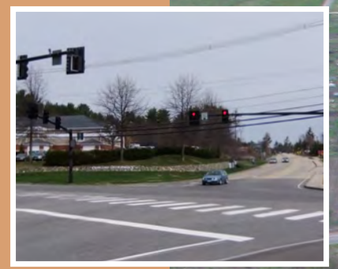

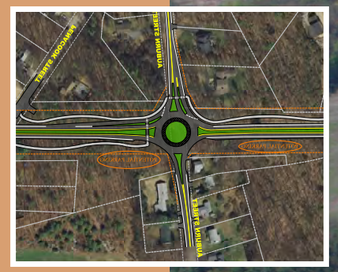

Transportation Feasibility Study
Langley Parkway Phase 3

CONCORD, NEW HAMPSHIRE

PREPARED FOR:
City of Concord

PREPARED BY:
VHB | Bedford, New Hampshire

JANUARY 2015

Transportation Feasibility Study

Langley Parkway Phase 3 – Concord, NH

Prepared for

The City of Concord, New Hampshire

Prepared by

Vanasse Hangen Brustlin, Inc.
Bedford, New Hampshire

January 2015

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Executive Summary

Introduction/Background

The City of Concord has retained Vanasse Hangen Brustlin, Inc. (VHB) to conduct a Transportation Feasibility Study for the final phase of the Langley Parkway. The third and final phase of the project will complete the vision to provide a parkway that extends from Clinton Street to the south to North State Street and Bouton Street to the north. The parkway will create a bypass of the downtown with direct access to the regional medical facilities and other major destinations within the City. The Langley Parkway project has been a work in progress for more than 50 years and is a key element of the City's 2030 Master Plan.

The purpose of this study is to develop a conceptual plan for Phase 3 that evaluates options for connectivity to/ from Langley Parkway and the surrounding neighborhoods, with a focus on connectivity that provides convenience for local traffic without creating cut-through routes on the local system. The study also assesses potential environmental impacts and identifies likely environmental permitting requirements.

Project Need

Traffic safety and operational issues will continue to perpetuate in the downtown and along Pleasant Street without the completion of the parkway. It is estimated that 10,000 vehicles per day cut through the City's west end neighborhoods traveling to and from regional medical facilities, major businesses, schools, and institutional employment centers located along Pleasant Street. Public benefits associated with the completion of Langley Parkway include congestion relief, improved traffic flow and safety, and enhanced pedestrian and bicycle safety. The completion of the parkway also provides for enhanced access to the major business centers and institutions along the northwesterly perimeter of the downtown, as well as improved access and an alternative route to Concord Hospital. The parkway also extends recreational (non-motorized) travel opportunities along the corridor, building upon the growing popularity of walking and bicycling along the southern Phase 2 segment.

Description of Roadway Alternatives

The study presents two design options for the mainline roadway segments of the parkway and two design options for each mainline intersection. Mainline alternatives, which cover the parkway segment from the current terminus of the roadway just north of the medical facilities to the point where the roadway would tie into the existing system in the vicinity of Penacook and Rumford Streets, include a median and non-median divided roadway. Both alternatives provide a single travel lane in each direction with pedestrian and bicycle facilities; however, one option includes a raised center median. The cross sections of the non-median and median divided roadways approximate 62 feet and 78 feet respectively. Alternatives to connect to the local roadway system include the consideration of roundabouts and traffic signals at the intersections of Langley Parkway with the northern access to Concord Hospital, Auburn Street, and Rumford Street. Other local connections proposed via unsignalized intersections include Granite Ledges, Jennings Drive, and Bradley Street. Two design alternatives (cul-de-sac and hammer-head) are also shown for the termination of Penacook Street at the parkway.

It is important to note that the individual design elements of each option for the roadway segments and local intersections are interchangeable, giving the City the flexibility in selecting a preferred alternative. In addition, alternatives presented are fully compliant with the 'complete streets' provision of the City's Comprehensive Transportation Policy (adopted in January 2010) and provide for all users including motorists, pedestrians, bicycles, and public transit riders.

Through the study process, roadway improvements outside of the Phase 3 segment were also identified as being beneficial to the project and improve traffic operations within the study area. These improvements include enhanced access Concord Hospital on both Langley Parkway and Pleasant Street, additional capacity at the North State Street intersection with Penacook Street, and improvements to the intersection of North Street with Rumford Street.

Key Findings

Traffic Operations

As traffic volumes continue to growth, operations throughout the downtown will continue to deteriorate. By the forecast year 2035, six of the ten signalized intersections studied are projected to operate at level of service (LOS) E or F with some intersections experiencing volume to capacity (v/ c) ratios greater than 1.0. In addition, traffic operations at numerous unsignalized intersections studied are also expected to degrade with substantial increases in delay, operating at LOS F.

All new intersections, and those to be reconstructed or improved as a result of the project, have been conceptually designed to accommodate traffic volume demands through the forecast year 2035 and operate at acceptable levels of service. In addition, the parkway will divert substantial traffic away from the downtown street network. As a result, six of the existing downtown signalized intersections studies are projected to experience moderate to

substantial reductions in delay and v/ c ratios. Five of the six signalized intersections are projected to have improved or better LOS under the 2035 Build condition than under the 2035 No Build condition. Improved traffic operations are also projected for the unsignalized intersections studied, with all intersections operating at LOS D or better.

Secondary and Emergency Access to the Regional Medical Facilities

Concord Hospital is the region's only Level 2 Trauma Center. As traffic volumes continue to grow and congestion increases along Pleasant Street, the need for secondary access will become increasingly more important. Under the existing condition, no secondary access to the medical center potentially compromises public safety in the event of a major incident on Pleasant Street if the roadway is closed and blocking direct access to the hospital. The completion of the parkway also presents the opportunity for reduced life-safety emergency response times to the trauma facilities from the north and east, particularly during peak hour conditions.

Environmental Assessment

The environmental resources evaluation revealed that the mainline median alternative would have slightly more impact than the no median alternative. Based on the conceptual design, it has been estimated that the wetland impacts could range from 17,100 square feet to 25,600 square feet depending on the choice of no median or raised median for the preferred alternative. Both alternatives would generally impact ten wetlands and two streams (Bow Brook and one unnamed tributary system). These impacts are approximately half of the wetland impacts originally projected for Phase 3 of the parkway back in 1992.

The signal alternative has slightly more impervious surfaces, totaling an estimated 19.0-acres in comparison the 18.0-acres for the roundabout alternative. Imperious surfaces (number of acres of proposed pavement) are the primary measure of water quality. It is important to note that this preliminary assessment does not account for stormwater treatment measures that will mitigate and reduce the potential for water quality impacts (to be addressed at the next stage of design).

Anticipated aquifer and farmland impacts are similar for the median and no median alternatives with the median option having a slightly larger footprint. Aquifer disturbance areas approximate 7.5-acres and farmland disturbance areas approximate 15.0-acres.

There are no known rare, threatened, or endangered species directly in the study area. There are also no floodway or floodplain resources within the study. No known historic properties are anticipated to be directly impacted by the project.

Right-of-Way Impacts

Non-City owned parcels from the assessor's database were compared to the conceptual right-of-way (ROW) lines associated with each alternative to identify the number of abutting parcels that may be impacted. It has been estimated that approximately 32 to 36 properties could be impacted depending on the selection of the design alternatives. The conceptual designs indicate that the no full property acquisitions will be necessary to accommodate the project, only small strip areas for ROW.

Potential Environmental Permitting Requirements

Currently, there is no plan to use of federal or state funding for the project. Even without the use of these funding sources, the project is still expected to be required to obtain a number of environmental permits from various agencies as part of the approval process. These permits include Wetland Dredge and Fill, Water Quality Certification, Alteration of Terrain (AOT), Stormwater, and Rare Species Coordination.

Cost Estimates

Planning-level construction cost estimates (2014 Dollars) were developed for programming purposes based on the conceptual design. As stated above, the study presents both mainline and intersection alternatives whose parts are interchangeable. Estimated construction costs for the roundabout alternative range from $13,600,000 with no median on Langley Parkway to $14,300,000 with the median. Similarly, the signal alternative ranges from $14,700,000 with no median on the mainline to $15,400,000 with the median. These planning-level cost estimates do not include costs related to utility construction or relocation, right-of-way acquisition, mitigation, or engineering design fees. Cost estimates can be further refined upon the selection preferred alternative and completion of preliminary engineering design.

Next Steps

The evaluation presented in this planning study identified key issues and potential improvement plans on a conceptual basis, and should not be interpreted as a conclusive study of impacts. More formal analysis of impacts will need to occur during the next preliminary design and environmental analysis phase with the more detailed evaluation of the alternatives under the permitting process.

The City's staff plans to present this report to the City Council in early 2015 at which time the Council will determine how to proceed with the project. The next phase of design and environmental study will include a robust public participation process. Upon approval of the project and receipt of all the necessary permits, construction would commence.

1

Introduction

1.1 Project Background

Vanasse Hangen Brustlin Inc. (VHB) has been retained by the City of Concord to conduct a Transportation Feasibility Study for the final phase of the Langley Parkway. The vision for Langley Parkway is to provide a roadway that extends from Clinton Street to the south to North State and Bouton Streets to the north, creating a bypass around the downtown area with direct access to the regional medical facilities located along Pleasant Street and more convenient access to other major destinations in the City, such as the New Hampshire State Office Park. Being a key element of the 2030 City Master Plan, the Langley Parkway project has been a work in progress for more than 50 years including the evaluation of parkway layout alternatives with a wide-range of configurations. The general parkway alignment considered in this feasibility study is the one which has been planned for and pursued by the City in recent decades. Throughout this time, the City has secured nearly all the right-of-way required to complete the project and has progressed the parkway in three phases: Phase 1 (Langley Parkway from Pleasant Street north through the Concord Hospital campus area, 1995) and Phase 2 (Clinton Street north to Pleasant Street, 2008) are complete. Alternative configurations for Phase 3 are studied herein. The July 21, 2010 *Langley Parkway & The Northwest Bypass* exhibit (Figure 1.1-1) prepared by the City of Concord shows the completed Phase 1 and Phase 2 segments of the Parkway, as well as the future Phase 3 segment.

A Wetlands Application was prepared for the project in September 2001 for the Phase 2 construction, which was completed in 2008. Although the 2001 application encompassed the project in its entirety (including Phase 3), enough time has lapsed that an updated review of potential transportation and environmental impacts associated with the final phase is warranted. Additionally, all of the regulatory programs at the New Hampshire Department of Environmental Services (NHDES) and the New Hampshire Division of Historical Resources (NHDHR) have passed numerous changes to their statute and regulations, which requires that some of the previous analysis be re-examined. This Transportation Feasibility Study examines permitting efforts necessary for Phase 3 to comply with current environmental regulations for the extension of the Parkway from Pleasant Street to North State and Bouton Streets. The purpose of this work effort is to collect and compile base information that will provide a clear understanding of the existing conditions and environmental constraints within the study area. The existing conditions information and the previously identified roadway alignment serve as the basis for current, more detailed transportation and environmental evaluations.

Phase 3 of Langley Parkway would construct a ±1.6-mile, two-lane roadway on a new alignment. The new roadway would connect the northern terminus of Phase 1 to North State Street in the northern portion of the City. With the preliminary alignment and cross section of the final roadway segment determined, the goals of the transportation portion of this study are:

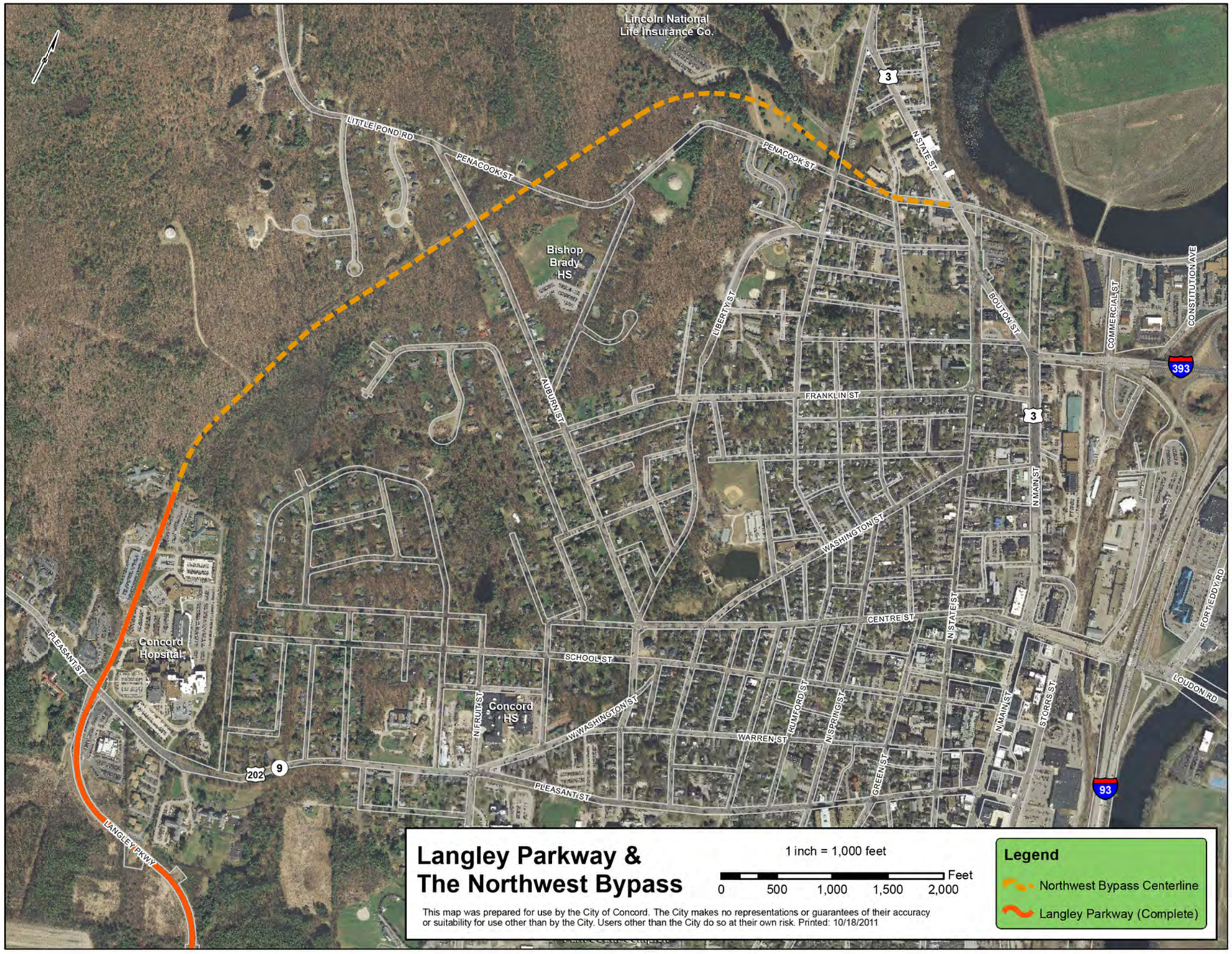
- To develop a conceptual plan for Phase 3 that addresses the long term functional needs of the corridor and reinforces the previously outlined access management policy, which defines the number and location of future private driveways and public intersections.

- To evaluate options for local connectivity to/ from the parkway and the surrounding neighborhoods of Penacook Street/ Auburn Street, Rumford Street, and Bouton Street that benefit and provide convenience for local traffic, without creating cut-through routes that would negatively impact the local system.

The goal of the environmental portion of this study is to compile updated base information to identify any new significant issues not previously identified. The updated data serves as the basis for estimating environmental impacts and identifying likely environmental permitting requirements, including flagging any critical issues that should be considered in developing the schedule and budget for the project development process. At the time of completing this feasibility study, there are no federal funds identified for the construction of the project. If federal funds are not used for the project, compliance with the National Environmental Policy Act (NEPA) will not be applicable.

1.2 Project Need

Even with the completion of Phases 1 and 2 of the parkway, safety and operational issues in the downtown and along Pleasant Street will continue to perpetuate without the completion of the third and final phase of the project. It is estimated that approximately 10,000 vehicles per day (vpd) cut-through the City's west end neighborhoods, traveling to and from the regional medical facilities, major businesses, schools and institutional employment centers located along Pleasant Street. Cut-through traffic further compromises safety and livability in the neighborhoods, as well as at major pedestrian traffic generators such as Concord High School, Memorial Field, and Bishop Brady High School.



VHB Vanasse Hangen Brustlin, Inc.

Figure 1.1-1
Langley Parkway & the Northwest Bypass

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

As traffic volumes continue to grow and congestion increases on Pleasant Street, the need for a secondary access to Concord Hospital (the region's only Level 2 Trauma Center) will become increasingly more important. Life-safety emergency response time to the trauma facilities from the north and east could be substantially reduced with the completion of the parkway, which would have limited intersections and obstacles to be navigated by emergency vehicles. Under the existing conditions, no secondary access to the medical center area also potentially compromises public safety in the event of a major incident on Pleasant Street if the roadway is closed, blocking direct access to the hospital.

With the completion of Phase 3 of Langley Parkway, the public benefits would include:

- Congestion relief, improved traffic flow, and enhanced pedestrian safety in the older, densely-populated neighborhoods, north and west of downtown Concord.
- Enhanced access to major employment and institutional centers along the northwesterly perimeter of the downtown area, including independent access in the event of a blockage along Pleasant Street, Clinton Street, South Fruit Street, Warren Street, or School Street.
- Improved access and reduced travel time for emergency vehicles to Concord Hospital.

Exhibit 1.2-1 shows existing and future traffic flow patterns with the implementation of Langley Parkway Phase 3.

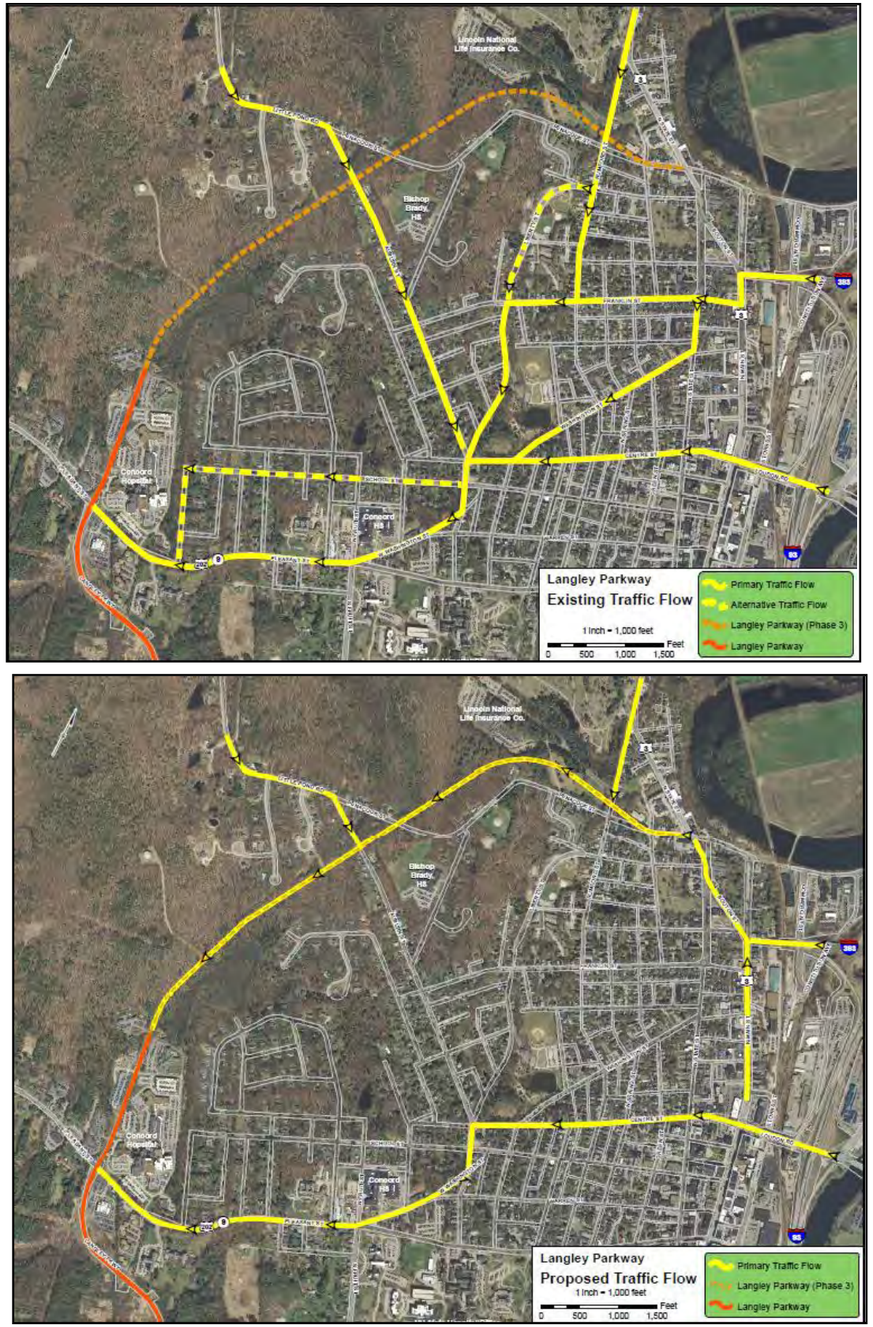


EXHIBIT 1.2-1 EXISTING AND PROPOSED TRAFFIC FLOW PATTERNS

1.3 Study Area

The study areas for the transportation and environmental evaluations have been delineated based on the anticipated limits of project-related impacts for each discipline and therefore differ from each other. The study area for the evaluation of environmental, cultural resources, and historic impacts is limited in size and encompasses a corridor generally following the alignment shown on the *Langley Parkway & The Northwest Bypass* exhibit (Figure 1.1-1). The future roadway envelop is defined as a corridor approximately 250 feet wide, centered on the conceptual roadway alignment provided by the City.

The study area for the evaluation of traffic operational impacts is more substantial and includes several existing arterial routes and local streets through the downtown area. The general limits of study are encompassed by: Langley Parkway (existing and future segments) to the west and north; North Main Street and North State Street to the east; and Pleasant Street and Clinton Street to the south. Other downtown roadways reviewed for project-related impacts include (but are not limited to): Auburn Street, Penacook Street, Rumford Street, Columbus Avenue, Little Pond Road, Warren Street, School Street, Washington Street, Franklin Street, Bouton Street, and Centre Street. In addition to these roadways, twenty-three (23) existing intersections have been included in the study for the purpose of collecting data and conducting detailed traffic operational analyses. These intersections are shown in Figure 1.1-2 and include:

- North State Street and Rumford Street
- North State Street and Bouton Street
- North Main Street, Bouton Street, and US 202/ US 4
- North State Street, Penacook Street, and Horseshoe Pond Lane
- North State Street and Franklin Street
- North State and Centre Street
- Centre Street and Washington Street
- Centre Street at North Main Street
- North State Street and Pleasant Street
- North Main Street and Pleasant Street
- Rumford Street and Penacook Street
- Washington Street and Center Street
- Auburn Street, Liberty Street, and Centre Street
- Auburn Street, Penacook Street, and Little Pond Road
- Auburn Street and Columbus Avenue
- Auburn Street and Franklin Street
- Penacook Street and Columbus Avenue
- Pleasant Street, North Fruit Street, South Fruit Street, and Warren Street
- Pleasant Street and Langley Parkway
- Clinton Street and Langley Parkway
- Clinton Street and South Street
- Clinton Street and I-89 Northbound Ramps
- Clinton Street and I-89 Southbound Ramps

1.4 Committee Review and Public Information Process

Throughout the study process, conceptual plans were reviewed by various City departments and staff members, and the City's Transportation Policy Advisory Committee (TPAC) to provide feedback and critique design elements of the future segment of the parkway. This review process eventually led to the development of two design alternatives for the roadway segment of the parkway and two traffic control alternatives for each new intersection along the parkway. Both design options (presented in Chapter 4) were carried forward for presentation to the public and for future consideration by the City.

In addition to participation by City staff and TPAC in the study development process, outreach to the major businesses whose existing access is likely to be directly or indirectly affected by Phase 3 was coordinated and neighborhood meetings were conducted to solicit feedback on the project.

LEGEND

* - Study Area Intersections

0 1200 2400 Feet

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 1.1-2
Transportation Study Area Intersections

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

1.4.1 Data Gathering and Informational Meetings

Early in the study, data gathering meetings were held with the two major employers that have the potential for future employment growth on their campuses and whose accesses will directly or indirectly be altered as a result of Phase 3 of the parkway – Concord Hospital and Lincoln Financial Group. Data gathered included employer assessments of future employment capacity on campus (discussed in more detail in Section 3.4.1 – Site Specific Future Trips), as well as existing on-site physical constraints that would need to be considered during the planning process for the corridor with regard to modifying the access to these sites.

Upon completion of the conceptual roadways plans, informational meetings to present the design alternatives were held with Lincoln Financial Group and the Pleasant Street/ Medical Area businesses. Meeting dates are shown in Table 1.4-1.

