

Chapter 2

Alternatives Screened and Evaluated

2.1 Introduction

To address the capacity and operational issues within the study limits as stated in the Project Purpose and Need (see Section 1.7), the NHDOT has evaluated various roadway widening and interchange improvements along the 4.5-mile segment of I-93 in Bow and Concord. The development of potential solutions for the corridor occurred in two parts. Part A was a planning study to identify potential solutions, screening of these solutions using a qualitative set of criteria, and determining a range of reasonable solutions. Part B is preliminary engineering and environmental documentation that began with the range of reasonable solutions from Part A, developed build alternatives that meet the purpose and need for the project, and the selection of a Preferred Alternative. In addition to the Build Alternatives developed during Part B, the No-Build (or No Action Alternative) has been included in the alternatives analysis. This chapter provides a summary of the alternative development process and detailed descriptions of those alternatives considered during Part B.

2.2 Part A Alternatives Summary

The alternatives developed in Part A were conceptual in nature as the goal of the study was to “identify all alternatives, concepts or options that could be considered for the corridor”, per the *Summary/Classification Report for the Bow-Concord Interstate 93 Transportation Planning Study* dated April 2008. These Part A alternatives included measures such as widening of the existing I-93, as well as bypasses, alternative routes, passenger rail, and local road improvements. Many of these alternatives were deemed unreasonable due to their cost, inability to address the purpose and need, associated property impacts, and/or significant environmental impacts.






Chapter 5 of the *Part A Summary/Classification Report for the Bow-Concord Interstate 93 Transportation Planning Study* provides details of how each alternative and component was screened. The screening process included extensive public involvement and utilization of a local stakeholders group, the Planning Group. The Planning Group was convened by NHDOT and included representation from community, environmental and transportation groups.

Part A also included “components” that were concepts that, by themselves, did not address the project purpose and need, but when combined with other alternatives or concepts potentially addressed the purpose and need. Components included shifting I-93 to the east, placing I-93 in a tunnel, passenger rail, and relocation of a section of the Merrimack River. In some cases, a concept was both an alternative and a component. As with the alternatives, some components were deemed unreasonable due to their cost,

inability to address the purpose and need, associated property impacts, and/or significant environmental impacts.

Each alternative or component was screened by the Planning Group using standard criteria to ensure the credibility of the screening. A colored circle scoring system was used with red indicating a negative score and green indicating a positive score. A yellow circle was used to indicate a neutral score. **Figure 2.1 Part A Screening Scoring System** presents the scoring system in more detail.

Figure 2.1: Part A Screening Scoring System

Part A Scoring System				
				
Fatal Flaw Impact Serious Degradation Unreasonable Strong Opposition	Negative Impact Degradation Opposition	Neutral Not Applicable No Impact	Benefit Improvement Enhancement Support	Substantial Benefit Substantial Improvement Reasonable Strong Support

The screening resulted in reasonable and required alternatives and reasonable components as follows. The first three of these four are alternatives that are required to be evaluated in Part B by the NEPA and FHWA processes.

Reasonable and Required Alternatives

- No Build
- Travel Demand Management (TDM) strategies
- Transportation System Management (TSM) strategies
- Opportunity Corridor Concept Option 1 (widen I-93 with interchange improvements)

Reasonable Components

- Transportation System Management (TSM) strategies
- Alternate land use
- I-93 Tunnel
- Rail Transit in I-93 Median
- Preservation of the rail corridor
- Safety improvements
- Enhanced pedestrian and bicycle facilities
- Travel Demand Management (TDM) strategies

Several of the components that were specifically identified during Part A that should be part of all build alternatives in Part B include:

- Preservation of the rail corridor
- Safety improvements
- Enhanced pedestrian and bicycle facilities
- Travel Demand Management (TDM) strategies

2.3 Part B Alternatives

This section details the range of alternatives considered during Part B, including the three alternatives identified in Part A as required by NEPA/FHWA that have been brought forward to the Part B evaluation process. The required alternatives include No Build, TDM and TSM.

2.3.1 No Build Alternative

The No Build Alternative serves as a benchmark for comparison to the build alternatives. The No Build assumes that no improvements are made to the I-93 corridor or its interchanges to address capacity and operational issues within the project area. However, other projects that have been programmed and approved for the project area and region have been included, such as the following:

- Langley Parkway
- Storrs Street north extension
- Storrs Street south extension
- Whitney Road Extension
- Manchester Street widening to 2 lanes in each direction
- I-89 Exit 2 Roundabouts
- McKee Square Roundabout

Traffic volumes for the corridor are assumed to increase based on projections prepared by the Central NH Regional Planning Commission (CNHRPC), which is the designated Metropolitan Planning Organization for the region. The increased traffic volumes will result in increased congestion, especially during peak periods. Crashes are likely to increase since the existing deficiencies will remain, with higher traffic volumes. Other aspects of the No Build include the continued deterioration of Red List and other bridges as well as the continued discharge of stormwater into area waterways without treatment.

2.3.2 Travel Demand Management

Travel Demand Management (TDM) strategies aim to reduce the demand for travel during peak travel periods such as the morning and afternoon commuting times, rather than increase the capacity of the transportation system. These strategies require changing travel behavior during peak travel periods to reduce the number of vehicles on the road.

By eliminating trips, shortening trips, or shifting trips out of the peak periods, there is less demand for the transportation network to accommodate. Typical TDM strategies include:

- Expanded Transit Service
- Park and Ride Facilities
- Work from Home
- Flexible Work Hours
- Toll Pricing
- Increased Law Enforcement
- High Occupancy Vehicle Lanes
- Car-Pooling

2.3.3 Transportation Systems Management

Transportation Systems Management (TSM) refers to low cost easy to implement measures to address safety and congestions issues. These measures typically can be implemented without significant impacts or cost. Typical TSM measures include:

- Intelligent Transportation Systems
- Ramp Metering
- New Traffic Signals
- Re-timing Traffic Signals
- Turn Lanes
- New Lane Striping
- Signage

2.3.4 Development of Part B Build Alternatives

The only conceptual build alternative that was carried forward from Part A is the Opportunity Corridor Concept Option 1 (OCCO1). As discussed in the Part A *Summary/Classification Report for the Bow-Concord Interstate 93 Transportation Planning Study*, the base Opportunity Corridor Concept was developed in greater detail because it was part of another study conducted in 2005, the *2005 Concord Opportunity Corridor Master Plan*. The *2005 Concord Opportunity Corridor Master Plan* developed a concept that included widening of I-93 to six lanes and reconfiguring Exits 14 and 15. It also included other improvements to the road network that are not part of this project.

The OCCO1 did not propose improvements to other interchanges within the limits of the project. OCCO1 did specify that there is a need to reconfigure the other interchanges within this project limits, however, no specific configurations were developed. Part A included four other options of the Opportunity Corridor Concept, but all of those were deemed unreasonable by the Planning Group during the screening process due to cost, property impacts and/or elements outside the scope of the project.

For the purposes of Part B, the OCCO1 has been developed to include improvements to the other interchanges in the project area, in addition to widening of I-93 and reconfiguring Exits 14 and 15 reviewed in the *2005 Concord Opportunity Corridor Master Plan*. The specific configurations for Exit 14 and Exit 15 proposed by OCCO1 have been considered, but Part B did not limit the improvements of Exits 14 and 15 to those proposed in the OCCO1.

As discussed above in Section 2.2, there were four components identified in Part A that the Planning Group specifically recommended should be part of all build alternatives. Below is a discussion of how each of these components was incorporated into the Part B build alternatives.

- Preservation of the rail corridor: All build alternatives discussed later in this chapter preserve the existing rail corridor and accommodate for future passenger rail service as proposed in the Capitol Corridor Rail and Transit Alternatives Analysis.
- Safety improvements: The build alternatives have specifically addressed the deficiencies outlined in Sections 1.5 and 1.6 of the EA, including both the roadway geometry issues and the Red List Bridges. Six bridges within the project limits that are currently on the Red List would be addressed by all of the considered build alternatives.
- Enhanced pedestrian and bicycle facilities: Within the project limits the build alternatives include expanded sidewalks and bicycle lanes on all local roads. In particular, in all of the build alternatives Loudon Road would be improved to include sidewalks and bicycle lanes on both sides of the road, which would facilitate non-motorized access from Downtown Concord to Fort Eddy Road and The Heights District, a significant concern for residents of Downtown Concord.
- Travel Demand Management (TDM) strategies: The build alternatives preserve and in some cases expand Park and Ride capacities within the project limits.

2.3.5 Interstate 93 Widening

As stated in the Project Purpose and Need statement (Chapter 1, Section 1.7), “increased congestion and increased travel times are expected” along I-93 if traffic volumes increase. The traffic projections developed for the project indicate that traffic volumes would increase and by the 2035 design year, I-93 through Bow and Downtown Concord would require six traffic lanes, three in each direction, to accommodate this future traffic demand. See discussion below regarding auxiliary lanes, which are warranted and proposed between the interchanges. The traffic demand modeled for 2035 design year does not justify an eight-lane interstate, four lanes in each direction. Therefore, all the build alternatives developed for the project include the widening of I-93 to a basic six-lane interstate from south of I-89 through Exit 15. **Table 2.1 I-93 Traffic Volumes** outlines the peak hour traffic, both AM and PM, for the various segments of I-93 within the project limits for the base year 2014 and projected demand for 2035.

Table 2.1: I-93 Traffic Volumes

	Peak Hour Volumes (Vehicles per Hour)					
	Existing 2014 ¹		Projected 2035 ²		Percent Change	
	AM	PM	AM	PM	AM	PM
Between I-89 and Exit 12						
Northbound	3,452	3,458	4,039	4,352	+17.0%	+25.9%
Southbound	2,617	3,625	3,267	4,192	+24.8%	+15.6%
Between Exit 12 & 13						
Northbound	3,430	3,807	4,045	4,747	+17.9%	+24.7%
Southbound	2,854	3,657	3,633	4,238	+27.3%	+15.9%
Between Exit 13 & 14						
Northbound	3,005	3,836	3,398	4,697	+13.1%	+22.4%
Southbound	3,246	3,128	4,077	3,968	+25.6%	+26.9%
Between Exit 14 & 15						
Northbound	2,035	3,351	2,265	4,104	+11.3%	+22.5%
Southbound	3,567	2,723	4,714	3,265	+32.2%	+19.9%

¹ The existing volumes are based on actual counts in 2014.

² The projected volumes are demand volumes from the Central NH Regional Model developed by RSG in 2015. The projected volumes represent true demand and not just the volume that can be accommodated by the existing roadway system.

Much of the proposed widening of I-93 is symmetric, meaning the centerline of the corridor is retained and the widening occurs equally on both sides. This balances the impacts and allows the widening to be completed within the existing right-of-way, in most cases. Retaining walls are proposed to avoid additional impacts to environmental and cultural resources and to reduce impacts outside of the I-93 right-of-way limits. The one exception to the centerline widening is near Exits 14 and 15 where shifts of I-93 are considered. These shifts are discussed later in this chapter.

The widening of I-93 and the reconstruction of the ramps at the interchanges also requires an evaluation of the need for auxiliary lanes on the mainline between successive ramps. As specified in AASHTO, the two main criteria used to evaluate the need for auxiliary lanes were the operation of the ramp merges and diverges and the spacing between successive entrance and exit ramps. As a result of this evaluation, it was determined that auxiliary lanes are warranted between interchanges for all segments of I-93, both northbound and southbound.

Between I-89 and Exit 12 and between Exits 13 and 14, the distance between the entrance ramps and subsequent exit ramps is less than the minimum 2,000 feet distance recommended by ASSHTO. Therefore, auxiliary lanes are proposed to address this deficiency.

Between Exits 12 and 13 the volume of traffic, and the amount of traffic entering and exiting I-93 with the concurrent merging and weaving of traffic, creates congestion that results in poor operations. The operations of these merges and diverges is measured by its Level of Service (LOS). LOS is the measure of density and speed that occurs at the merges and diverges. For the purposes of the project, a peak period LOS of A through D is considered acceptable. An LOS E or F is considered unacceptable. The auxiliary lanes improve the operations to the acceptable levels. **Table 2.2 LOS Criteria for Freeway Segments** outlines the various LOS grades and descriptions for basic, weave, merge, and diverge segments. Auxiliary lanes are proposed to provide an acceptable LOS between Exits 12 and 13 in both directions.

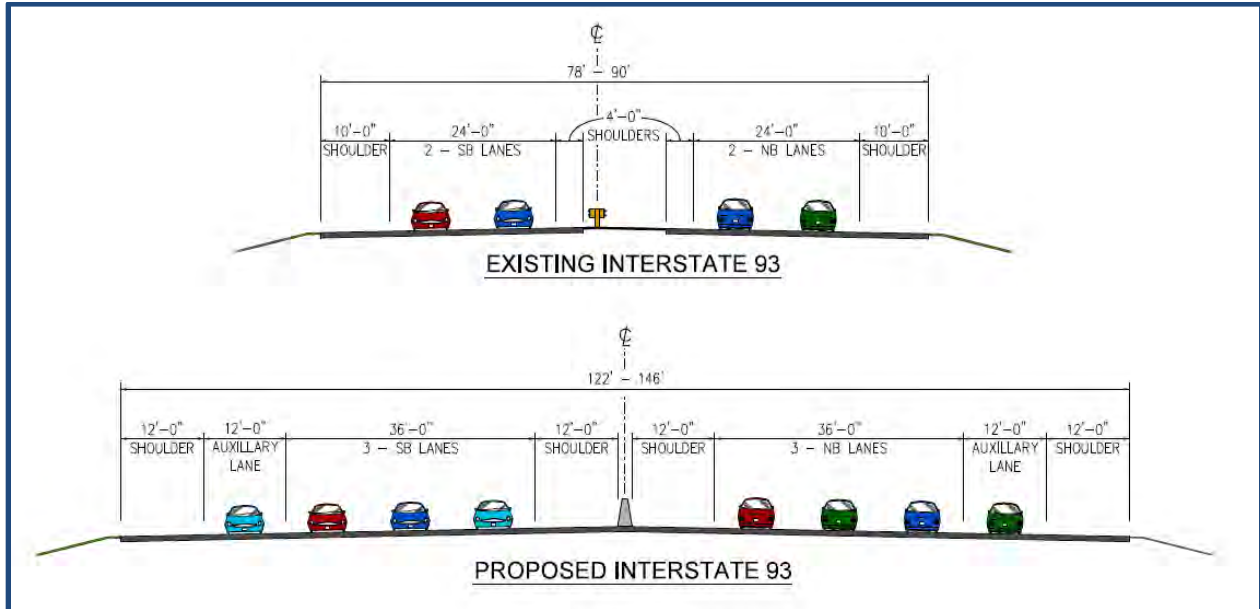
Table 2.2: LOS Criteria for Freeway Segments

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

Source: Highway Capacity Manual, 6th Edition

Between Exits 14 and 15 the distance between the entrance ramps and subsequent exit ramps is less than the minimum 2,000 feet distance recommended by AASHTO. However, the particular concept addresses this deficiency with different strategies, including auxiliary lanes, collector-distributor roads, or the elimination of ramps.

The widening would also accommodate standard 12-foot inside and outside shoulders throughout the 4.5-mile corridor. **Figure 2.2 I-93 Typical Sections** depicts the existing and proposed typical sections for I-93.

Figure 2.2: I-93 Typical Sections

Within the project area there are seven full access interchanges that would be impacted by the widening of I-93. Each of these interchanges have their own issues and deficiencies that this project must address as simply widening I-93 does not fully meet the project purpose and need. Some of these interchanges are in close proximity to each other and must be evaluated together due to their interaction. Therefore, for the purposes of alternatives development, the project area has been separated into four segments. The four segments are geographic and are referred to as follows:

- I-89 Area (Includes Exit 1 on I-89)
- Exit 12 Area
- Exit 13 Area
- Exit 14/15 Area (Includes Exit 1 on I-393)

Figure 2.3 I-93 Segments depicts the four project segments and improvement projects completed by NHDOT in 2002, 2010, 2015 and 2016.

The development of concepts for each of the four segments was completed in a multi-phased manner. The design team gathered information on each segment from previous studies, NHDOT generated concepts, or concepts previously developed. Once a concept was envisioned, the design team developed horizontal geometry to determine whether a concept was feasible and met the purpose and need. In many cases the concept was determined not to be feasible and it was discarded. At the end of this phase each segment had numerous concepts for consideration. These concepts were presented to the NHDOT for review and those that addressed the purpose and need to the fullest extent were retained for further investigation and development. In many cases two

concepts were very similar and the better of the two was selected for further consideration. This is why the naming of concepts does not include all letters or numbers sequentially. **Table 2.3 Build Concepts for each Segment** lists the build concepts developed for each segment and the following sections contain detailed descriptions of the concepts that have been carried forward for detailed evaluation in this document.

Table 2.3 Build Concepts for each Segment

SEGMENT	CONCEPT	DESCRIPTION
I-89 Area	C	Shifted I-89 Exit 1.
	K	Eliminate weaving between I-89 Exit 1 and I-93.
	P	Same as Concept K with all directional ramps between I-89 and I-93.
Exit 12 Area	E	Partial cloverleaf with signalized intersections.
	F	Partial cloverleaf with hybrid roundabout intersections.
Exit 13 Area	A	Retain Exit 13 with new signal for northbound exit ramp.
	B	Retain Exit 13 with new signal and dual right turn for northbound exit ramp.
Exit 14/15 Area	D2	Retain Exit 14 and 15 configurations except eliminate northbound entrance ramp at Exit 14.
	F	SPIU ¹ at Exit 14 and cloverstack at Exit 15 with C-D ² Roads between Exits 14 & 15.
	F2	Retain Exit 14 configuration except eliminate northbound entrance ramp and cloverstack at Exit 15.
	O3	Flip Exit 14 orientation, depress I-93, directional ramps at Exit 15, C-D Road southbound between Exits 14 & 15.

¹ Single Point Urban Interchange

² Collector-Distributor Road

For each concept a total concept cost estimate has been developed based upon the preliminary design. For each of the project segments the cost estimates include the work on I-93, I-89 and/or I-393 as well as the work associated with the interchanges. The cost estimate includes the cost of construction, construction engineering, design engineering, right-of-way acquisition, mitigation, and utility relocation.

2.3.6 Interstate 89 Area

The I-89 Area covers the I-93/I-89 interchange area consisting of approximately 3,700 feet of I-93 beginning where the six-lane section extending from Manchester terminates just south of I-89 and continues north to a point approximately half way between the I-93/I-89 interchange and Exit 12 (Route 3A). There is a third southbound lane that originates at the Exit 12 on ramp and continues south through the I-93/I-89 interchange,

which was constructed as part of a recent bridge replacement project. It also covers approximately 4,700 feet of I-89 from I-93 north to beyond Exit 1. I-89 begins at the I-93/I-89 interchange with the I-89 extending for an additional 1,000 feet from the ramps connecting with Route 3A and Hall Street, known as Bow Junction, which is also included within the project area. The intersection of I-89, Route 3A and Hall Street is known as Bow Junction to the travelling public. See **Figure 2.4 I-89 Existing Conditions** for the existing conditions of the I-89 Area.

A main element of this area is the I-93/I-89 Interchange, which is a critical junction in Central New Hampshire. It is a modified trumpet interchange where I-89 ends at I-93 and is a system interchange linking two freeways. There are direct and loop ramps connecting the two Interstate routes. Exit 1 on I-89 is located only $\frac{1}{4}$ mile from the I-93/I-89 Interchange. Exit 1 on I-89 is a partial cloverleaf interchange with all ramps located on the west side of South Street in order to provide the maximum separation between the ramps and the I-93/I-89 Interchange. Exit 1 is the only interstate full access interchange that provides direct access to the Town of Bow.

The close proximity of the two interchanges results in a short weaving section for both northbound and southbound I-89 traffic between the two interchanges. AASHTO describes weaving as “highway segments where the pattern of traffic entering and leaving at contiguous points of access results in vehicle paths crossing each other”. In particular, the southbound weave that involves traffic entering from Exit 1 and I-89 traffic exiting to southbound I-93 has long been a concern for those traveling in Bow. The distance between the entrance and exit ramps is approximately 440 feet, which is less than the AASHTO recommended 2,000 feet. This weave is made worse by the excessive speeds that are driven by traffic on southbound I-89. The grade of I-89 in the area is about 3% downhill and keeping traffic at or below the 40-mph speed limit has been unsuccessful. Reduced speed warning signs were installed several years ago but speeds continue to be well above the speed limit. The limited sight distance for those entering at Exit 1 contributes to the poor operations as this entering traffic is traveling at speeds much lower than the traffic it is weaving with I-89.

This weave currently operates at a level of service (LOS) E/D (AM Peak Period/PM Peak Period) that projects to LOS F/E by 2035. As stated above, for the purposes of the project, a peak period LOS of A through D is considered acceptable. An LOS E or F is considered unacceptable. For the southbound I-89 weave between Exit 1 and I-93, this unacceptable LOS exists even while input received at public meetings over many years has indicated that some residents of Bow avoid using Exit 1 because they feel the interchange is not safe.

The northbound I-89 weave between I-93 and Exit 1 currently has an LOS B/E that by 2035 is projected to be LOS F/E. There is a substantial increase in morning peak hour traffic on the southbound I-93 to northbound I-89 ramp that results in the dramatic reduction in LOS between 2014 and 2035. The distance between the entrance and exit ramps is approximately 500 feet, which is less than the AASHTO recommended 2,000

feet. Speed is not as critical an issue for this weave as traffic is starting from a stopped condition at the Route 3A/Hall Street intersection.

