documented further violations of the acute chloride standard, resulted in listing Beaver Brook (AU NHRIV700061203-16) as impaired for chloride on the 2006 CWA 303(d) list and ultimately led to the development of a TMDL study and implementation plan for Beaver Brook to meet water quality standards (NHDES, 2008a; NHDES, 2011a).

Because of the chloride threshold exceedances observed in portions of Beaver Brook and some of the contributing tributaries, and as a result of the I-93 widening project, NHDOT and NHDES entered into an MOA (NHDES, 2016d) to develop and implement a TMDL study for chloride in Beaver Brook. The TMDL study was a permit condition of the CWA Section 401 Water Quality Certificate issued for the Salem-Manchester I-93 widening project (NHDES, 2006).

The Beaver Brook chloride TMDL, completed in April 2008, documented chloride levels in selected areas of the Upper Beaver Brook watershed and identified and quantified the contributing sources of chloride. According to the TMDL, the majority (approximately 95 percent) of chloride loading in the watershed is associated with de-icing activities for public and private roadways and parking lots. The TMDL was set as a load duration curve based on the chronic water quality standard (230 mg/L Cl) reduced by 10 percent to include a 10 percent margin of safety (=207 mg/L Cl) multiplied by each streamflow value in a 4-day average flow duration curve developed by NHDES (NHDES, 2008a). The load duration curve expresses the TMDL in tons of chloride per day that can be imported to the watershed at a given flow and meet the chronic water quality standard (NHDES, 2008a). Of the daily chloride load expressed by the TMDL, 66 percent is reserved for the WLA (MS4 permittees) and 34 percent is reserved for the LA (nonpoint sources) (NHDES, 2008a).

[13] Most chloride values are determined indirectly by correlation of chloride concentration to measurements of specific conductance. In this document, we do not provide specific conductance values in addition to the calculated chloride values, and we note that most of the reported chloride levels were derived from specific conductance measurements.

NHDES has also expressed the TMDL for Beaver Brook as an alternative form, the Percent Reduction Goal, which establishes an annual quantity of salt to be applied (known as the "salt load allocation") in tons of salt per year (NHDES, 2008a). The annual salt load allocation is not the TMDL (the TMDL is the load duration curve), but it is used for implementing the TMDL by establishing a longer term goal (i.e., versus daily criteria) for watershed salt imports that can be expected to meet water quality standards. Based on empirical water quality data and annual salt imports from all salt sources in the watershed and including a 10 percent margin of safety, NHDES set the salt load allocation at 9,069 tons of salt per year (NHDES, 2008a). The TMDL report also sets forth the process by which each sector would be allocated a percentage of the total salt load allocation. The recommended sector salt load allocations were negotiated via a Salt Reduction Workgroup, with representatives from each sector of salt applicators (NHDES, 2008a). Recommended salt load allocations per sector were established in the *Chloride Reduction Implementation Plan for Beaver Brook–Derry, Londonderry, Auburn, Chester, NH* (NHDES, 2011a). Although sector salt load allocations can be changed and redistributed by the Salt Reduction Workgroup, the total watershed salt load allocation of 9,069 tons will remain unchanged as the maximum level of salt imports that can be assimilated by the Upper Beaver Brook watershed in support of water quality standards (NHDES, 2008a).

The TMDL specifies the chloride load (point source waste load + nonpoint source load) that can be imported to the watershed while achieving water quality standards and describes the activities that should be used to meet the chloride load (NHDES, 2008a). The *Chloride Reduction Implementation Plan for Beaver Brook* (NHDES, 2011a) specifies a number of BMPs to optimize salt use efficiency and identifies activities and target dates for achieving compliance with the TMDL (see Table 4.11-3). The BMPs were identified consistent with the implementation plan goals to reduce salt loads and attain chloride water quality standards in the Upper Beaver Brook watershed while preserving winter road maintenance standards and traffic safety (NHDES, 2011a).

Table 4.11-3. Chloride Reduction Implementation Plan Matrix

		Target Completion Date of Responsible Agencies							
Action		NHDES	UNH	NHDOT	Towns[a]	LER[b]	RPC[c]	PS[d]	NH DOS[e]
Objective: Creation of Educational Manuals, Training Programs and Procedural/Operational Strategies									
1	State Snow and Ice BMP Manual for Roadways	2012		2012					
2	State Snow and Ice BMP Manual for Parking Lots	2012		2012				2012	
3	Develop DOT Winter Maintenance Training Program for Salt Reduction			2012					
4	Certification Training Program for Private Sector		2011						
5	Training and Certification Program for Municipal Staff		2011		2011				
6	Legislative approval of salt applicators license program	DLA[f]							

	Action	Target Completion Date of Responsible Agencies							
		NHDES	UNH	NHDOT	Towns[a]	LER[b]	RPC[c]	PS[d]	NH DOS[e]
7	Legislative approval of mandatory use of snow tires								DLA
8	Develop Join Incident Protocols			2011					2011
9	Complete Driver Behavior Study	2012							
10	Adopt traffic violation procedure to address reckless driving during inclement road conditions								DLA
11	Develop winter driving training and require attendance for repeat traffic violation offenders								DLA
12	Develop training for inexperienced drivers, such as high school students				2012				2012
13	Reduce driving speed limits during inclement weather conditions			2010	2010				
14	Hold prewinter meetings to review LOS				2011	2011			
15	Develop call-back ranking system				2012	2012			
16	Develop and adopt a formal snow and ice removal policy				2011				
17	Revise site plan review process to include designs and/or management strategies that may decrease chloride use				2012		2012		
18	Revise permit review process to include designs and/or management strategies that may decrease chloride use	2012							
19	Creation of a salt reduction ordinance				2015				
20	Require mandatory training for employees and contracted staff that deal with winter maintenance			2012	2012			2012	
21	Review and update Salt Management Plans every 5 years				2015				
22	Development of company operational procedure manual for snow and ice removal							2015	
23	Develop record keeping strategy for salt application			2012	2012			2012	
24	Properly store salt under cover and on an impervious surface and away from surface water			2011	2011			2011	
	Objective: Snow and Ice Removal BMP Applications								
1	Modify existing equipment for pre-wetting				2012			2012	
2	Implement pre-wetting watershed wide			2014	2014			2014	
3	Implement anti-icing watershed wide			2016	2016			2016	
4	Use handheld or truck mounted spreaders			2011	2011			2011	

