Chapter 3
Affected Environment

3.1 Introduction

This chapter describes the existing social, economic, and environmental resources that could be affected by the various project alternatives. For resources that do not occur in the vicinity and could not be affected by the alternatives, documentation is provided and the resource is not included for further consideration. The impacts of the various project alternatives, including the preferred alternative, are evaluated against the affected environment in Chapter 4.

3.2 Traffic and Transportation

Interstate 93 (I-93) through Bow and Concord is a four-lane divided urban principal arterial highway with limited access. The 4.5-mile segment provides the primary north-south travel route for both regional and local traffic. It also facilitates key east-west travel by connecting I-89, I-393, US Route 4 and US Route 202. See **Figure 3.1 Project Transportation Elements** for an overview of the transportation elements of the project.

There are seven interchanges within the project limits, including two system interchanges connecting I-89 and I-393, and five service interchanges. The system interchanges connect I-93 to regional routes including I-89 and I-393. The service interchanges provide access to and from I-93 for the local roadway systems in Bow and Concord that provide access to key destinations, including the State capitol building and State office complexes.

Other arterials within the project area that access I-93 include US Route 3, NH Route 3A, and NH Route 9. he Merrimack River runs along the east side of I-93 and there are crossings of the river at Exit 13 (US Route 3) and Exit 14 (NH Route 9).

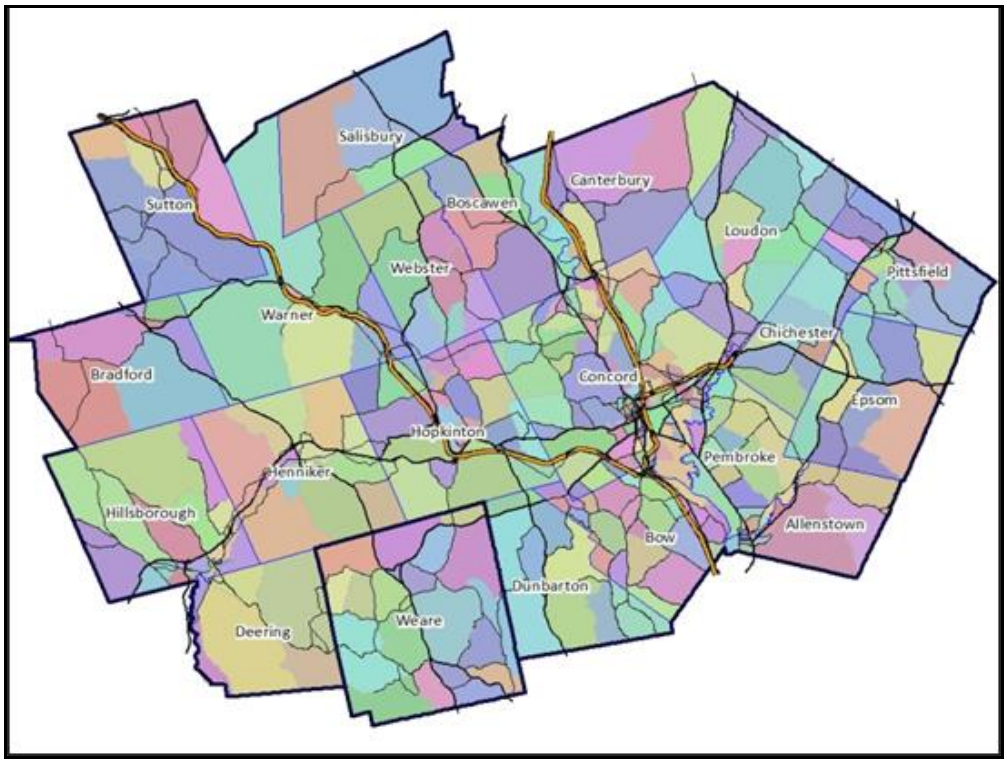
This section summarizes the traffic data collection effort, existing operational conditions, vehicle crash research, and identifies existing infrastructure deficiencies along the I-93 project area.

3.2.1 Traffic Data Collection

I-93 through Bow and Concord is a regionally significant corridor. Traffic data has been collected from both within the corridor and from outside the corridor. In cooperation with the Central New Hampshire Regional Planning Commission (CNHRPC), a regional del has been developed for the Central NH Region. The Regional Model includes the 20 communities that comprise the Central NH Region

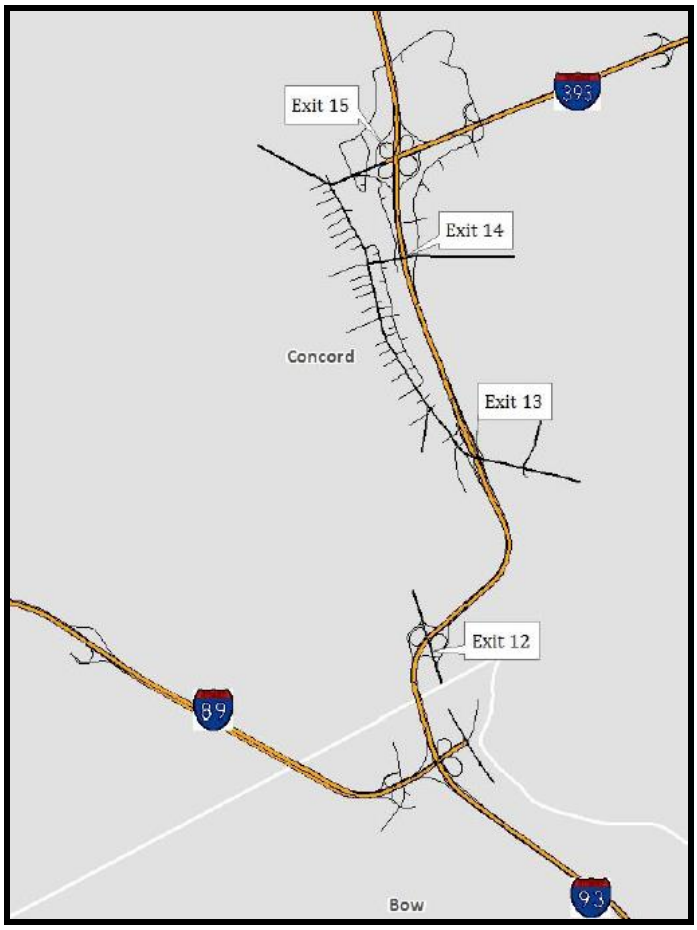
and the Town of Weare, which is part of the Southern NH region. The model was calibrated using actual traffic and land use data to emulate actual traffic conditions in the region. **Figure 3.2 Regional Model Limits** depicts the limits of the Regional Model.

Figure 3.2 Regional Model Limits



To appropriately evaluate the complex roadway network that comprises the I-93 corridor, a Microsimulation Model has also been developed for the project area. The Microsimulation Model is a detailed model of the corridor that provides more detailed information on the interaction of traffic between and within the interchanges. Information from the Regional Model is used to generate estimates for traffic entering and exiting the Microsimulation Model boundary. **Figure 3.3 Microsimulation Model Limits** depicts the limits of the Microsimulation Model. The roadways shown in the figure are those included in the Microsimulation Model, and include US 3, NH 3A, and NH 9, as well as local intersecting streets.

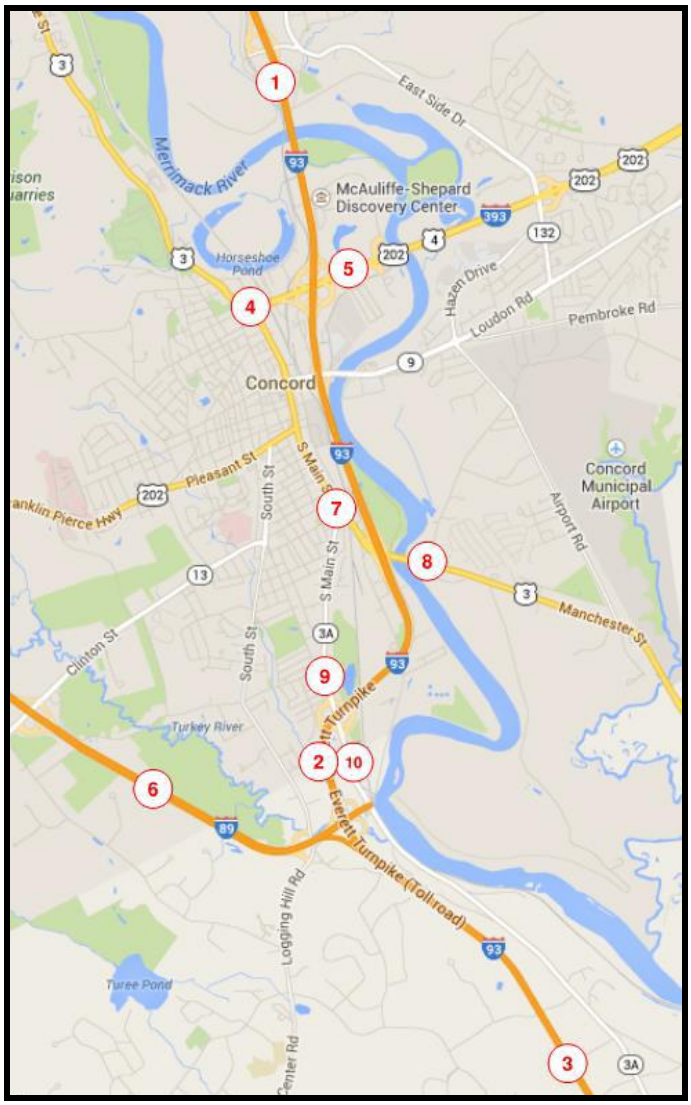
Figure 3.3: Microsimulation Model Limits



3.2.1.1 Origin-Destination Study

In addition to target traffic volumes, origin-destination data was collected along the I-93 corridor at the 10 locations shown below in **Figure 3.4 Bluetooth Monitoring Locations**, from April 30, 2014 through May 7, 2014. Unique and anonymous media access control identification numbers associated with passing Bluetooth devices were recorded at the Bluetooth monitoring stations shown in **Figure 3.4** and used to inform the distribution of traffic origin-destination pairs between interchanges. This origin-destination study was developed specifically for the project and was conducted to gain a better understanding of the traffic patterns in the project area, which aided in the calibration of the traffic models.

Figure 3.4: Bluetooth Monitoring Locations



3.2.1.2 Vehicle Classification

Vehicles are classified by their type (*e.g.* passenger car, single-unit truck, tractor-trailer, or bus) because different vehicles impact the environment in different ways. Air quality and noise, in particular, are influenced by the mix of vehicle types in the project area.

The percentage of trucks (vehicles with 6 or more axles) is higher on I-93 through Bow and Concord than on other classes of roadways in the area. A key function of the interstate system is to move goods and this is reflected in the high percentage of trucks observed. **Table 3.1 Percentage of trucks** outlines the percentage of trucks on I-93 and I-89 in the project area.

Table 3.1 Percentage of Trucks

Roadway	Direction	Percent Trucks	
		AM	PM
I-93	Northbound	12%	4%
I-93	Southbound	4%	5%
I-89	Northbound	12%	6%
I-89	Southbound	5%	6%

3.2.1.3 Commuting Patterns

The City of Concord is a major employment center in Central New Hampshire. As the State Capitol, the City is home to many government agencies, and the State of New Hampshire is the top employer in the City. In addition, the City supports major employers in the medical, retail, financial, educational, and industrial sectors. Therefore, during morning commute hours, traffic is heading into Concord from all directions. Two major commuter destinations are the state campuses near the NH Hospital Grounds in Central Concord and Hazen Drive on The Heights. During afternoon commute hours traffic is heading away from Concord as workers leave for the day.

Throughout the year, I-93 through Bow and Concord also serves as the dominant north-south corridor in New Hampshire for access to the White Mountains and the Lakes Region, both of which are major tourist and recreational destinations throughout the year. Refer to Section 3.2.3 for further details on the traffic conditions within the project area.

3.2.2 Traffic Volumes

This section presents the existing traffic conditions along I-93 through Bow and Concord. The volume of traffic counted, growth trends, and traffic operations along the corridor and at each interchange are presented and discussed.

3.2.2.1 Traffic Volumes

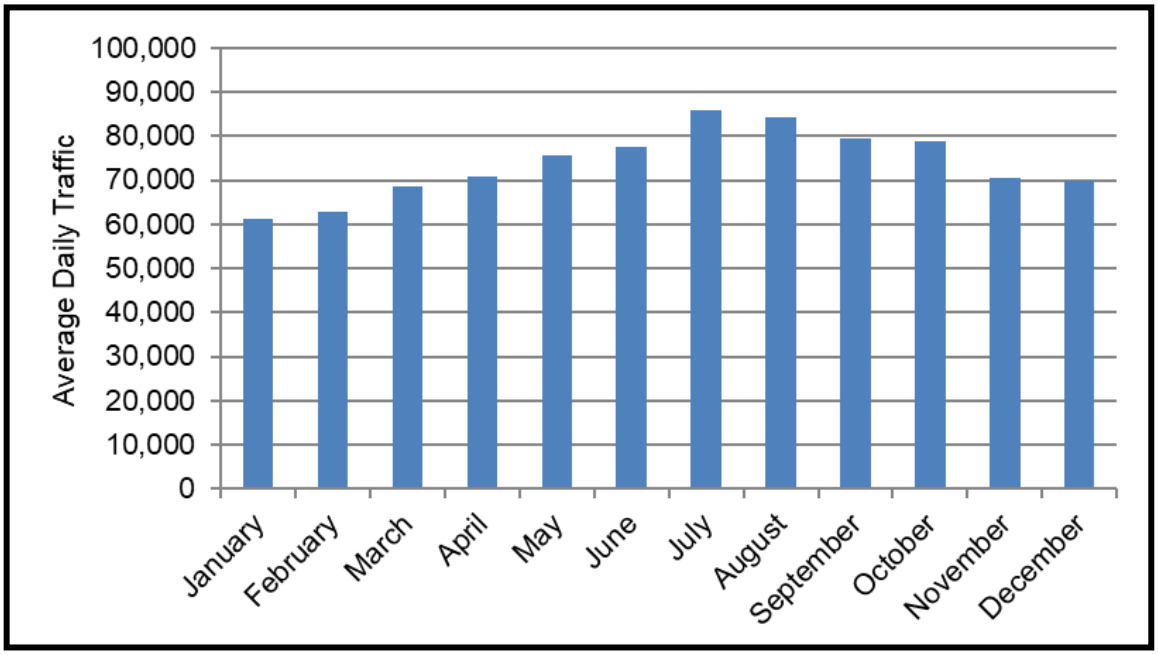
The automatic traffic volume recorder counts, NHDOT periodic counts, and counts conducted specifically for this project were used in the development of the Microsimulation Model discussed in Section 3.2.1. The Microsimulation Model is a peak hour model that uses a design hour for both morning (AM) and afternoon (PM) peak hour traffic. The design hour represents the average peak hour of the peak month. For this project, the peak AM month is September and peak PM month is

August. Therefore, the AM design hour represents the average AM peak hour condition for the month of September and the PM design hour represents the average PM peak hour for the month of August. **Figure 3.5 Base Year 2014 Peak Hour Traffic Volumes** depicts the Base Year 2014 AM and PM peak hour volumes within the project limits.

3.2.2.2 Traffic Volume Trends

The NHDOT maintains an automatic traffic volume recorder station along I-93 between Exits 12 and 13 (Station 1099011/1099012). This recorder station provides counts for every hour of the day, all year. **Figure 3.6 I-93 Monthly Variation between Exits 12 and 13 (2015)** below depicts the monthly variation in traffic volumes (adjusted average daily traffic) at this location.

Figure 3.6 I-93 Monthly Variation between Exits 12 and 13 (2015)

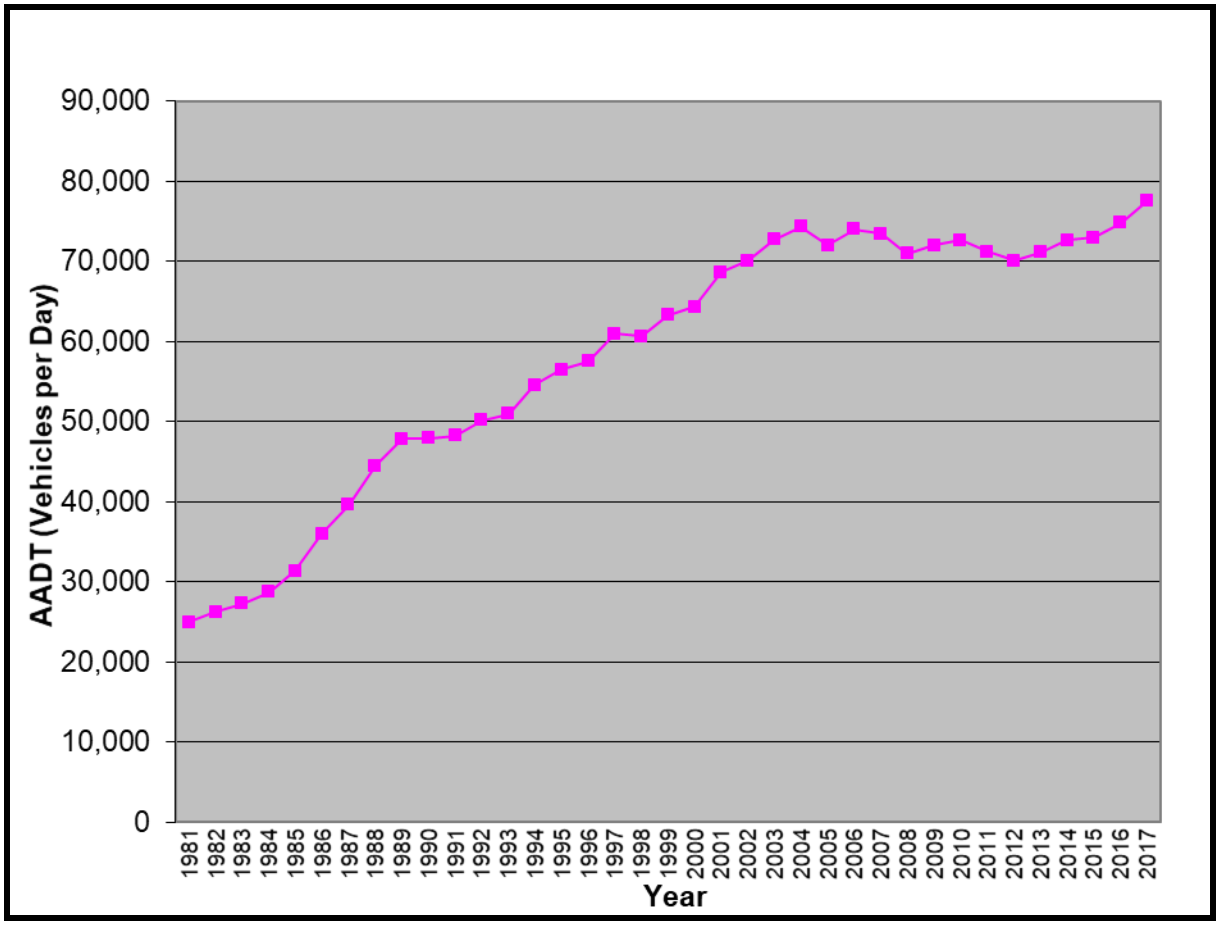


Source: NHDOT Traffic Volume Reports, 2015

In 2015, the peak month for traffic on I-93 was July with an adjusted average daily volume of 85,876 vehicles per day (vpd). The recently published volume for July 2016 shows a 1.36% increase over 2015 with an average of 87,046 vpd. July represents a full summer month with the July 4th holiday as a major travel event. On July 14, 2017 the total volume on I-93 during that day surpassed 100,000 vehicles. July represents a 28% increase in traffic over the lowest month, which was December (61,257 vpd) in 2015. Although the winter months have peak traffic due to winter sport activities in the White Mountains and Lakes Region, it is important to note the fall months have higher traffic volumes due to Columbus Day and foliage season.

In addition to the monthly variation of traffic on I-93, the automatic traffic volume recorder station along I-93 between Exits 12 and 13 also provides data on the historic growth trends of traffic in the corridor. **Figure 3.7 I-93 AADT between Exits 12 and 13 (1981 to 2017)** below is a graph showing the AADT volumes between 1981 and 2017.

Figure 3.7 I-93 AADT between Exits 12 and 13 (1981 to 2017)



Source: NHDOT Traffic Volume Reports

Figure 3.7 illustrates that the growth of traffic on I-93 has steadily increased for more than 20 years before leveling off in 2004. The average annual growth rate was approximately 7.5% between 1981 and 1990, and approximately 3.2% between 1990 and 2004.Traffic volumes on I-93 have tripled since 1981. From 2004 until 2012, however, the average annual growth rate was slightly negative (-0.7%). From 2012 to 2017, traffic volumes increased with an average annual growth rate of 2.1%.

3.2.3 Existing Traffic Operations

The volume of traffic on a highway is not the only indicator of the quality of the flow of traffic. In the case of I-93 through Bow and Concord, the number and spacing of the interchanges has a definite impact on the quality of travel. The *Highway Capacity*

Manual, 6th Edition (HCM) contains procedures for estimating the operating conditions of a roadway based on level-of-service (LOS). LOS is a qualitative measure describing the operating conditions as perceived by motorists driving in a traffic stream.

The HCM divides freeway facilities into three types of segments:

1. Basic – sections with no ramps
2. Merge or Diverge – 1,500-foot sections with either an on-ramp or an off-ramp
3. Weaving – sections with an on-ramp followed within 2,500 feet or less by an off-ramp.

Freeway LOS for all three segment types is based on vehicle density per lane, which is calculated by dividing the number of vehicles by the number of lanes and the average speed of those vehicles. There are six levels of service (LOS A to F) defined by the flow of traffic. **Figure 3.8 LOS Examples for Basic Freeway Segments** illustrates the six levels of LOS for a basic freeway using photographs to show the various traffic conditions. **Table 3.2 LOS Criteria for Freeway Segments** shows the LOS Criteria for each segment type.

Figure 3.8 LOS Examples for Basic Freeway Segments

LOS A: Free Flow Operations

LOS B: Reasonably Free Flow Operations

LOS C: Flow with Speeds near Free Flow

LOS D: Declining Speeds with increased flow

LOS E: At or near capacity

LOS F: Unstable flow

Source: Highway Capacity Manual, 6th Edition

Table 3.2 LOS Criteria for Freeway Segments

LOS	Characteristics	Density (Passenger cars per mile per lane)		
		Basic	Weaving	Merge/Diverge
A	Free-flow operations	≤ 11	0-10	≤ 10
B	Reasonably free-flow	> 11-18	> 10-20	> 10-20
C	Speeds near free-flow	> 18-26	> 20-28	> 20-28
D	Speeds decline	> 26-35	> 28-35	> 28-35
E	Operation at capacity	> 35-45	> 35-43	> 35
F	Breakdown/Unstable flow	Demand Exceeds Capacity OR Density > 45	> 43, OR Demand Exceeds Capacity	Demand Exceeds Capacity

Freeway segments with LOS A to LOS C are considered acceptable. LOS D is considered acceptable during peak periods as the cost to make improvements to meet LOS C are typically unjustifiable. LOS E and LOS F are considered unacceptable with improvements necessary to provide an acceptable level of service.

I-93 within the project limits has few “Basic” freeway segments because the interchanges are close to one another. The 1,500-foot “Merge” and “Diverge” segments overlap between each interchange from I-89 to Exit 14. Between Exits 14 and 15, within Exit 15, and northbound at the I-93/I-89 interchange, there are “Weaving” segments as auxiliary lanes exist. The “Basic” segments exist within the interchanges, Exit 12, 13 and 14, and southbound at the I-93/I-89 interchange.

The traffic operations analyses for this project were developed using the project Microsimulation Model. The results of the freeway analyses are summarized in **Table 3.3a and 3.3b 2014 Existing Conditions I-93 Freeway Segments for AM/PM Peak Period (Northbound and Southbound)**. Those segments with LOS E or F are highlighted in red, indicating that improvements are necessary. A CD Road is a “Collector Distributor” Road, which is a roadway that runs parallel to the freeway.

Table 3.3a 2014 Existing Conditions I-93 Freeway Segments for AM/PM Peak Period (Northbound)

			AM/PM Peak Period		
I-93 Segment	Direction	Type	Segment Density (veh/mi/lane)	Speed (mph)	LOS (AM/PM)
I-89 Off ramp	Northbound	Diverge	18/21	65/64	B/C
At I-89	Northbound	Basic	24/26	52/52	C/D
I-93/I-89 Weave	Northbound	CD Weaving	41/38	30/31	E/E
I-89 On ramp	Northbound	Merge	44/41	35/40	E/E
Exit 12 Off ramp S	Northbound	Diverge	44/41	44/45	E/E
Exit 12 Off ramp N	Northbound	Diverge	42/39	46/49	E/E
Exit 12 On ramp	Northbound	Merge	49/43	39/44	F/E
Exit 13 Off ramp	Northbound	Diverge	60/44	34/48	F/E
Between Exit 13 Ramps	Northbound	Basic	27/35	54/51	D/E
Exit 13 On ramp	Northbound	Merge	33/54	46/31	D/F
Exit 14 Off ramp	Northbound	Diverge	36/51	47/42	E/F
Between Exit 14 Ramps	Northbound	Basic	20/34	54/51	C/D
Between Exit 14 & 15	Northbound	Weaving	23/44	52/45	C/E
Exit 15 Weave	Northbound	Weaving	21/37	48/46	C/E
Exit 15 On ramp	Northbound	Merge	11/29	59/53	B/D
North of Exit 15	Northbound	Basic	13/31	58/53	B/D

Table 3.3b 2014 Existing Conditions I-93 Freeway Segments for AM/PM Peak Period (Southbound)

			AM/PM Peak Period		
I-93 Segment	Direction	Type	Segment Density (veh/mi/lane)	Speed (mph)	LOS (AM/PM)
North of Exit 15	Southbound	Basic	34/19	52/57	D/C
Exit 15 Off ramp	Southbound	Diverge	45/20	41/55	F/C
Exit 15 Weave	Southbound	Weaving	59/37	35/42	F/E
Between Exit 14 & 15	Southbound	Weaving	45/33	48/52	F/D
Between Exit 14 Ramps	Southbound	Basic	32/27	54/55	D/D
Exit 14 On Ramp	Southbound	Merge	33/34	50/46	D/D
Exit 13 Off ramp	Southbound	Diverge	36/35	52/51	E/E
Between Exit 13 Ramps	Southbound	Basic	26/27	55/53	C/D
Exit 13 On ramp	Southbound	Merge	29/45	50/34	D/F
Exit 12 Off ramp N	Southbound	Diverge	32/43	52/45	D/E
Exit 12 Off ramp S	Southbound	Diverge	34/42	49/47	D/E
Exit 12 On ramp	Southbound	Merge	13/24	56/53	B/C
At I-89	Southbound	Basic	13/15	59/59	B/B
I-89 On ramp	Southbound	Merge	11/11	66/66	B/B
South of I-89	Southbound	Basic	18/20	63/63	C/C

I-89 and I-393 are included in the project because of their proximity to I-93. The segments of I-89 and I-393 between I-93 are “Weaving” segments as auxiliary lanes exist. “Basic” segments exist within Exit 1 on both I-89 and I-393. The results of the traffic operations analyses are summarized in **Table 3.4 2014 Existing Conditions I-89 Freeway Segments for AM/PM Peak Period and Table 3.5 2014 Existing Conditions I-393 Freeway Segments for AM/PM Peak Period**. Those segments with LOS E or F are highlighted in red, indicating that improvements are necessary.