There is also a short weave within the I-93/I-89 Interchange between the two loop ramps. A collector-distributor (C-D) Road connects the northbound I-93 ramp to I-89 northbound, as well as the southbound I-89 ramp to I-93 northbound. This weave currently has an LOS E/E that projects to LOS F/F by 2035. The distance between the entrance and exit ramps is approximately 400 feet, which is less than the recommended 1,600 feet for this location by AASHTO. AASHTO standards allow a shorter weave distance on C-D Roads than on highway mainlines. These ramps have high volumes of traffic as they accommodate traffic moving between the two interstates.

There is one Red List bridge within the I-89 Area; the bridge that carries I-89 over South Street (Bridge #132/160). The deck and superstructure of this bridge are rated in poor condition. The bridges that carry I-93 over I-89 were recently replaced with the ability to accommodate a six-lane interstate.

There are bicycle routes located in the I-89 Area that include one designated state bicycle path, the I-89 Bicycle Path in Bow. The I-89 Bicycle Path begins at the end of Valley Road where it heads northeast through the I-93/I-89 interchange. The path includes two tunnels under interchange ramps. The path ends at the Route 3A/Hall Street intersection. The remaining bicycle routes follow existing local roads.

2.3.6.1 – Interstate 89 Area Concept C

The first alternative under consideration for the I-89 Area is Concept C – Shifted Exit 1. Concept C proposes shifting Exit 1 further to the west to lengthen the weave between Exit 1 and the I-93 ramps to approximately 1,000 feet, which is less than the 2,000 feet recommended by AASHTO. Providing a longer weaving length does improve the operations of both the northbound and southbound weaves. The southbound weave would improve from LOS F/E to LOS D/C in 2035. The northbound weave would improve from LOS F/E to LOS B/B in 2035. Concept C does not address the weave for the northbound C-D Road within the I-93/I-89 Interchange. This concept replaces the I-89 Bridge over South Street, which is on the Red List. See **Figure 2.5 I-89 Area Concept C** for a plan.

There are four structures within the I-89/Exit 1 Area that do not need to be modified to accommodate Concept C, but which would have routine preservation work conducted by the project. Routine preservation planned for this alternative includes, but is not limited to, new pavement, new joints and protective membrane for bridges and concrete repairs for the culvert. The structures are:

- South Street bridge over the Turkey River
- I-93 southbound to I-89 northbound Ramp bridge over the Turkey River
- I-93 northbound C-D Road bridge over I-89 and the Turkey River
- I-89 over the Turkey River (box culvert)

The Bicycle Path in the I-89 Area would not be affected by Concept C.

The total cost for Concept C is estimated at \$34.1 million.

2.3.6.2 – Interstate 89 Area Concept K

Concept K retains the basic configuration of both interchanges; however, it proposes “braided” ramps between the two interchanges. The term “braid” refers to a grade separated crossing that occurs at an acute angle that resembles braids. The braided ramps eliminate the weaving section between the two interchanges. Additional ramps are proposed to allow retention of all of the existing accesses, but without the need for vehicles to cross each other in a weave. See **Figure 2.6 I-89 Area Concept K** for a plan.

Concept K proposes a C-D Road for southbound I-89 traffic that would accommodate traffic utilizing Exit 1 and travelling southbound on I-93. The Exit 1 ramp would diverge from the C-D Road, which would continue and cross over the Exit 1 entrance ramp via a bridge. The Exit 1 entrance ramps would later split to accommodate traffic destined for northbound I-93, along I-89 south to the existing loop ramp area, and southbound I-93. Concept K proposes a local connector road between Route 3A and South Street to accommodate northbound I-89 traffic. This connector road would provide access to South Street from Bow Junction. The southbound exit ramp from I-93 to northbound I-89 would cross, or braid, the connector road, thereby eliminating the existing northbound weave. A signal would be necessary at the intersection of South Street, the new connector road, and the I-89 northbound ramps. All improvements proposed by Concept K would be accommodated by the new bridges that carry I-93 over I-89 and the Turkey River as well as the existing bridge that carries the C-D Road over I-89 and the Turkey River. New bridges would be needed to realize the braided ramps for both I-89 segments between I-93 and Exit 1.

Concept K would include construction of a new directional ramp for northbound I-93 to northbound I-89 traffic. The new directional ramp proposed in Concept K would have a 40-mph design speed as compared to the existing loop ramp that has a 25-mph design speed. While the existing northbound C-D Road would remain, a significant portion of the traffic volume in the weave would be diverted since the northbound I-93 to northbound I-89 traffic would use the new directional ramp. The reduced traffic would result in an improvement of the weave from LOS F/F to LOS D/B by 2035. The existing loop would be reconfigured to terminate at the new connector road, which would provide an access route to Bow Junction from I-93 that currently does not exist. This connection also perpetuates the connection for northbound I-93 traffic to access South Street.

Providing the new directional ramp for northbound I-93 to northbound I-89 traffic would result in the elimination of the direct connection of the I-89 extension to Bow Junction. This traffic could still access Bow Junction, but would have a longer route to do so, using Exit 1 on I-89, Exit 12 on I-93, or the proposed I-93/I-89 interchange. This diversion of traffic is of concern, including for local businesses, as Route 3A is a truck route and many

trucks use the Bow Junction intersection to access I-89. The additional traffic on South Street and Logging Hill Road would require that both Exit 1 ramp intersections be signalized. Improvements to Logging Hill Road would also be included to provide adequate sight distance near the southbound ramps intersection.

There are two structures within the I-89/Exit 1 Area that do not need to be modified to accommodate Concept K, but which would have routine preservation work conducted by the project. Routine preservation includes, but is not limited to, new pavement, new joints and protective membrane for bridges and concrete repairs for the culvert. The structures are:

- I-93 northbound C-D Road bridge over I-89 and the Turkey River
- I-89 over the Turkey River (box culvert)

Retaining walls would be required along several of the ramps to minimize property impacts and impacts to the Turkey River. These walls would be between 6 feet and 25 feet in height and would be adjacent to homes and businesses.

The existing I-89 Bicycle Path would be abandoned and replaced with accommodation on the new connector road proposed in Concept K.

The total cost for Concept K is estimated at \$70.0 million.

2.3.6.3 – Interstate 89 Concept P

Concept P is identical to Concept K except that it proposes new 50 mph directional ramps to replace both loop ramps at the I-93/I-89 Interchange. The northbound I-93 to northbound I-89 directional ramp proposed in Concept K would have a 40-mph design speed. All of the results discussed above in Concept K concerning Exit 1 and the weaving between Exit 1 and I-93 would be the same for Concept P. The proposed southbound I-89 to northbound I-93 directional ramp would be a third level flyover bridge. See **Figure 2.7 I-89 Area Concept P** for a plan.

The new directional ramps at the I-93/I-89 Interchange eliminate the need for the existing C-D Road and eliminate the weave within the interchange. Concept P also proposes a ramp off the northbound I-93 to northbound I-89 ramp to the new connector road. This provides access to Bow Junction from I-93 that currently does not exist. The area once utilized for the northbound I-93 to northbound I-89 loop ramp could be used as a Park and Ride lot as shown in the plan for Concept P, **Figure 2.7**.

Retaining walls would be required along several of the ramps to minimize impacts to properties and impacts to the Turkey River. These walls would be between 6 feet and 25 feet in height and would be adjacent to homes and businesses. The proposed flyover ramp for Concept P would require a 40-foot high retaining wall along I-89 to allow the flyover ramp to rise adjacent to I-89. A retaining wall would also be required along I-93 northbound to minimize impacts to properties and impacts to Bow Brook.

The existing I-89 Bicycle Path would be abandoned and replaced with accommodation on the new connector road proposed in Concept P.

The total cost for Concept P is estimated at \$92.8 million.

2.3.6.4 – Interstate 89 Area Summary

Table 2.4 I-89 Area Comparison Matrix below provides a comparison of the three concepts considered for the I-89 Area.

Table 2.4: I-89 Area Comparison Matrix

CONSIDERATIONS/ RESOURCES	CONCEPT C	CONCEPT K	CONCEPT P
Exit 1 To I-93 Weaves	Improved	Eliminated	Eliminated
I-93 northbound to I-89 northbound Weave	No Change	Improved	Eliminated
I-89 / Route 3A Access	No Change	Via Exit 1 or Via I-93 Exit 12	Via Exit 1 or Via I-93 Exit 12
Property Impacts	<ul style="list-style-type: none"> • Cilley State Forest • 4 full parcel acquisitions • 9 partial parcel acquisitions 	<ul style="list-style-type: none"> • Cilley State Forest • Bow Mobil and 5 full parcel acquisitions • 14 partial parcel acquisitions 	<ul style="list-style-type: none"> • Cilley State Forest • Bow Mobil and 5 full parcel acquisitions • 16 partial parcel acquisitions
Red List Bridges	1	1	1
Existing Bridges Retained	7	4	2
Existing Bridges Replaced/ Rehabilitated/Widened	0	3	4
New Bridges	0	4	5
Estimated Project Cost	\$34.1 M	\$70.0 M	\$92.8 M
Wetland Impacts	0.6 Acres	0.7 Acres	1.8 Acres
Conservation Land Impacts	9.7 Acres of Cilley State Forest	0.7 Acres of Cilley State Forest	0.7 Acres of Cilley State Forest
Wildlife Considerations	<ul style="list-style-type: none"> • State-listed species and Species of Concern • Essential Fish Habitat 	<ul style="list-style-type: none"> • State-listed species and Species of Concern • Essential Fish Habitat 	<ul style="list-style-type: none"> • State-listed species and Species of Concern • Essential Fish Habitat
Potentially Contaminated Parcels Impacted	1	2	2
Historic Property Impacts	No Historic Properties Effectuated	2 Historic Properties Effectuated	2 Historic Properties Effectuated

2.3.7 Exit 12 Area

The Exit 12 Area covers approximately 4,000 feet of I-93 beginning from a point half way between I-93/I-89 Interchange and Exit 12 (Route 3A) to a point half way between Route 3A and Exit 13 (Route 3 - Manchester Street). The area includes Exit 12, which provides access to Route 3A. Exit 12 is a partial clover-leaf interchange with dual exit ramps for both northbound and southbound exiting traffic. The bridge carrying Route 3A over I-93 was replaced in 2016 as a single-span bridge and can accommodate up to eight lanes of traffic on I-93. The bridge was constructed with three Route 3A lanes to accommodate the existing configuration, which includes a center turn lane. See **Figure 2.8 Exit 12 Area Existing Conditions** for the existing conditions of the Exit 12 Area.

Three of the exit ramps at Exit 12 have deficient deceleration distances as vehicles exit I-93 and approach the first horizontal curve of the ramps. Both of the southbound exit ramps and the northbound exit ramp to northbound Route 3A have deficient deceleration distances.

The intersections of the Exit 12 ramps with Route 3A are currently operating at acceptable levels. The traffic analysis indicates that they will continue to operate at acceptable levels in 2035 because the dual exit ramps provide a high level of access from I-93 to Route 3A. However, the deficient deceleration that exists because of the dual exit ramps requires this configuration to be revised.

There are no Red List bridges within the Exit 12 Area. The existing I-93 bridge over the Pan Am Railroad would need to be widened for both of the concepts considered.

A 5-foot sidewalk, ending at Broadway, is provided along the west side of Route 3A within the project limits. There are no dedicated bicycle lanes provided along Route 3A, however, 5-foot shoulders were provided on the bridge that can accommodate bicycles.

2.3.7.1 *Exit 12 Concept E*

The first alternative under consideration for the Exit 12 Area is Concept E, which proposes to retain the partial cloverleaf configuration, but would eliminate one exit ramp in each direction. Limiting each direction to one exit ramp allows standard exit ramp geometry and proper deceleration distance. The partial cloverleaf configuration was chosen for this concept over a standard diamond as the exit ramps for the diamond would require greater property and environmental impacts

All exiting traffic would terminate at Route 3A at an intersection compared to the existing exit ramps that merge with Route 3A. Intersection control would be required in order to provide acceptable levels of service because all exiting I-93 traffic would access Route 3A via an intersection. Concept E proposes two signalized intersections to accommodate northbound and southbound I-93 traffic. The LOS at the southbound intersection would be LOS B/B and the northbound intersection would be to LOS C/C by 2035. See **Figure 2.9 Exit 12 Area Concept E** for a plan.

The two intersections would be only about 1,000 feet apart, which restricts the amount of vehicle storage that can be provided for those vehicles turning left to access I-93.... Also, exiting traffic from northbound I-93 to southbound Route 3A and southbound I-93 to northbound Route 3A would be required to make a left turn to access Route 3A rather than a right merge, as all traffic does presently. The stop condition would result in queuing occurring on Route 3A for these approaches.

Retaining walls would be required along southbound I-93 near the South End Marsh to avoid impacts to the City of Concord's sewer main and wetlands. Retaining walls would be required along the northbound entrance ramp to avoid impacts to the railroad, wetlands, and an existing wetland mitigation site.

The sidewalk along the west side of Route 3A would be retained by Concept E. Also, shoulder/bike lanes would be provided in both directions of Route 3A within the project limits.

The total cost for Concept E is estimated at \$36.2 million.

2.3.7.2 *Exit 12 Concept F*

The other alternative for the Exit 12 Area is Concept F – Roundabout Intersections. Concept F has the similar configuration as Concept E, a partial cloverleaf with single exit and entrance ramps. However, the two ramp intersections are proposed as hybrid roundabouts. A hybrid roundabout is one that has some two-lane movements and some one-lane movements. In the case of Concept F, the southbound Route 3A traffic would have two lanes and the northbound traffic would have one lane. The northbound ramp intersection roundabout would also include a slip ramp for northbound Route 3A traffic entering northbound I-93. See **Figure 2.10 Exit 12 Area Concept F** for a plan.

The LOS at the southbound intersection roundabout would improve to LOS A/C and the northbound intersection roundabout would improve to LOS B/B by 2035.

The retaining walls mentioned above for Concept E would all be required for Concept F.

The sidewalk along the west side of Route 3A would be retained by Concept F. Also, shoulder/bike lanes would be provided in both directions of Route 3A within the project limits.

The total cost for Concept F is estimated at \$33.9 million.

2.3.7.3 *Exit 12 Summary*

Table 2.5 Exit 12 Area Comparison Matrix below provides a comparison of the two concepts considered for the Exit 12 Area.

Table 2.5: Exit 12 Area Comparison Matrix

CONSIDERATION	CONCEPT E	CONCEPT F
Northbound Ramps Intersection LOS (AM/PM)	LOS B/B with Queuing	LOS B/B with Little Queuing
Southbound Ramps Intersection LOS (AM/PM)	LOS B/B with Queuing	LOS B/B with Little Queuing
Property Impacts	<ul style="list-style-type: none"> • 4 full parcel acquisitions • 2 partial parcel acquisitions 	<ul style="list-style-type: none"> • 6 partial parcel acquisitions
Red List Bridges	0	0
Existing Bridges Retained	1	1
Existing Bridges Replaced/Rehabilitated/Widened	2	2
New Bridges	0	0
Estimated Project Cost	\$36.2 M	\$33.9 M
Wetland Impacts	0.29 Acres	0.29 Acres
Conservation Land Impacts	0.0 Acres	0.0 Acres
Wildlife Considerations	State-listed species and Species of Concern	State-listed species and Species of Concern
Potentially Contaminated Parcels Impacted	0	0
Historic Property Impacts	No Historic Properties Effected	No Historic Properties Effected

2.3.8 Exit 13 Area

The Exit 13 Area covers approximately 6,900 feet of I-93 beginning from a point half way between Route 3A and Route 3 (Manchester Street) and a point half way between Route 3 (Manchester Street) and Route 9 (Loudon Road). The area also includes Exit 13, which provides access to Route 3 (Manchester Street and Water/South Main Street) and the State Capitol Building. Exit 13 is a diamond configuration with a single point urban interchange (SPUI). The Pan Am rail corridor parallels the west side of I-93 north of Exit

13. See **Figure 2.11 Exit 13 Area Existing Conditions** for the existing conditions of the Exit 13 Area.

Exit 13 was reconstructed in 2002 with the SPUI and a new bridge that accommodates up to six lanes on I-93. The intersection and ramps were also designed so that they would not be impacted when the widening of I-93 occurred. However, the ramp entrances and exits would have to be reconstructed to accommodate the widening and addition of auxiliary lanes. Therefore, the majority of the improvements associated with the Exit 13 Area would be widening of I-93 within the existing median.

One deficiency identified for Exit 13 concerns the northbound exit ramp. During AM peak periods, traffic backs up daily onto I-93 from the intersection of Manchester Street (Route 3). The cause of the backup is the high volume of traffic that makes a right turn onto Manchester Street. This movement is controlled by a stop sign and additionally the limited sight distance requires each turning vehicle to wait to make the turn.

The City of Concord is planning a project to improve the Manchester Street/Old Turnpike Road intersection, which is about 1,100 feet south of the SPUI. The City is proposing to widen the intersection to provide dual left turn and dual right turn movements between Manchester Street and Old Turnpike Road to accommodate the high volume of commuter traffic traveling between Exit 13 and Old Turnpike Road (shown in red on **Figure 2.12**).

There is one Red List bridge within the Exit 13 Area; it is the bridge that carries southbound I-93 over Hall Street (Bridge #201/096). The substructure of this bridge is rated in poor condition. This bridge also has a deficient vertical clearance (13'-6") over Hall Street. A truck hit and damaged a beam in 2008. This bridge would be replaced for all of the build concepts and the new bridge would be built with adequate vertical clearance (15'-0") provided.

The bridge that carries I-93 over US Route 3 at Exit 13 does not need to be modified to accommodate any of the concepts, but would have routine preservation work conducted by the project. Routine preservation includes, but is not limited to, new pavement, new joints, and a new protective membrane.

Sidewalks exist along both sides of Route 3 within the project limits. There are shoulders on both sides of Route 3 that are wide enough to accommodate bicycles. These would be retained by both build alternatives.

2.3.8.1 *Exit 13 Area Concept A*

The first alternative under consideration for the Exit 13 Area is Concept A – Signalized Northbound Right Turn. Concept A proposes retaining the existing configuration of Exit 13 with one exception, signaling the northbound exit ramp right turn onto Manchester Street. By signaling this movement the queue of vehicles that currently backs onto I-93 can be reduced and it would only back up about half way along the ramp in 2014.

However, by 2035 the anticipated increased volume of traffic would cause the backup to extend onto I-93. See **Figure 2.12 Exit 13 Area Concept A** for a plan.

The total cost for Concept A is estimated at \$33.6 million. Most of the cost for the Exit 13 Area Concept A is for the widening of I-93.

2.3.8.2 *Exit 13 Area Concept B*

The other concept for the Exit 13 Area is Concept B - Widened Northbound Right Turn. Concept B proposes retaining the existing configuration of Exit 13 with widening the northbound exit ramp to Manchester Street, and the right turn would also be signalized as discussed for Concept A. The widening of the ramp would allow for a dual right turn onto Manchester Street to address the heavy volume of traffic. The backup issue on the ramp would be eliminated. See **Figure 2.13 Exit 13 Area Concept B** for a plan.

The widening of the ramp requires an approximately 160-foot bridge from the shore connecting to the existing bridge that carries Manchester Street over the Merrimack River. Property acquisition is also required. The existing bridge is capable of accommodating the proposed ramp bridge. Retaining walls would also be required to avoid impacts to the river.

The total cost for Concept B is estimated at \$39.0 million. Most of the cost for the Exit 13 Area Concept B is for the widening of I-93.

2.3.8.3 *Exit 13 Area Summary*

Table 2.6 Exit 13 Area Comparison Matrix below provides a comparison of the two concepts under consideration for the Exit 13 Area.

Table 2.6: Exit 13 Area Comparison Matrix

CONSIDERATION	CONCEPT A	CONCEPT B
Queuing on the northbound Exit Ramp	Onto I-93 by 2035	No queuing onto I-93 by 2035
Property Impacts	<ul style="list-style-type: none"> • 3 full parcel acquisitions • 1 partial parcel acquisition 	<ul style="list-style-type: none"> • 4 full parcel acquisitions • 1 partial parcel acquisition
Red List Bridges	1	1
Existing Bridges Retained	1	1
Existing Bridges Replaced/Rehabilitated/Widened	1	1
New Bridges	0	1
Estimated Project Cost	\$33.6 M	\$39.0 M
Wetland Impacts	0.0 Acres	0.0 Acres
Conservation Land Impacts	0.0 Acres	0.0 Acres
Wildlife Considerations	<ul style="list-style-type: none"> • State-listed species and Species of Concern • Essential Fish Habitat 	<ul style="list-style-type: none"> • State-listed species and Species of Concern • Essential Fish Habitat
Potentially Contaminated Parcels Impacted	1	1
Historic Property Impacts	No Historic Properties Effected	No Historic Properties Effected

2.3.9 Exit 14/15 Area

The Exit 14/15 Area covers approximately 10,000 feet of I-93 beginning from a point half way between Route 3 (Manchester Street) and Route 9 (Loudon Road) to just south of the bridge that carries I-93 over the Merrimack River. It also covers approximately 2,700 feet of I-393 from I-93 to just west of the bridge that carries I-393 over the Merrimack River. I-393 begins at I-93 but the project limits continue onto US Route 202 for an additional 2,000 feet to the North Main Street intersection. This last section of roadway

is not considered I-393, but remains US Route 202. See **Figure 2.14a Exit 14/15 Area Existing Conditions** for the existing conditions of the Exit 14/15 Area. See **Figure 2.14b I-93 North Existing Conditions** for the existing conditions of the north portion of I-93. See **Figure 2.14c I-393 Exit 1 Existing Conditions** for the existing conditions of the I-393 portion of Exit 14/15 Area.

One particularly challenging area just south of Exit 14 is referred to as the “Pinch Point”. At this location the Merrimack River, I-93, a Unitil electrical -substation, the Pan Am rail corridor, historic resources, and a shopping plaza all converge at one location. The widening of I-93 and potential improvements to Exit 14 at the “Pinch Point” could impact one or more of these elements.

