3.0 ALTERNATIVES

Several alternatives to the E2W Project were evaluated to determine whether they would be reasonable and environmentally preferable to the proposed action. These alternatives included the No Action or Postponed Action Alternative, system alternatives, route alternatives, minor route variations, and aboveground facility site alternatives.

The evaluation criteria for selecting potentially reasonable and environmentally preferable alternatives include whether they:

- are technically and economically feasible and practical;
- offer significant environmental advantage over the proposed Project; and,
- meet the Project objectives within the same general timeframe as the proposed Project.

As described in section 1.1, the stated objectives of the E2W Project are to provide:

- 746,500 dth/d of additional east to west transportation service to New England and other Northeast markets;

- increased diversity of supply by accessing natural gas from the LNG projects recently constructed or under construction offshore of Massachusetts and in New Brunswick, Canada; and

- increased reliability and security of the existing natural gas system by eliminating delivery bottlenecks in Algonquin's current pipelines.

In conducting a reasonable alternatives analysis, it is important to recognize the environmental advantages and disadvantages of the proposed action in order to focus the analysis on those alternatives that may reduce impacts and offer a significant environmental advantage. A detailed discussion of the environmental consequences of the Project (both positive and negative) is included in section 4.0.

Using the evaluation criteria discussed above and subsequent environmental comparisons, each alternative was considered to the point where it was clear that the alternative was either not reasonable, would result in substantially greater environmental impacts that could not be readily mitigated, offered no potential environmental advantages over the proposed Project, or could not meet the Project's objectives. Those alternatives that appeared to result in less than or similar levels of environmental impact were reviewed in greater detail. The following sections discuss and analyze each of the alternatives evaluated in sufficient detail to explain why they were eliminated from further consideration or retained for analysis in section 4.0 of this EIS.

The analysis was based on information provided by Algonquin, field reconnaissance, aerial photographs, U.S. Geological Survey (USGS) topographic maps, other publicly available environmental data, agency consultations, and public scoping comments.

3.1 NO ACTION OR POSTPONED ACTION ALTERNATIVE

The action triggering this environmental review was Algonquin's application to the FERC for a Certificate. This environmental review will also satisfy the COE's NEPA responsibilities in considering issuance of a section 404/10 Individual Permit for activities associated with the Project, and is intended to address the alternative requirements of MEPA. The agencies have three courses of action in considering

the proposed Project. They may: 1) grant the approval with or without conditions; 2) deny the approval; or 3) postpone action pending further study.

If the No Action Alternative is selected by denying the proposal, the short and long-term environmental impacts identified in section 4.0 of this document would not occur. If the agencies postpone action on the application, the environmental impacts identified in section 4.0 would be delayed or, if the applicant decided not to pursue the Project, the impacts would not occur. In addition, if either the No Action Alternative or the Postponed Action Alternative is selected, the stated objectives of Algonquin's proposal would not be met.

Natural gas is regionally important in the production of electricity and other industrial activities as well as for space heating and cooking. The Energy Information Administration (EIA) estimates that natural gas currently accounts for an estimated 22.9 percent of the energy consumption in New England (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut) (EIA, 2007a). The EIA also projects that consumption of natural gas will increase by about 1.3 percent per year from 2005 to 2030. Diversity of supply, increased transportation infrastructure, and a more reliable and secure delivery system will be important to meet the projected demand for natural gas in the Northeast. If the proposed Project was denied or a decision postponed, it is possible that Algonquin's customers would pursue alternative energy sources and energy conservation practices to offset the demand for natural gas in the markets targeted by the E2W Project. A discussion of the ability of such resources to meet the Project objectives is provided below.

3.2 ENERGY AND ENERGY CONSERVATION ALTERNATIVES

3.2.1 Renewable Energy

Renewable energy sources, including wind, hydropower, municipal solid wastes, solar, wood, and other biomass, are projected to have a role in meeting the country's future energy needs. The EIA estimates that renewable sources account for about 7.2 percent of New England's total energy consumption and predicts that consumption of renewable energy will increase by 0.5 percent annually between 2005 and 2030 (EIA, 2007b). Information on the status of different types of renewable energy technologies in New England is presented below.

Wind power is a proven technology that has experienced significant technological advancements, reductions in installation costs, improved turbine performance, and reduced maintenance costs over the last 20 years. Although wind projects have no emissions, such developments can impact wildlife, avian, visual, and other environmental resources. In New England, there are numerous proposed projects totaling about 1,915 megawatts (MW) (New England Wind Forum, 2008a). In this region, a number of wind sites exist offshore of Massachusetts or in the mountainous areas of northern Maine, New Hampshire, and Vermont, but in the later case, existing transmission line infrastructure is insufficient to bring that power to the southern parts of New England and, in the former case, significant regulatory hurdles must be overcome. It appears that these and other wind projects will continue to be pursued depending on tax credits and/or other financial incentives, state programs, technology improvements, transmission availability, and the public interest. However, the probability of these projects receiving regulatory approval and then being constructed and thus able to provide power to southern New England remains uncertain.

Hydroelectric generation is fully commercialized, including both run-of-river and large impoundment-type projects ranging in capacity from less than 1 MW to hundreds of MWs. The EIA (2007a) predicts there will be little new hydroelectric capacity developed through 2030. Additionally, because of significant environmental impacts and high construction costs of large impoundment projects,

it is expected that future hydro projects would largely consist of smaller run-of-river facilities (Low Impact Hydro Institute, 2007; Baird, 2007). Thus it appears that hydroelectric facilities will not provide a substantial amount of additional energy to New England in the foreseeable future (Baird, 2007).

Combustion of biomass is a proven technology using biomass feedstocks that, if properly grown, represent a renewable resource. The most probable areas for developing these generating facilities are located in northern New England where biomass is most abundant (EIA, 2007c). However, these areas are far from the southern New England market and the existing electric transmission grid is inadequate to deliver the power generated by these facilities. If the existing electric transmission constraints become severe and congestion charges on the grid system are correspondingly high, then transmission customers could request an expansion of the transmission capacity in some way (Porter, 1998). However, the construction and operation of biomass power plants, transmission lines, and fuel harvest areas would impact air, water, ecological, and other resources.

Photovoltaic power systems convert sunlight directly into electricity. These systems are not well-suited for use as large-scale generation in New England due to relatively low direct insulation, higher capital costs, and lower efficiencies. The EIA (2007a) states that solar technologies in general remain too costly for grid-connected applications; however, demonstration programs and various state policies do support some growth in central-station solar photovoltaic and small-scale customer-sited photovoltaic applications. The EIA (2007a) has projected that grid-connected solar generation will only increase to 0.1 percent of total generation by 2030. In addition, a large-scale solar project would require construction within a large area with associated land use, vegetation and wildlife, wetlands, habitat, and other environmental impacts.

Wave energy technology is in the early stages of development and is not currently commercially available. Furthermore, it appears that the high cost of construction and potential environmental considerations may limit development. In contrast, tidal power technology is proven, but the criteria for suitable site selection include the presence of relatively large water flows through narrow channels that lead into a substantial tidal basin. While many of the suitable tidal power sites in New England have been identified along the Maine coast, there are other bays and river estuaries along the east coast that may also be suitable for tidal power development (Gorlov, 2007). However, none of these sites are undergoing permitting at this time and the potential of and timeframe for their development is uncertain.

In conclusion, while it is clear that the generation and consumption of renewable energy in New England is projected to grow, the use of renewable energy sources as an alternative to natural gas use are either not physically or commercially available in the region or have not been developed to the point where they would be viable substitutes for natural gas at this time.

3.2.2 Nuclear Energy

Energy from nuclear power is important regionally and currently accounts for approximately 9.0 percent of New England's annual energy consumption (EIA, 2007a). Moreover, increased use of nuclear power is seen by some as a means of reducing greenhouse gas (GHG) emissions associated with the burning of fossil fuels.

The Energy Policy Act of 2005 incorporated a wide range of measures to support current nuclear plants and provided important incentives for building new nuclear plants, and several companies are expected to submit applications for licenses to construct and operate new nuclear power plants over the next several years (Nuclear Energy Institute, 2008). However, none of these proposed plants are in New England and, because the subject of nuclear power remains a polarizing issue, any plans to construct new or expand existing plants in the region would likely face significant public opposition. Furthermore, there

are environmental and regulatory challenges concerning safety and security, the disposal of toxic materials (spent fuel), and alterations to hydrological/biological systems that would need to be addressed before any new plants could be constructed. For these reasons, nuclear power is not currently a viable alternative to the E2W Project.

3.2.3 Fossil Fuels

An insufficient supply of natural gas could cause many of Algonquin's northeastern customers to use or pursue the option of using other fossil fuels, such as coal or oil, for their energy supplies. Many natural gas power plants have the option of switching to fuel oil if natural gas becomes unavailable or prohibitively expensive. Residential customers may also seek the option of using other fossil fuels to heat and power their homes. However, increased use of other fossil fuels would lead to increased emissions of combustion byproducts, including sulfur oxides (SO_x), NO_x, hydrocarbons, and carbon dioxide (CO_2).

Compared to other fossil fuels, natural gas is a relatively clean and efficient fuel. Combustion of fuels such as oil or coal can generate 60 to 110 percent more CO_2 than natural gas. Other emissions from oil or coal combustion, including GHGs, are also significantly higher than those from natural gas. The use of other fossil fuels in place of natural gas would not only increase atmospheric pollution, but would also result in secondary impacts associated with production (e.g., coal mining and oil drilling), transportation (e.g., oil tankers, rail cars, and pipelines), and refining.

For these reasons, alternatives that result in the use of other fossil fuels are not environmentally preferable to the E2W Project.

3.2.4 Energy Conservation Alternative

Energy conservation measures are playing an increasing role in reducing future energy demand in the United States. At the federal level, the Energy Policy Act of 2005 provides guidelines to diversify America's energy supply and reduce dependence on foreign sources of energy, increase residential and businesses energy efficiency and conservation (Energy Star Program), improve vehicular energy efficiency, and modernize the domestic energy infrastructure.

State-led initiatives have also contributed to energy conservation in the region. In Massachusetts, the Division of Energy Resources (DOER) is responsible for reviewing the energy efficiency plans of electricity distribution utilities, which are funded by ratepayer charges. The DOER also regulates the Renewable Energy Portfolio Standard, which requires that power suppliers obtain an increasing amount of their electricity from renewable sources of energy. The DOER provides analysis and public information in the interest of ensuring an adequate supply of clean, reliable energy of all forms in Massachusetts (DOER, 2008). In April of 2007, the DOER issued a report that summarized the performance of ratepayer-funded electric energy efficiency investments made during 2003 through 2005. Some of the highlighted benefits of the ratepayer-funded electric efficiency programs include:

- costs to achieve energy savings dropped 15 percent while costs to produce electricity increased by 61 percent;
- each dollar invested in electric efficiency will create an estimated $2.84 in benefits over the life of the installed measures;
- for an investment of $371 million in ratepayer funds, the cumulative lifetime bill savings to all participating customers will be approximately $1.2 billion;

- for $48 million investments that improve low-income household efficiencies, those households could avoid approximately $140 million in electricity costs over the lifetime of the installed measures;

- a 216-MW reduction in demand for summer peak power produced $19.5 million in wholesale price savings by reducing the amount of wholesale power needed to meet overall demand during the most expensive hours of the year;

- investments made in electric efficiency will reduce cumulative power plant emissions over their lifetime;

- more efficient lighting will contribute over 54 percent of the total electricity savings achieved over the life of these investments;

- incentives for energy-efficient equipment typically provided about 60 percent of project costs, with participating customers paying the balance; and

- the lifetime economic impacts of the efficiency investments made between 2003 and 2005 will stimulate over 11,000 job years, increase personal disposable income by $650 million, and will add almost $1.4 billion to the Gross State Product (DOER, 2008).

Energy conservation measures are operating in Connecticut as well. In the interest of implementing energy conservation measures that are cost-effective and easy to live with, the state partnered with the state's utility companies to establish the Connecticut Energy Efficiency Fund (CEEF). The CEEF supports a variety of energy efficiency programs that provide financial incentives to help reduce statewide energy consumption (CEEF, 2008). These programs are implemented by Connecticut Light & Power (CL&P) and The United Illuminating Company (UI) and are funded by their customers through the combined public benefits charge on their electric bills, reviewed by the Energy Conservation Management Board, approved by the Connecticut Department of Public Utility Control, and administered by the CL&P and UI (Connecticut Energy Information, 2008). Through the CEEF, energy efficiency programs offer incentives to help lower operating costs and improve productivity while alleviating potential electricity shortages and reducing stress on Connecticut's transmission lines by reducing overall energy consumption and reducing load during periods of peak critical demand (CEEF, 2008).

Although both federal and state energy conservation measures continue to play a role in slowing the increase in energy consumption, these measures are not anticipated to eliminate an increase in consumption. The EIA estimates total national energy consumption will still grow 19 percent between 2006 and 2030 and natural gas consumption will grow 4.6 percent over the same period (EIA, 2007b). Given the projected increase in energy consumption both regionally and nationally, existing energy conservation programs cannot fully offset the projected growth in demand for additional energy. Thus, energy conservation alone would not preclude the need for the E2W Project and is not currently a viable alternative to the proposed Project.

3.3 SYSTEM ALTERNATIVES

System alternatives would make use of other existing, modified, or proposed pipeline systems to meet the stated objectives of the proposed Project. A system alternative would make it unnecessary to construct all or part of the proposed Project, although some modifications or additions to another existing pipeline system may be required to increase its capacity, or another entirely new system may need to be constructed. Such modifications or additions would result in environmental impact; however, the impact could be less than, similar to, or greater than that associated with construction of the proposed Project.

The purpose of identifying and evaluating system alternatives is to determine whether potential environmental impacts associated with the construction and operation of the proposed facilities could be avoided or reduced while still allowing the stated basic objectives of the Project to be met.

In order to be viable, system alternatives to the E2W Project, other systems or modified systems would need to meet the stated Project objectives (see section 3.1).

3.3.1 Other Existing Pipeline System Alternatives

The Tennessee Gas Pipeline system (TGPL) is the only other system located within reasonable proximity to the proposed E2W Project facilities in Massachusetts (see figure 3.3.1-1). It may be possible to redirect the nominated supplies from the Maritimes & Northeast Pipeline system (M&NE) to the Dracut Interconnection with TGPL. These volumes could then be redelivered to Algonquin at the Mendon Interconnection with TGPL. However, the current capacity of TGPL's system in Dracut is only around 300,000 dth/d on a firm year-round basis (see TGPL's Dracut Expansion Project Docket No. CP01-360-000). In order to meet the stated capacity of the E2W Project, TGPL would have to more than double the capacity of its pipeline. The modifications necessary to achieve this would likely have similar, if not greater, environmental impact than the E2W Project. In addition, the use of TGPL as a system alternative would not enable the delivery of gas supplies from the two recently approved LNG terminals located offshore of Massachusetts. Natural gas originating from these LNG terminals would pass through Algonquin's existing HubLine Pipeline, but TGPL does not currently have a direct interconnection with the HubLine Pipeline. Furthermore, given that Algonquin's E-3 system is the only system serving the southeastern Connecticut and southwestern Rhode Island market areas, any system alternative to the E2W Project would also require construction of a new pipeline to these markets. Lastly, unless a TGPL expansion project that includes all of the above elements is currently being planned, it is unlikely that such a project would be able to meet the stated objectives of the E2W Project within the same general timeframe.