Table 3.4 2014 Existing Conditions I-89 Freeway Segments for AM/PM Peak Period

			AM/PM Peak Period		
I-89 Segment	Direction	Type	Segment Density (veh/mi/lane)	Speed (mph)	LOS (AM/PM)
North of Exit 1	Southbound	Basic	26/21	52/52	D/C
Exit 1 Off ramp	Southbound	Diverge	30/24	39/39	D/C
Between Exit 1 Ramps	Southbound	Basic	39/31	35/36	E/D
Between Exit 1 & I-93	Southbound	Weaving	43/34	37/38	E/D
I-93 NB Off ramp	Southbound	Diverge	23/16	41/41	C/B
I-93 NB On ramp	Northbound	Merge	10/15	52/48	B/B
Between Exit 1 & I-93	Northbound	Weaving	18/36	51/42	B/E
Between Exit 1 Ramps	Northbound	Basic	12/21	64/60	B/C
Exit 1 On ramp	Northbound	Merge	11/19	69/67	B/B

Table 3.5 2014 Existing Conditions I-393 Freeway Segments for AM/PM Peak Period

			AM/PM Peak Period		
I-393 Segment	Direction	Type	Segment Density (veh/mi/lane)	Speed (mph)	LOS (AM/PM)
At I-93 Exit 15	Eastbound	Weaving	7/16	49/48	A/B
Between I-93 and Exit 1	Eastbound	Weaving	10/20	55/51	B/B
Between Exit 1 Ramps	Eastbound	Basic	11/23	57/54	A/C
Exit 1 On ramp	Eastbound	Merge	11/27	56/48	B/C
East of Exit 1	Eastbound	Basic	11/27	56/53	B/D
East of Exit 1	Westbound	Basic	25/20	51/49	C/C
Exit 1 Off ramp	Westbound	Diverge	22/18	53/53	C/B
Between Exit 1 Ramps	Westbound	Basic	23/17	52/51	C/B
Between I-93 and Exit 1	Westbound	Weaving	16/16	53/48	B/B
At I-93 Exit 15	Westbound	Weaving	25/19	39/40	C/B

3.2.4 Crash Statistics

For the ten-year period from January 2007 to December 2016, a total of 2,195 crashes were reported to the NHDOT within the study area limits. hese crashes occurred on I-93, I-89, I-393, the on and off ramps to each interstate, the intersections where the ramps terminate with other roadways, and these other roadways, all within the project limits. This data is only as accurate as the crashes that are reported. **Table 3.6 Crashes within Study Limits (2007 – 2016)** below provides an approximate summary of the crashes per project segment.

Table 3.6 Crashes within Study Limits (2007 – 2016)

Location	Total Number of Crashes	Injury Crashes	Fatalities
I-89 / I-93 Area	482	126	2
Exit 12 Area	237	48	0
Exit 13 Area	329	90	0
Exit 14 / 15 Area	1,147	248	4
Totals	**2,195**	**512**	**6**

The highest number of crashes (52%) were reported for the Exit 14/15 Area where six weaving segments exist. Of the four fatalities in the Exit 14/15 Area, two occurred on I-93 between the two exits, one on I-393 at its river crossing, and one on Fort Eddy Road.

The majority of crashes occurred under normal conditions as can be seen in **Table 3.7 Crashes by Weather Conditions (2007 – 2016) and Table 3.8 Crashes by Roadway Conditions (2007 – 2016)** that provide the summary of crashes by weather and roadway conditions.

Table 3.7 Crashes by Weather Conditions (2007 – 2016)

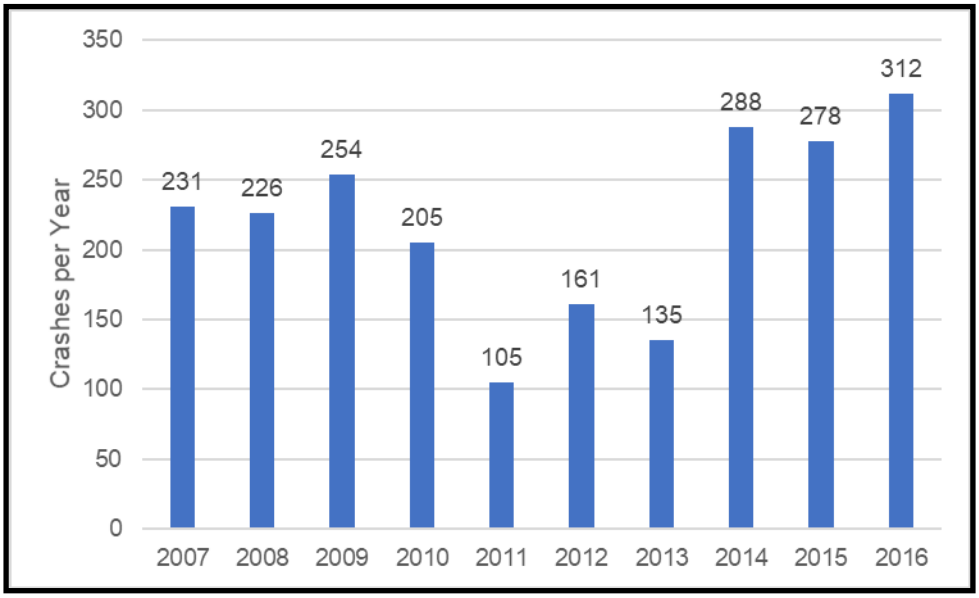
Weather Conditions	Total Number of Crashes	Percentage
Clear or Cloudy	1,762	80.3%
Rain	190	8.7%
Snow or Sleet	196	8.9%
Other or Unknown	47	2.1%
Totals	**2,195**	

Table 3.8 Crashes by Roadway Conditions (2007 – 2016)

Roadway Conditions	Total Number of Crashes	Percentage
Dry	1,571	71.6%
Wet	310	14.1%
Snow or Slush	188	8.6%
Ice	92	4.1%
Unknown	34	1.6%
Totals	**2,195**	

Table 3.9 Crashes by Year (2007 – 2016) below presents the number of crashes within the project limits for each year between 2007 and 2016. The lower number of crashes between 2011 and 2013 do not necessarily meant there were fewer crashes, but rather that fewer were reported.

Table 3.9 Crashes by Year (2007 – 2016)



3.2.5 Geometric Deficiencies

There are several geometric deficiencies that exist along I-93 within the project limits. These were identified by comparing the existing geometry against the standards set forth in the NHDOT *Highway Design Manual* and *A Policy on Geometric Design of Highways and Streets* from the American Association of State Highway and Transportation Officials (AASHTO), commonly referred to as the "Green Book".

Many of the geometric deficiencies are expected with a transportation system that is approaching 60 years of age. There are two main types of deficiencies present: inadequate weaving lengths and inadequate deceleration distances at exit ramps.

Inadequate weaving lengths occur in several places and are a result of interchanges being located too close to one another. The term weaving refers to the segment of highway between critical points where traffic is entering and exiting and the vehicle paths must cross each other. Inadequate deceleration occurs when the exit ramp leading to a horizontal curve is not of sufficient length for vehicles to comfortably decelerate outside the main flow of traffic. See **Table 3.10 Table 3.10 Existing Geometric Deficiencies** below for a list of the geometric deficiencies in the project area.

Table 3.10 Existing Geometric Deficiencies

Deficiency	Location
Weaving	I-89 southbound between Exit 1 entrance ramp and the I-93 southbound exit ramp
Weaving	I-89 northbound between the I-93 southbound entrance ramp and the Exit 1 northbound exit ramp
Weaving	I-93 southbound between Exits 14 and 15
Weaving	I-93 northbound between Exits 14 and 15
Weaving	I-93 southbound between Exit 15 loop ramps
Weaving	I-93 northbound between Exit 15 loop ramps
Weaving	I-393 eastbound between Exit 15 loop ramps
Weaving	I-393 westbound between Exit 15 loop ramps
Weaving	I-393 eastbound between Exit 15 and Exit 1 on I-393
Weaving	I-393 westbound between Exit 1 on I-393 and Exit 15
Deceleration	I-93 northbound exit ramp to southbound Route 3A at Exit 12
Deceleration	I-93 northbound exit ramp to northbound Route 3A at Exit 12
Deceleration	I-93 southbound exit ramp to northbound Route 3A at Exit 12
Deceleration	I-93 southbound exit ramp to southbound Route 3A at Exit 12

The inadequate deceleration distances at the four Exit 12 exit ramps exist because the ramps have curved geometry with posted speeds of 25 mph and the exit ramps leading to these curves are not of sufficient length for vehicles to comfortably decelerate from 55 mph to 25 mph.

3.2.6 Infrastructure Deficiencies

I-93 through Bow and Concord was originally constructed in the late 1950s and early 1960s but has seen improvements over the years. In the last several years, many of the Red List bridges in the corridor have been rehabilitated or replaced and the median barriers and guardrail have been upgraded. However, deficiencies remain, including six Red List bridges. Specific infrastructure deficiencies and concerns within the 4.5-mile project area are listed below in **Table 3.11 Existing Infrastructure Deficiencies**.

Table 3.11 Existing Infrastructure Deficiencies

Deficiency	Location
Red List Bridge (State Priority #7)	I-393 over I-93 Bridge
Red List Bridge (State Priority #13)	I-93 SB over Hall Street
Red List Bridge (State Priority #15)	Route 202 over NHRR and Constitution Avenue
Red List Bridge (State Priority #26)	I-89 over South Street
Red List Bridge (State Priority #34)	I-393 over Fort Eddy Road
Red List Bridge (State Priority #99)	Delta Drive over I-93
Culvert	Culvert failure resulted in a sink hole that closed I-93 for ten hours
Flooding	Flooding around Exit 15 occurs periodically
Vertical Clearance	Hall Street under I-93 limited to 13’-6” of clearance. Bridge has been hit several times.

3.2.7 Transportation Demand Management

Transportation Demand Management (TDM) strategies are designed to reduce the demand for travel rather than increase capacity to accommodate increased demand. These strategies require changing travel behavior to reduce the number of vehicles on the road during peak periods. This is accomplished by eliminating trips, shortening trips, or shifting trips out of the peak congestion periods. Below are the TDM elements that currently exist in the region.

3.2.7.1 Park-and-Ride Lots

Park-and-Ride Lots support those who travel by carpool, vanpool or bus. Within the project area there are three Park-and-Ride Lots owned and operated by NHDOT. These include the following:

- Bow: NH Route 3A at the intersection of I-89 and Hall Street (60 space capacity).
- Concord: Iron Works Road at I-89 Exit 2 (100 space capacity)
- Concord: Stickney Avenue at I-93 Exit 14 (340 space capacity)

The lot at Stickney Avenue also serves the Concord Transportation Center Bus Terminal, as described below in Section 3.2.7.3.

3.2.7.2 Ride-Matching / Employer Measures / Congestion Pricing

NHDOT provides a free service, *NH Rideshare*, which works with the state's Regional Planning Commissions and employers to provide information to commuters on ways to access alternative transportation opportunities. *NH Rideshare* offers a Ride Match service whereby commuters with similar commutes are matched for carpooling. They also provide information to employers on the benefits of carpooling, vanpooling, and telecommuting. There is currently no congestion pricing in New Hampshire.

3.2.7.3 Bus Transit Services

Concord Area Transit (CAT) provides a fixed-route bus service in the City of Concord. CAT has three routes that run throughout the City Monday through Friday from 6:00 AM to 6:30 PM. None of the routes utilize I-93 but two routes use Loudon Road (NH Route 9) to cross I-93 and the Merrimack River, providing access from the downtown area to the east side of Concord. Each route has 12 scheduled runs during the day.

Manchester Transit Authority (MTA) runs a Manchester to Concord bus service Monday through Saturday from 6:30 AM to 6:30 PM. This service runs from downtown Manchester and stops at the Concord Transportation Center on Stickney Avenue and the State House located on Main Street in downtown Concord.

Concord Coach Lines runs several services connecting central and northern NH to downtown Boston and Logan International Airport. All of the routes pass through the Concord Transportation Center on Stickney Avenue, which is operated by Concord Coach Lines. Their service is seven days a week.

Greyhound Lines also use the Concord Transportation Center as a stop for their inter-city bus services with daily trips.

3.2.7.4 Rail Transit Services

There is no passenger rail service in the vicinity of the project. The nearest passenger rail is located in Lowell, Massachusetts, over 50 miles south of the project area. However, studies to bring passenger rail to New Hampshire and Concord have proposed extending the existing service in Lowell north through Nashua, Manchester, and then to Concord.

3.2.8 Transportation System Management

Transportation System Management (TSM) refers to low cost, short term measures to address congestion and safety concerns. These measures typically can be implemented with no new pavement or right-of-way acquisition required. Measures include:

- Intelligent Transportation Systems (ITS)
- Ramp Metering
- New and Re-timed Traffic Signals
- Striping Modifications Signage

Within the project limits, TSM measures have been implemented, such as:

- Additional signage along I-89 from Exit 2 eastbound to reinforce the speed reduction at the terminus of I-89 and the I-93/I-89 interchange.
- Intelligent Transportation System (ITS) elements have been installed on the I-93 corridor for additional camera surveillance that is used by the NH Transportation Management Center (TMC) for congestion monitoring and incident management.

3.3 Air Quality

The Federal Clean Air Act requires that the U.S. Environmental Protection Agency (EPA) establish health-based National Ambient Air Quality Standards (NAAQS). The EPA has identified “criteria” pollutants for which NAAQS have been promulgated. The management of criteria pollutants is largely accomplished through control measures tailored by state, local, and tribal governments in their State Implementation Plans (SIP). The process of determining the classification of the SIP begins with State and Local Air Monitoring Stations (SLAMS) indicating Ambient Air Pollutants. The EPA monitors these stations and revises the ambient air standards every 5 years based on new scientific findings. The EPA then classifies state regions according to recent standards. This classification indicates “attainment” or meeting NAAQS, “non-attainment” or not meeting NAAQS, and “maintenance” or in remediation from previous non-attainment classification. The states amend or cater SIPs to meet the current standards pending EPA approval.

On July 18, 1997, the EPA adopted a new NAAQS for ozone and fine particulate matter. Under the 1997 NAAQS the New Hampshire Counties of Merrimack, Hillsborough, Rockingham, and Strafford were classified as either serious or marginal nonattainment. On July 20, 2013, all of New Hampshire was re-classified as unclassifiable/attainment under the 2008 8-hour Ozone NAAQS, also known as the 2008 ozone standard, and the 1997 8-Hour Ozone NAAQS was revoked for transportation conformity purposes in the Boston-Manchester-Portsmouth (SE) NH area.

On April 23, 2018, the FHWA sent out the memorandum “Interim Guidance on Conformity Requirements for the 1997 Ozone NAAQS” that states recent court proceedings struck down portions of the 2008 Ozone NAAQS and reinstituted the 1997 8-Hour Ozone NAAQS. It should be noted that the project is not located within the 1997 Boston-Manchester-Portsmouth (SE) NH area. On March 10, 2014, EPA approved maintenance plans, known as “limited maintenance plans,” for the City of Manchester and City of Nashua. These limited maintenance plans have a 2021 horizon year. (The second ten-year carbon monoxide (CO) maintenance period terminates on January 29, 2021.)

On June 2, 2010 the EPA issued a final rule revising the primary sulfur dioxide (SO2) NAAQS, and simultaneously revoked both the existing 24-hour and annual primary SO2 standard redesignating parts of central New Hampshire under Non-attainment.

Section 176(c) of the Clean Air Act prohibits Federal agencies from funding or approving activities that do not conform to an applicable SIP for achieving compliance with the NAAQS. A conformity determination may involve analysis of both regional and project level air quality effects.

This proposed project is included in the latest Statewide Transportation Improvement Program (STIP) plan (amended 02/05/2018) and is listed as a regionally significant project. The 2017 – 2020 NH STIP has been developed through a statewide and metropolitan planning process that is consistent with the requirements of 23 CFR Part 450.216. All projects designated as regionally significant by the Metropolitan Planning Organizations (MPO) and Interagency Consultation (IAC), regardless of the funding source, are included in the STIP. The proposed widening of I-93 to 3 travel lanes and one auxiliary lane in each direction, as embodied in the proposed alternative, was included as part of this conformity determination. Therefore, a regional analysis outside of that completed for the STIP conformity determination is not necessary.

Refer to Chapter 4, Section 4.3 for further details on the methods and results of the microscale air quality analysis that was completed for the proposed project. Refer to Appendix E (Volume 2) for a complete copy of the air quality report.

3.4 Noise

3.4.1 Introduction

This section documents the results of a traffic noise analysis conducted for the proposed project. This analysis was prepared according to federal noise regulations, 23 CFR 772 (*Procedures for Abatement of Highway Traffic and Construction Noise*), and the *New Hampshire Department of Transportation Policy and Procedural Guidelines for the Assessment and Abatement of Highway Traffic Noise for Type I & II Highway Projects* (2016). Under the guidelines, Type I projects are defined as those involving the construction of new highways and/or the alteration of existing highways (e.g., realignment or addition of travel lanes). The alternatives addressed in this analysis are those that are considered Type I.

3.4.2 Methodology

The noise analysis included the following steps, in accordance with FHWA and NHDOT policy:

1. Identification of existing activities and developed lands along the proposed alignment that may be impacted by highway noise.

2. Measurement of existing noise levels in the project area.

3. Determination of existing and future traffic noise levels for the project area, based on the field measurement data and the FHWA Traffic Noise Prediction Model (TNM 2.5).

4. Determination of existing and future traffic noise impacts. Impacts occur when traffic noise levels approach (within 1 decibel) or exceed the FHWA Noise Abatement Criteria, or when the predicted future traffic noise levels exceed the existing noise levels by 15 decibels or more.

5. Evaluation of traffic noise abatement measures at impacted locations.

6. Consideration of construction noise.

3.4.2.1 Criteria for Determining Impacts

Traffic Noise Terminology

Traffic noise levels are expressed in terms of the A-weighted sound level in decibels (dBA). The A-weighting scale approximates the frequency response of the human ear. Generally, when sound levels exceed the mid-60 dBA range, an outdoor conversation with a person approximately one meter (three feet) away becomes difficult to hear. A 10-decibel increase in sound levels is typically judged by the

listener to be twice as loud as the original sound and a 10-decibel reduction is typically perceived as half as loud. A doubling of traffic volumes will increase the sound level by approximately 3 dB, which is considered to be the smallest change to the A-weighted sound level that people, without specifically listening for a change, could notice.

Most environmental noise fluctuates from moment to moment, so it is customary to condense sound-level data from measurement periods into a single level called the equivalent sound level (Leq). The Leq is the value of a steady sound level that contains the same amount of energy as the actual time varying sound evaluated over the same period. Typically, the A-weighted Leq for traffic-noise analysis is evaluated during a one-hour period when the traffic volume and noise levels are at a daily high. The notation for this daily high Leq is LAeq1h.

Noise Abatement Criteria (NAC) and Determination of Impact

23 CFR 772 identifies Noise Abatement Criteria (NAC) for various land uses (See **Table 3.12**). The NAC defines thresholds which, when approached or exceeded, indicate when noise abatement must be considered. By NHDOT policy, “approach” is defined as within 1 dBA of the NAC. Thus, impacts were determined to occur at properties where exterior sound levels were 66 dBA or higher for Activity Category B. Impacts were also determined for properties within Category C and Category E.

Noise impacts also occur, and consideration of abatement measures is also required, when the predicted future traffic noise is substantially higher than the existing noise levels. NHDOT policy defines “substantial” as an increase of 15 dB or more.

In determining traffic noise impacts and abatement measures, the primary consideration is given to exterior areas where a lowered noise level will be beneficial to “frequent human use” areas. Areas of “frequent human use” in residential areas are evidenced by the presence of patio furniture, picnic equipment, play equipment, gardens, etc. The entire outdoor area of a residential lot would be unlikely to be defined as an area of ‘frequent human use’, instead those areas with evidence of regular outdoor use would be considered. Field reviews are conducted to identify areas where frequent human use occurs and a lowered noise level would be of benefit. Locations where “lowered noise levels will be beneficial” do not normally include areas such as parking lots, athletic fields, or farm property.

3.4.2.2 Existing Land Use and Noise Sensitive Areas

Existing land use in the project area was identified by reviewing maps and aerial photography and conducting field investigations.

Noise Sensitive Areas (NSAs) are areas that represent logical groupings of receptors for the purposes of noise prediction and abatement analysis. The

groupings can be based on a number of factors, including land use characteristics, the proximity of individual houses or structures to existing and proposed roadways, the terrain, and the location of the area. Three NSAs were identified within the 4.5 mile project area. *Receptors* are individual sites or properties (e.g., a residence or playground). For this project, receptor locations for each NSA were selected to include the range of receptors that could be impacted or benefitted by the project.

Based on field review, 15 sites were selected within the three NSAs and noise measurements were conducted. A description of the three NSAs and the location of the noise readings within each follows:

Noise Sensitive Area 1 (NSA 1) is located within the southern terminus of the project area in the I-89/Exit 1 area. Within NSA 1, four noise readings were collected (1-1, 1-2, 1-3, and 1-4). The land use within this area is primarily residential with a few commercial businesses, located on both the east and west sides of I-93. The four noise reading locations include the following:

- NSA 1-1 is located at 6 Logging Hill Road (residential)
- NSA 1-2 at 3 Everett Avenue (residential)
- NSA 1-3 at 28 Grandview Road (residential)
- NSA 1-4 at 25 Grandview Road (residential)

Noise Sensitive Area 2 (NSA 2) is located in the center of the project area and encompasses both I-93 Exit 12 and Exit 13. Seven noise readings were collected within NSA 2. The primary land use within NSA 2 is a mixture of residential and commercial, including Reed Playground, multiple hotel complexes and part of Healy Park. The seven noise reading locations include the following:

- NSA 2-1 is located at 49 Heather Lane (residential)
- NSA 2-2 is located at 37 Nivelle Street (residential)
- NSA 2-3 at 14 Haig Street (residential)
- NSA 2-4 at 7 Longmeadow Drive (residential)
- NSA 2-5 at 406 S Main Street (Day's Inn Hotel)
- NSA 2-6 at Reed Playground on Hall Street
- NSA 2-7 at 71 Hall Street (Comfort Inn Hotel)

Noise Sensitive Area 3 (NSA 3) is located along the northern portion of the project area and encompasses I-93 Exits 14 and 15. Four noise readings were collected within NSA 3. Within the vicinity of NSA 3, land use can be described as primarily commercial with residential structures throughout and the NHTI, Community College complex. The four noise reading locations include the following:

- NSA 3-1 is located at 266 North Main Street (Kimball Jenkins School of Art)
- NSA 3-2 at 6 Herbert Street (residential)
- NSA 3-3 at 3 Stevens Drive (residential)
- NSA 3-4 at 31 College Drive (NHTI Community College)

These three NSAs were further broken down into 20 smaller NSAs to reflect neighborhood areas or logical groupings of receptors for the purposes of noise prediction and abatement analysis. The groupings were based upon a number of factors, including land use characteristics, the proximity of individual house or structures to existing and propose roadways, the terrain, and the location of the area. Receptors are individual sites or properties (e.g., a residence or playground). For this project, receptor locations for each NSA were selected to include a range of receptors that could be impacted or benefitted by the project.

Refer to **Table 3.13** for the details on the 20 NSAs including the estimated number of receptors within each. Refer to **Figures 3.23-1 and 3.23-2 Noise Sensitive Areas** for the location of each of the 20 NSAs within the project corridor.

Table 3.12 Noise Abatement Criteria

Activity Category	LAeq1h *	Description of Activity
A	57 (Ext.)	Land on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Ext.)	Residential.
C	67(Ext.)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails and trail crossings.
D	52(Int.)	Auditoriums, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, television studios.
E	72 (Int.)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	-	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	-	Undeveloped lands that are not permitted

Hourly A-weighted sound level in decibels (DBA). Ext. = Exterior; Int. = Interior.

Table 3.13 Noise Sensitive Area Locations (NSAs)

NSA	Description	Activity Category	Approx. # of Receptors	Noise Measurement Location
1-A	Residential area along southbound/south side of I-89. (Wilderness Lane)	B	3	NA
1-B	Residential area along southbound/south side of I-89. (Logging Hill Road, South Street, Everett Avenue, Valley Road)	B	14	1-1, 1-2
1-C	Residential area along southbound/west side of I-93. (Grandview Road)	B	13	1-3
1-D	Residential area along northbound/east side of I-93. (Grandview Road, Carriage Road)	B	20	1-4
1-E	Residential area along northbound/north side of I-89. (South Street)	B	2	NA
2-A	Residential area along southbound/west side of I-93. (Heather Lane, Gabby Lane)	B	2	2-1
2-B	Residential area along southbound/west side of I-93 at Exit 12. (S. Main Street, Haig Street, Broadway Street, Joffre Street, Donovan Street, Rockingham Street, Hope Avenue, Wood Avenue)	B	60	2-2, 2-3
2-C	Residential area along northbound/east side of I-93. (off of Basin Street)	B	60	2-4
2-D	Hotel along northbound/east side of I-93. (NH Route 3A)	E	1	2-5
2-E	Recreational area/hotel along the southbound/west side of I-93. (Hall Street)	C/E	25	2-6, 2-7
2-F	Recreational site along northbound/east side of I-93. (Basin Street)	C	1	NA
2-G	Recreational site along northbound/east side of I-93. (Healy Park)	B	1	NA
2-H	Outdoor seating area along southbound/west side of I-93. (Gulf Street, Water Street, PAR Railroad)	E	2	2-6, 2-7
3-A	Outdoor seating area along northbound/east side of I-93. (Fort Eddy Road)	E	1	3-3

3-B	Residential area along westbound/north side of I-393/202/4 intersection with Main Street. (Main Street, PAR Railroad)	B	10	3-1
3-C	Residential area along southbound/south side of on-ramp to I-93 from I-393/202/4. (Stickney Avenue)	B	10	3-2
3-D	Residential area along Fort Eddy Road near eastbound/south side of I-393/202/4. (Grappone Drive, Stevens Drive, McKee Drive	B	20	3-3
3-E	Hotel along southbound/west side of off-ramp from I-93 to I-393/202/4. (Constitution Avenue, Commercial Avenue)	E	1	NA
3-F	NHTI Campus along northbound/east side of I-93. (Fan Road, Institute Drive)	B/C/D	60	3-4
3-G	Recreational field along southbound/west side of I-93. (Commercial Street)	C	1	NA

3.4.2.3 Noise Measurement Procedures

Field noise measurement data were collected at the 15 Noise Measurement Sites on May 16 and 17, 2017. A 3M SoundPro DL-2 sound level meter was used to measure sound levels at each measurement site over one 15-minute period. One measurement was taken at each site. Measurements were taken during daytime hours, including some AM and PM peak traffic hour periods. Vehicle classification counts were taken during each measurement period to record the volume of cars, medium trucks, heavy trucks, buses, and motorcycles for the 15-minute period when the noise measurement was taken.

3.4.2.4 Traffic Analysis

The noise analysis uses peak traffic volumes, when traffic volumes are at or near their highest levels and noise conditions are most likely to be at their highest levels, to determine noise levels in the project area. Traffic is broken down into autos/light trucks, medium trucks, heavy trucks and motorcycles.

3.4.2.5 Prediction of Noise Levels

The FHWA traffic noise prediction model, TNM 2.5, was used to predict traffic noise levels expected to occur with implementation of the proposed project. Peak-hour traffic projections were developed for existing (2017) and Design Year (2035) conditions, for both the No Build and the Preferred Alternative, including vehicle-mix information.

As a first step in the prediction process, the noise model was set up and run using the traffic volumes and classifications recorded during the 15-minute measurement periods. The noise levels predicted by the model were then compared to the measured noise levels. The measured noise levels and modeled noise levels were found to be within 1-3 decibels of each other at all measurement sites. This variation is considered acceptable and indicates that the overall model setup in terms of input variables (roadway and receiver geometry, traffic volumes, traffic mix and speeds, etc.) produces results that reflect actual conditions.

The year 2017 peak hour traffic volumes were then modeled, with the existing roadway configuration, to establish a baseline LAeq1h. Year 2035 (Design Year) noise levels for the No-Build and Build conditions were then predicted using the model. The predicted Year 2035 noise levels were compared to the Noise Abatement Criteria and the 2017 modeled baseline LAeq1h (not to the 2017 measured noise levels) to determine the noise impacts associated with the project.

3.4.2.6 Noise Impact Analysis

Noise levels in the project area were evaluated in accordance with the noise impact analysis methodology described above. The existing and predicted noise levels were calculated for the receptors within each NSA location that could be impacted by project noise. The calculated noise levels were compared to the appropriate Noise Abatement Criteria. The abatement analysis (Chapter 4) considered the receptors at each location which could benefit from noise abatement. Future noise levels and impacts along with an analysis of abatement measures are in Chapter 4.

3.5 Water Resources

This section describes the water resources located within the study area including groundwater, surface water, floodplains, wetlands, water quality, drinking water supplies, and applicable state and federal regulatory programs.

3.5.1 Groundwater

Groundwater and drinking water are regulated principally under two New Hampshire laws. The Groundwater Protection Act (RSA 485-C) provides for groundwater classification according to groundwater quality and yields. The New Hampshire Safe Drinking Water Act (RSA 485) regulates water systems according to the type and size of population they serve.