This segment includes three interchanges; Exit 14 and Exit 15 on I-93 and Exit 1 on I-393. These interchanges are in close proximity to one another and therefore cannot be evaluated independently. Exits 14 and 15 are only 2,800 feet apart and Exit 15 and Exit 1 are only 2,200 feet apart. AASHTO states a “general rule of thumb for minimum interchange spacing is 1 mile (5,280 feet) in urban areas and 2 miles in rural areas.” It also states that “in urban areas, spacing of less than 1 mile may be developed by grade separating ramps or by adding collector-distributor roads.”

Exit 14 provides access to Loudon Road (Route 9), which is one of the main access points to the State Capitol. It is currently a diamond interchange with the northbound ramps offset where they connect to Loudon Road (Route 9). The bridge that carries I-93 over Loudon Road was rehabilitated in 2010, however, it was not widened to accommodate widening of I-93 and it was not lengthened to accommodate widening of Loudon Road. This bridge would therefore have to be replaced.

The layout of Loudon Road within Exit 14 is comprised of up to seven narrow lanes with no shoulders. This configuration was implemented several years ago when a large retail store was opened along Fort Eddy Road in order to fit double left turn lanes to I-93 southbound under the existing I-93 bridge. The seven lane section narrows to the east to 5 lanes as Loudon Road crosses the Merrimack River. Within the project limits in the Exit 14 area, there are four signalized intersections along Loudon Road within 650 feet that cause significant queuing and delay during peak periods. In particular, the westbound approach to the Loudon Road/Fort Eddy Road/northbound Exit Ramp intersection is modeled to have a LOS F/F by 2035.

Exit 15 connects I-93 to I-393 and is a system interchange linking two freeways. It also connects I-93 to the City of Concord’s downtown area by way of Route 202. Exit 15 is a full cloverleaf configuration that includes four loop ramps and four directional ramps connecting these interstate highways. There are four short weave sections within the interchange, two for I-93 and two for I-393. These weaves are problematic because of the high volume of traffic using the ramps and because the weaves occur on the mainline. The weave distances are below those recommended by AASHTO, however, AASHTO treats cloverleaf interchanges differently than other weave conditions.

The weaves within Exit 15 along I-93 operate at unacceptable levels while those along I-393 operate at acceptable levels. The southbound weave within Exit 15 currently operates at LOS F/E that is anticipated to deteriorate to a LOS F/F by 2035. The northbound weave within Exit 15 currently operates at LOS C/E that is anticipated to remain LOS C/E by 2035.

The Exit 15 area includes two Red List bridges; the bridge that carries I-393 over I-93 (Bridge #152/108) and the bridge that carries Route 202 over the NH Rail and Transit Railroad (NHRR) tracks and Constitution Avenue (Bridge #150/107). The I-393 Bridge would be replaced with any of the build concepts because it does not accommodate the widening of I-93 and is also in poor condition. The Route 202 Bridge would be replaced with any of the build alternatives due to its poor condition.

Exit 1 of I-393 provides access to Fort Eddy Road and College Drive. College Drive is the main access to the New Hampshire Technical Institute (NHTI). Exit 1 of I-393 is a partial cloverleaf with all ramps on the west side of College Drive because of its close proximity to the Merrimack River. The bridge that carries I-393 over Fort Eddy Road/College Drive is on the Red List due to the poor condition of its deck. This bridge is a candidate for rehabilitation, because the build alternatives would not require the widening or lengthening of the bridge.

The minimal distance between Exits 14 and 15 results in deficient weaves on I-93 for both southbound and northbound directions. AASHTO recommends 2,000 feet between entrance and exit ramps for this ramp condition, the existing southbound weave is 380 feet long and the existing northbound weave is 370 feet long. The southbound weave along I-93 between Exits 14 and 15 operates at unacceptable levels. The current LOS F/D that projects to LOS F/E by 2035. The northbound weave along I-93 between Exits 14 and 15 operates at unacceptable levels where the current LOS C/E is anticipated to be LOS C/F by 2035.

The close proximity of I-93 Exit 15 and I-393 Exit 1 results in deficient weaves on I-393 for both eastbound and westbound directions. AASHTO recommends 2,000 feet between entrance and exit ramps for this ramp condition. The existing eastbound weave is 540 feet long and the existing westbound weave is 600 feet long. However, the LOS for these two weaves is acceptable due to the relatively low volume of ramp traffic using I-393 Exit 1.

There is one remaining Red List bridge in the Exits 14/15 Area, it is Delta Drive over I-93 (Bridge #142/116) at the northern end of the project. This bridge would be replaced for all build alternatives due to its poor condition and as it is not long enough to accommodate the widening of I-93.

There are two bridges within the Exit 14/15 Area that do not need to be modified to accommodate the build alternatives but would have routine preservation work conducted by the project, the Route 202 bridge over the Pan Am Railroad and I-393 bridge over the pedestrian underpass. Routine preservation includes, but is not limited to, new

pavement, new joints and new protective membranes for bridges and concrete repairs for underpasses.

There are several rail facilities within the Exit 14/15 Area. The active “Main Line North” freight rail line parallels I-93 to the west until just south of Exit 14. It then veers to the northwest where it passes under Loudon Road adjacent to Storrs Street underneath the same bridge that crosses over Storrs Street. The “Main Line North” continues northwest away from I-93 where it passes under Route 202 and bridges over Horseshoe Pond. The “Main Line North” line is owned and operated by Pan Am Railways within the project limits.

Pan Am Railways has abandoned the “Main Line North” line from Horseshoe Pond north to the Boscawen Town Line, where its ownership ends. The NHDOT owns the “Main Line North” from the Boscawen Town Line to its terminus in Lebanon. The majority of the NHDOT portion has been abandoned and converted to a rail trail.

Between Exits 14 and 15 the “White Mountain Branch” line begins as it separates from the “Main Line North” creating two independent rail corridors. The “White Mountain Branch” line heads north and hugs the ramps at Exit 15 before heading north again. This line is owned by NHDOT.

The current freight traffic through the area utilizes the “Main Line North” up to the point where the “White Mountain Branch” connects and then uses the “White Mountain Branch”. The freight operations are conducted by Pan Am Railways on the “Main Line North”, but are conducted by New England Southern Railroad on the “White Mountain Branch”.

Preservation of the rail corridors is an established goal of the project. There have been recent studies exploring opportunities for enhancing passenger rail for New Hampshire including the *Capitol Corridor Rail and Transit Alternatives Analysis*, which proposed a Concord Rail Station between Exits 14 and 15. The design goal for the I-93 project is to preserve both rail corridors and to accommodate a future passenger platform in the Exit 14/15 Area. Though Pan Am Railways has abandoned the “Main Line North” line north of Horseshoe Pond, this corridor must still be preserved for potential future use.

Sidewalks exist along both sides of Loudon Road within the project limits. There are no bicycle lanes provided along Loudon Road.

The City of Concord has a proposed project within the Exit 14/15 Area (shown in red on Figures 2.14a through 2.20a) that would extend Storrs Street north and connect it to either Constitution Avenue or South Commercial Street. Relocation of the railroad tracks would be required for the Storrs Street Extension

The Stickney Avenue area is of particular interest to the City of Concord as they have identified it for potential redevelopment as well as the location of a potential future rail station. A Concord Coachline Bus Depot and a NHDOT Park and Ride lots presently

exist in this area. NHDOT owns other property in the area that was once the Highway Garage, but it is no longer used for this purpose. Maintaining access to this area from I-93 is a prime goal for the project.

2.3.9.1 *Exit 14/15 Concept D2*

Many concepts were developed to address the deficiencies that exist within the Exit 14/15 Area. In the end, four alternatives were selected for further consideration. The first is Concept D2, which retains most of the existing configurations for each interchange and proposes widening I-93 to six lanes to a point south of the bridge over the Merrimack River. The one exception to maintaining the existing configuration is at Exit 14 where the northbound entrance ramp would be eliminated. Eliminating this ramp would allow the alignment of I-93 to be shifted east at the “Pinch Point” to avoid impacts along the west side of the corridor. Concept D2 avoids impacts to Stickney Avenue, the Unitil substation, the Pan Am railroad, and a shopping plaza. See **Figure 2.15a Exit 14/15 Area Concept D2** for a plan. See **Figure 2.15b I-93 North Concept D2** for a plan of the north portion of Exit 14/15 Area. See **Figure 2.15c I-393 Concept D2** for a plan of the I-393 portion of Exit 14/15 Area.

The elimination of the northbound entrance at Exit 14 would also eliminate one of the deficient weaving sections on I-93. However, the remaining deficient and undesirable weaves in the area remain. The widening of I-93 would improve the LOS of the weaves. By adding a lane and capacity to the mainline, vehicles passing through the area on I-93 could remain in the left lanes, which would provide more capacity in the right lanes for the weaving traffic. The southbound weave on I-93 between Exits 14 and 15 that is presently at LOS F/D, and is modeled to be LOS F/D by 2035, would improve to an acceptable LOS C/B under Concept D2. The northbound weave on I-93 between Exits 14 and 15 which is presently at LOS C/E, and is modeled to be LOS B/E by 2035, would improve to an acceptable LOS B/C under Concept D2. And finally, the southbound weave within Exit 15 that is presently at LOS F/E, and is modeled to be LOS F/E by 2035, would improve to an acceptable LOS C/B under Concept D2.

The Loudon Road corridor would benefit from the ramp elimination as well because this signalized intersection would be eliminated. Also, standard lane widths and shoulders would be provided along Loudon Road since the new bridge over Loudon Road would be longer. The westbound approach to the Loudon Road/Fort Eddy/northbound Exit Ramp intersection that is projected to be at a LOS F/F by 2035, would improve to LOS C/E with minimal delays. The PM delay would be reduced from 765 seconds to 65 seconds.

Sidewalks and bicycle lanes would be provided along both sides of Loudon Road within the project limits for Concept D2. All proposed build alternatives would provide the sidewalks and bicycle lanes.

Stickney Avenue would not be impacted by Concept D2 and could therefore continue to function as it does today. Access to the historic Ralph Pill Building, a National Register eligible building, would be maintained.

Concept D2 would not alter the weaves between Exit 15 and Exit 1, on I-393, therefore the deficient weaves would remain. The LOS for these two weaves would remain at acceptable levels due to the relatively low volume of ramp traffic at Exit 1.

Concept D2 would include a new connection from the end of Stickney Avenue across the railroad tracks that would connect to South Commercial Street and the proposed extension of Storrs Street. This new connection would provide access to northbound I-93 that would be lost under this concept at Exit 14. The new connection would also provide access to Stickney Avenue from the I-393 extension (Route 202) that would be lost due to the proposed elimination of the existing slip ramp from the I-93 southbound entrance ramp at Exit 15.

There is one bridge within the Exit 14/15 Area, Route 202 over the Pan Am Railroad, that would not be impacted by Concept D2 but which would have routine preservation work conducted by the project. Routine preservation includes, but is not limited to, new pavement, new joints, and new protective membrane for bridges.

A retaining wall would be required along the east side I-93 south of Exit 14 at the “Pinch Point” to avoid impacts to the Merrimack River.

The total cost for Concept D2 is estimated at \$91.7 million.

2.3.9.2 *Exit 14/15 Concept F*

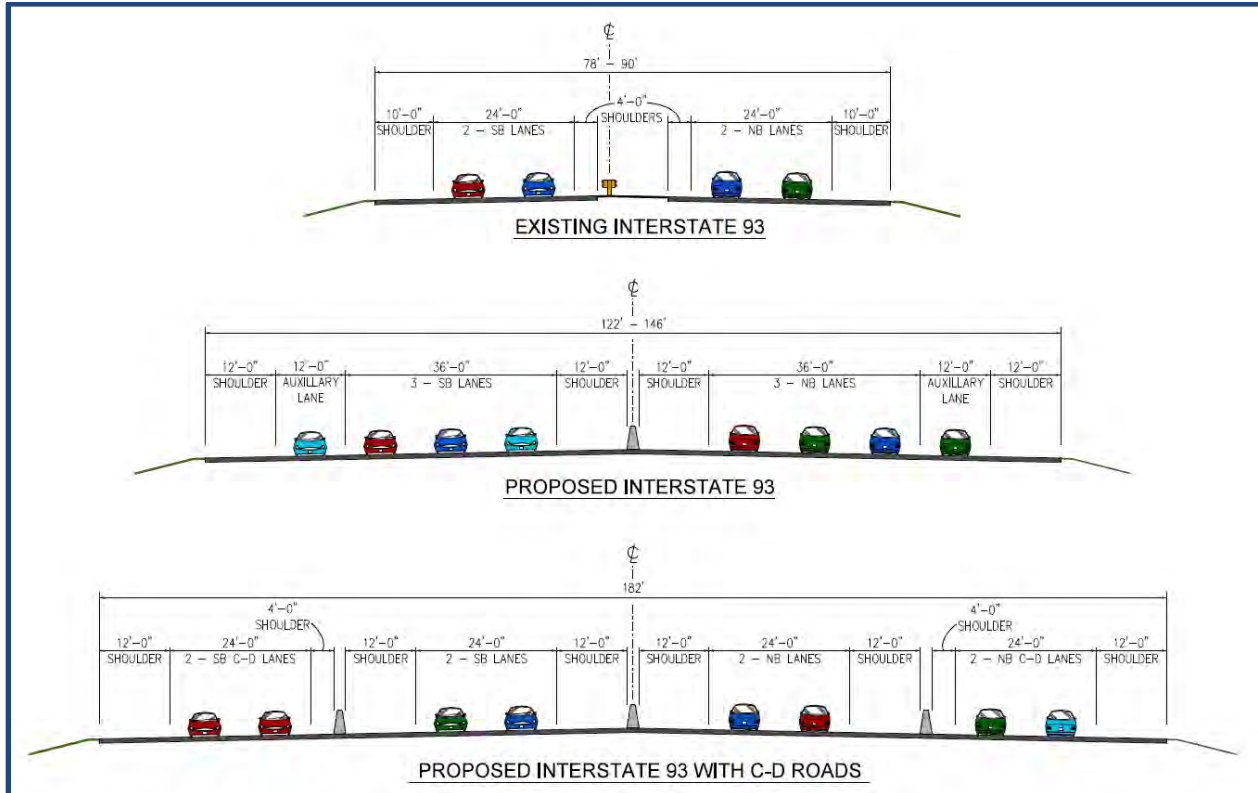
Concept F proposes significant changes to I-93, Exit 14 and Exit 15 as follows:

- Collector-Distributor (C-D) Roads for northbound and southbound I-93.
- A Single Point Urban Interchange (SPUI) at Exit 14.
- A Cloverstack interchange at Exit 15.
- A new access to Stickney Avenue Area.

See **Figure 2.16a Exit 14/15 Area Concept F** for a plan. See **Figure 2.16b I-93 North Concept F** for a plan of the north portion of Exit 14/15 Area. See **Figure 2.16c I-393 Concept F** for a plan of the I-393 portion of Exit 14/15 Area.

Concept F does not propose changes to Exit 1 of I-393. Concept F does propose a separation of I-93 traffic from south of Exit 14 to north of Exit 15. I-93 traffic that is passing through the area and not desiring to exit I-93 to Exits 14 or 15 would be directed to remain to the left where two lanes would be carried through the area. Traffic destined for Exits 14 or 15 would be directed to remain to the right to access the C-D Roads. The C-D Roads would run parallel to, but separated from the through lanes by concrete barriers. See **Figure 2.17** below for a Typical Section of I-93 that includes the C-D Road configuration.

Figure 2.17 I-93 Typical Section with C-D Roads



The weaving that currently occurs on I-93 between Exits 14 and 15 would occur on the C-D Roads for Concept F. Weaving on C-D Roads is preferred because there is less traffic and the speeds are lower. AASHTO recommends 1,600 feet between entrance and exit ramps when using a C-D Road, compared to 2,000 feet between entrance and exit ramps when on the mainline. For Concept F, the southbound weave would increase to about 550 feet and the northbound weave would increase to about 600 feet, still less than recommended. The slower speeds and reduced traffic would result in improvement of the LOS of the weaves.

The southbound weave on I-93 between Exits 14 and 15 that is modeled to have a LOS F/D by 2035, would improve to an acceptable LOS B/B under Concept F. The northbound weave on I-93 between Exits 14 and 15 that is anticipated to be LOS B/E by 2035, would improve to an acceptable LOS A/B under Concept F.

Concept F proposes a SPUI for Exit 14. A SPUI would utilize a single signalized intersection to control the four ramps that would intersect Loudon Road. This is the same configuration that currently exists at Exit 13. The northbound exit ramp that intersects opposite Fort Eddy Road would remain.

The Loudon Road corridor would benefit from the elimination of two signalized intersections as part of Concept F. The SPUI intersection would operate at acceptable

levels in 2035. Also, standard lane widths and shoulders would be provided along Loudon Road since the new bridge over Loudon Road would be longer than the existing and designed to accommodate the proposed 8 lanes. The westbound approach to the Loudon Road/Fort Eddy/northbound Exit Ramp intersection that is modeled to have a LOS of LOS F/F by 2035, would improve to LOS B/E.

The proposed widening of I-93 and the footprint of the SPUI at Exit 14 under Concept F would require the corridor to be shifted to the west to avoid the Merrimack River. As a result, Concept F would impact Stickney Avenue, an electrical substation, overhead electric lines, the railroad, historic properties, and a shopping plaza. The Stickney Avenue connection to Loudon Road could not be maintained in Concept F. Other access options for Stickney Avenue would need to be provided as discussed below. Also, the driveway opposite Stickney Avenue that provides access to the Ralph Pill Building, the Concord Electric Light Station building, and the Unitil substation could not be maintained. Access to the Ralph Pill Building, the Concord Electric Light Station building, and the Unitil substation would be eliminated by Concept F.

Various options for accessing the Stickney Avenue area other than Loudon Road have been evaluated, including the following:

- Option A: An extension of South Commercial Street from where it meets Constitution Avenue over the NHRR railroad tracks as shown on **Figure 2.18a**. This would include an at-grade railroad crossing. Access from Stickney Avenue to I-93 would be straightforward by way of Exit 15. However, access from I-93 to Stickney Avenue would be circuitous utilizing Exit 15, Commercial Street along Horseshoe Pond, and Constitution Avenue.
- Option B: A grade separated crossing of the railroad near the existing northern limit of Storrs Street as shown on **Figure 2.18b**. Storrs Street would be elevated to allow the grade separated crossing. Access to I-93 would include using North Main Street to Loudon Road and Exit 14.
- A new overpass from Fort Eddy Road over I-93 to Stickney Avenue as shown on **Figure 2.18c**. Access to I-93 would entail using Fort Eddy Road to Exit 14. The high volume of traffic on Fort Eddy Road would be an issue for this option.

The options presented above could be combined with any alternative that would not maintain the Stickney Avenue connection to Loudon Road.