Table 1.4-1. Businesses/Stakeholder Informational Meetings

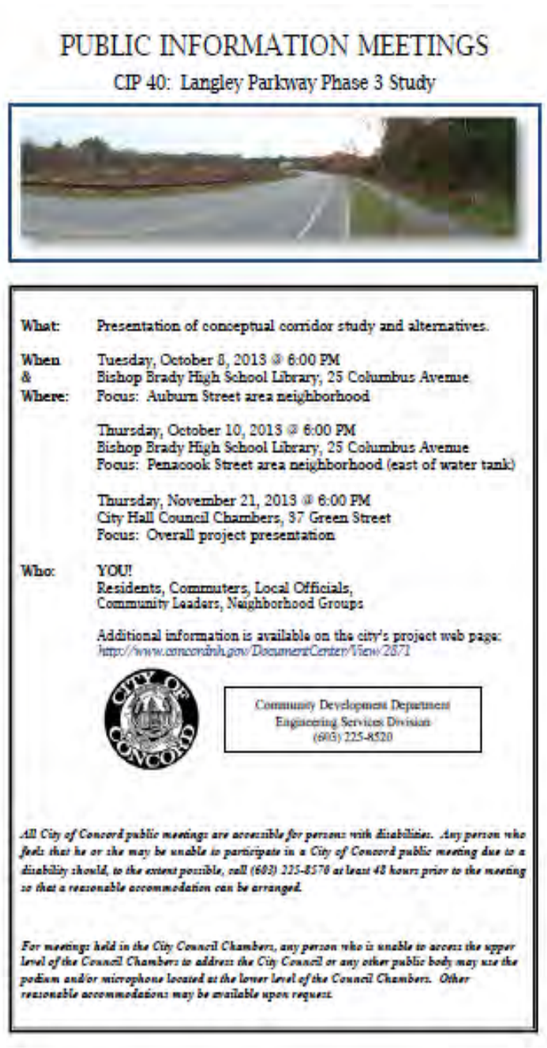
Meeting	Date	Purpose
1	9/11/13	Lincoln Financial Group - Presentation of Conceptual Plans and Access Modifications
2	9/25/13	Pleasant Street/Medical Area Businesses – Presentation of Conceptual Plans and Access Modifications

1.4.2 Public Informational Meetings

Public informational meetings were also held to present significant study findings relative to anticipated transportation influences of Langley Parkway Phase 3 within the City, along with the conceptual roadway plans and design alternatives. Attendee sign-in sheets were provided at all public meetings. Opportunity for public comment was provided at each meeting, which was documented by City staff. In addition, email and phone numbers for City staff were also provided for public comment purposes for those that did not want to speak at the meetings. Following each meeting, presentation material was posted on the City's website. The purpose and timing for the public informational meetings are listed in Table 1.4-2. Neighborhood meetings were held in the library at Bishop Brady High School and the public informational session was held in City Council Chambers.

Table 1.4-2. Public Informational Meetings

Meeting	Date	Purpose
1	10/8/13	Auburn Street Neighborhood Meeting
2	10/10/13	Penacook Street Neighborhood Meeting
3	11/21/13	Public Informational Meeting



PUBLIC INFORMATION MEETINGS

CIP 40: Langley Parkway Phase 3 Study

What: Presentation of conceptual corridor study and alternatives.

When & Where:
Tuesday, October 8, 2013 @ 6:00 PM
Bishop Brady High School Library, 25 Columbus Avenue
Focus: Auburn Street area neighborhood

Thursday, October 10, 2013 @ 6:00 PM
Bishop Brady High School Library, 25 Columbus Avenue
Focus: Penacook Street area neighborhood (east of water tank)

Thursday, November 21, 2013 @ 6:00 PM
City Hall Council Chambers, 37 Green Street
Focus: Overall project presentation

Who: YOU!
Residents, Commuters, Local Officials,
Community Leaders, Neighborhood Groups

Additional information is available on the city's project web page:
http://www.concordnh.gov/DocumentCenter/View/2871

Community Development Department
Engineering Services Division
(603) 225-8520

All City of Concord public meetings are accessible for persons with disabilities. Any person who feels that he or she may be unable to participate in a City of Concord public meeting due to a disability should, to the extent possible, call (603) 225-8570 at least 48 hours prior to the meeting so that a reasonable accommodation can be arranged.

For meetings held in the City Council Chambers, any person who is unable to access the upper level of the Council Chambers to address the City Council or any other public body may use the podium and/or microphone located at the lower level of the Council Chambers. Other reasonable accommodations may be available upon request.

2

Existing Conditions

2.1 Introduction

This chapter describes the existing or baseline conditions in the study area. Current transportation infrastructure and traffic-operating conditions, as well as environmental and socioeconomic resources, are described. Information on the natural and cultural resources was obtained from file reviews, agency consultations, geographic information system (GIS) database retrieval, and a windshield-level field-reconnaissance effort. It is this affected environment that the impacts of the new roadway are evaluated against in Chapter 5.

2.2 Transportation

This section summarizes the existing transportation infrastructure and traffic operating conditions in the study area, which is generally bound by Langley Parkway (existing and future segments) to the west and north; North Main Street and North State Street to the east; and Pleasant Street and Clinton Street to the south. Subsection 2.2.1 describes the existing transportation facilities including roadways, bus service, and bicyclist and pedestrian amenities. Subsection 2.2.2 summarizes existing 2011 traffic volumes, the development of appropriate existing design hour volumes (DHVs) for analysis purposes, and results of the existing traffic-operations evaluation. Subsection 2.2.3 summarizes the existing roadway and intersection deficiencies identified through crash research and crash analysis, and further supported through physical inventories of the geometric conditions and operational analyses.

2.2.1 Existing Facilities

Roadways

Langley Parkway is the major transportation link currently connecting Clinton Street (NH Route 13) and Pleasant Street (US Route 202 / NH Route 9) in the southwestern portion of the City. The parkway is a two-lane roadway that starts at Clinton Street, east of Interstate-89 (I-89) Exit 2, and terminates just north of Pleasant Street in the vicinity of Granite Ledges of Concord (assisted living facility). Two major signalized intersections exist along Langley Parkway at Clinton Street and Pleasant Street; at these locations the parkway widens to provide separate turn lanes approaching the intersections. Sidewalk is provided along the east side of Langley Parkway. Bicycle traffic is accommodated via a widened shoulder. The southern leg of the Langley Parkway (between Clinton Street and Pleasant Street) has a posted speed limit of 30 miles per hour and accommodates only one driveway, which provides access to the Dartmouth-Hitchcock medical facility. To the north of Pleasant Street, Langley Parkway has a posted speed limit of 25 miles per hour and provides access to the several adjacent properties including the Concord Hospital campus, Concord Orthopedics, and Granite Ledges of Concord.

Clinton Street (NH Route 13) is a two-lane roadway with one lane in each direction, providing east-west travel through the southern portion of Concord between Bow and South Street. Clinton Street serves as the primary transportation link between downtown and points to the north and west on I-89 (via Exit 2). Land uses along Clinton Street are a mix of commercial and residential with a posted speed of 30 miles per hour. Sidewalk is provided along the south side of Clinton Street between Langley Parkway and South Street and along the north side of the road between South Fruit Street and South Street. Clinton Street is a State designated bike route.

Pleasant Street (US Route 202 / NH Route 9) is a two-lane roadway with one lane in each direction, providing east-west travel through the southern portion of Concord between western Concord and Main Street. Pleasant Street serves as the primary transportation link between downtown and points to the west in Hopkinton. Land uses along Pleasant Street are a mix of commercial and residential with a posted speed of 30 miles per hour. Sidewalk is provided along the north side of Pleasant Street between Minot Street and Storrs Street, and throughout the study area on the south side of the street, west of Langley Parkway to Storrs Street. Pleasant Street is a State designated bike route.

Penacook Street is a two-lane roadway with one lane in each direction, providing east-west travel between Long Pond Road and North State Street. Land uses along Penacook Street are primarily residential with limited commercial properties in the vicinity of North State Street. Sidewalk is provided along the south side of Penacook Street between Columbus Avenue and North State Street. The posted speed limit is 30 miles per hour. Penacook Street approaching North State Street, as well as the northerly segment of Rumford Street, constitute the northerly terminus of the City's North-South Bike Route.

North Main Street (US Route 3) provides north-south travel through downtown Concord. North Main Street is a four-lane roadway (two lanes in each direction) with turn lanes at major intersections and a posted speed limit of 30 miles per hour. On-street parking is provided on both sides of the North Main Street south of Centre Street/ Loudon Road, and sidewalks are provided on both sides of the entire roadway. Land use along the North Main Street is a mix of retail, residential, and commercial. North Main Street is a State designated bike route.

North State Street (US Route 3) provides north-south travel between downtown Concord and to Penacook to the north. North State Street transitions between a two lane roadway (one lane in each direction) in downtown to a four-lane roadway (two lanes in each direction) between Bouton Street and Penacook Street and then back again to a two lane roadway north of Penacook Street. The posted speed limit along North State Street is 30 miles per hour. On-street parking is provided on both sides of the North State Street south of Centre Street and on the east side of the roadway between Centre Street and Washington Street. Sidewalks are provided on both sides of the roadway for the entire length of North State Street within the study area. North State Street north of Bouton Street is a State designated bike route.

Bus Service

Concord Area Transit (CAT) provides fixed route transportation within the City of Concord Monday through Friday from 6:00 AM to 6:30 PM on three fixed routes (Penacook, Heights, and Crosstown). CAT's fixed service routes are shown in Figure 2.2-1.

CAT also provides demand response transportation to seniors and people with disabilities. Specifically, Paratransit/ Special Transit Service (STS) is the Americans with Disabilities Act (ADA) component of the fixed route system that operates at the same time of the fixed route and provides service within a three-quarter mile radius of the system. Concord Senior Transit (CST) transports seniors to medical appointments, shopping, social activities, work and education. Both ADA complementary STS and CST services are provided with 100 percent accessible equipment along with the four existing fixed routes using Main Street as the transfer point.

The New Hampshire Department of Transportation (NHDOT) constructed a multi-modal transportation terminal known as the Concord Transportation Center located at 30 Stickney Avenue between Exits 14 & 15 of I-93 in 1995. The Concord Transportation Center is the home to Concord Coach Lines (a.k.a. Concord Trailways) with bus service to Boston, northern New Hampshire, and Portland, Maine.

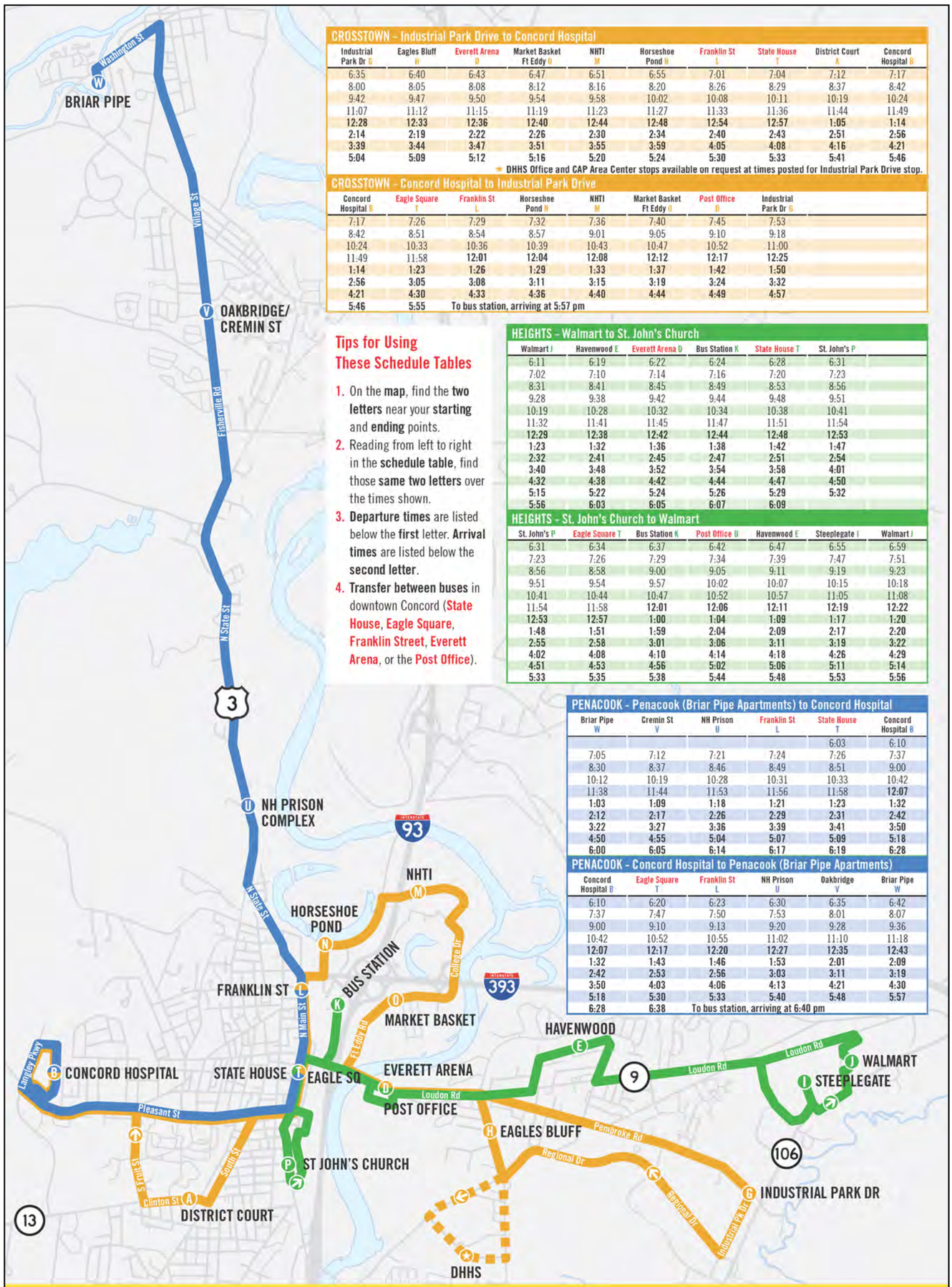
2.2.2 Traffic Volumes

To determine the existing traffic volume demands and flow patterns in the study area, recent count data available from the City was compiled and reviewed. This existing historical data was supplemented with a detailed traffic volume count program focused on key locations within the study area. The count program was conducted in May 2011 and included both automatic traffic recorder (ATR) counts and manual intersection turning movement counts (TMC). ATR counts were performed for 48-hours during typical weekday conditions on the following roadways:

- Pleasant Street west of Langley Parkway
- Pleasant Street east of Langley Parkway
- Auburn Street south of Columbus Avenue
- North State Street north of Rumford Street
- Penacook Street east of Auburn Street
- Rumford Street north of Franklin Street
- North State Street north of Centre Street
- Columbus Avenue south of Penacook Street
- Little Pond Road west of Auburn Street
- Pleasant Street east of Fruit Street
- Warren Street east of Fruit Street
- School Street west of Liberty Street

TMC's were performed at the twenty-three (23) study area intersections during the weekday morning (7:00 - 9:00 AM) and evening (4:00 - 6:00 PM) commuter peak periods. Supplemental TMCs were collected by the City along Langley Parkway adjacent to the Hospital in July of 2012. Copies of the traffic counts are provided in the Technical Appendix.

Table 2.2-1 summarizes the recent weekday traffic volumes recorded along the study area roadways.



CROSSTOWN - Industrial Park Drive to Concord Hospital

Industrial Park Dr G	Eagles Bluff H	Everett Arena D	Market Basket Ft Eddy O	NHTI M	Horseshoe Pond N	Franklin St L	State House T	District Court A	Concord Hospital B
6:35	6:40	6:43	6:47	6:51	6:55	7:01	7:04	7:12	7:17
8:00	8:05	8:08	8:12	8:16	8:20	8:26	8:29	8:37	8:42
9:42	9:47	9:50	9:54	9:58	10:02	10:08	10:11	10:19	10:24
11:07	11:12	11:15	11:19	11:23	11:27	11:33	11:36	11:44	11:49
12:28	**12:33**	**12:36**	**12:40**	**12:44**	**12:48**	**12:54**	**12:57**	**1:05**	**1:14**
2:14	**2:19**	**2:22**	**2:26**	**2:30**	**2:34**	**2:40**	**2:43**	**2:51**	**2:56**
3:39	**3:44**	**3:47**	**3:51**	**3:55**	**3:59**	**4:05**	**4:08**	**4:16**	**4:21**
5:04	**5:09**	**5:12**	**5:16**	**5:20**	**5:24**	**5:30**	**5:33**	**5:41**	**5:46**

* DHHS Office and CAP Area Center stops available on request at times posted for Industrial Park Drive stop.

CROSSTOWN - Concord Hospital to Industrial Park Drive

Concord Hospital B	Eagle Square T	Franklin St L	Horseshoe Pond N	NHTI M	Market Basket Ft Eddy O	Post Office D	Industrial Park Dr G
7:17	7:26	7:29	7:32	7:36	7:40	7:45	7:53
8:42	8:51	8:54	8:57	9:01	9:05	9:10	9:18
10:24	10:33	10:36	10:39	10:43	10:47	10:52	11:00
11:49	11:58	**12:01**	**12:04**	**12:08**	**12:12**	**12:17**	**12:25**
1:14	**1:23**	**1:26**	**1:29**	**1:33**	**1:37**	**1:42**	**1:50**
2:56	**3:05**	**3:08**	**3:11**	**3:15**	**3:19**	**3:24**	**3:32**
4:21	**4:30**	**4:33**	**4:36**	**4:40**	**4:44**	**4:49**	**4:57**
5:46	**5:55**	To bus station, arriving at 5:57 pm					

Tips for Using These Schedule Tables

1. On the **map**, find the **two letters** near your **starting** and **ending** points.
2. Reading from left to right in the **schedule table**, find those **same two letters** over the times shown.
3. **Departure times** are listed below the **first** letter. **Arrival times** are listed below the **second letter**.
4. **Transfer between buses** in downtown Concord (**State House**, **Eagle Square**, **Franklin Street**, **Everett Arena**, or the **Post Office**).

HEIGHTS - Walmart to St. John's Church

Walmart J	Havenwood E	Everett Arena D	Bus Station K	State House T	St. John's P
6:11	6:19	6:22	6:24	6:28	6:31
7:02	7:10	7:14	7:16	7:20	7:23
8:31	8:41	8:45	8:49	8:53	8:56
9:28	9:38	9:42	9:44	9:48	9:51
10:19	10:28	10:32	10:34	10:38	10:41
11:32	11:41	11:45	11:47	11:51	11:54
12:29	**12:38**	**12:42**	**12:44**	**12:48**	**12:53**
1:23	**1:32**	**1:36**	**1:38**	**1:42**	**1:47**
2:32	**2:41**	**2:45**	**2:47**	**2:51**	**2:54**
3:40	**3:48**	**3:52**	**3:54**	**3:58**	**4:01**
4:32	**4:38**	**4:42**	**4:44**	**4:47**	**4:50**
5:15	**5:22**	**5:24**	**5:26**	**5:29**	**5:32**
5:56	**6:03**	**6:05**	**6:07**	**6:09**	

HEIGHTS - St. John's Church to Walmart

St. John's P	Eagle Square T	Bus Station K	Post Office D	Havenwood E	Steeplegate I	Walmart J
6:31	6:34	6:37	6:42	6:47	6:55	6:59
7:23	7:26	7:29	7:34	7:39	7:47	7:51
8:56	8:58	9:00	9:05	9:11	9:19	9:23
9:51	9:54	9:57	10:02	10:07	10:15	10:18
10:41	10:44	10:47	10:52	10:57	11:05	11:08
11:54	11:58	**12:01**	**12:06**	**12:11**	**12:19**	**12:22**
12:53	**12:57**	**1:00**	**1:04**	**1:09**	**1:17**	**1:20**
1:48	**1:51**	**1:59**	**2:04**	**2:09**	**2:17**	**2:20**
2:55	**2:58**	**3:01**	**3:06**	**3:11**	**3:19**	**3:22**
4:02	**4:08**	**4:10**	**4:14**	**4:18**	**4:26**	**4:29**
4:51	**4:53**	**4:56**	**5:02**	**5:06**	**5:11**	**5:14**
5:33	**5:35**	**5:38**	**5:44**	**5:48**	**5:53**	**5:56**

PENACOOK - Penacook (Briar Pipe Apartments) to Concord Hospital

Briar Pipe W	Cremin St V	NH Prison U	Franklin St L	State House T	Concord Hospital B
				6:03	6:10
7:05	7:12	7:21	7:24	7:26	7:37
8:30	8:37	8:46	8:49	8:51	9:00
10:12	10:19	10:28	10:31	10:33	10:42
11:38	11:44	11:53	11:56	11:58	**12:07**
1:03	**1:09**	**1:18**	**1:21**	**1:23**	**1:32**
2:12	**2:17**	**2:26**	**2:29**	**2:31**	**2:42**
3:22	**3:27**	**3:36**	**3:39**	**3:41**	**3:50**
4:50	**4:55**	**5:04**	**5:07**	**5:09**	**5:18**
6:00	**6:05**	**6:14**	**6:17**	**6:19**	**6:28**

PENACOOK - Concord Hospital to Penacook (Briar Pipe Apartments)

Concord Hospital B	Eagle Square T	Franklin St L	NH Prison U	Oakbridge V	Briar Pipe W
6:10	6:20	6:23	6:30	6:35	6:42
7:37	7:47	7:50	7:53	8:01	8:07
9:00	9:10	9:13	9:20	9:28	9:36
10:42	10:52	10:55	11:02	11:10	11:18
12:07	**12:17**	**12:20**	**12:27**	**12:35**	**12:43**
1:32	**1:43**	**1:46**	**1:53**	**2:01**	**2:09**
2:42	**2:53**	**2:56**	**3:03**	**3:11**	**3:19**
3:50	**4:03**	**4:06**	**4:13**	**4:21**	**4:30**
5:18	**5:30**	**5:33**	**5:40**	**5:48**	**5:57**
6:28	**6:38**	To bus station, arriving at 6:40 pm			

CONCORD AREA TRANSIT SCHEDULE

Effective November 5, 2011

Service operates Monday-Friday except major holidays.

Holiday Saturday service provided on the Heights and Penacook routes November 5, 2011 through January 7, 2012.

For more information, call 603-225-1989 or visit www.concordareatransit.org.

Figure 2.2-1
Concord Area Transit Fixed Service Routes

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

VHB Vanasse Hangen Brustlin, Inc.

Table 2.2-1 Existing Traffic Volume Summary*

Roadway Segment	AWDT (vpd)**	AM Peak (vph)***	Percent of Daily Traffic	PM Peak (vph)	Percent of Daily Traffic
Langley Parkway, north of Clinton Street	6,450	685	10.6	700	10.9
Pleasant Street, west of Langley Parkway	9,370	840	9.0	845	9.0
Pleasant Street, east of Langley Parkway	11,570	820	7.1	1,020	8.8
Pleasant Street, east of Fruit Street	6,250	455	7.3	500	8.0
Auburn Street, south of Columbus Avenue	2,170	275	12.7	200	9.2
North State Street, north of Rumford Street^	16,190	1,030	6.4	1,250	7.7
Penacook Street, east of Auburn Street	2,220	225	10.1	240	10.8
Rumford Street, north of Franklin Street^	1,300	105	8.1	130	10.0
North State Street, north of Centre Street	8,660	610	7.0	860	9.9
Columbus Avenue, south of Penacook Street	835	180	21.6	75	9.0
Little Pond Road, west of Auburn Street	3,450	400	11.6	355	10.3
Warren Street, east of Fruit Street	6,850	575	8.4	610	8.9
School Street, west of Liberty Street	2,225	245	11.0	210	9.4

*All data collected in May 2011 with the exception of Langley Parkway, which was collected in November 2009.

**AWDT – Average weekday traffic expressed in vehicles per day.

***vph – vehicles per hour.

^Traffic data collected at this location may have been affected by roadway construction occurring along North State Street.

A review of the hourly traffic volume variations on key roadways within the study area for a typical weekday shows typical commuter-route characteristics. As shown in Table 2.2-1 the highest recorded traffic volumes generally occur during the weekday evening peak period.

Seasonal Adjustment

A discussion with the City Traffic Engineer confirmed that a peak month condition would be appropriate for this feasibility study and consistent with other planning efforts within the City. The most recent three years of reliable traffic data (2007, 2008, and 2010) from the NHDOT Urban Highway (Group 4) Averages[1] was reviewed to determine seasonal traffic variations for the downtown. A review of this data revealed that the 2010 data would provide the most appropriate seasonal adjustments. The 2010 data indicates that peak month conditions occur in September for the weekday morning peak hour and in June for the weekday evening peak hour. In both cases, the peak month peak hour conditions were approximately 2 percent greater than May peak hour conditions. Therefore, the May 2011 traffic data was increased by 2 percent for the weekday morning and weekday evening peaks to reflect peak month conditions. Detailed calculations for the seasonal adjustments are provided in the Technical Appendix.

[1] NHDOT Group 4 Averages 2009 data has been determined to be problematic and was not used.

2.2.3 Existing Traffic Operations

Measuring the volume of traffic in the study area indicates the importance of these roadways and intersections to the regional transportation system but does not necessarily indicate the quality of traffic flow. To assess the quality of traffic flow within the Study Area, capacity analyses were conducted to determine how well the roadway facilities serve the traffic demands placed on them. The traffic-performance measures and the evaluation criteria used in the operational analyses are based on the methodology presented in the *2000 Highway Capacity Manual*[2] and calculated using SYNCHRO software.