For the reasons specified above, use of an existing pipeline system is not considered a viable alternative to the proposed action and, therefore, was eliminated from further consideration.

3.3.2 Algonquin System Alternatives

Algonquin considered the following system alternatives to its existing system to meet the stated objectives of the E2W Project:

- increased compression;
- looping[1] of existing pipeline facilities;
- lift and replacement of existing pipeline facilities; and
- construction of new pipeline facilities.

These alternatives are discussed below.

[1] A loop is a segment of pipeline that is usually installed adjacent to an existing pipeline and connected to it at both ends. The loop allows more gas to be moved through the system.

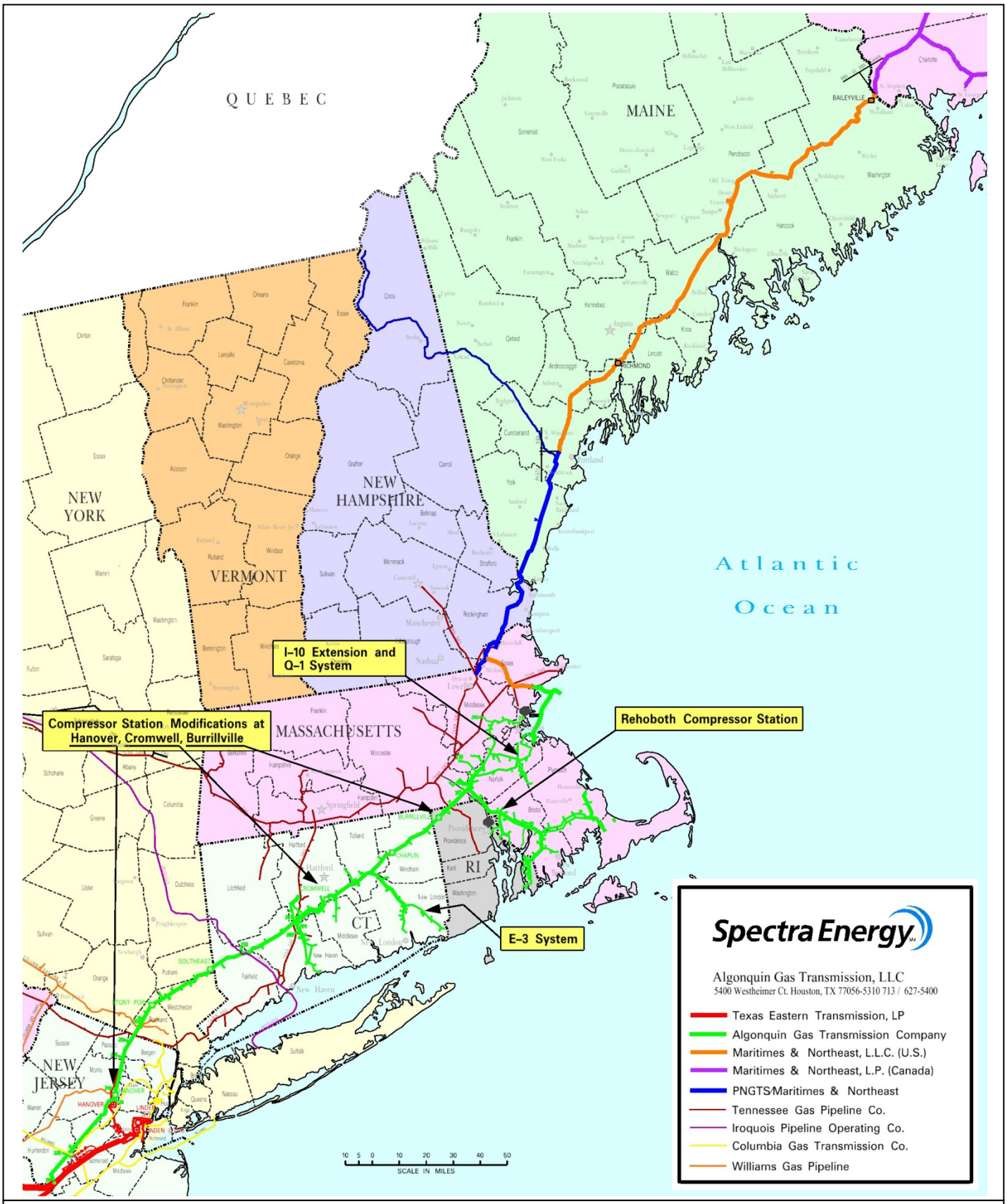

Figure 3.3.1-1
HubLine/East to West Project
Existing Pipeline Systems and Proposed Facilities

3.3.2.1 Compression Only Alternative

A compression only alternative would entail increasing compression on Algonquin's existing pipelines through modifications to existing compressor stations or construction of new compressor stations rather than adding loops or larger diameter pipe to expand the capacity of the pipeline system. Compression facilities are key components in the hydraulic design of a pipeline system. Their suitability in supplementing pipeline capacity can be affected by a number of factors including concerns for system reliability and flexibility, potential environmental impacts, and technical issues such as pipeline design limitations. Compressor reliability is critical to meet peak flow demand periods. However, because compressors are either running or not running, and have finite upper and lower flow limits, they do not allow the flexibility of operation that is inherently present in pipeline facilities. Additionally, in order to avoid compression breakdowns at critical times, compressors frequently need to be shut down and serviced. Although shut downs are typically planned for low-use periods, the required servicing inherently limits system reliability.

Other potential concerns associated with using a compression only alternative include:

- the MAOP of the existing lines could be exceeded;
- gas velocities could be too high without increased pipeline diameter or looping;
- compressor station suction pressures could be lower than acceptable;
- fuel usage at the compressor stations would increase significantly; and
- operational flexibility and reliability would not be achieved.

Because of the operational issues described above, the compression only alternative is not considered a viable alternative to the E2W Project.

3.3.2.2 Q-1 System Replacement and E-3 System Replacement Alternatives

Q-1 System Loop Alternative

The Q-1 system, which extends from Algonquin's mainlines to the Ponkapoag delivery point in Milton, Massachusetts, consists of 16- and 24-inch-diameter pipelines with MAOPs of 750 psig. Algonquin has indicated that increasing the capacity of the Q-1 system to accommodate the proposed volumes of the E2W Project solely through the use of added compression would be inadequate because the existing pipelines would have to operate at or above their MAOPs. To address this limitation, Algonquin evaluated two options: the proposed option, involving the replacement of the existing 24-inch-diameter pipeline with a 36-inch-diameter pipeline, and an alternative that would involve looping the existing 24-inch-diameter pipeline with a 30-inch-diameter loop. Algonquin's analysis concluded that both of these options would provide the same performance; however, installation of a 30-inch-diameter loop would most likely require a larger permanent right-of-way width, which would result in greater long-term impacts than the proposed Q-1 System Replacement.

Because there are no relative operational advantages of looping the 24-inch-diameter portion of the Q-1 system with a 30-inch-diameter loop and because installation of a 30-inch-diameter loop would likely require a larger permanent right-of-way, looping the Q-1 system is not environmentally preferable to the proposed replacement of the existing 24-inch-diameter pipeline.

E-3 System Loop Alternative

The proposed modifications to the E-3 system were chosen to meet the delivery requirements of the shippers and to optimize operational performance of the system. In its application to the FERC,

Algonquin indicated that small pressure fluctuations along the existing E-1 system are magnified on the E-3 system due to the small diameter of the existing E-3 pipelines (the two E-3 pipelines are 4 and 6 inches in diameter, respectively). This magnification can result in an unacceptable degradation in the delivery pressure along the E-3 system. The delivery volumes requested by Algonquin's customers would exacerbate the problem and contribute to the degradation in delivery pressure. To address this limitation, Algonquin evaluated two options: the proposed option involving the replacement of the E-3 pipeline with larger diameter pipe, and an alternative, that would involve looping the E-3 system. Algonquin's analysis concluded that both of these options would provide the same performance; however, looping would require a larger permanent right-of- way width, which would result in greater long-term impacts than the proposed E-3 System Replacement.

Because there are no relative operational advantages of looping the E-3 system and because installation of a loop would require a larger permanent right-of-way width, looping the E-3 system is not environmentally preferable to the proposed replacement of the E-3 pipeline with a larger diameter pipeline.

3.3.2.3 I-10 Extension Alternatives

Algonquin evaluated three options that could meet the system delivery capacity needs associated with transporting additional gas from Algonquin's existing 30-inch-diameter HubLine Pipeline to delivery points further west. The proposed option involves the construction of the I-10 Extension, which is a new 12.9-mile-long, 36-inch-diameter pipeline that would primarily follow an NSTAR powerline right-of-way. The other two options, referred to as the I-System Replacement Alternative and the I-3 System Alternative, would mostly involve replacement of portions of Algonquin's Q-1, I-3, I-8, and I-9 pipeline facilities with a larger diameter pipeline instead of constructing the entire proposed I-10 Extension. An environmental evaluation and comparison of these two options with the proposed I-10 Extension is presented below.

I-System Replacement Alternative

The I-System Replacement Alternative would utilize a combination of facility upgrades to Algonquin's Q-1, I-3, I-8, and I-9 pipeline facilities to provide a system delivery capacity comparable to the proposed I-10 Extension without the development of a new pipeline right-of-way. Table 3.3.2-1 summarizes the components of pipeline replacement by facility.

TABLE 3.3.2-1

Components of Pipeline Replacement by Facility Along the I-System Replacement Alternative

Existing Facility Name	Current Diameter (inches)	Replacement/New Diameter (inches)	Length (miles)
Q-1 System [a]	24	36	2.0
I-3 System	24	42	7.0
I-8 System	18	42	2.0
I-9 Lateral	N/A	42 [b]	0.5
Total			11.5

[a] The length of replacement pipe along the Q-1 system would be in addition to the proposed Q-1 system modifications.

[b] The I-System Replacement Alternative would parallel, but not replace, the existing I-9 pipeline for approximately 0.5 mile.

N/A = Not available.

The I-System Replacement Alternative (shown on figure 3.3.2-1, sheets 1, 3, 4, and 6) begins at Algonquin's existing Fore River Meter Station in the Town of Weymouth, Massachusetts. From there, it proceeds southwest for approximately 0.5 mile, crossing the Weymouth Fore River adjacent to Algonquin's I-9 pipeline. The alternative then leaves the I-9 alignment and proceeds generally south where it would replace about 2.0 miles of the existing I-8 pipeline until it reaches the existing East Braintree Meter Station located near the intersection of Birchcroft Road and Stonewood Lane in East Braintree, Massachusetts. From the East Braintree Meter Station, the alternative proceeds generally west, and would replace approximately 7.0 miles of the existing I-3 pipeline until it reaches the intersection of the I-3 system with the Q-1, I-1, and I-2 systems less than 0.1 mile north of the intersection of Flintlock Lane and York Street in the Town of Randolph, Massachusetts. From this point, the alternative proceeds southwest and would replace about 2.0 miles of the Q-1 pipeline until it ends at MP 12.9 near Turnpike Street in Canton, Massachusetts.

An environmental comparison of the I-System Replacement Alternative with the proposed I-10 Extension is presented in table 3.3.2-2.

TABLE 3.3.2-2

Environmental Comparison of the I-System Replacement Alternative with the Proposed I-10 Extension (MPs 0 to 12.9)

Environmental Factor	Unit [a]	I-System Replacement Alternative	Proposed I-10 Extension
Total Length	Miles	11.5	12.9
Adjacent to Existing Right-of-Way	Miles	11.5	10.1
Total Wetlands Affected [b]	Acres	27.1	15.8
Forested Wetlands Affected [b]	Acres	0.0	5.7
Waterbodies Crossed [c]	Number	12	14
Major Waterbodies Crossed (>100 feet)	Number	2	1
Areas of Critical Environmental Concern Affected [c]	Acres	1.7	13.6
Upland Forest Affected [c]	Acres	0.0	52.2
Public Surface Water Supplies (Zones A, B, and C) [c]	Miles	2.1	3.4
Outstanding Resource Water Watershed Affected [c]	Acres	22.1	80.4
Rare, Threatened, and Endangered Species Habitat [c]	Acres	8.8	19.5
Certified Vernal Pools within 100 feet of the Construction Right-of-Way [c]	Number	0	2
Potential Vernal Pools within 100 feet of the Construction Right-of-Way [c]	Number	0	6
Public Open Space [c]	Acres	22.9	13.5
Agricultural Land Affected [c]	Acres	0.0	0.0
Structures within 50 feet of the Construction Right-of-Way	Number	396	73
Roads Crossed	Number	47	31
Construction within Roadways	Miles	2.3	0.1

[a] Acreage calculations are based on a nominal 85-foot-wide construction right-of-way.
[b] Derived from Massachusetts Department of Environmental Protection Wetland Conservancy Wetland Areas
[c] Derived from MassGIS public data.

As shown in table 3.3.2-2, the I-System Replacement Alternative is shorter, utilizes more existing right-of-way, and crosses fewer waterbodies than the corresponding segment of the proposed route. It also avoids crossing Martin E. Young School land; crosses less public surface water supply zones; and would result in less impact on mapped rare, threatened, and endangered species habitat, upland forest land, forested wetlands, and Outstanding Resource Water (ORW) watershed. Additionally, it passes near

fewer certified and potential vernal pools. The relative difference regarding vernal pools may be less than assumed. We note that the mapped locations of vernal pools in the Mass GIS database may not always reflect their actual field position. Algonquin's wetland delineation, for example, confirmed that several of the mapped vernal pools near the proposed pipeline route are either not present or located farther away than indicated in the GIS database. Algonquin's delineations also confirmed that many existing vernal pools have yet to be mapped. It is important to consider these limitations when drawing conclusions from the GIS-based data. Another advantage of the I-System Replacement Alternative is that it would impact approximately 11.9 acres less of the Cranberry Brook Watershed ACEC than the proposed I-10 Extension.