Figure 2.18a Stickney Avenue Access Option A

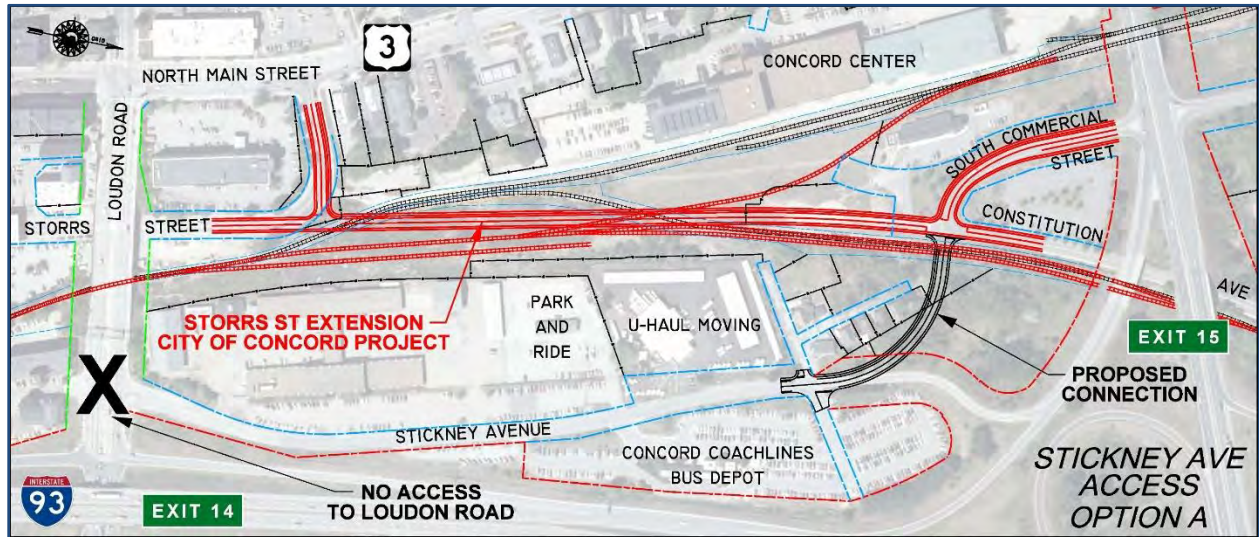


Figure 2.18b Stickney Avenue Access Option B

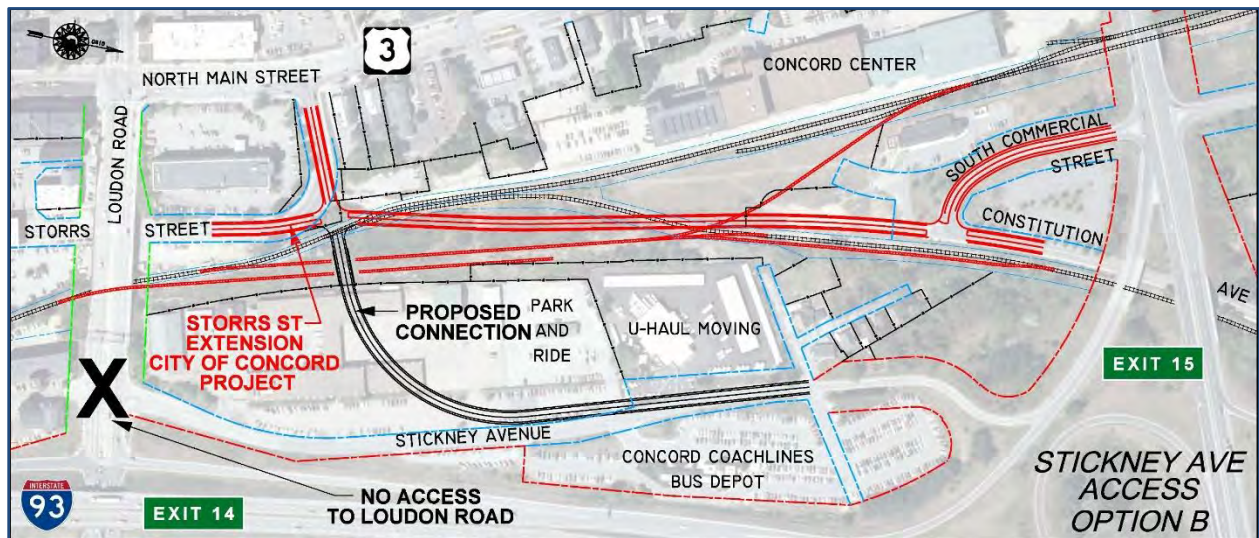
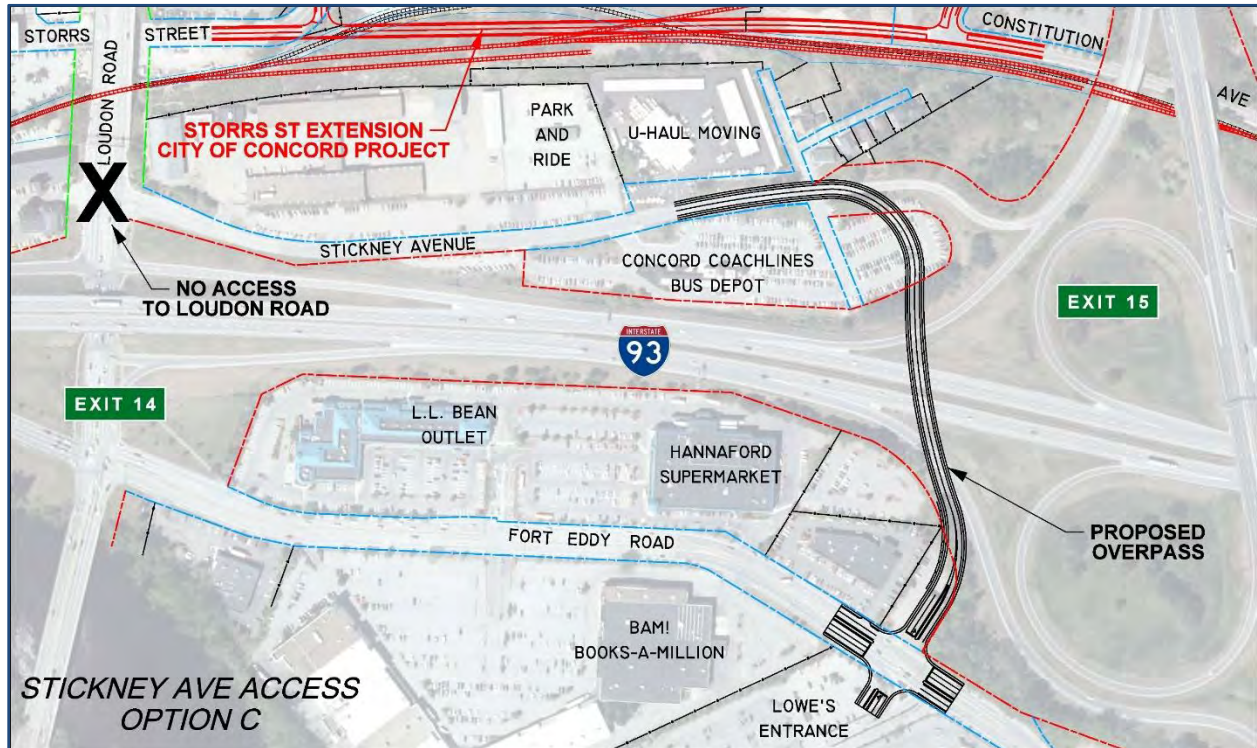


Figure 2.18c Stickney Avenue Access Option C

Concept F proposes a cloverstack configuration for Exit 15. A cloverstack is a hybrid interchange that retains elements of the cloverleaf but without the weave sections. As proposed for Concept F, two loop ramps would be eliminated and replaced with directional ramps. The limited space at Exit 15 restricts the geometry of the new directional ramps and the design speed is increased from 20 mph to 35 mph. By eliminating two of the loop ramps at Exit 15, four weave sections would be eliminated.

The alterations to Exit 15 as part of Concept F would increase the weave distances between Exit 15 on I-93 and Exit 1, on I-393. The eastbound weave would increase to 800 feet and the westbound weave would increase to 740 feet. Also, Concept F proposes formal auxiliary lanes for this weave. The auxiliary lanes would improve the weave segments as the weaving operation occurs at lower speeds.

The total cost for Concept F is estimated at \$189.1 million.

2.3.9.3 Exit 14/15 Concept F2

Concept F2 is a hybrid alternative that contains elements of Concept F and Concept D2. Like Concept D2, it includes a modified diamond interchange at Exit 14 where the northbound entrance ramp would be eliminated. The elimination of the entrance ramp at Exit 14 would also eliminate the northbound weave between Exits 14 and 15. It would also include a southbound C-D Road between Exits 14 and 15. Like Concept F, it would include a cloverstack interchange at Exit 15 where two of the loop ramps would be

eliminated. The directional ramps for Concept F2 would have a design speed of 30 mph as opposed to 35 mph for Concept F in order to eliminate impacts to the bus depot on Stickney Avenue. See **Figure 2.19a Exit 14/15 Area Concept F2** for a plan. See **Figure 2.19b I-93 North Concept F2** for a plan of the north portion of Exit 14/15 Area. See **Figure 2.19c I-393 Concept F2** for a plan of the I-393 portion of Exit 14/15 Area.

The benefits identified above for Concepts D2 and F that are also realized for Concept F2 would include the following:

- Avoids impacts to the Unitil substation, the railroad, historic properties and a shopping plaza.
- Maintains access to Stickney Avenue, the Ralph Pill Building, and the Concord Electric Light Station from Loudon Road.
- Eliminates four of the weave segments within Exit 15.
- Eliminates one of the signalized intersections along Loudon Road.
- Allows longer weave segments between Exit 15 and Exit 1.

A retaining wall would be required along the east side I-93 south of Exit 14 at the “Pinch Point” to avoid impacts to the Merrimack River.

The total cost for Concept F2 is estimated at \$125.0 million.

2.3.9.4 *Exit 14/15 Concept O3*

Concept O3 proposes several substantial modifications to the Exit 14/15 Area. At Exit 14, Concept O3 proposes “flipping” the interchange whereby I-93 would be depressed and Loudon Road would cross over the interstate. A benefit of the flip is that the White Mountain Line active rail corridor could be shifted east closer to I-93, thereby potentially creating an area between it and Storrs Street for redevelopment without the rail corridor bisecting it. However, the existing “Main Line North” rail corridor north of Exit 14 must be preserved for any potential future use of the corridor. The northbound entrance ramp at Exit 14 would be eliminated. See **Figure 2.20a Exit 14/15 Area Concept O3** for a plan. See **Figure 2.20b I-93 North Concept O3** for a plan of the north portion of Exit 14/15 Area. See **Figure 2.20c I-393 Concept O3** for a plan of the I-393 portion of Exit 14/15 Area.

Two of the loop ramps at Exit 15 would be eliminated and replaced with directional ramps. As with the cloverstack configuration in Concepts F and F2, this would eliminate the four weaves that exist within Exit 15. The limited space at Exit 15 restricts the geometry of the new directional ramps, but the design speed would increase from 20 mph to 40 mph.

Access to and from southbound I-93 for Concept O3 would be provided with a combination of C-D roads and “slip ramps”. A C-D road would be provided for southbound traffic between Exits 14 and 15. A portion of this road would be for two-way traffic and a portion would be for one-way traffic. The two-way portion would provide access to the Stickney Avenue area by the way of bridges over the relocated railroad corridor. The

one-way portion of the C-D road would provide access to Loudon Road from southbound I-93 and westbound I-393. The southbound connection between Exits 15 and 14 would be eliminated by Concept O3 and this traffic would have to use local roadways.

The proposed combination of eliminating ramps, directional ramps, C-D Roads, and slip lanes would result in the elimination of all weaving sections along I-93 at Exits 14 and 15. The only weaving sections to remain would be those between Exit 15 and Exit 1 on I-393, which operate at acceptable levels of service by 2035.

A benefit of Concept O3 is that the area around Stickney Avenue identified for redevelopment would not be bisected by the active railroad corridor. However, the bus depot would be impacted and would need to be relocated.

The Loudon Road corridor would benefit from the ramp elimination as well because one of the signalized intersections would be eliminated. Also, standard lane widths and shoulders would be provided along Loudon Road since a new bridge would carry Loudon Road over I-93. The westbound approach to the Loudon Road/Fort Eddy/northbound Exit Ramp intersection that projects to be LOS F/F by 2035, would improve to LOS D/D with minimal delay. The PM delay would be reduced from 765 seconds to 46 seconds.

One anomaly of Concept O3 is that the southbound exit ramp from I-93 to Loudon Road that is now accommodated by Exit 14 would occur north of the exit ramp to Route 202 west that is now accommodated by Exit 15. In other words, the southbound exit for Exit 14 would occur before the exit for Exit 15.

The reconstruction of Exit 14 to depress I-93 and carry Loudon Road over the highway would require the closure of Loudon Road for an extended period of time. The closure would last at least a year and possibly longer to allow for the phased lowering of I-93 while maintaining traffic on I-93. The Loudon Road bridge over Storrs Street would have to be replaced due to the revised profile of Loudon Road.

A retaining wall would be required along the east side I-93 south of Exit 14 at the “Pinch Point” to avoid impacts to the Merrimack River.

The total cost for Concept O3 is estimated at \$171.0 million. This cost does not include any cost to relocate the rail, as the rail would remain in its current location unless development in the area would propose for it to be relocated.

The Exit 14 “flip” proposed by Concept O3 could be a component of any alternative. It would have similar benefits as described above as well as the same challenges. Any flip of Exit 14 would require extensive retaining walls along I-93, a lengthy closure of Loudon Road to construct, and limit views of the City for drivers on I-93. It would allow for the relocation of the railroad and redevelopment opportunities for the Stickney Avenue area.

2.3.9.5 Exit 14/15 Area Summary

Table 2.7 Exit 14/15 Area Comparison Matrix below provides a comparison of the four concepts under consideration for the Exit 14/15 Area.

Table 2.7 Exit 14/15 Area Comparison Matrix

CONSIDERATION	CONCEPT D2	CONCEPT F	CONCEPT F2	CONCEPT O3
Exit 14 To Exit 15 Weaves	Improved	C-D Roads	Northbound – Eliminated Southbound – C-D Roads	Eliminated
Exit 15 Weaves	Improved	Eliminated	Eliminated	Eliminated
Northbound Entrance Ramp	Eliminated	No Change	Eliminated	Eliminated
Property Impacts	<ul style="list-style-type: none"> • 1 full parcel acquisition • 5 partial parcel acquisitions 	<ul style="list-style-type: none"> • Ralph Pill Bldg. • Electric Light Station Bldg. • Unitil Substation • Railroad Corridor • Storrs Street Shopping Plaza • Bus Depot • 6 partial parcel acquisitions 	<ul style="list-style-type: none"> • 1 full parcel acquisition • 11 partial parcel acquisitions 	<ul style="list-style-type: none"> • Bus Depot • 1 full parcel acquisition • 4 partial parcel acquisitions
Red List Bridges	4	4	4	4
Existing Bridges Retained	2	2	2	2
Existing Bridges Replaced/ Rehabilitated/ Widened	5	5	5	5
New Bridges	0	4	2	7
Estimated Project Cost	\$91.7 M	\$189.1 M	\$125.0 M	\$171.0 M
Wetland Impacts	0.3 Acres	0.4 Acres	0.4 Acres	0.2 Acres
Conservation Land Impacts	0.0 Acres	0.0 Acres	0.0 Acres	0.0 Acres

Table 2.7 Exit 14/15 Comparison Matrix (cont'd)

CONSIDERATION	CONCEPT D2	CONCEPT F	CONCEPT F2	CONCEPT O3
Wildlife Considerations	<ul style="list-style-type: none"> • State-listed species and Species of Concern • Essential Fish Habitat • Exemplary Community 	<ul style="list-style-type: none"> • State-listed species and Species of Concern • Essential Fish Habitat • Exemplary Community 	<ul style="list-style-type: none"> • State-listed species and Species of Concern • Essential Fish Habitat • Exemplary Community 	<ul style="list-style-type: none"> • State-listed species and Species of Concern • Essential Fish Habitat • Exemplary Community
Contaminated Parcels Impacted	3	3	3	3
Historic Property Impacts	5 Historic Properties Effected	5 Historic Properties Effected	4 Historic Properties Effected	5 Historic Properties Effected

2.4 Agency and Public Input Received on Alternatives Considered

This section summarizes the agency and public involvement process that occurred concurrently with the development of the concept alternatives and the selection of the preferred alternative. The process involved evaluating conditions along the corridor, considering resources potentially subject to impact, and considering issues of concern to local officials, members of the community, state, and federal agencies.

A number of meetings were held by the NHDOT with the various Federal, State and local project stakeholders. These include regularly scheduled Natural Resource Agency and Cultural Resource meetings held at NHDOT, an effects determination meeting with NH State Historic Preservation Office, (NHSHPO), planning board meetings, selectmen meetings, and several meetings with town and city staff. The NHDOT and the FHWA are the state and federal agencies responsible for technical oversight and development of the EA. Information gathered during development of the conceptual ideas as well as during development of the concept alternatives, and technical analysis of the alternatives was presented or distributed to the various agencies and to the general public in attendance at four Public Informational Meetings and through the Project Website.

Another level of review includes both federal and state environmental Natural Resource Agencies, such as the U.S. Army Corps of Engineers and the NH Department of Environmental Service. These agencies are responsible for making or influencing permitting decisions based on state and federal laws and regulations, and serve to protect natural, cultural, and socio-economic resources potentially affected by the project. The agencies are focused on assuring the least environmentally damaging practical alternative (LEDPA) in which the impacts are minimized to the extent practicable, while providing a feasible solution that meets the project purpose and need.

Meetings with local and regional, appointed and elected public officials of the two communities directly affected as well as the general public were held periodically. These meetings included review of project findings, concept alternatives, and the preferred alternative, and discussion of the project schedule including construction time frame. Public Informational Meetings were held to present and review project-related information, and importantly to obtain information and solicit input from these stakeholders. Revisions and additional studies, as appropriate, have been conducted to address comments received.

A complete listing of the agency, local officials, and public meetings that have occurred during Part B is included in Chapter 7 Coordination and Consultation.

2.5 Preferred Alternative

The coordination and input received from the public and resource agencies described above in Section 2.4 informed selection of preferred concepts for the four project areas. The preferred concepts were selected in consideration of the extent to which each concept meets the Project's Purpose and Need. The following sections outline the most important features of each project area and the reasons for selection of the preferred concept. The four preferred concepts together form the Preferred Alternative for the project. The Preferred Alternative was presented to the public at Public Informational Meetings held on February 14 and 15, 2018 (see **Figure 2.21**).

2.5.1 Interstate 89 Area Preferred Concept (Concept K)

The key considerations for selection of the preferred concept for the I-89 Area include:

- Maintain valued interstate access for the Town of Bow
- Address the deficient weaves that discourage the use of Exit 1 due to safety concerns
- Address the deficient northbound weave at the I-93/I-89 interchange
- Minimize property impacts
- Minimize resource impacts

Concept K has been selected as the Preferred Concept for the I-89 Area because it is the most cost-effective concept with the fewest impacts that addresses the project Purpose and Need as well as the key considerations for the area. The deficient weaves within the area are all addressed by Concept K with minimal impacts outside the existing interstate right-of-way. The direct access between Route 3A at Bow Junction and I-89 would be eliminated. To travel between Bow Junction and I-89, traffic would use the proposed local connector road to South Street and access I-89 at Exit 1. Exit 1 and the access road would need to be designed to accommodate the high volume of truck traffic that would be expected.

Concept C was not selected as it does not provide sufficient improvement to the area weaves and it requires a 9.6-acre impact to the Cilley State Forest.

Concept P was not selected because the additional directional ramps would be very expensive. Construction of Concept K would not preclude the future construction of the additional directional ramps if determined to be required.

2.5.2 Exit 12 Area Preferred Concept (Concept F)

The key considerations for selection of the preferred concept for the Exit 12 Area include:

- Address the deficient deceleration distances for the exit ramps
- Provide acceptable LOS for the Route 3A intersections
- Minimize property impacts
- Minimize resource impacts

Concept F has been selected as the Preferred Concept for the Exit 12 Area because it addresses the project Purpose and Need as well as the key considerations for the area, and provides the better LOS for the Route 3A intersections compared to the signalized intersections, Concept E. The use of roundabouts has been supported by the public at this location, as well as throughout the City of Concord.

2.5.3 Exit 13 Area Preferred Concept (Concept B)

The key considerations for selection of the preferred concept for the Exit 13 Area include:

- Address the daily back-up that occurs at the Exit 13 northbound exit ramp.
- Minimize property impacts
- Minimize resource impacts

Concept B has been selected as the Preferred Concept for the Exit 13 Area because it addresses the project Purpose and Need as well as the key considerations for the area, and addresses the queuing issue for the northbound exit ramp beyond 2035. The widened northbound exit ramp eliminates the queuing that extends onto I-93.

Concept A was not selected because it does not address the queuing issue for the northbound exit ramp by 2035.

2.5.4 Exit 14/15 Area Preferred Concept (Concept F2)

The key considerations for selection of the preferred concept for the Exit 14/15 Area include:

- Address the deficient weaves between Exits 14 and 15
- Address the deficient weaves within Exit 15
- Maintain access to the Stickney Avenue area
- Minimize property impacts
- Minimize resource impacts

Concept F2 has been selected as the Preferred Concept for the Exit 14/15 Area because it addresses the project Purpose and Need as well as the key considerations for the area. The northbound entrance ramp at Exit 14 is eliminated and this diverted traffic must be

accommodated throughout the area by ensuring the other roadways and intersections would function at acceptable levels of service. The additional cost of Concept F2 was deemed acceptable due to the benefit of addressing the weaving that occurs within Exit 15.

Concept D2 was not selected because it does not sufficiently address the weaving sections in the area.

Concept F was not selected because it includes extensive impacts to property, historic resources and infrastructure, and these impacts are quite costly.

Concept O3 was not selected because of the high construction cost, construction impacts, and visual impacts.

The “flip” of Exit 14 was not selected as a component because the cost, long term disruptions in order to construct this Concept, and the visual impact are considered to be unreasonable.

2.5.5 Preferred Alternative Summary

The Preferred Alternative is comprised of the preferred concept for each of the four segments as outlined in **Table 2.8 Preferred Alternative** below.

Table 2.8 Preferred Alternative

SEGMENT	CONCEPT	COST
I-89 Area	K	\$70.0 million
Exit 12 Area	F	\$33.9 million
Exit 13 Area	B	\$39.0 million
Exit 14/15 Area	F2	\$125.0 million
Total		\$267.9 million

See **Figure 2.21 Preferred Alternative** for a composite plan of the Preferred Alternative.