Action		NHDES	UNH	NHDOT	Towns[a]	LER[b]	RPC[c]	PS[d]	NH DOS[e]
		Target Completion Date of Responsible Agencies							
5	Install ground speed oriented spreaders to trucks			2014	2014			2014	
6	Use alternative snow fighting methods such as snow fences where applicable			2011	2011			2011	
7	Manage overflow parking areas based on level of use			2013				2013	
8	Properly maintain and calibrate equipment			2011	2011			2011	
9	Complete periodic inspections of parking lots and walk ways for over application of deicer. Follow up with staff/contractor on findings							2012	
10	Adopt BMPs at all salt storage and handling facilities			2012	2012			2012	
11	Track salt use utilizing salt accounting system developed by the University of New Hampshire Technology Transfer Center							2012	
12	Install automatic vehicle location systems to collect real time data			2015	2015				

Source: NHDES (2011)
[a] Derry and Londonderry
[b] LER - Local Emergency Responders
[c] RPC - Rockingham Planning Commission
[d] PS - Private Sector
[e] NH DOS - NH Department of Safety
[f] DLA - Dependent on Legislative Approval

Since development of the NHDOT TMDL implementation plan in 2009 (NHDOT, 2009), incorporated into the NHDES Chloride Reduction Implementation Plan in 2011 (NHDES, 2011a), NHDOT has implemented many BMPs for reducing chloride imports to the Upper Beaver Brook watershed as documented in a letter from NHDOT (NHDOT, 2018), which demonstrates compliance with NHDOT permits related to the I-93 roadway. A summary of the BMP activities implemented in the I-93 roadway, including in the Upper Beaver Brook watershed, follows (NHDOT, 2018).

- Salt accounting—NHDOT meticulously monitors its salt stock in each patrol shed and reports that information annually to NHDES.
- Pre-wetting—NHDOT applies liquid deicer to dry salt at time of application.
- Anti-icing—NHDOT applies brine directly to the pavement in advance of an oncoming storm when conditions allow.
- Underbelly plows—NHDOT uses these plows that enhance snow scraping/removal capabilities.
- Ground-speed spreader controllers—All NHDOT trucks utilized out of Shed 528 have ground-speed, closed loop controllers.

- Mobile pavement temperature sensors—All NHDOT trucks located in Shed 528 have mobile pavement temperature sensors. Several road weather stations have also been established along the I-93 corridor.
- Equipment calibration—NHDOT annually calibrates their spreader equipment prior to each season.
- Enhanced training—NHDOT provides enhanced training tracks participation via an online accounting system. Hired equipment operators are encouraged to attend.
- Improved storage practices—NHDOT has just completed upgrading a depot shed in Salem which has increased indoor storage capacity.
- Snow and ice forecasting—NHDOT utilizes computer software that provides forecast for plowing and salting with information feed from it Roadside Weather Information System.
- Enhanced plow blade technology—NHDOT uses flexible plow blades that provide better road contact and enhance snow scraping/removal capabilities.
- Global positioning system (GPS)/automatic vehicle location (AVL) technology—All NHDOT spreader trucks located in Shed 528 are equipped with GPS/AVL, which helps track salt usage by specific trucks and areas or interest.
- Variable messaging signs—Variable messaging signs have been installed to warn drivers of impending or current weather and traffic conditions and set lower speed limits.
- Enhanced material reporting relative to winter severity—NHDOT has been reporting post-implementation salt usage relative to pre-implementation usage while adjusting for winter weather severity.

To address the Beaver Brook chloride TMDL, the Town of Derry developed a salt reduction plan in 2011 (Town of Derry, 2011) with subsequent updates in 2016 (Town of Derry, 2016b); the plan was also incorporated into the *2011 Chloride Reduction Implementation Plan for Beaver Brook* (NHDES, 2011a). The 2016 salt reduction plan details several measures that have been implemented to reduce salt loading in Beaver Brook (Town of Derry, 2016b):

- Five salt-reducing plow trucks were purchased.
- New trucks include salt pre-wetting sprayers, groundspeed controls, and pavement temperature sensors.
- A salt spreader calibration program was developed and implemented to ensure accurate application rates.
- All Derry municipal operators have been trained in the Green Snow Pro Program offered by the University of New Hampshire (UNH) Technology Transfer Center.
- Derry regularly hosts the Green Snow Pro Program training in its municipal center on Manning Street.
- Derry officials supported the passage of the voluntary certified salt applicator law each time it was presented to the state legislature.

- Derry has filmed and broadcast plow truck ride-alongs on its public access television station.
- Derry has provided ride-alongs for the NHDES Salt Reduction Coordinator.
- Derry public television interviewed NHDES and UNH salt reduction experts during a segment about the chloride contamination issues in Beaver Brook.

Derry committed in 2016 to equipping nine plow trucks with AVL technology which will allow the town to track the amount of salt applied on each salt route and will log salt applied in a central database. This system also helps avoid duplicating salting efforts by displaying a trail showing where other salt applicators have been.

The Town of Londonderry also developed a salt reduction plan (Town of Londonderry, 2011) in response to the TMDL that was incorporated into the *2011 Chloride Reduction Implementation Plan for Beaver Brook* (NHDES, 2011a). The salt reduction plan identified BMPs and implementation goals for reducing salt loads, including equipment upgrades, improved equipment calibration procedures, private sector outreach, and improved weather monitoring. In *Town of Londonderry, NH Salt Reduction Best Management Practices for the Beaver Brook Watershed within the Boundaries of the Town of Londonderry* (Town of Londonderry, 2018), the town reports that, as of March 2018, it has completed the following steps:

- Purchase of five dump trucks with underbody discharge spreaders
- New trucks include salt pre-wetting, groundspeed controls, and pavement temperature sensors
- Spreader control units on new trucks allow adaptive road treatment
- Spreader calibration policies were developed and implemented
- Salt use tracking policies were developed and implemented
- A salt reduction training program is required for town staff and road maintenance contractors
- The local weather forecast service was upgraded to aid the road maintenance decision-making process

NHDES's 2011 chloride reduction plan for Beaver Brook provides recommendations for salt reduction by the private sector including reporting of salt usage to the UNH Technical Transfer Center (NHDES, 2011a). Specific elements of the implementation plan applicable to the private sector are itemized in Table 4.11-3. NHDES has also published *Best Management Practices and Salt-Use Minimization Efforts in Chloride-Impaired Watersheds of New Hampshire–A Guidance Document for Private Developers and Contractors* (NHDES, 2016e), which reiterates elements of the 2011 chloride reduction plan and provides specific guidance on how to develop an individual salt minimization plan. Individual salt minimization plans identify and describe the development being maintained and provide the following:

