Alternative D

Alternative D would have virtually identical impacts on WHPAs as discussed for Alternative A. The Alternative D footprint overlaps no private wells and is within 150 feet of 18 private wells. Alternative D is also within 250 feet of community wells 16 and 17, which do not have WHPAs associated with them.

Alternative F

Alternative F would not result in any impacts on existing wells or WHPAs. It is within 150 feet of 4 private wells.

4.13.3 Mitigation

Mitigation measures for potential impacts related to groundwater resources would be consistent with NHDES's *Recommendations for Groundwater Protection Measures When Siting or Improving Roadways* (NHDES, 1995).This document provides recommendations for structural and non-structural BMPS to protect groundwater based on the proximity of the roadway to a WHPA for wells serving community and nontransient, non-community public wells, locally designated groundwater protection areas, and high value aquifers reserved for future water supply. Structural BMPs include lined treatment swales and non-structural BMPs include providing the water supplier, NHDES, and the Office of Emergency Management with site-specific information to aid in isolating a spill.

4.14 Aquatic Life and Essential Fish Habitat

4.14.1 Affected Environment

The study area for aquatic life and Essential Fish Habitat (EFH) corresponds to the previously defined study area for surface water and water quality.

Aquatic Life

Lakes and Ponds

Beaver Lake

Beaver Lake, located in Derry, has a history of management for both warm water and cold water fish species by the New Hampshire Fish and Game Department (NHFGD) (Connor and O'Loan, 1993). Beaver Lake is known to have populations of smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), horned pout/brown bullhead (*Ameiurus nebulosus*) white perch (*Morone americana*), yellow perch (*Perca flavescens*), eastern chain pickerel (*Esox niger*), American eel (*Anguilla rostrata*), bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), brook trout (*Salvelinus fontinalis*), and rainbow trout (*Oncorhynchus mykiss*) (NHFGD, 2016a; NHFGD, 2017). NHFGD manages Beaver Lake for both brook trout and rainbow trout and last completed stocking for these species in 2016 (NHFGD, 2016b). Brook trout is listed in the NH Wildlife Action Plan as a species of greatest conservation need (NHFGD, 2015a).

Lower Shields Pond and Scobie Pond

Lower Shields Pond and Scobie Pond are located in the northern portion of the study area. Aquatic life data were not available for Lower Shields Pond, whose waters join the outflow from Scobie Pond. Total phosphorous and chlorophyll levels for Scobie Pond indicate average (mesotrophic) conditions for phytoplankton (NHDES, 2017a). Scobie Pond supports fish species such as largemouth bass, black crappie, golden shiner (*Notemigonus crysoleucas*), bluegill (*Lepomis macrochirus*), smallmouth bass, creek chubsucker (*Erimyzon oblongus*), eastern chain pickerel, yellow bullhead (*Ameiurus natalis*), horned pout/brown bullhead, American eel, pumpkinseed sunfish (*Lepomis gibbosus*), and banded sunfish (*Enneacanthus obesus*) (NHFGD, 2016a; NHFGD, 2017).

Both the banded sunfish and American eel are listed as species of greatest conservation need in the NH Wildlife Action Plan and have also been identified as species of regional conservation concern (NHFGD, 2015a).[17] Additionally, recent surveys indicate that the banded sunfish is more common in southern NH than previously thought (NHFGD, 2015a).

Hoods Pond

Hoods Pond is located in the central portion of the study area. Hoods Pond exhibits a high amount of DO in its bottom waters (NHDES, 2017a), a condition that is considered supportive of fish populations, and has a satisfactory pH for aquatic organism survival. Chlorophyll and total phosphorous levels are reported to be excessive, although available data are limited to a single sampling event in August of 1997. Plant abundance is reported to be sparse, and the Hoods Pond waters are classified as having moderate algal production (NHDES, 2017a). Hoods Pond is listed as a warm water fishery (AECOM, 2012) and reportedly supports brook trout, eastern chain pickerel, horned pout/brown bullhead, and bluegill (NHFGD, 2016a). NHFGD stocks Hoods Pond with eastern brook trout (NHFGD, 2016b). Because Hoods Pond is impaired by cyanobacteria, a phosphorous TMDL study was recently conducted that concluded that an 80 percent reduction in phosphorous loading would be needed to meet water quality objectives (AECOM, 2012).