A primary result of capacity analysis is the assignment of level of service (LOS), which is a qualitative measure describing operational conditions. LOS generally describes these conditions in terms of such factors as speed and travel time, density or freedom to maneuver, traffic interruptions, comfort, and convenience, thereby providing an index to quality of traffic flow. Six LOSs are defined that range in letter designation from LOS A to LOS F, with LOS A representing the best operating condition and LOS F representing the worst. LOS C describes a stable flow condition and is considered desirable for design hour traffic flow. LOS D and LOS E are generally considered acceptable in urban areas when the cost and impacts of making improvements to provide LOS C are deemed unjustifiable.

Level of service is based on delay and calculated differently for signalized and unsignalized intersections. For signalized intersections, the average control delay per vehicle is estimated for each lane group, aggregated for each approach, and then assigned for the intersection as a whole. For unsignalized intersections, the control delay is not calculated for the entire intersection, but defined for each minor movement at the intersection (i.e., turns to and from the side street or driveway). Table 2.2-2 shows the range of delay used to define the LOS for signalized and unsignalized (two-way stop) intersections.

Table 2.2-2 Intersection LOS Criteria

LOS	Signalized Intersection Control Delay*	Unsignalized Intersection Control Delay*
A	≤10	0 – 10
B	>10 – 20	>10 – 15
C	>20 – 35	>15 – 25
D	>35 – 55	>25 – 35
E	>55 – 80	>35 – 50
F	>80	>50

* Delay expressed in seconds per vehicle.

Results of the 2011 existing conditions operational analyses for the signalized and unsignalized study area intersections are summarized in Tables 2.2-3 and 2.2-4 respectively.

As shown in Table 2.2-3, results of the 2011 existing conditions operational analyses at the signalized intersections show that the intersection of North Main Street at Bouton Street

[2] *2000 Highway Capacity Manual, Special Report 209*, Transportation Research Board, Washington, DC.

currently operates over capacity at LOS E with long delays. The intersection of North Main Street at Centre Street operates below capacity, but also at LOS E. The rest of the signalized intersections in the study area currently operate below capacity and at LOS D or better.

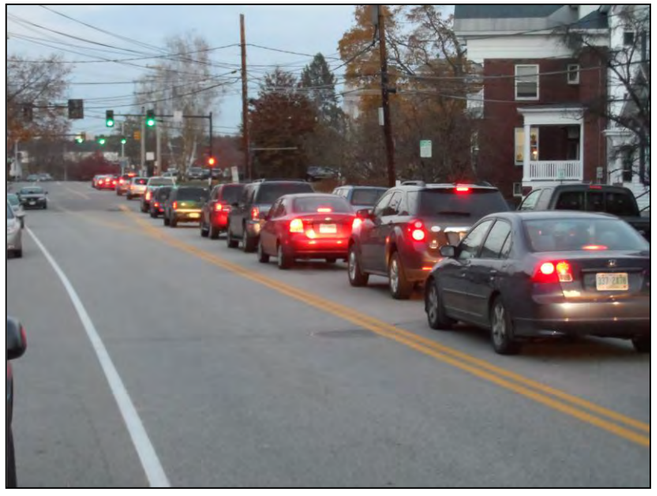


Table 2.2-3. Existing Signalized Intersection Capacity Analysis Summary

Location	Peak Period	2011 Existing Condition v/c*	Delay+	LOS^
North State Street at	AM	0.86	41	D
Penacook St/Horseshoe Pond Lane	PM	0.77	33	C
North State Street at	AM	0.44	12	B
Bouton Street	PM	0.60	15	B
North State Street at	AM	0.88	33	C
Centre Street	PM	0.75	22	C
South State Street at	AM	0.51	17	B
Pleasant Street	PM	0.54	23	C
North Main Street at	AM	0.87	40	D
Bouton Street	PM	1.04	75	E
North Main Street at	AM	0.83	71	E
Centre Street	PM	0.91	78	E
North Main Street at	AM	0.44	23	C
Pleasant Street	PM	0.60	34	C
Pleasant Street at	AM	0.80	50	D
Langley Parkway	PM	0.83	40	D
Pleasant Street at	AM	0.73	35	C
N. Fruit St./S. Fruit St./Warren St.	PM	0.78	36	D
Clinton Street at	AM	0.66	15	B
Langley Parkway	PM	0.72	22	C
Clinton Street at	AM	0.91	51	D
South Street/Broadway	PM	0.80	42	D

*Volume-to-capacity ratio

+Delay expressed in seconds per vehicle

^Level of service

Results of the 2011 existing conditions analyses for the unsignalized intersections (Table 2.2-3) reveal that many side-street movements within the study area operate at poor levels of service (i.e., LOS E and F). Most notably, the minor street approaches at the intersections of Centre Street at Washington Street/ Pine Street, Clinton Street at I-89 exit 2 northbound and southbound ramps, North State Street at Rumford Street, and Penacook Street at Rumford Street currently operate at a LOS E or F with long delays during peak hour conditions.

There are many other local intersections within the study area that were not included in this study due to funding constraints. One of these that currently exhibits substantial over-capacity conditions during the afternoon peak is Washington Street/ North State Street.

Table 2.2-4. Existing Unsignalized Intersection Capacity Analysis Summary

	Peak	2011 Existing Condition		
Location/Movement	Period	Demand*	Delay+	LOS^
North State St at Rumford St				
EB movements from Rumford St	AM	40	44	E
NB movements from N State St	AM	395	1	A
EB movements from Rumford St	PM	80	+300	F
NB movements from N State St	PM	905	1	A
Penacook St at Rumford St				
EB movements from Penacook St	AM	270	18	C
WB movements from Penacook St	AM	380	23	C
NB movements from Rumford St	AM	95	12	B
SB movements from Rumford St	AM	175	15	B
EB movements from Penacook St	PM	140	13	B
WB movements from Penacook St	PM	210	15	B
NB movements from Rumford St	PM	145	12	B
SB movements from Rumford St	PM	460	37	E
Penacook St at Little Pond Rd/Auburn St				
EB movements from Little Pond Rd	AM	345	13	B
WB movements from Penacook St	AM	40	11	B
NB movements from Auburn St	AM	35	6	A
EB movements from Little Pond Rd	PM	130	12	B
WB movements from Penacook St	PM	185	15	B
NB movements from Auburn St	PM	90	7	A
Penacook St at Columbus Ave				
WB movements from Penacook St	AM	65	11	B
SB movements from Penacook St	AM	180	7	A
WB movements from Penacook St	PM	40	9	A
SB movements from Penacook St	PM	195	1	A
Auburn St at Columbus Ave				
SB movements from Columbus Ave	AM	70	11	B
SB movements from Columbus Ave	PM	30	10	A

* Demand in vehicles per hour

\+ Delay expressed in seconds per vehicle

^ Level of service

Table 2.2-4. Continued Existing Unsignalized Intersection Analysis

Location/Movement	Peak Period	2011 Existing Condition Demand*	Delay+	LOS^
Auburn St at Franklin St				
EB movements from Franklin St	AM	35	9	A
WB movements from Franklin St	AM	115	10	A
NB movements from Auburn St	AM	125	10	A
SB movements from Auburn St	AM	195	11	B
EB movements from Franklin St	PM	25	8	A
WB movements from Franklin St	PM	105	8	A
NB movements from Auburn St	PM	125	8	A
SB movements from Auburn St	PM	75	8	A
Auburn St at Liberty St				
EB right-turn from Auburn St	AM	180	12	B
NB movements from Liberty St	AM	210	5	A
EB right-turn from Auburn St	PM	80	10	A
NB movements from Liberty St	PM	275	3	A
Centre St at Washington St/Pine St				
EB movements from Centre St	AM	390	4	A
WB movements from Washington St	AM	310	1	A
NB movements from Pine St	AM	35	24	C
SB movements from Washington St	AM	255	51	F
EB movements from Centre St	PM	540	5	A
WB movements from Washington St	PM	280	1	A
NB movements from Pine St	PM	60	31	D
SB movements from Washington St	PM	150	19	C
Clinton St at I-89 Exit 2 SB Ramps				
WB left-turn from Clinton St	AM	150	10	A
NB movements from SB Off Ramp	AM	430	85	F
WB left-turn from Clinton St	PM	270	8	A
NB movements from SB Off Ramp	PM	160	12	B
Clinton St at I-89 Exit 2 NB Ramps				
EB left-turn from Clinton St	AM	15	8	A
NB movements from NB Off Ramp	AM	370	190	F
EB left-turn from Clinton St	PM	5	10	A
NB movements from NB Off Ramp	PM	280	31	D

* Demand in vehicles per hour

^ Level of service

+ Delay expressed in seconds per vehicle

Table 2.2-5 provides the capacity analysis results for the two existing roundabout intersections within the study area: North State Street at Franklin Street and Centre Street at Liberty Street. However, it should be noted that the performance of roundabouts is not measured by LOS or delay as traditional unsignalized intersections, but rather is based on gap acceptance and volume to capacity (v/ c) ratios. The v/ c ratio is the comparison of flow rate (volume) to the capacity of the intersection to accommodate such demand. An intersection is assumed to be operating at capacity when the v/ c ratio reaches 1.0. As shown below, the calculated v/ c ratios for all approaches at both roundabouts remain well under capacity under both peak hour conditions.

Table 2.2-5. Existing Roundabout Intersection Capacity Analysis Summary

Location	Peak Period	2011 Existing Condition Demand*	v/c**
North State Street at Franklin Street			
EB from Franklin Street	AM	190	0.31
WB from Franklin Street		420	0.48
NB from North State Street		130	0.16
SB from North State Street		285	0.44
EB from Franklin Street	PM	170	0.21
WB from Franklin Street		320	0.45
NB from North State Street		310	0.38
SB from North State Street		185	0.24
Centre Street at Liberty Street			
EB from Centre Street	AM	70	0.15
WB from Centre Street		415	0.53
NB from Liberty Street		445	0.52
SB from Liberty Street		405	0.60
EB from Centre Street	PM	60	0.16
WB from Centre Street		390	0.46
NB from Liberty Street		625	0.70
SB from Liberty Street		240	0.34

* Demand in vehicles per hour.

**Volume to capacity ratio.

2.2.4 Crash Evaluation

Crash data from the City of Concord for the three year period (2008 through 2010) was reviewed and summarized for the study area intersections. Overall, 200 crashes were reported at the study area intersections within the three year period; however, the number of crashes reduced each year from 78 crashes in 2008 to 69 crashes in 2009 and 53 crashes in 2010. The three intersections with the highest number of crashes are controlled by traffic signals.

The signalized intersection of North Main Street at Bouton Street and Route 202/ Route 4 experienced the highest number of reported crashes with 22 over the three year period, an average of just over 7 crashes per year. The North State Street at Centre Street signalized intersection reported slightly fewer crashes over the three year period at 20. Pleasant Street at Langley Parkway experienced 16 crashes over the three year period, an average of approximately 5 crashes per year. All other study area intersections reported less than 5 crashes per year on average.

Approximately 31 percent (62 of 200) of the crashes were reported in the winter (December – February), 21 percent (41 of 200) in the spring (March – May), 24 percent (48 of 200) in the summer (June – August), and 25 percent (49 of 200) in the fall (September – November). A summary of the crashes reported at the study area intersections is provided in the Appendix.

2.3 Environmental Resources

This section describes the environmental resources in the environmental study area, which consists of a 250 foot wide corridor centered on the conceptual Phase 3 alignment (Figure 2.3-1). The existing conditions inventory was compiled using various sources, as discussed herein. Environmental resources inventoried include: wetlands: surface water; groundwater; floodplains; farmlands; rare, threatened, and endangered species; wildlife habitat; and potential soil and groundwater contaminated sites.

2.3.1 Wetlands

The National Wetlands Inventory (NWI) mapping, National Resources Conservation Service (NRCS) hydric-soils mapping, and the 1992 wetland delineation for the original Langley Parkway Wetland Application were reviewed to determine the potential location of wetlands in the Phase 3 environmental study area. Environmental scientists verified potential wetlands by completing a walk-over field-reconnaissance effort on June 7, 2011. Global Positioning System (GPS) units with an accuracy of submeter or better were used to verify and update existing wetland mapping and to collect previously unidentified wetland boundaries. GPS points were collected at the corners of wetlands to map their general extent in the environmental study area. Formal wetland delineations were not performed. Figure 2.3-2 shows the extent of wetlands in the Phase 3 environmental study area.

According to NRCS digital GIS soil data, patches of soil units consisting of Paxton- Fine sandy loam, Canton very fine sandy loam, Scituate fine sandy loam, Chatfield-Hollis-Montauk complex, Timakwa mucky peat and urban land are found in the Phase 3 environmental study area.

The previously identified wetlands data from the 1992 wetland delineation indicated 17 wetland systems located in the environmental study area. The walk-over reconnaissance level survey added one wetland, a detention basin, and confirmed and/ or adjusted the previously mapped boundaries to reflect current hydrology.

Table 2.3-1 Delineated Wetlands

1992 Delineated Wetlands	2011 Corresponding
Wetland PA	W-1
Wetland PB	W-3
Wetland PC	W-4
Wetland PD/PE/PF	W-5
Wetland PG	W-6
Wetland PI/PJ	W-7
Wetland PK/PL	W-8
Wetland PM/PN	W-9
Wetland AA	W-10
Wetland AB	W-11
Wetland AC	W-12
Wetland AE	W-13
	W2

Wetland W-1 is located just north of the terminus of Phase 1 on the western side of the alignment. W-1 consists primarily of forested habitat, with pockets of scrub/ shrub and emergent habitat. At the terminus of pavement on the existing Langley Parkway, a recently constructed detention basin (W-2) is adjacent to the existing paved hospital parking. Wetland W-3, an isolated forested wetland, is located approximately 350 feet from the terminus of pavement on the west side of the corridor. A large forested wetland (wetland W-4) is located on the east side of the corridor, north of the Hospital. At the southern end of W-4, the wetland dominated by eastern hemlock and the remainder, red maple, sphagnum and cinnamon fern. Bow Brook enters via a culvert at the northern end of the wetland. One additional forested wetland (wetland W-5) is located on the southern end of the alignment. Bow Brook also flows through W-5 and is connected to W-4 via a culvert.

Three wetlands are located on the northern end of the alignment (between Penacook Street and North State Street), wetlands W-11, W-12, and W-13. All three wetlands are forested broad-leaved deciduous wetlands with hillside seepage over poorly drained soils.

Wetlands identified from the middle to the northern end of the environmental study area; W-6, W-7, W-8, W-9, and W10 are small forested wetlands with some emergent vegetation. Some drainage ways are connected via culverts. W-7 is a constructed detention pond with residential housing to the northeast and roadway drainage.

Path: nhbedata\projects\52500.00 Langley Parkway\GIS\Project\ReportGraphics\Figure2.3-1.mxd Date: 12/5/2013

Legend

Langley Parkway Project Alignments

- Phase 3 Project Alignment
- Phase 2 Alignment (Compelted 2008)
- Phase 1 Alignment (Completed 1995)
- Environmental Study Area (250 Foot Wide Corridor)
- Assessor's Tax Parcels (2012)
- River/Stream (City of Concord 2011 Aerial Survey)

0 600 1,200 Feet

VHB Vanasse Hangen Brustlin, Inc.

Figure 2.3-1
Environmental Study Area

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

Path: nhbedata\projects\52500.00 Langley Parkway\GIS\Project\ReportGraphics\Figure1.mxd Date: 12/5/2013

Legend

Langley Parkway Project Alignments

- Phase 3 Project Alignment
- Phase 2 Alignment (Compelted 2008)
- Phase 1 Alignment (Completed 1995)
- Environmental Study Area (250 Foot Wide Corridor)
- Assessor's Tax Parcels (2012)
- Wetland Resource Area (Not a Delineated Boundary)
- River/Stream (City of Concord 2011 Aerial Survey)

0 600 1,200 Feet

VHB Vanasse Hangen Brustlin, Inc.

Figure 2.3-2
Wetland Resources

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

2.3.2 Surface Waters

Using the NHGRANIT GIS databases, the presence of all surface waters including streams, ponds and lakes were mapped within the environmental study area. Bow Brook, located within the Turkey River Watershed, and an unnamed tributary stream to Woods Brook, located within the Merrimack River Watershed, are the only surface waters within the environmental study area. The Phase 3 alignment crosses Bow Brook approximately 1,800 feet south of Auburn Street, and crosses the unnamed tributary stream approximately 1,000 feet north of Penacook Street. Both Bow Brook and Woods Brook are listed in the New Hampshire Department of Environmental Services' (NHDES) 2012 303(d) list of impaired water bodies, as impaired for mercury. The potential source is from atmospheric deposition. NHDES has indicated a target date of 2017 to complete a Total Maximum Daily Load (TMDL) study to address the water quality impairment of these brooks.

2.3.3 Groundwater Resources

Information on groundwater resources (Figure 2.3-3) in the form of aquifers mapped by the US Geological Survey was retrieved from the NHGRANIT GIS database. An area of the environmental study area, approximately 500 feet west of Rumford Street to North Main Street is underlain by a glacial lake bottom deposits.

GIS data from NHDES was retrieved to determine whether the study area is located within a designated Well Head Protection Area (WHPA) or Source Water Protection Area (SWPA), or if there are any mapped public or private wells in the vicinity. This research revealed no WHPA's, public wells or private wells within the environmental study area. The entire City of Concord is located in a SWPA watershed of the Pennichuck Water Works drinking water intake located in Nashua, NH.

2.3.4 Floodplains

All federal projects potentially impacting floodplains require an evaluation under Executive Order 11988, Floodplain Management (May 24, 1977). The regulation that sets forth the policy and procedures of this order is entitled Floodplain Management and Protection of Wetlands (44 CFR §9), which is under the authority of the Federal Emergency Management Agency (FEMA).

Information on the Regulatory Floodway and 100-year floodplain within the study area was obtained by reviewing the FEMA Digital Flood Insurance Rate Map (FIRM) for Merrimack County (Community Panels 33013C0533E, 33013C0530E). The FIRM information also provides users with automated flood-risk data that can be used to locate Special Flood Hazard Areas (SFHA); the risk zones are depicted on a community's hardcopy FIRM maps. The FIRM mapping did not identify any floodplain resources within the environmental study area.

2.3.5 Farmland

Information on Important Farmland Soils as defined by the Farmland Protection Policy Act (FFPA) was retrieved from the NRCS Web Soil Survey for Merrimack County. The Web Soil Survey contains current digital mapping and soil-unit attribute information on Prime Farmland, Farmland of local importance and Farmland of Statewide importance (Figure 2.3-4). In addition to the data provided by the NRCS, aerial photography was used to determine the presence or absence of active farmlands in the study area.

Prime Farmlands

The NRCS database did not identify prime farmland soil within the Phase 3 study area.

Farmland of Local Importance

Farmland of local importance is identified in the areas of Paxton fine sandy loam located throughout the environmental study area. The identified locations are within existing residential, forested upland and wetland habitat.

Farmland of Statewide Importance

According to NRCS, Farmland of Statewide importance is not occurring within the environmental study area. Some of the locations mapped by the NRCS as farmland based on soil type include waterways and vegetated wetlands, and do not necessarily reflect areas conducive to agricultural production.

2.3.6 Rare, Threatened, and Endangered Species

Requests were made to the New Hampshire Natural Heritage Bureau (NHNHB), US Fish and Wildlife Services (USFWS) and New Hampshire Fish and Game (NHFG) to document whether there are any records of rare species, plants, and/ or rare or exemplary natural communities or ecosystems in the study area. A response from the NHNHB was received on June 20, 2011. The NHNHB concluded that there were two known vertebrate species listed in its database in proximity to the environmental study area. The two vertebrate species are listed below:

- State listed endangered, the Common Nighthawk (*Chordeiles minor*), have been surveyed in the downtown Concord and surrounding areas.
- State listed rare or uncommon, the Northern Leopard Frog (*Rana pipiens*) has been located in the Merrimack River Floodplain.

A response from NHFG Nongame and Endangered Wildlife Program was received on July 11, 2011. The response from NHNHB regarding Northern Leopard frog and Common Nighthawk was recognized by NHFG. However, NHFG concluded that these species are not expected to be impacted due to the vicinity of the project and the identified locations of these species. NHFG did note that design features should be used to reduce the possible impacts to amphibians and reptiles from road mortality and entrapment in catch basins.

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Legend

Langley Parkway Project Alignments

- Phase 3 Project Alignment
- Phase 2 Alignment (Compelted 2008)
- Phase 1 Alignment (Completed 1995)
- Environmental Study Area (250 Foot Wide Corridor)
- Assessor's Tax Parcels (2012)
- Glacial Lake Bottom Deposits
- River/Stream (City of Concord 2011 Aerial Survey)

Note: The entire City of Concord is located in a Source Water Protection Area (SWPA) watershed for the Pennichuck Water Works in Nashua, NH.

0 600 1,200 Feet

Vanasse Hangen Brustlin, Inc.

Figure 2.3-3
Groundwater Resources

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

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Langley Parkway Project Alignments

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- Phase 1 Alignment (Completed 1995)
- Environmental Study Area (250 Foot Wide Corridor)
- Assessor's Tax Parcels (2012)

NRCS Farmland Soils

- All areas are prime farmland
- Farmland of local importance
- River/Stream (City of Concord 2011 Aerial Survey)

0 600 1,200 Feet

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Figure 2.3-4
NRCS Farmland Soils

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

2.3.7 Wildlife Habitat

The NH Fish and Game Department (NHFG) is responsible for managing and protecting resident wildlife species. NHFG has promulgated rules (FIS 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.

Based on a review of the NHFG Wildlife Action Plan and NHGRANIT GIS Data (Figure 2.3-5), the corridor includes the following habitat types:

- Appalachian-Oak-Pine Forest
- Hemlock-Hardwood-Pine Forest
- Grasslands
- Peatlands
- Pine Barren Forest

The NHFG analyzed the habitat areas and developed a statewide three-tiered ranking scheme to identify the highest quality habitat (Tiers 1 &2) in the State. The environmental study area does not include any highest ranked habitat, only supporting landscapes, or Tier 3 habitat (Figure 2.3-6).

2.3.8 Hazardous Materials

Available databases of known environmental-hazard sites supplied by the NHDES were reviewed for the vicinity of the environmental study area. The review identified known locations of Resource Conservation and Recovery Act (RCRA) small quantity generators, and potential groundwater contamination sites (Figure 2.3-7). These sites are likely contained and are not expected to pose a threat to the Phase 3 study area. However, it is expected that issues related to hazardous sites will be considered in more detail if acquiring ROW is necessary for any option advanced to the design and construction phases.

2.3-9 Historical/Archaeological Resources

A cultural resources survey was conducted within the environmental study area consisting of two components. The first component was the identification of previously recorded properties, compiled at the New Hampshire Division of Historical Resources (NHDHR). The second component consisted of a site visit, which involved a walker over of the preliminary Phase 3 alignment. A site file search at NHDHR for above-ground properties was performed on May 26, 2011, and again on June 8/ 9, 2011 to gather information on previously documented resources. Generally speaking, the site file search was limited to properties located within a 0.25-mile radius for above-ground resources and a 5-mile radius for archaeological resources.

The site file research and site visit was used to prepare a Request for Project Review (RPR), which was submitted to NHDHR on May 1, 2012. The intent of the RPR was to continue the historical/ archaeological process that began during previous phases, identifying historic properties that could be affected by construction of Phase 3 and providing NHDHR the opportunity to provide its comments on the conceptual alignment. NHDR responded that additional archaeological and architectural surveys would be required if Phase 3 advances (See Environmental Appendix for a copy of the RPR and NHDHR's response).

Historical Resources

There are buildings within the study area but no buildings lie directly on the centerline or within the preliminary proposed parkway right-of-way. A map with handwritten notes dated June 1, 1993, shows the age of the buildings along Penacook Street between Rumford and North State streets. It appears the Perkins House originally anchored development in the area. The next oldest structure would have been the 1855 Carpenter House (no longer present) in the vicinity of the intersection of Rumford and Penacook Streets. The Carpenter House was the reported location of Native American burials.

Based on the historic maps for the area, including the Rust Maps, the project area was rural and hosted small farmsteads. By the late 1850s, the vicinity of North State Street and Penacook was gradually being urbanized. In the 20th century, this process continued with the construction of small to medium-sized residences. In the last two decades, office complexes have been erected west of Rumford Street and the west end of Phase 3 has experienced more build out by the hospital complex and associated office buildings.

Archaeological Resources

A traditional background and literature review was completed for the environmental study area. As outlined above, site files at NHDHR and at the State Archives were reviewed by VHB cultural resources staff on May 26, 2011 and again on June 8th and 9th, 2011.

On June 8, 2011 a walkover was completed of the environmental study area between North State Street and the office complex west of Rumford Street, along Penacook Street between Rumford Street and the centerline crossing of Auburn Street, and between Auburn Street and the environmental study area's south terminus. The purpose of the walkover was to review existing conditions.