Figure 2.4 I-89 Area Existing Conditions

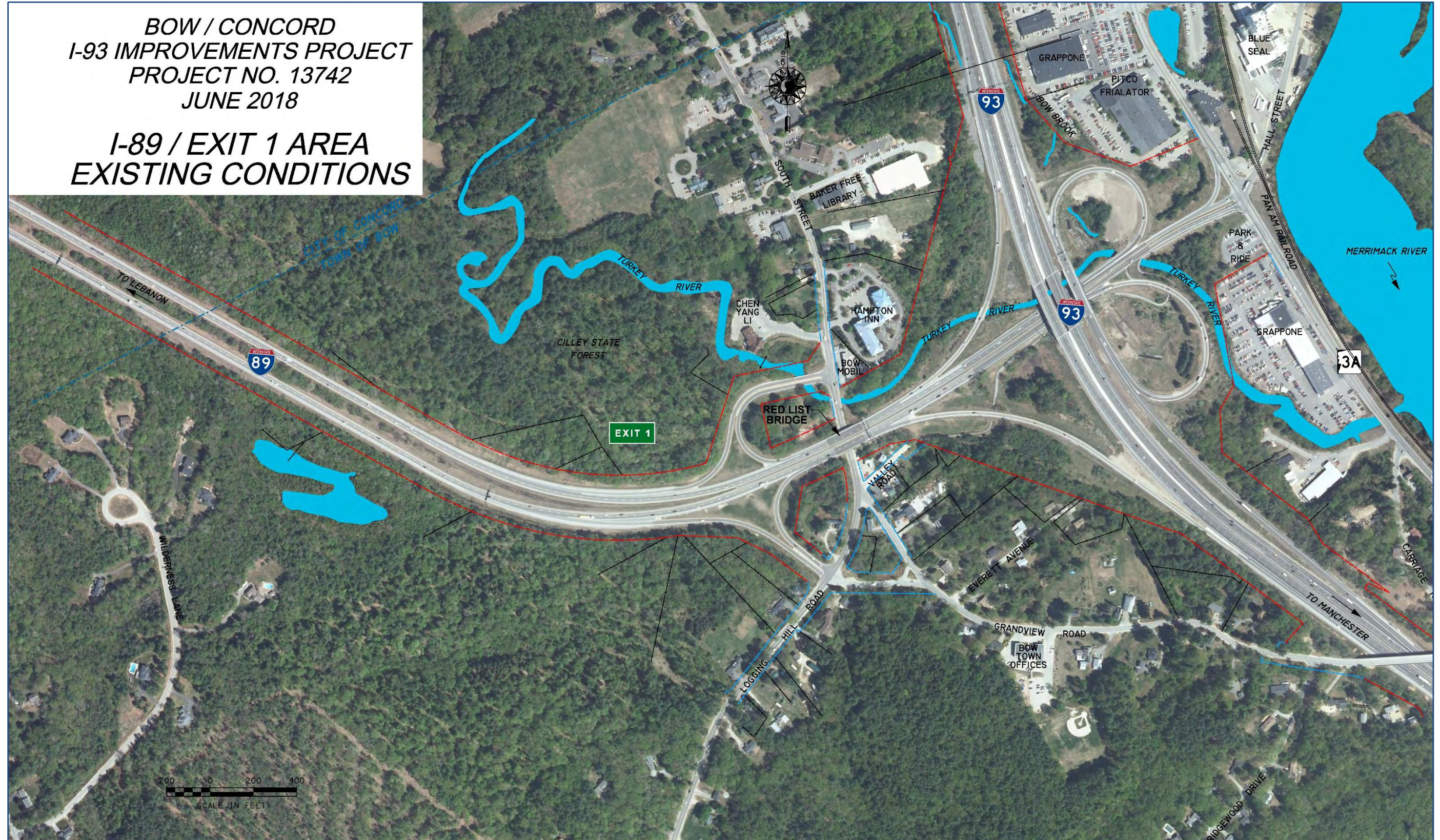


Figure 2.5 I-89 Area Concept C

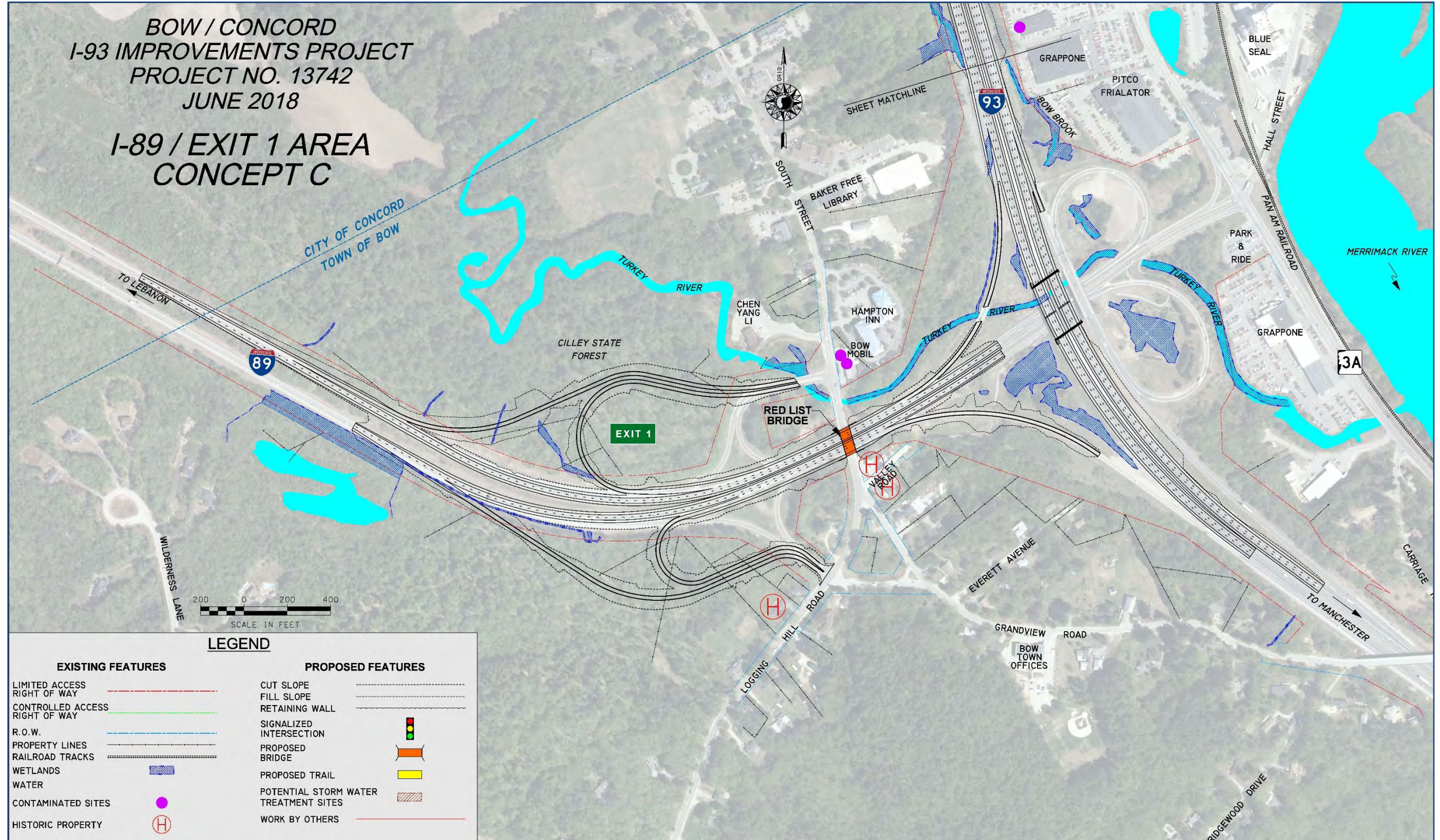


Figure 2.6 I-89 Area Concept K

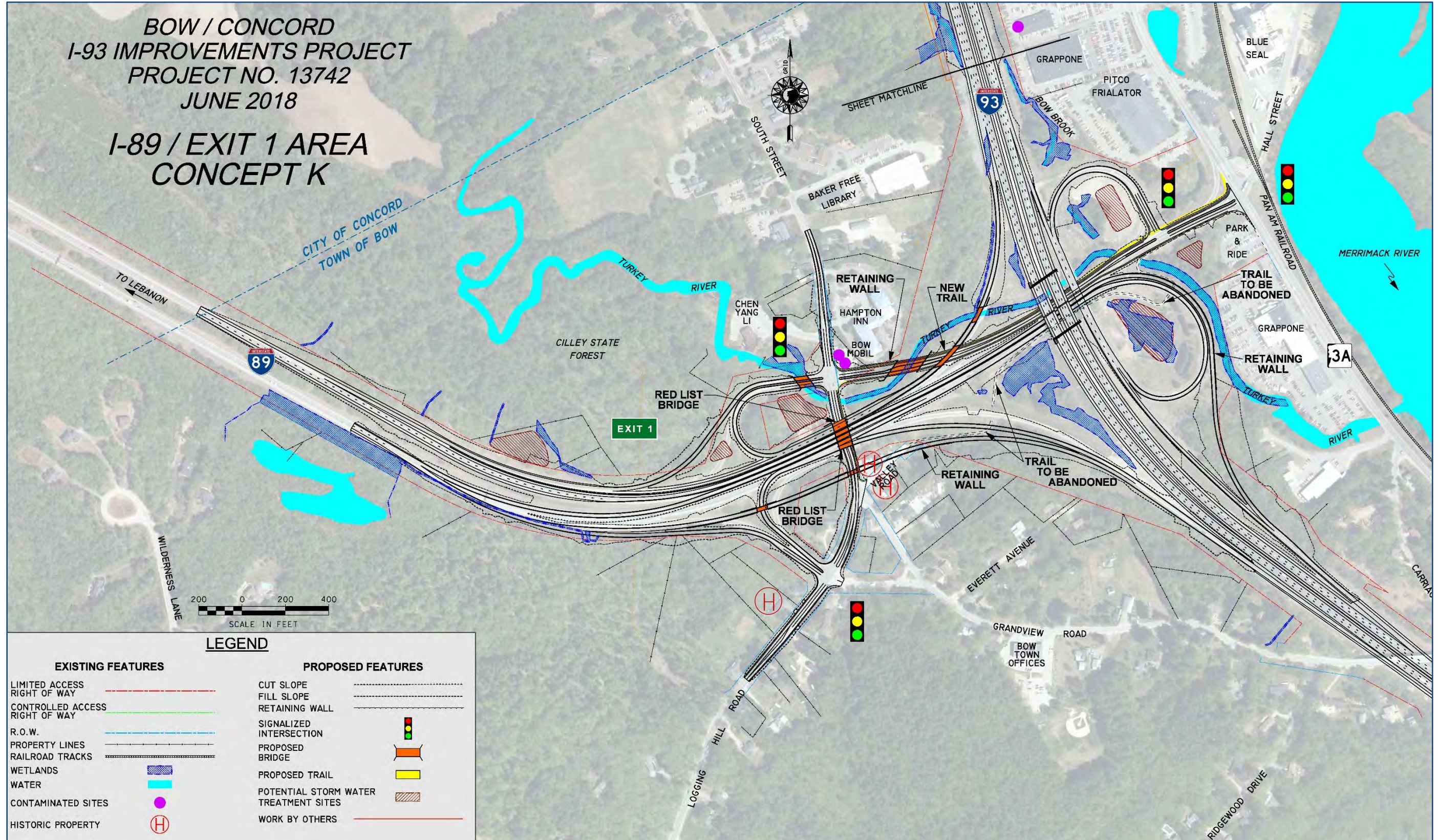


Figure 2.7 I-89 Area Concept P

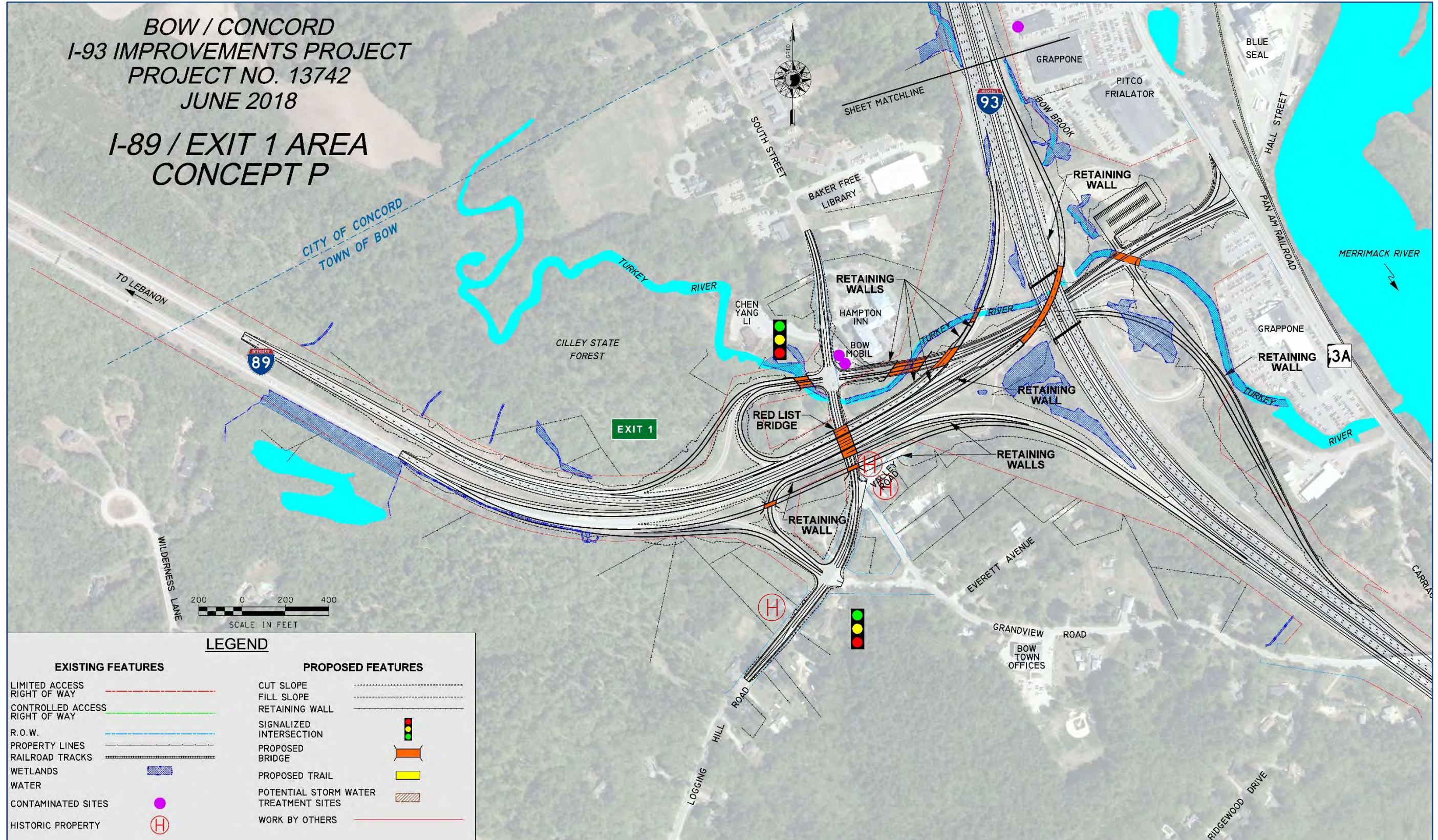


Figure 2.8 Exit 12 Area Existing Conditions



Figure 2.9 Exit 12 Area Concept E

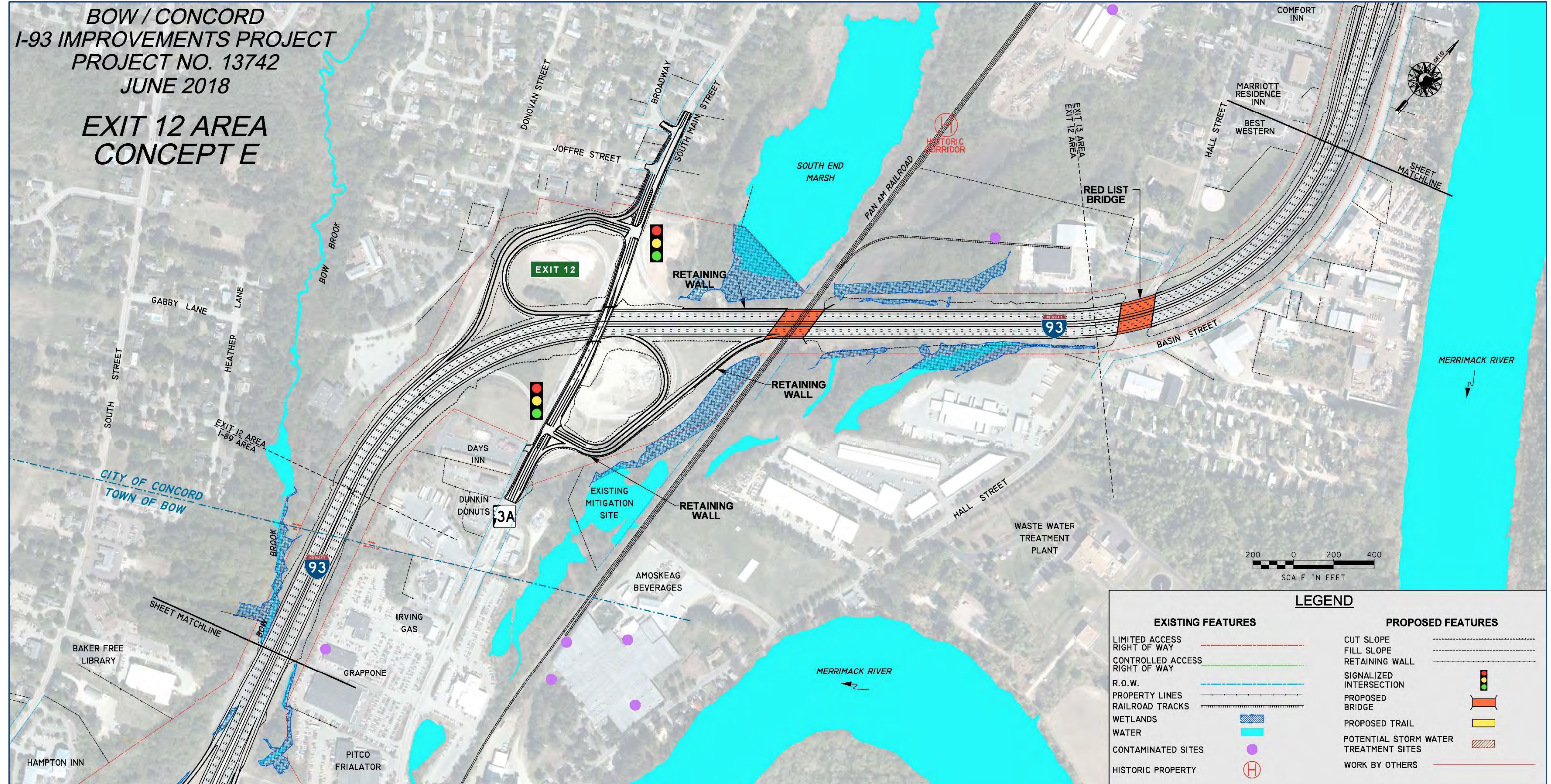


Figure 2.10 Exit 12 Area Concept F