The I-System Replacement Alternative, however, has a number of environmental disadvantages when compared to the I-10 Extension because it would impact nearly twice the amount of wetlands and cross 1 more major waterbody and 16 more roads. It also crosses the parking lot of North Junior High School. Significant issues with the alternative also include its constructability and its potential impact on the local communities and nearby residences. In total, more than five times the number of structures abut the construction right-of-way along the alternative as along the proposed route. These include 12 residences within the Eagle Farm Estates that border the portion of the alternative route along the existing Q-1 system, and 10 residential subdivisions (including approximately 165 residences) and 5 commercial developments along the existing I-3 system. Moreover, in some areas along the I-3 system, the distance between residences on opposite sides of the right-of-way is 40 feet or less. This is less than Algonquin has indicated it requires to construct or operate the pipeline, and construction may not be practicable in some areas. At a minimum, Algonquin would need to work in very close proximity to homes. Additionally, relatively large extra workspaces would be needed in physically constrained areas to prepare the pipeline, weld induced bends to the pipe, stockpile soils, and park construction vehicles and equipment. These large staging areas would require the cutting and removal of trees, ornamental shrubs, and landscaping along the roadways and within residential properties. Work near residences would also increase noise and dust.

In addition to working very close to homes, Algonquin has indicated that the existing space constraints in some areas would force it to deviate from the existing right-of-way and relocate the pipeline within public roadways. This would further impact residents and increase traffic delays. Additionally, due to the anticipated depth of the ditch (at least 12 feet) within the roadways, the stove-pipe construction technique would progress at a slow rate of 20 to 40 feet per crew per day. In addition, some landowner relocations would likely be required while construction is underway.

There would be similar challenges along the portion of the alternative that follows the existing I-8 system. As shown in table 3.3.2-2, the alternative would require approximately 2.2 miles more in-street construction than the proposed route, much of which would occur along the I-8 system. In this area, the alternative crosses numerous underground utilities located within town roadways (e.g., water, sewer, gas, stormwater, telephone, and electric services). Algonquin has indicated that it would be impossible to install the larger 42-inch-diameter pipeline in some locations due to the presence of these existing underground utilities and other obstructions.

Algonquin's review of as-built drawings identified at least 30 areas where the alternative would have to be installed substantially deeper than the existing and smaller diameter I-8 system. This is because there is insufficient clearance above the utilities for the proposed, larger diameter pipeline (whereas there is sufficient clearance above the utilities for the existing, smaller diameter pipeline). Algonquin has also identified at least 12 locations where it believes the pipeline alignment would need to be shifted to increase the clearance between the proposed pipeline and existing manholes. A reroute

would also be required to avoid existing underground infrastructure beneath Mill Lane. These deviations would require the establishment of a new right-of-way outside of the existing I-8 system corridor.

Significant construct challenges also exist at the alternative crossings of Smelt Brook and the Monatiquot River, at the intersection of Shaw Street and Haywood Street, and the crossing of State Route 53 (Quincy Avenue). Finally, there is insufficient space along the alternative alignment to fabricate the full length of the prefabricated pipe section or pipe string that would be needed for the HDD crossing of the Weymouth Fore River. Additionally, the limited space that is available could be reduced even further if the Braintree Electric Light Department follows through on its plans to install a new electric generating unit at its Potter Station. Because of these space limitations, the pipe string for the HDD would need to be fabricated in several smaller segments, which would be welded together during the HDD pullback operation. This would require the pullback operation to be halted for extended periods to make the necessary welds. This is not preferred by drilling experts and would increase the risk of HDD failure or complications.

The I-System Replacement Alternative would also require a new regulator station at the junction of the, I-1, I-2, and I-3 systems in Canton to protect the existing in-service pipelines from over-pressure. Modifications to the existing East Braintree and the Potter Meter Stations would also be necessary to accept the higher pressures.

Given the environmental concerns and constructability challenges discussed above, the I-System Replacement Alternative is not environmentally practicable or preferable to the proposed I-10 Extension.

Following the submittal of Algonquin's application, we received comments from NSTAR primarily expressing concern about the proposed route of the I-10 Extension, and stating its preference for the I-System Replacement Alternative, which would completely avoid NSTAR's right-of-way. NSTAR's specific concerns include the potential for construction of the I-10 Extension, including the use of blasting, to damage existing towers, thus impacting the reliability of electric service in the region; the potential for lightning and other electrical discharges to cause a catastrophic pipeline event; and normal maintenance and emergency response issues that may arise as a result of locating the I-10 Extension within and adjacent to NSTAR's right-of-way. These specific comments have been evaluated within the applicable resource sections of this EIS.

One of NSTAR's major concerns is that Algonquin's use of the NSTAR right-of-way would interfere with future expansion and reconfiguration of electric transmission facilities. Algonquin's proposed pipeline would occupy space within NSTAR's right-of-way and, if constructed, would require NSTAR to consider its presence when maintaining its existing facilities or planning future infrastructure within the same corridor.

We understand NSTAR's concern regarding the potential impact of the pipeline on its right-of-way and have considered this in our analysis, but NSTAR has not made a compelling argument supported by details that leads us to conclude that the presence of the pipeline would necessarily preclude NSTAR's ability for future expansion or that it would by itself force NSTAR to build a future expansion outside of the existing right-of-way. It has been our experience that overhead powerlines and buried pipelines can coexist in the same corridor and that potential conflicts between the two can generally be reconciled through close coordination and cooperation between the electric and natural gas transmission companies. While NSTAR's letters to the Commission indicate the combined efforts of the two companies have not

yet been sufficient to address NSTAR's concerns,[2] Algonquin has made numerous recent minor modifications to the proposed alignment of the I-10 Extension to increase the distance of the pipeline from NSTAR's powerlines and/or right-of-way. These minor modifications are described in section 3.5 of this EIS.

I-3 System Alternative

The I-3 System Alternative was identified as an optimization of the I-System Replacement Alternative described above by meeting the objectives of the proposed I-10 Extension while avoiding the environmental and construction challenges along the I-8 pipeline replacement portion of the I-System Replacement Alternative.

As shown on figure 3.3.2-1 (sheets 1, 3, 4, and 6), the I-3 System Alternative begins at Algonquin's existing Fore River Meter Station in the Town of Weymouth Massachusetts and proceeds south following the proposed I-10 Extension alignment for approximately 3.2 miles. The alternative then leaves the I-10 Extension alignment and proceeds generally northwest along the northeasterly side of State Route 3 for approximately 1.1 miles until it intersects with the I-3 system. At this point, the alternative proceeds generally west where it would replace approximately 6.2 miles of the existing I-3 pipeline until it reaches the intersection of the I-3 system with the Q-1, I-1, and I-2 systems, less than 0.1 mile north of the intersection of Flintlock Lane and York Street in the Town of Randolph, Massachusetts. From this point, the alternative proceeds southwest and would replace about 2.0 miles of the Q-1 pipeline until it ends at MP 12.9 near Turnpike Street in Canton, Massachusetts.

An environmental comparison of the I-3 System Alternative with the proposed I-10 Extension is presented in table 3.3.2-3.

As shown in table 3.3.2-3, the I-3 System Alternative (like the I-System Replacement Alternative) is shorter, utilizes more existing right-of-way, and crosses fewer waterbodies than the corresponding segment of the proposed route. It also avoids crossing Martin E. Young School land and would result in less impact on mapped rare, threatened, and endangered species habitat; upland forest land; forested wetlands; and ORW watershed. Additionally, it passes near fewer certified and potential vernal pools. Another advantage of the alternative is that it would impact approximately 11.9 acres less of the Cranberry Brook Watershed ACEC than the proposed I-10 Extension.

[2] See NSTAR's July 11, 2008 Motion to Intervention and Protest of NSTAR Electric Company (20080711-5120); August 12, 2008 Motion for Leave to Answer and Answer of NSTAR Electric Company (20080812-5082); and September 5, 2008 Motion in Opposition of NSTAR Electric Company (20080905-5147). Also see Algonquin's July 28, 2008 Motion for Leave to Answer and Answer of Algonquin Gas Transmission, LLC (20080728-5100); and August 29, 2008 Motion for Leave to Answer and Answer of Algonquin Gas Transmission, LLC (20080904-0534). These documents can be viewed on the FERC Internet website at http://www.ferc.gov. Using the "eLibrary" link, select "Advanced Search" from the eLibrary menu and enter the corresponding accession number in parenthesis above in the "Accession Number" field. The documents are also available for public inspection at the FERC's Public Reference Room in Washington, DC (call (202) 502-8317 for instructions).

TABLE 3.3.2-3

Environmental Comparison of the I-3 System Alternative with the Proposed I-10 Extension (MPs 3.2 to 12.9)

Environmental Factor	Unit [a]	I-3 System Alternative	Proposed I-10 Extension
Total Length	Miles	9.2	9.7
Adjacent to Existing Right-of-Way	Miles	8.2	6.8
Total Wetlands Affected [b]	Acres	22.1	9.9
Forested Wetlands Affected [b]	Acres	0.0	4.6
Waterbodies Crossed	Number	8	10
Major Waterbodies Crossed (>100 feet)	Number	1	0
Areas of Critical Environmental Concern Affected [c]	Acres	1.7	13.6
Upland Forest Affected [c]	Acres	0.0	46.5
Public Surface Water Supplies (Zones A, B, and C) [c]	Miles	2.6	2.5
Outstanding Resource Water Watershed Affected [c]	Acres	27.0	67.4
Rare, Threatened, and Endangered Species Habitat [c]	Acres	8.1	19.5
Certified Vernal Pools within 100 feet of the Construction Right-of-Way [c]	Number	0	2
Potential Vernal Pools within 100 feet of the Construction Right-of-Way [c]	Number	0	3
Public Open Space [c]	Acres	19.8	13.5
Agricultural Land Affected [c]	Acres	0.0	0.0
Structures within 50 feet of the Construction Right-of-Way	Number	218	52
Roads Crossed	Number	40	23
Construction within Roadways	Miles	1.4	0

[a] Acreage calculations are based on a nominal 85-foot-wide construction right-of-way.
[b] Derived from Massachusetts Department of Environmental Protection Wetland Conservancy Wetland Areas.
[c] Derived from MassGIS public data.

The I-3 System Alternative, however, has a number of environmental disadvantages. These are similar to the disadvantages of the I-System Replacement Alternative and include that it would impact more than twice the amount of wetlands and cross 1 more major waterbody and 16 more roads than the corresponding segment of the proposed route. It also crosses the parking lot of North Junior High School. Additionally, although it avoids the challenges of the I-System Replacement along the I-8 system, it still has significant constructability issues and would have substantial impact on the local communities and nearby residences. In total, more than four times the number of structures abut the construction right-of-way along the alternative as along the proposed route. These include 12 residences within the Eagle Farm Estates along the existing Q-1 system right-of-way; 10 residential subdivisions (including approximately 165 residences) and 5 commercial developments along the existing I-3 system right-of-way; and 1 home adjacent to the proposed right-of-way along State Route 3. Moreover, in some areas along the I-3 system, the distance between residences on opposites sides of the right-of-way is 40 feet or less. This is less than Algonquin has indicated it needs to construct or operate the pipeline and construction may not be practicable in some areas. At a minimum, Algonquin would need to work in very close proximity to homes. Additionally, relatively large extra workspace would be needed in physically constrained areas to prepare the pipeline, weld induced bends to the pipe, stockpile soils, and park construction vehicles and equipment. These large staging areas would require the cutting and removal of trees, ornamental shrubs, and landscaping along the roadways and within residential properties. Work near residences would also increase noise and dust.

In addition to working very close to homes, Algonquin has indicated that the existing space constraints in some areas would force it to deviate from the existing right-of-way and relocate the pipeline

within public roadways. This would further impact residents and increase traffic delays. Additionally, due to the anticipated depth of the ditch (at least 12 feet) within the roadways, the stove-pipe construction technique would progress at a slow rate of 20 to 40 feet per crew per day. In addition, some landowner relocations are likely to be required while construction is underway.

The I-3 System Alternative would also require new regulator stations at the junction of the Q-1 and I-2 systems in Canton and where the alternative ends on the north side of State Route 3 to protect the existing in-service pipelines and facilities from over-pressure.

Given the environmental concerns and constructability challenges discussed above, we have concluded that the I-3 System Alternative would not be preferable to the proposed I-10 Extension.

3.4 ROUTE ALTERNATIVES

Route alternatives, in the context of the proposed E2W Project, were identified to determine if impacts could be avoided or reduced on environmentally sensitive resources, such as wetland areas, waterbody crossings, and public open space. While the origin and delivery points of route alternatives are generally the same as for the corresponding segment of a proposed pipeline route, the alternatives could follow significantly different alignments. Route alternatives were only assessed for the proposed I-10 Extension. Because the proposed E-3 and Q-1 system modifications primarily involve same ditch lift and replacement of the existing pipeline, only minor variations from the existing rights-of-way were evaluated for these facilities (see section 3.5).

3.4.1 Cranberry Brook Alternatives

During the Pre-Filing Process, we received a number of comments requesting a review of alternatives that could reduce or eliminate the crossing of the Cranberry Brook Watershed ACEC, which is located between MPs 5.0 and 6.3 of the proposed I-10 Extension. More information about the ACEC can be found in section 4.8.4.1. In response to these concerns, we evaluated three route alternatives. Figure 3.3.2-1 (sheets 2 and 3) shows the location of these alternatives. These alternatives are described below.

3.4.1.1 Cranberry Brook Alternative 1

The Cranberry Brook Alternative 1 begins at approximately MP 4.5 of the proposed I-10 Extension and proceeds south along an abandoned and reforested powerline right-of-way for about 1.2 miles. It then proceeds west along an NSTAR powerline right-of-way (not the same right-of-way utilized by the proposed I-10 Extension) for about 0.8 mile until it rejoins the proposed route near MP 6.1 in Holbrook, Massachusetts.

An environmental comparison of the Cranberry Brook Alternative 1 with the corresponding segment of the proposed I-10 Extension is presented in table 3.4.1-1.

Both routes avoid crossing agricultural land, large waterbodies, and close proximity to structures. The major advantages of the Cranberry Brook Alternative 1 is that it would reduce the area of impact on the Cranberry Brook Watershed ACEC by 10.3 acres and the area of impact on public open space by 5.3 acres. It also avoids crossing any roads. In every other respect, the alternative is environmentally inferior when compared to the proposed route. It is slightly longer, disturbs more land, and would utilize a lower percentage of existing rights-of-way. More significantly, the alternative would disturb nearly three times the amount of wetland and more than five times the amount of forested wetland as the proposed route. It also nearly triples the total amount of upland forest that would be cleared and crosses one more

waterbody. Additionally, it crosses near (within 100 feet of) one certified vernal pool as opposed to none along the proposed route, and would increase the amount of ORW watershed affected by 6.9 acres; the amount of public surface water supply zones crossed by more than 9,000 feet; and the amount of mapped rare, threatened, and endangered species habitat by 2.5 acres. For these reasons, the proposed route through the ACEC is environmentally preferable to the Cranberry Brook Alternative 1.