RSA 485-C, the Groundwater Protection Act, authorizes municipalities and public water suppliers to develop local groundwater protection programs and establishes best management practices for regulated substances to help protect water quality. The law recognizes four classes of groundwater:

- GAA: Delineated Wellhead Protection Areas
- GA1: Groundwater of high value for present or future drinking water
- GA2: Potentially valuable stratified drift aquifers
- GB: All groundwater not assigned to a higher class

Areas classified as GAA are the most stringently regulated groundwater sources, and are, by definition, within delineated wellhead protection areas (WHPAs). A WHPA is defined as the area under which groundwater flows to a producing well. For bedrock wells, the WHPA is a circle whose radius depends on the maximum daily amount of water withdrawn from the well. For till and gravel wells, the WHPA is calculated based on existing hydrogeologic information. Class GA1 is "assigned to groundwater in a defined zone of high value for present or future drinking water supply" (RSA 485-C:5). There are no groundwater resources within the project corridor that have been reclassified to GAA or GA1.

Class GA2 is assigned to groundwater within aquifers identified as highly productive for potential use as a public water supply by the U.S. Geological Survey (USGS) regional groundwater studies, or other regional studies. Zones of stratified drift with a saturated thickness greater than 20 feet, and a transmissivity (the rate at which groundwater flows horizontally through an aquifer) greater than 1,000 feet squared per day (ft^2/day) are designated as class GA2. Zones of bedrock with average well yields greater than 50 gallons per minute are also designated as class GA2. All other areas, by default, are classified as GB.

3.5.1.1 Aquifers

The majority of the study area is underlain by an aquifer that has a transmissivity ranging from 0 - 1,000 ft^2/day; therefore, it is classified as GB. This aquifer is not a Sole Source Aquifer regulated by the U.S. EPA. There is a small area adjacent to the Merrimack River and I-393 that is classified as a GA2 aquifer.

The Town of Bow has an Aquifer Protection Overlay District Ordinance (Article 10.03 of the Zoning Ordinance). The Town of Bow Aquifer Overlay District is located in the vicinity of the I-89 interchange to the Concord City Line, and south along the Merrimack River. Refer to **Figure 3.9 Groundwater Resources Overview**, for the location of the Aquifer Overlay District. There is also a proposed Aquifer Overlay District west of and adjacent to the existing one, on the northern side of I-89.

The City of Concord has seven Aquifer Protection Districts (APs). The closest AP to the study area is located in the vicinity of Horseshoe Pond and continues north along the Merrimack River. However, this district is outside the project study area.

3.5.1.2 Public Drinking Water Systems

Under RSA 485, the New Hampshire Safe Drinking Water Act, water systems are regulated according to the type and size of population they serve, as follows:

Public Water System: This is a system that consists of a "piped water system for human consumption, serving 15 or more services or 25 or more people for at least 60 days per year." Public water systems are classified into the following types:

Community Water System*:* This is public water system that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

Transient Non-Community Water System: This is a system that is not a community water system, such as a restaurant or hotel. These are sometimes referred to as "Transient" water systems.

Non-Transient Non-Community Water System: This is a system that is not a community water system and that serves the same 25 people, or more, over 6 months per year (for example, a school or workplace).

There are 23 public water systems that occur within 1,000 feet of the study area. NHDES recommends that construction materials and equipment not be stored within 400 feet of public water systems. Public water systems are depicted on **Figure 3.10 Public Water Supply Overview.** All public well locations along the I-93 will have to be confirmed prior to construction.

Drinking water Administrative Rules Env-Dw 406.11(c) state that non-community water system wells shall be kept at least 50 feet from the edge of the road right-of-way. As the project progresses, coordination with NHDES will occur regarding potential impacts to the public water supply wells and their associated WHPAs.

3.5.1.3 Wellhead Protection Areas

Under New Hampshire RSA 485-C, a WHPA "means the surface and subsurface area surrounding a water well or wellfield, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield." The wellhead protection program commits public water suppliers to regular inspections within the delineated WHPA to ensure that best management practices are being followed. Private domestic wells do not have delineated WHPAs.

All 23 public water supply wells located within 1,000 feet of the study area are bedrock wells. These wells are concentrated around the southern end of the study area in Bow near the I-89 interchange. This area also coincides with the Town of Bow Aquifer Overlay District. Groundwater Resources are shown on **Figure 3.9.** The radius of WHPAs for bedrock wells is based on the maximum daily amount of water withdrawn from the well. A total of 11 WHPAs are located within the study area, many of which are overlapping. In addition to the WHPAs, a 400-foot Sanitary Protection Radius is applicable to the both Transient wells and the Non-Transient Non-Community wells, as per State regulations. Roadway projects within WHPAs

should follow DES recommendations for stormwater treatment to the extent practicable. [1]

Community systems have a Sanitary Protective Radius (SPR) that varies by well from 75 to 400 feet depending on the output of the well. Under the law, land use within this radius must be controlled by the supplier, either through ownership or easement. NHDES has provided recommendations with respect to community and non-transient non-community wells that address issues specific to roadways, such as stormwater treatment, snow storage, and salt application.[2]

3.5.2 Surface Waters

Surface water resources within the study area consist of rivers, streams and ponds. Surface waters are regulated under the federal Clean Water Act (33 U.S.C. 1251 – 1376) and the New Hampshire Dredge and Fill Law (NH RSA 482-A). State surface water regulations are administered by the New Hampshire Department of Environmental Services, Water Division. **Figure 3.11 Surface Water Overview** depicts an overview of the surface waters and watersheds in and around the study area.

3.5.2.1 Lakes and Ponds

Horseshoe Pond

Horseshoe Pond, is a broad oxbow pond approximately 45 acres in size. The pond is a remnant feature of the Merrimack River, created by a historic meander in the river channel that has since been abandoned. The pond is located northwest of Exit 15 and is outside the study area. Wattanummon Brook is a small stream that flows through the project area from Horseshoe Pond to the east, in box culvert under I-93 and is hydrologically connected to the Merrimack River. The pond is classified as L1UBH, or lacustrine, limnetic (deepwater), with an unconsolidated bottom and permanently flooded. Both the north and south ends of the pond are shallower than in the middle and support aquatic emergent vegetation around the perimeter. A cornfield is located on the peninsula of land surrounded by the pond.

Fort Eddy Pond

Fort Eddy Pond is located east of I-93 and just north of I-393, near the northern end of the study area. Like Horseshoe Pond, it was created from a historic oxbow of the Merrimack River. The pond is approximately 20 acres is size, and is also classified as L1UBH. The pond drains from the southern end to the east, and is hydrologically connected to the Merrimack River through a series of culverts and wetlands

1 *Recommendations for Implementing Groundwater Protection Measures When Siting or Improving Roadways* NHDES, 1995

2 *Recommendations for Implementing Groundwater Protection Measures When Siting or Improving Roadways* NHDES, 1995

(Wetland CC and DD) that flow under the I-393 Exit 1 ramps and College Drive before outletting into the Merrimack River.

South End Marsh

The South End Marsh is located just north of the Exit 12 interchange. This wetland complex has a large area of open water with a palustrine emergent wetland fringe around the perimeter. The entire area is approximately 26 acres. This area drains to the south, underneath I-93, and into another large wetland complex (Wetland Q). This area continues to drain to the south and is hydrologically connected to the Merrimack River.

3.5.2.2 Rivers and Streams

Merrimack River

The Merrimack River is the largest and most prominent surface water feature in the study area. The Merrimack River begins at the confluence of the Pemigewasset and Winnipesaukee Rivers in Franklin, NH, and flows south before turning east in northern Massachusetts, and flowing into the Atlantic Ocean in Newburyport, MA. The entire river is approximately 116 miles in length. The watershed originates in the White Mountains of New Hampshire and has a total area of approximately 5,000 square miles. At the location of the I-393 crossing in Concord, NH, the Merrimack is a fourth order river with a watershed size of approximately 2,383 square miles. It is fed by several tributaries, including the Pemigewasset River, Winnipesaukee River, Contoocook River, and the Turkey River, which joins the Merrimack in the southern part of the study area (near the I-93 and I-89 interchange) in Bow.

In the study area, I-93 roughly parallels the Merrimack River to the west and spans the river just north of the study area. North of Loudon Road, the river is a riverine system classified as R2UBH, or lower perennial with an unconsolidated bottom, and permanently flooded. South of the Loudon Road Bridge, the Merrimack River transitions to a lacustrine (lake) system with a classification of L1UBHh, limnetic (deepwater), with an unconsolidated bottom, permanently flooded, and impounded. The impoundment is created by the dam at Garvin Falls in Bow, approximately 0.6 miles south of the study area.

Despite flowing through the relatively urban and developed study area, the river retains much of its riparian buffer and floodplains. In some areas, development has encroached upon the banks of the river, including the I-89 and I-93 interchange at NH Route 3A (Bow Junction), the area south of Exit 13, and in the vicinity of Exit 14. Agricultural fields are found within the River's floodplain, scattered throughout the study area, and patches of floodplain forest are located adjacent to the river, especially in the northern half of the study area and along the eastern bank. The banks are vegetated with silver maple, red maple, green ash, basswood, and gray birch.

The Merrimack River is an important resource for fish and wildlife, plant communities, and for recreation, including boating, fishing, and swimming. Historically, the river was a major source of industrial power and water quality was negatively impacted by associated discharges. However, water quality has improved in recent years through state and local protection measures that have limited point source pollution.

Turkey River

The Turkey River is a tributary of the Merrimack River, originating from Turkey Pond in Concord, west of the study area. The Turkey River flows southeast, north of I-89, before entering the study area at Exit 1. It continues through the I-89 and I-93 interchange under five separate crossings before flowing into the Merrimack River. The Turkey River is a perennial stream with a watershed size of approximately 35 square miles.

Bow Brook

Bow Brook is a perennial stream and a tributary to the Turkey River. Bow Brook begins in central Concord and flows south for approximately 3.8 miles to its confluence with the Turkey River at the I-89 and I-93 interchange. The total watershed size is approximately 1.6 square miles. The headwaters of this stream originate in a large forested area; however, as the stream flows south, the watershed becomes increasingly more residential and urban, with the stream flowing through numerous culverts through the City of Concord.

Unnamed Streams

I-89 Area – There are two intermittent streams that flow from the south, under I-89 and drain to the north into the Turkey River. The westernmost stream crossing has a watershed size of approximately 154 acres. The next stream crossing to the east has a watershed size of approximately 25 acres.

I-93 Southern Terminus of Project Area – There are two small, unnamed streams near the southern end of the project area that flow from the west to the east, under I-93. One stream drains into the Turkey River before ultimately reaching the Merrimack River, and the other stream flows directly into the Merrimack River near the southern limits of the study area. The channels of these streams have been modified by previous highway construction activities including the placement of stone riprap in the channel, channelization, and the installation of culverts. The southernmost stream is located south of the Grandview Road overpass, and has a watershed size of approximately 52 acres. This stream drains directly into the Merrimack River. The next stream north of the Grandview Road overpass has a watershed size of approximately 375 acres and drains into the Turkey River, just west of its confluence with the Merrimack River.

There is a small, unnamed stream with a watershed size of approximately 44 acres, located south of Exit 14.

There is an unnamed stream located just south of Exit 15 with a watershed size of approximately 377 acres.

Wattanummon Brook is a perennial stream near the northern end of the study area that drains from Horseshoe Pond and flows east under I-93 before draining into the Merrimack River.

3.5.2.3 Federal and State Regulatory Jurisdiction

National Wild and Scenic River Program

The National Wild and Scenic Rivers System was created by Congress in 1968 to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. In order to be designated a Wild and Scenic River, a river must be found both eligible and suitable. In 1999, the National Park Service determined that the Upper Merrimack River from Franklin to Concord was eligible for the National Wild and Scenic River system. However, the river did not meet all of the suitability criteria, specifically, there was a lack of local support for designation, and so, the National Park Service recommended against national designation. Therefore, there are no rivers in the study area currently listed within the National Wild and Scenic Rivers Program.

New Hampshire Designated Rivers

The section of the Merrimack River that flows through the project area is designated for protection under the New Hampshire Rivers Management and Protection Act (RSA 483). This program was established in 1988 to protect certain rivers for their outstanding natural and cultural resources. The Upper Merrimack Designated River segment begins at the confluence of the Pemigewasset and Winnipesaukee Rivers in Franklin and flows south for approximately 30 miles to the Garvin Falls Dam in Bow. The Upper Merrimack River was designated in 1990.

The Rivers Management and Protection Act classifies the entire length of designated rivers using four categories: Natural, Rural, Rural-Community, and Community. Protection measures apply to each of these categories. The segment of the Upper Merrimack River within the project area is classified as Rural. Rural rivers are those adjacent to lands which are partially or predominantly used for agriculture, forest management, and dispersed or clustered residential development. Some instream structures may exist, including low dams, diversion works and other minor modifications. Management of rural rivers and segments shall maintain and enhance the natural, scenic, and recreational value of the river and shall consider, protect, and ensure the rights of riparian owners to use the river for agriculture, forest

management, public water supply, and other purposes which are compatible with the instream public uses of the river and the management and protection of the resources for which the river segment is designated. Designated Rivers have a river corridor associated with them. The Designated River corridor is defined as the river and the land area located within a distance of 1,320 feet (¼ mile) of the normal high-water mark or to the landward extent of the 100-year floodplain as designated by the Federal Emergency Management Agency (FEMA), whichever distance is larger.

Each Designated River has a Local River Management Advisory Committee (LAC). The LAC develops and implements a River Management Plan and coordinates activities affecting the river on a regional basis. At the state level, the NHDES assists with the development and implementation of the management plan and enforces regulations concerning the quality and quantity of flow in protected river segments. Through the City of Concord, Interstate 93 roughly parallels the Designated Upper Merrimack River to the west, and much of the project corridor occurs within the protected river corridor. Since the project falls within the Designated River corridor, coordination will occur with the Upper Merrimack River LAC regarding the proposed project.

Navigable Waters

Under Section 9 of the Rivers and Harbors Act of 1899, and the General Bridge Act of 1946, the US Coast Guard has the authority to approve proposed bridge and/or causeway locations and plans. The primary purpose of these Acts is to preserve the public right of navigation and to prevent interference with interstate and international commerce. The Merrimack River is a Federally-designated navigable water from the Massachusetts state line to Concord, NH. Work within the river will require coordination with the US Coast Guard.

New Hampshire Stream Crossing Rules

The NHDES Stream Crossing Rules (Env-Wt 900) classify stream crossings as Tier 1, Tier 2, or Tier 3 based on watershed size. A Tier 1 stream crossing has a watershed of less than or equal to 200 acres, a Tier 2 stream crossing has a watershed size greater than 200 acres and less than 640 acres, and a Tier 3 stream crossing has a watershed size of 640 acres or greater.

The Stream Crossing Rules also allow for a Tier 1 or 2 stream crossing to be upgraded to a Tier 3 stream crossing if any of the following conditions are met: the stream crossing is located within ¼ mile of a designated river; the stream crossing is located within 100 feet of a prime wetland unless a prime wetland buffer waiver has been granted; the stream crossing is in a jurisdictional area that contains a protected species or habitat; the stream crossing is located within a 100-year floodplain or fluvial erosion hazard zone; or the stream crossing carries a watercourse that is listed as not attaining surface water quality standards based on benthic

macroinvertebrate index, fish assemblage index, habitat assessment, or stream channel stability on the current Clean Water Act 305(b) Report (see section *3.5.2.4 Surface Water Quality*) .

A stream crossing that is classified as Tier 3 based solely on the presence of protected species or habitat can be downgraded to a Tier 1 or Tier 2, based on watershed size, with the concurrence of NH Natural Heritage Bureau (NHB), and/or NH Fish and Game Department (NHF&G) that impacts to the protected species or habitat will be avoided or mitigated.

There are a total of six Tier 1 stream crossings, two Tier 2 stream crossings, and six Tier 3 stream crossings located in the project area. The Tier 3 crossings include: I-393 over the Merrimack River; I-93 over Bow Brook, and four crossings over the Turkey River associated with the I-89/I-93 interchange. The Tier 1 and 2 crossings are made up of the smaller unnamed intermittent and perennial streams that flow through the project area.

Shoreland Water Quality Protection Act

The Shoreland Water Quality Protection Act (SWQPA) (NH RSA 483-B) was enacted in 1991 to establish minimum standards for use and development of lands adjacent to New Hampshire's public waterbodies. Public waters include all fourth order and greater streams and rivers, lakes and ponds larger than ten acres, as well as rivers designated under RSA 483. Protected Shoreland includes all land located within 250 feet from the reference line of protected waterbodies. The reference line for lakes and ponds is defined by the surface elevation listed on the *Consolidated List of Waterbodies subject to the Shoreland Water Quality Protection Act*, as maintained by NHDES. The reference line for rivers and streams is the ordinary high-water mark.

Streams can be classified by size based on a hierarchy of tributaries, known as the Strahler stream order system. First order streams are the smallest tributaries at the headwaters located in the upper reaches of a watershed. The stream order increases when two streams of the same order meet. For example, a second order stream begins at the confluence of two first order streams, and a third order stream begins at the confluence of two second order streams.

The Merrimack River and Turkey River are seventh and fourth order streams, respectively, and so, are subject to the SWQPA. Fort Eddy Pond and Horseshoe Pond in Concord are 20.0 and 44.9 acres respectively, and are also subject to the SWQPA.

A permit from NHDES will be required for any earth disturbance, filling, and/or tree clearing within the Protected Shorelands.

3.5.2.4 Surface Water Quality

Surface waters in New Hampshire are classified as A or B by NHDES. Class B is the default classification. Class A waters are the highest quality and are considered suitable for water supply after adequate treatment. Sewage discharges are prohibited in Class A water bodies. New Hampshire RSA 485-A:8, Water Pollution and Waste Disposal, and Administrative Rules Env-Wq 1700, provide thresholds for pollutants, dissolved oxygen, color, temperature, and other criteria that must be met. These standards differ for Class A and Class B waters. All the surface waters in the project area are considered Class B waters.

The Federal Water Pollution Control Act (33 U.S.C. 1251 – 1376), commonly called the Clean Water Act (CWA), as last reauthorized by the Water Quality Act of 1987, requires each state to submit two surface water quality documents to the U.S. Environmental Protection Agency (EPA) biennially. Section 305(b) of the CWA requires the submittal of a report that describes the quality of a state's surface waters, and an analysis of 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.

Section 303(d) of the CWA requires each state to submit a list of impaired waters to the EPA every two years to identify surface waters that are impaired or threatened by pollutants, are not expected to meet water quality standards within a reasonable time, and that require the development and implementation of a Total Maximum Daily Load (TMDL) Study. A TMDL establishes the maximum amount of a pollutant allowed in a waterbody and serves as a starting point or planning tool to implement those reductions in order to restore the water quality. According to the NHDES 2016 303(d) List (most current list available, approved by EPA November 30, 2017), there are five waters in the project area listed as impaired. These are shown on **Figure 3.12 Impaired Waters Overview**, and the details of each are listed in **Table 3.14 Impaired Waters in Study Area.**

Table 3.14 Impaired Waters in Study Area

Assessment Unit ID	Use Description	Impairment(s)	TMDL Priority
Turkey River-Bow Brook	Aquatic Life	Benthic-Macroinvertebrate Bioassessment; Dissolved Oxygen Saturation; Oxygen, Dissolved; pH	Low
Turkey River	Aquatic Life	Aluminum	Low
Merrimack River-Garvins Falls Dam	Aquatic Life	pH	Low
Merrimack River	Aquatic Life	Aluminum; pH	Low
Horseshoe Pond	Aquatic Life Primary Contact Recreation	Chloride; pH; Chlorophyll-a	Low

Source: NHDES 2016 303(d) List

New Hampshire Water Quality regulations Env-Wq 1708 provide antidegradation standards to preserve and protect existing beneficial uses and minimize degradation of the state's surface waters. Antidegradation applies to:

- any proposed new or increased activity, including point and nonpoint source discharges of pollutants that would lower water quality or affect the existing or designated uses;
- a proposed increase in loadings to a waterbody when the proposal is associated with existing activities;
- an increase in flow alteration over an existing alteration; and
- all hydrologic modifications, such as dam construction and water withdrawals.

Impairments of Waters in the Study Area

Benthic macroinvertebrates are aquatic organisms that are found living along the substrate of a waterbody. Examples of benthic macroinvertebrates include insect larvae, adult aquatic insects, aquatic worms, shellfish, and crayfish. The composition and diversity of these species is an important indicator of overall water quality. Waters in the project area that do not meet the standards for benthic macroinvertebrates and which have been listed as impaired for this category include: Turkey River and Bow Brook.

The acidity, or pH, of freshwater streams can be influenced by bedrock composition, organic material in the water, and acid deposition. In New Hampshire, acid deposition, combined with the low prevalence of calcium-rich bedrock, results in lower pH in freshwater systems across large areas of the landscape. Waters impaired for pH include: Turkey River, Bow Brook, Horseshoe Pond, and Merrimack River.

All aquatic species require a certain range of dissolved oxygen for survival. Dissolved oxygen concentrations in freshwater will vary naturally by season, temperature, and water depth, but can also be influenced by ecosystem disturbances. Colder water can retain higher concentrations of dissolved oxygen than warmer water. Sources of dissolved oxygen include the atmosphere as well as aquatic plants and algae through the process of photosynthesis. Increased organic matter in a waterbody can lead to increased decomposition by microorganisms. This process consumes oxygen and can deplete dissolved oxygen the water. Waters impaired for dissolved oxygen include: Turkey River and Bow Brook.

Aluminum is an abundant metal in the earth's crust, occurring in many different types of rocks. Aluminum ions in surface waters may result from industrial wastes or the wash water from drinking water treatment plants. High levels of aluminum in surface waters in the Northeastern United States are generally considered to be the result of acid deposition. As soil pH decreases, the solubility of aluminum increases, leading to its mobilization through the soil and its eventual accumulation in streams and ponds. Water containing high concentrations of aluminum can become toxic to aquatic life if the pH is lowered. Waters impaired for aluminum include: The Turkey River and the Merrimack River.

Chloride is found naturally in some surface waters and groundwater; however, high concentrations of chloride can become detrimental to water quality. The application of road salt and associated runoff is a common source of increased chloride levels in surface water and groundwater. Waters impaired for Chloride include: Horseshoe Pond.

Chlorophyll-a is an indicator of the abundance of algae in a body of water. High concentrations of chlorophyll-a correlates to high concentrations of algae. Concentrations of algae can increase when the concentrations of nutrients such as

phosphorus and nitrogen increase in a body of water. Common sources of phosphorus and nitrogen include stormwater, residential, and agricultural runoff. Waters impaired for Chlorophyll-a include: Horseshoe Pond.

3.5.3 Floodplains

Federal regulations (23 CFR 650, 44 CFR 9) and Executive Order 11988 specify that federal projects must evaluate and address impacts to floodplains and floodways, and avoid to the extent possible, long and short term adverse impacts associated with the occupancy and modification of floodplains. For the purposes of federal regulations, the 100-year floodplain is the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year The Federal Emergency Management Agency (FEMA) defines Base Flood as "the flood having a one percent chance of being equaled or exceeded in any given year" (44 CFR 59.1). This term is used in the National Flood Insurance Program (NFIP) to indicate the minimum level of flooding to be used by a community in its floodplain management regulations.

The Regulatory Floodway is defined in FEMA's regulations (44 CFR 59.1) as "…the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height." The floodway also holds waters traveling at the highest velocities during a flood event.

Floodplains and watercourse reaches with designated Regulatory Floodways within the study area are shown on **Figure 3.13 Flood Hazard Areas Overview**. The Town of Bow and City of Concord participate in the NFIP and have adopted local regulations governing development within the areas designated as special flood hazard areas on FEMA's Flood Insurance Rate Maps (FIRM). The local ordinances pertaining to floodplains are found in the Town of Bow's Zoning Ordinance 10.02 Floodplain (F) District, and the City of Concord's Zoning Ordinance 28-3-2 Flood Hazard (FH) District. State Executive Order 96-4 requires all NH state agencies to comply with the floodplain management regulations of communities that participate in the NFIP. Coordination with FEMA is necessary only if there are impacts to the regulatory floodway or changes to the boundary of the floodplain or floodway due to an increase in water surface elevation above what has been calculated in the Flood Insurance Study.

In the City of Concord, a Conditional Use Permit may be granted by the Planning Board for the construction of a structure, placement of fill, or other encroachment in the Regulatory Floodway, if the project proponent can demonstrate that a proposed action will meet the following conditions: there will be no adverse effect to the flood carrying capacity of the floodway or the flood heights along the floodway; there will be no increase in the base flood level or other adverse effect to the flood levels along the floodplain; and there will be no increased hazard to life and property.

In the Town of Bow, Conditional Use Permits are also administered by the Planning Board. Regulations in the Floodplain District along watercourses with a designated Regulatory Floodway prohibit encroachments within the Floodway that would result in an increase in flood levels during the base flood discharge. Along watercourses that do not have a designated Regulatory Floodway, no encroachment is permitted within Zones A and AE on the FIRM, unless it can be demonstrated that the cumulative effect of the proposed development, when combined with all existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community. Zones A and AE both comprise the 100-year floodplain. The difference between Zones A and AE is that base flood elevations have not been determined for Zone A, while in Zone AE base flood elevations have been determined.

Floodplain and floodway areas within the study area occur along the Turkey River through the I-89/I-93 interchange, along the Merrimack River on the east side of I-93 from Manchester Street (US Route 3) to Loudon Road (NH Route 9), along I-393 between the Merrimack River crossing at Exit 1 to I-93 Exit 15, at the northwestern quadrant of the Exit 15 interchange, and along the northern section of the study area just south of I-93 crossing over the Merrimack River.

3.5.4 Wetlands

Wetlands are regulated by the federal government under the Clean Water Act (CWA). Section 404 of the CWA provides that discharges of dredged or fill materials into waters of the United States require a permit from the Army Corps of Engineers (ACOE). Waters of the United States include any non-isolated wetlands that meet the three parameters (hydrology, soils, and vegetation) as defined in the *1987 Corps of Engineers Wetland Delineation Manual, Technical report Y-87-1 (*1987 *ACOE* Manual). The ACOE has issued General Permits (GP) for minimal impact work in New Hampshire, which expedite the ACOE permit review process for projects with up to three acres of jurisdictional impact. Projects or actions with greater than three acres of impacts or that do not satisfy the conditions of the GP, require that an Individual Section 404 permit be secured from the ACOE.

Federal Executive Order 11990, issued in 1977, is intended to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands". The Order, which applies to federal activities and programs affecting land use, requires federal agencies to consider alternatives to wetland impacts and to limit potential damage if an activity affecting a wetland cannot be avoided.

Wetlands are regulated in New Hampshire under RSA 482-A, Fill and Dredge in Wetlands. The law defines a wetland as “an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal conditions does support, a prevalence of vegetation typically

adapted for life in saturated soil conditions." Under NHDES Administrative Rules, wetlands are delineated on the basis of the 1987 ACOE Manual. NH law also regulates surface waters and their banks. "Bank" is defined as "the transitional slope immediately adjacent to the edge of a surface water body, the upper limit of which is usually defined by a break in slope…." A permit is required from DES if the applicant proposes dredge or fill in jurisdictional areas (wetlands, banks, and channels).

Wetland boundaries within the study area were delineated in the summer and fall of 2014 and 2015, in accordance with the three-parameter approach as described in the 1987 ACOE Manual. The delineated wetlands were flagged and the flag locations were located using a handheld GPS system, see **Figure 3.14 Delineated Wetlands**. National Wetland Inventory (NWI) mapped wetlands were added outside the limits of the study area, see **Figure 3.15 NWI Wetlands.** The NWI was established by the U.S. Fish and Wildlife Service in order to conduct a nationwide inventory of wetlands in the U.S. The NWI maps and classifies wetlands based on aerial imagery. These maps are a useful tool for planning, management, protection and restoration.

The vegetative and hydrological characteristics of the wetlands were classified using the US Fish and Wildlife Services (USFWS) Cowardin methodology for the *Classification of Wetlands and Deepwater Habitats of the United States,* December 1979. The wetland classification codes are a series of letter and number codes that have been developed to correspond to the classification nomenclature that best describes the habitat (for example, PFO1E). A legend for this system describing each "code" is depicted in Appendix C Cowardin Classification.

The classification system uses a hierarchy broken into systems, subsystems, classes, and subclasses to categorize wetlands and deepwater habitats. Systems (marine, estuarine, riverine, lacustrine and palustrine) refer to the type of hydrologic setting in which the wetlands are found (or in relation to) *i.e.*, oceans, estuaries, rivers and streams, lakes, and other vegetated non-tidal wetlands. Palustrine, riverine, and lacustrine systems have been mapped along the study area. More specifically, the following wetland cover type classifications were identified: palustrine forested (PFO), palustrine emergent (PEM), palustrine scrub/shrub (PSS), palustrine open water (PUB), riverine lower perennial unconsolidated bottom (R2UB), riverine upper perennial unconsolidated bottom (R3UB), riverine intermittent streambed (R4SB), and lacustrine limnetic unconsolidated bottom (L1UB).