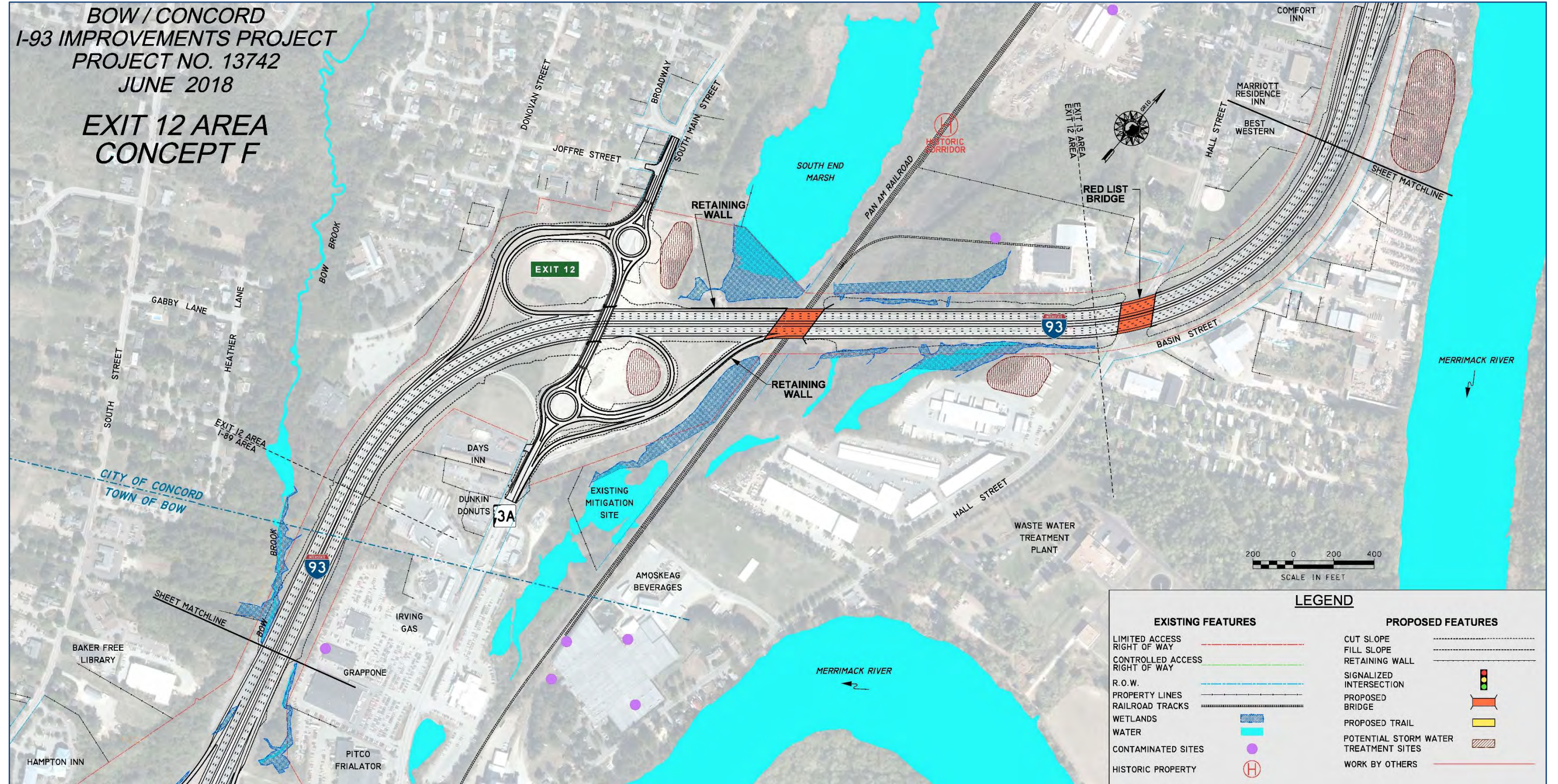


Figure 2.12 Exit 13 Area Concept A

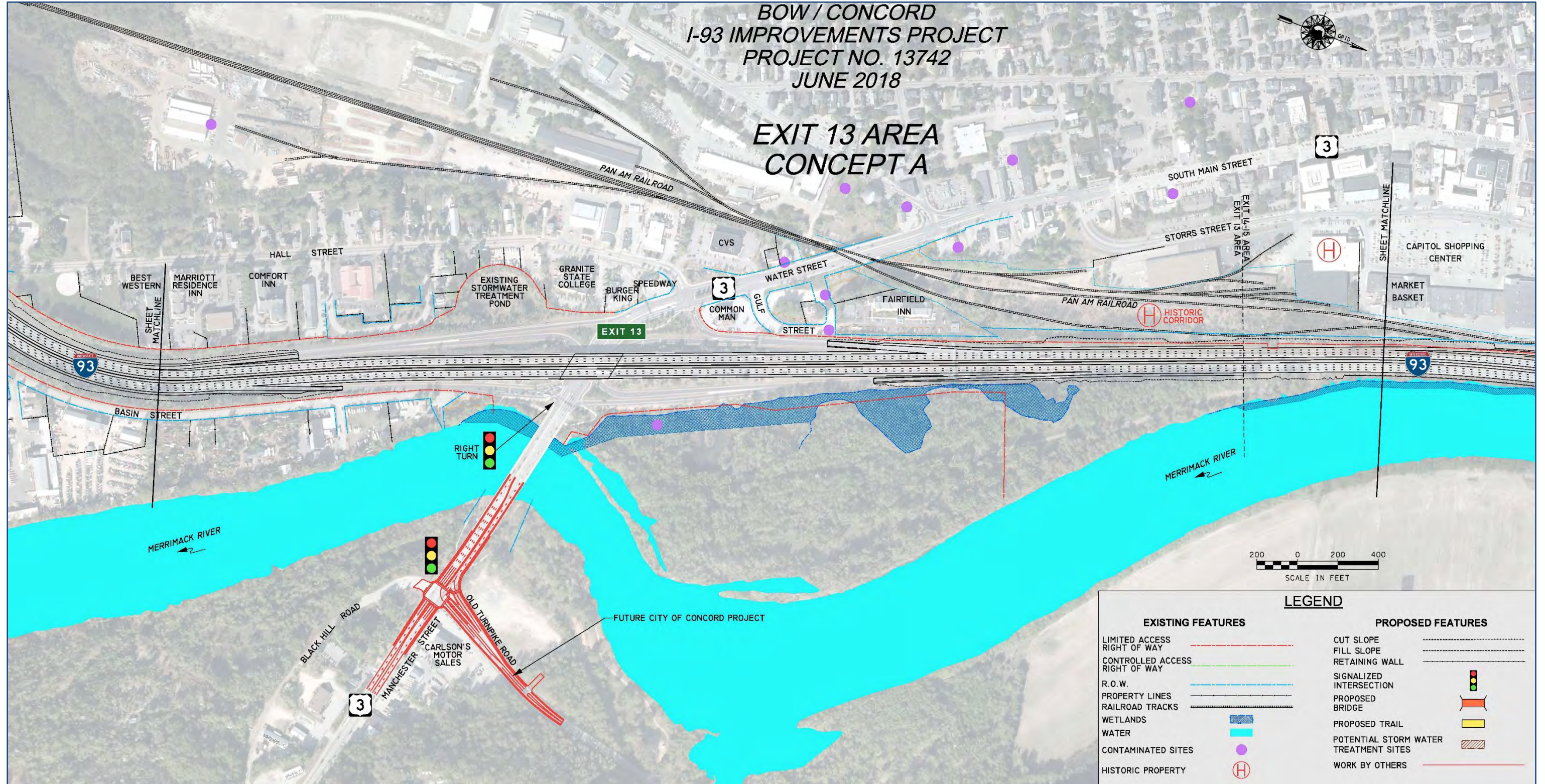


Figure 2.13 Exit 13 Area Concept B

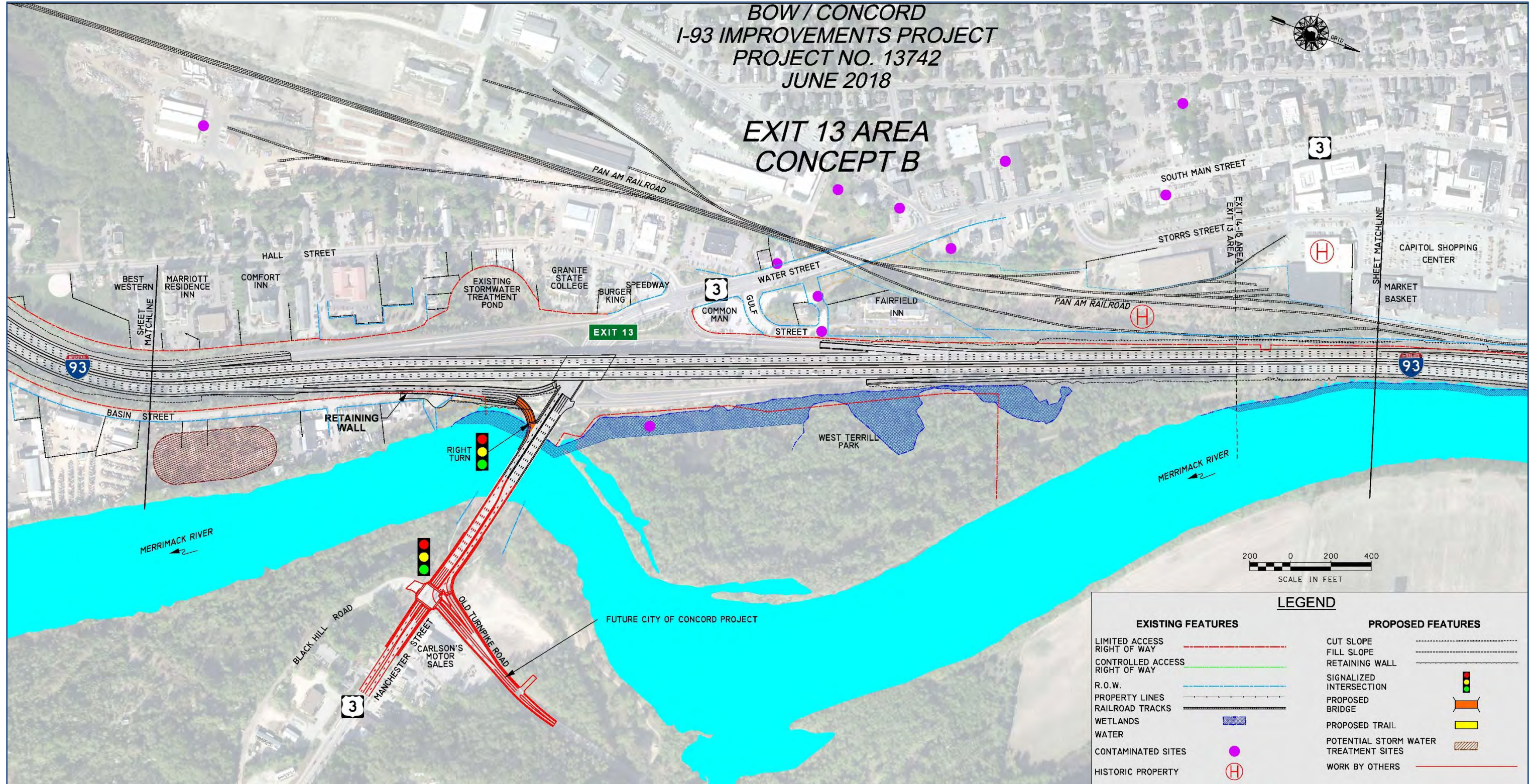


Figure 2.14a
Exit 14/15 Area Existing Conditions

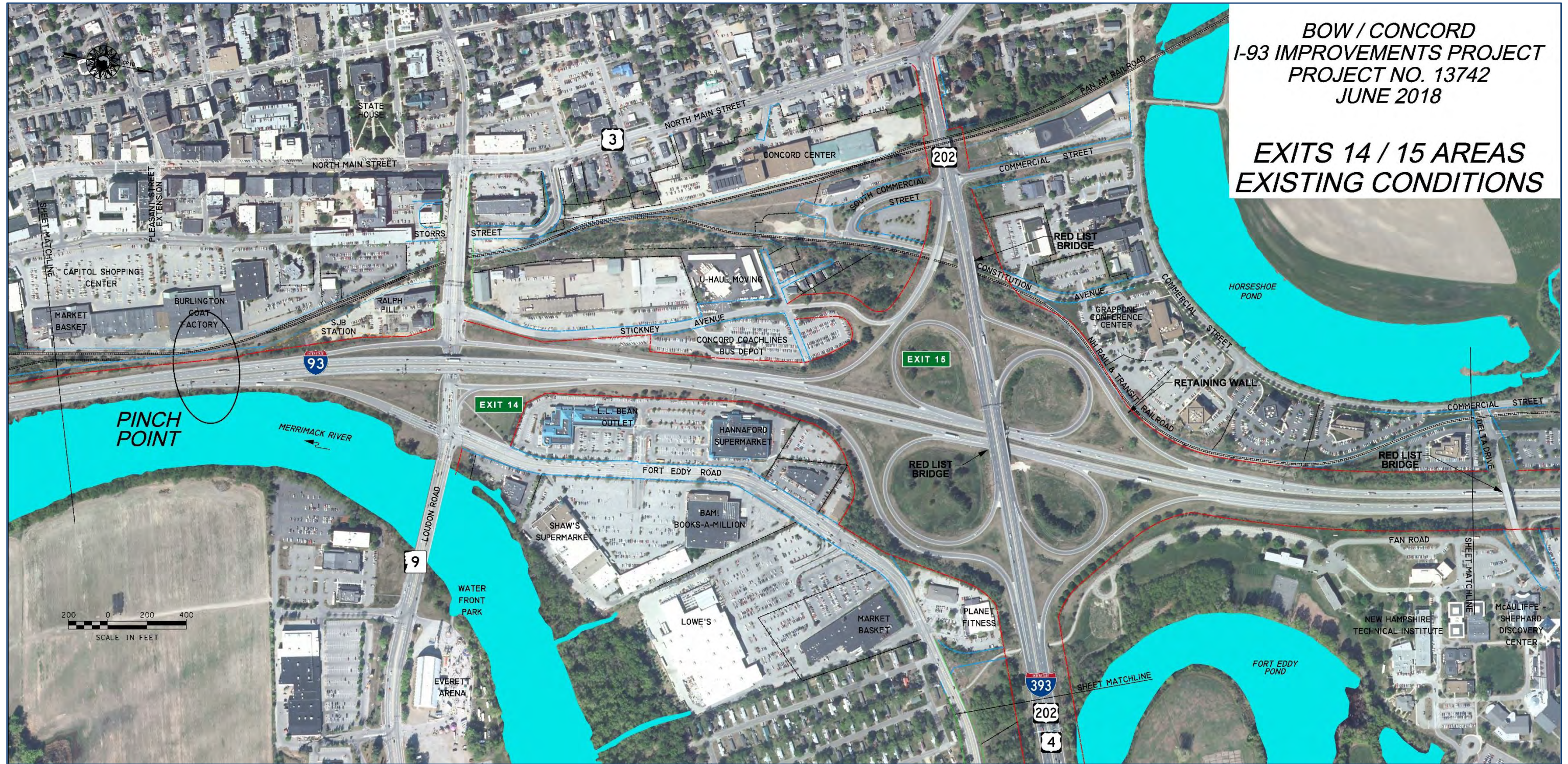


Figure 2.14b I-93 North Existing Conditions

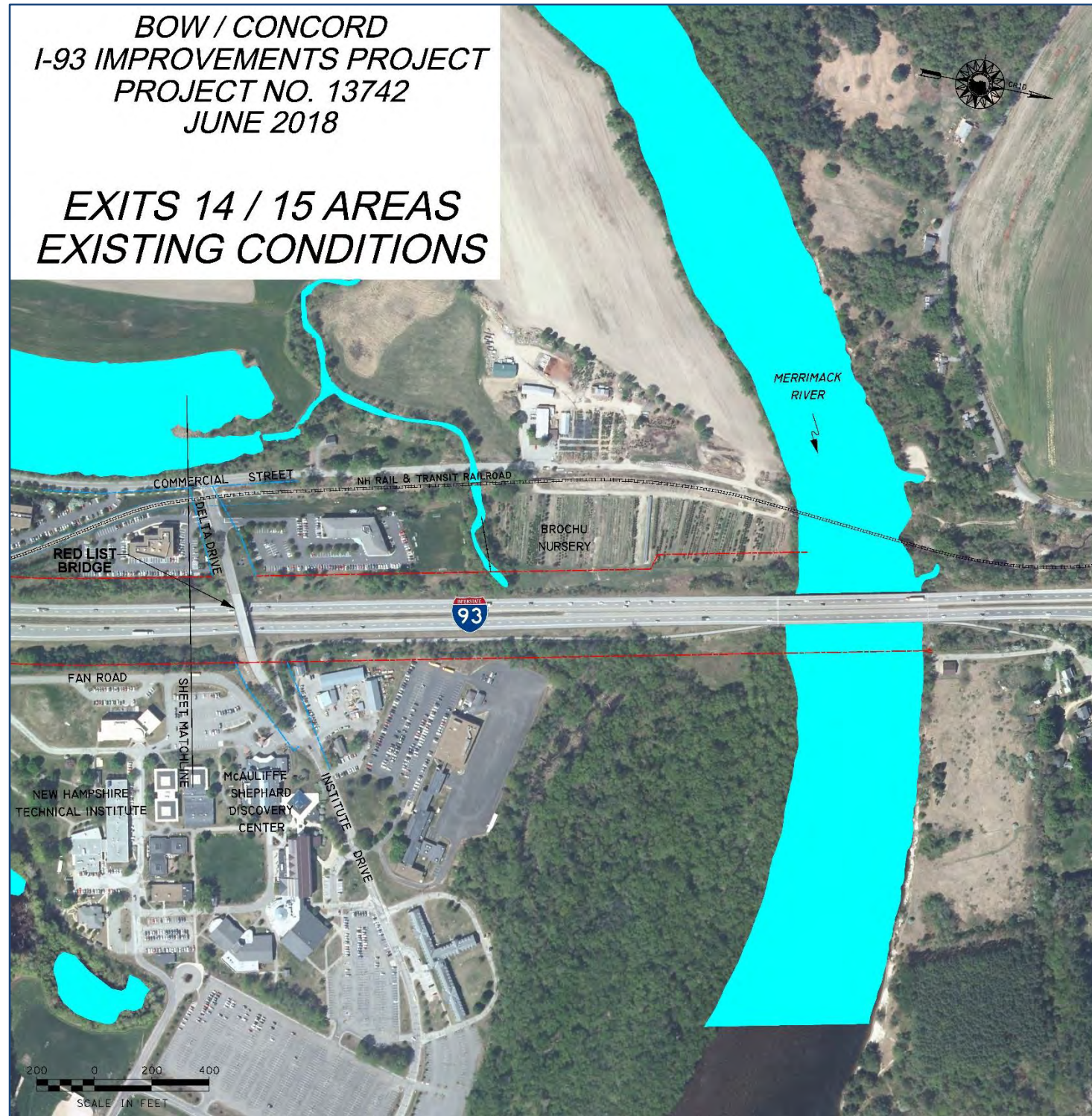


Figure 2.14c I-393 Exit 1 Existing Conditions

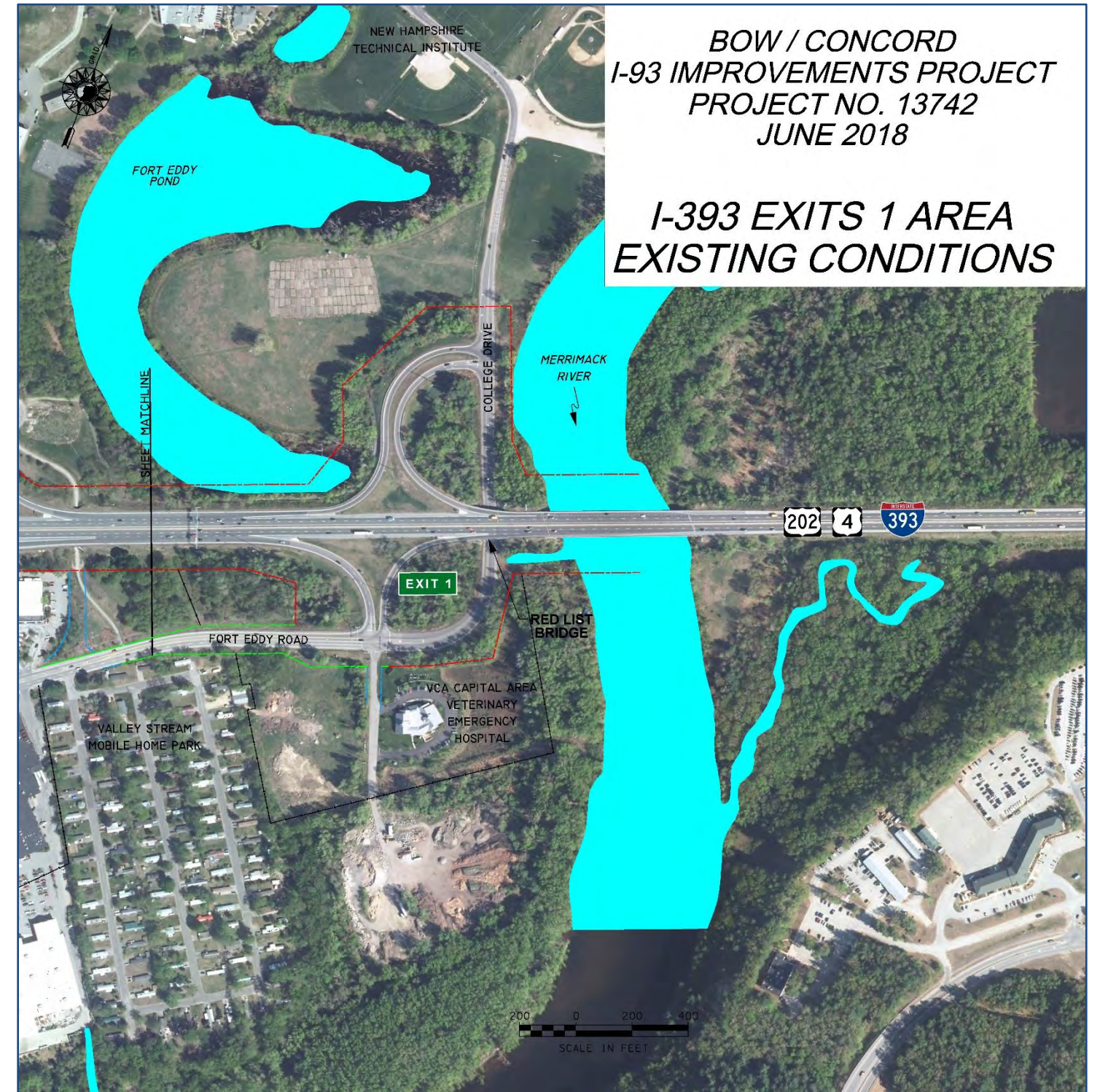