Wheeler Pond

Wheeler Pond is located immediately east of I-93 Exit 4. It receives waters from small tributary streams that flow along I-93 near Trolley Car Lane, as well as the Exit 4 interchange. Wheeler Pond outlets through a weir at a driveway entrance to a local commercial business, and the unnamed outlet stream flows under NH 102 before discharging into Beaver Brook. Aquatic life data were not available for Wheeler Pond.

Streams

The study area contains several streams and brooks, both named and unnamed, including Shields Brook, Beaver Brook, Little Cohas Brook, a small section of West Running Brook, and Flat Rock Brook. It also includes several unnamed drainages and tributaries.

[17] Species of regional concern are those species identified by the Northeast Wildlife Diversity Technical Committee as a regional concern, and did not include those species already listed as endangered or threatened.

Shields Brook

Shields Brook captures waters from Rainbow Lake (located north of the study area), Lower Shields Pond, Scobie Pond, and their accompanying tributaries. Hoods Pond and Horns Pond are impoundments located along Shields Brook. The stream meanders through some of the more highly developed portions of the study area, including the commercial and industrial areas along NH 28 near the Derry/Londonderry town line. Downstream of NH 28, Shields Brook flows into Hoods Pond before flowing through Horns Pond and downtown Derry, to its confluence with Beaver Brook. Shields Brook supports horned pout/brown bullhead, bluegill (*Lepomis macrochirus*), common white sucker, creek chubsucker (*Erimyzon oblongus*), brook trout, fallfish (*Semotilus lumbee*), smallmouth bass, banded sunfish, and redfin pickerel (NHFGD, 2017). Surveys conducted in 2000 and 2005 also documented the presence of pumpkinseed sunfish in Shields Brook (NHFGD, 2017). The banded sunfish and redfin pickerel are both listed as species of greatest conservation need in the NH Wildlife Action Plan (NHFGD, 2015a; 2017). Shields Brook supports 35 macroinvertebrate species. Habitat data show that, overall, Shields Brook exhibits low habitat quality (NHDES, 2000b).

Beaver Brook

Wheeler Pond; Shields Brook, including associated tributaries and ponds; Horns Pond; and Beaver Lake all drain into Beaver Brook, the major surface water feature in the study area. Sampling in Beaver Brook in Londonderry conducted in 2000 identified eight species of finfish, including common white sucker, pumpkinseed sunfish, fallfish, blacknose dace (*Rhinichthys atratulus*), golden shiner, common shiner, silvery minnow (*Hybognathus nuchalis*), and yellow bullhead (*Ameiurus natalis*) (NHFGD, 2017). Farther downstream, and outside the study area in Pelham, sampling conducted in Beaver Brook in 2006 documented the same species observed in Beaver Brook within Londonderry, as well as creek chubsucker (NHFGD, 2017). In both Derry and Windham species documented included American eel (*Anguilla rostrata*), horned pout/brown bullhead, eastern chain pickerel, largemouth bass, smallmouth bass, and redbreast sunfish (*Lepomis auritus*). The American eel is listed as species of greatest conservation need in the NH Wildlife Action Plan (NHFGD, 2015a). At a monitoring station located south of the study area, Beaver Brook was classified as having overall optimal fish and macroinvertebrate habitat; 31 insect species were also documented. However, Beaver Brook's Index of Biotic Integrity only narrowly exceeds the benchmark criterion for the southern NH bioregion (NHDES, 2000b). NHFGD stocks Beaver Brook in Derry and Londonderry with rainbow trout and eastern brook trout (NHFGD, 2016a).

Other Tributaries to Beaver Brook

Numerous tributaries exist within the study area, including West Running Brook and several small, unnamed streams that drain to Beaver Lake near the northeastern corner of the study area. No aquatic life data were available from either NHFGD or NHDES for these streams.

Essential Fish Habitat

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-265; 16 U.S.C. 1801 et seq.) established requirements for identifying and

protecting EFH.[18] In NH, the final determination of what areas constitute EFH is the responsibility of the New England Fisheries Management Council (NEFMC). Under the regulations, any federal agency that funds, permits, or initiates an activity potentially affecting designated EFH is required to consult with the National Marine Fisheries Service (NMFS).

Recent correspondence from NMFS to FHWA (letter dated November 18, 2016, Appendix A) stated that the Project area did not contain areas identified as EFH; therefore, no EFH conservation recommendations would be made for the proposed action.