Wetlands are interspersed throughout much of the study area in Bow and Concord. Many of these wetlands are associated with the perennial rivers, streams, and small ponds that are found within the study area.

The Merrimack River is the most prominent feature in the study area, and wetlands associated with this system include the river itself, and extensive floodplain forests north of Manchester Street and Exit 13 in the area of West Terrill Park, and in the north of Exit 15, east of I-93 in the vicinity of the end of the study area. Historic

oxbows of the Merrimack River have formed what are now Horseshoe Pond and Fort Eddy Pond. Both of these areas have extensive palustrine wetland systems associated with them.

The South End Marsh is a large wetland area just north of Exit 12. This large wetland complex drains south towards the Merrimack River and has several large associated wetlands on both sides of the I-93 corridor.

Several of the wetlands in the vicinity of the I-89 and I-93 interchange are associated with the Turkey River and Bow Brook. Highway construction in previous years along I-93 and I-89 has altered these areas and the hydrology. There are several small ditched wetlands and drainages along the highways, and wetland depressions within the interchanges themselves.

A more detailed description of the wetland areas that occur in the study area is included in the following sections.

3.5.4.1 New Hampshire Prime Wetlands

In New Hampshire, under RSA 482-A:15 and NHDES Administrative Rules Env-Wt 700, individual municipalities may choose to designate certain high-quality wetlands as “prime wetlands”. wetland may receive this designation based on its large size, pristine character, and presence of rare or threatened plant and animal species. Prime wetlands have a protected 100-foot buffer associated with them unless the municipality is granted a waiver of this buffer. The City of Concord does not have any designated prime wetlands. The Town of Bow contains prime wetlands; however, there are none in the vicinity of the study area.

3.5.4.2 Description of Wetlands Functions and Values

The NH Wetlands Law (RSA 482-A) and the ACOE recognize several functions and values provided by wetlands. The ACOE provides a method for identifying wetland functions in their *Highway Methodology Workbook* and the *Highway Methodology Workbook Supplement*[3]. The functions recognized by ACOE, excerpted from the Highway Methodology Workbook Supplement, are listed below.

***Groundwater Recharge / Discharge*:** This function considers the potential for a wetland to serve as a groundwater recharge and/or discharge area.

Floodflow Alteration (Storage and Desynchronization): This function considers the effectiveness of the wetland in reducing flood damage by attenuation of floodwaters for prolonged periods following precipitation events.

[3] The Highway Methodology Workbook, NAEEP-360-1-30a, 1999

***Fish and Shellfish Habitat**:* This function considers the effectiveness of seasonal or permanent waterbodies associated with the wetland in question for fish and shellfish habitat.

Sediment / Toxicant / Pathogen Retention: This function reduces or prevents degradation of water quality. It relates to the effectiveness of the wetland as a trap for sediments, toxicants, or pathogens.

***Nutrient Removal / Retention / Transformation*:** This function relates to the effectiveness of the wetland to prevent adverse effects of excess nutrients entering aquifers or surface waters.

Production Export (Nutrient): This function relates to the effectiveness of the wetland to produce food or usable products for humans or other living organisms.

Sediment / Shoreline Stabilization: This function relates to the effectiveness of a wetland to stabilize streambanks and shorelines against erosion.

***Wildlife Habitat*:** This function considers the effectiveness of the wetland to provide habitat for various types and populations of animals typically associated with wetlands and the wetland edge.

***Recreation (Consumptive and Non-Consumptive)*:** This value considers the effectiveness of the wetland and associated watercourses to provide recreational opportunities such as canoeing, boating, fishing, hunting, and other active or passive recreational activities.

***Educational / Scientific Value*:** This value considers the effectiveness of the wetland as a site for an “outdoor classroom” or as a location for scientific study or research.

***Uniqueness / Heritage*:** This value relates to the effectiveness of the wetland or its associated waterbodies to produce certain special values.

***Visual Quality / Aesthetics*:** This value relates to the visual and aesthetic qualities of the wetland.

***Threatened or Endangered Species Habitat*:** This value relates to the effectiveness of the wetland or associated waterbodies to support threatened or endangered species.

3.5.4.3 Description of Wetlands within the Study Area

The following is a summary of the wetlands delineated within the study area. Complete details are provided in the Wetland Delineation Report, dated September

2015, prepared for this project. These wetlands are graphically depicted on **Figure 3.14**.

Wetland A is located along the south side of I-89, west of the I-89/I-93 interchange and Exit 1. This wetland system includes the edges of a permanent pond, forested wetlands adjacent and downslope of the pond, and drainages leading from the pond within the forested wetlands. The pond is classified as PUBH and forested wetland are classified as PFO1E. The primary functions and values exhibited by Wetland A include floodflow alteration, groundwater recharge, sediment/toxicant retention, nutrient removal, and wildlife habitat.

Wetland B is located along the north side of I-89, west of the I-89/I-93 interchange. Wetland B is comprised of three intermittent streams with wetland vegetation along the edges. These streams are hydrologically connected to Wetland A on the south side of I-89 through a system of culverts. The three streams that make up Wetland B are very similar in nature, with beds varying from cobble, to gravel, and loose soil. Wetland B is classified as R4SB2. The primary wetland functions and values exhibited by these intermittent streams include groundwater recharge/discharge, sediment/shoreline stabilization, and wildlife habitat.

Wetland C is a palustrine emergent (PEM1E) drainage ditch west of Exit 1, which runs parallel to the highway along the south side of I-89 flowing from west to east. The vegetation is dominated by emergent species with some shrubs and saplings along the edges. The primary wetland functions and values exhibited by the drainage swale include wildlife habitat and sediment/toxicant retention and nutrient removal.

Wetland D is located along the north side of I-89, east of Wetland B and north of Wetland C. Wetland D includes an intermittent stream classified as R4SB2 with a palustrine forested fringe (PFO1E) along the banks. This intermittent stream carries a mixture of roadway drainage from I-89 and is also hydrologically connected to Wetland C through a culvert. The primary wetland functions and values exhibited by this intermittent stream include groundwater recharge/discharge, sediment/shoreline stabilization, and wildlife habitat.

Wetland E include the Turkey River, a perennial stream with a classification of R2UBH, and the associated palustrine forested wetlands (PFO1E) adjacent to the river. The Turkey River flows into the project area just north of Exit 1, and flows east, parallel to the north side of I-89, before crossing under I-93 and I-89 just upstream from its confluence with the Merrimack River. The primary wetland functions and values exhibited by the Turkey River and adjacent wetland pockets include groundwater recharge/discharge, floodflow alteration, fish and shellfish habitat, production export, sediment/shoreline stabilization, wildlife habitat, recreation, educational/scientific value, and aesthetics.

Wetland G is predominately a palustrine emergent depression (PEM1E) with areas of palustrine forested wetland (PFO1E), located just south of I-89 and west of I-93, within the interchange. The functions and values of Wetland G include sediment/toxicant retention, floodflow alteration, and limited wildlife habitat. Common reed (*Phragmites australis*), an invasive plant, is present throughout the emergent area.

Wetland H is a palustrine emergent depression (PEM1E) located south of I-89 and east of I-93 within the interchange. This area has been recently modified by a highway improvement project. Dominant herbaceous vegetation includes goldenrods, sedges, common rush, and grasses. Functions and values include floodflow alteration, sediment/toxicant retention, and limited wildlife habitat.

Wetlands I and J are linear drainage features that have been modified during the construction and maintenance of I-93. Wetland I is located on the west side of I-93 north of Grandview Road, and Wetland J is located on the east side of I-93 south of Grandview Road. These drainages are best classified as PFO1E. The primary wetland function and value exhibited by these intermittent drainages is limited wildlife habitat.

Wetland K is a palustrine emergent swale (PEM1E) located along the I-89 North onramp from I-93 South. This area drains to the south towards the Turkey River. Vegetation in this wetland is regularly disturbed by maintenance mowing activity along the highway. Functions and values associated with Wetland K are limited, but likely include sediment/toxicant retention given its proximity to the highway and dense herbaceous vegetation cover.

Wetlands N, O, and P are associated with Bow Brook, a perennial stream that flows through the project area. These wetland areas include the stream itself and associated palustrine emergent and forested wetlands adjacent to the stream. The stream is classified as R2UB2 and the associated wetlands are PEM/FO1E. Wetland P is located west of I-93, just north of the I-89 interchange. Bow Brook flows east under I-93 through a culvert. On the east side of I-93, Bow Brook flows south between the highway and a developed area to the east. The stream flows through a culvert under the I-89 North onramp and briefly daylights in the cloverleaf formed by the I-89 North onramp, before flowing into a twin culvert structure that outlets into the Turkey River. Wetland functions and values associated with Bow Brook and the adjacent wetlands include groundwater recharge/discharge, floodflow alteration, fish and shellfish habitat, sediment/shoreline stabilization, and wildlife habitat.

Wetland Q is a palustrine emergent marsh (PEM1E) with areas of open water (PUBF). This area includes the mitigation wetland site located southeast of Exit 12, between the I-93 North onramp and the railroad tracks to the east. This area drains to a small pond to the south, outside the study area and is hydrologically connected to the Merrimack River to the South. Functions and values of this wetland area include floodflow alteration, sediment/toxicant removal, and nutrient

removal/retention. This system is hydrologically connected to Wetland R located on the opposite side of I-93 to the north.

Wetland R is located just north of I-93 and Exit 12 between Route 3A to the west and the railroad tracks to the east. This large wetland complex is known as the South End Marsh, and has a large area of open water associated with it. This wetland has a classification of PEM1F/PUBH. This area is hydrologically connected to Wetland Q to the south, on the opposite side of I-93. Functions and values associated with Wetland R include groundwater recharge/discharge, floodflow alteration, fish and shellfish habitat, sediment/toxicant retention, nutrient removal/retention, sediment/shoreline stabilization, wildlife habitat, and visual quality/aesthetics.

Wetland S is a palustrine forested/scrub-shrub wetland (PFO/SS1E) located south of I-93 just east of Exit 12. There are areas of open water associated with this wetland. Wetland S is hydrologically connected to Wetland Q outside the study area. This wetland complex provides several functions and values because of its size, location, accessibility and hydrologic connection to other wetlands. These include groundwater recharge/discharge, floodflow alteration, sediment/toxicant retention, and wildlife habitat.

Wetland T is a palustrine scrub-shrub wetland (PSS1E) located north of I-93 east of the railroad bed separating this area from the South End Marsh (Wetland R). This area is hydrologically connected to Wetlands R, S, Q, and U Wetland T provides several functions and values due to its size, diversity, location, accessibility and hydrologic connection to other wetlands. These include groundwater recharge, floodflow alteration, sediment/toxicant retention, and wildlife habitat.

Wetland U is a linear palustrine forested ditch (PFO1E) located parallel to I-93 and Wetland T. This area is separated from Wetland T by a gravel road. Wetland U has limited functions and values including sediment/toxicant retention and moderate wildlife habitat.

Wetland V is a palustrine emergent wetland (PEM1E) located northeast of Wetland S. Wetland V begins as a drainage swale that parallels I-93, draining to the southwest before opening into a larger marsh with areas of open water. This area is hydrologically connected to Wetland S outside the study area. Vegetation in this wetland is dominated by common reed, an invasive plant, with some speckled alder along the edges. Functions and values associated with Wetland V include floodflow alteration, groundwater recharge, and sediment/toxicant retention.

Wetland X is a palustrine forested wetland (PFO1E) located north of Exit 13. This area is part of the Merrimack River floodplain. There are pockets of palustrine scrub-shrub wetlands (PSS1E) and small areas of open water and several backwater channels throughout the floodplain. The vegetation in this wetland is typical of rich bottomland floodplain forests along a large river. Silver maple (*Acer saccharinum*),

green ash (*Fraxinus pennsylvanica*) and American elm are dominant in the overstory. Functions and values associated with Wetland X include floodflow alteration, groundwater recharge/discharge, sediment/toxicant retention, sediment/shoreline stabilization, wildlife habitat, and recreation.

Wetland Z is a small palustrine emergent depression (PEM1E) located adjacent to South Commercial Street, Constitution Avenue, and a parking lot. This small wetland has limited functions and values, but likely includes some sediment/toxicant retention potential.

Wetland AA is a palustrine emergent drainage ditch (PEM1E) located along the Exit 15 ramp in the northeast cloverleaf. Functions and values of this wetland are limited but include some sediment/toxicant removal potential.

Wetland BB is the southern edge of Fort Eddy Pond located just north of I-393. This wetland is dominated by shallow open water and is classified as L1UBH, with a palustrine scrub-shrub/forested (PSS/FO1E) fringe along the perimeter. Wetland BB drains to the east, under the I-393 Exit 1 ramps, and is hydrologically connected to Wetlands CC and DD and ultimately drains to the Merrimack River. Functions and values of Wetland BB include groundwater recharge/discharge, floodflow alteration, fish and shellfish habitat, sediment/shoreline stabilization, wildlife habitat, and visual quality/aesthetics.

Wetland CC is a palustrine forested wetland (PFO1E) located north of I-393 in the wooded area surrounded by the Exit 1 off ramp and College Drive. This area is hydrologically connected to Fort Eddy Pond (Wetland BB) to the east, and Wetland DD to the west. Wetland functions and values associated with Wetland CC include sediment/toxicant retention and wildlife habitat.

Wetland DD is located north of I-393 and east of College Drive. This area is a palustrine forested (PFO1E) swale that drains into the Merrimack River (R2UBH) and is hydrologically connected to Wetland CC and BB. The functions and values associated with Wetland DD include sediment/toxicant retention and wildlife habitat.

Wetland EE is a palustrine forested ditch (PFO1E) located between Fort Eddy Road and the I-93 North onramp. Functions and values associated with Wetland EE include sediment/toxicant retention.

Wetland FF is a palustrine forested ditch (PFO1E) south of I-393 and east of Fort Eddy Road. This area is hydrologically connected to Wetland EE through a culvert under Fort Eddy Road. This area outlets into the Merrimack River. Functions and values associated with Wetland EE include sediment/toxicant retention.

Wetland GG is a perennial stream (Wattanummon Brook) that drains from Horseshoe Pond, flowing east through a culvert under I-93 and draining into Wetland

HH. This stream is classified as R3UBH. The stream continues through Wetland HH and flows into the Merrimack River.

Wetland HH is located within the Merrimack River floodplain and is classified as PFO1A. This area has been identified by the NH Natural Heritage Bureau as a silver maple-false nettle-sensitive fern floodplain forest, an exemplary natural community in the State. The primary functions and values exhibited by this wetland area include floodflow alteration, groundwater recharge/discharge, fish and shellfish habitat, nutrient removal, production export, sediment/shoreline stabilization, wildlife habitat, recreation, educational/scientific value, uniqueness/heritage and aesthetics.

Wetland II is located east of I-93 at the northern end of the study area. Wetland II is a palustrine forested wetland (PFO1A) in the floodplain of the Merrimack River, and is hydrologically connected to Wetland HH outside of the study area. The primary functions and values exhibited by Wetland II include floodflow alteration, groundwater recharge/discharge, wildlife habitat, sediment/shoreline stabilization, recreation, and educational/scientific value.

Wetland Functions and Values are summarized in **Table 3.15 Wetland Functions and Values**.

Table 3.15 Wetland Functions and Values

Wetland ID	Wetland Classification	Groundwater Recharge & Discharge	Floodflow Alteration	Fish & Shellfish Habitat	Sediment & Toxicant Retention	Nutrient Removal, Retention, & Transformation	Production Export	Sediment & Shoreline Stabilization	Wildlife Habitat	Recreation	Educational & Scientific	Uniqueness & Heritage	Visual Quality & Aesthetics	Endangered Species
A	PFO1E/PUBH	X	X		X	X			X					
B	R4SB2	X			X			X	X					
C	PEM1E				X	X			X					
D	R4SB2/PFO1E	X						X	X					
G	PEM/FO1E		X		X				X					
H	PEM1E								X					
I, J	PFO1E								X					
K	PEM1E				X									
N, O, P	R2UB2/PEM/FO1E	X	X	X				X	X					
Q	PEM1E/PUBF		X		X	X								
R	PEM1F/PUBH	X	X	X	X	X		X	X				X	
S	PFO/SS1E	X	X		X				X					
T	PSS1E	X	X		X				X					
U	PFO1E				X				X					
V	PEM1E	X	X		X									
X	PFO1E	X	X		X			X	X	X				
Z	PEM1E				X									
AA	PEM1E				X									
BB	L1UBHh/R2UBH	X	X	X				X	X				X	
CC	PFO1E				X				X					
DD	PFO1E				X				X					
EE	PFO1E				X									
FF	PFO1E				X									
GG	R3UBH	X	X	X		X	X	X	X	X	X		X	
HH	PFO1A	X	X	X		X	X	X	X	X	X	X	X	
II	PFO1A	X	X					X	X	X	X			

3.5.4.4 Vernal Pools

A vernal pool is a specific type of wetland that exhibits a seasonal flooding and drying cycle. According to NHDES (Env-Wt 101.108) vernal pools typically have the following characteristics: cycles annually from flooded to dry conditions, although the hydroperiod, size, and shape of the pool might vary from year to year; forms in a shallow depression or basin; has no permanently flowing outlet; holds water for at least two continuous months following spring ice-out; lacks a viable fish population; and supports one or more primary vernal pool indicators, or three or more secondary vernal pool indicators. Primary vernal pool indicators include the presence or physical evidence of breeding by spotted salamander (*Ambystoma maculatum*), Jefferson Salamander (*Ambystoma jeffersonianum*) blue-spotted salamander (*Ambystoma laterale*), marbled salamander (*Ambystoma opacum*), wood frog (*Lithobates sylvatica*), or fairy shrimp (*Eubranchipus spp.*). Vernal pools are considered essential breeding habitat for these primary indicator species.

Secondary indicator species include clam shrimp (Orders: *Spinicaudata and Laevicaudata*), fingernail clams (Family: *Sphaeriidae*), spire-shaped snails (Families: *Physidae and Lymnaeidae*), flat-spire snails (Family: *Planorbidae*), aquatic beetle larvae (Families: *Dytiscidae, Gyrinidae, Haliplidae, Hydrophilidae*), caddisfly larvae (Families: *Limnephilidae, Phryganeidae, Polycentropodidae*), damselfly larvae (Families: *Coenagrionidae and Lestidae*), dragonfly larvae (Families: Aeshnidae and Libellulidae), and true fly larvae or pupae (Families: Culicidae, Chaoboridae, Chironomidae). Vernal pools also provide valuable habitat for a variety of other species of amphibians, turtles, snakes, birds, and mammals

A preliminary determination was made during the wetland delineation effort (conducted during summer of 2014 and fall of 2015) that vernal pools are not present within the project area.

3.5.5 Coastal Zone Management

Section 307 of the Federal Coastal Zone Management Act of 1972 (PL92-583) and the Implementation Regulations of the National Oceanic and Atmospheric Administration (15 CFR Part 930) stipulate that all federal activities affecting coastal zones must be consistent with an approved State Coastal Zone Management (CZM) Program. The Coastal Barriers Resources Act of 1982 (PL97-348) prohibits most federal funding for development within the designated Coastal Barriers Resource System. The study area is not within the coastal zone and is not subject to these Acts.

3.6 Land Resources

This section describes the existing conditions within the study area for land resources including geology, soils, farmlands, wetlands, and wildlife.

3.6.1 Geology and Soils

3.6.1.1 Bedrock and Surficial Geology

The US Geological Survey bedrock geology map shows that the entire study area is underlain by the Concord Granite (Late Devonian) unit, a common type of igneous rock in New Hampshire. The primary rock type within this bedrock unit consists of gray two-mica granite, and locally grades to tonalite, a granite having greater than 20% quartz. In the Merrimack River Valley, surficial geology consists of quaternary sandy till, lake sand, and pebbles. Refer to **Figure 3.16 Soils and Bedrock Overview** for a location of the bedrock resources.

3.6.1.2 Soils

Soils in the project area possess drainage capacities ranging from excessively well drained to poorly drained. Refer to **Figure 3.16** for the location of these soils. Based upon on the US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) soil survey, the most common soil types in the project area include urban land-Pootatuck complex, Windsor-urban land complex, urban land, Raynham silt loam, and Canton very fine sandy loam.

3.6.2 Farmlands

3.6.2.1 Important Farmland Soils

The NRCS also administers the Farmland Protection Policy Act (FPPA), which provides guidelines to federal agencies involved in proposed projects that may convert farmland to non-agricultural uses. The purpose of the FPPA is "to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses...”

The four categories of farmland soils addressed in the FPPA include prime farmland, unique farmland, farmland of statewide importance, and farmland of local importance. In addition, active farmland or agriculture areas are discussed. Each farmland category is described in general terms below:

Prime Farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops when the land is treated and managed using acceptable farming methods.

Unique Farmland is land other than prime farmland that is used for the production of specific high value food and fiber crops. It has the special combination of soil quality,

location, growing season, and moisture supply needed to economically produce sustained high quality and/or high yields of a specific crop when treated and managed according to acceptable farming methods. Examples of such crops in New Hampshire are apple orchards, lowbush blueberries, vegetable truck gardens, and maple sugar groves.

Farmland of Statewide Importance is land that is of statewide importance for the production of food, feed, fiber, forage, and oilseed crops. Generally, these farmlands include those areas that are nearly prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods.

Farmland of Local Importance includes certain additional farmlands for the production of food, feed, fiber, forage, and oilseed crops that are not identified as having national or statewide importance.

Land use within areas where the mapped soils fall into these classifications does not have to be in agricultural use for the classification to be valid, because land that is not irreversibly committed to another non-agricultural use could potentially be used in the future for agriculture. Urban built-up land and water are not subject to the FPPA.

Figure 3.17 Agricultural Resources Overview depicts farmland soils as identified from NRCS soil survey maps within the I-93 study area. Land currently in use as farmland in the vicinity of the study area include cornfields north of Horseshoe Pond and northwest of Exit 15. These farm fields are in active cultivation and most are located on soils designated as Prime Farmland by the NRCS. These include Pootatuck and Occum fine sandy loams, both of which are floodplain soils.

The project corridor contains soils classified as Farmland of Local Importance and Prime Farmland (if not frequently flooded). Some of these areas are active farmland. Important Farmland Soils and active farmlands are depicted on **Figure 3.17 Agricultural Resources Overview**. The FPPA contains provisions that exempt construction within an existing right-of-way, as well as projects involving land within areas classified as urbanized by the US Census Bureau. The entire project, with the exception of an area along the north side of Interstate 89 to the west of Exit 1, is located within an urbanized area. The area that is not within the urbanized area does not contain farmland soils.

3.6.2.2 Active Farmlands

Active farmlands are lands that are currently in active agricultural use. These lands were identified from aerial photos and windshield surveys. The only active farmland within the study area is located adjacent to I-93 to the west, near the northern end of the study area. This area is a tree nursery. Additional active farmlands in the general

vicinity include cornfields located west of the tree farm adjacent to Horseshoe Pond and the Merrimack River, east of the Merrimack River in the vicinity of Exit 14, and east of Exit 12. Sycamore Community gardens is located east of Fort Eddy Pond on the west side of College Road and north of I-393. All of the areas of Active Farmland are located in areas of Prime Farmland if not frequently flooded.

3.6.3 Conservation and Public Recreational Lands

3.6.3.1 Conservation Lands

Conservation lands within the study area include properties protected by state agencies (NHDES, NH Fish and Game, and NH Department of Natural and Cultural Resources), private conservation agencies, the City of Concord, the Town of Bow and private landowners. Inquiries were made and coordination with state agencies was conducted to determine if certain lands, such as those under the jurisdiction of NH Conservation Land Stewardship program (CLS), NH Land and Community Heritage program (LCHIP), and the Land and Water Conservation Fund (LWCF), are located in the project corridor or vicinity.

Conservation lands were also identified from publicly available GRANIT data and are shown on **Figure 3.18 Conservation and Public Lands**. Conservation lands can be in the form of either fee ownership or in the form of a conservation easement that restricts the uses that can occur on the land.

Conservation lands that are within or adjacent to the study area are summarized in **Table 3.16 Conservation Lands** and include the owner, size of the parcel, and whether public access is permitted.

Table 3.16 Conservation Lands

Conservation Area Name	Acreage	Land Protection Type	Land Protection Agency	Agency Type	Public Access
Cilley State Forest	174.1	Fee Ownership	NH Dept. of Resources & Economic Dev. (DRED)	State	Allowed
Bow99-628	6.0	Conservation Easement	Town of Bow	Municipal/County	Allowed
Mitigation Wetland	4.4	Fee Ownership	NH Dept. of Transportation	State	No response to survey
South End Marsh	19.6	Fee Ownership	City of Concord	Municipal/County	Allowed
West Terrill Park	53.6	Fee Ownership	City of Concord	Municipal/County	Allowed
Woodman	124.8	Conservation Easement	Society for the Protection of NH Forests	Private	No response to survey
Merrimack River Access	1.7	Fee Ownership	NH Fish & Game	State	Allowed
Technical Institute Low Area	33.4	Fee Ownership	NH Technical Institute (Concord)	State	No response to survey

3.6.3.2 Section 6(f) Lands

Conservation lands are among the resources that may be protected under Section 6(f) of the LWCF Act. The LWCF is a Federal program that provides funding and grant matching to federal, state, and local governments for the acquisition of land and water for the benefit of the American public. If a LWCF property is proposed to be converted to a non-conservation or non-recreational purpose, specific requirements must be addressed pursuant to Section 6(f). Grant assisted areas are prohibited from conversion to non-recreation uses, unless approved by the Secretary of the Interior and replaced with comparable lands. There are no properties within the study area that are under the jurisdiction of Section 6(f).

3.6.3.3 Public Recreational Lands

Section 4(f) of the U.S. Department of Transportation Act of 1966 (49 USC 303(c)) requirements stipulate FHWA and other DOT agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites unless the following conditions apply:

- There is no feasible and prudent avoidance alternative to the use of land; and the action includes all possible planning to minimize harm to the property resulting from such use;

  OR

- The Administration determines that the use of the property will have a *de minimis* impact.

There are two parks/recreational areas located within the study area. Reed Park contains a softball field, multi-use field and playground is owned by the City of Concord located off Hall Street between Exits 12 and 13, directly abutting southbound I-93. Healy Park is owned by the City of Concord and is located between I-93 and the Merrimack River north of Manchester Street. It contains walking trails.

3.6.3.4 Bicycles and Pedestrians

A walking trail, also used by bicycles, crosses the I-89 / I-93 Interchange within the NHDOT ROW in the Town of Bow. The trail begins at the end of Valley Road and crosses through the interchange via a tunnel under the I-89 southbound to I-93 southbound on-ramp, it continues parallel to I-89 under the I-93 bridges, under the I-93 northbound on-ramp from I-89 southbound via a tunnel, and parallels I-89 southbound to the I-89/NH Route 3A/Hall Street intersection at Bow Junction. The trail is not maintained in the winter by the Town of Bow, nor by the NHDOT, but is used throughout the year.

A segment of the East Concord Heritage Trail is located in the northern portion of the study area, north of Exit 15, in the vicinity of Horseshoe Pond and the NH Technical Institute (NHTI) campus. The trail extends from the Merrimack River at College Drive by Exit 1 of I-393 through NHTI, crosses over I-93 via the Delta Drive overpass, follows along Horseshoe Pond on Commercial Street ending at North Main Street. The Trail also extends north along a bicycle/pedestrian path from Delta Drive/NHTI campus parallel to northbound I-93, within the NHDOT ROW, over the Merrimack River on the I-93 northbound bridge and connects, beyond the project area, to Eastman Street on the north side of the Merrimack River.

Bicycle/pedestrian access from the NHTI campus to Fort Eddy Road is provided via a tunnel under I-393 in the Exit 15 area.

The NHDOT Bicycle Route Maps for the Merrimack Valley Region identify roadways within the study area as preferred recommended bicycle routes. These routes and roadways include: the NHTI path, I-93 Bicycle Path in Concord, I-89 Bicycle Path in Bow, Manchester Street, Water Street, Commercial Street, Constitution Avenue, and North Main Street.

3.6.3.5.3 River Access

Access points to the Merrimack River are locally important for recreational opportunities, including fishing and boating. The Kiwanis Riverfront Park provides

one access area within the study area, just north of the Loudon Road Bridge. This park has a parking area and a walk-in (car top) boat launch. Additional access points located in the vicinity of the project include the College Drive Boat Ramp north of I-393, Fort Eddy Pond walk-in (car top) site on NHTI property, and the NH Fish and Game gravel ramp northwest of the project area.