The site file research revealed the presence of 22 previously recorded archaeological sites within a five-mile radius of the environmental study area. Of this number, only one site, 27-MR-0083, is within 1500 feet (500 meters) of the environmental study area. The remaining sites are at greater distance and in some cases on the opposing side of the Merrimack River. Site 27-MR-0083 (the Garrison Site; NHAS Site No. NH-37-0009) is a historic archaeological site with minimal documentation that was recorded in 1986 by a State Conservation and Rescue Archaeology Program (SCRAP) member. The site's function and temporal affiliation are unrecorded. Of more interest is the reported, though unrecorded, presence of an archaeological site near the northeast corner of the intersection of Rumford and Penacook streets. It is within this section of the Phase 3 alignment that State Archaeologist Gary Hume expressed concerns in the 1990s and 2000s about Native American burials reportedly uncovered during the excavation of the Carpenter House cellar.

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Legend

Langley Parkway Project Alignments

- Phase 3 Project Alignment
- Phase 2 Alignment (Compelted 2008)
- Phase 1 Alignment (Completed 1995)
- Environmental Study Area (250 Foot Wide Corridor)
- Assessor's Tax Parcels (2012)

NH Fish & Game Wildlife Action Plan Habitat Areas

- Peatland
- Pine barren
- Wet meadow/shrub wetland
- Appalachian oak-pine
- Grasslands
- Hemlock-hardwood-pine

River/Stream (City of Concord 2011 Aerial Survey)

0 600 1,200 Feet

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Figure 2.3-5
NH Fish & Game Wildlife Action Plan Habitats

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City of Concord, NH

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Legend

Langley Parkway Project Alignments

- Phase 3 Project Alignment
- Phase 2 Alignment (Compelted 2008)
- Phase 1 Alignment (Completed 1995)
- Environmental Study Area (250 Foot Wide Corridor)
- Assessor's Tax Parcels (2012)

NH Fish & Game Ranked Habitat

- Highest Ranked Habitat in NH (None Present in Study Area)
- Highest Ranked Habitat in Biological Region (None Present in Study Area)
- Supporting Landscapes
- River/Stream (City of Concord 2011 Aerial Survey)

0 600 1,200 Feet

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Figure 2.3-6
NH Fish & Game Ranked Habitat

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

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Legend

Langley Parkway Project Alignments

- Phase 3 Project Alignment
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- Phase 1 Alignment (Completed 1995)
- Environmental Study Area (250 Foot Wide Corridor)
- Assessor's Tax Parcels (2012)

- Hazardous Waste (RCRA Site)
- Potential Threats to Groudwater Resources (NHDES C Sites)
- River/Stream (City of Concord 2011 Aerial Survey)

0 600 1,200 Feet

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Figure 2.3-7
PotentialHazardous Materials

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

The conditions observed during the June 8, 2011, walkover of Phase 3 were not appreciably different from those noted during the original cultural resources assessments completed in the early 1990s. Of particular note is the fact that the conditions between Rumford and Penacook streets are unchanged from those Gary Hume observed beginning in 1994. The stretch of the Phase 3 alignment in this segment has not been developed nor is there any surface indication that significant disturbance occurred to the locality during the removal of Carpenter House and the construction of the Boys Club. No shovel testing, however, was performed during the walkover and subsurface conditions are undocumented.

2.3-10 Park Lands and Recreation

Park lands and recreational resources are protected by various federal statutes that may apply to Phase 3 if federal funding is provided by FHWA.

Conservation Land

Based on a review of the most recent NHGRANIT Conservation/ Public Lands database, two occurrences of existing conservation land occur within the environmental study area. Both properties are held in a conservation easement by the City of Concord and are associated with the Capital Region Health Care Corporation development. Both properties are located adjacent to the cleared ROW corridor on the southern end of the alignment, just north of where pavement ends and turns to a dirt trail and are shown on Figure 2.3-8. Additionally, Winant Park, an approximately 100-acre conservation area and recognized as an official park by the City of Concord, is located just northwest of the environmental study area.

Section 6(f) LCWF

Properties that have been acquired or improved with LWCF funding are protected under Section 6(f) of the Land and Water Conservation Fund Act. A request was submitted to NH Department of Resources and Economic Development (NHDRED) to determine whether a formal Section 6(f) Consultation was required for Phase 3. A response was received from NHDRED on June 28, 2011 stating that no Section 6(f) properties are located in the environmental study area and not consultation was required during this phase of the project.

Recreational Resource

Based on a preliminary field review, Kimball Park/ Playground (owned by the City of Concord) is the only recognized recreational resource within close proximity of the environmental study area. However, the former roadbed located between the terminus of Phase 1 and Auburn Street, is currently being used as a recreational trail and walking path for those living and working in the immediate area. The trail also provides access to Winant Park. No other recreational resources are within close proximity to the environmental study area.

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Legend

Langley Parkway Project Alignments

- Phase 3 Project Alignment
- Phase 2 Alignment (Compelted 2008)
- Phase 1 Alignment (Completed 1995)
- Environmental Study Area (250 Foot Wide Corridor)
- Assessor's Tax Parcels (2012)
- Conservation/Public Land (NHGRANIT)
- River/Stream (City of Concord 2011 Aerial Survey)

0 600 1,200 Feet

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Figure 2.3-8
Conservation/Public Land

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

3

No Build Alternative

3.1 Introduction

The No Build Alternative is essentially the continuation and perpetuation of the existing conditions and the shortcomings inherent in the current study area roadways, intersections, and transportation system. The No Build Alternative serves as a baseline condition for comparison to the Langley Parkway Phase 3 Build Alternative. This chapter describes the methodologies, procedures, and assumptions used to establish the 2015 and 2035 No Build conditions including forecasting the 2011 existing conditions peak hour volumes into the future and updating the regional travel model for planned transportation infrastructure improvement projects. This chapter also presents the anticipated traffic operations under the forecast year conditions for the No Build scenario, which assumes no construction of Langley Parkway Phase 3.

3.2 Regional Travel Demand Model

NHDOT assisted the forecasting process by running the Central New Hampshire Regional Travel Demand Model for the study. The travel demand model uses QRS software for the Central New Hampshire Region which encompasses 12 communities, including Concord. The model is calibrated to the base year 2000 (using the 2000 US Census, noting that the 2010 Census data was not yet available at the time this work was conducted) and forecasts traffic to the year 2030. Traffic forecasting is based on anticipated growth in population and employment within the region. For the purpose of this study, the regional model was updated to be consistent with the projects included in the City's Master Plan.

3.3 2015 and 2035 Forecasting

Traffic volume forecasting consisted of a two-step process that included examining both regional growth, as well as site-specific development projects in the immediate area of the parkway that could influence the design elements of the new roadway. These two steps are described in the following sections.

3.3.1 Regional Background Traffic Growth

Traffic volumes for the Langley Parkway Feasibility Study were developed from an extensive data collection program and use of the QRS Regional Travel Demand Model. As discussed in the previous chapter, 2011 base traffic volumes were adjusted to reflect peak month conditions based on historical count data from the NHDOT Urban Highway Group 4 Average (2010). Output from the regional model was reviewed to establish growth trends for forecasting traffic volumes throughout the study area. Overall, the model indicated that traffic volumes would grow at a relatively low rate of approximately 0.5 percent annually for the majority of the study area. However, two specific areas displayed higher levels of traffic growth. The area of Clinton Street and Pleasant Street west of Langley Parkway was shown to have a projected average annual growth rate of approximately 1.0 percent. Traffic in the area of Little Pond Road, Penacook Street, and Auburn Street generally west of Columbus Avenue is projected to grow at a slightly higher rate at approximately 2.0 percent annually.

3.3.2 Site Specific Development

In addition to the regional background growth, site specific developments that could affect the forecast traffic volumes in the immediate area of Langley Parkway Phase 3 were also investigated. Conversations with the City of Concord planning and engineering staff revealed three substantial employers within the study area with plans for growth within the project forecast horizon:

- Concord Hospital's long-term plans consider the construction of an additional 100,000 square feet of medical office space on their campus located on Langley Parkway.
- The New Hampshire Hospital Campus Master Plan build out scenario considers expansion for 870 additional employees in four buildings (Bancroft, Thayer, Main, and Annex) located on their campus with access on Pleasant Street, South Fruit Street, and Clinton Street.
- Lincoln Financial Group has the potential to add approximately 225 employees at their existing campus located on Granite Place with access onto Rumford Street.

3.3.3 Traffic Volume Network Development

Future year 2105 and 2035 No Build traffic volumes were developed by applying the above-mentioned annual growth rates of 0.5, 1.0, and 2.0 percent respectively to the 2011 seasonally adjusted (peak month) peak hour volumes and adding the site-generated traffic associated with the three potential development programs at Concord Hospital, New Hampshire Hospital Campus, and Lincoln Financial Group. Figures 3.3-1 through 3.3-4 show the traffic volume No Build networks for the 2015 and 2035 weekday morning and evening peak hours.

3.4 Planned Transportation Infrastructure Improvement Projects

Several future roadway improvement projects within the Study Area are assumed to be in place for the analysis of the 2035 forecast year:

- Route 3 North Corridor - includes intersection improvements at the intersection of Route 3 (North State Street) at Rumford Street. Left-turns entering and exiting from Rumford Street are prohibited (CIP 35, Phase 5).
- A complete-street redesign of the Pleasant Street/ Warren Street/ Fruit Street intersection with lane-widening and signalization or a roundabout (assumed) for traffic control (CIP 283).
- The widening of Clinton Street to 4 lanes (2 lanes in each direction) from Silk Farm Road to Langley Parkway (2030 Concord Master Plan).
- Installation of traffic signals (assumed) or roundabouts for traffic control on Clinton Street at the two ramp intersections with I-89 Exit 2 (NHDOT 2015-2024 Ten Year Plan).

3.5 No Build Traffic Operations

Traffic operational analyses were conducted for the study area intersections for the 2015 and 2035 No Build weekday morning and evening peak hour conditions. Results of the analyses for the signalized, unsignalized, and roundabout intersections are summarized in Tables 3.5-1, 3.5-2, and 3.5-3 respectively.

Results of the 2015 and 2035 No Build analyses show that several signalized intersections are expected to degrade over time as a result of anticipated traffic growth with volumes at or over capacity and operations at LOS E or F. Specifically, the intersections of North State Street at Centre Street, North Main Street at Bouton Street, North Main Street at Centre Street, North Main Street at Pleasant Street, Pleasant Street at Langley Parkway, and Clinton Street at South Street/ Broadway are expected to operate poorly by 2035. It is noted that 6 of the signalized intersections are identified as having operational deficiencies by the forecast year 2035, which is an increase of 4 intersections over the 2 intersections identified in the 2011 Existing conditions analysis. The remaining signalized intersections are projected to operate below capacity and at a LOS D or better under the 2035 No Build condition.

Table 3.5-1 No Build Signalized Intersection Capacity Analysis Summary

	Peak	2015 No Build			2035 No Build		
Location	Period	v/c*	Delay+	LOS^	v/c	Delay	LOS
North State Street at	AM	0.73	25	C	0.78	29	C
Penacook St/Horseshoe Pond Lane	PM	0.91	32	C	0.98	37	D
North State Street at	AM	0.45	12	B	0.49	12	B
Bouton Street	PM	0.61	15	B	0.69	16	B
North State Street at	AM	0.90	35	C	1.04	69	E
Centre Street	PM	0.77	23	C	0.81	30	C
South State Street at	AM	0.52	17	B	0.55	18	B
Pleasant Street	PM	0.55	24	C	0.71	27	C
North Main Street at	AM	0.89	43	D	1.00	63	E
Bouton Street	PM	1.06	80	E	1.13	94	F
North Main Street at	AM	0.85	74	E	0.91	91	F
Centre Street	PM	0.92	80	E	1.04	107	F
North Main Street at	AM	0.45	23	C	0.49	28	C
Pleasant Street	PM	0.61	35	D	0.73	57	E
Pleasant Street at	AM	0.87	48	D	1.02	88	F
Langley Parkway	PM	0.85	41	D	1.01	87	F
Pleasant Street at	AM	0.74	35	D	Roundabout		
N. Fruit St./S. Fruit St./Warren St.	PM	0.79	36	D			
Clinton Street at	AM	0.67	16	B	0.67	17	B
Langley Parkway	PM	0.75	23	C	0.70	21	C
Clinton Street at	AM	0.93	53	D	1.07	76	E
South Street/Broadway	PM	0.81	44	D	0.86	48	D
Clinton Street at	AM	Unsignalized			0.48	6	A
I-89 Exit 2 SB Ramps	PM				0.46	6	A
Clinton Street at	AM	Unsignalized			0.55	5	A
I-89 Exit 2 NB Ramps	PM				0.61	9	A

*Volume-to-capacity ratio

+Delay expressed in seconds per vehicle

^Level of service

Table 3.5-2. No Build Unsignalized Intersection Capacity Analysis Summary

Location/Movement	Peak Period	2015 No Build Demand*	2015 No Build Delay+	2015 No Build LOS^	2035 No Build Demand	2035 No Build Delay	2035 No Build LOS
North State St at Rumford St							
EB rights from Rumford St	AM	5	17	C	5	19	C
EB rights from Rumford St	PM	5	15	B	5	15	B
Penacook St at Rumford St							
EB movements from Penacook St	AM	275	18	C	310	19	C
WB movements from Penacook St	AM	395	26	D	485	32	D
NB movements from Rumford St	AM	95	12	B	135	13	B
SB movements from Rumford St	AM	180	16	C	245	17	C
EB movements from Penacook St	PM	140	13	B	155	13	B
WB movements from Penacook St	PM	225	16	C	255	16	C
NB movements from Rumford St	PM	145	12	B	160	12	B
SB movements from Rumford St	PM	495	54	F	650	108	F
Penacook St at Little Pond Rd/Auburn St							
EB movements from Little Pond Rd	AM	375	14	B	560	20	C
WB movements from Penacook St	AM	45	11	B	65	13	B
NB movements from Auburn St	AM	35	6	A	60	6	A
EB movements from Little Pond Rd	PM	140	12	B	210	13	B
WB movements from Penacook St	PM	200	16	C	305	21	C
NB movements from Auburn St	PM	95	7	A	145	7	A
Penacook St at Columbus Ave							
WB movements from Penacook St	AM	65	12	B	105	13	B
SB movements from Penacook St	AM	195	7	A	290	7	A
WB movements from Penacook St	PM	45	10	A	65	10	B
SB movements from Penacook St	PM	210	1	A	320	1	A
Auburn St at Columbus Ave							
SB movements from Columbus Ave	AM	75	12	B	115	12	B
SB movements from Columbus Ave	PM	30	10	B	50	11	B

* Demand in vehicles per hour

\+ Delay expressed in seconds per vehicle

^ Level of service

Table 3.5-2. Continued - No Build Unsignalized Intersection Analysis

Location/Movement	Peak Period	2015 No Build Demand*	2015 No Build Delay+	2015 No Build LOS^	2035 No Build Demand	2035 No Build Delay	2035 No Build LOS
Auburn St at Franklin St							
EB movements from Franklin St	AM	35	9	A	60	9	A
WB movements from Franklin St	AM	125	10	B	180	11	B
NB movements from Auburn St	AM	135	10	A	200	10	B
SB movements from Auburn St	AM	210	11	B	310	12	B
EB movements from Franklin St	PM	25	8	A	40	8	A
WB movements from Franklin St	PM	115	8	A	165	9	A
NB movements from Auburn St	PM	130	8	A	205	9	A
SB movements from Auburn St	PM	80	8	A	120	9	A
Auburn St at Liberty St							
EB right-turn from Auburn St	AM	185	12	B	200	12	B
NB movements from Liberty St	AM	215	5	A	245	5	A
EB right-turn from Auburn St	PM	80	10	A	90	10	A
NB movements from Liberty St	PM	280	3	A	345	3	A
Centre St at Washington St/Pine St							
EB movements from Centre St	AM	395	4	A	460	4	A
WB movements from Washington St	AM	315	1	A	365	1	A
NB movements from Pine St	AM	35	24	C	40	30	D
SB movements from Washington St	AM	260	54	F	325	153	F
EB movements from Centre St	PM	540	5	A	665	5	A
WB movements from Washington St	PM	280	1	A	320	1	A
NB movements from Pine St	PM	60	31	D	70	46	E
SB movements from Washington St	PM	150	19	C	200	38	E
Clinton St at I-89 Exit 2 SB Ramps							
WB left-turn from Clinton St	AM	155	10	A		Signalized	
NB movements from SB Off Ramp	AM	445	111	F			
WB left-turn from Clinton St	PM	280	8	A		Signalized	
NB movements from SB Off Ramp	PM	165	12	B			
Clinton St at I-89 Exit 2 NB Ramps							
EB left-turn from Clinton St	AM	15	8	A		Signalized	
NB movements from NB Off Ramp	AM	385	+300	F			
EB left-turn from Clinton St	PM	5	10	B		Signalized	
NB movements from NB Off Ramp	PM	290	35	D			

* Demand in vehicles per hour

^ Level of service

\+ Delay expressed in seconds per vehicle

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 3.3-1

2015 No Build Weekday Morning Peak Hour

Langley Parkway Phase 3 Feasibility Study

City of Concord, NH

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 3.3-2

2015 No Build Weekday Evening Peak Hour

Langley Parkway Phase 3 Feasibility Study

City of Concord, NH

VHB Vanasse Hangen Brustlin, Inc.

Figure 3.3-3

2035 No Build Weekday Morning Peak Hour

Langley Parkway Phase 3 Feasibility Study

City of Concord, NH

0 1200 2400 Feet

VHB Vanasse Hangen Brustlin, Inc.

Figure 3.3-4

2035 No Build Weekday Evening Peak Hour

Langley Parkway Phase 3 Feasibility Study

City of Concord, NH

Results of the 2015 and 2035 No Build analyses for the unsignalized intersections reveal that minor street approaches (side streets under stop control) at 4 study area intersections are projected to operate at poor levels of service (LOS E and F) with long delays during the peak hours. Specifically, the Rumford Street southbound approach to Penacook Street is projected to operate at LOS F during the weekday evening peak hour under the 2015 and 2035 conditions with the delay doubling from 54 seconds to 108 seconds. This movement was calculated to operate at LOS E under the 2011 existing condition.

In addition, the Pine Street and Washington Street approaches at the Centre Street intersection are expected to operate at LOS E or F. The weekday morning peak hour represents the critical (worst-case) condition at the location with the Washington Street southbound approach experiencing the most delay. Morning average delays exiting from Washington Street are projected to increase from 54 to 153 seconds per vehicle over the 10-year forecast horizon.

Finally, the two unsignalized off-ramps from I-89 Exit 2 to Clinton Street are projected to operate at LOS F in 2015 during the weekday morning peak hour when traffic volumes exiting the highway are heaviest. Delays are projected to increase by 30 percent or more from the 2011 Existing levels. As noted in Section 3.4, these ramps are assumed to be signalized under the 2035 future year condition.

The results of the roundabout analyses indicate that the existing roundabouts at the intersections of North State Street with Franklin Street and Centre Street with Liberty Street will continue to operate well below capacity through the future year 2035 under the No Build scenario. In addition, as discussed in Section 3.4, a future roundabout is planned for the intersection of Pleasant Street with South Fruit Street and Warren Street. As shown in Table 3.5-3, the Pleasant Street roundabout is projected to operate below capacity through the year 2035 during the weekday morning peak hour. However, during the 2035 weekday evening peak hour, the eastbound traffic flow on Pleasant Street is projected to exceed capacity with a v/ c ratio of 1.09.

Table 3.5-3. No Build Roundabout Intersection Capacity Analysis Summary

	Peak	2015 No Build		2035 No Build	
Location	Period	Demand*	v/c**	Demand	v/c
North State Street at Franklin Street					
EB from Franklin Street	AM	190	0.31	220	0.33
WB from Franklin Street		430	0.49	530	0.61
NB from North State Street		130	0.16	160	0.17
SB from North State Street		290	0.45	320	0.50
EB from Franklin Street	PM	170	0.21	210	0.25
WB from Franklin Street		325	0.46	380	0.54
NB from North State Street		315	0.39	365	0.39
SB from North State Street		190	0.25	215	0.29
Centre Street at Liberty Street					
EB from Centre Street	AM	70	0.15	80	0.15
WB from Centre Street		420	0.54	490	0.56
NB from Liberty Street		455	0.54	530	0.58
SB from Liberty Street		410	0.61	510	0.73
EB from Centre Street	PM	60	0.16	65	0.11
WB from Centre Street		395	0.47	470	0.56
NB from Liberty Street		640	0.72	800	0.83
SB from Liberty Street		245	0.35	290	0.39
Pleasant Street at Fruit/Warren Streets					
EB from Pleasant Street	AM	Signalized		560	0.64
WB from Pleasant Street				310	0.52
NB from S. Fruit Street				475	0.67
SB from Warren Street				520	0.79
EB from Pleasant Street	PM	Signalized		905	1.09
WB from Pleasant Street				335	0.66
NB from S. Fruit Street				330	0.65
SB from Warren Street				505	0.76

* Demand in vehicles per hour.

**Volume to capacity ratio.

4

Build Alternative and Design Options

4.1 Introduction

As discussed in Chapter 1, the corridor alignment of the entire parkway (including Phase 3) was previously determined through detailed environmental study and permitting associated with Phases 1 and 2. Therefore, for the purpose of this study, the alignment of the roadway is considered to be confined to the layout previously determined and generally within the right-of-way previously secured by the City. Chapter 4 examines the various roadway cross-sections, intersection traffic control options, and other design elements that could be constructed to accommodate Phase 3. Although two general concepts are presented (the signalized option and the roundabout option), it is important to point out that the individual design elements of each (whether it be roadway segments or intersection type) are interchangeable, giving the City flexibility in selecting a preferred alternative.

4.2 Design Criteria

Several applicable regulations, guides, policies and references were compiled to assist with determining the initial design criteria that would be applied to the development of the study's conceptual roadway and intersection plans. The primary references include:

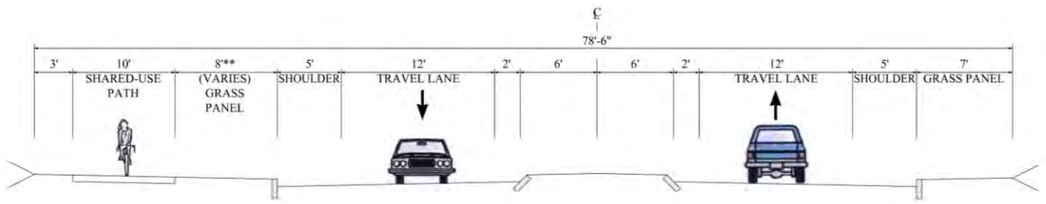
- A Policy on Geometric Design of Highways and Streets, AASHTO, "Green Book"
- New Hampshire Department of Transportation Highway Design Manual Volumes 1 and 2
- Roadside Design Guide, AASHTO 4th Edition, 2011
- Roundabouts: An Informational Guide, NCHRP Report 672, 2012
- Manual on Traffic Control Devices (MUTCD), FHWA, 2009 Edition
- Subdivision Regulations, City of Concord, Adopted December 15, 2010, with amendments
- Construction Standards and Details, City of Concord, 2009

Early in the planning process, it was determined that Phase 3 of the parkway would be fully compliant with the 'complete streets' provision of the City's Comprehensive Transportation Policy as adopted in January 2010. Essentially, all users would be provided for: motorists, pedestrians, bicyclists and public transit riders. And in a manner consistent with Phase 2, unique segments of the corridor would be designed to be context sensitive to the surrounding environment and neighborhoods. The expected posted speed limit would be 30 miles per hour, consistent with the Phase 2 section.

4.3 Mainline Alternatives

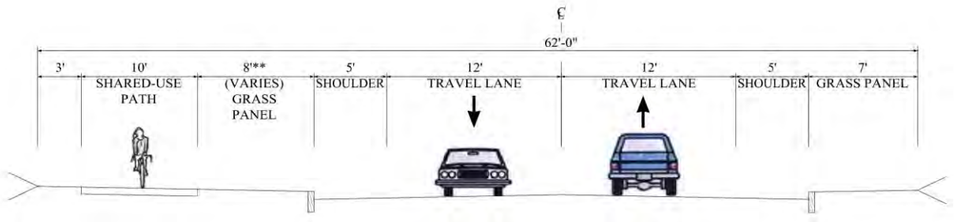
Two alternatives were developed for the new mainline segment of the parkway, which would extend from the existing terminus of Langley Parkway just north of the medical facilities area to the point where the roadway would tie into the existing street system in the vicinity of Penacook and Rumford Streets. Although both alternatives generally fit within the designated right-of-way and provide for two travel lanes (one travel lane in each direction) with pedestrian and bicycle facilities, each provides a different cross section and character for the new roadway segment.

The first alternative provides for a median divided roadway, as shown in Exhibit 4.3-1. The median divided alternative provides a 12-foot wide center median that could be landscaped with street-trees and other plantings, creating a boulevard effect. The landscaped median is intended to break up the pavement width of the travel way, creating an aesthetically pleasing view of the road. This cross section also includes 12-foot travel lanes, 5-foot shoulders, and a 10-foot shared-use path for bicycles and pedestrians that is separated from the roadway by a variable-width grass panel. It should be noted that these widths have been shown for graphical purposes, but can be modified (reduced) during the formal engineering design phase. For example, through travel lanes can vary in width between 10 and 12 feet.



EHIBIT 4.3-1
MEDIAN DIVIDED ROADWAY ALTERNATIVE

The second alternative provides a narrower cross section by eliminating the landscaped median divisor. This alternative provides 12-foot travel lanes and 5-foot shoulder for a total travel way width of 34-feet, which is 16-feet narrower than the travel way under alternative 1 with the raised median. Similar to alternative 1, this alternative also provides a 10-foot shared use path for bicycles and pedestrians that would be separated from the roadway with a variable width grass panel. Exhibit 4.3-2 shows the non-median divided roadway alternative. As mentioned above, the widths shown on this alternative can also be modified or reduced during the final design process.