4.14.2 Environmental Consequences

Aquatic Life

No Build Alternative

The No Build Alternative would not require any new disturbance or additional paved surfaces. Therefore, any new impacts on aquatic life, above and beyond those already occurring, would be as a result of continued development within the watersheds of the perennial streams, and from increasing traffic volumes.

Build Alternatives

Development projects, including roadways, may result in impacts on adjacent water bodies and the areas surrounding water bodies. These impacts can affect the physical, chemical, and biological features of a water body, including streams, and may include:

- Alteration of stream geomorphology (i.e., channelization of the stream, changes in patterns of erosion and deposition);
- Loss of structural complexity of existing stream banks;
- Changes to existing stream hydraulics;
- Loss or reduction in the complexity of stream flows (e.g., changes in the ratio of ripples to pools);
- Shading caused by bridges, culverts, and other engineered structures;
- Reduction in shading due to vegetation clearing;
- Changes in water temperature and DO levels; and
- Increases in pollutant loads from runoff (e.g., Na, Cl, metals) with acute and chronic effects.

Any combination of these potential impacts can result in the loss or degradation of existing habitat for aquatic life. The following analysis focuses on anticipated direct effects to aquatic life associated with each Build Alternative, as expressed by the number of proposed stream crossings and linear feet of physical disturbance to streams. No direct impacts to waterbodies (i.e., ponds or lakes) would occur under any of the alternatives.

[18] The 1996 amendments to the Magnuson-Stevens Act were promulgated by the Sustainable Fisheries Act (Public Law 104-297). Under the regulations, EFH is defined to include those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity.

In addition to the direct impact information presented, indirect impacts to streams can also occur as a result of construction activities and normal operations of roadways. Indirect impacts may result from increased pollutant loading from stormwater runoff, sedimentation, and vegetation removal. Section 4.11-1 provides a pollutant loading analysis.

A total of 10 perennial and 8 intermittent or ephemeral stream segments would be affected by one or more of the Build Alternatives. Impacts to these streams would occur as a result of constructing a new bridge or culvert crossing, extending an existing culvert or bridge; or potentially relocating the alignment of an existing stream. For comparison, all impacts are identified as "Crossings."

Table 4.14-1 compares linear feet of stream impact for the five Build Alternatives. For this SDEIS, linear impacts are measured as impacts to the centerline of the stream. Stream crossings are identified in Figure 4.14-1. The stream impact values for Alternative A, which has been identified as the preferred alternative, have been refined based on a more detailed design. In addition to the stream crossings discussed below, there are wetland crossings, both existing and proposed, that involve culverts to carry flow that is not channelized. These impacts are identified in Section 4.12-1, *Wetlands and Vernal Pools*. Stream impact totals are summarized for each Alternative in Table 4.14-2. Alternative F would involve the least total impact on stream channels, because all of the improvements would be on existing alignment. Alternative A has slightly greater impacts than Alternative B, but Alternative B would have more impacts from new crossings on new alignment. Alternatives C and D would not have any new stream crossings, but Alternatives C and D would involve wetland crossings as described in Section 4.12.

Table 4.14-1. Summary of Direct Stream Disturbance Associated with Build Alternatives

Crossing	Flow Regime[a]	Watershed Size (Acres)[b]	Location	Activity Description	Linear Feet of Stream Impact by Alternative[c]				
					A	B	C	D	F
1	Perennial	269	New access ramp W of I-93 at southern Exit 4A interchange -71°20'56" 42°53'4"	Relocate perennial stream channel. Portions of channel already impacted from I-93 construction.	1,095	511	0	0	0
2	Perennial, Shields Brook	3,767	N. High St–between Ferland Drive and Franklins St -71°19'54 42°53'23"	Extend existing culvert crossing to the north to accommodate connector road.	447	0	0	0	0
3	Intermittent	148	Tsienneto Road–Approx. 200 ft west of Scenic Drive -71°18'26" 42°54'27"	Extend culvert to accommodate road widening.	38	0	0	22	0
4	Intermittent	30	Tsienneto Road–between Scenic Drive and Jeff Lane -71°18'21" 42°54'31"	Extend culvert to accommodate road widening.	35	0	0	13	0
5	Perennial, Unnamed	850	Tsienneto Road–250 ft west of NH 102 -71°18'10 42°54'37	Extend culvert to accommodate road widening.	73	0	13	0	0
6	Perennial, Unnamed	1,061	NH 102–700 ft south of Tsienneto Road -71°18'9 42°54'29	Extend culvert to accommodate road widening.	0	0	8	0	0
7	Intermittent	35	New access ramp–E of I-93 at southern interchange -71°20'56 42°53'11	Extend culvert under new I-93 northbound off-ramp and southbound on-ramp.	177	109	0	0	0