3.7 Wildlife and Fisheries

A review of published materials and on-site field visits indicate that a variety of wildlife habitats exist within the study area, including upland hardwood forests, upland softwood forests, mixed upland forests, forested (primarily red maple) wetlands, scrub-shrub wetlands, emergent marshes, ponds, streams, rivers, agricultural fields and pastures, “old fields” (i.e., shrublands), and recently disturbed areas.

3.7.1 Wildlife

Nearly all habitats along the study corridor have been affected to some extent by their proximity to the highway. Residential and commercial development is prevalent along this 4.5 mile section of I-93, particularly in Concord. The wildlife value of much of the existing habitat is reduced due to fragmentation (by the encroaching development and the highway itself), frequent human disturbance such as vehicular traffic, human activity (including occasional foot traffic), noise, and pollution from highway and development runoff, and various other non-point sources.

The most valuable existing habitats in the study area are the riparian areas along the rivers, streams and ponds with accompanying buffer zones, and the larger emergent wetlands. Also, any large contiguous blocks of forest, particularly those on public property such as the Cilley State Forest, or within wetlands where there is some measure of protection against development, are important wildlife habitats. The Cilley State Forest is known to host a variety of wildlife including large mammals such as moose and black bear.

The NH Fish and Game Department (NHF&G) is responsible for managing and protecting resident wildlife species. NHF&G has promulgated rules (NH Administrative Rules Chapter 1000) for the protection and management of these species. These rules pertain almost entirely to the exploitation of the species and not to the habitats. The rules set seasons, bag limits, and legal means for the taking of game, fish, and furbearing species. Some wildlife habitat is protected as state forests, state parks, or state-owned or state-managed wildlife management areas where additional restrictions on land use apply. Consultation with th3e NHF&G occurred on this matter.

3.7.2 Fisheries

Three surface waters within the study area are important habitat for fisheries. These waters are the Merrimack River, Turkey River, and Bow Brook. These waters contain a wide variety invertebrates, fish, amphibians, reptiles, aquatic mammals, birds, and aquatic plants. From a regional perspective, the Merrimack River is a common fishing destination and is fished for brook trout, brown trout, rainbow trout and other species.

3.7.3 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act requires the federal government to identify Essential Fish Habitat (EFH) and make conservation recommendations to agencies whose actions could impact it. The Merrimack River, Turkey River, and Bow Brook are listed as EFH for all life cycle stages of Atlantic Salmon (*Salmo salar*).

The EFH Assessment Worksheet, specifically for Federal agencies, was completed and submitted for review. Refer to Chapter 4, Section 4.7 for further information and the results of this consultation.

3.8 Rare, Threatened and Endangered Species

3.8.1 Federal Jurisdictions

The US Endangered Species Act of 1973 (ESA) (P.L. 93-205), as amended in 1973 and 1978, recognizes the need, and provides the means to protect rare plants, invertebrates and vertebrate species of fish and wildlife, and provides for the protection of critical habitats and the management of endangered species. Per the 1978 Amendments to the ESA, separate (geographically or genetically isolated) but rare populations of fish and wildlife (but not plants or invertebrates) may be protected as well as entire species. Listed species are categorized as either endangered species (which are in danger of extinction throughout all or a substantial portion of its ranges) or threatened species (which are likely to become endangered throughout all or a substantial portion of its range).

Section 7 of the ESA dictates that all federal agencies must consult the US Fish and Wildlife Service (USFWS) or National Oceanic and Atmospheric Administration (NOAA) (for marine species only) to ensure that actions taken under federal funding, federal assistance, or federal permits (e.g. Section 404 Army Corps Permits) do not jeopardize the existence of threatened or endangered species. Jurisdiction is given to the USFWS and NOAA to recommend changes to the project to avoid such jeopardy (including impacts to the habitat as well as to the plants or animals themselves).

The Bald and Golden Eagle Protection Act (16 USC 668-668d) prohibits the "take" of bald eagles and golden eagles, including their parts, nests, and eggs. The act also prohibits impacts from human activities that result in nest abandonment or interruption of normal breeding, feeding, or sheltering habits. Neither of these species was reported by the NH Natural Heritage Bureau (NHB) or NHF&G as a potential concern in the project area. The USFWS Information for Planning and Consultation (IPaC) webtool identified bald eagles as potentially occurring within the project area.

The USFWS Information, Planning, and Consultation (IPaC) web tool was utilized to obtain an Official Species List for federally listed species or critical habitats that could occur in the study area.

3.8.2 New Hampshire Jurisdictions

The 2015 NH Wildlife Action Plan (WAP) provides the framework for conserving Species of Greatest Conservation Need (SGCN) and their habitats in New Hampshire. The WAP identifies 169 SGCN and focuses on 27 habitats that support these species. The WAP includes a habitat-based statewide map that identifies "Highest Ranked Wildlife Habitat" as shown on **Figure 3.19 Plants and Wildlife Overview**.

In New Hampshire, the Endangered Species Conservation Act (RSA 212-A) delegates authority and responsibility for the listing and protection of threatened and endangered species of wildlife to the NHFG. This statute outlines NHF&G authority and directs other state agencies to take reasonable steps to ensure their actions do not jeopardize the continued existence of threatened or endangered species or result in the destruction or modification of their critical habitat. NHF&G has in turn promulgated the rules for the protection of these species in Fish and Game Rules, Conservation of Endangered Species. Species eligible for listing under these rules include invertebrates and vertebrate species of fish and wildlife (plants are not included). Protected animal species are placed in one of two categories, threatened or endangered, depending on their rarity.

The New Hampshire Native Plant Protection Act RSA 217-A, enacted by the State Legislature in 1987, established the authority for the State to develop a list of rare plant species. The NH NHB was empowered with this authority and developed the list in NH Administrative Rules Chapter Res 1100. Plants deemed as rare in the State and in need of protection were listed as either endangered, threatened, or special concern plant species in descending order of rarity. The Native Plant Protection Act also gives the NHB the authority to identify exemplary natural communities in the State. These plant communities are high quality examples of natural community types and are given the same protections as rare plants.

Unlike federally listed species, plant or wildlife species need only be rare within the State of New Hampshire to be state-listed, not rare over the entire range of the species. Therefore, many state-listed species are rare because New Hampshire is at the edge of their range, or because there is a limited amount of habitat for the species within the state. Legal protection is also much less stringent in state statutes. Besides the prohibitions on the taking or killing of state-listed wildlife species, protection of state listed plants or animals is largely restricted to recommendations by the aforementioned state agencies for the approval or disapproval of projects that might impact the environment. All projects initiated or funded by the state, or applying for such state permits as Wetlands Dredge and Fill Permits, must be reviewed by the NHB and NHF&G.

The NHB maintains a database of records of known occurrences of rare species (plants and animals) and exemplary natural communities. A request was made to the NHB through their online Data Check Tool to identify any known records of rare species and exemplary natural communities in the vicinity of the proposed project area. The results of these queries to USFWS and NHB are presented in the sections that follow. Appendix B, Exhibit 1)

3.8.3 Exemplary Natural Communities/Critical Habitats

Based upon the results of the inquiries to the USFWS and NHB, there are no critical habitats within the study area. The NHB has identified one exemplary natural community in the study area. The community is described as a silver maple-false nettle-sensitive fern floodplain forest. This community type is primarily found in the central and southern parts of the state on large to medium sized rivers and tends to occur on sandier, somewhat acidic soils. This community is located at the northern end of the study area along the Merrimack River, on the east side of I-93 within the NH Technical Institute Low Area conservation land.

There are no publicly or privately-owned wildlife refuges within the study area or vicinity.

3.8.4 Plants

Federal Threatened and Endangered Species

According to the USFWS Official Species List, the federally threatened small whorled pogonia (*Isotria medeoloides*) may occur in the project area since habitat is known to exist in Merrimack County, New Hampshire. This species most often occurs in hemlock-beech-oak-pine forests and tends to prefer mesic/seasonally damp soils. Other habitat preferences can include Skerry fine sandy loams or other soils in which a fragipan exists, somewhat poorly drained soils and/or a seasonally highwater table, or terraces above streams. Small intermittent streams, ephemeral

runoff channels, or old logging roads often provide breaks in the forest canopy that this species seems to prefer.

According to the NH NHB document *Rare Plants, Rare Animals, and Exemplary Natural Communities in New Hampshire Towns* (July 2013) one known population of small whorled pogonia is located in Bow. An area of potential small whorled pogonia habitat was identified and investigated in June, 2018 by NH NHB staff. A determination was made by the NH NHB staff that the small whorlded pogonia was not present within the habitat investigated.

State Rare, Threatened and Endangered Species

The NHB did not report any known occurrences of any rare, threatened, or endangered plants in the study area.

3.8.5 Wildlife

Federal Threatened and Endangered Species

According to the USFWS Official Species List (Appendix B, Exhibit 2), the study area is within the range of the federally-threatened and state-endangered northern long-eared bat (*Myotis septentrionalis*). The NHB did not report any known winter hibernacula within 0.5 miles nor any documented maternity roost trees within 0.25 miles of the project. According to the USFWS, suitable summer habitat for northern long-eared bat consists of a variety of forested habitats. This species generally prefers closed canopy forest with an open understory. Potential roost trees include live trees or snags, at least 3" in diameter, with exfoliating bark, cracks, crevices, or cavities. Potential roosting habitat does exist within the study area. Also, the project proposes significant tree clearing. Therefore, an acoustic survey was undertaken in the summer of 2017 to determine whether northern long-eared bats are present in the study area. The survey resulted in no acoustic files manually identified as northern long-eared bat; therefore, the presence of this species is not considered probable.

State Rare, Threatened and Endangered Species

The NHB reported known records of four species of rare wildlife including the state-endangered brook floater (*Alasmidonta varicosa*), and the following state species of Special Concern: American eel (*Anguilla rostrata*), Northern Leopard Frog (*Rana pipiens*), and Wood Turtle (*Glyptemys insculpta*).

American eels can be found in almost any freshwater habitat that can be accessed from the ocean. The NHFG has documented American eels in the Merrimack River and many of the larger tributaries including the Turkey River.

Northern leopard frogs are typically found near wetlands. They require shallow standing water and emergent vegetation for breeding, egg deposition, and tadpole development. In the summer, northern leopard frogs can be found in a variety of wetland habitats. They typically overwinter in permanent bodies of water or streams that do not freeze solid. The NHB database has documented sightings of northern leopard frogs in the study area in the floodplain forests of the Merrimack River north of Exit 13, and in the vicinity of Horseshoe and Fort Eddy Ponds.

Wood turtles require slow moving streams and channels with sandy substrates for hibernation. Foraging habitat includes floodplains, grasslands, and shrublands. The NHB reports wood turtles in the vicinity of the Merrimack River and Fort Eddy Pond, northeast of Exit 15, and in the vicinity of Bow Brook.

The brook floater is a species of freshwater mussel that occurs in clean, well oxygenated rivers and streams. It is found in the Merrimack River and several of its tributaries. Coordination with NHF&G resulted in a commitment to conduct a mussel survey during final design of the project.

The acoustic survey completed in 2017 determined that the presence of little brown bat (*Myotis lucifugus*) and tricolored bat (*Perimyotis subflavus*) is considered probable. Both are NH-listed endangered species. Both species are also under review by the USFWS for potential future listing under the Endangered Species Act.

3.8.6 Invasive Species

Plants

An invasive plant is a non-native plant that is able to persist and proliferate outside of cultivation, resulting in ecological and/or economic harm. Under the statutory authority of NH RSA 430:55 and NH RSA 487:16-a, the NH Department of Agriculture, Markets & Food and NHDES prohibit the spread of invasive plants listed on the NH Prohibited Species List. The project area contains purple loosestrife (*Lythrum salicaria*), bush honeysuckle (*Lonicera* sp.), common reed (*Phagmites australis*) and Japanese knotweed (*Fallopia japonica*), all of which are invasive plants listed on the NH List of Prohibited Invasive Species (AGR PART 3802.01).

Insects

The emerald ash borer (*Agrilus planipennis*) is an invasive insect and a federally-regulated pest that has been documented in both Bow and Concord. In July of 2015 the New Hampshire Department of Agriculture implemented the Emerald Ash Borer Quarantine in order to prevent the unregulated movement of infested or potentially infested materials. Ash trees in the genus *Fraxinus* are the host species for the emerald ash borer. Quarantined areas in New Hampshire include Belknap, Hillsborough, Merrimack, and Rockingham Counties. The quarantine states that:

"No person shall move, carry, transport, or ship (or authorize or allow any other person to do the same) regulated articles and commodities from inside the quarantine area to outside of the quarantine area, unless specifically authorized in writing via Compliance Agreement issued by the New Hampshire Department of Agriculture Markets and Food (NHDAMF) and moving with a Plant Protection and Quarantine (PPQ) 540 (certificate) or PPQ 530 (limited permit).

3.9 Cultural Resources

State Requirements

The New Hampshire Division of Historic Resources (DHR) is charged under RSA 227-C:9, Directive for Cooperation in the Protection of Historic Resources, with coordination of the identification and evaluation of cultural resources in the State of New Hampshire, which includes the review of historical resources under Section 106 of the National Historic Preservation Act.

The DHR, in cooperation with the NHDOT and FHWA, has established a method of identification and evaluation to meet the requirements of this historic preservation review. The purposes of this process are to (1) locate and identify historical, architectural, archaeological, and historical archaeological resources within the project's area of potential effects (APE); (2) apply the criteria for evaluation of significance to any resources in the APE to determine possible eligibility for the National Register of Historic Places (NRHP), if the resource(s) is/are not already known to be eligible or listed; (3) assess the probable effects of a project on resources listed on or eligible for the National Register; and (4) develop appropriate mitigation methods to lessen the project's impact on affected historic properties.

Section 4(f) of the U.S Department of Transportation Act of 1966 stipulates that agencies cannot approve the use of land from publicly owned parks, recreational areas, wildlife and waterfowl refuges or public or private historical sites unless the following apply:

- There is no feasible and prudent avoidance alternative to the use of land; and the action includes all possible planning to minimize harm to the property resulting from such use; or,
- FHWA determines that the use of the property will have a *de minimis* impact.

A detailed discussed on the resources subject to a Section 4(f) evaluation is provided in Chapter 5.

Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires Federal agencies to take into account the effects of their undertakings on historic properties. Under the National Historic Preservation Act, a historic property is "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in the National Register of Historic Places (NRHP) maintained by the Secretary of the interior."

A historical resources assessment was completed to identify structures that are listed on or that may be eligible for the National Register of Historic Places within the study area.

A Phase 1A archaeological sensitivity assessment in accordance with the National Historic Preservation Act Section 106 process was conducted to define all known or potential archaeological resources that may be located within the study areas. Potential archaeological resources include Native American sites as well as any subsurface features related to the eighteenth to early twentieth-century use.
.
The Phase 1A report included information gathered through background research and reviewing archaeological files at NHDHR and review of local maps and local historic collections. The Phase 1A also included fieldwork and site inspections throughout the study area. The findings in the report concluded that numerous areas within the study area were moderately sensitive or highly sensitive relative to archaeological resources.

Historic properties, including archaeological sites that are listed or eligible for listing in the National Register of Historic Places are given protection by Section 106 of the National Historic Preservation Act and Section 4(f) of the Department of Transportation Act of 1966.

Table 3.17 Properties/Districts Eligible for the National Register of Historic Places lists the Properties/Districts Eligible for the National Register of Historic Places within the study area.

Table 3.17 Properties/Districts Eligible for the National Register of Historic Places

Town	Name	Address
Bow	Lamora's Garage	521 South Street & 1 Valley Road
Bow	Upton House &Store	2 Valley Road
Concord	Carrigan House	244-246 North Main Street
Concord	Robert J. Hart Building	50 Storrs Street
Concord	Boston, Concord & Montreal Railroad Historic District	
Concord	New Hampshire Technical Institute Historic District	
Concord	IBM Corp. Branch Office	207 North Main Street
Concord	Concord Shoe Co/Ralph Pill Building	22 Bridge Street
Concord	Concord Electric Light Station	24 Bridge Street
Concord	Rumford Arms	248-250 North Main Street
Concord	NHDOT Garage Historic District	Stickney Avenue

3.10 Socio-economic Resources

3.10.1 Introduction

An inventory of the demographic and economic characteristics was conducted within the following study area:

- A broad corridor of influenced area, extending approximately 15 miles from the project limits (Exit 10 in northern Manchester to the south and Exit 20 in Tilton to the north, in the Franklin area), and
- The immediate communities along the corridor, including Bow and Concord.

Within the 15-mile corridor influence area, the following characteristics are present:

- The total population of the corridor influence area was 209,000 in 2017;
- The corridor's population is expected to increase modestly, to a figure of around 215,000 in 2022, a 2.5 % growth rate, which is essentially identical to the projected State population growth rate;
- There are just under 90,000 housing units within the corridor influence area;
- 56% of the housing units in the corridor influence area are owner-occupied;
- The corridor influence area is expected to add 2,400 new housing units by 2022, an increase of just over 2.5%
- Median home value in the corridor is $245,000, slightly lower than the State's $258,000;
- Median 2017 household income within the influence area was $67,400, a bit lower than the State's $69,800;
- The influence area's population is 91% white, with no single minority group dominating the balance of the racial make-up.

The regional economy of the influence area is supported by the confluence of I-89 and I-93, which affords access to the north, west and south, including interstate access to Massachusetts, Vermont and Canada.

In view of the above, the corridor influence area has a significant population base that is expected to grow modestly, at about the same pace as the State's population in the short-term future. The housing inventory is expected to grow by about 500 units a year during the next five years to accommodate anticipated population growth. The corridor's socio-economic composition also closely mirrors State-wide figures including median income, housing values, and racial composition.

Looking more narrowly at the immediate project area, the communities of Bow and Concord adjacent to the proposed I-93 improvements, the following characteristics are present:

- The combined population of the two communities in 2017 was 51,500, with approximately 90% in Concord and 10% in Bow;
- The population in the project area is expected to increase by about 10% through 2040 according to projections prepared by the NH Office of Strategic initiatives;
- There are 20,650 housing units within the corridor communities, with an expected annual growth of about 60 units per year during the next five years.
- 40% of the housing units in the corridor are rental units—this ratio has been and is expected to remain relatively constant;
- The job base within the two communities totals 44,400 jobs of which 90% are in Concord;
- The predominant economic driver of the communities is that Concord is the State's capital, with a total of 11,000 government jobs. High levels of government employment provides stability to the community's economic base;
- Concord also functions as an important retail and service center serving a broad regional market, particularly to the north, east and west (the influence of Metropolitan Manchester truncates the market influence to the south), and this role is supported by access to I-93 and I-89;
- The job base of the combined corridor communities is expected to increase by 3,400 jobs by 2026;
- Bow has experienced job growth, particularly in the wholesale trade (recent addition of the State Liquor warehouse) and construction sectors, while Concord's job base has been relatively stable;
- The concentration of government jobs, which pay middle income wages, lends a decidedly middle income profile to the area's households, who have a median income of $65,700 (2017), a bit lower than the State's median income of $69,800;
- The middle income character of the communities is further reflected in their median housing value, which is estimated to be $243,000 versus a State median of $258,000 in 2017.

The corridor communities have experienced balanced, moderate growth, and support a moderate income economic base. The presence of the State capital, with the 11,000 government jobs, provides a stable and middle-income base to the local economy. The confluence of I-93 and I-89 provides the communities with a broad market reach, particularly to the north, west, and east (via NH Routes 4 and 9). This, in turn, supports a strong retail presence both on the periphery of Concord and in its revitalizing downtown. The presence of the State capital also supports a concentration of legal and financial services clustered in downtown. Most recently, downtown Concord is beginning to see a resurgence of market rate housing, paralleling trends in other New Hampshire downtown settings.

3.10.2 General Socio-economic Observations

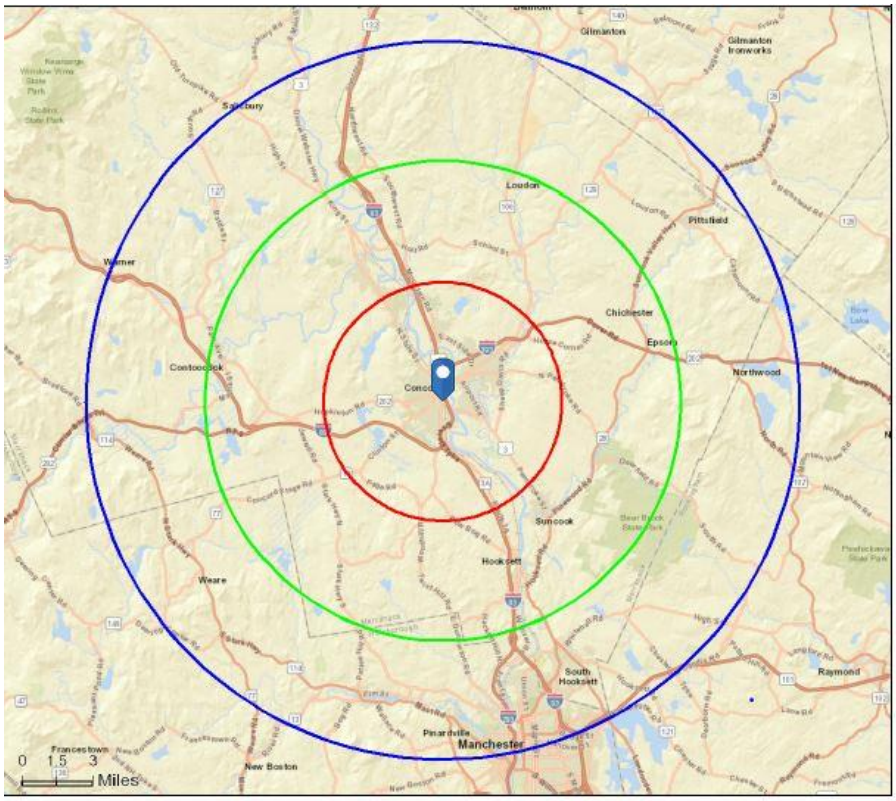
I-93 and the I-89 connection serve several important functions. They allow commuters access to the 44,000 jobs in Bow and Concord and they allow the residents of these communities access to regional job opportunities, particularly in the State's growing southern counties. I-93 and I-89 allow residents of these communities to bypass local streets, providing convenient intra-regional access. From a broader State-wide perspective, I-93 and I-89 are critical to the health of the State's tourism industry, and without them the Lakes Region and North Country, which are heavily dependent on tourism, would suffer.

Interviews with planners at the local and regional levels indicate support for improving this vital component of the regional infrastructure. According to US Census figures, 14,600 residents of the Concord Labor Market commute to jobs outside of the Concord Labor Market and 23,400 residents of other labor market areas commute to jobs within the Concord Labor Market. As such, commuting in and out of Concord substantially outnumbers the 28,600 residents that both live and work in the Concord Labor Market. Currently, rush hour congestion and weekend tourism related congestion are significant.

3.10.3 The Influence Area Trends and Characteristics

The influence area consists of 5, 10 and 15 mile rings from the center of the study area corridor, see **Figure 3.20 Socio-Economic Influence Areas** below:

Figure 3.20 Socio-Economic Influence Areas



The 5-mile ring includes the areas that rely heavily on the corridor for intra-area movements, often daily. The 10-mile ring was chosen to depict those areas that are most strongly linked to the corridor communities for employment, services, and shopping. The 15-mile ring includes those communities that interact with the corridor communities but that are not as intimately tied to the corridor.

There are several distinguishing elements to the economic aspects of the influence area. Most importantly, Concord is the State capital, with 11,000 government workers and a total employment base of 40,400 jobs in 2016, providing an economic and commuting drawing power on the surrounding region. Concord has a vibrant downtown with service, retail, and cultural attractions. Concord also has a diverse mix of big box retail along Route 106 and Fort Eddy Road that attracts shoppers from throughout the influence area. It is an important retail and service center of its economic region, which extends broadly to the east, north and west, although it is somewhat truncated to the south by the larger concentration of retail opportunities in Manchester, Bedford and Londonderry.

In contrast to Concord, Bow is a more rural community with an employment base of 4,000 jobs. A prominent economic driver specific to the Town of Bow is the coal fired power plant, developed by the former Public Service of New Hampshire and more

recently operated by Eversource, the successor to PSNH. The community also houses a concentration of auto dealerships and several manufacturing and construction firms.

Population Trends

The total population within the 15-mile influence area stands at 209,450, reflecting a growth of nearly 25,000 since the year 2000.[4] The area's population has increased by nearly 6,500 since the year 2010, a modest growth of just under 3%, which mirrors the State's growth rate during this period. All three of the analysis rings experienced rising population during the past several decades, see **Table 3.18 Population Trends**.

Population growth has tended to be more pronounced in the communities surrounding Concord, including Bow, due to greater land availability and a regional transportation system that allows for efficient commuting, although peak hour delays are experienced within the entire I 93 study area corridor.

Table 3.18 Population Trends

					Change		
Population	**2000**	**2010**	**2017**	**2022**	**2000-2010**	**2010-2017**	**2017-2022**
5 mile	42,353	43,876	44,992	45,786	1,523	1,116	794
10 mile	82,991	87,720	89,907	91,680	4,729	2,187	1,773
15 Mile	190,748	203,018	209,458	214,656	12,270	6,440	5,198

Population within the influence area is expected to continue to increase in the short term future, adding just under 5,200 new residents. Short term population projections, prepared by ESRI (mapping and analytical software) through the year 2022, anticipate continued modest population growth with the influence area, with total population growth in the 15-mile corridor influence area estimated at just under 5,200—a growth rate of just under 2.5%, essentially identical to ESRI's population growth rate estimate for the State.

Housing Trends and Characteristics

There are currently just under 90,000 housing units within the 15-mile corridor influence area, in contrast to 77,500 in the year 2000, reflecting an increase of just under 9,500 units (12%) between 2000 and 2010 and an additional 2,900 units (3%) since 2010, see **Table 3.19 Housing Trends**.

[4] The source of the demographic information in this section of the analysis is ESRI, a proprietary data source drawing on US Census data including the American Community Survey.

Table 3.19 Housing Trends

					Change		
Housing Units	**2000**	**2010**	**2017**	**2022**	**2000-2010**	**2010-2017**	**2017-2022**
5 mile	17,079	18,885	19,376	19,820	1,806	491	444
10 mile	33,032	37,147	38,056	38,953	4,115	909	897
15 Mile	77,503	86,982	89,934	92,327	9,479	2,952	2,393

Between 2000 and 2010, the average annual growth was 950 housing units per year. Because of the 2007-2012 recession, the average annual growth in units fell to about half that pace between 2010 and 2017—a decline experienced state-wide.

Projections prepared by ESRI anticipate continued modest housing growth during the 2017-2022 period, with an overall addition of just under 2,400 units within the 15-mile influence area, an average annual pace of 500 units.

The influence area incorporates a diverse mix of housing unit types. Concord, a more urban setting, dominates the 5-mile ring, and includes a higher concentration (42%) of rental housing than the 10 and 15-mile ring study areas. In these larger areas the concentration of rental housing drops into the 32-36% range, see **Table 3.20 Rental Housing.**

Table 3.20 Rental Housing

2017 Housing Occupancy	**5 Mile**	**10 Mile**	**15 Mile**
% Owner Occupied	52%	62%	56%
% Renter Occupied	42%	32%	36%
% Vacant	7%	6%	8%
	100%	100%	100%

Median home values within the influence area fall into the range of $240,000-$245,000, slightly lower than the State median of $258,500. ESRI anticipates that median home values will increase modestly during the coming years, a projection that is consistent with recent trends reported State-wide by the New Hampshire Housing Finance Authority, see **Table 3.21 Median Home Value**.

Table 3.21 Median Home Value

Median Home Value	**5 Mile**	**10 Mile**	**15 Mile**
2017	$243,395	$240,436	$245,597
2022	$256,334	$256,403	$263,111

Household Income

The corridor influence area is best characterized as a middle-income area. Median household income in 2017 fell in the $65,000- $70,000 range—the comparable state median income is $69,800, see **Table 3.22 Median Household Income**.

Table 3.22 Median Household Income

Median Household Income	5 Mile	10 Mile	15 Mile
2017	$65,735	$70,533	$67,370
2022	$74,806	$77,416	$75,100

The concentration of government jobs within the influence area leads to a tendency for household incomes to cluster close to the median, as most government jobs are middle income jobs. There are just over 83,000 households (with tabulated household income) within the 15-mile corridor influence area. 35% of the households have incomes in the $50,000- $99,000 range, while only 16% have incomes under $25,000 and 13% have incomes of $150,000 and over.