- Operational Guidelines

- Winter Operator Certification Requirements—such as Green SnowPro[14] Training, which is administered by NHDES
- Weather Monitoring—how weather information is gathered and communicated
- Equipment Calibration Requirements
- Mechanical Removal—information such as snow storage and plowing frequency
- Salt Usage Evaluation and Monitoring—description of salt usage monitoring and reporting
- Analysis of Alternative De-icing Materials, Site Design Considerations, and Watershed Offsets

Statewide Bacteria TMDL

In 2010, NHDES completed and EPA approved a New Hampshire Statewide TMDL for Bacteria Impaired Waters (NHDES, 2010) to document impairments to state waters, establish allowable loadings, and identify reductions needed to meet water quality standards. Currently, there is no implementation plan for the statewide bacteria TMDL. Conformance with the TMDL is stated as percentage reduction and threshold values for mean and single sample bacteria concentrations for each waterbody specific TMDL. Table 4.11-4 lists the waterbodies in the Exit 4A Project Area identified in the 2010 Bacteria TMDL, with the TMDL threshold and achievement criteria for each AU.

Table 4.11-4. Statewide Bacteria TMDL—Affected AUs in Exit 4A Project Area

Waterbody	TMDL Threshold	TMDL Achievement Criteria
Beaver Brook (AU NHRIV700061203-09)	126 CTS/100ml for a geometric mean and 406 CTS/100ml for a single sample	29% reduction in the geometric mean for E. coli sample concentration
Beaver Brook (AU NHRIV700061203-22)	126 CTS/100ml for a geometric mean and 406 CTS/100ml for a single sample	21% reduction in the geometric mean value for E. coli sample concentration and a 63% reduction in the single sample value of E. coli concentration
Beaver Lake (AU NHLAK700061203-02-02)	47 CTS/100ml for a geometric mean and 88 CTS/100ml for a single sample (NHDES, 2010)	55% reduction in the geometric mean value for E. coli sample concentration and a 78% reduction in the single sample value of E. coli concentration
Hoods Pond (AU NHLAK700061203-03-02)	47 CTS/100ml for a geometric mean and 88 CTS/100ml for a single sample	69% reduction in the geometric mean value for E. coli sample concentration and a 94% reduction in the single sample value

Hoods Pond Phosphorous TMDL

Hoods Pond, an impoundment of Shields Brook located in the center of the Exit 4A Project area, has experienced periodic summer cyanobacteria blooms and was listed on the 2006, 2008, and

[14] Voluntary Certified Salt Applicator Program, authorized in Env-Wq 2200.

2010 303(d) lists as having a primary contact recreation use impairment due to the presence of hepatotoxic cyanobacteria (NHDES, 2006; NHDES, 2008a; NHDES, 2010, AECOM, 2012). Subsequently, a phosphorous TMDL study was completed for Hoods Pond in 2012 (AECOM, 2012) because nutrient enrichment, specifically total phosphorous, was identified as the most likely contributing factor to the documented cyanobacteria impairment. The TMDL study identified contributions from the Shields Brook watershed to Hoods Pond as the primary source (96.8 percent of total) of the annual total phosphorous load in Hoods Pond (AECOM, 2012). A lake loading response model was used to determine the annual and daily phosphorous loads that would support a numeric water quality target in Hoods Pond of 12 ug/L total phosphorous. Previously, NHDES identified an in-lake total phosphorous water quality target value of 12 ug/L as a threshold criterion for mesotrophic status (Hoods Pond is classified as mesotrophic) as discussed further in the Hoods Pond phosphorous TMDL study (AECOM, 2012). The TMDL study recommends a maximum annual load of 273 pounds (lbs)/year total phosphorous, about a 75 percent reduction from existing conditions as of 2012, to meet the water quality target in Hoods Pond. The maximum daily load in Hoods Pond was set at 2.18 lbs/day of total phosphorous and allocated to a single waste load allocation because the report authors found it infeasible to separate point and nonpoint source loads in the watershed.

The Hood Pond phosphorous TMDL study outlines an implementation plan to achieve total phosphorous reductions in Hoods Pond. The implementation plan advocates a watershed approach to achieving the phosphorous reduction goals due to the majority of the total phosphorous load originating from a number of sources in the Shields Brook watershed. The implementation plan outlines a number of BMPs for stormwater management that can be used to reduce nutrient loads to the watershed and help achieve the total phosphorous target reductions. BMPs considered in the implementation plan were selected for mitigation effectiveness for a variety of factors and are categorized in Table 4.11-5 based on nutrient removal rankings (from AECOM, 2012).

Table 4.11-5. Nutrient Mitigation BMPs from Hoods Pond Phosphorous TMDL Implementation Plan

Good Mitigation	Moderate Mitigation	Minimal Mitigation
Infiltration swale Infiltration trench/galley Retention infiltration basin Bioretention Green roof Minimize disturbance area Minimize site imperviousness Porous pavement Rain garden	Disconnecting impervious area Flow path practices Preserve infiltratable soils Preserve natural depression areas Rain barrels/cisterns Soil amendment Vegetated filter strip Vegetation preservation Created wetland/biofilter detention Extended detention pond Wet detention, sand/organic filter Swale	Deep sump catch basins Water quality inlet

Source: AECOM (2012)

Regional Mercury TMDL

Fish consumption in all surface waters in New Hampshire is impaired by elevated mercury caused by atmospheric deposition. EPA approved a regional TMDL for all surface waters for mercury in 2007 (NEIWPCC, 2007), including all waterbodies in the Project area. Major point sources of air pollution are restricted to a concentration of 0.3 parts per million (ppm) mercury in emissions to meet the mercury reduction goals in the TMDL.

CWA Section 319 Nonpoint Source Pollution Plans

The Project area includes one waterbody (Beaver Lake) with a completed watershed management plan funded in part by CWA Section 319 nonpoint source pollution grants (EPA, 2018b.

Beaver Lake Watershed Management Plan

In recognition of increasing development pressure and population growth since 1960 and reduced water quality in Beaver Lake and its tributaries, the Beaver Lake Watershed Partnership (BLWP) developed the Beaver Lake Watershed Management Plan in 2007 (BLWP, 2007) to address the threats and impairments to water quality in the Beaver Lake watershed using a Section 319 grant from NHDES (EPA, 2018b). The Beaver Lake Watershed Management Plan identifies a number of specific goals and targets for protecting the Beaver Lake watershed from polluted nonpoint source runoff including local land use regulations implemented by the partnering towns and affects development in the Project area.