TABLE 3.4.1-1

Environmental Comparison of the Cranberry Brook Alternative 1 with the Corresponding Segment of the Proposed I-10 Extension (MPs 4.5 to 6.1)

Environmental Factor	Unit [a]	Cranberry Brook Alternative 1	Proposed I-10 Extension
Total Length	Miles	2.1	1.6
Adjacent to Existing Right- of- Way	Miles	0.8 [b]	1.6
Total Wetlands Affected [c]	Acres	9.3	3.2
Forested Wetlands Affected [c]	Acres	8.1	1.5
Waterbodies Crossed	Number	3	2
Major Waterbodies Crossed (>100 feet)	Number	0	0
Areas of Critical Environmental Concern Affected [d]	Acres	3.4	13.7
Upland Forest Affected [c]	Acres	19.2	6.6
Public Surface Water Supplies (Zones A, B, and C) [d]	Miles	2.2	0.4
Outstanding Resource Water Watershed Affected [d]	Acres	24.5	17.6
Rare, Threatened, and Endangered Species Habitat [c]	Acres	14.6	12.2
Certified Vernal Pools within 100 feet of the Construction Right-of-Way [d]	Number	1	0
Potential Vernal Pools within 100 feet of the Construction Right-of-Way [d]	Number	0	0
Public Open Space [d]	Acres	3.4	8.7
Agricultural Land Affected [d]	Acres	0.0	0.0
Structures within 50 feet of the Construction Right-of-Way	Number	0	0
Roads Crossed	Number	0	2

[a] Acreage calculations are based on a nominal 85-foot-wide construction right-of-way plus temporary extra workspace.
[b] Distance does not include the length adjacent to the abandoned and reforested powerline right-of-way.
[c] Based on Algonquin's field surveys.
[d] Derived from MassGIS public data.

3.4.1.2 Cranberry Brook Alternative 2

The Cranberry Brook Alternative 2 begins at approximately MP 4.5 of the proposed I-10 Extension and follows the same alignment as the Cranberry Brook Alternative 1 for about 1.2 miles. At this point, the Cranberry Brook Alternative 2 deviates from the Cranberry Brook Alternative 1 and continues south and then southwest along a powerline right-of-way for about 1.0 mile. After crossing Pine Street, the Cranberry Brook Alternative 2 turns and proceeds generally west along the powerline for about 1.1 miles until it rejoins the proposed I-10 Extension route near MP 7.2 in Holbrook, Massachusetts.

An environmental comparison of the Cranberry Brook Alternative 2 with the corresponding segment of the proposed I-10 Extension is presented in table 3.4.1-2.

TABLE 3.4.1-2

Environmental Comparison of the Cranberry Brook Alternative 2 with the Corresponding Segment of the Proposed I-10 Extension (MPs 4.5 to 7.2)

Environmental Factor	Unit [a]	Cranberry Brook Alternative 2	Proposed I-10 Extension
Total Length	Miles	3.3	2.7
Adjacent to Existing Right-of-Way	Miles	2.1 [b]	2.7
Total Wetlands Affected [c]	Acres	6.9	5.0
Forested Wetlands Affected [c]	Acres	4.0	2.4
Waterbodies Crossed	Number	4	3
Major Waterbodies Crossed (>100 feet)	Number	0	0
Areas of Critical Environmental Concern Affected [d]	Acres	0.0	17.3
Upland Forest Affected [c]	Acres	25.4	13.0
Public Surface Water Supplies (Zones A, B, and C) [d]	Miles	2.3	0.4
Outstanding Resource Water Watershed Affected [d]	Acres	33.6	36.8
Rare, Threatened, and Endangered Species Habitat [c]	Acres	22.3	23.3
Certified Vernal Pools within 100 feet of the Construction Right-of-Way [d]	Number	4	1
Potential Vernal Pools within 100 feet of the Construction Right-of-Way [d]	Number	1	0
Public Open Space [d]	Acres	4.0	10.9
Agricultural Land Affected [d]	Acres	0.0	0.0
Structures within 50 feet of the Construction Right-of-Way	Number	15	4
Roads Crossed	Number	4	6

[a] Acreage calculations are based on a nominal 85-foot-wide construction right-of-way plus temporary extra workspace.
[b] Distance does not include the length adjacent to the abandoned and reforested powerline right-of-way.
[c] Based on Algonquin's field surveys.
[d] Derived from MassGIS public data.

Both routes avoid crossing agricultural land and large waterbodies and cross similar amounts of mapped rare, threatened, and endangered species habitat. The major advantages of the Cranberry Brook Alternative 2 are that it avoids the Cranberry Brook Watershed ACEC and reduces the amount of public open space that would be impacted by 6.8 acres and the amount of ORW watershed that would be affected by 3.2 acres. It also crosses two fewer roads. In every other respect the alternative is environmentally inferior to the corresponding segment of the proposed route. It is slightly longer, would disturb more land, utilizes a lower percentage of existing rights-of-way, and would require slightly more construction within roadways. The alternative would also disturb more wetland and more forested wetland than the proposed route and passes near (within 100 feet of) three more certified vernal pools and one more potential vernal pool. Additionally, it crosses nearly 10,000 feet more public surface water supply zones, nearly doubles the total amount of upland forest that would be cleared, and crosses one more waterbody. It also passes close to four times the number of structures as the proposed route and thus would result in greater residential impacts. For these reasons, the proposed route through the Cranberry Brook Watershed ACEC is environmentally preferable to the Cranberry Brook Alternative 2.

3.4.1.3 Cranberry Brook Alternative 2A

The Cranberry Brook Alternative 2A begins at approximately MP 4.5 of the proposed I-10 Extension and follows the same alignment as the Cranberry Brook Alternative 2 for about 2.5 miles. The Cranberry Brook Alternative 2A then separates from the Cranberry Brook Alternative 2 and proceeds northwest along new right-of-way for about 0.4 mile until it rejoins the proposed I-10 Extension route near MP 6.5 in Holbrook, Massachusetts.

An environmental comparison of the Cranberry Brook Alternative 2A with the corresponding segment of the proposed I-10 Extension is presented in table 3.4.1-3.

TABLE 3.4.1-3

Environmental Comparison of the Cranberry Brook Alternative 2A with the Corresponding Segment of the Proposed I-10 Extension (MPs 4.5 to 6.5)

Environmental Factor	Unit [a]	Cranberry Brook Alternative 2A	Proposed I-10 Extension
Total Length	Miles	2.9	2.0
Adjacent to Existing Right-of-Way	Miles	1.3[b]	2.0
Total Wetlands Affected [c]	Acres	9.1	4.2
Forested Wetlands Affected [c]	Acres	6.2	2.3
Waterbodies Crossed	Number	4	2
Major Waterbodies Crossed (>100 feet)	Number	0	0
Areas of Critical Environmental Concern Affected [d]	Acres	0	17.3
Upland Forest Affected [c]	Acres	25.2	9.6
Public Surface Water Supplies (Zones A, B, and C) [d]	Miles	2.3	0.4
Outstanding Resource Water Watershed Affected [d]	Acres	27.7	25.1
Rare, Threatened, and Endangered Species Habitat [c]	Acres	19.8	16.5
Certified Vernal Pools within 100 feet of the Construction Right-of-Way [d]	Number	5	1
Potential Vernal Pools within 100 feet of the Construction Right-of-Way [d]	Number	1	0
Public Open Space [d]	Acres	4.0	10.9
Agricultural Land Affected [d]	Acres	0.0	0.0
Structures within 50 feet of the Construction Right-of- way	Number	5	2
Roads Crossed	Number	2	3

[a] Acreage calculations are based on a nominal 85-foot-wide construction right-of-way plus temporary extra workspace.
[b] Distance does not include the length adjacent to the abandoned and reforested powerline right-of-way.
[c] Based on Algonquin's field surveys.
[d] Derived from MassGIS public data.

Both routes avoid crossing agricultural land and large waterbodies, and would not require construction within roadways. Additionally, both routes would affect nearly the same amount of ORW watershed area. The major advantage of the Cranberry Brook Alternative 2A is that it avoids the Cranberry Brook Watershed ACEC and would reduce the disturbance of public open space by about 6.8 acres. It also crosses one less road. In every other respect, the Cranberry Brook Alternative 2A is environmentally inferior to the corresponding segment of the proposed I-10 Extension. It is slightly longer, would disturb more land, and utilizes a lower percentage of existing rights-of-way. The Cranberry Brook Alternative 2A would also more than double the total amount of wetlands and forested wetlands affected than the proposed route, passes near three more structures, and passes near four more certified vernal pools and one more potential vernal pool. Additionally, it crosses two more waterbodies, would increase the disturbance of mapped rare, threatened, and endangered species habitat by 3.3 acres, and would more than double the amount of upland forest clearing. For these reasons, the proposed route through the Cranberry Brook Watershed ACEC is environmentally preferable to the Cranberry Brook Alternative 2A.

3.4.2 Canton/Stoughton Alternatives

We evaluated three route alternatives to the proposed I-10 Extension in the Canton/Stoughton area in response to concerns raised by local residents and the Town of Stoughton after Algonquin

announced its original pipeline route through the area along the NSTAR powerline right-of-way. Algonquin's originally proposed alignment through the Canton/Stoughton area is referred to as the NSTAR Alternative and the other two alternatives are referred to as the Central Street Alternative and the I-2 Replacement Alternative (see figure 3.3.2-1 sheets 4, 5, and 6). These alternatives are described below.

3.4.2.1 Central Street Alternative

As depicted on figure 3.3.2-1 (sheets 5 and 6), the Central Street Alternative deviates from the proposed I-10 Extension near MP 9.7. From this point, the alternative proceeds southwest for approximately 1.8 miles along an abandoned railroad until it reaches Central Street. The route then proceeds west-northwest following Central Street for approximately 1.5 miles until it reaches the intersection of Central Street and State Route 138. The alternative then turns and follows State Route 138 north for about 0.4 mile where it leaves the roadway and proceeds northwest along new right-of-way for about 1.0 mile where it connects with the Q-1 system at MP 18.5 of the Q-1 system. The Central Street Alternative connection with the existing Q-1 system occurs approximately 1.1 miles southwest of the proposed I-10 Extension connection at MP 19.6 of the Q-1 system. The environmental impacts associated with this 1.1-mile length along the Q-1 pipeline were added into the proposed I-10 Extension alignment for comparative purposes in this analysis.

An environmental comparison of the Central Street Alternative with the corresponding segment of the proposed I-10 Extension is presented in table 3.4.2-1.

TABLE 3.4.2-1

Environmental Comparison of the Central Street Alternative with the Corresponding Segment of the Proposed I-10 Extension (MPs 9.7 to 18.5 on the Q-1 System)

Environmental Factor	Unit [a]	Central Street Alternative	Proposed I-10 Extension [b]
Total Length	Miles	4.7	4.3
Adjacent to Existing Right-of-Way	Miles	1.8	1.1
Total Wetlands Affected [c]	Acres	1.0	4.7
Forested Wetlands Affected [c]	Acres	1.0	1.8
Waterbodies Crossed	Number	2	2
Major Waterbodies Crossed	Number	0	0
Areas of Critical Environmental Concern Affected [d]	Acres	0.0	0.0
Upland Forest Affected [d]	Acres	17.7	22.3
Public Surface Water Supplies (Zones A, B, and C) [d]	Miles	2.6	1.1
Outstanding Resource Water Watershed Affected [d]	Acres	5.7	6.9
Rare, Threatened, and Endangered Species Habitat [d]	Acres	0.0	0.0
Certified Vernal Pools within 100 feet of the Construction Right-of-Way [d]	Number	0	0
Potential Vernal Pools within 100 feet of the Construction Right-of-Way [d]	Number	0	3
Public Open Space [d]	Acres	8.9	0.7
Agricultural Land Affected [d]	Acres	0.0	0.0
Structures within 50 feet of the Construction Right-of-Way	Number	119	10
Road Crossings	Number	3	6
Construction within Roadways	Miles	2.5	0.0

[a] Acreage calculations are based on a nominal 85-foot-wide construction right-of-way.
[b] Approximately 1.1 miles of pipeline right-of-way along the Q-1 system were included in the impact calculations for the proposed I-10 Extension to allow for the same beginning and ending points.
[c] Derived from Massachusetts Department of Environmental Protection Wetland Conservancy Wetland Areas.
[d] Derived from MassGIS public data.

As shown in table 3.4.2-1, neither route crosses agricultural land, large waterbodies, or specially designated areas such as ACECs, or mapped rare, threatened, or endangered species habitat. Additionally, neither route passes near (within 100 feet of) certified vernal pools and both routes are similar with respect to waterbody crossings, utilization of existing rights-of-way (as a percentage of its overall length), and would create similar amounts of new right-of-way (about 2.9 miles for the alternative and 3.2 miles for the proposed route). Both routes would also have a similar impact on ORW watersheds.

One advantage of the Central Street Alternative is that it crosses three fewer roads. Another advantage is that it would impact 4.6 fewer acres of upland forest and 3.7 fewer acres of total wetlands including 0.8 fewer acre of forested wetlands. However, the magnitude of these advantages is diminished by the fact that most of the wetlands on the proposed route are along the portion of the route that follows the Q-1 system, which is previously disturbed (both by construction of the Q-1 pipeline and subsequent right-of-way maintenance). Another advantage of the Central Street Alternative is that it avoids crossing near any potential vernal pools, whereas three such pools were identified within 100 feet of the construction right-of-way of the proposed route.

However, there are also a number of environmental drawbacks associated with the alternative. These include its greater length, which would result in more land disturbance, and its greater crossing of public surface water supply zones. More significantly, the alternative would impact 8.2 more acres of public open space within the Towns of Canton and Stoughton, the majority of which is along the western, forested portion of the alternative. Construction and operation of the alternative through the public open space would create a new, permanent right-of-way in an area where none presently exists. The construction right-of-way of the alternative also passes within 50 feet of 109 more structures than the proposed route including 100 residences, 4 apartment complexes, and a school. It also would require approximately 2.5 miles of construction within roadways, whereas the proposed route would not require in-road construction. The alternative would require the installation of a 36-inch-diameter pipeline within Central Street, which is a two-lane, major thoroughfare across the Town of Stoughton. Additionally, a portion of the alternative is adjacent to a heavily traveled portion of State Route 138. Algonquin has indicated that construction of the pipeline along Central Street and State Route 138 would require at least one lane of each roadway to be closed during construction. Along Central Street, closure of the entire road may be necessary. The closure or partial closure of Central Street and State Route 138 and the proximity of the alternative to residences would increase the socioeconomic impact of the Project on area residences and businesses, including elevated noise, dust, traffic delays, and other inconveniences.

In summary, although the Central Street Alternative offers some environmental benefits, it also has significant drawbacks that, on balance, lead us to conclude that it is not environmentally preferable to the proposed route.

3.4.2.2 I-2 Replacement Alternative

The I-2 Replacement Alternative would replace portions of Algonquin's existing 24-inch-diameter pipeline along the Q-1 system with 36-inch-diameter pipeline to the I-2 tap in Canton and replace the existing 16-inch-diameter pipeline along the I-2 system with 36-inch-diameter pipeline.