Racial Composition

The corridor influence area, within 15 miles surrounding the project area, is not racially diverse. Over 90% of the influence area is white, with the remaining 10% of the population spread across a range of racial categories with no one minority group standing out as a concentration, see **Table 3.23 2017 Racial Composition**.

Table 3.23 2017 Racial Composition

	5 Mile	10 Mile	15 Mile
Total	44,991	89,907	209,457
White Alone	91.1%	93.3%	91.5%
Black Alone	2.5%	1.7%	2.2%
American Indian Alone	0.3%	0.3%	0.3%
Asian Alone	3.8%	2.6%	2.8%
Pacific Islander Alone	0.0%	0.0%	0.0%
Some Other Race Alone	0.5%	0.5%	1.2%
Two or More Races	1.8%	1.7%	2.1%
	100.0%	100.0%	100.0%

3.10.4 Profile of the Immediate Corridor Communities

The immediate corridor communities are those communities abutting the proposed project area. The demographic and economic characteristics of these two communities closely parallel those of the abutting communities described in the preceding paragraphs - not surprisingly since the immediate corridor communities and the influence area function within the same regional economic setting.

Population and Housing

The total population of the corridor communities in 2017 was 51,508. Between 2000 and 2010, population in the corridor communities increased by 2,389—a 5% increase that closely mirrors the State's population growth during that decade. Since 2010, the corridor communities' population increased by 1,294—a 3% growth rate during the 7-year period. ESRI projects that population in the corridor communities will increase by 942 from 2017 to 2022, reflecting a continuation of the modest growth experienced since the year 2000 and paralleling State growth rates, see **Table 3.24 Corridor Community Profile (Bow and Concord**.

Table 3.24 Corridor Community Profile (Bow and Concord)

					Change		
	2000	2010	2017	2022	2000-2010	2010-2017	2017-2022
Population	47,825	50,214	51,508	52,450	2,389	1,294	942
Households*	18,525	20,298	20,647	21,032	1,773	349	385
Housing Units	19,211	21,659	22,197	22,711	2,448	538	514
% Rental	41.7%	39.3%	40.6%	40.3%			

*Occupied Housing Units

The inventory of households (occupied housing units) and changes in total housing units correlates with population changes. That is, modest growth has been experienced and is expected to continue. Rental units represent 40% of the housing inventory in the corridor communities, with most of the rental units located in Concord—close to downtown Concord, within the Concord Heights section bordering Loudon Road to the east of the I-93 corridor.

Corridor Community Economic Profile

The economy of the corridor communities is driven primarily by non-manufacturing sectors, including just over 11,000 government jobs in Concord, the State capital. The communities added 226 jobs between 2006 and 2016, with Bow experiencing significant job growth, while Concord saw modest job losses because of the economic recession, see **Table 3.25 Corridor Covered Employment Trends**.

Table 3.25 Corridor Covered Employment Trends

2006	Bow	Concord	Combined
Manufacturing	760	1,478	2,238
Non Manufacturing	1,992	27,637	29,629
Government	471	11,848	12,319
Total	3,223	40,963	44,186

2016	Bow	Concord	Combined
Manufacturing	600	1,133	1,733
Non Manufacturing	2,961	28,248	31,209
Government	455	11,015	11,470
Total	4,016	40,396	44,412

Change 2006-2016	Bow	Concord	Combined
Manufacturing	(160)	(345)	(505)
Non Manufacturing	969	611	1,580
Government	(16)	(833)	(849)
Total	793	(567)	226

Source: NH Employment Security

Most of Bow's employment growth occurred in the construction and wholesale trade sectors—the State of New Hampshire's liquor warehouse, which is operated by a private vendor, was constructed in Bow during this period.

As is true state-wide, the corridor communities are essentially operating at full employment levels with a combined unemployment rate of 1.6% and 1.9% respectively in Concord and Bow (December 2017) slightly lower than the State's 2.3% figure. At these levels, the availability of labor is a constraint on employment and business growth.

Corridor Employment and Population Projections

The NH Employment Security Commission has prepared long term (10 year) employment projections for New Hampshire counties. Estimated future employment within the corridor communities is based on their share of employment within the County. NH Employment Security has projected an average annual growth of 600 jobs within Merrimack County. The corridor communities' share of County employment has been in the range of 58-60% during the past decade. Future employment in the corridor communities is projected at the recent 58% portion of the

County, resulting in an anticipated growth of 3,400 jobs during the next decade. This is more pronounced growth than experienced by the communities during the past decade, during which the "Great Recession" thwarted employment growth State-wide and within the corridor communities, see **Table 3.26 Corridor Employment Projections**.

Table 3.26 Corridor Employment Projections

				Change
	2006	2016	2026	2016-2022
Corridor Communities	44,200	44,400	47,800	3,400
Merrimack County	74,100	76,400	82,400	6,000
Corridor Share of County	60%	58%	58%	

The New Hampshire Office of Strategic Initiatives has prepared population projections for the State, its counties and municipalities. The most recent projections were released in 2016 and indicate that the corridor communities are expected to realize modest population growth through the year 2040, see **Table 3.27 Population Projections**.

Table 3.27 Population Projections

						Change		
	2015	2025	2035	2040		2015-2025	2025-2035	2035-2040
Bow	7,700	8,100	8,600	8,700		400	500	100
Concord	42,400	43,000	45,700	46,400		600	2,700	700
	50,100	51,100	54,300	55,100		1,000	3,200	800
Merrimack County	147,800	154,500	164,000	166,800		6,700	9,500	2,800
New Hampshire	1,330,501	1,374,700	1,402,900	1,432,700		44,199	28,200	29,800

Source: NH Office of Strategic Initiatives, 2016

The projections anticipate that the population in the corridor communities will increase from a 2015 estimate of 50,100 to a figure of 55,100 in 2040. This reflects an anticipated growth of 10 percent during the 25-year projection period.

3.10.5 Commuting Patterns

There is substantial commuting into and out of the Concord Labor Market. According to the NH Employment Security, Economic Labor Market Information Bureau and US Census figures, currently 14,684 residents of the Concord Labor market commute to jobs outside of the Concord Labor Market and 23,419 residents of other labor market areas commute to jobs within the Concord Labor Market. As such, commuting in and out substantially outnumbers the 28,600 residents that both live and work in the Concord Labor Market.

3.11 Land Use and Zoning

General land use patterns and zoning were inventoried throughout the study area. Below is a summary of the land use and zoning within the study area in the Town of Bow and the City of Concord. Refer to **Figure 3-21 Zoning and Land Use** for the location of the prominent land uses and zoning categories.

Town of Bow

The Town of Bow is located in Merrimack County, New Hampshire, and is located just south of the City of Concord. Land use in the study area in Bow is primarily open space, residential areas, and some commercial development. The I-89 corridor in the study area is primarily forested with some residential areas, a gas station and a hotel are located in the vicinity of Exit 1. Residential areas are located adjacent to the I-93 corridor south of the I-89 interchange. Commercial and industrial development dominates the area east of I-93 in the vicinity of the I-89 interchange, including car dealerships and manufacturing facilities.

The current zoning in this area of Bow is a mix of residential, commercial, and institutional. The Residential District is located along the southern side of I-89 and the western side of I-93, south of the interchange. South of the interchange along the east side of I-93 is also zoned as Residential. The Residential District is designed to accommodate a range of residential uses at low densities in areas where sewer service is available or the extension of such is anticipated at some future time, as indicated in Bow's Master Plan.

The area east and north of the I-89 and I-93 interchange in Bow is zoned as the Commercial District. The Commercial District is designed to allow a broad range of commercial uses including retail, service, offices, restaurants, recreational, institutional, and transportation-related uses along arterial roads where sewer

service is available or the extension of such is anticipated at some future time, as indicated in Bow's Master Plan.

The northern side of I-89 and the western side of I-93 north of the interchange is zoned as the Institutional District. The Institutional District is intended to accommodate office and institutional uses in an area where sewer service is available.

City of Concord

Concord is the capital city of New Hampshire, and the third largest city in the state. The majority of the study area is located in a highly developed urban area. Land use in the study area is a mix of primarily commercial and industrial uses with some residential areas and open space interspersed. Northwest of Exit 12 is a residential area and to the northeast of Exit 12 there is an area of open space known as the South End Marsh. Continuing north along I-93 the highway corridor is bordered by commercial development to the west, consisting primarily of hotels, and industrial development to the east including an automotive salvage yard, and automotive repair facilities.

Land use in the vicinity of Exit 13 is primarily commercial development to the west consisting of gas stations, restaurants, and hotels. Between Exits 13 and 14 the Merrimack River is located just east of I-93. There is a floodplain forest in West Terrill Park, north of Exit 13. A large shopping plaza is located west of I-93, south of Exit 14. This shopping plaza includes a grocery store, retail shopping, and restaurants. The I-93 corridor between Exits 14 and 15 is highly developed and includes industrial areas and a park and ride to the west, and retail shopping and a grocery store to the east. The NHTI Community College is located north of Exit 15 on the east side of I-93. Industrial office complexes are located west of I-93, north of Exit 15.

In Concord, the study area passes through many different zoning districts including: Institutional, General Commercial, Open Space Residential, Medium Density Residential, Industrial, Opportunity Corridor Performance, and Gateway Performance Districts.

The current zoning includes an Institutional District, which is located southwest of Exit 12 and northeast of Exit 15. The area in the vicinity of Exit 15 includes the New Hampshire Technical Institute Community College. In the study area the General Commercial District is located southeast of Exit 12 and includes a hotel, a gas station, and a fast food restaurant.

3.11.1 Regional Plans and Policy

The "Central New Hampshire Regional Planning Commission Regional Transportation Plan" provides recommendations for transportation services and facilities in the central New Hampshire region. Bow and Concord are both considered in this plan. The plan provides nine major recommendations for improving transportation, as follows:

1. Towns in the region need to focus on Smart Growth and create town centers for public transportation hubs
2. A Transportation Management Association (TMA) is needed in the region
3. Park and Ride facilities are being utilized and should be expanded
4. Corridor studies are needed throughout the region to maintain connections
5. Efforts to establish passenger rail should be encouraged
6. Airports should develop long range plans to ensure smart growth
7. The public ought to be involved in transportation changes
8. Programs enabling children to walk or bike to school should be encouraged
9. Support the Coordinated Transit Study

Specifically, the plan states: *Measures should be made to improve the current roadway system in terms of safety and capacity without major reconstruction or road building. Some of the recommended improvements may include intelligent signalized traffic light systems, corridor monitoring, and adequate access management*.

3.11.2 Community Facilities

There are numerous community resources in the study area and vicinity including schools, parks, recreational facilities, and police and fire stations. Because Concord is the State Capital and the largest community in Merrimack County, there are many state and county facilities in addition to town and municipal facilities. Important public/community facilities nearby the I-93 corridor in Bow and Concord include:

- State Capital
- Concord City Hall
- Concord Library
- Museum of New Hampshire History
- Merrimack County Courthouse
- NH Technical Institute
- Baker Free Library
- Everett Arena
- Water Front Park
- Terrill Park
- Reed Playground

Refer to **Figure 3-22 Community Resources Overview** for the location of community facilities within the vicinity.

3.12 Visual Resources

The visual setting and resources were inventoried throughout the study area. Features such as topography, structures, waterways, and vegetation were evaluated to determine the visual context of the study area in four segments. Federal Highway Administration Visual Resource Manual was used as a reference to guide the inventory. A general description of the visual resources follows:

I-89 Area

The I-89 Area is located in the Town of Bow. The Turkey River runs west to east beneath South Street and the exit ramp to I-89 and connects to the Merrimack River to the east. Vegetation is dense near the embankment of the river and then gradually thins as the elevation rises closer to I-89. Areas of maintained grass surround I-89. In general, the I-89 area contains a mix of vegetation including evergreen and deciduous trees with an overgrown understory layer throughout the undeveloped lands.

The grading of South Street is at a consistent elevation as it passes beneath I-89, but the road begins to rise as it passes the Bow Mobil Gas station and continues to the north. On the east side of South Street a continuous bituminous concrete pedestrian sidewalk passes beneath the bridge but terminates at the Bow Mobil.

The roadway consists of one vehicular travel lane in the north/south direction along South Street. The exit ramp from I-89 meets South Street directly opposite the Bow Mobile, with one travel lane for entry and exit purposes. There are currently no accommodations for bikes in this area.

Exit 12 Area

The Exit 12 Area is located in the City of Concord. The large wetland complex and open water feature known as South End Marsh is located to the north of Exit 12. South End Marsh is adjacent to a large undeveloped forested area, also on the north side of I-93. The railroad corridor fragments these areas of undeveloped vegetation. Residential neighborhoods are located along South Main Street. To the east of I-93 is the built up commercial area known as the Concord Business Center. On the south side of I-93, a Wetland Mitigation site is present that is owned by the NHDOT.

The existing vegetation adjacent to I-93 and Exit 12 is mainly mown grass with a single group of deciduous and evergreen tree plantings, which do provide some visual buffering from I-93 for the residential neighborhood to the north.

The grading of South Main Street is at a consistent elevation as it passes over I-93 but begins to fall as it continues to the south on Route 3A. On the west side of South Main Street, a continuous bituminous concrete pedestrian sidewalk continues to the south. Delineated pedestrian crosswalks exist where the entry and exit ramps of I-93 interrupt the sidewalk. The outside shoulders along South Main Street accommodate bicycles although they are not designated bike routes.

Route 3A consists of one vehicular travel lane in the north/south direction. The exit ramp from I-93 South meets Route 3A in two separate locations, with one travel lane for entry and exit purposes. There are currently no accommodations for bikes. Utility poles with overhead power lines dominate the landscape.

Exit 13 Area

The Exit 13 Area is located in the City of Concord. To the east, a six-lane bridge carries Route 3 (Manchester Street) over the Merrimack River and then the road proceeds beneath I-93. A raised concrete median helps to separate the vehicular traffic moving in the east/west direction. Sidewalks exist on both sides of Manchester Street in the Exit 13 Area. Lighting, in the style of ornamental shepherd's crook lamps, illuminates Manchester Street. As it passes over Route 3, I-93 is a four-lane highway with two lanes heading in each direction.

The existing vegetation adjacent to this exit is primarily on the northeast side of I-93 adjacent to the Merrimack River. This vegetation is predominantly deciduous trees. On either side of the bridge, concrete retaining walls support some additional plantings. These plantings are made up of deciduous trees, ornamental trees, shrubs, and vines. The splitter islands on both sides of I-93 are planted with similar species. There is also a central grass median located on I-93 which separates the north/south traffic into two travel lanes in each direction.

The grading of Route 3 is at a consistent elevation as it passes over the bridge, from the east, across the Merrimack River, but begins to rise as it continues north on Water Street. Pedestrian access across the bridge is supported by a concrete sidewalk on both sides of the road. These sidewalks connect to Basin Street to the south and to a pedestrian riverfront walk to the north. The sidewalks continue in a westerly direction toward Water Street. There are no accommodations for bikes in the current layout.

Exit 14/15 Area

The Exit 14/15 Area is located in the City of Concord. To the east a five-lane bridge carries Loudon Road over the Merrimack River and then the road proceeds beneath I-93 to downtown Concord. A striped median helps to separate the vehicular traffic moving in the east/west direction. Commercial outlets are located to the east along Fort Eddy Road, which runs parallel to I-93. The main intersection at Loudon Road,

Fort Eddy Road, and the I-93 off-ramp is controlled by 4-way overhead signalization. Signalized intersections also exist for the northbound entrance ramp, southbound ramps, and Stickney Avenue. Vehicular scaled light fixtures illuminate the bridged section of Loudon Road.

The existing vegetation adjacent to this exit is mainly on the east side of I-93 adjacent Fort Eddy Road. The area is primarily mown lawn with sporadically placed deciduous trees. On the west side of I-93, mown lawn is also prevalent. A few deciduous trees are located on the banks of the Merrimack River in this location. Steep slopes of mown lawn are located on the east and west sides of I-93.

The grading of Route 9 (Loudon Road) is at a consistent elevation as it passes over the bridge from the east, across the Merrimack River, but begins to rise as it continues west toward North Main Street. Pedestrian access across the bridge is supported by a concrete sidewalk on both sides of the road. These sidewalks lead all the way to downtown Concord and the commercial outlets (big box) located along Fort Eddy Road. There are no accommodations for bikes in the current layout.

3.13 Contaminated Properties and Structures

Hazardous waste sites are regulated by both the federal Resource Conservation and Recovery Act of 1980 (RCRA) (40 CFR Part 261 C) and the Comprehensive Environmental Response, Compensation, and Liability Act of 1986 (CERCLA). NHDES regulations incorporate by reference 40 CFR 260-270 (hazardous waste). The regulations include procedures for identifying hazardous waste, requirements for generators and transporters of hazardous waste, requirements for treatment, storage and disposal facilities, and other provisions. This section provides a summary of the existing conditions based upon a cursory records review of readily available information. Refer to Appendix H (Volume 2) Hazardous Materials Report for further detail.

Database Review

Existing records and databases were searched for records of hazardous materials spills or known occurrences within the study area. Environmental regulatory agency records were searched through State and Federal databases accessed and summarized by Environmental Data Resources, Inc. (EDR) in the winter of 2018. In addition, NHDES records were reviewed in the January of 2018 through the NHDES's OneStop Records Database. Refer to Appendix H for a detailed discussion and the locations of these sites.

The majority of sites listed in the EDR and NHDES databases have been "closed"; however, even closed sites could present a potential risk for encountering contaminated soils or groundwater during construction. The sites that have been determined to have greater potential for resulting in impacts to the project, based on

type of site and proximity to the project, are described below. The status of these sites are "open" and summarized below in eight sections of the project study area from south to north. The information provided below is preliminary in nature and would be updated and reevaluated during final design. Based upon this future work, sites with the potential to impact the project would be identified in regard to surface and subsurface conditions such as: type and depth of contaminant, medium impacted (soil and/or groundwater) and similar.

I-89 Exit 1 Area

One potential area of contamination relative this area was identified.

- The Mobil service station, located at 519 South Street, Bow. Contaminants of concern being MtBE and 1,1-DCE in relation to an underground storage tank (UST) petroleum release.

I-89 and I-93 Interchange Area

One potential area of contamination relative to this area was identified.

- Grappone Honda, located at 507 Route 3A, Bow. Contaminants of concern being oil, toluene, acetone, and MtBE.

I-93 Exit 12 Area

No sites identified.

I-93 Exit 13 Area

Six potential areas of contamination relative to this area were identified.

- The Concord Coal Gas Site, located at the junction of Gas Street and South Main Street, Concord. Contaminants of concern including BTEX, Naphthalene, Styrene, 1,2,4-TMB, and SVOCs.

- The Coal Tar Pond at Exit 13, located at the Manchester Street Bridge Area, Concord. Contaminants of concern including Benzene, Naphthalene, MtBE, tBA, and PAHs.

- The former Johnson & Dix Bulk Fuel facility located a 1 Gulf Street, Concord. Contaminants of concern including BTEX, Naphthalene, 1,2,4-TMB, 1,3,5-TMB, PCE, and cis-1,2-DCE.

- The Prolerized New England Company and former Advanced Recycling, located at 25 Sandquist Street, Concord. Contaminants of concern including PCE, TCE, MtBE, and tBA.

- Store 24, located at 201 South Main Street, Concord. Contaminants of concern including BTEX, MtBE, Naphthalene, 1,2,4-TMB, 1,3,5-TMB, and Isopropylbenzene in relation to a leaking underground storage tank (LUST).

- Lot 26-1-10, located at 14-16 Water Street, Concord. Contaminants of concern include Benzo[a]pyrene and Indeno[1,2,3-cd]pyrene, in relation to hazardous waste.

I-93 Exit 14 Area

Three potential areas of contamination relative to this area were identified.

- The Concord Cleaners, located at 80 South Main Street, Concord. Contaminants of concern including PCE, TCE, and cis-1,2-DCE.

- The Mobil service station located at 129 South Main Street, Concord. Contaminants of concern including Benzene, tBA, and 1,2-DCA in relation to a LUST.

- The Citgo service station located at 81 South Main Street, Concord. Contaminants of concern including BTEX, MtBE, tBA, Naphthalene, 1,2,4-TMB, 1,3,5-TMB, and EDB in relation to a LUST.

○

I-93 Exit 14 and 15 Area

Eight potential areas of contamination relative to this area were identified.

- Concord Center Trust, located at 10 Ferry Street, Concord. Contaminants of concern including PCE and Asbestos in relation to an inactive asbestos disposal site.

- The Cumberland Farms service station located at 165 North Main Street, Concord. Contaminants of concern including Benzene, Napthalene, MtBE, tBA, and 1,2,4-TMB in relation to a LUST.

- The Exxon facility located at 196 North Main Street, Concord. Contaminants of concern including BTEX, Naphthalene, MtBE, tBA, tAME, 1,2,4-TMB, and PCE in relation to a LUST.

- The Getty service station, located at 242 North main Street, Concord. Contaminants of concern including BTEX, Naphthalene, and 1,2,4-TMB in relation to a LUST.

- The Hess Station located at 175 North Main Street, Concord. Contaminants of concern including BTEX, MtBE, and Naphthalene.

- The New Hampshire DOT Highway Garage 12, located at 11 Stickney Avenue, Concord. Contaminants of concern including Fuel Oil, BTEX, Naphthalene, tBA, MtBE, and TCE in relation to hazardous waste and a LUST.

- Prescott & Sons Oil, located at 196 North Main Street, Concord. Contaminant of concern fuel oil in relation to a leaking aboveground storage tank (LAST).

- The Mobil service station located at 32 South Commercial Street, Concord. Contaminants of concern including Ethylbenzene, Xylenes, Isopropylbenzene, n-Propylbenzene, 1,2,4-TMB, and 1,3,5-TMB in relation to a LUST.

Asbestos in Soils Along the Corridor

Asbestos was used in a wide variety of building materials until approximately the 1970s. Buildings within the City of Concord and Town of Bow are known to have historically used asbestos-containing materials. When buildings were demolished or renovated, asbestos was often disposed of as fill material in construction sites, including construction of the turnpike. According to the NHDES database there is one documented Asbestos Disposal Site in the vicinity of the project area. It is located at 10 Ferry Street, approximately 1,000 feet southwest of Exit 15. It is assumed that fill along the corridor contains asbestos, and NHDOT has committed to conduct necessary subsurface investigations prior to project construction sufficient to identify and characterize asbestos in areas of proposed earthwork. NHDOT will plan for the proper handling and disposal of any contaminated materials that may be encountered during project construction.

Limited Reuse Soils

Statewide analytical data collected by NHDOT, as well as nationwide information, indicates that roadside soils commonly contain metals at concentrations above naturally occurring background conditions, and Polycyclic Aromatic Hydrocarbons (PAHs) exceeding acceptable reuse concentrations. These “Limited Reuse Soils” (LRS) excavated from within the operational right-of-way must be addressed in accordance with applicable NHDES rules and/or waivers. Soils that are anticipated to meet the definition of LRS may be subject to management through a Soils Management Plan. Roadside soils currently managed as LRS by the Department

include all topsoil within the limits of the existing right-of-way, regardless of its depth. In those instances where there is no measurable topsoil, LRS will be measured from the top of the ground to a depth of six inches.

LRS will be generated by the project and a soils management plan will need to be developed prior to the start of construction. The LRS material will require reuse on-site, disposal, and/or temporary stockpiling. Any excess materials that result from the project within the operational right-of-way will be addressed in accordance with applicable NHDOT guidance and NHDES rules and the soil management plan.

Per- and Polyfluoroalkyl Substances (PFAS)

Per- and polyfluoroalkyl (PFAS) are a diverse group of compounds resistant to heat, water, and oil. For decades, they have been used in hundreds of industrial applications and consumer products such as carpeting, apparels, upholstery, food paper wrappings, fire-fighting foams and metal plating. PFAS have been found at very low levels both in the environment and in the blood samples of the general U.S. population.

The current regulatory parameters for per- and polyfluoroalkyl (PFAS) substances is evolving at this time and information updates will be ongoing throughout this project and into its next phase, final design.

This section provides a summary of readily available information from the NHDES PFAS informational webpage. The PFAS database includes a state-wide map of all current PFAS sampling sites; however, this database is in the preliminary stages and does not include all possible sites, only those where testing has been conducted and reported. For privacy purposes, the map does not include ownership information or addresses; but it does provide a qualitative assessment of whether there are potential PFAS issues along the study corridor.

The PFAS database indicates that there are three sites with PFAS detections just to the north of the I-89/I-93 interchange, but at concentrations well below the AGQS of 70 parts per trillion. There are no other PFAS detections shown in the database along the remainder of the corridor. During final design the PFAS database will be reviewed again to determine if the sites and/or concentrations have changed. If new sites are detected, higher concentrations are observed, or if thresholds are reduced, the PFAS contaminated water would need to be managed in accordance with NHDES rules.