- Goal 1: All watershed towns share the same vision for protecting the watershed and coordinate their approach to regulations and protections.
- Goal 2: The watershed is protected through land use policies that minimize adverse impacts to the Beaver Lake watershed.
- Goal 3: Land use in the Beaver Lake watershed is consistent with watershed protection.
- Goal 4: All non-prime wetlands within the Beaver Lake watershed have greater buffer protection.
- Goal 5: Auburn, Chester, and Derry have Open Space Ordinances.

BLWP provides a means for measuring success with achieving the goals by conducting annual reviews of the Beaver Lake Watershed Management Plan to make revisions and develop annual work plans.

Exit 4A Regulatory Environment

The Exit 4A Project would be subject to several regulatory and existing permit requirements as outlined in the *Regulatory Framework* section of 4.11.1. Specifically, the Project would be subject to the following requirements.

NH Small MS4 General Permit

In January 2017, EPA released the General Permits for New Hampshire MS4s, which became effective July 1, 2018 (EPA, 2017c). Both Derry and Londonderry, and therefore the Exit 4A

Project area are included in this program. Because both towns have discharges that impact an impaired AU for which a TMDL has been prepared (i.e., Beaver Brook), both are required to meet additional requirements of the MS4 permitting program. One requirement will be to develop BMP-based chloride reduction plans that include specific actions designed to achieve chloride reduction on both municipal and private facilities that discharge to applicable MS4s. Chloride reduction plans, already developed as part of the TMDL process, have addressed chloride loading from all sectors. The new MS4 permit requires each town to explicitly address the private sector in their chloride reduction plan, with plan enforcement prescribed through town ordinances.

The 2017 NH MS4 defines in section 6.0 of the permit (EPA, 2017c) requirements for transportation agencies and requires transportation agencies to comply with all conditions of the permit. Under Appendix F–Requirements of Approved Total Maximum Daily Loads of the MS4 general permit (Appendix F of the MS4) Part I.1, municipalities (which includes NHDOT under this permit) must develop a chloride reduction plan by July 1, 2019, which must be fully implemented by July 1, 2023. Elements of the municipal chloride reduction plan, briefly, are:

- Tracking of salt applied (starting July 1, 2020)
- Planned activities for salt reduction such as:
- Operational changes (pre-wetting, pre-treating salt stockpile, increased plowing prior to de-icing, monitoring of road surface temperature) – implemented by July 1, 2019
- New or modified equipment
- Staff training—implemented by July 1, 2019
- Adoption of guidelines for application rates
- Equipment calibration
- Designation of no-salt and low salt zones
- Estimate of total tonnage of salt reduction expected
- Implementation schedule—full implementation by July 1, 2023

Alteration of Terrain Permit

As a NHDOT-sponsored project, Exit 4A would be exempt from obtaining an individual permit from the AoT Bureau as outlined above. The Project would be subject to all of the design standards, state and federal regulations, contract provisions, and BMPs listed in the 2011 agreement between NHDOT and NHDES as discussed previously in the Regulatory Framework section of 4.11.1.

401 WQC

As discussed in section 4.11.1, proponents of federal actions that propose discharges to waters of the U.S. that require a federal permit or license, such as a permit under Section 404 or Section 402 (e.g., MS4 general permit) of the CWA are required to obtain a WQC through Section 401 of the CWA. In New Hampshire, the NHDES Watershed Management Bureau administers this program. For projects that require a Section 404 permit from USACE and that fall under the NH

Programmatic General Permit (USACE, 2017) the 401 WQC is programmatic under state WQC #2017-404P-001, and no separate application is needed. Projects that require an individual Section 404 permit from USACE must apply for a WQC from the NHDES Watershed Management Bureau. The proposed Exit 4A Project would likely require an individual WQC.

The NHDES Watershed Management Bureau commonly requires applicants for individual WQCs to develop and adopt a BMP-based Chloride Management Plan, as discussed in "*Best Management Practices and Salt-Use Minimization Efforts in Chloride-Impaired Watersheds of New Hampshire–A Guidance Document for Private Developers and Contractors*" (NHDES, 2016c). Accordingly, the WQC issued for Exit 4A would likely require a condition that NHDOT and the Towns prepare and adopt BMP-based Chloride Management Plans similar to the chloride reduction plan required in Appendix F of the MS4.

4.11.2 Environmental Consequences

Total Suspended Solids and Nutrients

Conventional stormwater systems have been traditionally designed to efficiently convey runoff from roadways and other impervious surfaces while modifying flow rates and timing at discharge points to surface waters. Without treatment, however, highway runoff can be a significant contributor to nonpoint source pollution in surface waters (NHDES, 2008b).

Current stormwater regulations (e.g., 2017 NH MS4 permit–EPA, 2017c) require treatment of pollutants, including total suspended solids (TSS) and nutrients, primarily nitrogen and phosphorous, prior to discharge into any surface water. Pollutant loads from roadways and other impervious surfaces, as used in stormwater treatment planning and design, are typically estimated based on published loading rates. Various sources cite a range of values for estimating average annual loading rates resulting from stormwater runoff from roadways. The 2017 NH MS4 permit (EPA, 2017c) cites estimated annual loading rates from connected highway impervious surfaces as 1.34 lbs/acre/year for phosphorous and 10.5 lbs/acre/year for nitrogen. The NHDES SIMPLE method (NHDES, 2015b) indicates 1,098 lbs/acre/year for TSS, 2.5 lbs/acre/year for phosphorous, and 23.2 lbs/acre/year for nitrogen as the annual load from urban highways (assuming 40 in. of rainfall and a runoff producing event fraction of 0.9). The *Fundamentals of Urban Runoff Management* (Shaver et al., 2007) lists the annual loading rates from highway runoff as 1,700 lbs/acre/year for TSS, 0.9 lbs/acre/year for phosphorous, and 12.8 lbs/acre/year for nitrogen (as Total Kjedahl nitrogen + nitrate-N + nitrite-N). The Exit 4A Project Build Alternatives plan for creation of new impervious surface in the Upper Beaver Brook watershed that, left untreated, could result in additional stormwater contributions to suspended solids and nutrients in the watershed. Regulatory requirements for stormwater treatment at new development and redevelopment construction projects are discussed in Section 4.11.2.

No Build Alternative

The No Build Alternative assumes that no major new construction would occur for the Exit 4A Project except for projects that are already planned and programmed. Under the No Build Alternative, no development or redevelopment is planned as a direct result of the Project that would result in any new additions of roadway or impervious surface, and no development- or redevelopment-related changes in land use are planned. Therefore, no increases in the Upper

Beaver Brook watershed pollutant load would occur as a direct result of added impervious surface, roadway, or other changes in land use resulting from the Project.