Figure 2.15a Exit 14/15 Concept D2

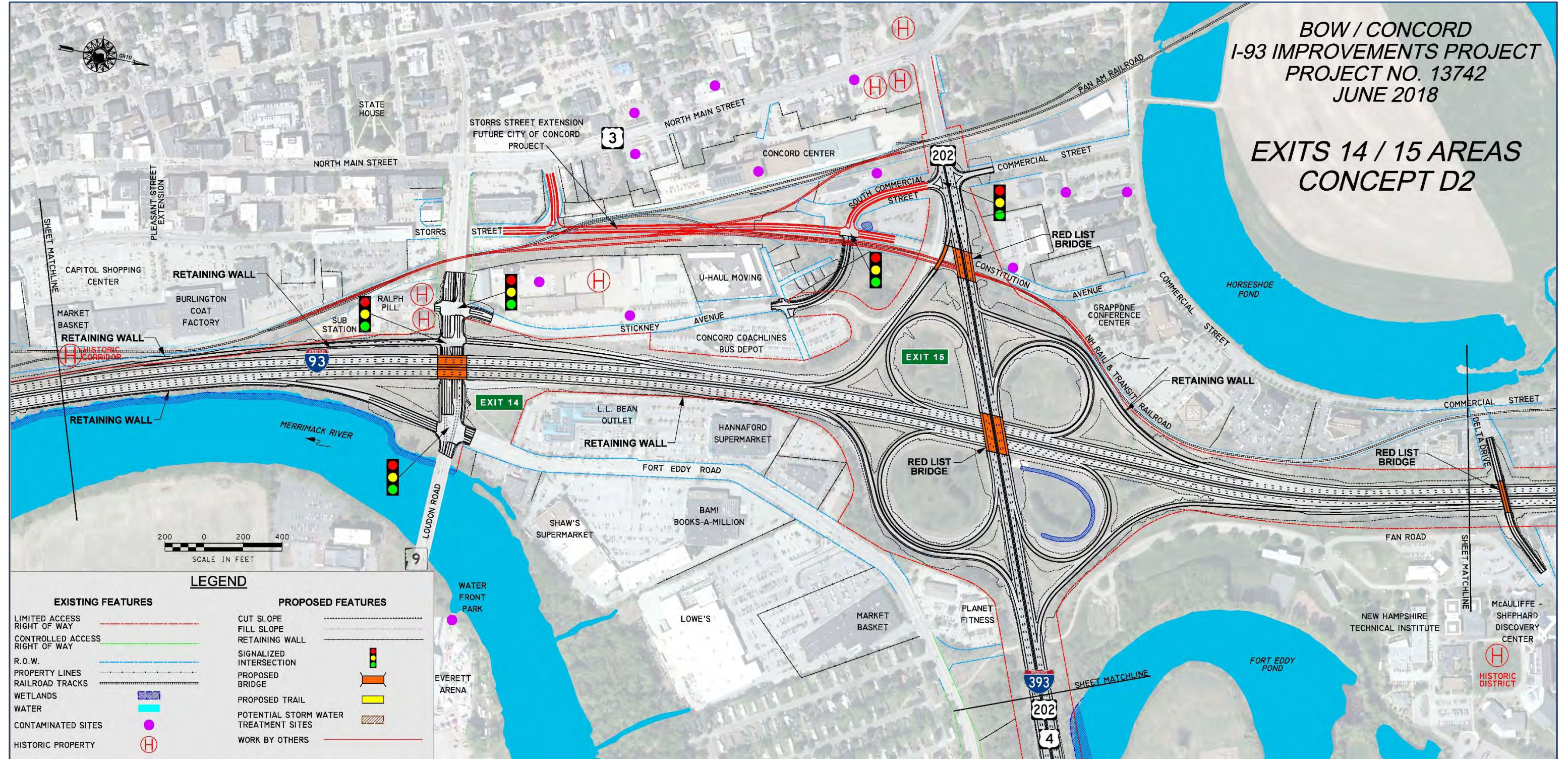


Figure 2.15b I-93 North Concept D2

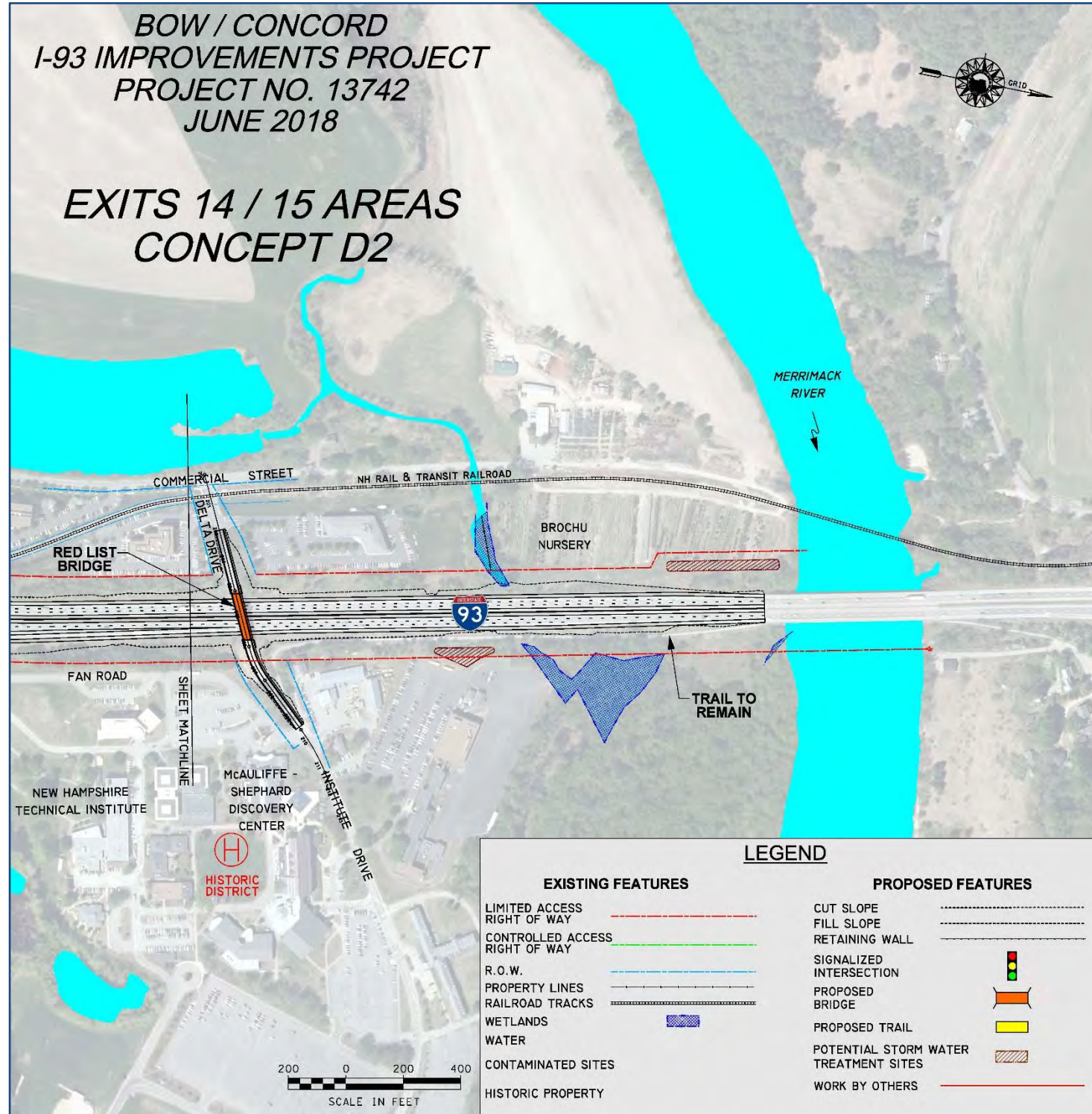


Figure 2.15c I-393 Concept D2

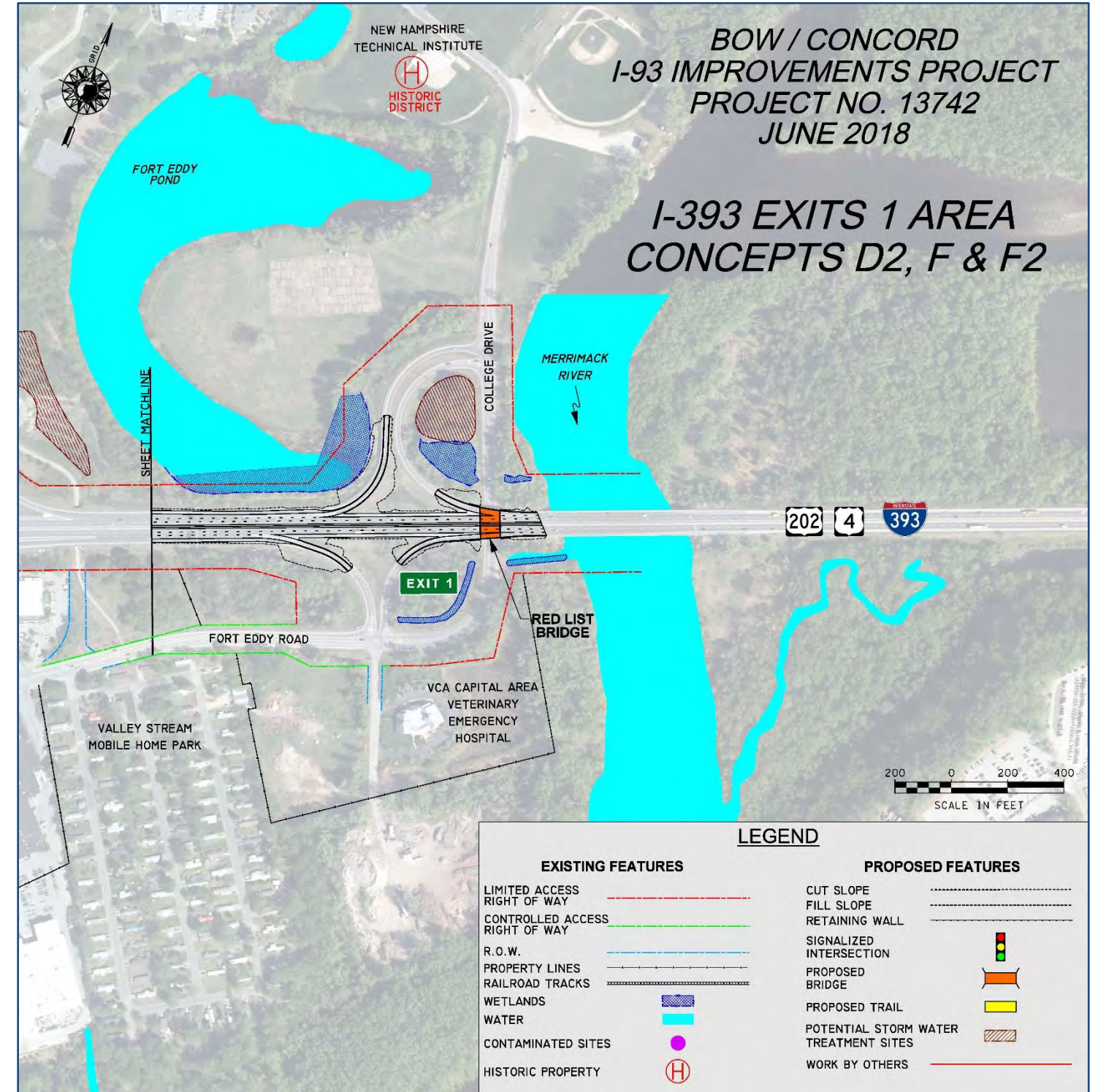


Figure 2.16a Exit 14/15 Concept F

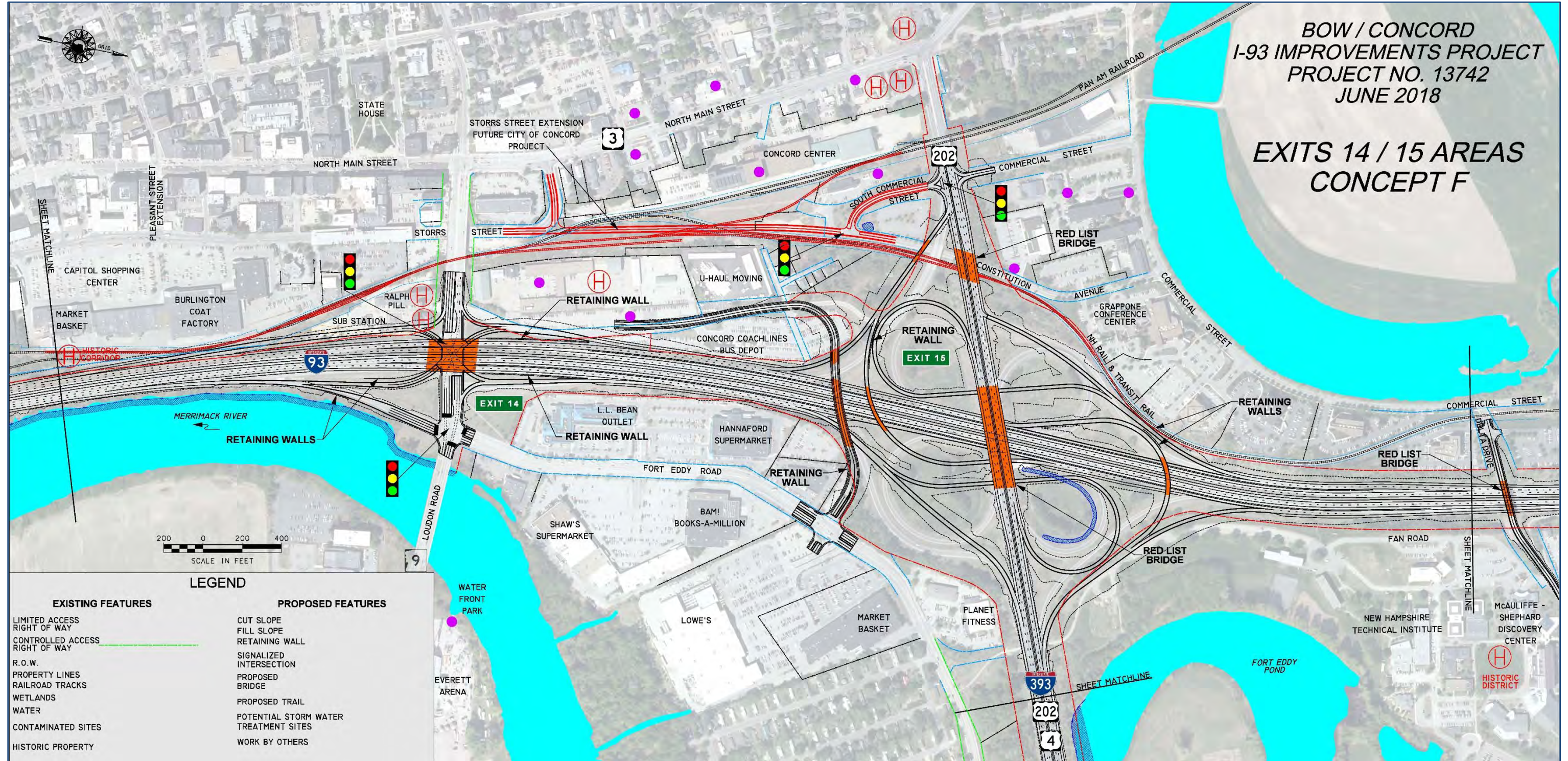


Figure 2.16b I-93 North Concept F

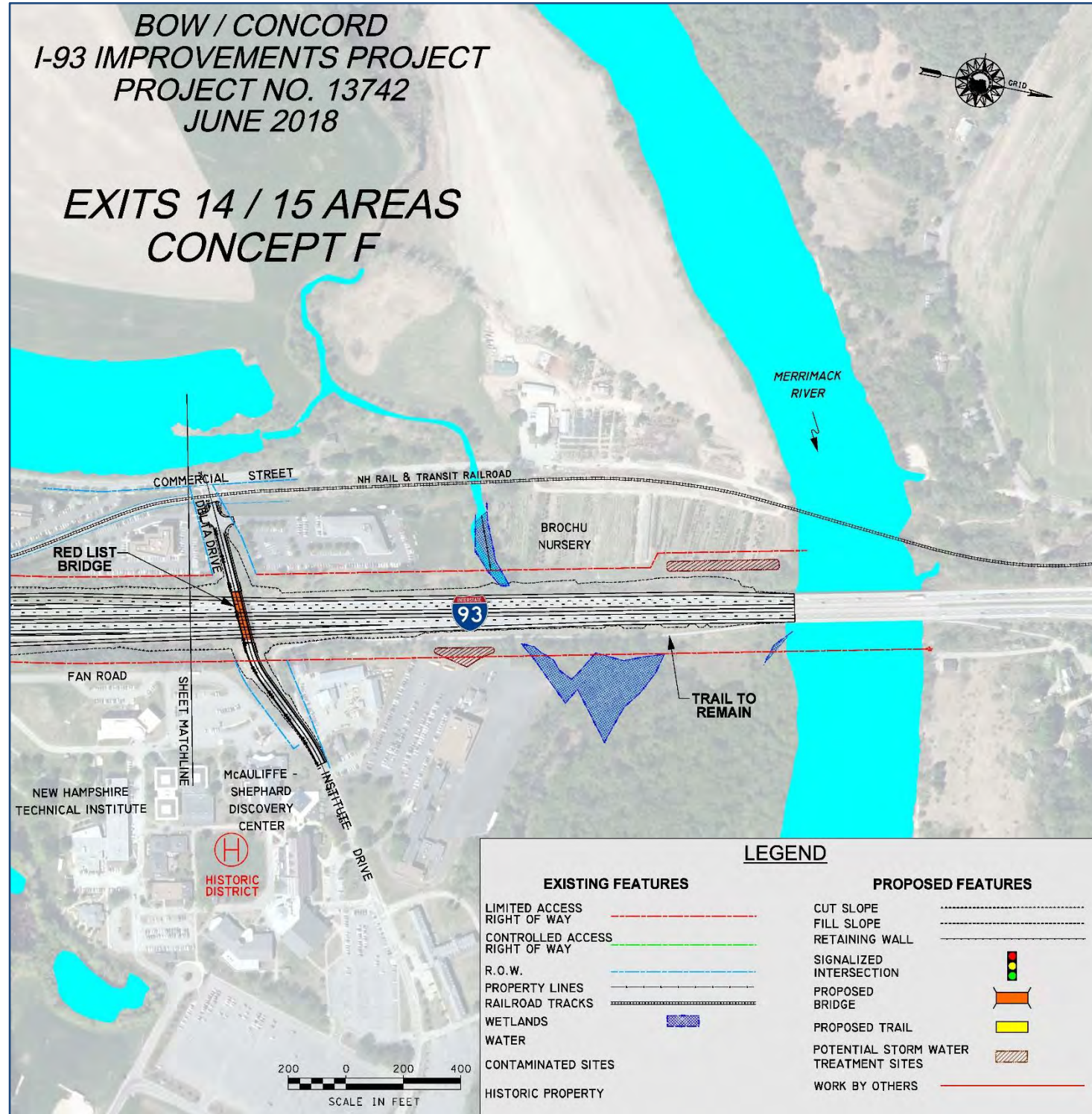


Figure 2.16c I-393 Concept F

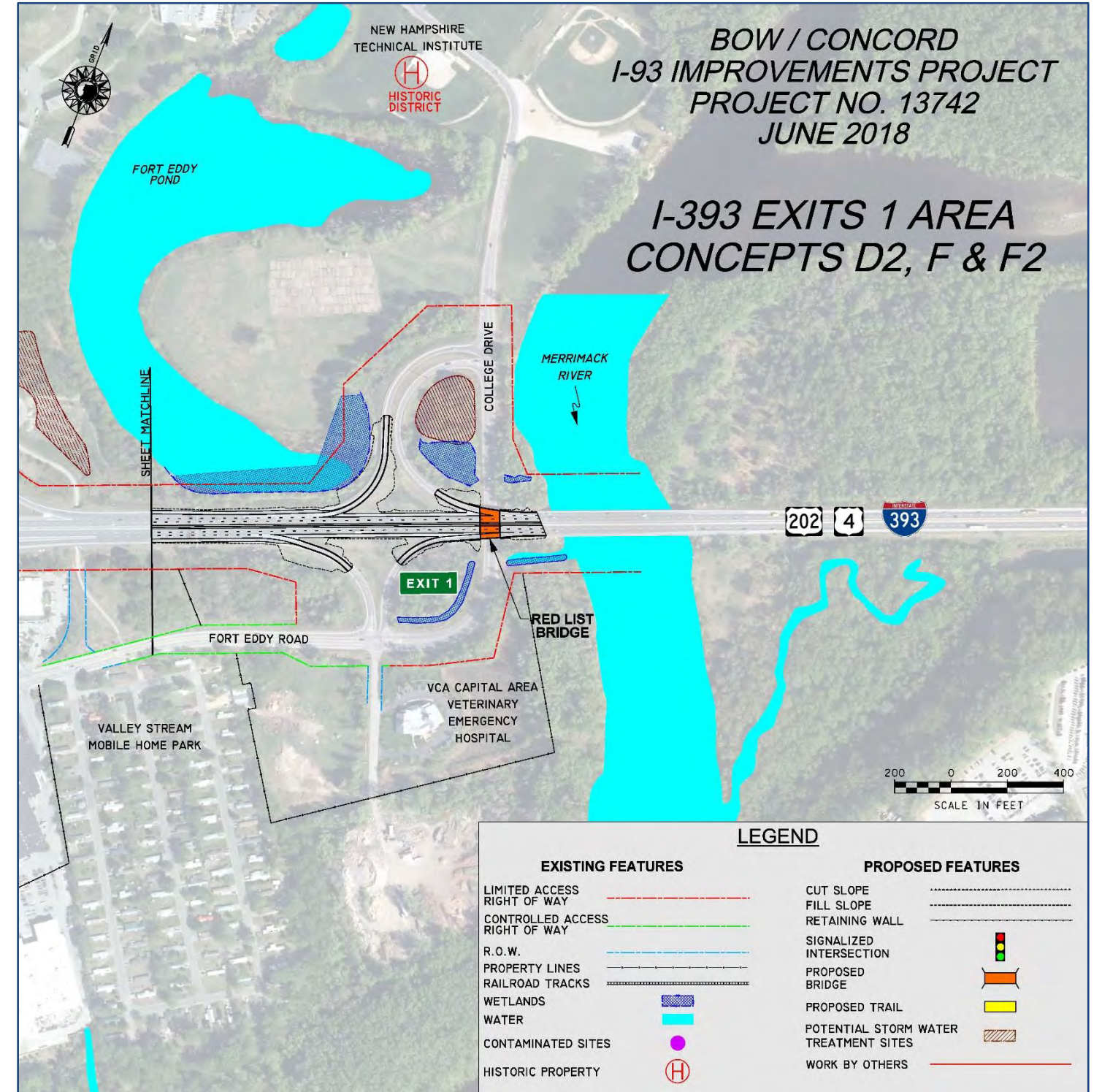


Figure 2.19a Exit 14/15 Concept F2