As depicted on figure 3.3.2-1 (sheets 4, 5, and 6), the I-2 Replacement Alternative deviates from the proposed I-10 Extension at approximately MP 10.2. From this point, the alternative proceeds northwest, and would replace approximately 2.5 miles of the existing 16-inch-diameter I-2 pipeline with 36-inch-diameter pipeline. At the intersection of the existing I-2 and Q-1 pipelines, the alternative turns and proceeds southwest where it would replace about 1.3 miles of the existing 24-inch-diameter Q-1 pipeline with 36-inch-diameter pipeline before it rejoins the proposed route at MP 12.9.

An environmental comparison of the I-2 Replacement Alternative with the corresponding segment of the proposed I-10 Extension is presented in table 3.4.2-2.

TABLE 3.4.2-2

Environmental Comparison of the I-2 Replacement Alternative with the Corresponding Segment of the Proposed I-10 Extension (MPs 10.2 to 12.9)

Environmental Factor	Unit [a]	I-2 Replacement Alternative	Proposed I-10 Extension
Total Length	Miles	3.9	2.6
Adjacent to Existing Right-of-Way	Miles	3.9	0
Total Wetlands Affected [b]	Acres	12.5	0.8
Forested Wetlands Affected [b]	Acres	6.1	0.7
Waterbodies Crossed	Number	2	1
Major Waterbodies Crossed	Number	0	0
Areas of Critical Environmental Concern Affected [c]	Acres	0.0	0.0
Upland Forest Affected [c]	Acres	11.5	19.8
Public Surface Water Supplies (Zones A, B, and C) [c]	Miles	0.7	0.6
Outstanding Resource Water Watershed Affected [c]	Acres	8.4	1.3
Rare, Threatened, and Endangered Species Habitat [c]	Acres	0.0	0.0
Certified Vernal Pools within 100 feet of the Construction Right-of-Way [c]	Number	0	0
Potential Vernal Pools within 100 feet of the Construction Right-of-Way [c]	Number	0	3
Public Open Space Affected [c]	Acres	0.0	0.7
Agricultural Land Affected [c]	Acres	0.0	0.0
Structures within 50 feet of the Construction Right-of-Way	Number	23	7
Roads Crossed	Number	10	7
Construction within Roadways	Miles	0.0	0.2

[a] Acreage calculations are based on a nominal 85-foot-wide construction right- of- way.
[b] Derived from Massachusetts Department of Environmental Protection Wetland Conservancy Wetland Areas.
[c] Derived from MassGIS public data.

As shown in table 3.4.2-2, neither route crosses agricultural land, large waterbodies, or specially designated areas such as ACECs, or mapped rare, threatened, or endangered species habitat. One advantage of the I-2 Replacement Alternative is that it is collocated with existing right-of-way for its entire length and would not require any new permanent right-of-way. It also would require clearing 8.3 fewer acres of upland forest than the proposed route. Additionally, the alternative avoids construction within roadways and the crossing of public open space. The proposed route in contrast would require construction within 0.2 mile of roadway and would impact 0.7 acre of public open space. Neither route passes near certified vernal pools. However, the alternative avoids any potential vernal pools, whereas three potential vernal pools were identified within 100 feet of the construction right-of-way of the proposed route.

There are also a number of environmental drawbacks associated with the I-2 Replacement Alternative including its greater length, which would result in more land disturbance, its greater crossing of public surface water supply zones, and its crossing of three more roads. More significantly, the alternative would impact 7.1 more acres of ORW watershed. The alternative also passes within 50 feet of more than three times the number of structures (mostly residences) as the proposed route and would have a greater socioeconomic impact than the corresponding segment of the proposed route.

In summary, although the I-2 Replacement Alternative offers some environmental benefits, it also has significant drawbacks that, on balance, lead us to conclude that it is not environmentally preferable to the proposed route.

3.4.2.3 NSTAR Alternative

As described in section 3.4.2, the NSTAR Alternative was part of Algonquin's originally proposed route, which was subsequently dropped after concerns were raised by area towns and residents. As depicted on figure 3.3.2-1 (sheets 5 and 6), the NSTAR Alternative deviates from the proposed I-10 Extension near MP 10.5 in Stoughton, Massachusetts and proceeds generally west along the NSTAR powerline right-of-way for about 1.4 miles. The alternative then leaves the powerline and proceeds generally northwest along new right-of-way for about 1.3 mile where it connects with the Q-1 system at MP 18.5 of the Q-1 system. The NSTAR Alternative connection with the existing Q-1 system occurs approximately 1.1 miles southwest of the proposed I-10 Extension connection at MP 19.6 of the Q-1 system. The environmental impacts associated with this 1.1-mile length along the Q-1 pipeline were added into the proposed I-10 Extension alignment for comparative purposes in this analysis.

An environmental comparison of the NSTAR Alternative with the corresponding segment of the proposed I-10 Extension is presented in table 3.4.2-3.

TABLE 3.4.2-3

Environmental Comparison of the NSTAR Alternative with the Corresponding Segment of the Proposed I-10 Extension (MPs 10.5 to 18.5 on the Q-1 System)

Environmental Factor	Unit [a]	NSTAR Alternative	Proposed I-10 Extension
Total Length	Miles	2.7	3.5 [b]
Adjacent to Existing Right-of-Way	Miles	1.4	1.1
Total Wetlands Affected [c]	Acres	1.9	8.1
Forested Wetlands Affected [c]	Acres	0.4	4.3
Waterbodies Crossed	Number	4	3
Major Waterbodies Crossed	Number	0	0
Areas of Critical Environmental Concern Affected [d]	Acres	0.0	0.0
Upland Forest Affected [c]	Acres	6.8	28.9
Public Surface Water Supplies (Zones A, B, and C) [d]	Miles	0.7	0.4
Outstanding Resource Water Watershed Affected [d]	Acres	0.0	0.0
Rare, Threatened, and Endangered Species Habitat [c]	Acres	0.0	0.0
Certified Vernal Pools within 100 feet of the Construction Right-of-Way [d]	Number	0	0
Potential Vernal Pools within 100 feet of the Construction Right-of-Way [d]	Number	0	3
Public Open Space Affected [d]	Acres	11.1	0.7
Agricultural Land Affected [d]	Acres	0.0	0.0
Structures within 50 feet of the Construction Right- of-Way	Number	1	9
Roads Crossed	Number	6	6

[a] Acreage calculations are based on a nominal 85-foot-wide construction right-of-way plus temporary extra workspace.
[b] Approximately 1.1 miles of pipeline right-of-way along the Q-1 system were included in the impact calculations for the proposed I-10 Extension to allow for the same beginning and ending points.
[c] Based on Algonquin's field surveys.
[d] Derived from MassGIS public data.

Neither the NSTAR Alternative nor the corresponding segment of the proposed route cross major waterbodies; ACECs; ORW watersheds; rare, threatened, and endangered species habitats; certified vernal pools; or agricultural land. The two routes would also require the same number of road crossings.

The primary advantages of the NSTAR Alternative are that it would affect about one fourth the amount of upland forest land and would reduce the impact on all wetlands by 6.2 acres and impact on forested wetlands by 3.9 acres. The alternative also has the advantage of being shorter, making greater use of existing rights-of-way, and minimizing the creation of new right-of-way. Additionally, it passes close to a smaller number of structures than the proposed route and, unlike the proposed route, avoids passing near mapped potential vernal pools.[3] While several of these advantages are compelling, upon closer examination, some of these advantages are less significant than they initially appear. When, for example, we examined wetland impacts including the results of Algonquin's wetland delineations, we determined that the vast majority of wetland impacts (approximately 63 percent) along the proposed route, including roughly 64 percent of the forested wetland impacts, would occur along the Q-1 system. These wetlands were disturbed by installation of the existing pipeline and continue to be disturbed by periodic right-of-way vegetation maintenance. Additionally, the potential socioeconomic impacts associated with passing close to more structures must be weighed against the wishes of the Town of Stoughton, which supports the proposed route primarily because of its increased distance from Dawe Elementary School and the New England Sinai Rehabilitation Hospital.

The NSTAR Alternative also has some significant disadvantages. Its primary disadvantage is that it crosses more protected and recreational open space, a resource that is almost completely avoided by the proposed route. More significantly, the majority of the public open space is along the western portion of the NSTAR Alternative that is not adjacent to an existing right-of-way. Construction through this open space would disrupt other uses of the area during construction, and would create a new permanent corridor. The establishment of this corridor would preclude the re-establishment of the forest, which currently covers much of the route. The alternative also increases the number of waterbody crossings and the crossing of public surface water supply areas.

Another disadvantage of the NSTAR Alternative is that it could negate the Agreement on Conveyancing, Permitting, and Mitigation (Agreement) that Algonquin has already entered into with the Town of Stoughton (Algonquin, 2008a) regarding the Gibson Property, which is Algonquin's preferred site for its compensatory wetland mitigation plan (see sections 4.4.4, 4.5.2, and 4.8.4.1). Under the terms of the Agreement between Algonquin and the town, Algonquin would acquire and transfer ownership of 96.0 acres of property to the town provided the town supports the proposed route and it is approved and certificated by the FERC. Of these 96.0 acres, 46.2 acres would be placed in a conservation easement pursuant to Algonquin's COE permit and wetland mitigation requirements. A total of 19.2 acres would be compensatory mitigation for wetland impacts. The conservation easement would also protect 23.7 acres of upland forest, which would offset the additional acreage of upland forest that would be cleared along the corresponding segment of the proposed route. Should the FERC issue a Certificate that does not substantially follow the proposed route, at Algonquin's written election, the Agreement is null and void unless otherwise agreed to or amended by Algonquin and the Town of Stoughton.

In summary, we recognize that the NSTAR Alternative has several positive attributes, but these advantages are relatively small when considered in the context of the Project as a whole. Additionally, the significance of some of these advantages (e.g., the avoidance of the three potential vernal pools along the proposed route) has not been fully determined. It is possible that the difference between the proposed route and alternative regarding vernal pools may be less than is assumed in this analysis. Moreover, any

[3] The analysis above compares the proximity of mapped vernal pools near the two routes. Algonquin's field surveys identified several unmapped vernal pools near the proposed route. However, similar delineation information was not available for the alternative.

comparison of an alternative to the proposed route must also weigh the alternative's apparent advantages against its disadvantages. This often requires a balancing of impacts on different types of resources. In this case for example, we must consider the greater wetland impacts of the proposed route against the greater impact of the alternative on public lands and waterbodies, and the possibility that it would negate the land transfer Agreement between Algonquin and the Town of Stoughton, which would compensate for wetland and upland forest impacts. Because the NSTAR Alternative possesses sufficient advantages to be considered a reasonable alternative that warrants further review, we have included additional analysis of this alternative in the resource discussions in section 4.0.

3.5 MINOR ROUTE VARIATIONS

Algonquin planned the proposed facilities to minimize impacts by following existing rights-of-way where possible. However, prior to and following submittal of its application, Algonquin identified several areas along the proposed E2W Project pipeline routes where site-specific conditions such as rock outcroppings, unstable soils, residences, and existing infrastructure require minor variations from the originally proposed route, including minor deviations from the existing pipeline or powerline rights-of-way. Some of the minor route variations were adopted to reduce impacts on sensitive resources (e.g., vernal pools and other wetlands), whereas others were adopted due to constructability issues (e.g., steep slopes, road crossings). In the case of the I-10 Extension, the majority of these minor route variations were identified during ongoing consultations between Algonquin and NSTAR in an attempt to address NSTAR's concerns and minimize potential construction or operational conflicts with NSTAR's electric transmission line system. In the case of the Q-1 and E-3 systems, these minor variations would preclude using the lift and replace method (i.e., removing the existing pipeline and then installing the replacement pipeline in the same ditch). Because these minor route variations avoid site-specific engineering, construction, and/or environmental constraints and would either reduce or not result in significant environmental impacts compared to the originally proposed route or a route adjacent to or within an existing right-of-way, we consider them to be both warranted and preferable and thus should be part of the proposed pipeline routes. Table 3.5-1 identifies the minor route variations that were incorporated into the proposed pipeline routes and the reasons for their adoption.

3.6 ABOVEGROUND FACILITY SITE ALTERNATIVES

3.6.1 Compressor Station Site Alternatives

Algonquin's only new proposed compressor station is the Rehoboth Compressor Station in Rehoboth, Massachusetts. The need for a new compressor station at this location has to do with the nature of the east to west flow pattern required by the E2W Project. Currently, when gas flows from west to east, gas enters Algonquin's Burrillville Compressor Station from the west on the suction side (lower pressure side) of the station and exits to the east on the discharge side (higher pressure side) of the station. The E2W Project facilities would reverse this. Pressures entering Algonquin's G pipeline system would have to drop to allow the new volumes to enter the system. This would effectively shift the G system from the discharge side to the suction side of the Burrillville Compressor Station. Without additional compression, the pressures previously available to transport the gas to customers along the G system would be reduced, which could curtail service. New compression is required to maintain service to Algonquin's existing G system customers and to provide the new deliveries nominated to the G system by Algonquin's E2W Project customers.

TABLE 3.5-1

Minor Route Variations Incorporated into the Proposed E2W Project Pipeline Routes

State/System Minor Route Variation Name	County/ Municipality	Milepost Start	 End	Length (miles)	Reason for Variation
Massachusetts					
I-10 Extension					
Mileposts (MPs) 0.0 to 1.6 Variation	Town of Weymouth	0.0	1.6	1.6	Relocate proposed horizontal directional drill (HDD) routing and pipeline alignment to the east to increase the separation from the existing NSTAR Electric Company (NSTAR) tower structures.
MPs 1.9 to 2.7 Variation	Town of Weymouth	1.9	2.7	0.8	Represents the combination of five pipeline alignment changes identified by Algonquin to increase the separation from NSTAR powerline wires and towers; minimize impacts on a stormwater management pond and wetlands; improve the alignment of the Washington Street crossing; and minimize potential impacts on a parking lot.
MPs 2.8 to 3.4 Variation	Town of Weymouth	2.8	3.4	0.7	Represents the combination of four pipeline alignment changes identified by Algonquin to increase the separation from NSTAR powerline wires and towers; minimize wetland impacts; avoid a rock ledge slope; improve the crossing location of State Route 3; and minimize rock blasting.
MPs 3.5 to 4.1 Variation	Town of Weymouth / Town of Braintree	3.5	4.1	0.6	Represents the combination of four pipeline alignment changes identified by Algonquin to increase the separation from NSTAR powerline wires and towers; avoid a severe side slope; minimize wetland impacts; and provide a better street crossing angle and location.
MPs 4.2 to 4.3 Variation	Town of Braintree	4.2	4.3	0.2	Increases the separation from NSTAR powerline towers.
MPs 4.3 to 4.5 Variation	Town of Braintree	4.3	4.5	0.2	Represents the combination of two pipeline alignment changes identified by Algonquin to increase the separation from NSTAR powerline wires and towers and to avoid some wooden utility poles.
MPs 4.5 to 4.5 Variation	Town of Braintree	4.5	4.5	<0.1	Increases the separation from NSTAR powerline towers.
MPs 4.6 to 4.7 Variation	Town of Braintree	4.6	4.7	<0.1	Increases the separation from NSTAR powerline towers.
MPs 4.8 to 4.8 Variation	Town of Braintree	4.8	4.8	<0.1	Increases the separation from NSTAR powerline towers.