Build Alternatives

Each of the Build Alternatives includes development of new roadway in undeveloped areas or areas with non-roadway current land use as well as redevelopment of existing roadway that would result in new impervious surface within Upper Beaver Brook watershed. The addition of new impervious roadway surfaces that contribute stormwater runoff to surface waters has the potential to add new TSS and nutrient loads to the watershed. As discussed previously, typical load rates for nutrients are on the order of pounds to tens of pounds/acre/year, and, for TSS, typical load rates are on the order of 1,000+ pounds/acre/year for roadways. The Build Alternatives would result in a minimum new roadway area of 3.0 acres for Alternative F and a maximum new roadway area of 27.4 acres for Alternative C. These roadway impervious areas were transformed to estimated annual pollutant loads using the loading rates cited previously. Total nitrogen (TN) loading rates were estimated to range from 10.5 lbs/acre/year–23.2 lbs/acre/year. Total phosphorous loading rates were estimated to range from 10.5 lbs/acre/year (EPA, 2017c)–23.2 lbs/acre/year. TSS loading rates were estimated to range from 1,098 lbs/acre/year–1,700 lbs/acre/year (Shaver et al., 2007). The Build Alternatives would potentially contribute a minimum post-construction annual pollutant load ranging from 143–316 pounds of nitrogen, 18–34 pounds of phosphorous, and 14,933–23,120 pounds of TSS at Alternative F to 501–1107 pounds of nitrogen, 64–119 pounds of phosphorous, and 52,375–81,090 pounds of TSS at Alternative D. The post-construction total impervious surface areas and associated annual pollutant load estimates are presented in Tables 4.11-6 through 4.11-9. The 2017 NH MS4 permit has requirements for stormwater treatment based on the total post-construction impervious area that are presented in Section 4.11.2.

Table 4.11-6. Post-Construction Impervious Surface Area by Alternative

Source	A	B	C	D	F
Redevelopment Impervious Surface Area (acres)	13.7	11.5	15.3	25.4	10.6
New Development Impervious Surface Area (acres)	21.4	25.8	27.4	22.3	3.0
Total Post-Construction Impervious Surface (acres)	35.1	37.4	42.7	47.7	13.6

Table 4.11-7. Post-Construction Annual Total Phosphorous Load by Alternative

Source	A	B	C	D	F
Post-Construction Total Phosphorous Load from Redevelopment Impervious Surfaces (lbs)	18–34	15–29	21–38	34–64	14–27
Post-Construction Total Phosphorous Load from New Development Impervious Surfaces (lbs)	29–54	35–65	37–69	30–56	4–8

Source	A	B	C	D	F
Post-Construction Total Phosphorous Load from New Development and Redevelopment Impervious Surfaces (lbs)	47–88	50–94	57–107	64–119	18–34

Table 4.11-8. Post-Construction Total Nitrogen Load by Alternative

Source	A	B	C	D	F
Post-Construction Total Phosphorous Load from Redevelopment Impervious Surfaces (lbs)	144–318	121–267	161–355	267–589	111–246
Post-Construction Total Phosphorous Load from New Development Impervious Surfaces (lbs)	225–496	271–599	288–636	234–517	32–70
Post-Construction Total Phosphorous Load from New Development and Redevelopment Impervious Surfaces (lbs)	369–814	393–868	448–991	501–1107	143–316

Table 4.11-9. Post-Construction Total Suspended Solids Load by Alternative

Source	A	B	C	D	F
Post-Construction Total Phosphorous Load from Redevelopment Impervious Surfaces (lbs)	15,043–23,290	12,627–19,550	16,799–26,010	27,889–43,180	11,639–18,020
Post-Construction Total Phosphorous Load from New Development Impervious Surfaces (lbs)	23,497–36,380	28,328–43,860	30,085–46,580	24,485–37,910	3,294–5,100
Post-Construction Total Phosphorous Load from New Development and Redevelopment Impervious Surfaces (lbs)	38,540–59,670	41,065–63,580	46,885–72,590	52,375–81,090	14,933–23,120

Chlorides

Chloride originating from road salt applied for winter road maintenance creates a potential impact to water quality and aquatic life. NHDES and EPA have an established chronic toxicity criterion for chloride of 230 mg/L and acute toxicity criterion of 860 mg/L to protect aquatic life in surface waters. As noted in Section 4.11.1, portions of Beaver Brook and its tributary, Shields Brook, are listed by NHDES as impaired due to chloride, with historic exceedances of the chronic water quality standard. A chloride TMDL study was completed in 2008 for the Upper Beaver Brook watershed that documented chloride levels in surface waters of the Upper Beaver Brook watershed and identified and quantified the contributing sources of chloride (NHDES, 2008a). The TMDL study concluded that the majority (approximately 95 percent) of chloride loading in the watershed is associated with de-icing activities for public and private roadways and parking lots. The TMDL study established a chloride load duration curve for the Upper Beaver Brook watershed (tons per day of salt imports for a given 4-day average stream flow) that could be expected to achieve water quality standards in the impaired reaches and identifies implementation goals and strategies for reducing salt imports in the watershed. The impaired segments of Beaver Brook and Shields Brook are downstream of the Build Alternatives for Exit 4A and could therefore be negatively affected by increased salting activities should one of Exit 4A’s Build Alternatives be constructed. All Build Alternatives would necessarily be expected to implement salt reduction strategies consistent with the TMDL and as will be required for Project permits (MS4, 401 WQC, and AoT rules), as discussed further in Section 4.11.2, *Mitigation*.

No Build Alternative

Under the No Build Alternative, no additional Project related increases in salt loading would occur. It is expected that the Towns and NHDOT would reduce salt loading, per their respective Salt Reduction Plans (Derry, 2016; Londonderry, 2018; NHDOT, 2009) and consistent with the recommended salt allocations that were determined by the Salt Reduction Workgroup and finalized in the Chloride Reduction Implementation Plan (NHDES, 2011a).

Build Alternatives

While many factors determine annual salt loading rates from winter road and parking lot maintenance, including the timing, frequency, duration, and type of winter precipitation events, and other winter weather elements including temperature and cloudiness (these elements are often evaluated cumulatively as the weather severity index, see NHDES, 2016d), the total winter salt application to roadways (i.e., the salt load) typically varies with the treated roadway area (i.e., treated lane miles). All Build Alternatives would result in increased road salt treated roadway within the Project area as demonstrated in and would therefore result in increased annual salt use if mitigation measures are not employed.