Crossing	Flow Regime[a]	Watershed Size (Acres)[b]	Location	Activity Description	Linear Feet of Stream Impact by Alternative[c]				
					A	B	C	D	F
8	Intermittent	19	New alignment–500 ft E of I-93 71°20'51" 42°53'15"	Construct new stream crossing/relocate stream for connector road.	291	333	0	0	0
9	Intermittent	25	New alignment 960 ft W of Franklin Street Ext. -71°20'18" 42°53'26"	Construct new stream crossing for connector road.	0	124	0	0	0
10	Intermittent	Undetermined[d]	New alignment–1,550 ft W of Franklin Street Ext. -71°20'24" 42°53'21"	Construct new stream crossing for connector road.	0	51	0	0	0
11	Ephemeral[a]	Undetermined[d]	New alignment–300 ft N of Madden Drive -71°20'9" 42°53'21"	Stream relocation/impact.	77	0	0	0	0
12	Perennial, Shields Brook	3,118	New alignment–540 ft W of Franklin Street Ext. -71°20'16" 42°53'30"	Construct new bridge crossing for connector road.	0	214	0	0	0
13	Perennial, Shields Brook	1,155	NH 28– (W branch) -71°20'40" 42°54'0"	Extend culvert for connector road.	0	0	476	476	0
14	Perennial, Shields Brook	1,629	NH 28– (E branch) -71°20'32" 42°53'57"	Extend culvert for connector road.	0	0	65	65	0
15	Perennial, Unnamed	826	NH 102–500 feet east of I-93 Exit 4 -71°20'17" 42°52'21"	Extension of existing culvert carrying water from Wheeler Pond.	0	0	0	0	61

Crossing	Flow Regime[a]	Watershed Size (Acres)[b]	Location	Activity Description	Linear Feet of Stream Impact by Alternative[c]				
					A	B	C	D	F
16	Perennial, Shields Brook	4,157	NH 102–between Griffin St and Storer Ct -71°19'49" 42°52'44"	Extend culvert for connector road.	0	0	0	0	52
17	Intermittent	Undeter-mined[d]	NH 102–100 ft E of Hood Road 71°19'4" 42°53'14"	Extend culvert for connector road.	0	0	0	0	17
18	Perennial	278	NH 102 -100 ft S of Hoodkroft Drive -71°18'53" 42°53'22"	Extend culvert for connector road.	0	0	0	0	23
70	Intermittent	65	New access ramp W of I-95 -71°20'56" 42°53'4"	Stream relocation/impact	48	0	0	0	0

[a] Flow regime based on observation and watershed size. In the absence of long term monitoring for streams in the Project area, streams with watersheds smaller than 200 acres were assumed to be intermittent, and larger than 200 acres were assumed to be perennial. Ephemeral streams had no measurable watershed and had physical characteristics meeting the NHDES definition of ephemeral streams.
[b] Watershed sizes based on Streamstats basin delineation: https://streamstats.usgs.gov/ss/.
[c] Linear disturbance estimates based on preliminary design information.
[d] Unable to determine watershed size using Streamstats.

Table 4.14-2. Stream Impacts by Alternative

Impact Metric	Alternative				
	A	B	C	D	F
Number of New Stream Crossings/Impacts	4	5	0	0	0
Number of Proposed Improvements of Existing Stream Crossings	5	3	4	4	4
Total Number of Stream Impacts	**9**	**8**	**4**	**5**	**4**
Linear Feet New Stream Crossings	1,511	1,217	0	0	0
Linear Feet Improvements of Existing Stream Crossings	770	124	562	577	153
Total Linear Feet of Stream Disturbance	**2,281**	**1,341**	**562**	**577**	**153**

Alternative A

Alternative A would result in direct impacts on streams at nine different locations (Table 4.14-2). This includes five streams where an extension of an existing culvert or bridge would be required, totaling 770 linear feet of disturbance. Of these five existing crossing extensions, the most substantial crossing would be an extension of the culvert where North High Street/Folsom Road crosses Shields Brook (Crossing 2), which would create 447 linear feet of stream channel impact. The other four existing stream crossings are an extension of a culvert crossing under I-93 (Crossing 7), three crossings under Tsienneto Road that would be improved (Crossings 3, 4, and 5), and an extension of an existing crossing under Franklin Street Extension.