EHIBIT 4.3-2
NON-MEDIAN DIVIDED ROADWAY ALTERNATIVE

4.4 Local Intersection Alternatives

Two general alternatives are presented for the local intersections along Phase 3 of the parkway: the roundabout alternative and the signalized alternative. It is important point out that the roundabout intersection alternative is presented in combination with the median divided roadway alternative, while the signalized alternative is presented with the non-median divided roadway. As discussed earlier, the roadway and intersection alternatives are flexible and can be interchanged to best accommodate the City's preferences.

With regard to local connections to the parkway, an evaluation was completed early in the study process to determine how to best provide access in the vicinity of Auburn and Penacook Streets. Previous work completed under Phase 2 of the parkway identified a number of potential local connection alternatives including: connecting at Auburn Street (terminating Penacook Street); connecting at Penacook Street (terminating Auburn Street); and combinations of connecting both Penacook and Auburn Streets. Based on a review of traffic volume demands, geometric needs, and the physical terrain under each of the scenarios, it was determined that the optimal connection would be via Auburn Street. Both the roundabout and signalized alternatives assume the Auburn Street connection.

4.4.1 Roundabout Alternative

Figures 4.4-1 through 4.4-6 graphically display the roundabout alternative for the local intersections along the parkway. Commencing at Concord Hospital's north access road and parking garage intersection, this alternative uses the implementation of a roundabout to begin a gateway or transition zone from the medical services area to the new segment of the parkway. A single lane roundabout at the northern hospital driveway will promote traffic calming and slower travel speeds as Langley Parkway transitions from a multi-lane roadway west of the intersection to a two-lane roadway to the north. Traveling north, Langley Parkway will maintain the driveway opening at Granite Ledges. Sidewalk is proposed along the west side of Langley Parkway between the hospital intersection and Granite Ledges. The 10-foot wide multi-use path is introduced on the west side of the parkway, north of the Granite Ledges driveway, and is carried north through the intersection at Auburn Street.

A single lane roundabout is provided at the intersection of Langley Parkway and Auburn Street with additional right-turn slip lanes on the Auburn Street eastbound and Langley Parkway southbound approaches to accommodate anticipated traffic volume demands. Pedestrian crossings are provided on the north and west legs of the intersection providing connectivity to the multi-use path. North of the Auburn Street roundabout, a multi-use path is provided on both sides of Langley Parkway up to Penacook Street, where the multi-use path is then only carried forward on the east side of Langley Parkway. The shift of the multi-use path from the west to the east side of the parkway is intended to minimize potential environmental impacts.

Penacook Street is terminated at a cul-de-sac just north of the Auburn Street roundabout; a new parkway connection to Penacook Street is provided further north in the vicinity of Jennings Drive. At this location, the Jennings Drive extension creates a three-way intersection with the Langley Parkway. A left-turn lane is provided on Langley Parkway to accommodate turns into the Jennings Drive extension and separate turn lanes are provided for vehicle exiting the extension. Vehicles exiting from the Jennings Drive extension would be stop controlled.

Under the roundabout alternative, Langley Parkway widens from a two-lane roadway to provide additional travel or turn lanes from the intersection of Rumford Street to North State Street. A multi-lane roundabout is provided at the intersection of Rumford Street where two lanes are provided traveling eastbound toward North State Street and one lane is provided traveling westbound. Similar to the Auburn Street roundabout, additional right-turn slip lanes are provided on Rumford Street southbound and Langley Parkway westbound approaches to facilitate efficient traffic flow. In addition, Granite Place (the driveway to Lincoln Financial Group) is relocated slightly north to provide better separation between this driveway and the Rumford Street roundabout. The multi-use path is maintained on the south side of the parkway through the intersection, along Penacook Street up to Bradley Street. However, pedestrian crossings with connectivity to a multi-use path are provided on all four approaches to the intersection. The multi-use path transitions back to the existing 5-foot

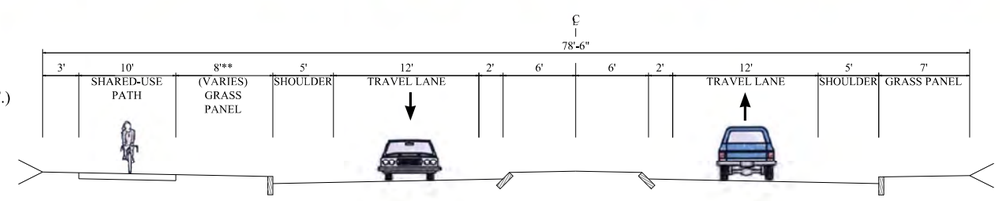
sidewalk heading away from the roundabout along Rumford Street and the north side of Penacook Street.

At the intersection of Bradley Street, Penacook Street provides a center left-turn lane and one through travel lane in each direction. Pedestrian crossings are provided on all four approaches to the intersection with sidewalk on both sides of Penacook Street (including the multi-use path on the south side Penacook Street west of Bradley Street). Penacook Street between Rumford Street and North State Street can be median divided to reduce the visual scale of the roadway pavement in the residential area. Under this alternative, the roundabout at Rumford Street and signal at North State Street can be used by local driveway movements to reverse direction.

0 100 200 Feet

LANGLEY PARKWAY
(HOSPITAL TO RUMFORD ST.)
NOT TO SCALE

** PANEL VARIES TO ACCOMODATE A MEANDERING SHARED USE PATH



LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 4.4-1
Roundabout Alternative - Hospital Northern Access

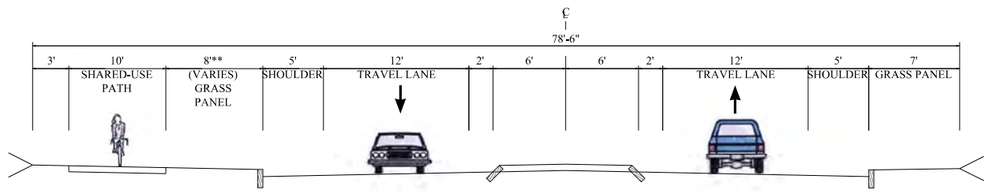
Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

POTENTIAL
WATER QUALITY
TREATMENT AREA

0 100 200 Feet

LANGLEY PARKWAY
(HOSPITAL TO RUMFORD ST.)
NOT TO SCALE

** PANEL VARIES TO ACCOMODATE A MEANDERING SHARED USE PATH



LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 4.4-2

Roundabout Alternative -
North of Medical Area (Median Divided)

Langley Parkway Phase 3
Feasibility Study

City of Concord, NH

POND PLACE LANE

SAMUEL DRIVE

AUBURN STREET

POTENTIAL PARKING

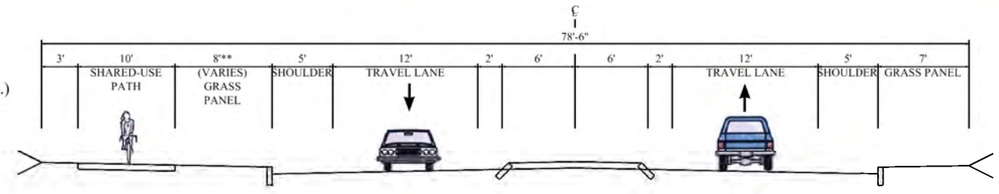
POTENTIAL PARKING

AUBURN STREET

0 100 200 Feet

LANGLEY PARKWAY
(HOSPITAL TO RUMFORD ST.)
NOT TO SCALE

** PANEL VARIES TO ACCOMODATE A MEANDERING SHARED USE PATH



LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

VHB Vanasse Hangen Brustlin, Inc.

Figure 4.4-3

Roundabout Alternative - Auburn Street

Langley Parkway Phase 3 Feasibility Study

City of Concord, NH

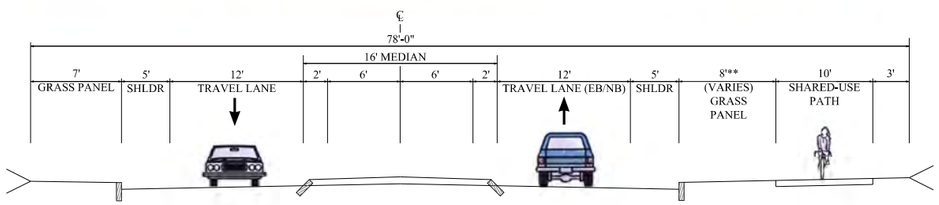
PENACOOK STREET

PENACOOK STREET

0 100 200 Feet

PENACOOK ST./LANGLEY PARKWAY
(AUBURN ST. TO RUMFORD ST.)
NOT TO SCALE

** PANEL VARIES TO ACCOMODATE A MEANDERING SHARED USE PATH



LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

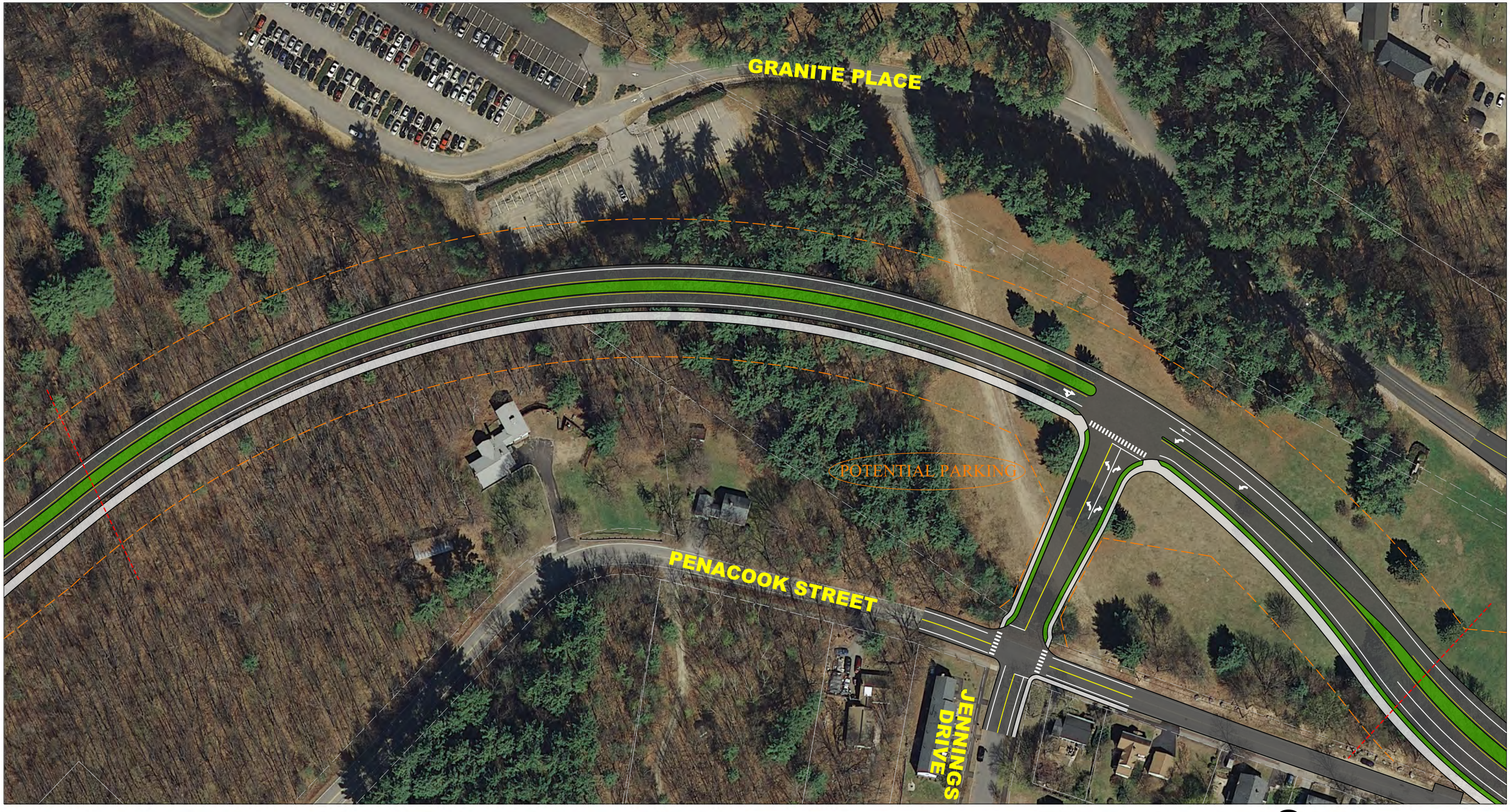
VHB *Vanasse Hangen Brustlin, Inc.*

Figure 4.4-4

Roundabout Alternative -
Penacook Street Hammer Heads

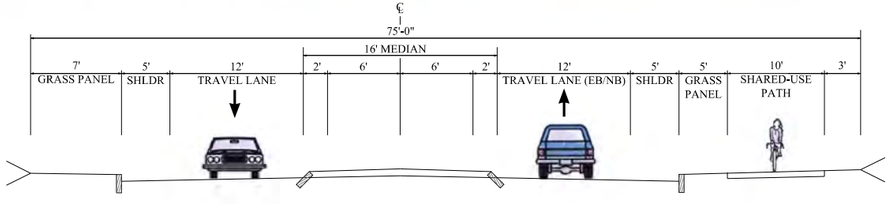
Langley Parkway Phase 3 Feasibility Study

City of Concord, NH



0 100 200 Feet

PENACOOK ST./LANGLEY PARKWAY
(AUBURN ST. TO RUMFORD ST.)
NOT TO SCALE



LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

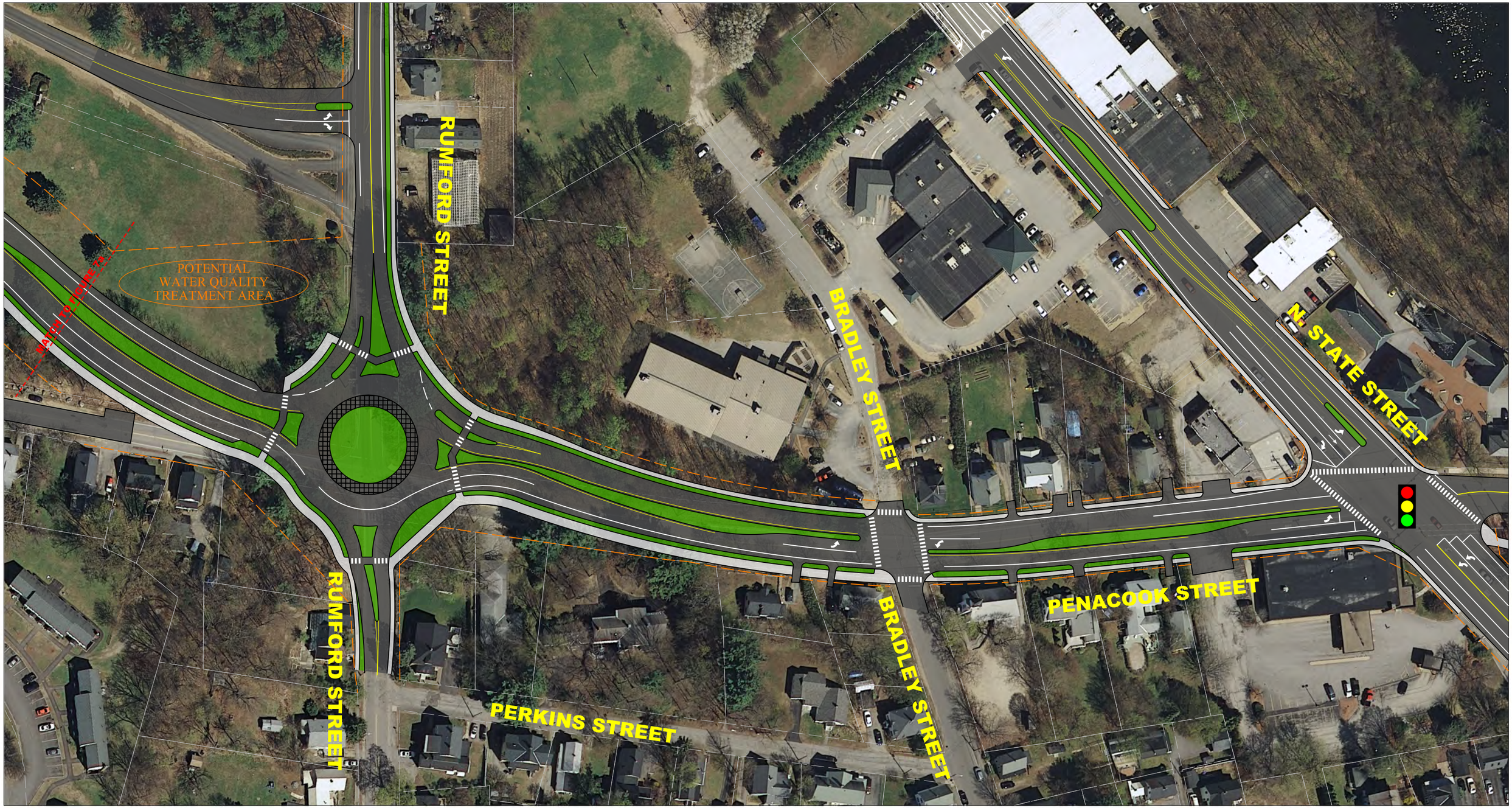
VHB *Vanasse Hangen Brustlin, Inc.*

Figure 4.4-5

Roundabout Alternative - Jennings Drive Extension

Langley Parkway Phase 3 Feasibility Study

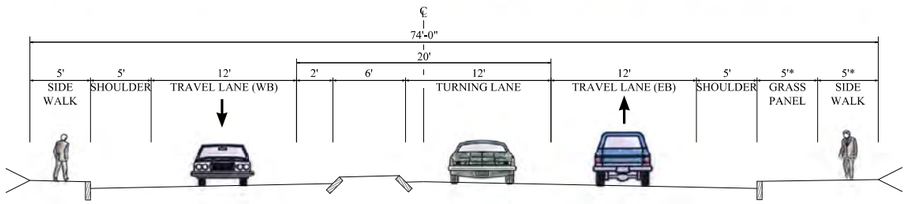
City of Concord, NH



0 100 200 Feet

LANGLEY PARKWAY
(RUMFORD ST. TO NORTH STATE ST.)
NOT TO SCALE

* MAINTIN EXIST. LANDSCAPED PANEL AND SIDEWALK



LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 4.4-6

Roundabout Alternative - Rumford Street

Langley Parkway Phase 3 Feasibility Study

City of Concord, NH

4.4.2 Signal Alternative

Figures 4.4-7 through 4.4-12 graphically display the signalized alternative for the local intersections along the parkway. Essentially, traffic signals and widening for turn lanes is developed instead of roundabouts at the Auburn Street and the Rumford Street intersections. In general, the use and layout of sidewalk and multi-use path along Langley Parkway from the medical facilities area to North State Street is consistent with that previously described under the roundabout alternative. Under this alternative, signalized pedestrian amenities would be provided at the signalized locations.

Beginning at the southern end of Phase 3, a new signal is provided at the intersection of Langley Parkway and the hospital northern access. At this location, Langley Parkway is widened to a three-lane cross section with a center left-turn lane and a single through travel lane in each direction. The hospital driveway westbound approach is also widened to provide separate left-turn and through/ right-turn lanes for vehicles exiting the medical facility. Extending north, Langley Parkway narrows to provide a single travel lane in each direction. A driveway intersection similar to that previously described under the roundabout alternative is provided at Granite Ledges.

Langley Parkway widens again at the signalized intersection with Auburn Street to provide additional turn lanes. Left-turn lanes are provided both northbound and southbound on the parkway at the intersection, and a separate right-turn lane is also provided in the southbound direction. Auburn Street is widened at this location to provide separate left-turn and through/ right-turn lanes at the intersection.

Similar to the roundabout alternative, Penacook Street is terminated just north of Auburn Street and reconnected via a new unsignalized intersection in the vicinity of Jennings Drive. The geometry and traffic control for this T-intersection is similar to that previously described in Section 4.4.1.

At the Rumford Street signalized intersection, Langley Parkway provides separate left-turn lanes in each direction, as well as a separate right-turn lane in the westbound direction. Both Rumford Street approaches are widened to provide a left-turn lane, a through lane, and a channelized right-turn lane. The driveway to the Lincoln Financial Group property (Granite Place) located on Rumford Street is also relocated under this alternative to provide better separation from the signalized intersection. East of the Rumford Street intersection, Penacook Street is the same as previously described under the roundabout alternative.

4.4.3 Other Design Considerations

In addition to the intersection options presented in the previous sections, two design options are presented for the Penacook Street termination points. Under either the roundabout or signal alternative, Penacook Street will be discontinued at three locations: north of Auburn Street (west of Langley Parkway); north of Auburn Street (east of Langley Parkway); and west of Rumford Street (south of Langley Parkway). Exhibit 4.4-1, below, shows the layout of traditional hammer-head turnarounds at the three termination points, while Exhibit 4.4-2 shows the layout of potential cul-de-sacs. Either option, also shown on Figures 4.4-10 and 4.4-12, is considered to be viable for implementation. However, the cul-de-sacs option in the Auburn Street area would likely require the acquisition of additional right-of-way or easements.

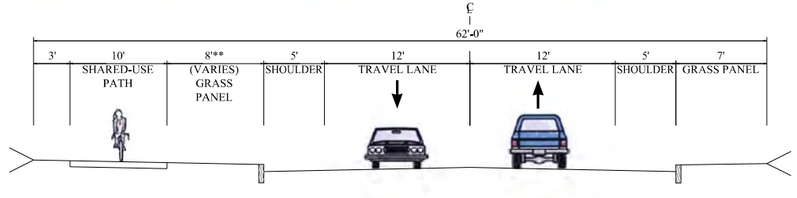
EXHIBIT 4.4-1
HAMMER-HEAD TURNAROUND LAYOUT

EXHIBIT 4.4-2
CUL-DE-SAC LAYOUT

0 100 200 Feet

LANGLEY PARKWAY
(HOSPITAL TO RUMFORD ST.)
NOT TO SCALE

** PANEL VARIES TO ACCOMODATE A MEANDERING SHARED USE PATH



LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 4.4-7

Signal Alternative -
Hospital Northern Access

Langley Parkway Phase 3 Feasibility Study

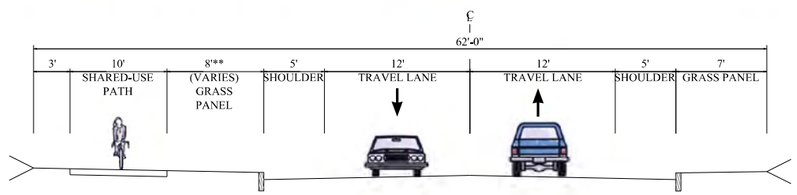
City of Concord, NH

POTENTIAL
WATER QUALITY
TREATMENT AREA

0 100 200 Feet

LANGLEY PARKWAY
(HOSPITAL TO RUMFORD ST.)
NOT TO SCALE

** PANEL VARIES TO
ACCOMODATE A MEANDERING
SHARED USE PATH



LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 4.4-8

Signal Alternative -
North of Medical Area (Non-Median Divided)