TABLE 3.5-1 (cont'd)

Minor Route Variations Incorporated into the Proposed E2W Project Pipeline Route

State/System Minor Route Variation Name	County/ Municipality	Milepost Start	Milepost End	Length (miles)	Reason for Variation
MPs 4.9 to 6.1 Variation	Town of Braintree	4.9	6.1	1.2	Represents the combination of six pipeline alignment changes identified by Algonquin to increase the separation from NSTAR powerline wires and towers; reduce residential impacts; avoid a steep side slope; avoid an Atlantic white cedar stand; minimize wetland impacts; increase the separation from Cranberry Pond; and avoid an electrical substation.
MPs 6.4 to 7.1 Variation	Town of Holbrook	6.4	7.1	0.7	Represents the combination of six pipeline alignment changes identified by Algonquin to increase the separation from NSTAR powerline wires and towers; avoid an existing stream channel and culvert under North Franklin Street; and avoid a steep slope.
MPs 7.2 to 7.4 Variation	Town of Holbrook	7.2	7.4	0.2	Increases the separation from NSTAR powerline wires and towers.
MPs 7.6 to 8.5 Variation	Town of Holbrook/ Town of Randolph	7.6	8.5	1.0	Represents the combination of six pipeline alignment changes identified by Algonquin to increase the separation from NSTAR powerline wires and towers; avoid Sylvan Lake; increase the separation from residences; improve the crossing location of Mill Street; avoid in-street construction impacts on Wyman Road; avoid a rock ledge; and avoid a steep side slope.
MPs 8.5 to 8.8 Variation	Town of Randolph	8.5	8.8	0.3	Represents the combination of two pipeline alignment changes identified by Algonquin to increase the separation from NSTAR powerline wires and towers.
MPs 8.9 to 8.9 Variation	Town of Randolph	8.9	8.9	0.1	Increases the separation from NSTAR powerline towers.
MPs 8.9 to 9.0 Variation	Town of Randolph	8.9	9.0	0.1	Increases the separation from NSTAR powerline towers.
MPs 9.29 to 10.5 Variation	Town of Randolph/ Town of Avon/Town of Stoughton	9.3	10.5	1.2	Represents the combination of three pipeline alignment changes identified by Algonquin to increase the separation from NSTAR powerline wires and towers; increase the separation from an existing stone quarry; avoid impacts on the Stoughton Landfill; and improve the crossing location and crossing angle of Route 24.
MPs 10.6 to 10.7 Variation	Town of Stoughton	10.6	10.7	0.1	Relocate the proposed pipeline to the east to avoid a steep side slope.
MPs 11.1 to 11.2 Variation	Town of Stoughton	11.1	11.2	0.1	Relocate the proposed pipeline to the north to avoid impacts on a vernal pool (B-VP-13).

TABLE 3.5-1 (cont'd)

Minor Route Variations Incorporated into the Proposed E2W Project Pipeline Route

State/System Minor Route Variation Name	County/ Municipality	Milepost Start	Milepost End	Length (miles)	Reason for Variation
MPs 11.5 to 11.8 Variation	Town of Stoughton	11.5	11.8	0.3	Relocate the proposed pipeline to avoid steep side slopes, large rock outcroppings, and impacts on a vernal pool (B-VP-09).
MPs 12.4 to 12.5 Variation	Town of Canton	12.4	12.5	0.2	Relocate the proposed pipeline to the west to avoid residential driveway impacts and to avoid impacts on a vernal pool (A-VP-15).
MPs 12.7 to 12.9 Variation	Town of Canton	12.7	12.9	0.1	Relocate the proposed pipeline to avoid large rock outcroppings, improve terrain, and minimize wetland impacts.
Q-1 System Replacement					
MPs 15.2 to 15.3 Variation	Town of Sharon	15.2	15.3	0.1	Represents the combination of two pipeline alignment changes identified by Algonquin to minimize residential impacts and increase the separation from NSTAR powerline tower.
MPs 15.7 to 16.9 Variation	Town of Sharon/ Town of Canton	15.7	16.9	1.2	Avoids or minimizes stream channel, wetland, and residential impacts.
MPs 16.7 to 16.8 Variation	Town of Canton	16.7	16.8	0.1	Relocate the proposed pipeline to minimize business interruption and increase the separation from NSTAR powerline towers.
MPs 16.9 to 16.9 Variation	Town of Canton	16.9	16.9	0.1	Relocate the proposed pipeline to the south to avoid constructing the proposed pipeline between existing NSTAR powerline towers.
MPs 16.9 to 17.0 Variation	Town of Canton	16.9	17.0	0.1	Avoids a steep side slope created by an adjacent development along the existing Q-1 system alignment.
Connecticut					
E-3 System Replacement					
MPs 2.9 to 4.1 Variation	City of Norwich/ Town of Preston	2.9	4.1	1.2	Optimizes the Shetucket River HDD alignment.
MPs 2.9 to 3.0 Variation	City of Norwich	2.9	3.0	0.1	Subsequent optimization of the MPs 2.9 to 4.1 Variation to improve the departure angle from the existing E-3 system alignment.
MPs 3.1 to 3.2 Variation	City of Norwich	3.1	3.2	0.1	Subsequent optimization of the MPs 2.9 to 4.1 Variation to avoid impact on a future cemetery expansion and a shopping center parking lot.
MPs 3.9 to 4.1 Variation	Town of Preston	3.9	4.1	0.2	Subsequent optimization of the MPs 2.9 to 4.1 Variation that relocates the pipeline adjacent to property lines along the rear portion of residential lots.

Note: The totals shown in this table may not equal the sum of addends due to rounding.

The proposed Rehoboth Compressor Station site is at the junction of the G-1 and G-5 systems, near Algonquin's G-5 tap at about MP 16.8 on the G-1 system. According to Algonquin, hydraulic studies indicate that this location is optimally situated from a hydraulic perspective to meet the required compression objectives. Specifically, the proposed station is at a point on the G-5 system where compression is needed to boost the gas pressure in the pipeline to the level required by Algonquin's customers. This location also provides Algonquin increased flexibility and efficiency by allowing, through the use of remotely operated valves, the option of compressing either the entire load on the G-1 system or tailoring the volume by bypassing gas going to the G-5 system.

During the site selection process, Algonquin evaluated five other sites for the Rehoboth Compressor Station near the hydraulically optimal location (see figure 3.6-1). Each of these sites was considered and ranked relative to the proposed site based on its size; distance and access from public roadways; potential impacts on wetlands, waterbodies, and ponds; proximity to noise-sensitive areas (NSAs) or other dwellings and structures; topography and potential for visual impacts; distance from the optimal hydraulic location; site elevation; flood potential; proximity to high tension powerlines; length of the required suction and discharge lines; and other environmental and land issues. An environmental comparison of the Rehoboth Compressor Station site alternatives with the proposed Rehoboth Compressor Station site is presented in table 3.6.1-1. An assessment of each site compared to the proposed site is presented below.

TABLE 3.6.1-1

Environmental Comparison of the Rehoboth Compressor Station Site Alternatives with the Proposed Rehoboth Compressor Station Site (Bristol County, Massachusetts)

Environmental Factor	Unit	Proposed Site	Alternative Site A	Alternative Site B	Alternative Site C	Alternative Site D	Alternative Site E
Facility Size [a]	acres	97.0	12.7	24.7	40.9	93.8	75.0
Access Road Length [b]	miles	0.5	0.1	[c]	0.4	0.3	0.3
Suction/Discharge Line Length	miles	0.5	0.3	[c]	0.2	0.6	0.7
Potential Vernal Pools within Site [d]	number	3	0	[c]	3	1	0
Wetlands	acres	18.2	0	[c]	15.2	30.9	6.2
Structures within 50 feet of Site Boundary	number	0	2	[c]	3	0	9

[a] Total area of land that would be acquired for the compressor station site.
[b] Includes the combined total if more than one access road would be required.
[c] Alternative Site B is under residential development and was not considered further.
[d] The number of potential vernal pools within the proposed site is based on Algonquin's field survey results. The number of potential vernal pools within the alternative compressor station sites is based on MassGIS data.

Alternative Site A

Alternative Site A is a 12.7-acre site located in the City of Attleboro, approximately 0.6 mile northwest of the proposed compressor station site in Rehoboth. The site is zoned "Single Residence D – 20,000 square feet." It is bounded by the G-1 system right-of-way to the north and residential areas to the east, south, and west. Alternative Site A could be accessed by constructing about a 340-foot-long access road from either Oak Hill Avenue to the southeast or from Chapel Drive to the northeast. It would also require a new 0.3-mile-long right-of-way for the 20- and 12-inch-diameter suction and discharge piping between the compressor station and Algonquin's existing G-1 and G-5 systems.

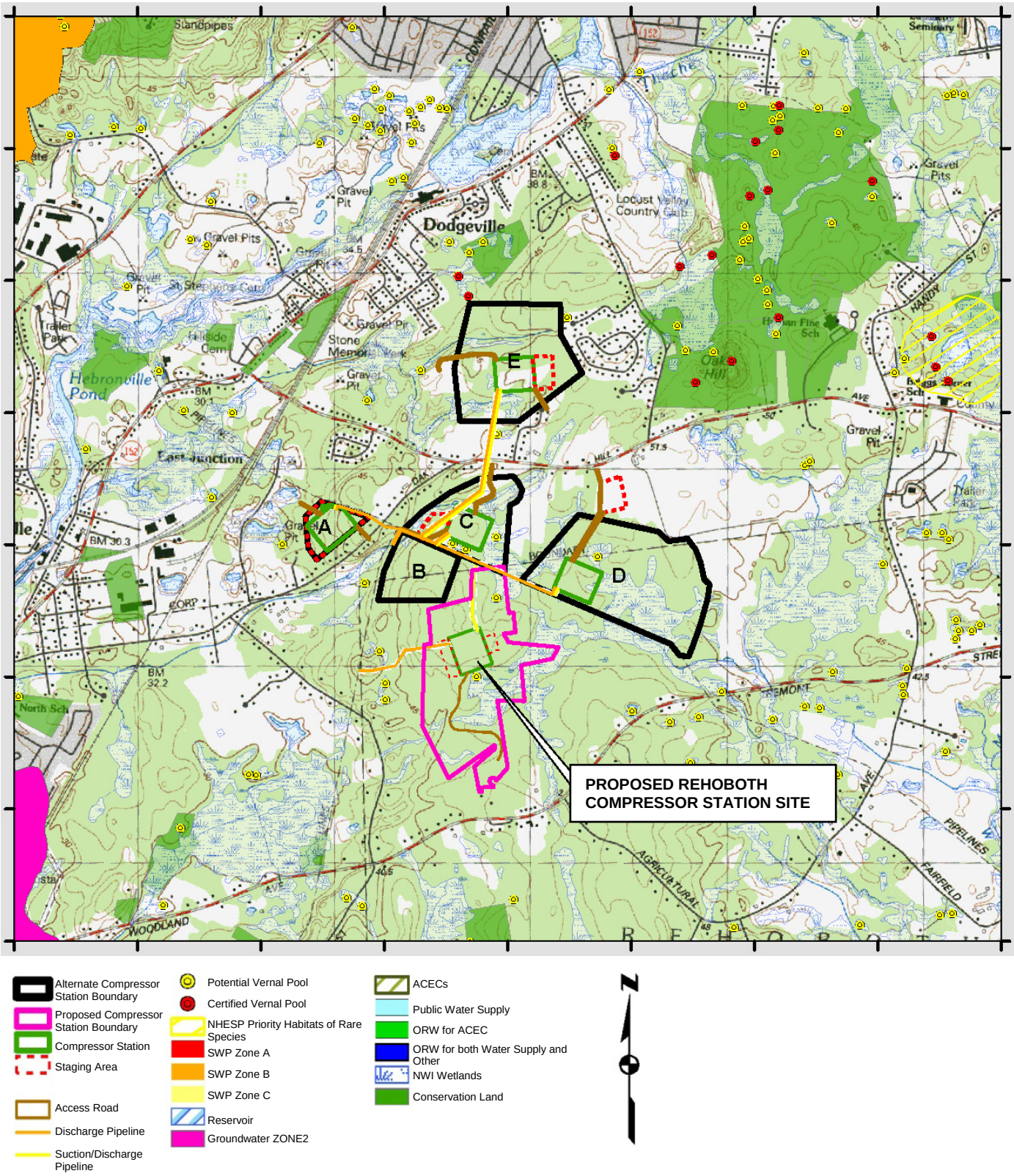

Figure 3.6-1
HubLine/East to West Project
Rehoboth Compressor Station
Proposed and Alternative Sites

The proposed and alternative compressor station sites both avoid public groundwater and/or surface water supplies; ORW watersheds; public open space; ACECs; mapped rare, threatened, and endangered species habitats; and certified vernal pools.

The primary advantage of the alternative is that, based on GIS data, there are no potential vernal pools on the site, whereas three potential vernal pools were identified during field surveys of the proposed site. In addition, Alternative Site A would require 0.2 mile less suction/discharge line right-of-way than the proposed site. These advantages are largely negated by the fact that development of the proposed site would not directly impact the potential vernal pools. One of the vernal pools is approximately 700 feet east of the proposed G-1 suction/discharge line location. The other two vernal pools are approximately 400 feet south and 75 feet east of proposed the proposed G-5 suction/discharge line location, respectively.

The primary disadvantage of Alternative Site A is its small size. The site is less than 13 acres, which would provide much less buffer between the compressor station and surrounding land uses than the proposed 97.0-acre site. Moreover, the site is surrounded by residential areas to the east, south, and west, and some residences abut the site property boundary. Because of the proximity of these homes, the alternative would likely affect a greater number of NSAs than the proposed site. Additionally, although Alternative Site A would require an approximately 0.4 mile shorter access road than the proposed site, the facility would be closer to public roads, which could result in increased visual impacts. For these reasons, we do not consider Alternative Site A to be environmentally preferable to the proposed site.

Alternative Site B

Alternative Site B is a 24.7-acre site located in the municipalities of Attleboro and Rehoboth, approximately 0.2 mile northwest of the proposed compressor station site. The portion of the site that is in Attleboro is zoned "Single Residence D – 20,000 square feet," and the portion of the site in Rehoboth is zoned "Residential/Agricultural District." The site is bounded by the G-1 and G-5 system rights-of-way to the north and west, respectively, and forest land to the south and east. Algonquin dropped Alternative Site B from further consideration after it discovered a paved cul-de-sac had been installed and homes were being constructed on the property. Due to the ongoing residential development, Alternative Site B is not considered to be environmentally preferable to the proposed site.