Table 4.11-10. Exit 4A Additional Lane Miles for Chloride Loading, by Build Alternative

Source	A	B	C	D	F
NHDOT Patrol Shed 528	1.51	1.69	1.81	1.81	0.00
Town of Londonderry	2.50	2.75	3.90	3.78	0.53
Town of Derry	3.59	6.66	4.84	2.73	0.81
Total	7.60	11.10	10.56	8.32	1.34

Notes: Calculation methodology is as follows:

For Town-maintained roads:

1. 1 salt pass for each direction on collector & minor arterial roadways with one or two lanes in each direction
2. 1 salt pass per through lane for principal arterial roadways
3. 1 salt pass total for local roads
4. 1 additional salt pass for turn lanes 300 feet or greater in length (single and double turn lanes only get one additional pass)

For State-maintained roads:

1. 1 salt pass for each ramp
2. 1 salt pass per through lane
3. 1 salt pass per turn lane

Chloride impacts for all Build Alternatives were quantified in a Chloride Technical Report prepared with this SDEIS (see Appendix G) and are summarized in Table 4.11-11. As demonstrated in 11, all Build Alternatives would result in new salt treated roadway and are therefore considered potential salt sources. Anticipated additional salt loading for each alternative is presented in Table 4.11-11. The methods used to estimate chloride loading from the Build Alternatives are presented in Section 4.1 of the Chloride Technical Report (provided in Appendix G of this SDEIS). All data were updated to include the FY16 salt loading data for the Upper Beaver Brook watershed (NHDES, 2017e). The presented estimated salt loading by alternative is based on historical salt application rates; actual salt application rates will be affected by the requirements of Project permits (including salt reduction BMPs) discussed further in Section 4.11.2, *Mitigation*.

Indirect impacts from the planned Woodmont Commons East development and additional commercial/industrial development in Derry, and cumulative impacts from the planned Woodmont Commons West development, including Market Basket redevelopment, were also evaluated and are presented in Section 5.4.3 of this SDEIS.

Table 4.11-11. Anticipated Salt Loading from Each Build Alternative

Generator	Average Annual Salt Usage FY08-FY16 (tons/lane-mile/year)	Estimated Salt Loading By Build Alternative (tons/year)				
		A	**B**	**C**	**D**	**F**
NHDOT Patrol Shed 528	21.90	33.10	36.99	39.69	39.69	0.00
Town of Londonderry	10.60	26.50	29.12	41.39	40.02	5.62
Town of Derry	11.10	39.85	73.96	53.71	30.34	8.98
	Total	**99.45**	**140.07**	**134.79**	**110.05**	**14.60**

Note: This quantity assumes that all chloride generators responsible for maintenance of Exit 4A would continue to employ the BMPs currently being used to minimize salt loading in the watershed.

4.11.3 Mitigation

Total Suspended Solids and Total Phosphorous

The Project would be subject to the regulatory requirements discussed previously in Section 4.11.1 including coverage under the 2017 NH MS4 permit, compliance with the Memorandum of Understanding exempting NHDES from AoT rules, and WQC under CWA Section 401.

The 2017 NH Small MS4 General Permit (EPA, 2017c), under which the Project would obtain coverage, requires permitted entities to reduce pollutants to the "Maximum Extent Practicable" as detailed in Part 2.3 of the MS4 permit. Part 2.3.6 of the MS4 permit details the requirements for stormwater management in new development and redevelopment areas. New development and redevelopment projects addressed in Part 2.3.6 include any project that disturbs one or more acres and discharges into the MS4. The Build Alternatives each include disturbances of more than 1 acre and would be required to develop a stormwater management program consistent with Part 2.3.6 of the MS4 permit. Further, Part 2.3.6.a.i of the MS4 permit states "*The permittee's new development/ redevelopment program shall include projects less than 1 acre if the project is part of a larger common plan of development or redevelopment which disturbs one or more acre*." Therefore, within each of the Exit 4A Build Alternatives, each roadway segment, whether new development or redevelopment of existing roadway, that creates any land disturbance, regardless of size, must be included in the stormwater program. Project road segments that are exclusively roadway maintenance and improvement and do not increase impervious area (i.e., no increase to pavement, parking lot, or sidewalk areas) are not required to manage stormwater in accordance with Part 2.3.6(a)ii.(e) (see Part 2.3.6(a)ii.(f)).

Alternatives A through F each contain areas of new development (e.g., creation of new roadway in areas of other current land use) and/or redevelopment (e.g., improvements such as redesign and reconstruction or resurfacing of existing roadway). The MS4 permit has stormwater treatment requirements designed to reduce or minimize the effects of land-disturbing projects on water quality as detailed in Part 2.3.6(a)ii.(d) for new development and Part 2.3.6(a)ii.(e) for redevelopment. These permit requirements include the use of stormwater BMPs with specific stormwater retention volumes, treatment volumes, or specific pollutant removal criteria to reduce pollutant loads from runoff (EPA, 2017c). New development sites are required to provide retention of stormwater runoff equivalent to the Water Quality Volume[15] (defined in Env-Wq 1504.10) for the new development site or are required to have BMPs designed to remove at least 90 percent of TSS and 60 percent of total phosphorous from the average annual pollutant load generated by the total post-construction impervious surface and are required to have long-term maintenance practices for stormwater BMPs (EPA, 2017c). Redevelopment sites have similar requirements but are also permitted to use BMP treatment of stormwater runoff equivalent to the Water Quality Volume or use BMPs designed to remove at least 80 percent of TSS and 50 percent of total phosphorous from the average annual pollutant load generated by the total post-construction impervious surface to satisfy condition 1 of Part 2.3.6(a)ii.(e) (EPA, 2017c). Redevelopment sites are also permitted to use offsite stormwater mitigation within the same USGS HUC10 or smaller watershed to satisfy condition 1 of Part 2.3.6(a)ii.(e) (EPA, 2017c).