Langley Parkway Phase 3
Feasibility Study

City of Concord, NH

POND PLACE LANE

SAMUEL DRIVE

AUBURN STREET

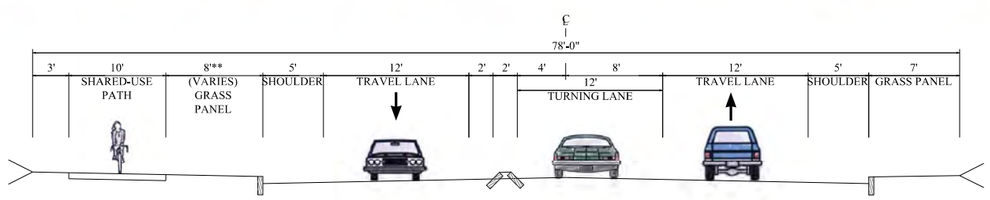
POTENTIAL PARKING

POTENTIAL PARKING

AUBURN STREET

0 100 200 Feet

LANGLEY PARKWAY
(HOSPITAL TO RUMFORD ST.)
NOT TO SCALE



** PANEL VARIES TO ACCOMODATE A MEANDERING SHARED USE PATH

LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

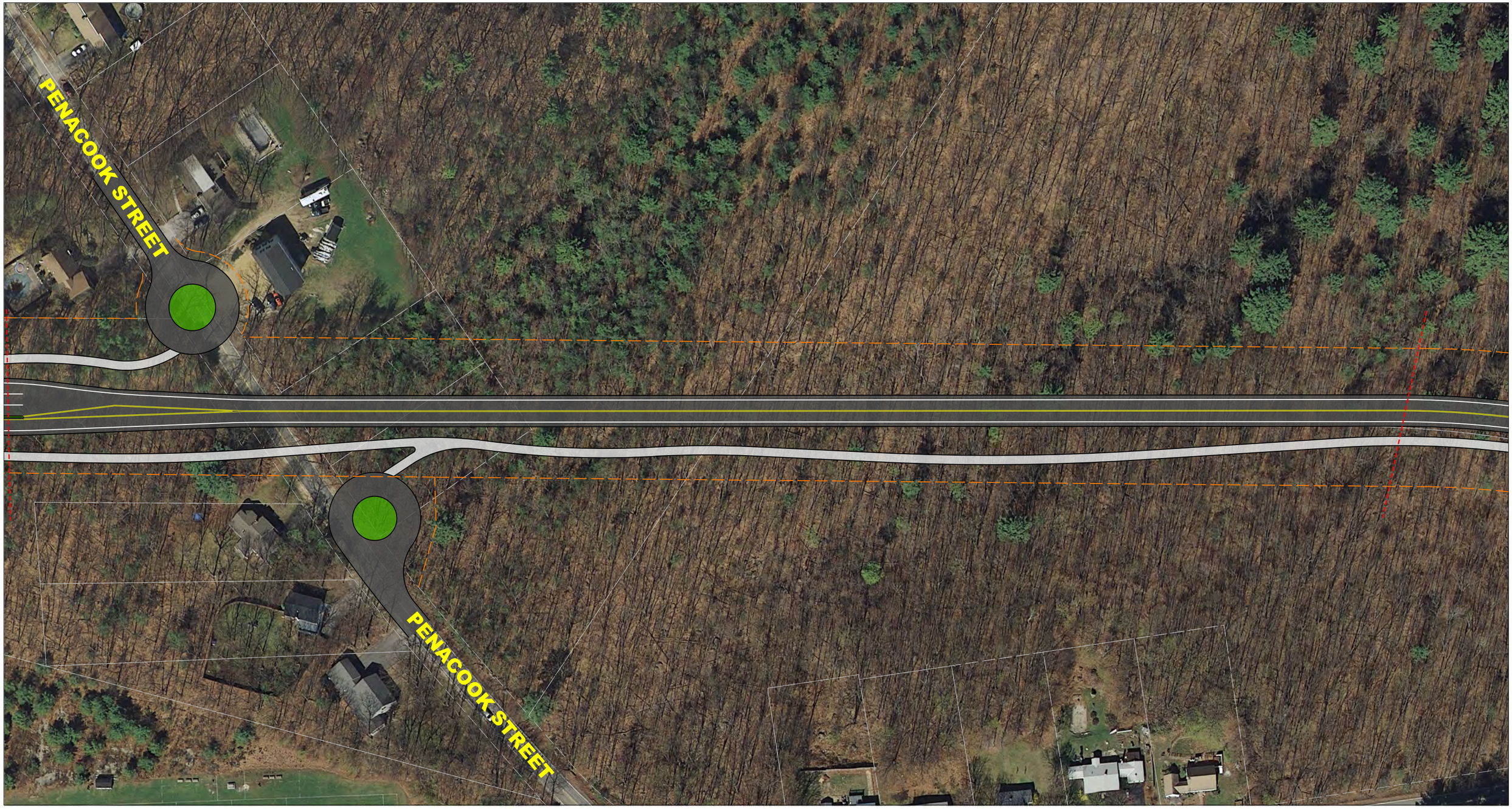
VHB *Vanasse Hangen Brustlin, Inc.*

Figure 4.4-9

Signal Alternative - Auburn Street

Langley Parkway Phase 3 Feasibility Study

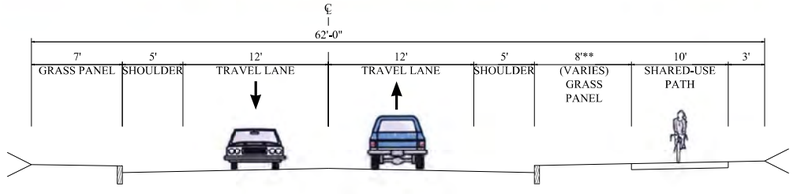
City of Concord, NH



0 100 200 Feet

PENACOOK ST./LANGLEY PARKWAY
(AUBURN ST. TO RUMFORD ST.)
NOT TO SCALE

** PANEL VARIES TO ACCOMODATE A MEANDERING SHARED USE PATH



LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

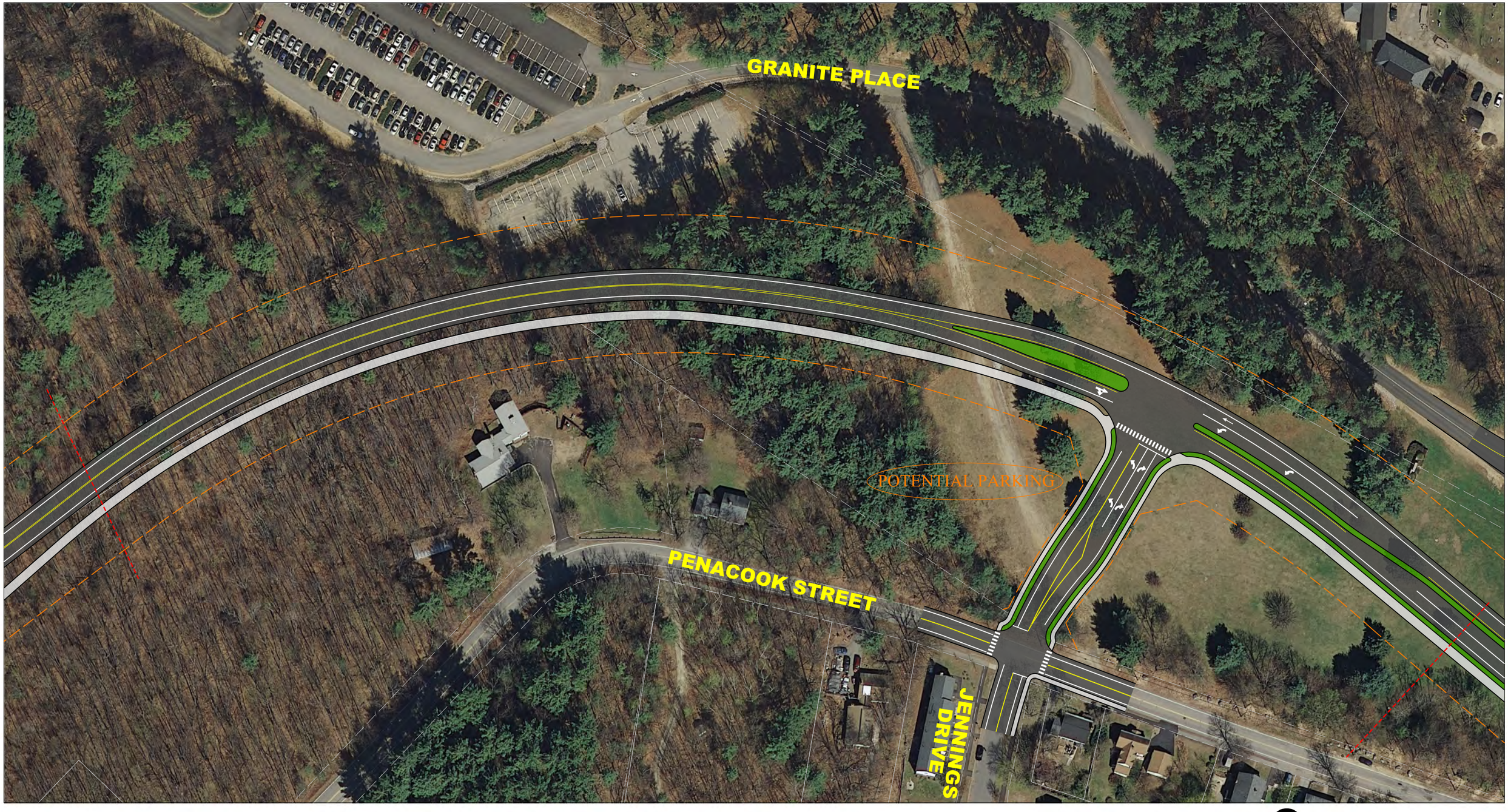
VHB *Vanasse Hangen Brustlin, Inc.*

Figure 4.4-10

Signal Alternative -
Penacook Street Cul-de-sacs

Langley Parkway Phase 3 Feasibility Study

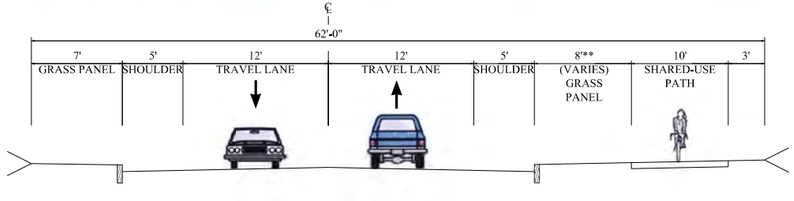
City of Concord, NH



0 100 200 Feet

PENACOOK ST./LANGLEY PARKWAY
(AUBURN ST. TO RUMFORD ST.)
NOT TO SCALE

** PANEL VARIES TO ACCOMODATE A MEANDERING SHARED USE PATH



LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 4.4-11
Signal Alternative -
Jennings Drive Extension

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

POTENTIAL
WATER QUALITY
TREATMENT AREA

RUMFORD STREET

BRADLEY STREET

N. STATE STREET

RUMFORD STREET

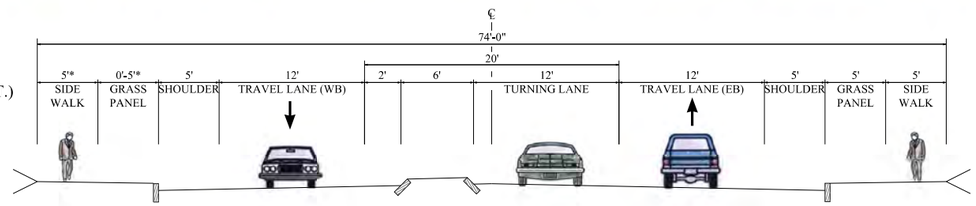
PERKINS STREET

BRADLEY STREET

PENACOOK STREET

0 100 200 Feet

LANGLEY PARKWAY
(RUMFORD ST. TO NORTH STATE ST.)
NOT TO SCALE



* MAINTAIN EXIST. LANDSCAPED PANEL AND SIDEWALK

LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 4.4-12

Signal Alternative - Rumford Street

Langley Parkway Phase 3 Feasibility Study

City of Concord, NH

4.5 Other Improvements to Support the Project

In addition to the construction of the Phase 3 segment of Langley Parkway, improvements at other locations outside of the Phase 3 limits are presented in support of the project. These improvements include enhanced access to Concord Hospital, additional capacity at the North State Street intersection with Penacook Street, and improvements at the North State Street intersection with Rumford Street. The improvements described below apply to both the roundabout and signal alternatives.

4.5.1 Enhanced Access to Concord Hospital

With the completion of Phase 3, traffic volumes will increase along the parkway and particularly at its intersection with Pleasant Street. Improvements constructed under Phase 2 for the intersection of Langley Parkway with Pleasant Street were completed leaving limited right-of-way available for future widening without substantially impacting the properties abutting the intersection. Therefore, during the study process of developing alternatives for Phase 3, solutions balancing the capacity needs and right-of-way limitations were investigated for this intersection. Various alternatives were evaluated; however, it was determined that the solution that would best balance traffic demands with the least potential to impact abutting properties would include modifying the current access configuration and on-site circulation pattern at Concord Hospital. More specifically, converting the existing hospital one-way entrance on Pleasant Street (primarily used by employees) to accommodate two-way employee and patient traffic would reduce traffic along the Parkway to a level where minimal additional improvements would be needed at the Langley Parkway and Pleasant Street intersection.

Figure 4.5-1 shows the Pleasant Street intersections with Langley Parkway and the hospital driveway under the Build condition. Both intersections are signalized. At the Langley Parkway intersection, the two Pleasant Street approaches and the parkway southbound approach are widened in the immediate vicinity of the intersection to provide separate right-turn lanes. At the hospital access, a center left-turn lane is already provided on Pleasant Street. In addition, a westbound right-turn lane is provided on Pleasant Street for vehicles entering the hospital. The hospital driveway would be widened to provide separate left-turn/ through and right-turn lanes for vehicles exiting.

In addition to the Pleasant Street improvements, modifications to the Phase 1 segment of Langley Parkway are also presented in support of Phase 3. As shown in Figure 4.5-2, the intersection of the hospital and Concord Orthopedics driveways is shifted approximately 100 feet north of their existing location and signalized. The relocation of the intersection improves spacing with the Pleasant Street intersection, maximizing storage for vehicles between the two signals. Langley Parkway is widened to provide a center left-turn lane for vehicles entering the hospital or orthopedics driveways.

4.5.2 North State Street at Penacook Street

A recent project completed by the City reduced the number of northbound through lanes on North State Street from two to one at its signalized intersection with Penacook Street and Horseshoe Pond Lane, eliminating the lane drop that formerly occurred north of the intersection in the vicinity of the bowling alley. In order to accommodate the traffic volume demands at this location under the Build condition, the improvement plan shown in Figure 4.5-3 uses width previously allocated on North State Street for the second northbound through lane to install a second northbound left-turn lane for vehicles accessing Penacook Street and Langley Parkway. Widening along Penacook Street is required to accept the two left-turn lanes, which then transition down to a single through lane prior to reaching Bradley Street.

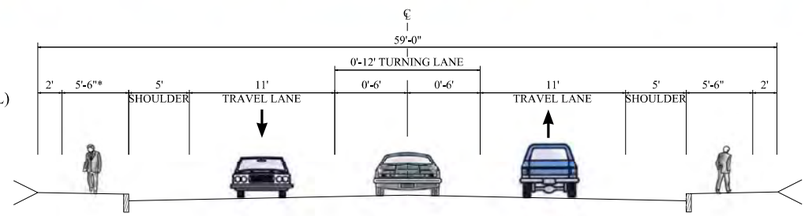
As discussed in Section 4.5.3 below, the conceptual design calls for installation of a traffic signal at the intersection of North State Street and Rumford Street. A traffic signal at this location will attract motorists destined to locations on North State Street north of the study area to use Rumford Street, which in turn helps to minimize widening and improvements needed along Penacook Street in the vicinity of Bradley Street.

4.5.3 North State Street at Rumford Street

Figure 4.5-3 shows a signalized intersection at North State Street and Rumford Street with minor modifications to the existing intersection layout. Under the future Build condition, a traffic signal is provided at the intersection, but only for vehicles exiting from Rumford Street; northbound left-turns from North State Street to Rumford Street would be prohibited. Southbound right-turns from North State Street to Rumford Street are accommodated with a channelized right-turn lane. Pedestrian crossings are provided on both North State Street and Rumford Street.

0 100 200 Feet

PLEASANT STREET
(LANGLEY PARKWAY AT HOSPITAL)
NOT TO SCALE



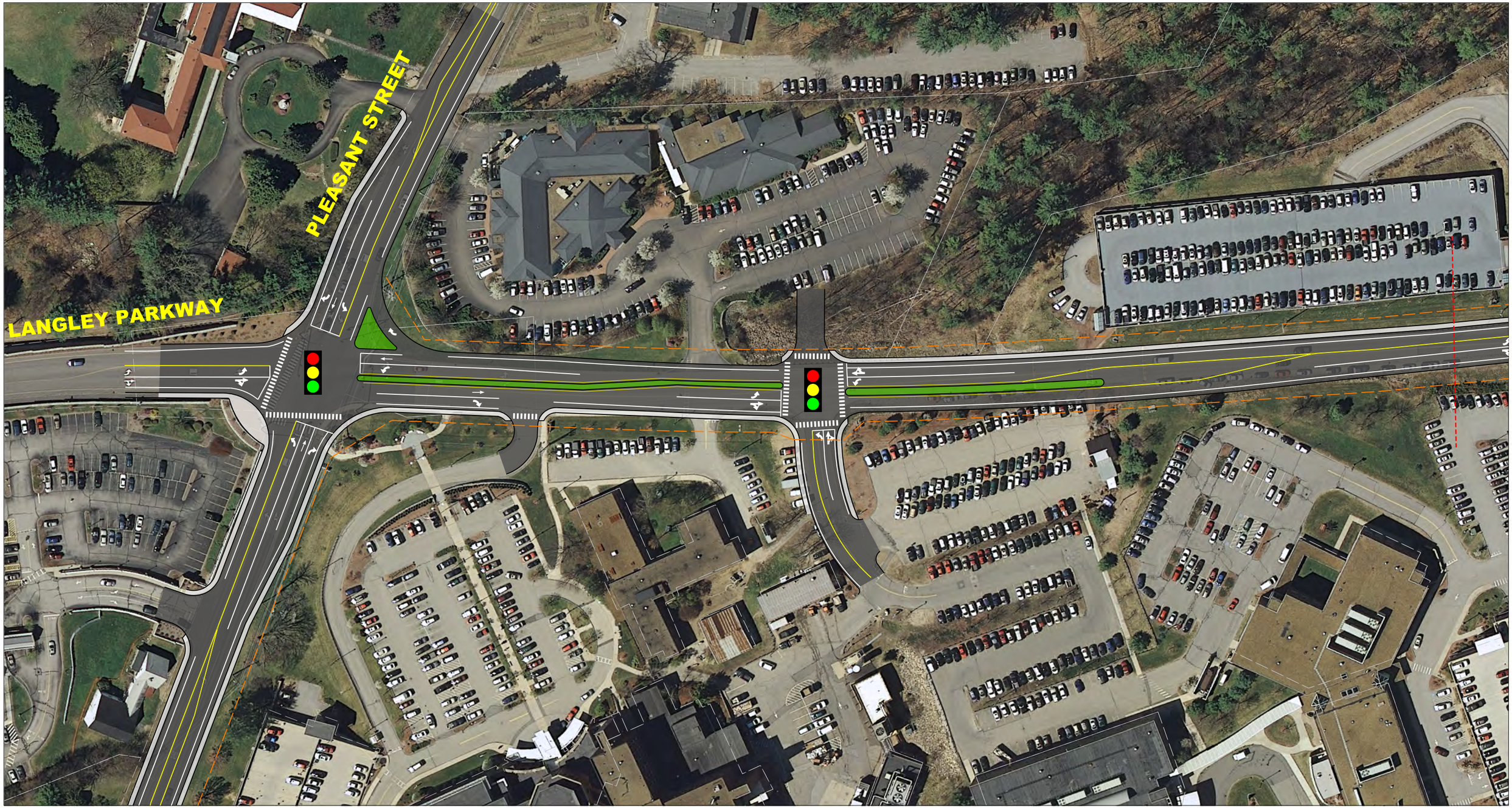
* MAINTAIN EXISTING SIDEWALK WIDTH

LEGEND
- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

VHB *Vanasse Hangen Brustlin, Inc.*

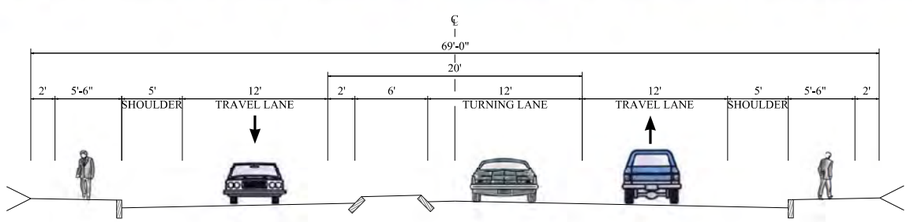
Figure 4.5-1
Langley Parkway at Pleasant Street

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH



0 100 200 Feet

LANGLEY PARKWAY
(PLEASANT ST. TO HOSPITAL)
NOT TO SCALE



LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

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Figure 4.5-2
Langley Parkway Phase I Modifications

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

CITY OF CONCORD
N. STATE STREET IMPROVEMENTS

N. STATE STREET

HORSESHOE POND LANE

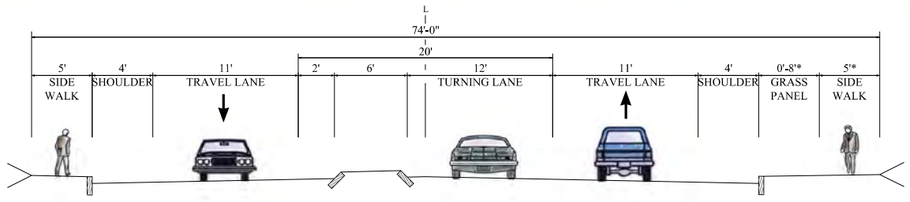
BRADLEY STREET

PENACOOK STREET

0 100 200 Feet

NORTH STATE STREET
(RUMFORD ST. TO PENACOOK ST.)
NOT TO SCALE

* MAINTIN EXIST. LANDSCAPED PANEL AND SIDEWALK



LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

VHB *Vanasse Hangen Brustlin, Inc.*

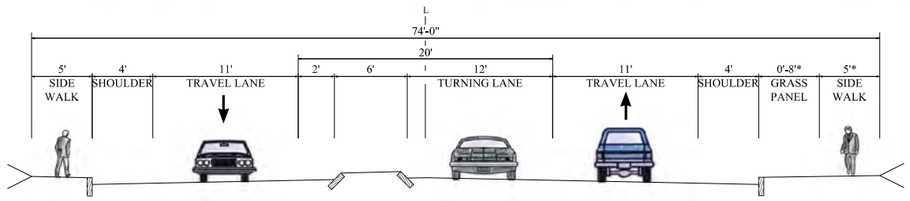
Figure 4.5-3
North State Street at Penacook Street

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

0 100 200 Feet

NORTH STATE STREET
(RUMFORD ST. TO PENACOOK ST.)
NOT TO SCALE

* MAINTIN EXIST. LANDSCAPED PANEL AND SIDEWALK



LEGEND

- PAVEMENT
- SIDEWALK/SHARED USE PATH
- EXISTING R.O.W.
- POTENTIAL R.O.W.

Vanasse Hangen Brustlin, Inc.

Figure 4.5-4
North State Street at Rumford Street

4.6 Planning –Level Cost Estimates

Planning-level construction cost estimates (2013 Dollars) were developed for programming purposes. Table 4.6-1 shows the range of potential costs for the various alternatives and options covered in this study. The alternative estimates represent approximated construction costs of the infrastructure shown on the respective concept plans. Roundabout and signal options are priced with either the median or no-median corridor options. The estimated construction costs range from $13.6 million to $15.4 million and have been broken down into two construction years. Note that the planning-level construction cost estimates do not include costs related to utility construction or relocation, right-of-way acquisition or relocation (if necessary), mitigation, or preliminary and final engineering fees. Upon the selection of a preferred alternative and the completion of preliminary engineering, cost estimates can be further refined.

Table 4.6-1. Planning-Level Cost Estimates

SEGMENT OPTION INTERSECTION OPTION	NO MEDIAN ROUNDABOUTS	WITH MEDIAN ROUNDABOUTS	NO MEDIAN SIGNALS	WITH MEDIAN SIGNALS
CONTRACT - Year 1				
Pleasant Street Terminus	$2,440,000	$2,440,000	$2,440,000	$2,440,000
Hospital Parking Garage Intersection	$350,000	$350,000	$770,000	$770,000
Hospital to Auburn Street	$1,880,000	$2,270,000	$1,880,000	$2,270,000
Auburn Street Intersection	$750,000	$750,000	$980,000	$980,000
SUBTOTAL	$5,420,000.00	$5,810,000	$6,070,000.00	$6,460,000.00
Mobilization (6%)	$325,200	$348,600	$364,200	$387,600
Contingencies (10%)	$542,000	$581,000	$607,000	$646,000
Construction Engineering (8%)	$433,600	$464,800	$485,600	$516,800
YEAR 1 CONSTRUCTION TOTAL	$6,720,800	$7,204,400	$7,526,800	$8,010,400
CONTRACT - Year 2				
Auburn Street to Jennings Drive	$1,970,000	$2,150,000	$1,970,000	$2,150,000
Rumford Street/Langley Intersection	$1,700,000	$1,700,000	$1,950,000	$1,950,000
North State Street Terminus	$1,580,000	$1,580,000	$1,580,000	$1,580,000
Rumford Street/North State Street	$230,000	$230,000	$230,000	$230,000
SUBTOTAL	$5480000	$5,660,000.00	$5,730,000.00	$5,910,000.00
Mobilization (6%)	$328,800	$339,600	$343,800	$354,600
Contingencies (10%)	$548,000	$566,000	$573,000	$591,000
Construction Engineering (8%)	$438,400	$452,800	$458,400	$472,800
YEAR 2 CONSTRUCTION TOTAL	$6,795,200	$7,018,400	$7,105,200	$7,328,400
TOTAL	**$13,516,000**	**$14,222,800**	**$14,632,000**	**$15,338,800**
PROJECT TOTALS	**$13,600,000**	**$14,300,000**	**$14,700,000**	**$15,400,000**

5

Evaluation of Build Alternative

5.1 Evaluation Criteria

When considered in the context of the existing transportation system and environmental resources described in Chapters 2 and 3, review of the conceptual plans described in Chapter 4 allows comparison of the relative benefits and impacts of Langley Parkway Phase 3 and each option for local connectivity. The methodologies and criteria used in conducting such an evaluation are described in this chapter, along with results of the analysis.