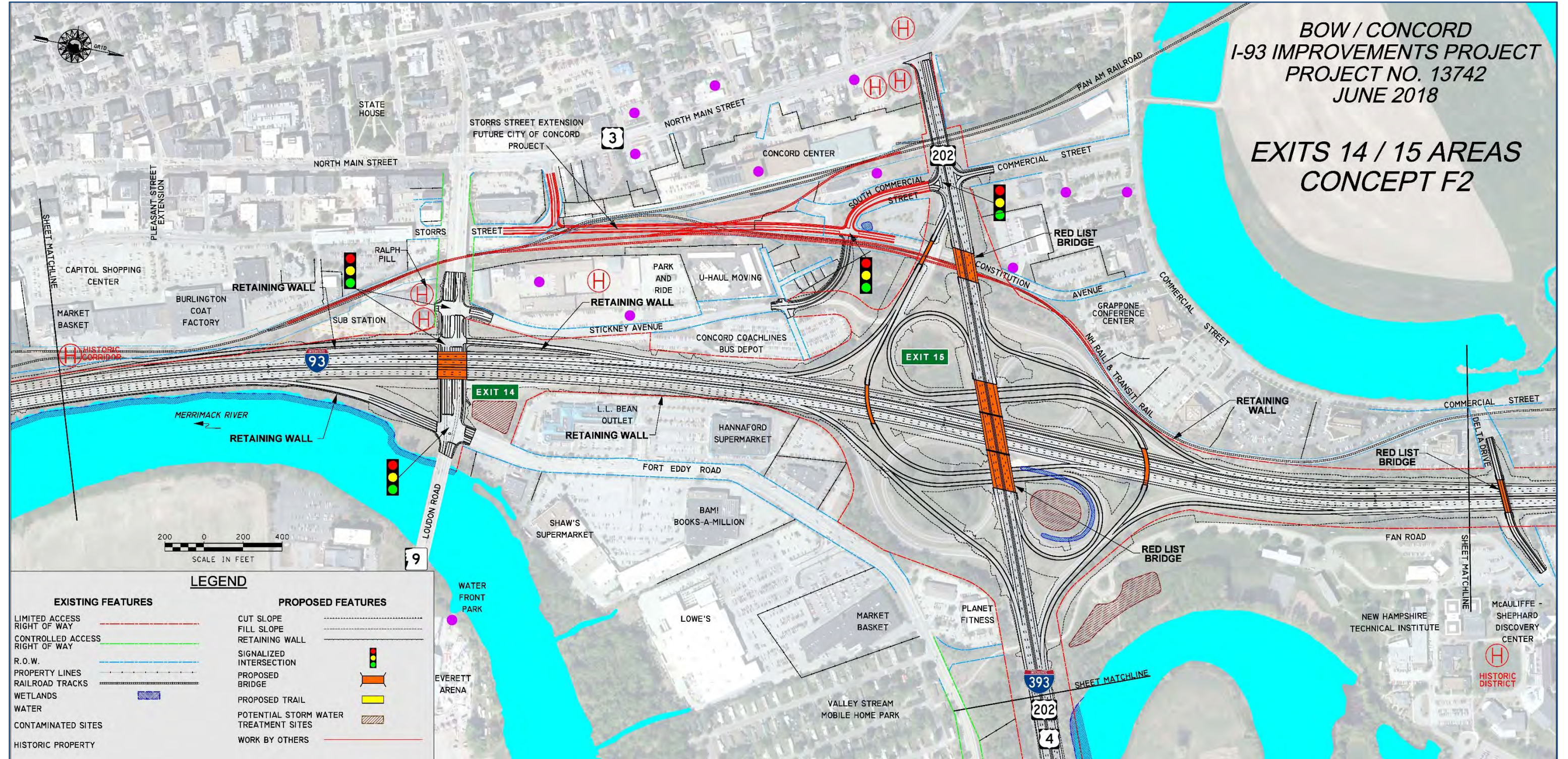


Figure 2.19b I-93 North Concept F2

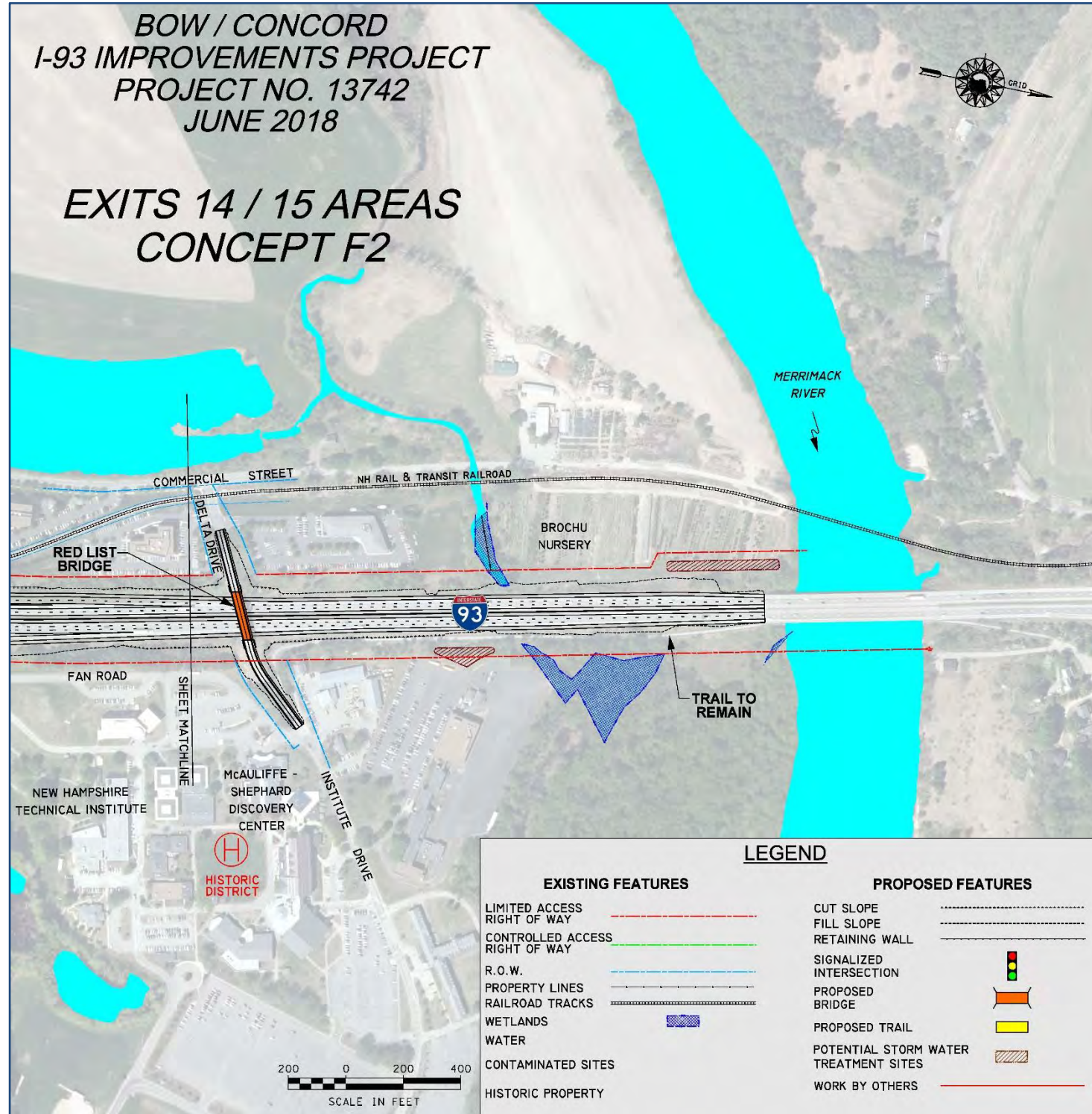


Figure 2.19c I-393 Concept F2

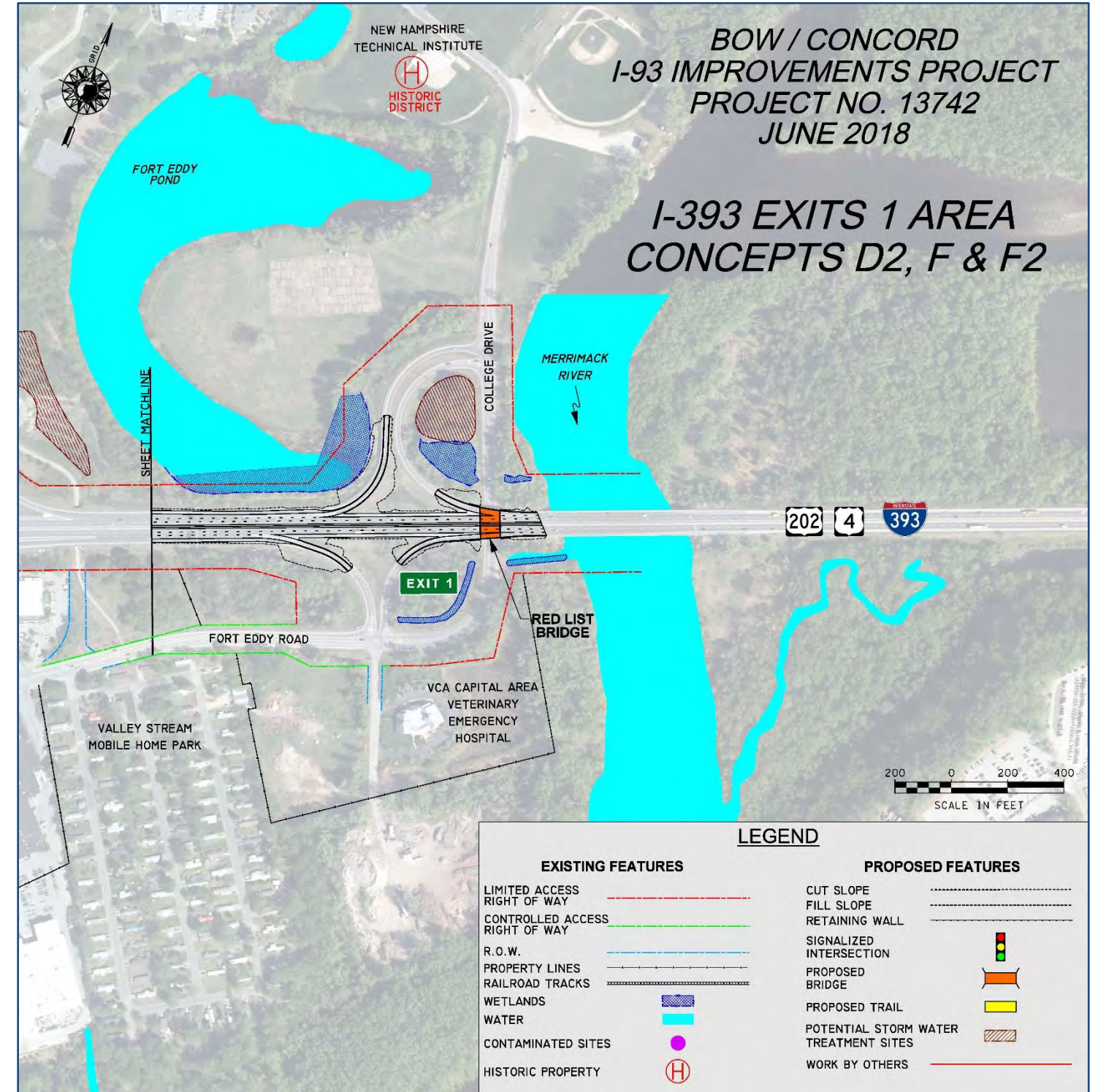


Figure 2.20a Exit 14/15 Concept O3

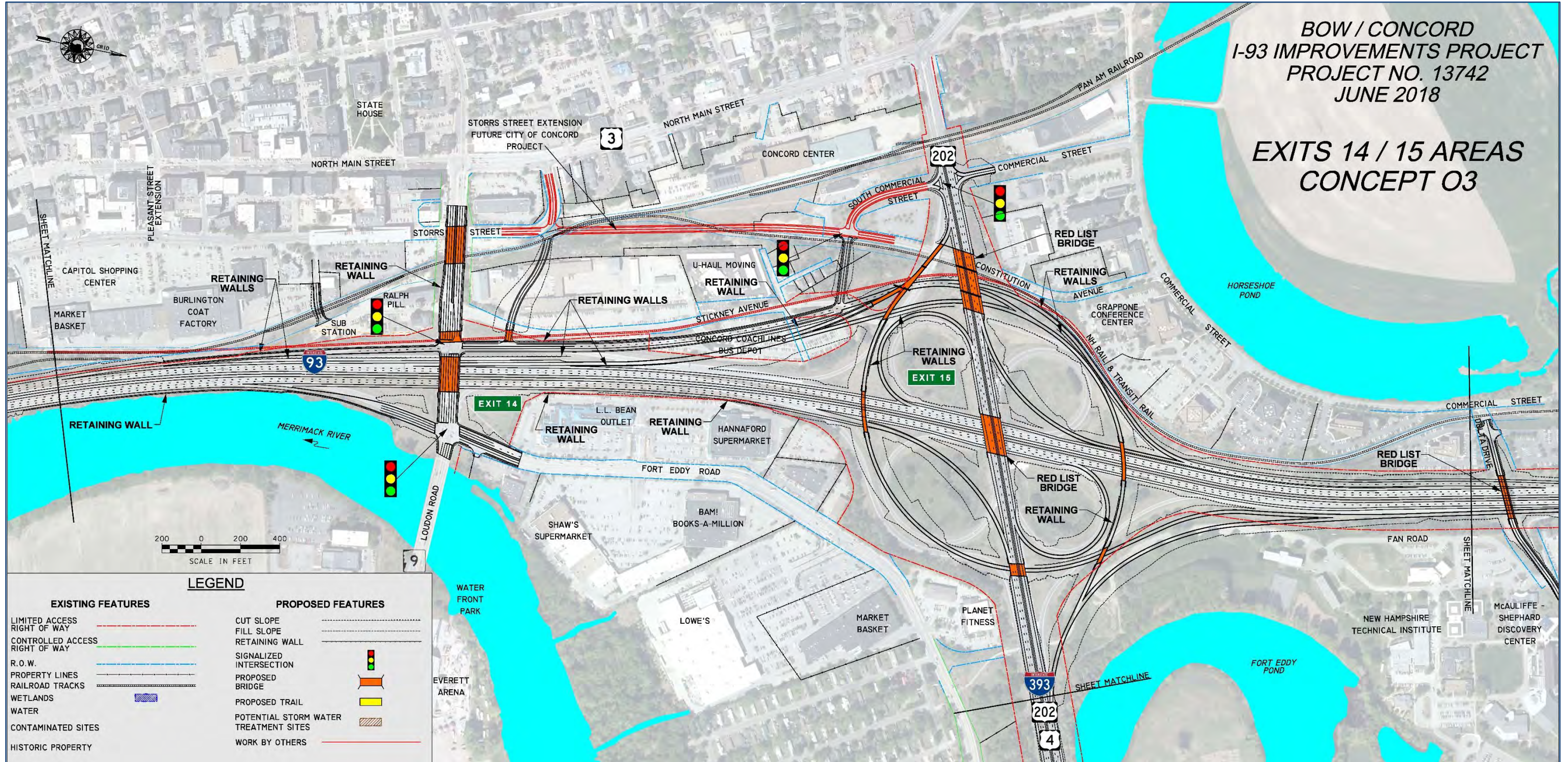


Figure 2.20b I-93 North Concept O3

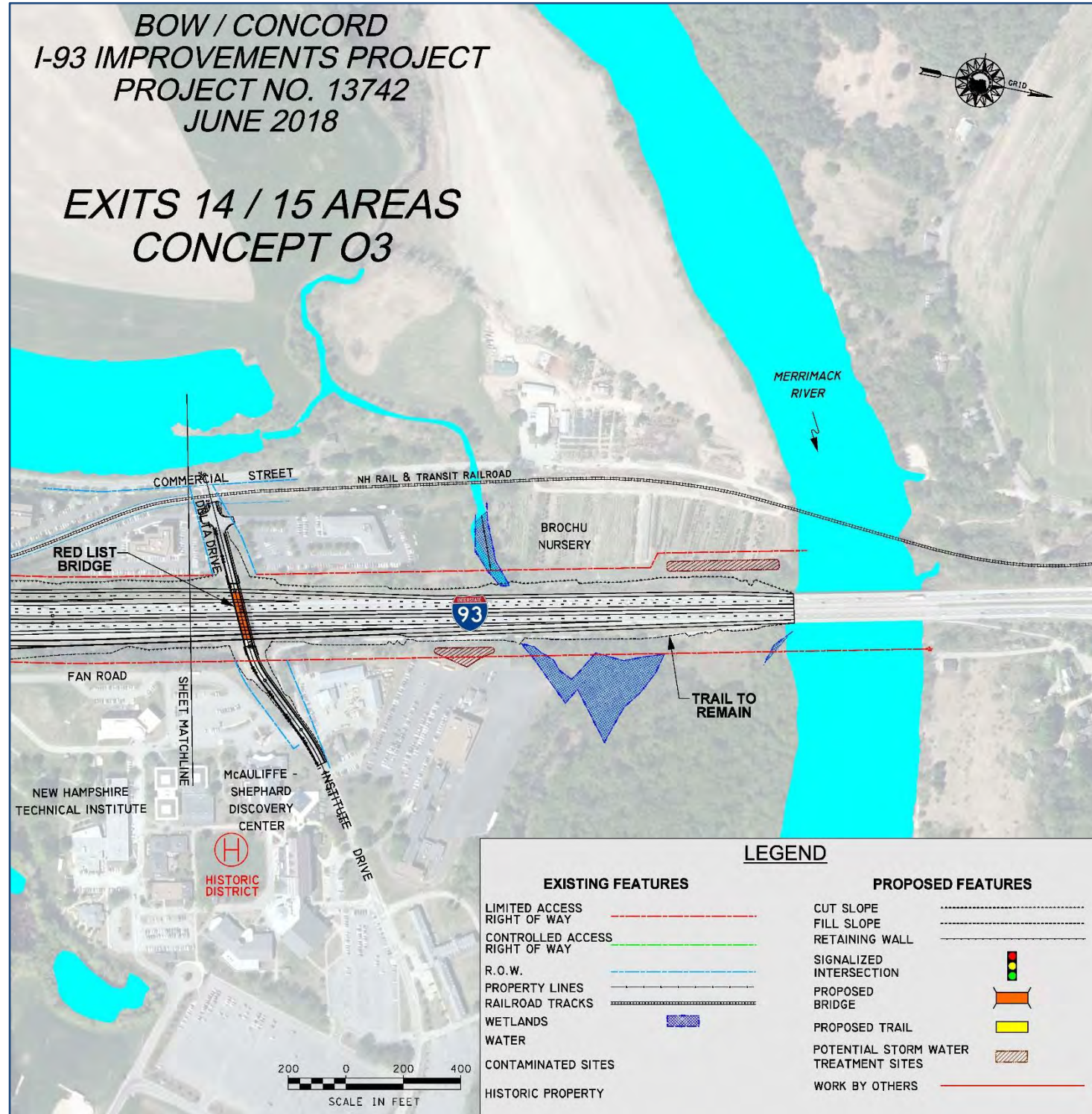


Figure 2.20c I-393 Exit 1 Concept O3

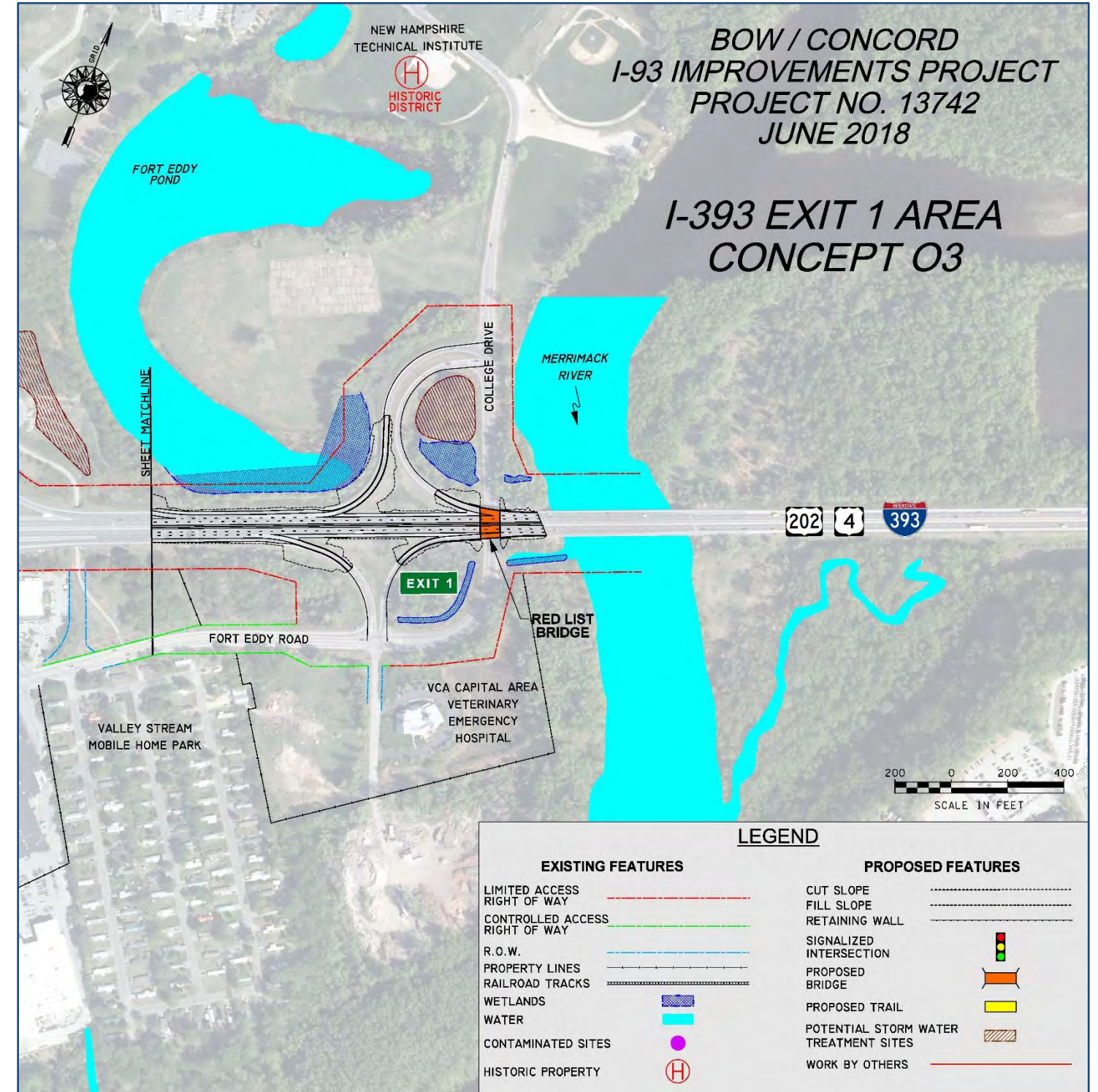


Figure 2.21 Preferred Alternative