Roadway pavement areas shown in Table 4.11-11 indicate the total new development and redevelopment post-construction impervious surface that would result from each of the Build Alternatives. Because each of the Build Alternatives would increase the post-construction impervious surface, stormwater retention or treatment would be required for each Build Alternative in accordance with Part 2.3.6 of the MS4 permit (EPA, 2017c). Final stormwater management plans are not available at the time of this report, but are expected to fully meet the required stormwater retention or treatment provisions of the MS4 permit by using BMPs to the maximum extent practicable. New development roadway segments are expected to be fully treated and meet either the Water Quality Volume retention criteria or the specified TSS and total phosphorous removal efficiencies detailed in the MS4 permit. Redevelopment areas are also expected to be fully treated and meet either the Water Quality Volume retention or BMP treatment criteria or the specified TSS and total phosphorous removal efficiencies detailed the MS4 permit. If redevelopment areas cannot be treated onsite (e.g., due to the space constraints of the developed urban areas), then stormwater would be treated within the same HUC10 watershed (0107000612 Stony Brook-Merrimack River) as is required in the MS4 permit.

The MS4 permit has additional requirements that, for new or increased discharges to impaired waters, no net increase of pollutant(s) for which the waterbody is impaired will occur. The permittee may demonstrate compliance with this permit condition by documenting that the pollutant(s) for which the waterbody is impaired are not present in the MS4's discharge or by documenting that the total load of the pollutant(s) of concern from the MS4 to the impaired water body would not increase as a result of the activity (EPA, 2017c).

Build Alternatives A, B, C, and D would result in development and/or redevelopment in the Beaver Lake watershed, which is shown on the latest 303(d) list (NHDES, 2017b) as impaired for aquatic life due to total phosphorous, chlorophyll *a*, DO saturation, and pH. When stormwater plans are finalized, they must be consistent with the requirement that either no new or increased stormwater discharges would be introduced to Beaver Lake (i.e., the stormwater management area within the watershed would not increase as a result of the Project) or the stormwater management would need to be designed such that the pollutant load from the new or increased discharge would not increase for any of the Beaver Lake impairments. The latter condition can be easily met for the redevelopment roadway segments of the Build Alternatives where the planned use of stormwater BMPs would result in treatment of currently untreated stormwater areas (e.g., Tsienneto Road and NH 102) and should easily offset the effects of minor road widening pavement increases.

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[15] Water Quality Volume = 1 inch of rainfall * total area draining to a stormwater structure * [0.05 + (0.9 * % imperviousness of drainage area)]. From NH Administrative Rule Env-Wq 1504.10.

The 2017 NH MS4 permit includes further requirements for discharges to waterbodies with an approved TMDL for which there is a specified Waste Load Allocation. The Hoods Pond phosphorous TMDL identifies a Waste Load Allocation for total phosphorous within the Hoods Pond watershed and has an MS4 nexus with the Project as detailed in the requirements of Appendix F of the MS4. The MS4 permit requires that permittees develop a lake phosphorous control plan designed to reduce the amount of phosphorous in stormwater discharges and specifies the percent reduction in stormwater phosphorous load for each municipality consistent with the Waste Load Allocation in the applicable phosphorous TMDL. Permittees may develop an alternative phosphorous control plan in coordination with and approval from NHDES.

Build Alternatives A, B, C, and D would have development and/or redevelopment road segments with potential stormwater impacts to tributaries of Hoods Pond. The Project would be required to develop and/or adopt a lake phosphorous control plan or other approved management plan consistent with the requirements of the MS4 permit to demonstrate conformance with the water quality goals of the Hoods Pond phosphorous TMDL. It is expected that the Project stormwater management plan can be consistent with the waste load allocation goals of the Hoods Pond TMDL, which amounts to a 76 percent reduction of total phosphorous load in Shields Brook watershed. Currently, stormwater treatment BMPs are not used in the Project area within the Hoods Pond watershed. The provisions for BMP treatment of stormwater in new development and redevelopment projects specified in Part 2.3.6 of the MS4 permit and the Project plans that include treating currently untreated stormwater areas should result in a net decrease in pollutants in the Hoods Pond watershed. Final stormwater plans would have to ensure that the Project stormwater treatment plans are consistent with Hoods Pond phosphorous TMDL goals.

Chloride

Chloride mitigation in the Upper Beaver Brook watershed is addressed in the 2017 NH MS4 permit (EPA, 2017c), which became effective on July 1, 2018, and is discussed in Section 4.11.1. The Towns, as well as NHDOT, would be required to obtain coverage under the MS4 permit and, consequently, the Exit 4A Project would be subject to all permit conditions, including specific conditions for permittees that discharge to a watershed subject to an approved TMDL for chlorides. A requirement of the 2017 MS4 permit is for permittees that discharge to a watershed subject to an approved chloride TMDL to develop a chloride reduction plan by July 2019, as detailed in Appendix F of the MS4 permit. One of the key components to developing a successful chloride reduction plan will be identifying mitigating actions (BMPs) to reduce chlorides and achieve the waste load allocation specified in the applicable chloride TMDL (EPA, 2017c).

The TMDL chloride reduction implementation plan (NHDES, 2011a), developed in support of the Beaver Brook chloride TMDL, outlines a number of BMPs that can be used to achieve significant reductions in salt use by the various salt users in the watershed as discussed in Section 4.11.1. Many of the same salt reduction activities identified in the TMDL implementation plan are also identified in Appendix F of the MS4 permit as recommended components of a chloride reduction plan as required for dischargers to watersheds subject to an approved chloride TMDL. The salt reduction BMPs identified in the TMDL chloride reduction implementation plan (NHDES, 2011a) are summarized in Table 4.11-13 including the associated percent chloride reduction potential for each BMP and the implementation status to date by the NHDOT and the Towns. As demonstrated in Table 4.11-13, many salt applicator BMPs that are planned or already implemented in the watershed have the potential to reduce salt use, during the specified operation, by as much as 30–50 percent. These actions also satisfy the salt reduction activities listed in Appendix F of the MS4 permit and therefore would likely be included as core components of the required chloride reduction plans for NHDOT and the Towns and would likely be extended to any future actions requiring chloride mitigation, including the proposed Exit 4A Project.