5.1.1 Traffic Volumes

The regional travel demand model was used to assist with estimating Build traffic volume networks with the completion of Langley Parkway. In general, there are two basic trip diversion patterns that are expected to occur with the completion of Phase 3: local shifts and citywide shifts. Some local shifts in traffic consider travel routes that traverse the downtown street system to gain access to the Pleasant Street/ Langley Parkway area. Primary routes currently include Penacook Street, Rumford Street, Franklin Street, Washington Street, Centre Street, and Liberty Street. Local trips currently using these (and other local streets) will change their travel pattern to utilize Langley Parkway as travel times will be quicker and less congested. It is estimated that approximately 325 vehicles will shift from Penacook Street (east of Auburn Street) to the parkway during the weekday morning peak hour and 400 vehicles during the weekday evening peak hour. In addition, approximately 450 to 475 vehicles will shift from the other downtown primary routes to Langley Parkway during the peak hours. Overall, Phase 3 of the parkway is expected to remove roughly 500 vehicles per hour off the downtown street network during the 2035 weekday morning and evening commuter peak hours.

Citywide shifts consider more regional effects of completing the parkway. These are motorists that are not currently traveling through the study area but will change their travel route as a result of Phase 3 being in place. Citywide shifts are expected to occur to/ from roadways such as I-93, I-89, North State Street (north of Rumford Street), and Fisk Road. It is estimated that an additional 400 vehicles will travel via Langley Parkway as a result of citywide shifts during the weekday morning peak hour and 550 vehicles during the weekday evening peak hour.

Overall Langley Parkway Phase 3 is anticipated to carry approximately 1,200 vph east of Auburn Street and 875 vph west of Auburn Street during the 2035 weekday morning peak hour and 1,425 vph to the east and 1,025 to the west during the 2035 weekday evening peak hour. Figures 5.1-1 and 5.1-2 show the 2015 Build weekday morning and evening peak hour traffic volume networks respectively. Figures 5.1-3 and 5.1-4 show the 2035 Build weekday morning and evening peak hour traffic volume networks.

5.1.2 Traffic Operations Criteria

Level of Service

As previously discussed in Subsection 2.2.3, traffic operational performance measures and the evaluation criteria are primarily based on LOS, which is a qualitative measure describing operational conditions. Six LOSs are defined that range in letter designation from LOS A to LOS F, with LOS A representing the best operating condition and LOS F representing the worst. In the design of new roadway facilities, LOS C is generally considered desirable and LOS D is minimally acceptable. Under certain circumstances, LOS E operation may be considered acceptable. LOS E may encourage multi-modal use and reduce the use of single-occupant vehicles, particularly during the peak hours.

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 5.1-1

2015 Build Weekday Morning Peak Hour

Langley Parkway Phase 3 Feasibility Study

City of Concord, NH

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Figure 5.1-2

2015 Build Weekday Evening Peak Hour

Langley Parkway Phase 3 Feasibility Study

City of Concord, NH

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 5.1-3

2035 Build Weekday Morning Peak Hour

Langley Parkway Phase 3 Feasibility Study

City of Concord, NH

VHB *Vanasse Hangen Brustlin, Inc.*

Figure 5.1-4

2035 Build Weekday Evening Peak Hour

Langley Parkway Phase 3 Feasibility Study

City of Concord, NH

Travel Time

Pre- and post-construction travel time estimates were compared for various travel routes between the regional medical campus and points north and east of the downtown area that could benefit from the implementation of Phase 3 of the parkway. Pre-construction (existing) travel time runs were conducted during peak and off-peak conditions for directional traffic flow entering and exiting the downtown. Selected existing routes for sampling are shown in Figure 5.1-5 and include:

- Auburn Street/ Liberty Street/ Warren Street/ Pleasant Street
- North State Street/ Rumford Street/ Liberty Street/ Pleasant Street
- North State Street/ Franklin Street/ Liberty Street/ Pleasant Street
- US 202/ North State Street/ Franklin Street/ Liberty Street/ Pleasant Street

Post-construction travel times were estimated for the same routes, but with motorists travelling via Langley Parkway instead of the existing downtown network. Travel times were estimated using the calculated intersection delays from the capacity analyses for the roundabout alternative and assuming a posted speed limit of 30 mph (with an 85th percentile speed of 38 mph) for the Langley Parkway roadway segments. It is important to note that the pre- and post-construction travel times do not provide a direct comparison of No Build and Build conditions. The pre-construction travel time runs are based on existing conditions in the downtown, which, as mentioned previously, were conducted during peak and off-peak conditions. The post-construction travel time estimates were calculated for the 2015 Build condition which are based on higher traffic volumes and reflect travel only during the worst-case peak hour conditions. Travel time runs and estimates were compared to provide a sense of delay reduction that could occur with the construction of Phase 3.

5.1.3 Resource Evaluation Methods

Understanding potential impacts on environmental and social resources is another important element of the Study. To review these issues, an impact analysis of each alternative was conducted.

As described in Chapter 2, available GIS data for the study area were obtained from various state agencies, NHGRANIT, and the City. Existing environmental information was verified and updated in the field based on a reconnaissance-level effort. Information pertaining to ROW and property in the study area was obtained from 2012 GIS parcel mapping, including assessment records provided by the City of Concord.

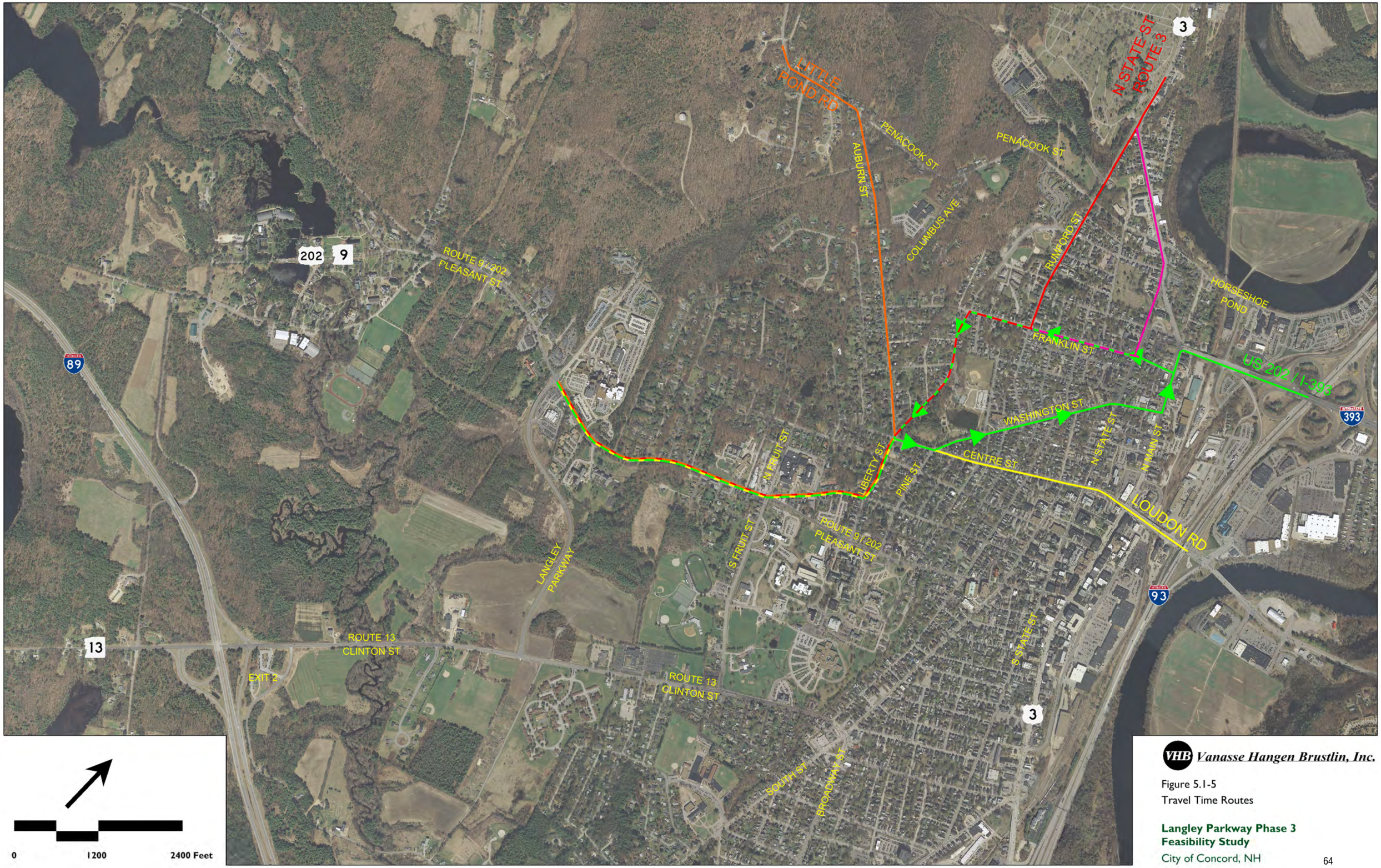
Potential impacts were then calculated using a GIS overlay analysis, in which the conceptual footprint of each roadway alternative was overlaid onto the various environmental resources. To evaluate many of the environmental resources (wetland, floodplain, hazardous material, farmland, aquifer, rare species, parks, cultural), the project footprint consisted of the areas of proposed pavement, proposed sidewalk and proposed grass fill. To assess water quality, the amount of proposed pavement associated with each alternative was used for the project footprint. Please note that slope limits were not developed for the conceptual design alternatives and are not represented in the resource evaluation. Table 5.1-1 summarizes the metrics used to evaluate these resources.

Impacts presented in this study must be interpreted cautiously. First, only direct impacts were considered. However, certain resources (i.e., historic buildings and historic districts) can be affected indirectly. Second, wetland and cultural resources were verified only along the 250 foot study corridor, which is centered on the preliminary Phase 3 alignment provided by the City. Resources were not verified in the field for the various intersection improvement areas that extend outside of the 250 foot corridor. The concepts for these areas (North State Street/ Rumford Street, and several of the intersection connectors) were developed after the field reconnaissance effort was completed.

Second, all identified impacts are preliminary estimates because they are based on 2D conceptual designs. Third, resource mapping relies primarily on landscape-level environmental data rather than detailed site-specific studies that would be required during a formal NEPA or permit evaluation. Fourth, the potential ROW estimates do not quantify any corresponding loss of tax base associated with the acquisition, as it too early in the design phase to quantify this information. Additionally, ROW impacts were quantified based on the number of non-City owned parcels crossed by the conceptual proposed row limits. The impacts, however, are still useful and appropriate for comparing the relative impacts of each option. Should the project advance to preliminary design, resource impacts will need to be re-evaluated in much closer detail.

Table 5.1-1 Environmental Evaluation Metrics

Resource/Impact	Metric
Wetlands	Acres of Disturbance Number of Stream Crossings
Water Quality	Acres of Disturbance
Floodplains	Acres of Disturbance
Aquifer	Acres of Proposed Pavement
Farmland	Acres of Disturbance
Rare, Threatened, Endangered Species/Habitat	# of Federally Listed Populations # of Populations Potentially Impacted
Parkland & Recreation	# of Sites Potentially Impacted
ROW Displacement	# of Parcels Affected
Hazardous Waste	# of Potential Sites Impacted



Vanasse Hangen Brustlin, Inc.

Figure 5.1-5
Travel Time Routes

Langley Parkway Phase 3 Feasibility Study
City of Concord, NH

5.2 Build Traffic Operations

5.2.1 Intersections

Tables 5.2-1, 5.2-2, and 5.2-3 summarize the intersection capacity analysis results for the Study Area signalized, unsignalized, and roundabout intersections respectively under the Build alternative for both the roundabout and signal options. For comparison purposes, the corresponding No Build results have also been provided.

The existing signalized intersection of North State Street and Bouton Street is projected to remain at LOS B operations under the No Build and Build conditions through the year 2035 with little change in delay or v/ c ratio as a result of the parkway. All new signalized intersections constructed as part of Langley Parkway are projected to operate well under capacity and at acceptable level of service (LOS D or better) through 2035. Likewise, future signaled intersections at the I-89 Exit 2 ramps at Clinton Street are projected to operate at very good levels of service (LOS A) through the year 2035 with v/ c ratios well below 1.0.

Changes in travel patterns and reductions in volumes through the downtown resulting from the implementation of Phase 3 of the parkway are projected to improve traffic operations at several existing signalized intersections. Moderate to substantial reductions in delay and the v/ c ratios are anticipated at the following intersections:

- North State Street at Centre Street
- North Main Street at Centre Street
- North Main Street at Bouton Street
- North Main Street at Pleasant Street
- Pleasant Street at Langley Parkway
- Clinton Street at South Street/ Broadway

Five of the six above intersections are projected to have better LOS under the 2035 Build condition than the 2035 No Build. Under Section 3.5 (No Build Traffic Operations), 6 existing signalized intersections were identified as having deficient traffic operations (LOS E or worse and/ or v/ c > 1.0) by the year 2035. With the implementation of the parkway, traffic operations at 3 of the 6 locations are improved to LOS D or better, operating under capacity.

Two existing signalized intersection are projected to experience a degradation in LOS with longer delays as a result of the project. These intersections include North State Street at Penacook Street/ Horseshoe Pond Lane and Clinton Street at Langley Parkway. However, both locations are projected to operate at LOS D or better with v/ c ratios well below 1.0.

All of the existing and new unsignalized intersections created as part of Phase 3 are projected to operate at LOS D or better through the year 2035 under the Build condition. Reduced delay and improved LOS is anticipated to occur at three of the existing unsignalized intersections as a result of constructing Phase 3 of the parkway. These intersections include Penacook Street at Little Pond Road/ Auburn Street, Penacook Street at Columbus Avenue, and Centre Street at Washington Street/ Pine Street. Most notably, substantial reductions in delay and improvements in LOS are projected to occur on the Washington Street approach to Centre Street where operations are projected to improve from LOS F (153 seconds delay) to LOS D (33 seconds delay) during the weekday morning peak hour and from LOS E (38 seconds delay) to LOS C (19 seconds delay) during the weekday evening peak hour.

Roundabouts at North State Street and Franklin Street and at Centre Street and Liberty Street are projected to operate under capacity through the year 2035 under the No Build and Build conditions. However, better operations and lower v/ c ratios are expected under the Build scenario where the parkway is projected to divert traffic away from these areas. The roundabout at Pleasant Street and Fruit Streets/ Warren Street is projected to operate under capacity under the 2035 No Build and Build scenarios during the weekday morning peak hour. However, weekday evening peak hour volumes at this location are projected to exceed capacity under the 2035 No Build scenario where the Pleasant Street eastbound approach is calculated to have a v/ c ratio of 1.09. With the construction of Phase 3 and the diversion of traffic away from the downtown, the eastbound approach on Pleasant Street is projected to operate with a v/ c ratio of 0.77 under the 2035 Build condition, restoring acceptable operations at this location.

The three proposed new roundabouts under the Roundabout Alternative (Langley Parkway at the Hospital North Access, Auburn Street, and Rumford Street) are projected to operate under capacity through the year 2035 under the Build scenario.

Table 5.2-1 Build Signalized Intersection Capacity Analysis Summary

Location	Peak Period	2015 No Build v/c*	2015 No Build Delay+	2015 No Build LOS^	2015 Build v/c	2015 Build Delay	2015 Build LOS	2035 No Build v/c	2035 No Build Delay	2035 No Build LOS	2035 Build v/c	2035 Build Delay	2035 Build LOS
North State Street at	AM	Unsignalized			0.53	6	A	Unsignalized			0.54	6	A
Rumford Street	PM				0.68	10	B				0.77	13	B
North State Street at	AM	0.73	25	C	0.74	34	C	0.78	29	C	0.82	43	D
Penacook St/Horseshoe Pond Lane	PM	0.91	32	C	0.82	42	D	0.98	37	D	0.88	42	D
North State Street at	AM	0.45	12	B	0.47	11	B	0.49	12	B	0.54	12	B
Bouton Street	PM	0.61	15	B	0.59	14	B	0.69	16	B	0.68	16	B
North State Street at	AM	0.90	35	C	0.79	29	C	1.04	69	E	0.95	53	D
Centre Street	PM	0.77	23	C	0.70	21	C	0.81	30	C	0.77	26	C
South State Street at	AM	0.52	17	B	0.51	19	B	0.55	18	B	0.53	23	C
Pleasant Street	PM	0.55	24	C	0.52	23	C	0.71	27	C	0.68	26	C
North Main Street at	AM	0.89	43	D	0.94	36	D	1.00	63	E	1.04	55	D
Bouton Street	PM	1.06	80	E	1.00	42	D	1.13	94	F	1.10	64	E
North Main Street at	AM	0.85	74	E	0.75	49	D	0.91	91	F	0.81	55	D
Centre Street	PM	0.92	80	E	0.92	86	F	1.04	107	F	1.02	98	F
North Main Street at	AM	0.45	23	C	0.43	29	C	0.49	28	C	0.42	26	C
Pleasant Street	PM	0.61	35	D	0.55	30	D	0.73	57	E	0.67	42	D
Pleasant Street at	AM	0.87	48	D	0.81	38	D	1.02	88	F	0.96	61	E
Langley Parkway	PM	0.85	41	D	0.79	35	D	1.01	87	F	0.99	50	D
Pleasant Street at	AM	0.74	35	D	0.70	34	C	Roundabout			Roundabout		
N. Fruit St./S. Fruit St./Warren St.	PM	0.79	36	D	0.67	33	C						

*Volume-to-capacity ratio

+Delay expressed in seconds per vehicle

^Level of service

Table 5.2-1 Continued - Build Signalized Intersection Capacity Analysis Summary

	Peak	2015 No Build			2015 Build			2035 No Build			2035 Build		
Location	Period	v/c*	Delay+	LOS^	v/c	Delay	LOS	v/c	Delay	LOS	v/c	Delay	LOS
Clinton Street at	AM	0.67	16	B	0.81	24	C	0.67	17	B	0.80	22	C
Langley Parkway	PM	0.75	23	C	0.98	48	D	0.70	21	C	0.87	37	D
Clinton Street at	AM	0.93	53	D	0.89	45	D	1.07	76	E	1.02	66	E
South Street/Broadway	PM	0.81	44	D	0.83	43	D	0.86	48	D	0.86	48	D
Clinton Street at	AM	Unsignalized			Unsignalized			0.48	6	A	0.51	6	A
I-89 Exit 2 SB Ramps	PM							0.46	6	A	0.48	6	A
Clinton Street at	AM	Unsignalized			Unsignalized			0.55	5	A	0.55	4	A
I-89 Exit 2 NB Ramps	PM							0.61	9	A	0.61	7	A
Langley Parkway at	AM	-	-	-	0.52	24	C	-	-	-	0.65	25	C
Rumford Street	PM	-	-	-	0.78	41	D	-	-	-	0.92	50	D
Langley Parkway at	AM	-	-	-	0.59	24	C	-	-	-	0.71	29	C
Auburn Street	PM	-	-	-	0.63	20	C	-	-	-	0.71	27	C
Langley Parkway at	AM	Unsignalized			0.56	22	C	Unsignalized			0.60	22	C
Hospital North Access (Garage)	PM				0.70	28	C				0.74	30	C
Langley Parkway at	AM	Unsignalized			0.65	24	C	Unsignalized			0.68	25	C
Hospital/Concord Orthopedics	PM				0.75	25	C				0.75	27	C
Pleasant Street at	AM	Unsignalized			0.55	18	B	Unsignalized			0.59	18	B
Hospital Driveway	PM				0.74	32	C				0.82	36	D

*Volume-to-capacity ratio

+Delay expressed in seconds per vehicle

^Level of service

Table 5.2-2. Build Unsignalized Intersection Capacity Analysis Summary

	Peak	2015 No Build			2015 Build			2035 No Build			2035 Build		
Location/Movement	Period	Demand*	Delay+	LOS^	Demand	Delay	LOS	Demand	Delay	LOS	Demand	Delay	LOS
Penacook St at Little Pond Rd/Auburn St													
EB movements from Little Pond Rd	AM	375	14	B	435	10	A	560	20	C	625	15	B
WB movements from Penacook St	AM	45	11	B	10	8	A	65	13	B	15	8	A
NB movements from Auburn St	AM	35	6	A	70	9	A	60	6	A	110	10	A
EB movements from Little Pond Rd	PM	140	12	B	140	8	A	210	13	B	210	10	A
WB movements from Penacook St	PM	200	16	C	15	8	A	305	21	C	30	9	A
NB movements from Auburn St	PM	95	7	A	340	11	B	145	7	A	475	17	C
Penacook St at Columbus Ave													
WB movements from Penacook St	AM	65	12	B	70	9	A	105	13	B	125	9	A
SB movements from Penacook St	AM	195	7	A	160	7	A	290	7	A	240	7	A
WB movements from Penacook St	PM	45	10	A	45	9	A	65	10	B	65	9	A
SB movements from Penacook St	PM	210	1	A	25	4	A	320	1	A	45	4	A
Auburn St at Columbus Ave													
SB movements from Columbus Ave	AM	75	12	B	75	12	B	115	12	B	115	15	C
SB movements from Columbus Ave	PM	30	10	B	30	10	A	50	11	B	50	10	B
Auburn St at Franklin St													
EB movements from Franklin St	AM	35	9	A	35	9	A	60	9	A	60	9	A
WB movements from Franklin St	AM	125	10	B	125	10	B	180	11	B	180	11	B
NB movements from Auburn St	AM	135	10	A	135	10	A	200	10	B	200	10	B
SB movements from Auburn St	AM	210	11	B	190	11	B	310	12	B	280	12	B
EB movements from Franklin St	PM	25	8	A	25	8	A	40	8	A	40	8	A
WB movements from Franklin St	PM	115	8	A	115	8	A	165	9	A	165	9	A
NB movements from Auburn St	PM	130	8	A	110	8	A	205	9	A	185	9	A
SB movements from Auburn St	PM	80	8	A	80	8	A	120	9	A	120	9	A
Auburn St at Liberty St													
EB right-turn from Auburn St	AM	185	12	B	165	10	B	200	12	B	180	11	B
NB movements from Liberty St	AM	215	5	A	195	5	A	245	5	A	225	5	A
EB right-turn from Auburn St	PM	80	10	A	80	9	A	90	10	A	90	9	A
NB movements from Liberty St	PM	280	3	A	210	3	A	345	3	A	270	3	A

* Demand in vehicles per hour

\+ Delay expressed in seconds per vehicle

^ Level of service

Table 5.2-2. Continued - Build Unsignalized Intersection Capacity Analysis Summary

Location/Movement	Peak Period	2015 No Build Demand*	2015 No Build Delay+	2015 No Build LOS^	2015 Build Demand	2015 Build Delay	2015 Build LOS	2035 No Build Demand	2035 No Build Delay	2035 No Build LOS	2035 Build Demand	2035 Build Delay	2035 Build LOS
Centre St at Washington St/Pine St													
EB movements from Centre St	AM	395	4	A	295	3	A	460	4	A	350	3	A
WB movements from Washington St	AM	315	1	A	225	1	A	365	1	A	320	1	A
NB movements from Pine St	AM	35	24	C	30	16	C	40	30	D	35	19	C
SB movements from Washington St	AM	260	54	F	230	18	F	325	153	F	290	33	D
EB movements from Centre St	PM	540	5	A	360	3	A	665	5	A	465	4	A
WB movements from Washington St	PM	280	1	A	240	1	A	320	1	A	275	1	A
NB movements from Pine St	PM	60	31	D	60	18	C	70	46	E	70	22	C
SB movements from Washington St	PM	150	19	C	150	14	B	200	38	E	200	19	C
Clinton St at I-89 Exit 2 SB Ramps													
WB left-turn from Clinton St	AM	155	10	A	155	11	B	Signalized			Signalized		
NB movements from SB Off Ramp	AM	445	111	F	520	274	F						
WB left-turn from Clinton St	PM	280	8	A	280	9	A	Signalized			Signalized		
NB movements from SB Off Ramp	PM	165	12	B	315	15	B						
Clinton St at I-89 Exit 2 NB Ramps													
EB left-turn from Clinton St	AM	15	8	A	15	8	A	Signalized			Signalized		
NB movements from NB Off Ramp	AM	385	+300	F	345	+300	F						
EB left-turn from Clinton St	PM	5	10	B	15	10	B	Signalized			Signalized		
NB movements from NB Off Ramp	PM	290	35	D	230	30	D						
Langley Pkwy at Jennings Dr Ext													
WB left-turn from Langley Pkwy	AM	-	-	-	155	9	A	-	-	-	160	10	A
NB left-turn from Jennings Dr	AM	-	-	-	5	18	C	-	-	-	5	20	C
NB right-turn from Jennings Dr	AM	-	-	-	85	14	B	-	-	-	50	14	B
WB left-turn from Langley Pkwy	PM	-	-	-	60	9	A	-	-	-	40	9	A
NB left-turn from Jennings Dr	PM	-	-	-	20	16	C	-	-	-	60	20	C
NB right-turn from Jennings Dr	PM	-	-	-	55	14	B	-	-	-	40	15	B
Penacook St at Jennings Dr													
NB movements from Jennings Dr	AM	-	-	-	30	11	B	-	-	-	20	11	B
SB movements from Jennings Dr	AM	-	-	-	155	9	A	-	-	-	165	9	A
NB movements from Jennings Dr	PM	-	-	-	10	10	B	-	-	-	10	11	B
SB movements from Jennings Dr	PM	-	-	-	60	9	A	-	-	-	60	9	A

* Demand in vehicles per hour

\+ Delay expressed in seconds per vehicle

^ Level of service

Table 5.2-3. Build Roundabout Intersection Capacity Analysis Summary

Location	Peak Period	2015 No Build Demand*	2015 No Build v/c**	2015 Build Demand	2015 Build v/c	2035 No Build Demand	2035 No Build v/c	2035 Build Demand	2035 Build v/c
North State Street at Franklin Street									
EB from Franklin Street	AM	190	0.31	170	0.27	220	0.33	200	0.29
WB from Franklin Street		430	0.49	340	0.38	530	0.61	435	0.49
NB from North State Street		130	0.16	130	0.16	160	0.17	160	0.17
SB from North State Street		290	0.45	290	0.41	320	0.50	320	0.46
EB from Franklin Street	PM	170	0.21	120	0.15	210	0.25	155	0.19
WB from Franklin Street		325	0.46	275	0.37	380	0.54	325	0.44
NB from North State Street		315	0.39	315	0.37	365	0.39	365	0.37
SB from North State Street		190	0.25	190	0.24	215	0.29	215	0.28
Centre Street at Liberty Street									
EB from Centre Street	AM	70	0.15	70	0.12	80	0.15	80	0.13
WB from Centre Street		420	0.54	350	0.44	490	0.56	415	0.47
NB from Liberty Street		455	0.54	335	0.39	530	0.58	400	0.44
SB from Liberty Street		410	0.61	290	0.40	510	0.73	380	0.51
EB from Centre Street	PM	60	0.16	60	0.14	65	0.11	65	0.10
WB from Centre Street		395	0.47	370	0.41	470	0.56	435	0.48
NB from Liberty Street		640	0.72	390	0.44	800	0.83	525	0.54
SB from Liberty Street		245	0.35	165	0.23	290	0.39	200	0.26
Pleasant Street at Fruit/Warren Streets									
EB from Pleasant Street	AM	Unsignalized		Unsignalized		560	0.64	420	0.48
WB from Pleasant Street						310	0.52	295	0.44
NB from S. Fruit Street						475	0.67	475	0.59
SB from Warren Street						520	0.79	355	0.53
EB from Pleasant Street	PM	Unsignalized		Unsignalized		905	1.09	640	0.77
WB from Pleasant Street						335	0.66	315	0.50
NB from S. Fruit Street						330	0.65	330	0.50
SB from Warren Street						505	0.76	395	0.58

* Demand in vehicles per hour.