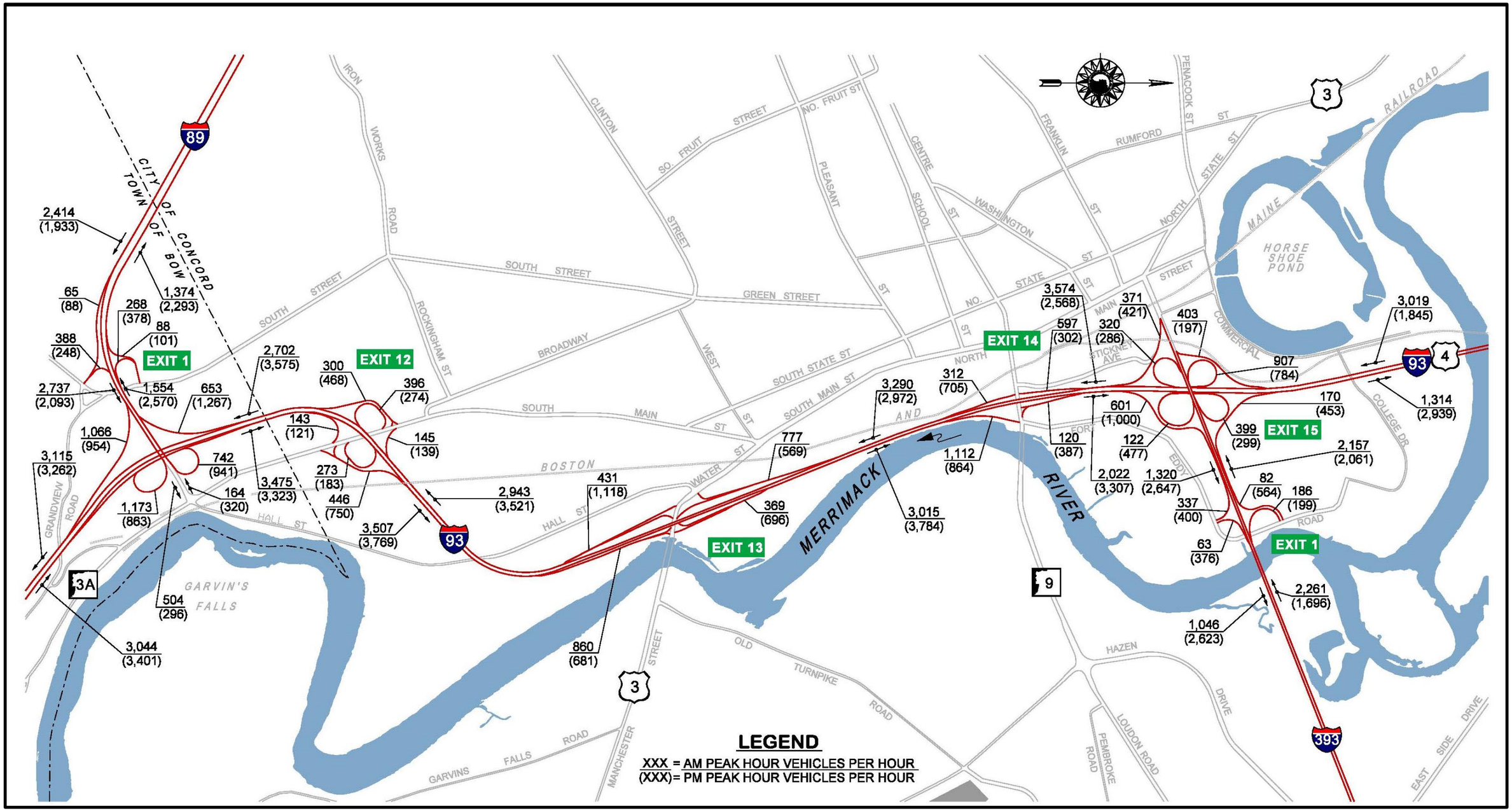
Asbestos and Lead in Bridge Materials

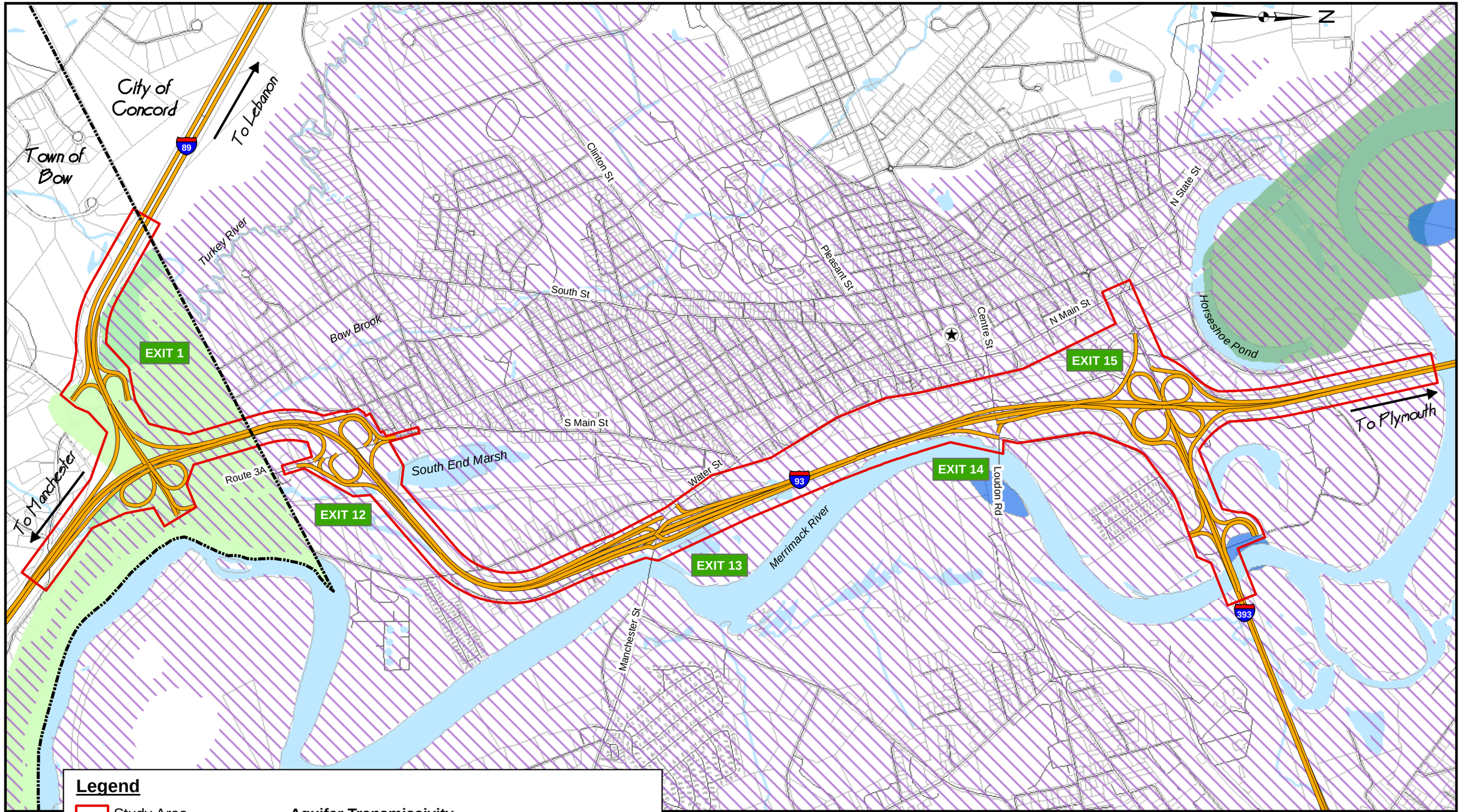
As-built plans from NHDOT of the bridges and overpasses present within the study area were reviewed for the potential presence of asbestos and lead. The as-built plans did not identify any evidence of the presence of asbestos or lead-based paint

in the building materials of the bridges and overpasses within the corridor. Inspections of these structures were not conducted as part of this assessment.

Figure 3.1: Project Transportation Elements

Figure 3.5 Base Year 2014 Peak Hour Traffic Volumes





Legend

- Study Area
- Parcels
- Streams
- Rivers and Ponds

Aquifer Transmissivity

- 0-1000 square feet/day
- Groundwater Classification GA2
- Town of Bow Aquifer Overlay District (existing)
- Town of Bow Aquifer Overlay District (proposed)
- City of Concord Aquifer Protection District

U.S. Department of Transportation Federal Highway Administration

New Hampshire DOT

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BOW-CONCORD I-93 IMPROVEMENTS

GROUNDWATER RESOURCES OVERVIEW

FIGURE 3.9

DATE: AUGUST 2018

SCALE: 1"=1500'

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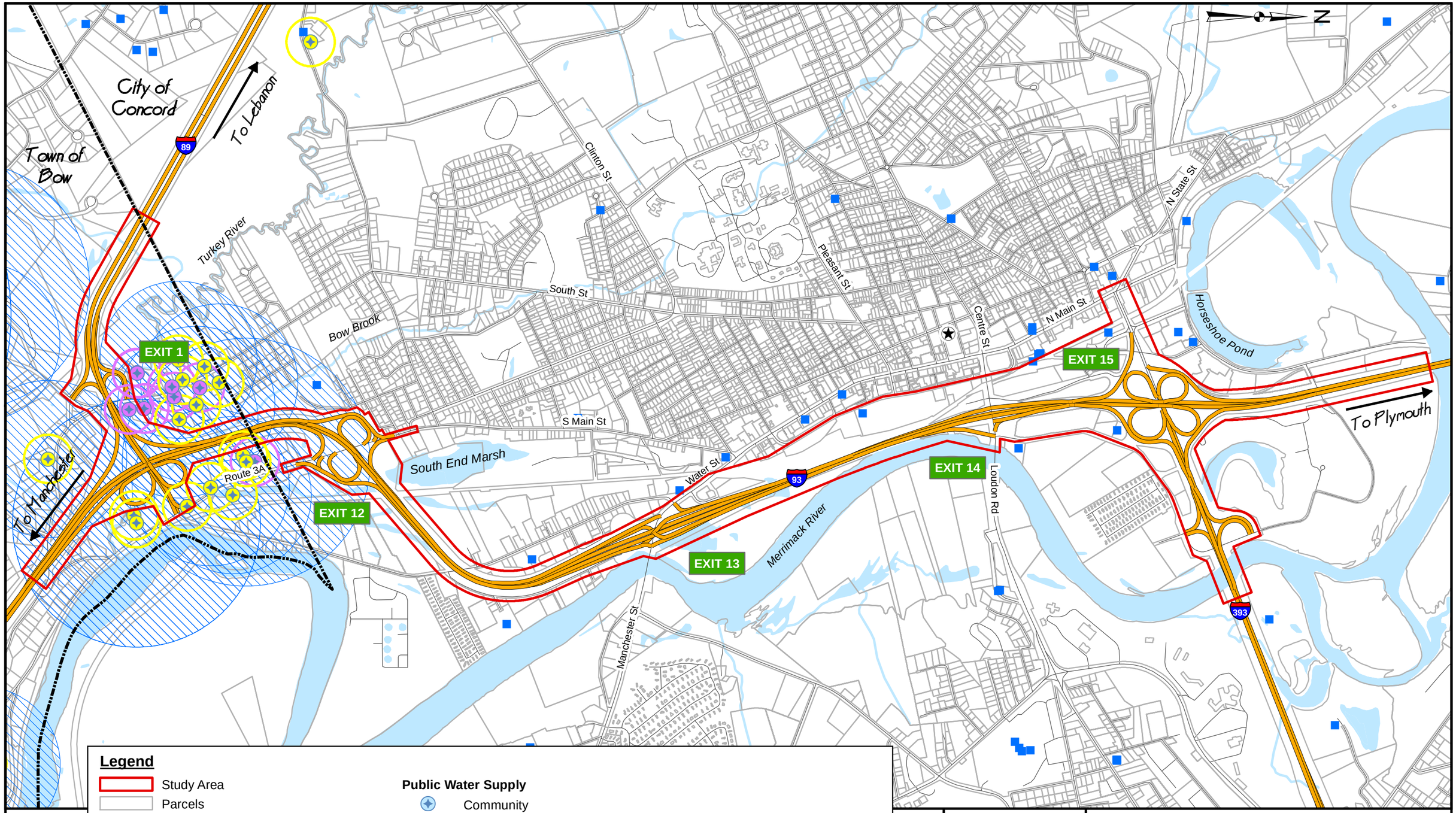

Legend

- Study Area
- Parcels
- Streams
- Rivers and Ponds
- Water Well Inventory
- NHDES Wellhead Protection Area

Public Water Supply

- Community
- Transient, Non-Community
- Non-Transient, Non-Community

Sanitary Protective Radius

- Transient Well 400' Construction Protection Radius
- Non-Transient Non-Community Well 400' Construction Protection Radius

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New Hampshire DOT

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BOW-CONCORD I-93 IMPROVEMENTS

PUBLIC WATER SUPPLY OVERVIEW

FIGURE 3.10

DATE: AUGUST 2018

SCALE: 1"=1500'

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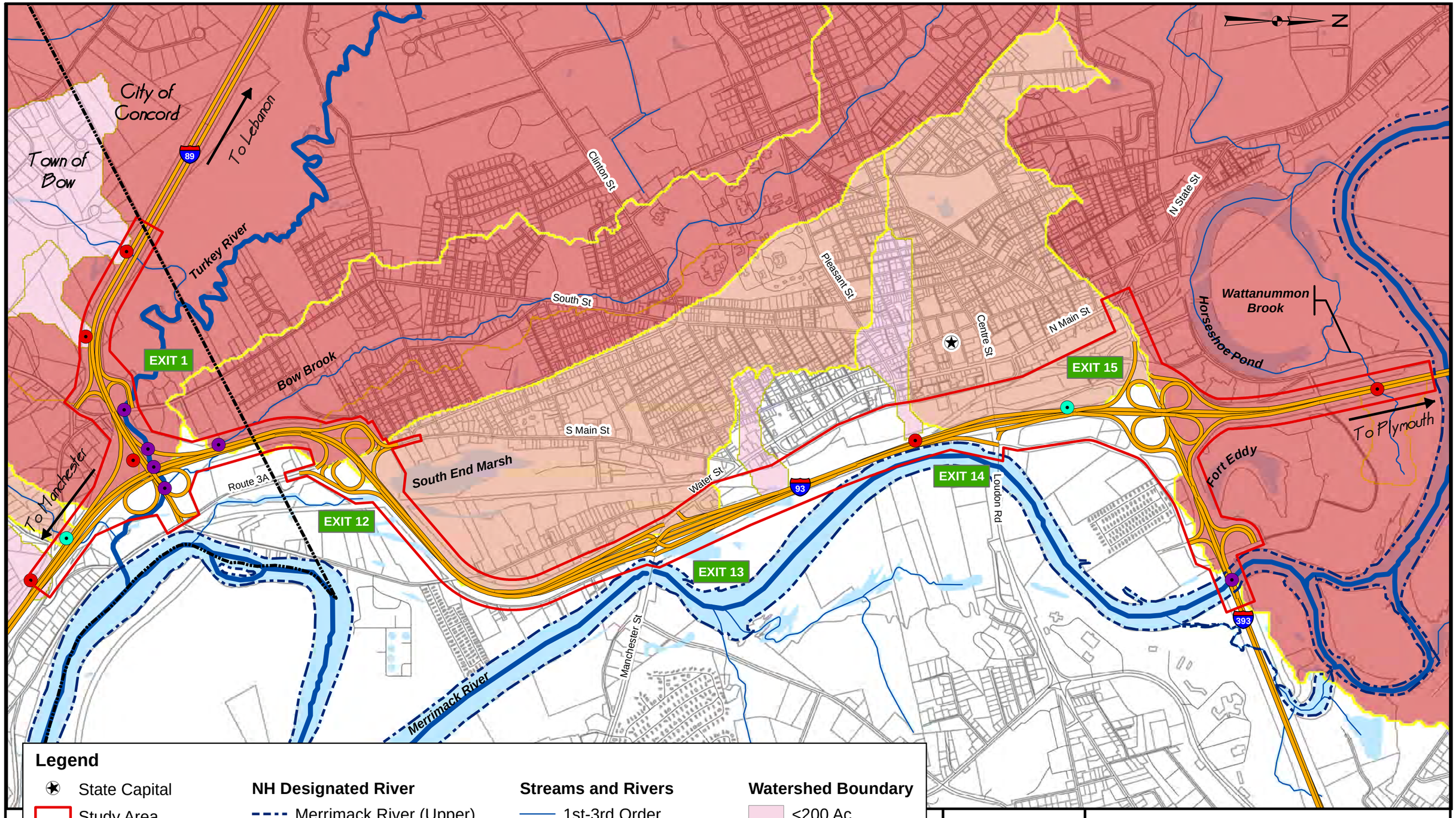

Legend

- State Capital
- Study Area
- Parcels
- Streams
- Rivers and Ponds

NH Designated River

- Merrimack River (Upper)

Stream Crossings

- Tier 1
- Tier 2
- Tier 3

Streams and Rivers

- 1st-3rd Order
- 4th Order or Larger

Watershed Boundary

- <200 Ac
- 200-640 Ac
- >640 Ac

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BOW-CONCORD I-93 IMPROVEMENTS

SURFACE WATER OVERVIEW

FIGURE 3.11

DATE: AUGUST 2018

SCALE: 1"=1500'

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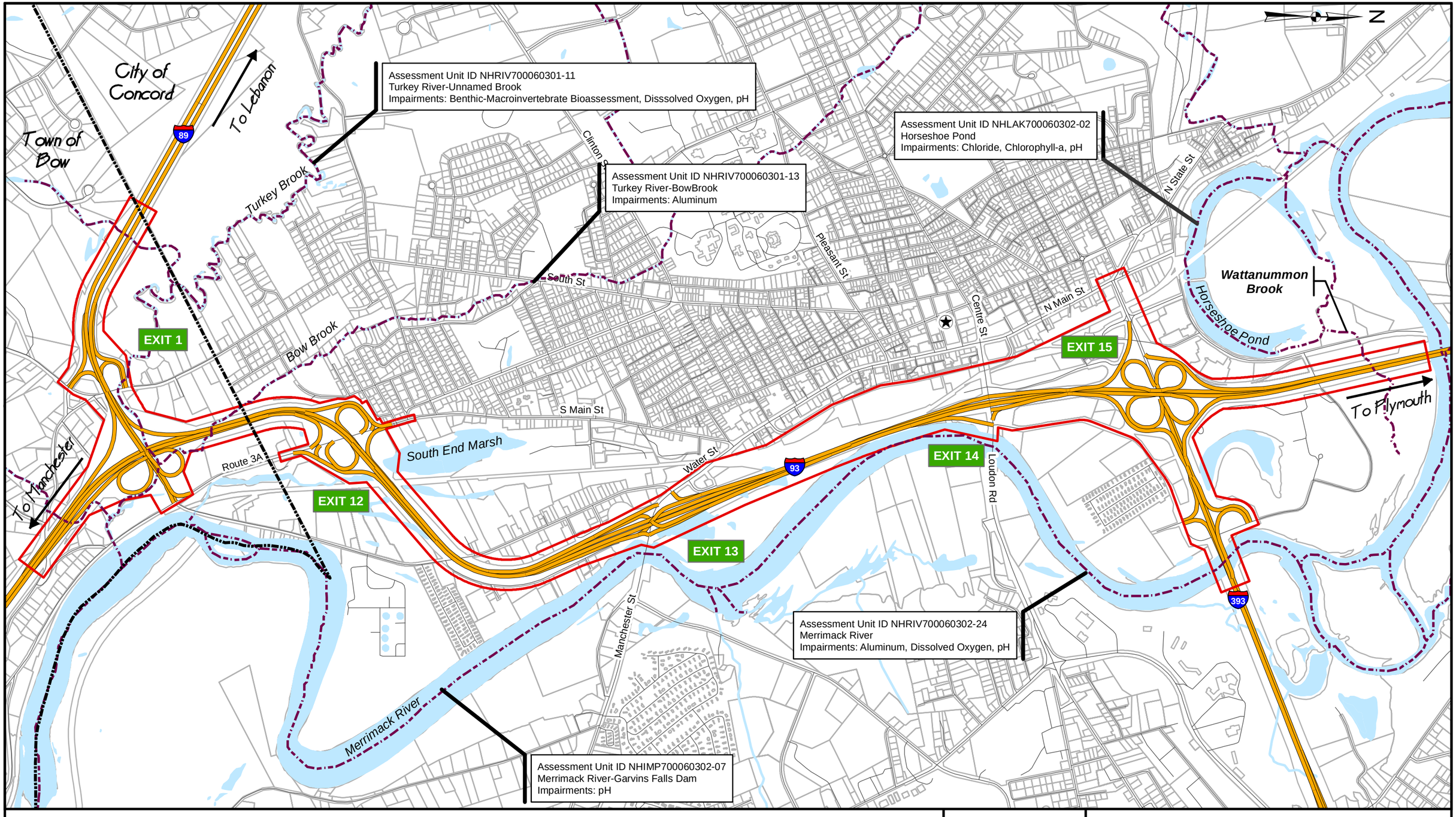

Legend

- Study Area
- Parcels
- Streams
- Rivers and Ponds
- Total Maximum Daily Load (TMDL) is Required - 2016 Section 303(d) List
- TMDL Required (Low Priority) - 2016 Section 303(d) List

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BOW-CONCORD I-93 IMPROVEMENTS

IMPAIRED WATERS OVERVIEW

FIGURE 3.12

DATE: AUGUST 2018

SCALE: 1"=1500'

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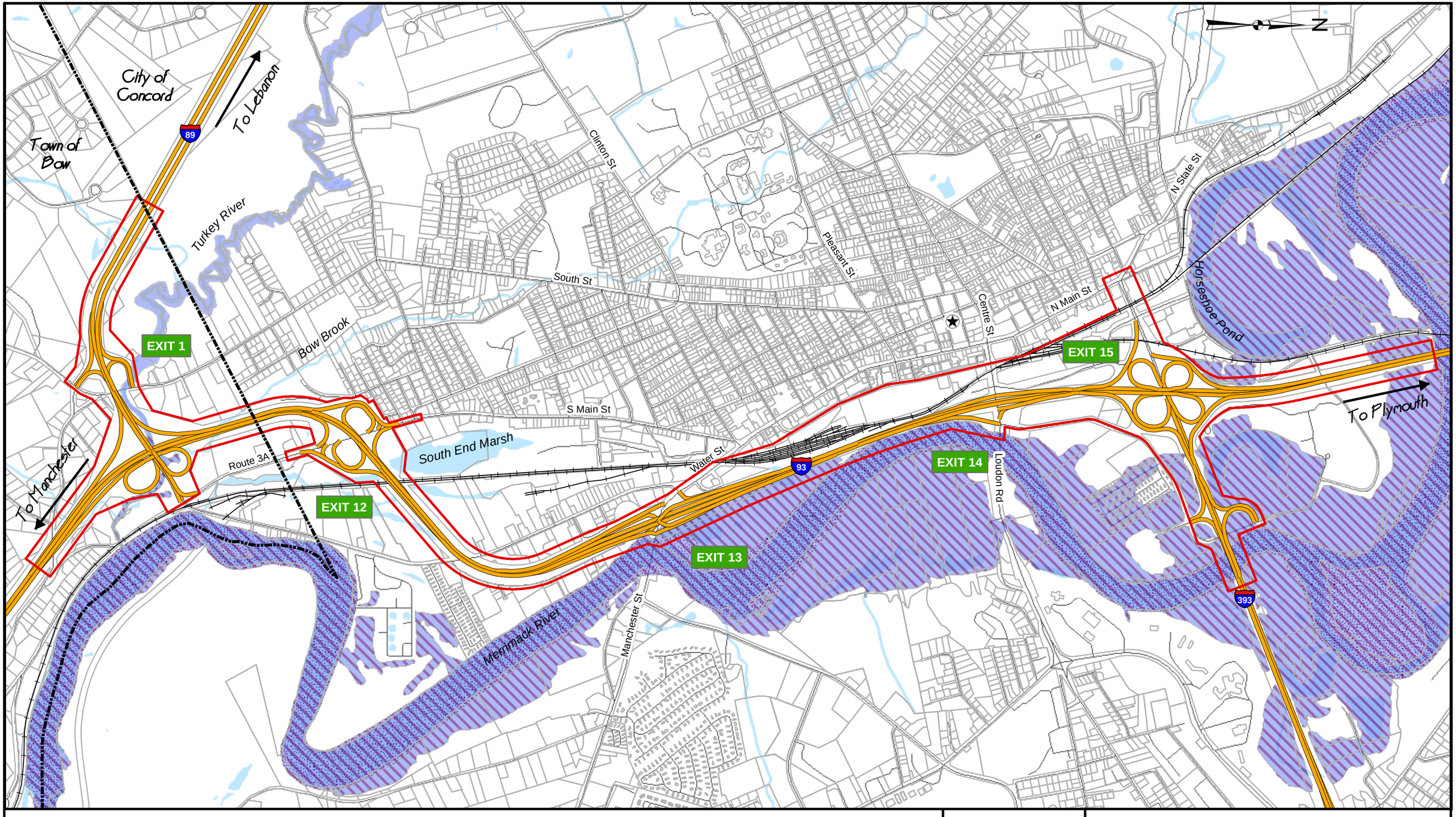

Legend

- Study Area
- Parcels
- Railroad
- Streams
- Rivers and Ponds
- Regulatory Floodway
- ZONE A - No Base Flood Elevation
- ZONE AE - Base Flood Elevation Provided

U.S. Department of Transportation Federal Highway Administration

New Hampshire DOT

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BOW-CONCORD I-93 IMPROVEMENTS

FLOOD HAZARD AREAS OVERVIEW

FIGURE 3.13

DATE: AUGUST 2018

SCALE: 1"=1500'

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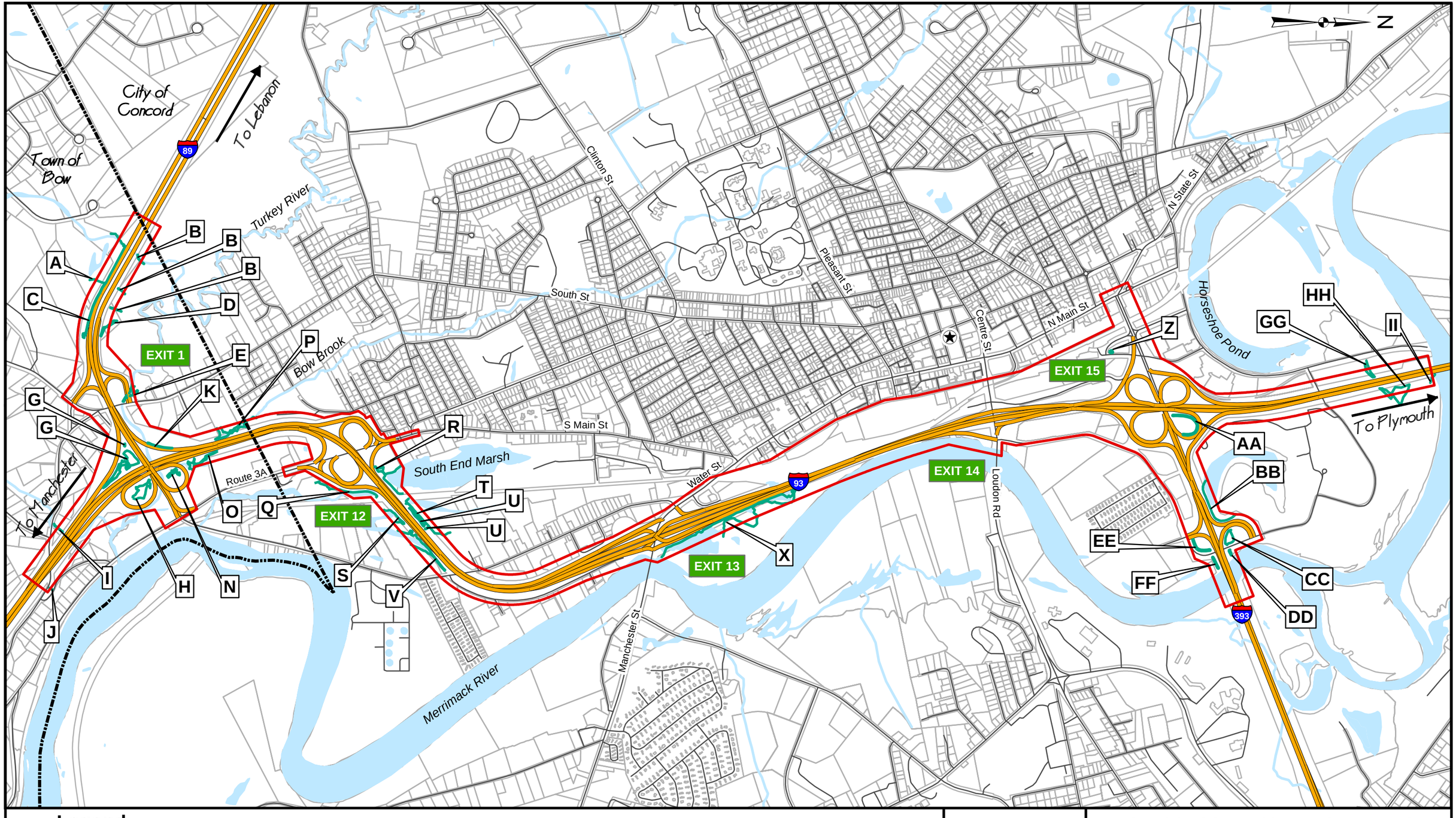

Legend

- State Capital
- Study Area
- Parcels
- Streams
- Rivers and Ponds
- Wetlands / Waterways

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BOW-CONCORD I-93 IMPROVEMENTS

DELINEATED WETLANDS

FIGURE 3.14

DATE: AUGUST 2018

SCALE: 1"=1500'

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N

City of Concord

Town of Bow

To Lebanon

89

Turkey River

Clinton St

South St

Pleasant St

Centre St

N Main St

N State St

Horseshoe Pond

EXIT 1

EXIT 15

Bow Brook

S Main St

To Plymouth

To Manchester

Route 3A

South End Marsh

Water St

93

EXIT 14

Loudon Rd

EXIT 12

EXIT 13

Manchester St

393

Merrimack River

National Wetland Inventory Key

L1UBH	PFO4E	PUBFh
L1UBHh	PSS/EM1E	PUBFx
PEM1A	PSS/FO1E	PUBH
PEM1Ad	PSS1A	PUBHh
PEM1E	PSS1Ad	PUBHx
PEM1F	PSS1C	R2UBH
PFO/SS1E	PSS1E	R2USA
PFO1A	PUB/EM1F	R2USC
PFO1E	PUBF	

Legend

- State Capital
- Study Area
- Parcels
- Streams
- Rivers and Ponds

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New Hampshire DOT

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BOW-CONCORD I-93 IMPROVEMENTS

NWI WETLANDS

FIGURE 3.15

DATE: AUGUST 2018

SCALE: 1"=1500'

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City of Concord

Town of Bow

To Lebanon

To Manchester

To Plymouth

N

89

93

393

EXIT 1

EXIT 12

EXIT 13

EXIT 14

EXIT 15

Turkey River

Bow Brook

South End Marsh

Merrimack River

Horseshoe Pond

Clinton St

South St

S Main St

Pleasant St

Centre St

N Main St

N State St

Water St

Manchester St

Loudon Rd

Route 3A

Legend

- State Capital
- Study Area
- Parcels
- Streams
- Rivers and Ponds

Bedrock

- Concord Granite (Late Devonian)
- Rangeley Formation

Soil Drainage Class

- Excessively drained
- Somewhat excessively drained
- Well drained
- Moderately well drained
- Poorly drained
- Very poorly drained
- Urban Land or Water

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BOW-CONCORD I-93 IMPROVEMENTS

SOILS AND BEDROCK OVERVIEW

FIGURE 3.16

DATE: AUGUST 2018

SCALE: 1"=1500'