Table 4.11-12. Chloride BMPs

Chloride Reduction BMPs	Definition	Potential % Chloride Reduction[a]	Implementation Status
Pre-Wetting	Application of salt brine or proprietary chemical to dry salt as it is being applied to the roadway	20%–30%	NHDOT–Implemented Derry–Implemented Londonderry–Not planned
Pre-Treating	Application of salt brine or proprietary chemical to dry salt either before, during, or after it has been loaded into the truck.	10%–30%	NHDOT–Planned Derry–Planned Londonderry–Not planned
Anti-Icing	Application of salt brine or proprietary chemical up to 48 hours in advance of onset of storm.	10%–30%	NHDOT–Implemented Derry–Planned Londonderry–Planned
Zero-Velocity Spreaders	Spreader ejects salt particles at the same velocity of the forward motion of the truck's traveling speed; allowing salt to drop as if the spreading vehicle was standing still.	10%–50%	NHDOT–Not planned Derry–Not planned Londonderry–Not planned
Groundspeed Oriented Spreader Controls	Allows accurate dispensation of prescribed salt application rates irrespective of vehicle speed. Controls can be integrated to automatically vary application rate with ground temperature. Controller units can integrate GIS and wirelessly download application rate data for review	10%–30%[b]	NHDOT–Implemented Derry–Implemented Londonderry–Implemented
Equipment Calibration	Ensures equipment application of chlorides is accurate	5–20%	NHDOT–Implemented Derry–Implemented Londonderry–Implemented
In-Cab Air/Ground Temp. Sensor	Installation of pavement and air temperature sensors with in-cab readout.	1%–10%[b]	NHDOT–Implemented Derry–Implemented Londonderry–Implemented
Training, improved storage and handling practices	Training staff about various BMPs, improving storage and handling practices for loading and unloading salt	10%–25%[b]	NHDOT–Implemented Derry–Implemented Londonderry–Implemented

Source: NHDES (2011a, Table 9)

[a] Reductions assumed do not take into account existing practices.

[b] Highly dependent on existing procedures and level of adoption.

The Beaver Brook chloride TMDL specifies a daily maximum Waste Load Allocation for chloride as discussed in Section 4.11.1. The alternative expression of the TMDL sets an annual salt load allocation for the Upper Beaver Brook watershed at 9,069 tons salt/year and is a not-to-exceed quantity for all salt imports in the watershed (NHDES, 2008a). The Exit 4A Project would be subject to the requirements of Appendix F of the MS4 permit including the requirement to "*reduce chloride discharges to support achievement of the WLA included in the applicable approved TMDL*." Because the Beaver Brook chloride TMDL has a fixed annual salt load allocation distributed among current sectors, and because the MS4 permit requires permittees to support achievement of the applicable TMDL Waste Load Allocation, any new development in the watershed would require load reductions elsewhere in the watershed to be consistent with the TMDL and MS4 permit conditions. Development projects such as Exit 4A can occur in the Upper Beaver Brook watershed as long as the 9,069 tons/year salt load allocation is not exceeded as a result of the development.

Salt-reducing BMPs have been implemented in the Upper Beaver Brook watershed by NHDOT and the Towns consistent with the TMDL Chloride Reduction Implementation Plan (NHDES, 2011a) and summarized in Table 4.11-13. The annual salt load from private roads and parking lots, one of the largest combined salt use sectors in the watershed (NHDES, 2008a), will likely decrease with adoption of the 2017 NH MS4 permit that became effective on July 1, 2018, due to the salt-reduction measures included in the permit. Given the current level of adoption of salt-reducing BMPs in the watershed by NHDOT and the Towns, and the anticipated further reductions that will be made in the private sector, it is likely that the watershed salt load, required to be reported in 2020 per the MS4 permit, will meet the TMDL goal. The Exit 4A Project would contribute an additional salt load to the watershed estimated to be about 14 to 140 tons/year as presented in Section 4.11.2. This load represents 0.1 to 1.5 percent of the 9,069 tons/year Upper Beaver Brook watershed salt load allocation, which is a minor increase. This additional salt load is expected to be offset by NHDOT and the Towns through development and execution of chloride reduction plans, as required in the 2017 NH MS4 permit, and through watershed-wide salt reductions already planned or implemented.

To ensure each of the Build Alternatives, if constructed, would be in conformance with the Beaver Brook chloride TMDL and to determine the water quality impacts due to construction of the Project and associated indirect impacts, in-stream water quality monitoring should be implemented downstream of the Project prior to construction. As part of the Beaver Brook chloride TMDL implementation plan (NHDES, 2008) two monitoring locations were identified by NHDES on Beaver Brook for determining achievement of the TMDL–Stations 09-BVR (located on Beaver Brook at the outlet of Kendall Pond) and 10A-BVR (located on Beaver Brook at Fordway Ext. Bridge). Although continuous water quality data have been collected at Station 10A-BVR since July 2006, consistent with the TMDL implementation plan, continuous water quality data have not been collected at Station 09-BVR since June 2009. Station 09-BVR is located downstream of each of the Build Alternatives and would be an ideal monitoring location to assess potential Project impacts in addition to TMDL compliance monitoring. NHDOT and the Towns will discuss with NHDES the option to resume monitoring at Station 09-BVR and are committed to offering Project support to this effort, if requested. Monitoring should also be continued at Station 10A-BVR, which is located downstream of portions of the Project impacts, and NHDOT and the Towns will also commit further support to this effort if requested. Continued monitoring at Stations 09-BVR and 10A-BVR will provide a baseline condition prior to construction of the Project and will allow for effective evaluation of Project direct and indirect impacts over time.

4.12 Wetlands and Vernal Pools

4.12.1 Affected Environment

Regulatory Overview

Federal Regulations

Wetlands are defined under Section 404 of the CWA as "…areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands include swamps, bogs, and marshes and do not necessarily feature standing water. Wetlands and surface waters (streams, rivers, ponds, and lakes) are regulated under federal and state law and local zoning and regulations. Under federal law, discharges of dredged or fill material into "waters of the United States," including wetlands, requires a permit under Section 404 of the CWA. In addition, work in "navigable" waters also requires a permit under Section 10 of the Rivers and Harbors Act. In both cases, the issuing authority is USACE. In addition to permitting requirements, federal actions must adhere to Executive Order 11990 (dated May 24, 1977), which requires, among other things, that, in complying with NEPA, federal agencies shall avoid undertaking or providing assistance for new construction in wetlands unless the agency finds that there is no practicable alternative and the proposed action includes all practicable means to reduce harm to wetlands.

State Regulations

New Hampshire's wetland definition is substantively the same as the federal definition. State law (RSA 482-A) and Administrative Rules (Wt 100-900) require a permit to be issued by the NHDES Wetlands Bureau prior to conducting regulated activities in wetlands. Derry and Londonderry each have a municipal Conservation Commission that reviews permit applications and makes recommendations to the NHDES Wetlands Bureau.

Municipal Regulations

Each community also has a locally regulated wetland protection district in their zoning ordinance.

<u>Londonderry Wetland Regulation</u>

Londonderry's zoning ordinance (Town of Londonderry, 2016) has a conservation overlay district that includes the following within the study area:

- specifically named wetlands and land area within 100 feet of the edge of these wetlands;
- specific perennial streams and adjoining land within 100 feet of the centerline of these streams; and