Alternative Site C

Alternative Site C is a 40.9-acre site located in the City of Attleboro, approximately 0.3 mile north of the proposed compressor station site. The site is zoned "Single Residence D – 20,000 square feet." It is bounded by the G-1 system right-of-way to the south, wetlands and recreational open land to the east, and residential areas to the north and northwest. Alternative Site C could be accessed by constructing about a 1,050-foot-long access road from either Oak Hill Avenue to the north or an 800-foot-long access road from Algonquin's existing right-of-way to the west. It would also require a new 0.2-mile-long right-of-way for the 20- and 12-inch-diameter suction and discharge piping between the compressor station and Algonquin's existing G-1 and G-5 systems.

The proposed and alternative compressor station sites both avoid public groundwater and/or surface water supplies; ORW watersheds; public open space; ACECs; mapped rare, threatened, and endangered species habitats; and certified vernal pools.

The primary advantages of Alternative Site C are that it is closer to public roads and thus would require a shorter access road (approximately 0.1 mile shorter), and it would require a 0.3 mile shorter suction/discharge line right-of-way than the proposed site.

The primary disadvantage of Alternative Site C is its smaller size. The site is less than one-half the size of the proposed site (40.9 acres versus 97.0 acres), and thus would provide less buffer between the compressor station and surrounding land uses. Based on GIS data, the alternative site also contains three potential vernal pools as does the proposed site. However, it is not known whether the potential vernal pools at Alternative Site C could be avoided as at the proposed site. Additionally, an intermittent waterbody and associated wetlands cross the north-northwest portion of the alternative site, and wetlands cross the east southeast portion of the site. Combined, these wetland areas cover 37 percent of the site, which would limit the area available for facilities and increase the likelihood that wetlands would be disturbed or filled to build and operate the compressor station. Alternative Site C is also bounded by residential areas to the north and northwest. Due to the proximity of these homes, the alternative would likely affect a greater number of NSAs and have a greater visual impact than the proposed site. For these reasons, we do not consider Alternative Site C to be environmentally preferable to the proposed site.

Alternative Site D

Alternative Site D is a 93.8-acre site located in the municipalities of Attleboro and Rehoboth, approximately 0.3 mile northeast of the proposed compressor station site. The portion of the site that is in Attleboro is zoned "Single Residence D – 20,000 square feet," and the portion of the site in Rehoboth is zoned "Residential/Agricultural District." The site is bounded by the G-1 system right-of-way to the south; forest, wetlands, and open land to the east and west; and forest and open land to the north. Alternative Site D could be accessed by constructing about a 1,530-foot-long access road from Oak Hill Avenue to the north or the G-1 system right-of-way to the south. It would also require a new 0.6-mile-long right-of-way for the 20- and 12-inch-diameter suction and discharge piping between the compressor station and Algonquin's existing G-1 and G-5 systems.

The proposed and alternative compressor station sites both avoid public groundwater and/or surface water supplies; ORW watersheds; public open space; ACECs; mapped rare, threatened, and endangered species habitats; and certified vernal pools, are similar in size, and would require approximately the same length of suction/discharge piping.

The primary advantages of the alternative are that there is only one potential vernal pool on the site based on GIS data and it is closer to a public road and thus would require a shorter access road (approximately 0.2 mile shorter). However, as discussed above, the vernal pool advantage is largely negated by the fact that development of the proposed site would not directly impact the three potential vernal pools on the proposed site.

The primary disadvantage of Alternative Site C is that wetlands cover the east-southeast portion of the site and extend north into the interior of the site and along the west-northwestern edge of the site. These wetland areas cover 33 percent of the alternative site, whereas only 19 percent of the proposed site is wetland. This limits the area available for facilities and increases the likelihood that wetlands would be disturbed or filled to build and operate the compressor station.

Another disadvantage of Alternative Site D is its location and distance downstream of the G-5 lateral tap location. Upstream of the G-5 tap, the G-1 laterals consist of 16-inch and 20-inch-diameter pipelines. Downstream of the G-5 tap, the 16-inch-diameter pipeline reduces to a 12-inch-diameter pipeline, which results in a loss of pressure. This pressure loss could only be restored by either increasing the Rehoboth Compressor Station site horsepower or by replacing the 12-inch-diameter pipeline with approximately 2,800 feet of 16-inch-diameter pipeline. For these reasons, we do not consider Alternative Site D to be environmentally preferable to the proposed site.

Alternative Site E

Alternative Site E is located in the City of Attleboro, approximately 0.7 mile north of the proposed compressor station site and approximately 0.4 mile north of the G-1 system right-of-way. The site is zoned as "Single Residence D – 20,000 square feet." It is bounded by residential areas to the east, southeast, and west; forest land to the north; and open land to the south. Alternative Site E could be accessed by constructing about a 1,200-foot-long access road from Valley Run Drive to the west or a 420-foot-long access road from a residential road to the southeast. It would also require a new 0.7-mile-long right-of-way for the 20- and 12-inch-diameter suction and discharge piping between the compressor station and Algonquin's existing G-1 and G-5 systems.

The proposed and alternative compressor station sites both avoid public groundwater and/or surface water supplies; ORW watersheds; public open space; ACECs; mapped rare, threatened, and endangered species habitats; and certified vernal pools.

The primary advantage of the alternative is that there are no potential vernal pools on the site based on GIS data as compared to three potential vernal pools identified on the proposed site. It is also closer to public roads and thus would require a shorter access road (approximately 0.2 mile shorter) than the proposed site. These advantages are largely negated by the fact that development of the proposed site would not directly impact the potential vernal pools on the property.

A primary disadvantage of Alternative Site E is that it is closer to more residences than the proposed site. Because of the proximity of these homes, the alternative would likely affect a greater number of NSAs and have a greater visual impact than the proposed site. In addition, two perennial waterbodies and associated wetlands cross the middle of the alternative site in an east to west direction. The location of these streams and wetlands limit the area available for the facilities and increases the likelihood that wetlands would be disturbed or filled to build and operate the compressor station.

Another disadvantage of Alternative Site E is its distance from the existing Algonquin pipeline system. Development of the site would require that both the G-1 system be rerouted from the existing right-of-way to the alternative site and then back again to the existing right-of-way. These lines and the discharge line to the G-5 system would require a new 150-foot-wide permanent right-of-way for a distance of about 3,500 feet, and this right-of-way would have to cross Oak Hill Avenue close to existing residences.

For the reasons outlined above, we do not consider Alternative Site E to be preferable to the proposed site.

3.6.2 Other Aboveground Facility Site Alternatives

The majority of the other proposed aboveground facilities are modifications that would be located within the fencelines of existing compressor stations or collocated with other similar existing facilities along Algonquin's existing right-of-way. Because no significant environmental resources would be impacted by these facilities, we believe that no environmentally preferable alternative exists; thus, an assessment of alternative facility sites is not warranted. As indicated in section 2.1.2, in addition to the proposed OPP regulator stations at the existing Fore River and Sharon meter Stations, Algonquin has proposed two relatively small (ranging from 1 acre to 1.2 acres of permanent easement) new OPP regulator stations at each end of the proposed Q-1 System Replacement (MPs 12.2 and 19.7). The proposed OPP regulator station at MP 12.2 is located within the Moose Hill Wildlife Sanctuary. However, the proposed station would be located along the pipeline right-of-way and adjacent to Interstate 95. Additionally, the facility would not directly impact wetlands, waterbodies, or threatened and

endangered species habitats. The proposed OPP regulator station at the end of the proposed Q-1 System Replacement (MP 19.7) is located near a commercial/industrial property and appears to be in a relatively open area. The facility would not directly impact any wetlands, waterbodies, or threatened and endangered species habitats. Given the proposed OPP regulator station sites have relatively small footprints, do not have any significant environmental concerns, and are located at optimal locations from a facilities' design standpoint, we believe that no environmentally preferable alternative exists; thus, we do not consider an assessment of alternative OPP regulator station sites to be warranted.

Algonquin proposes to install a mainline valve and remote blow-off valve near MP 1.3 of the I-10 Extension. The permanent right-of-way for the blow-off valve would be approximately 110 feet by 50 feet, with the long dimension oriented perpendicular to the pipeline route. The blow-off valve would be located in a forested area and would nearly abut the back property lines of three residences on Harding Avenue. To use the site, it appears Algonquin would need to clear the trees and level the site, which currently slopes upward toward the residences on Harding Avenue. The clearing and grading would remove most of the vegetation between the three residences and NSTAR's existing powerlines. It appears that Algonquin would need to construct a new access road to the facility extending west from Roosevelt Road, although this access road is not depicted on the alignment sheets. It is also unclear whether the permanent access road would permanently impact wetlands adjacent to Roosevelt Road.

We have some concerns about the proposed location and orientation of the blow-off valve and its close proximity to the residences abutting Harding Avenue. In addition to the clearing of vegetation between the residences and the powerlines discussed above, which may increase the visibility of the powerlines as well as the visibility of the blow-off valve, the proximity of the site to residences would also increase noise impacts should a blowdown occur. In section 4.11.2.3 we are recommending that Algonquin estimate the potential noise impact of the blow-off facility and, if needed, propose mitigation measures to ensure that the noise resulting from blow-off activities complies with federal and local noise ordinances. From our review of the alignment sheets, it appears that there is a potentially less forested site for the blow-off valve adjacent to the southeast side of Roosevelt Road that is approximately 350 south of the currently proposed location. This site is further from residences and would require a shorter permanent access road than the proposed site. For these reasons, **we recommend that:**

- **Algonquin should prepare an alternatives analysis for the proposed blow-off valve near MP 1.3 of the I-10 Extension. The analysis should evaluate modifications to the proposed valve site to minimize potential visual, vegetation, and wetland impacts, and evaluate a site adjacent to the southeast side of Roosevelt Road that is approximately 350 feet south of the currently proposed location from an environmental and engineering perspective, including access to the site. Algonquin may discuss any other factors that are relevant to the site selection. Algonquin should file this alternatives analysis with the Secretary of the Commission (Secretary) <u>during the draft EIS comment period</u>.**

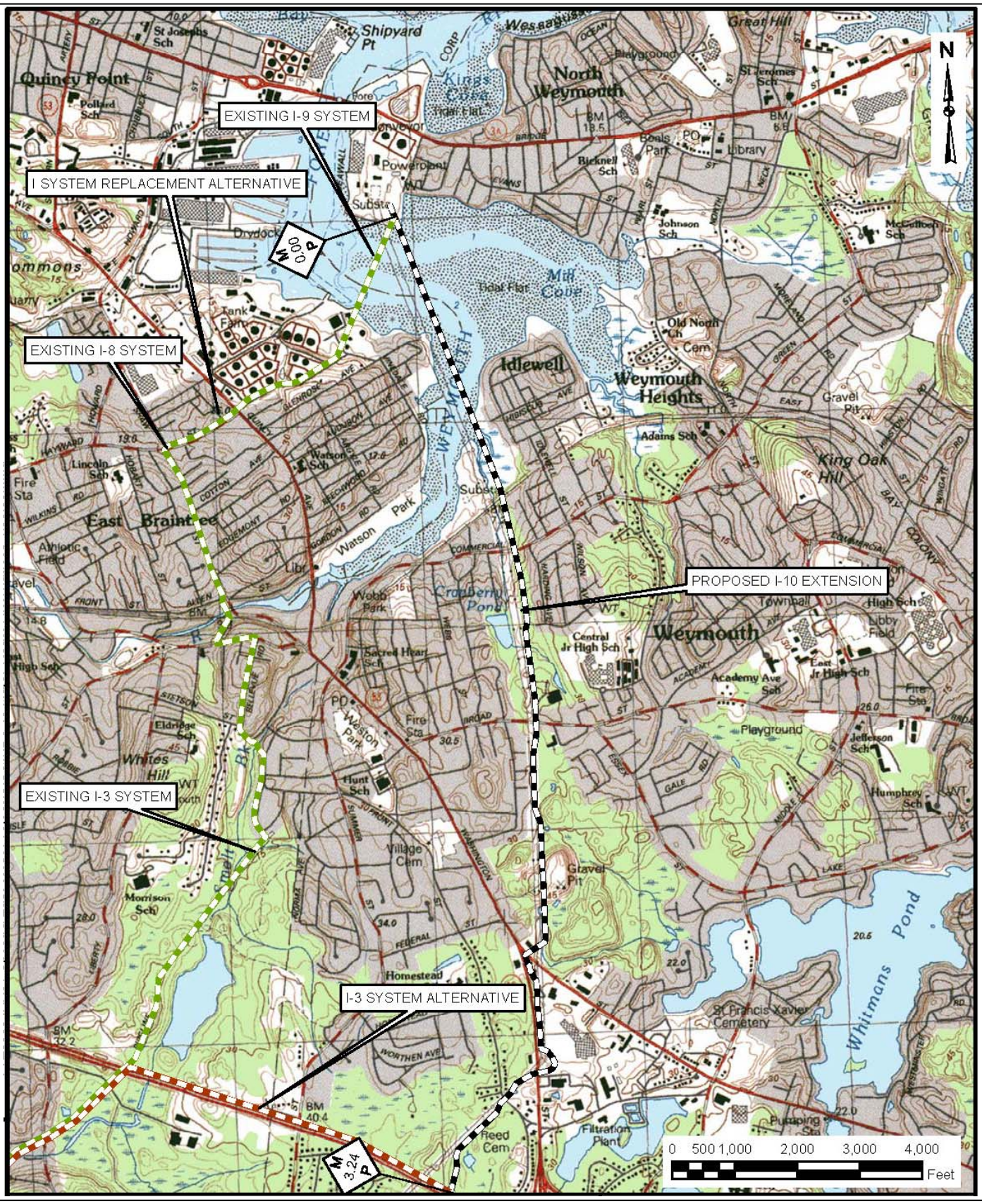

Figure 3.3.2-1
HubLine/East to West Project
Pipeline System and Route Alternatives to the Proposed I-10 Extension
Sheet 1 of 6