Stream impacts from new alignment would occur in four locations: west of I-93 where 1,095 linear feet of perennial stream would be relocated (Crossing 1), east of I-93 on new alignment where 291 linear feet of intermittent stream channel would be impacted, on new alignment north of Madden Road where 77 linear feet of an ephemeral stream channel would be impacted, and west of I-93 at the new access ramp/southern Exit 4A interchange where 48 linear feet of an intermittent channel would be impacted.

Alternative B

Alternative B would result in direct impacts to streams at eight locations. This includes five new stream crossings: three intermittent streams on new alignment west of Franklin Street Extension (Crossings 8, 9, and 10) and stream relocation impacts to Crossing 1. The largest new crossing would be a 210-foot long bridge over Shields Brook just west of the Franklin Street Extension/B Street intersection (Crossing 12).

Three existing culvert crossings, one under I-93 in the proposed southern Exit 4A interchange area (Crossing 7), a second along the Tsienneto Road just west of its intersection with NH 102 (Crossing 5), and a third on NH 102 south of Tsienneto Road would be extended. The total linear disturbance of streams associated with Alternative B, including stream relocations, would be 1,341 feet.

Alternative C

Alternative C would require direct impacts to four stream segments, all of which are extensions of existing crossings. The largest stream impact would be to Beaver Brook, which has two tributaries that meet just south of Rockingham Road (NH 28) (Crossings 13 and 14). The western

tributary flows parallel to the road for about 420 feet, which would have to be relocated to accommodate the roadway widening. Alternative C would also require an extension to the culvert carrying a perennial stream into Beaver Lake under NH 102 (Crossing 6). As with Alternatives A and B, there would be impacts on the crossing carrying a perennial stream from the prime wetland on the north side of Tsienneto Road into the stream channel on the south side (Crossing 5).

Alternative D

Alternative D would result in direct impacts to approximately 575 linear feet of stream bed at five existing crossing locations, including the Shields Brook crossings that would be impacted by Alternative C (Crossings 13 and 14). Three crossings on Tsienneto Road would also be expanded for this Alternative (Crossing 3, 4, and 5).

Alternative F

Alternative F would result in direct impacts at approximately 152 linear feet of stream bed at four separate crossing locations, all of which are on NH 102. The first crossing is about 100 linear feet north of the intersection between Nashua Road and Action Boulevard. This stream originates from Wheeler Pond and would require extension of the culvert and impacts on a drainage swale that leads from the adjacent parking lot. The existing crossing over Shields Brook would be extended, as would intermittent and perennial stream crossings that flow into the golf course south of NH 102.

4.14.3 Mitigation

Mitigation for stream impacts would be provided as part of the wetland mitigation package. Some of the stream crossings, such as Crossing 2 (Shields Brook) will be widened in accordance with requirements in NHDES Administrative Rules Env-Wt 900 et seq., Stream Crossings. The rules provide that mitigation is not required for any crossing that is "self-mitigating." The improvements proposed will provide improved hydraulic capacity and aquatic organism passage and as such will be self-mitigating. Stream impacts that are not self-mitigating will be mitigated through a payment to the Aquatic Resource Mitigation fund at NHDES and potentially preservation of conservation land. The in-lieu fee amount and conserved land, if any, would be in accordance with NH RSA 482-A:28 and NHDES Wetland Rules and with federal Section 404 guidelines in 40CFR (b)(1)J.

4.15 Floodplains

A floodplain is defined as the land along waterbodies that is inundated with water during floods. The Federal Emergency Management Agency (FEMA) oversees Flood Insurance Rate Mapping (FIRM) maps, which depict floodplains, floodways, and base flow elevations in some areas. The 100-year floodplain is the area with a 1 percent chance of flooding each year. FEMA defines the floodway as the channel of the stream, plus any additional floodplain areas, that must be kept free from encroachment so that the 100-year flood can be carried without an increase in flood elevation greater than 1 foot.

Beneficial floodplain functions include flood attenuation, water quality maintenance, groundwater recharge, riparian plant and wildlife habitat, natural beauty, open space, and agriculture. Absent appropriate design of fill placement and the hydraulic capacity of structures