**Volume to capacity ratio.

Table 5.2-3. Continued - Build Roundabout Intersection Capacity Analysis Summary

Location	Peak Period	2015 Build Demand	2015 Build v/c	2035 Build Demand	2035 Build v/c
Langley Parkway at Hospital North Access					
NB from Langley Parkway	AM	640	0.75	685	0.80
SB from Langley Parkway		515	0.70	565	0.76
EB from Garage		70	0.14	70	0.14
WB from Hospital		170	0.28	170	0.30
NB from Langley Parkway	PM	515	0.57	580	0.64
SB from Langley Parkway		425	0.61	485	0.70
EB from Garage		195	0.42	195	0.45
WB from Hospital		465	0.77	465	0.83
Langley Parkway at Auburn Street					
NB from Langley Parkway	AM	345	0.50	390	0.69
SB from Langley Parkway		385	0.47	545	0.50
EB from Auburn Street		415	0.55	610	0.87
WB from Auburn Street		45	0.09	70	0.15
NB from Langley Parkway	PM	570	0.66	640	0.80
SB from Langley Parkway		600	0.49	735	0.58
EB from Auburn Street		145	0.22	220	0.35
WB from Auburn Street		85	0.18	140	0.33
Langley Parkway at Rumford Street					
NB from Rumford Street	AM	100	0.16	140	0.24
WB from Langley Parkway		645	0.53	760	0.62
SB from Rumford Street		330	0.33	410	0.39
EB from Langley		615	0.35	695	0.42
NB from Rumford Street	PM	150	0.29	165	0.37
WB from Langley Parkway		405	0.58	455	0.68
SB from Rumford Street		670	0.60	845	0.84
EB from Langley		635	0.51	705	0.65

* Demand in vehicles per hour.

**Volume to capacity ratio.

5.2.2 Travel Times

As discussed in Section 5.1.2, existing travel time runs for select routes through the downtown were conducted during peak and off-peak traffic conditions for comparison to estimated travel times for motorists that chose to use Langley Parkway under a Build condition in the future. Table 5.2-4 compares existing travel time for the travel routes identified and color coded in Figure 5.1-5 to projected travel time using Langley Parkway. A single time noted under the existing column indicates that a single run was performed; a range of times indicates that multiple runs were conducted.

Table 5.2-4. Travel Times

Route	Peak Period	Direction of Travel	Existing Time	2015 Build Time
Auburn Street (orange route)	AM	Inbound	6:43	2:39
	PM	Outbound	5:21	2:37
North State Street /Rumford Street (red route)	AM	Inbound	6:24 to 6:57	3:45
	PM	Outbound	7:29 to 7:51	4:04
North State Street/Franklin Street (pink route)	AM	Inbound	7:32 to 9:15	3:45
	PM	Outbound	7:33 to 8:29	4:04
US 202 /Franklin Street (green route)	AM	Inbound	5:43 to 6:55	5:39
	PM	Outbound	8:47 to 15:00	7:42

It is important to note that travel times vary substantially throughout the day and can even vary greatly from one day to the next, as indicated by the weekday evening outbound data for the US 202/ Franklin Street route where the longest run time was 70 percent higher than the shortest run time. However, overall the future Langley Parkway connection is expected to reduce travel time getting to/ from the regional medical facilities and state office park areas along Pleasant Street and Langley Parkway.

5.3 Environmental Evaluation

This section summarizes the results of the environmental resource alternatives evaluation, based on the metrics previously identified in **Section 5.1**. The results of the evaluation are summarized in **Table 5.3-1** and discussed below.

Table 5.3-1 Environmental Resource Evaluation

Impacts	Metric	Roundabouts with Raised Median	Signalized Intersections with No Median
Wetlands	Square Feet of Impact	25,600	17,100
	Number of Stream Crossings	2	2
Water Quality	Acres of Proposed Pavement	18.0	19.0
Floodway	Acres of Disturbance	0	0
Floodplain	Acres of Disturbance	0	0
Aquifer	Acres of Disturbance	7.5	7.3
Farmland	Acres of Disturbance	15.8	14.5
Rare, Threatened, Endangered Species	# Populations Potentially Impacted	0	0
Public Parks & Recreation	# of Sites Potentially Impacted	0	0
Right-of-Way	# of Parcels Potentially Affected (Non-City Owned Lots)	36	32
Historic/Archaeological Resources	# of Known Historic Properties Directly Impacted	0	0
	# of Known Archaeological Sites Impacted	N/A	N/A
Hazardous Waste	# of Potential Sites Impacted	1	1

Environmental Impacts

Alternatives would generally impact 10 wetlands (W-1, W-3, W-4, W-5, W-7, W-8, W-9, W10, W-11, W-12, and W-13) and two streams (Bow Brook, and an unnamed tributary stream). However, the alternative which also assumes a 12 foot grass median has a slightly larger footprint and would impact about 25,600 square feet of wetland in comparison to the no-median alternative, which would impact about 17,100 square feet. Again, these estimates are based on conceptual drawings only and do not account for any fill/ dredge impacts that would be associated with necessary slope limits.

In addition to the wetland impacts, alternatives would require two stream crossings: Bow Brook, which is located approximately 1,800 south of Auburn Street, and an unnamed tributary stream to Woods Brook, located approximately 1,000 north of Penacook Street. Similar to the wetland impacts, the use of a raised median would have a slightly larger impact (80 linear feet to Bow Brook, and 55 linear feet to the unnamed stream), in comparison to the non-median alternative (55 linear feet to Bow Brook, and 50 linear feet to the unnamed stream).

In comparison to the *1992 Wetland Impact Assessment and Mitigation Planning Report* (prepared by The Smart Associates) the current wetland impacts are approximately half of what was originally estimated (47,549 square feet) along the Phase 3 alignment. The major difference in these estimates is directly related to slope limits, as the 1992 mitigation summary accounted for these additional impacts. Additionally, the field reconnaissance effort reduced the size of the previously delineated wetland boundaries to reflect currently hydrology. Once slope limits are developed for the current conceptual designs and the wetland boundaries are redelineated, the wetland impact analysis should be revaluated.

The primary measure of water quality used in the study is the area of impervious surfaces associated with the construction of each alternative measured as the number of acres of proposed pavement. The signal alternative, needing additional turning lanes, has slightly more impervious surfaces totaling an estimated 19.0-acres in comparison to the roundabout alternative, which has an estimated 18.0-acres of impervious surfaces. It is important to note that this assessment does not account for the stormwater treatment measures that will mitigate and reduce the potential for water quality impacts. Potential site locations of these measures are identified on the conceptual plans, but will need to be reevaluated and analyzed should the project advance.

Alternatives will not have an impact on FEMA floodway or floodplain resources, as these resources do not exist within the study area.

Aquifer and farmland impacts for each alternative are similar, but again because the raised-median option has a slightly larger footprint, the non-median option will impact a smaller amount of aquifer and farmland.

No known rare, threatened, or endangered species occur directly within the study area. The NHB indicated that the northern leopard frog, a species of concern in the state, is known to occur in the Merrimack River floodplain, which is in relative proximity the study area. In areas where the proposed alternatives would run near wetlands, NHB recommends that the steep slopes or straight granite curbing in conjunction with catch basins be eliminated in favor of gently sloped granite curbing or Cape Code asphalt curbing.

ROW Impacts

For the purposes of the environmental evaluation, non-City owned parcels from the assessor's database was compared to the proposed ROW lines associated with each alternative to identify the potential number of abutting properties that may be impacted. Similarly, to many of the environmental impacts, the roundabout alternative may impact several more non-City owned parcels (36 parcels), in comparison to the signal alternative,

which is estimated to impact 32 properties. This is primarily attributed to the differences in the intersection configurations between alternatives. It is important to note, that based on the current design, no full property acquisitions are required, only small strip areas for right-of-way.

Cultural and Recreational Resources

Neither of the alternatives requires any building demolitions. However, based on assessing records and the NHDHR site file search, there are number properties located along Penacook Street, Rumford Street and North State Street that are more than 50 years old. Should the project advance, NHDHR will likely request additional information on these properties.

Based on the site file research at NHDHR, there is a reported, though unrecorded, presence of an archaeological site near the northeast corner of the intersection of Rumford and Penacook streets. All alternatives would involve reconstructing the Rumford/ Penacook Street intersection, and for this reason NHDR has indicated that should the project move forward they will require shovel tests pits. Not enough information is available to determine if any archaeological resources will be impacted in this phase of the study.

The existing roadbed south of Auburn Street would no longer serve a walking path or recreational trail, however both the roundabout and signal alternative are designed with a sidewalk/ shared use path along the entire corridor and would improve recreational conditions. Additionally, both alternatives identify potential parking areas for citizens to access the sidewalk/ shared used path. It is not anticipated that any recreational resources will be impacted by either alternative.

Hazardous Waste

Both alternatives would overlay a site registered in NHDES's Potential Groundwater Contamination Database (CSites). The site of interest is a former temporary groundwater discharge location associated with construction dewatering of the Phase 2 Langley Parkway Project. The NHDES file has since been closed for this site and no other known sites occur with the limits of the study area.

5.4 Regulatory Analysis

5.4.1 National Environmental Policy Act

The National Environmental Policy Act of 1969 (NEPA) is a comprehensive federal law that applies to federal agencies and the programs they fund, and is the primary environmental statute applicable to the Langley Parkway project. NEPA requires that federal agencies consider the environmental consequences of any major action. In practice, a project is required to meet NEPA guidelines when a federal agency provides any portion of the financing or issues any license for the project.

The main provision of NEPA requires that the lead federal agency (i.e., the funding or permitting agency) study the environmental impacts of their actions. The intent of NEPA is to aid in decision making, to identify the feasible alternative that has the least impacts and to disclose the environmental consequences of the federal action. Generally, NEPA studies are broadly scoped documents which examine virtually all potential environmental, cultural and social impacts. NEPA studies contain information on everything from natural resources (e.g., wetlands, water quality, farmlands, rare species) to the social/ human environment (e.g., air quality, noise, visual impacts, socio-economics) to cultural resources (historical buildings and places, archeological resources).

NEPA studies can occur at one of three levels:

- An Environmental Impact Statement (EIS) must be written for all major federal actions which may have a "significant" impact on the environment. An EIS is a major undertaking that can require years to complete. An EIS results in a "Record of Decision," issued by the lead federal agency, in which the project purpose and need, affected environmental and environmental consequences are discussed.

- An Environmental Assessment (EA) can be prepared in lieu of an EIS when the significance of project impacts is uncertain. An EA can result in either a Finding of No Significant Impact (FONSI) or a decision to elevate the NEPA review to an EIS.

- Categorical Exclusions (CEs) are reserved for "actions which do not individually or cumulatively have a significant effect on the human environment." Processing of CEs is relatively straight-forward and expeditious compared to an EIS or EA.

Phase 2 of the Langley Parkway project was reviewed under NEPA by the US Army Corps of Engineers, as part of their Clean Water Act individual permit for that portion of the project. The EA written by the Corps resulted in a Finding of No Significant Impact (FONSI). This EA did not address the Phase 3 project which is the subject of this current study. Moreover, more than a decade has passed since the issuance of the original FONSI. Not only has the plan for the Parkway changed, but so have some environmental conditions, as well as certain provisions of NEPA and other state and federal environmental laws and regulations.

The application of NEPA to the Langley Parkway project will depend on whether FHWA or the Army Corps is the lead federal agency. If all funding for the project is from municipal and/ or state funds, then FHWA would not be involved in the NEPA process. The Army Corps does not routinely require the compilation of a project specific NEPA document, instead relying on a general EIS/ ROD that addresses their regulatory program as a whole. However, the fact that the Corps required an individual permit and a project-specific EA to be written for Phase 2 suggests that a similar process could be required for Phase 3.

5.4.2 Other State and Federal Environmental Regulatory Requirements

In addition to NEPA compliance, the project will require permits from the NH Wetlands Bureau, Alteration of Terrain Program and the US Army Corps of Engineers. These permitting processes, in particular the state wetlands permit process, have changed in some fairly substantial ways since Phase 2. The review of project mitigation, for example, has become far more formalized and is typically more stringent than previously. And, the Alteration of Terrain (AOT) Program regulations have evolved considerably and now require far more stormwater treatment than in the past, which may affect the amount of right-of-way needed. Table 5.4-1 below summarizes the main regulatory programs which will apply to the project.

Note that the timelines in Table 5.4-1 are general. Permit applications are typically made subsequent to or concurrent with the NEPA process. The regulatory agencies typically will not issue permits until after the NEPA process is concluded.

Table 5.4-1 Anticipated State and Federal Regulatory (Permitting) Reviews Required prior to Construction of the Langley Parkway Project.[1]

Permit/Approval	Authority	Citation	Required?	Review Time[2]	Notes
National Environmental Policy Act (NEPA)	FHWA/US Army Corps of Engineers	National Environmental Policy Act, 42 U.S.C. §4321 *et seq.*	Yes, if federal funds or licensing (e.g., Army Corps permit) are required.	See Note 3.[3]	Must consult with FHWA on project classification. Based on the scope and potential impacts associated with the project, it would most likely be processed as a Categorical Exclusion (CE) or Environmental Assessment (EA), although it is possible that it could be elevated to a full Environmental Impact Statement.
Wetlands Dredge and Fill Permit	NHDES	NH RSA 482-A	Yes	120 days	Impacts will likely exceed 20,000 sq ft of direct impact; therefore project would be reviewed as a "major impact."
Wetland Dredge and Fill Permit	US Army Corps of Engineers	Clean Water Act, Section 404	Yes	30-180 days	Possible SPGP since total impacts less than 3 acres. If so, 30 day review. However, this size project may trigger an Individual Permit-add up to 6 months permit review time.
Water Quality Certification	NHDES	Clean Water Act, Section 401	Yes	30 - 120 days	Likely a General permit, although very extensive or long term in-stream work or concerns about additional impervious pollutant loading may trigger individual 401 Certification process.[5]
Alteration of Terrain (AOT) Permit	NHDES	NH RSA 485-A:17	Yes	60 - 90 days	Focused on temporary and permanent erosion control, stormwater detention and stormwater treatment.
Cultural Resource Coordination	NH Division of Historical Resources	Section 106, National Historic Preservation Act	Yes, if federal funds or licensing (e.g., Army Corps permit).	30 days	Considers above-ground and archaeological resources. Additional surveys and coordination required, based on NHDHR May 7, 2102 response to initial RPR.
NPDES Stormwater General Permit	USEPA	Clean Water Act, Section 402; 63 CFR 7858	Yes	48 Hours	Required due to greater than 1 acre disturbance.
Rare Species Coordination	NH Fish & Game	NH Endangered Species Conservation Act (NH RSA 212-A)	Yes	30-120 days	Two protected species present: common nighthawk and northern leopard frog. Initial review suggests no impact to nighthawk, but additional review for northern leopard frog required during design.
Rare Species Coordination	NH Natural Heritage Bureau	NH Native Plant Protection Act (NH RSA 217-A)	No	30-120 days	Review completed on June 20, 2011. No protected plant species present in study area. Review will need to be completed again during permitting phase.
Shoreland Water Quality Permit[4]	NHDES	NH RSA 483-B	No	30-60 days	No Fourth Order Streams or Great Ponds present in study area.

Notes:

1. This table lists the types of permitting reviews required for construction of the Phase 3 Langley Parkway Project. The total number of review and time frames will depend on the final design concept. Additional permits are possible.

2. Review times are approximate and are typically to the first technical review, not to permit issuance.

3. FHWA is the likely lead federal agency, with the Corps possibly acting as a coordinating agency. Timeline will depend on actual NEPA classification. CE can be process in approximately 2-3 months, while an EA often requires up to one year.

4. Formerly "Comprehensive Shoreland Protection Act".

5. Under CWA Section 401, the State must certify that the action authorized by the Corps Section 404 permit complies with State Water Quality Standards (i.e., 401 Certification).

6

Conclusions

The purpose of this Transportation Feasibility Study is to evaluate the final Phase 3 of Langley Parkway. The Langley Parkway project has been a work in progress for more than 50 years with the evaluation of roadway layouts alternatives with a wide range of configurations. This study focuses on the preferred parkway layout that has been pursued by the City, with Phases 1 and 2 already complete. Alternatives presented herein consider design options for the mainline segment of the parkway, as well as options for local intersections. Development and review of the alternatives serves as the basis for estimating environmental impacts and identifying likely environmental permitting requirements. The following key findings emerged during the study.

No Build

It has been estimated that approximately 10,000 vpd cut-through the City's west end neighborhoods, traveling to and from the regional medical facilities and other major businesses and institutional centers located along Pleasant Street. This cut-through traffic compromises safety and quality of life within the older, dense neighborhoods, as well as at major pedestrian generators such as Concord High School, Memorial Field, and Bishop Brady High School.

As traffic volumes continue to growth and traffic operations degrade, secondary access to Concord Hospital will become increasingly more important. Life-safety response times to the trauma facilities from the north and east would be substantially reduced with the completion of Phase 3 of the parkway. The existing condition provides no means of secondary access to the medical center area, which also compromises public safety in the event of a major incident on Pleasant Street if the road were to be closed.

The analyses indicate that traffic operations throughout the downtown will continue to deteriorate through the forecast year 2035 under the No Build condition. Six of the ten existing study area signalized intersections are projected to operate at LOS E or F and/ or experience a v/ c ratio greater than 1.0. In addition, traffic operations at the unsignalized intersections of Penacook Street with Rumford Street and Centre Street with Washington Street/ Pine Street are also expected to degrade over time with substantial increases in delay and operating at LOS F. The intersection at Pleasant Street with Fruit Streets/ Warren Street is also projected to experience capacity issues by the year 2035 with particular emphasis on the Pleasant Street eastbound approach during the weekday evening peak hour. It is important to note that as traffic operations continue to deteriorate over time, so will emergency response times.

Alternatives

All alternatives evaluated are "complete street" compliant and conform to the City's Comprehensive Transportation Policy. In effect, all corridor options provide for all users: motorists, pedestrian, bicyclists and public transit riders.

The study presents two different cross sections for consideration for the mainline of Langley Parkway. Both options generally fit within the designated right-of-way and provide one travel lane in each direction with pedestrian and bicycle facilities; however, each provides a different cross section and character for the new roadway segment. One option provides for a landscaped median down the center of the roadway, creating a boulevard effect. The median is intended to break up the pavement width of the travel way, creating an aesthetically pleasing view of the road. The second option provides a narrow cross-section by eliminating the center median. The intent of this cross-section is to minimize the overall pavement width.

Alternatives are also presented for several intersections to be created as part of Phase 3 – either as roundabouts or signals. Roundabouts or signalized intersections would be provided at the intersections of Concord Hospital north access, Auburn Street, and Rumford Street along the parkway.

In addition, improvements outside of the limits of the Phase 3 segment would also be required to support the project. These other improvements include: adding right-turn lanes at the signalized intersection of Pleasant Street and Langley Parkway; reconfiguring the Concord Hospital driveway on Pleasant Street to accommodate two-way traffic flow and installing a traffic signal; shifting the existing Concord Hospital/ Concord Orthopedics driveways approximately 100 feet north and installing a traffic signal; constructing a second left-turn lane from North State Street to Penacook Street and widening Penacook Street to accept the two turn lanes; and reconfiguring the North State Street an Rumford Street

intersection to prohibit left-turns from North State Street and installing a signal to process left and right-turns exiting from Rumford Street.

Construction Costs

Phase 3 options included use of raised median vs. no median along the corridor, and roundabouts vs. signal at select rural intersections. Planning-level cost estimates were prepared for programming purposes. These estimates were developed interchanging each intersection alternative with the mainline option to determine a range of potential costs depending on the preferred alternative selected. The estimated construction costs range from $13.6 million to $15.4 million. Once a preferred alternative is selected and preliminary engineering design is completed, the cost estimates can be further refined.

Build

All new intersections and existing intersections to be reconstructed or improved as a result of the project have been conceptually designed to accommodate traffic volume demands through the forecast year 2035 and operate at acceptable levels of service.

In addition, the parkway will act to divert substantial traffic away from the downtown local street network. As a result, six of the existing downtown signalized intersections analyzed in this study are projected to experience moderate to substantial reductions in delay and v/ c ratios. Five of the six intersections are projected to have improved and better LOS under the 2035 Build condition than under the 2035 No Build condition. Improved traffic operations are also projected for the study area unsignalized intersections, with all intersections operating at LOS D or better under the Build scenario. Phase 3 is also expected to bring 2035 peak hour traffic volumes at the Pleasant Street/ Fruit Streets/ Warren Street roundabout back under capacity, where the 2035 No Build scenario has the Pleasant Street eastbound approach operating well over capacity during the weekday evening peak hour.

Public Benefits

Public benefits associated with the construction Langley Parkway Phase 3 include congestion relief, improved traffic flow, enhanced pedestrian safety and improved livability in the older, densely-populated neighborhoods, north and west of downtown Concord. The level of traffic relief provided by the parkway is substantial enough to postpone the need for long-range improvements to the Pleasant Street corridor, east of the hospital area. It is important to note that the operational benefits of the project go beyond the specific intersections selected as study area intersections. Traffic relief afforded by improved transportation choice will be experienced throughout the downtown grid, benefiting many more streets and intersections than evaluated herein. The parkway also extends recreational (non-motorized) travel opportunities along the corridor, building upon the growing popularity of walking and bicycling along the southern Phase 2 segment.

Phase 3 of the parkway will also provide enhanced access to major employment and institutional centers along the northwesterly perimeter of the downtown area, including independent access in the event of a blockage along Pleasant Street, Clinton Street, South Fruit Street, Warren Street, or School Street.

Lastly, although not statistically evaluated in this study, completion of Langley Parkway will improve access and reduce travel time for emergency vehicles to Concord Hospital. The new segment of the parkway will have minimal intersections and less congestion than the existing downtown network of local streets.

Potential Environmental Permitting Requirements

The permitting process is subject to federal and state requirements based on the funding sources used to design and construct the project. At this time, there are no federal or state sources identified to assist with funding the project. Therefore, other funding sources through local municipal contributions and/ or public/ private partnerships may be necessary to complete the project.

The use of federal funds will determine whether or not NEPA permitting will be required for the project. If federal dollars are not used for the project, there are still a number of other environmental permits that are expected to be required as part of the approval process. These potential permits include:

- Wetlands Dredge and Fill Permit (NHDES)
- Wetlands Dredge and Fill Permit (US Army Corps of Engineers)
- Water Quality Certification (NHDES)
- AOT Permit (NHDES)
- NPDES Stormwater General Permit (USEPA)
- Rare Species Coordination (NH Fish & Game)

Next Steps

The evaluation presented in this planning study identified key issues and potential improvement plans on a conceptual basis, and should not be interpreted as a conclusive study of impacts. More formal analysis of impacts will need to occur during the next preliminary design and environmental analysis phase with the more detailed evaluation of the alternatives under the permitting process.

The City's staff plans to present this report to the City Council in early 2015 at which time the Council will determine how to proceed with the project. The next phase of design and environmental study will include a robust public participation process. Upon approval of the project and receipt of all the necessary permits, construction would commence.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