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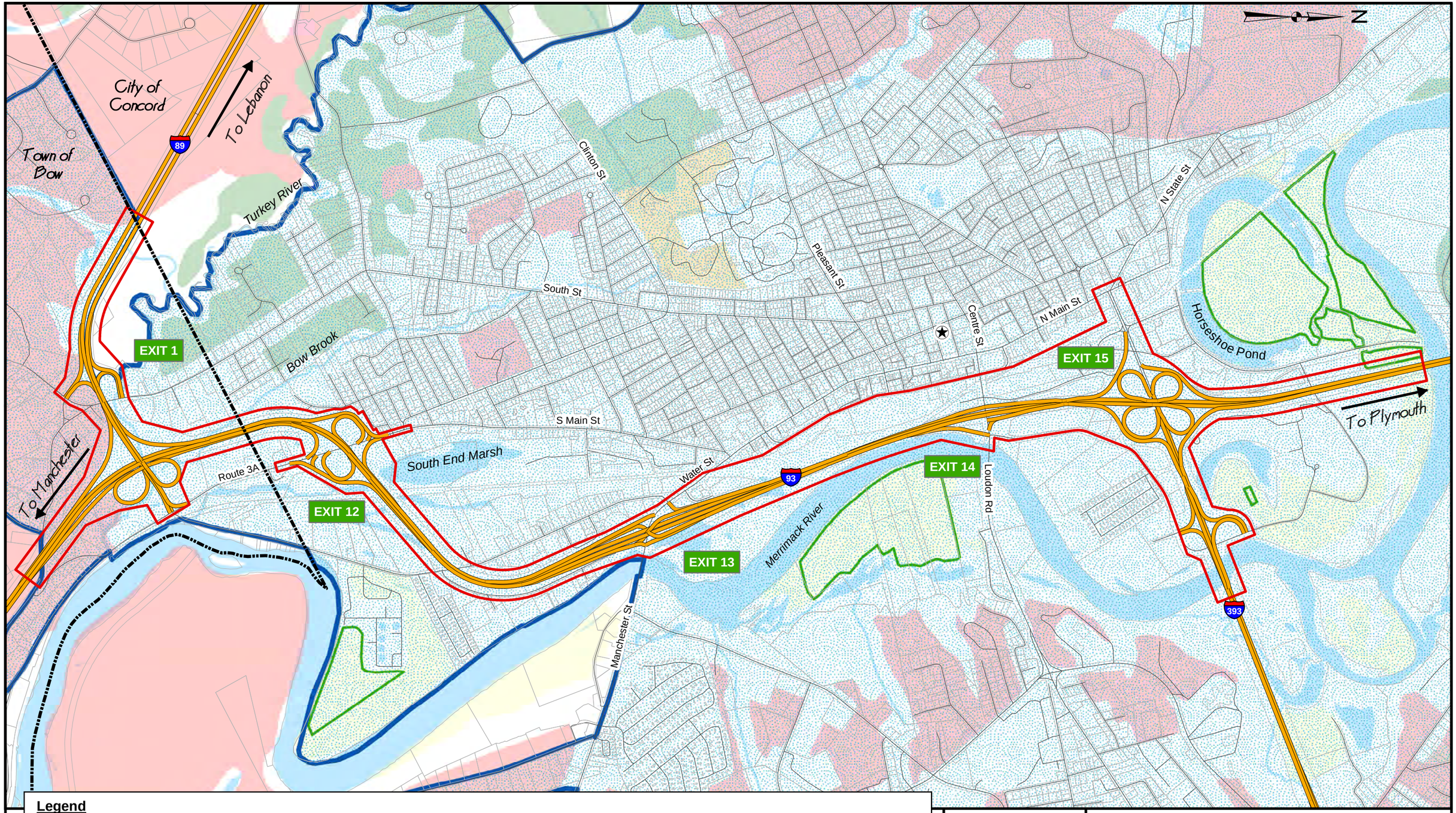

Legend

- StateCapital
- Study Area
- Parcels
- Streams
- Rivers and Ponds
- US Census Bureau 2010 Urbanized Cluster
- Active Agricultural Land

Soil Types

- Prime Farmland
- Farmland of statewide importance
- Farmland of local importance
- Prime farmland if not frequently flooded

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BOW-CONCORD I-93 IMPROVEMENTS

AGRICULTURAL RESOURCES OVERVIEW

FIGURE 3.17

DATE: AUGUST 2018

SCALE: 1"=1500'

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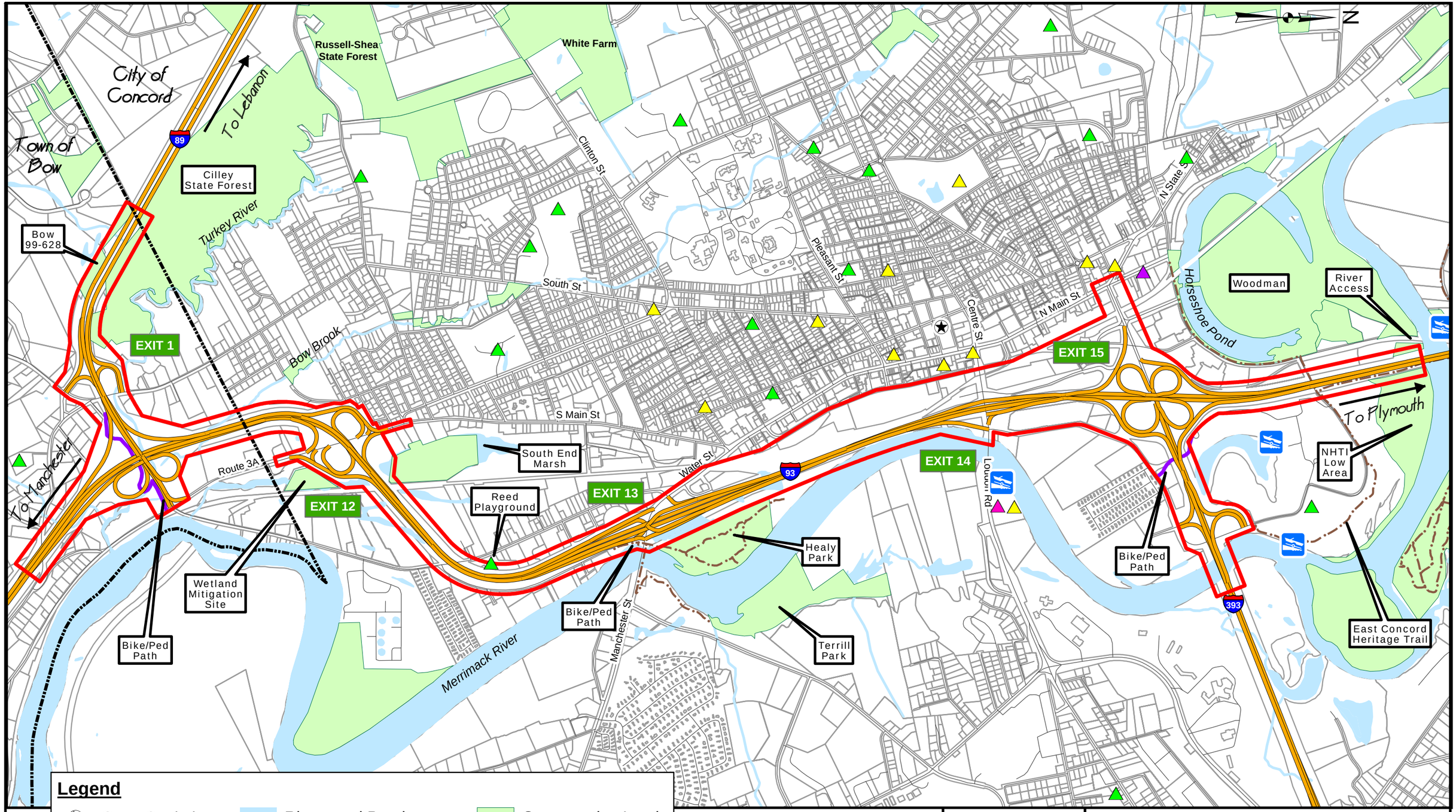

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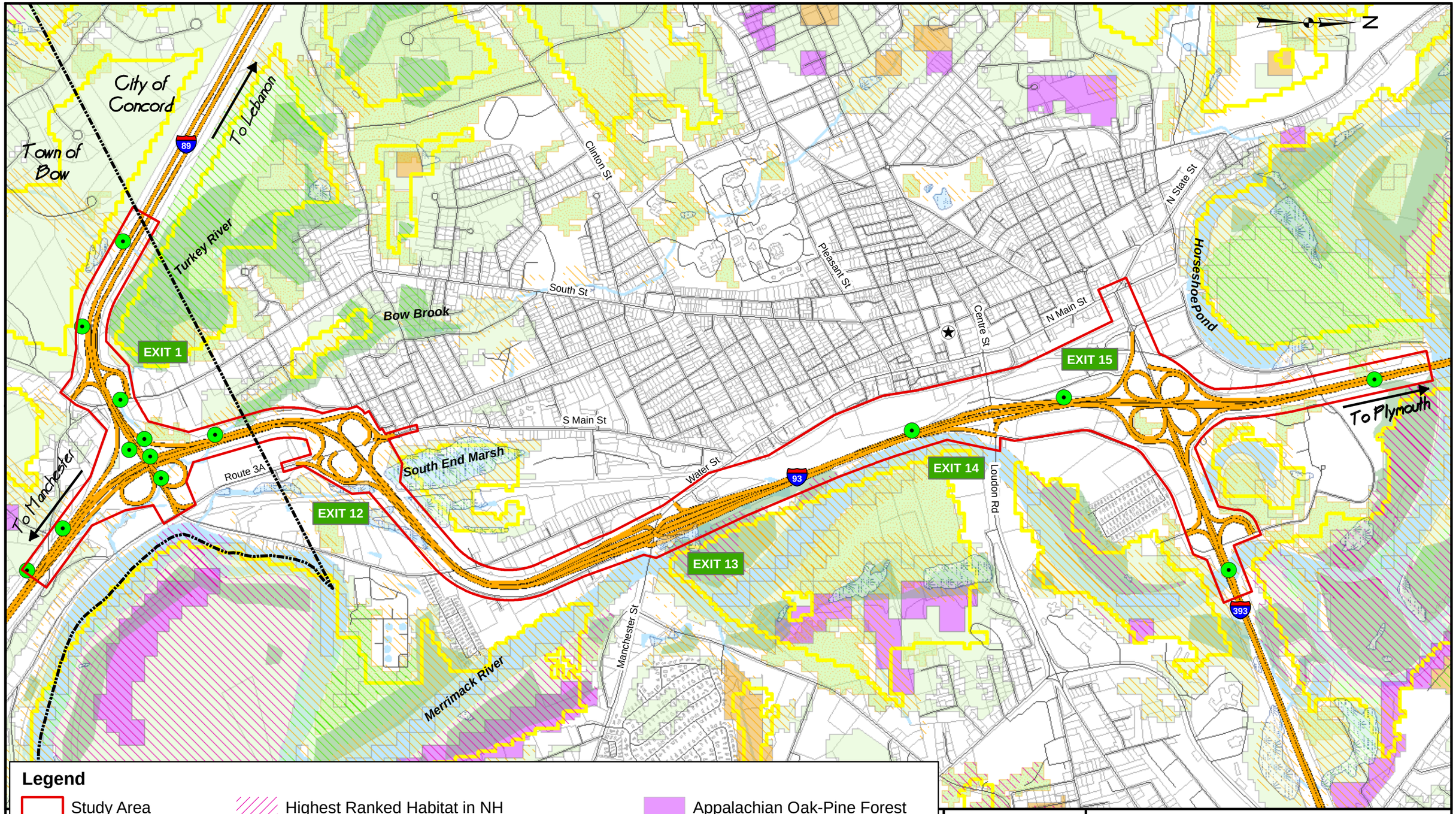
BOW-CONCORD I-93 IMPROVEMENTS

CONSERVATION AND PUBLIC LANDS

FIGURE 3.18

DATE: AUGUST 2018

SCALE: 1"=1500'



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BOW-CONCORD I-93 IMPROVEMENTS

PLANTS AND WILDLIFE OVERVIEW

FIGURE 3.19

DATE: AUGUST 2018

SCALE: 1"=1500'

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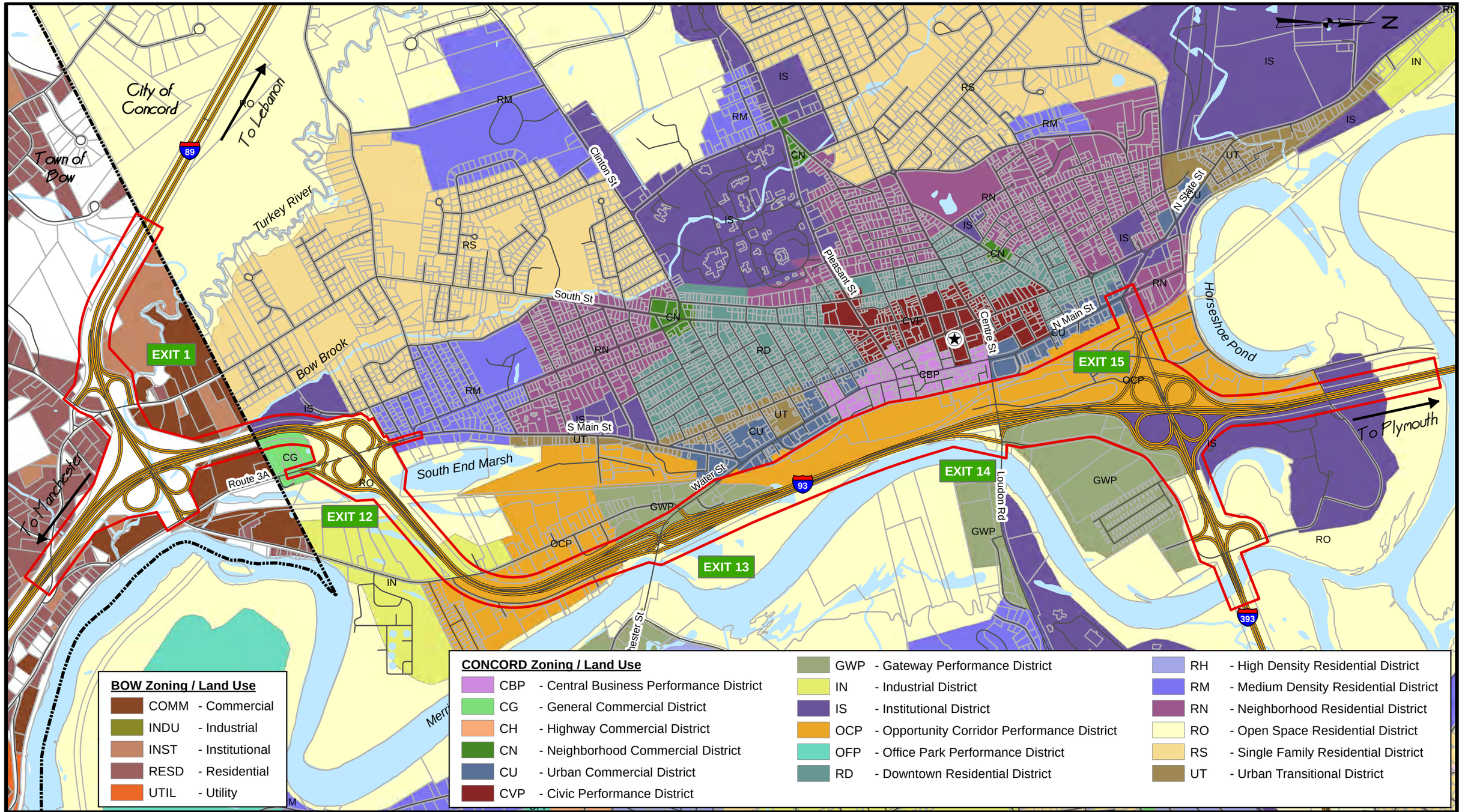

BOW Zoning / Land Use

COMM	- Commercial
INDU	- Industrial
INST	- Institutional
RESD	- Residential
UTIL	- Utility

CONCORD Zoning / Land Use

CBP	- Central Business Performance District
CG	- General Commercial District
CH	- Highway Commercial District
CN	- Neighborhood Commercial District
CU	- Urban Commercial District
CVP	- Civic Performance District
GWP	- Gateway Performance District
IN	- Industrial District
IS	- Institutional District
OCP	- Opportunity Corridor Performance District
OFP	- Office Park Performance District
RD	- Downtown Residential District
RH	- High Density Residential District
RM	- Medium Density Residential District
RN	- Neighborhood Residential District
RO	- Open Space Residential District
RS	- Single Family Residential District
UT	- Urban Transitional District

Legend

- State Capital
- Study Area
- Parcels
- Streams
- Rivers and Ponds

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BOW-CONCORD I-93 IMPROVEMENTS

ZONING AND LAND USE

FIGURE 3.21

DATE: AUGUST 2018

SCALE: 1"=1500'

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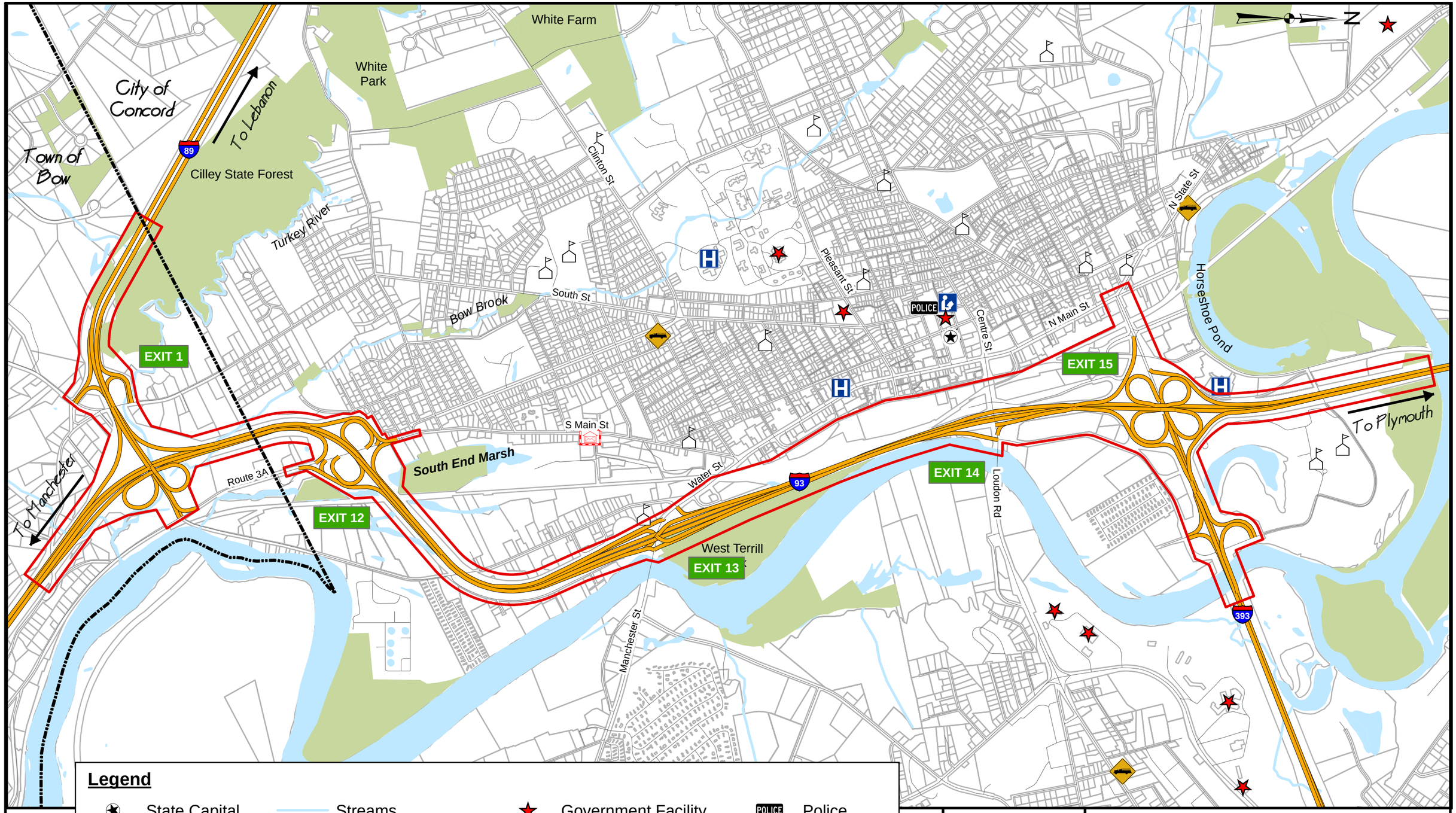

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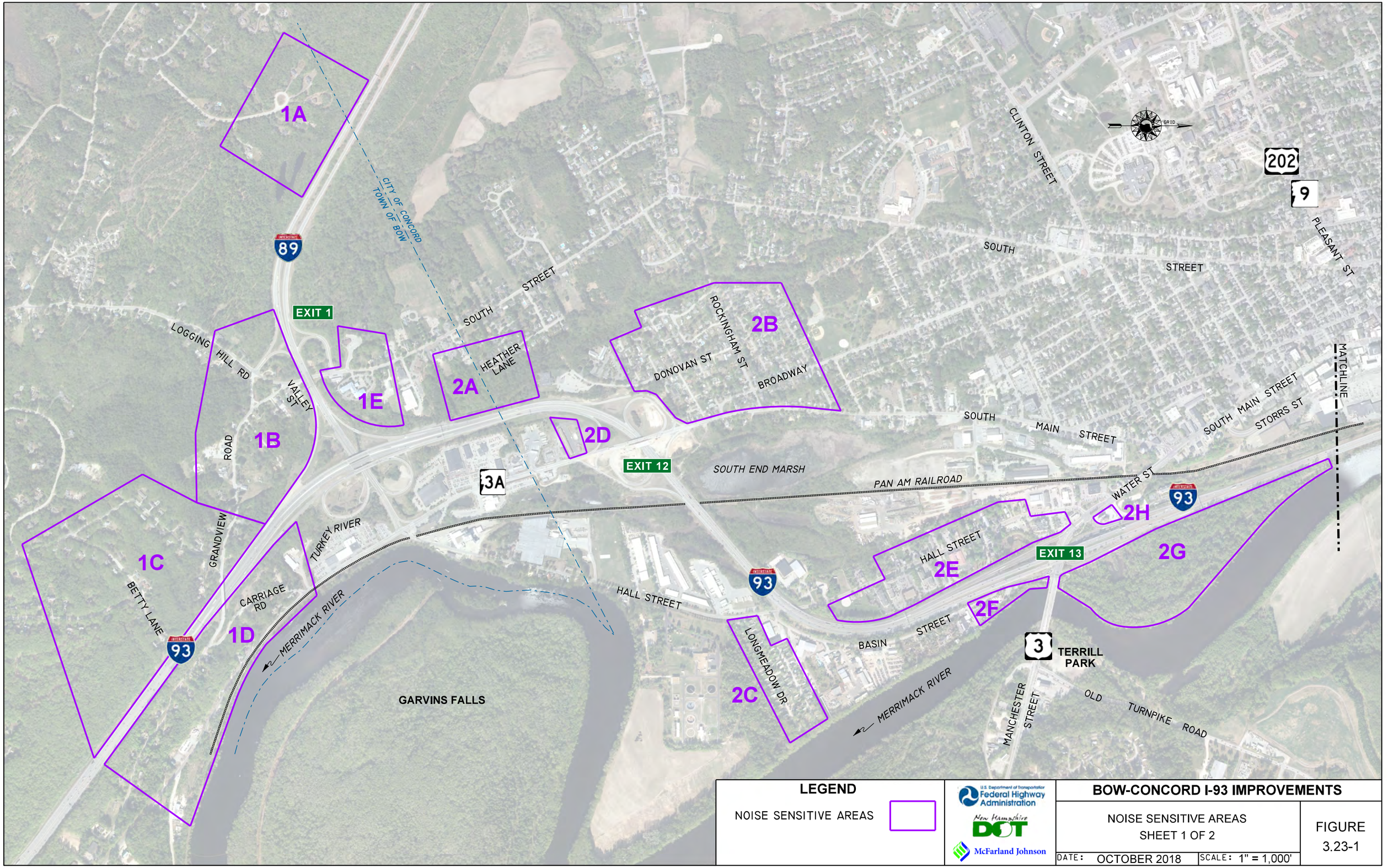
BOW-CONCORD I-93 IMPROVEMENTS

COMMUNITY RESOURCES OVERVIEW

FIGURE 3.22

DATE: AUGUST 2018

SCALE: 1"=1500'



LEGEND

NOISE SENSITIVE AREAS

U.S. Department of Transportation Federal Highway Administration

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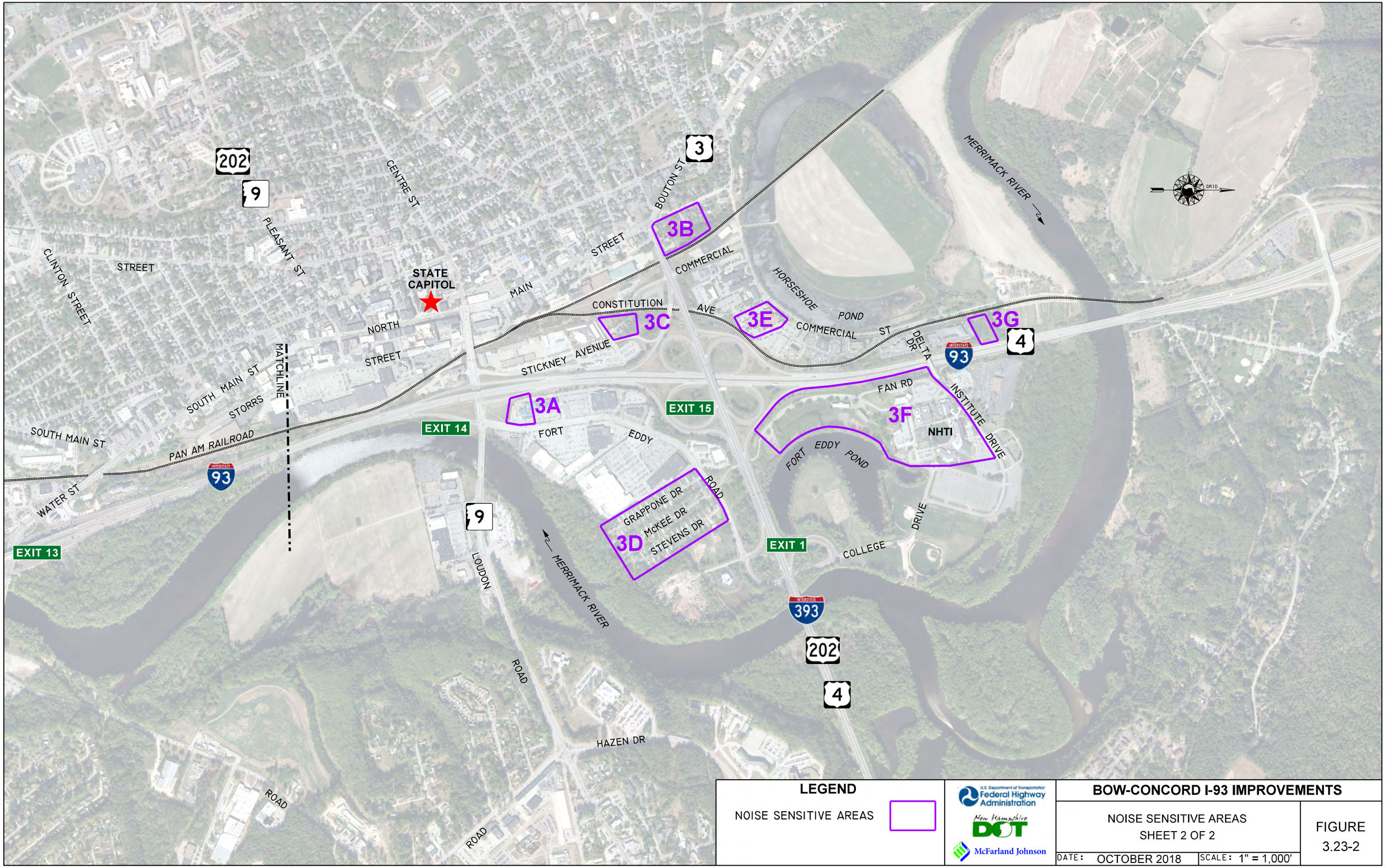
BOW-CONCORD I-93 IMPROVEMENTS

NOISE SENSITIVE AREAS
SHEET 1 OF 2

DATE: OCTOBER 2018

SCALE: 1" = 1,000'

FIGURE 3.23-1



LEGEND

NOISE SENSITIVE AREAS

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BOW-CONCORD I-93 IMPROVEMENTS

NOISE SENSITIVE AREAS
SHEET 2 OF 2

DATE: OCTOBER 2018

SCALE: 1" = 1,000'

FIGURE 3.23-2