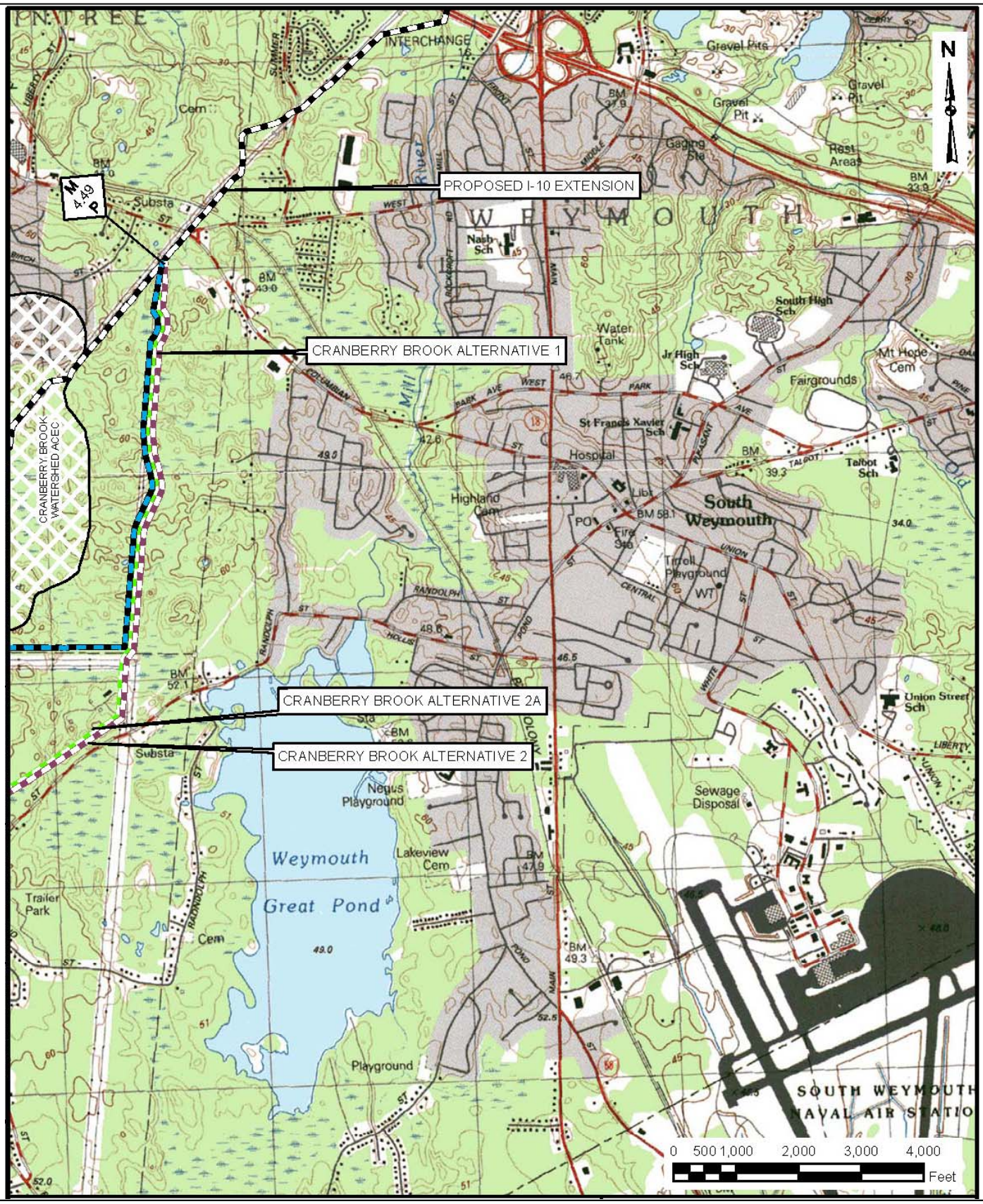

Figure 3.3.2-1
HubLine/East to West Project
Pipeline System and Route Alternatives to the Proposed I-10 Extension
Sheet 2 of 6

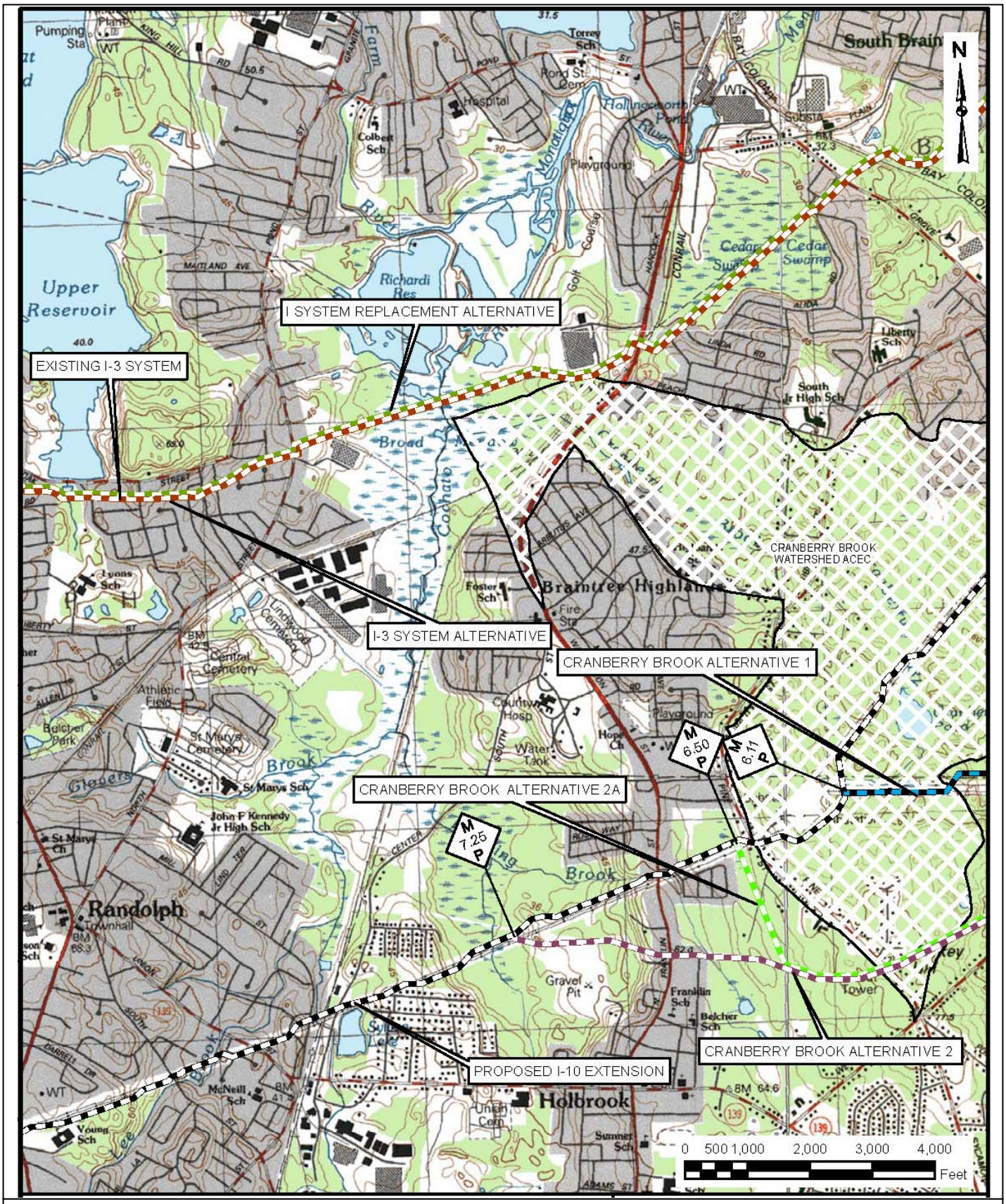

Figure 3.3.2-1
HubLine/East to West Project
Pipeline System and Route Alternatives to the Proposed I-10 Extension
Sheet 3 of 6

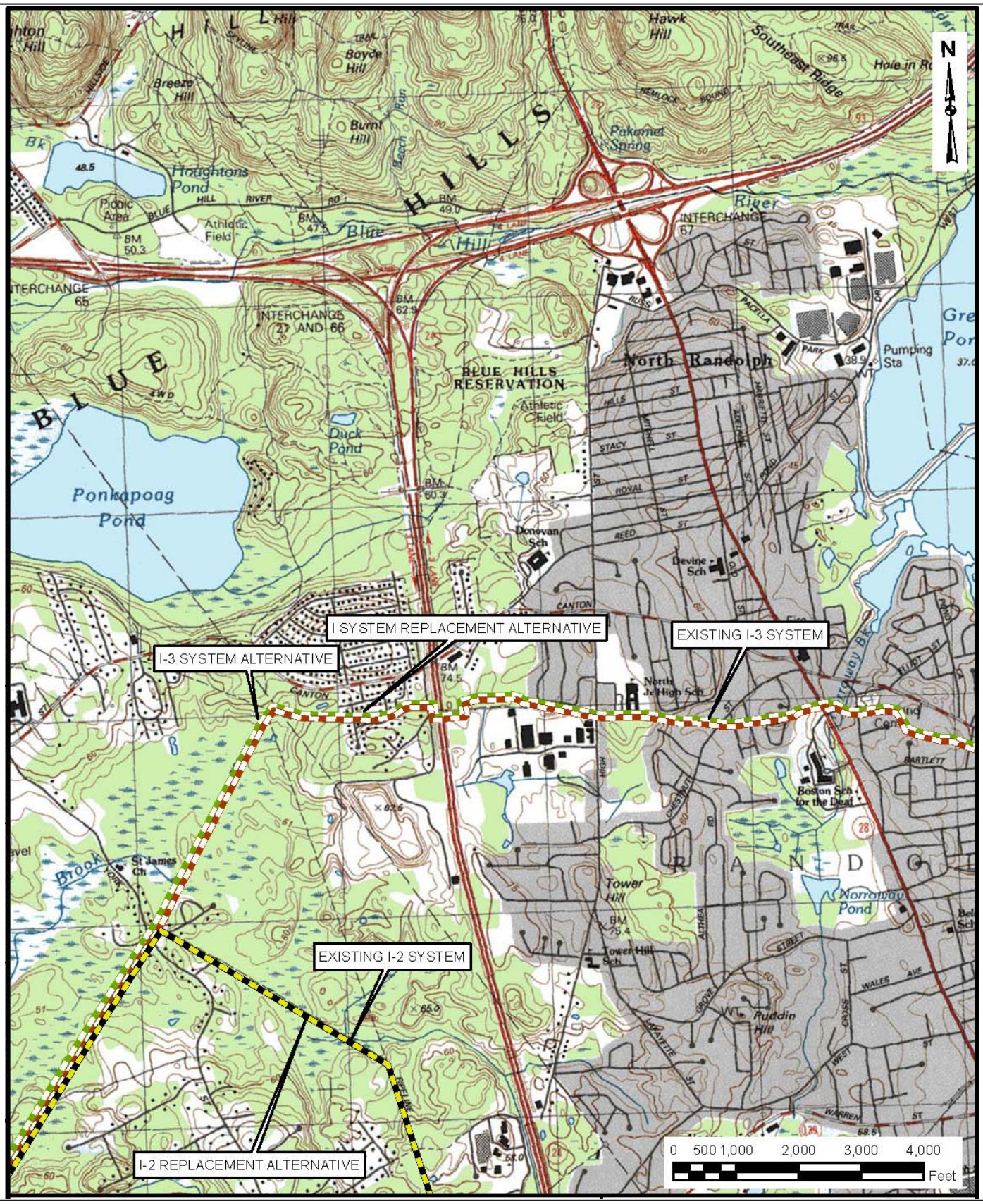

Figure 3.3.2-1
HubLine/East to West Project
Pipeline System and Route Alternatives to the Proposed I-10 Extension
Sheet 4 of 6

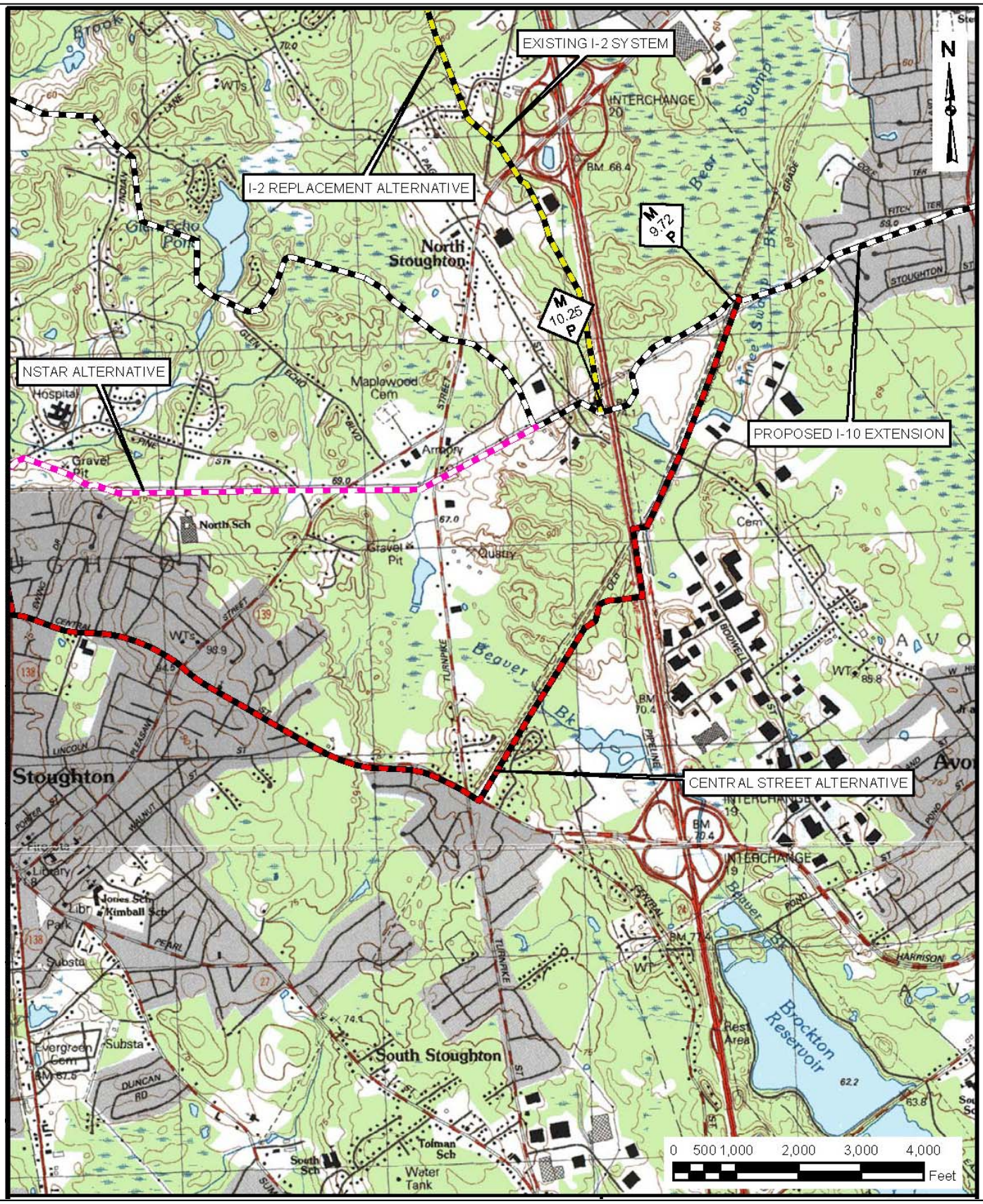

Figure 3.3.2-1
HubLine/East to West Project
Pipeline System and Route Alternatives to the Proposed I-10 Extension
Sheet 5 of 6

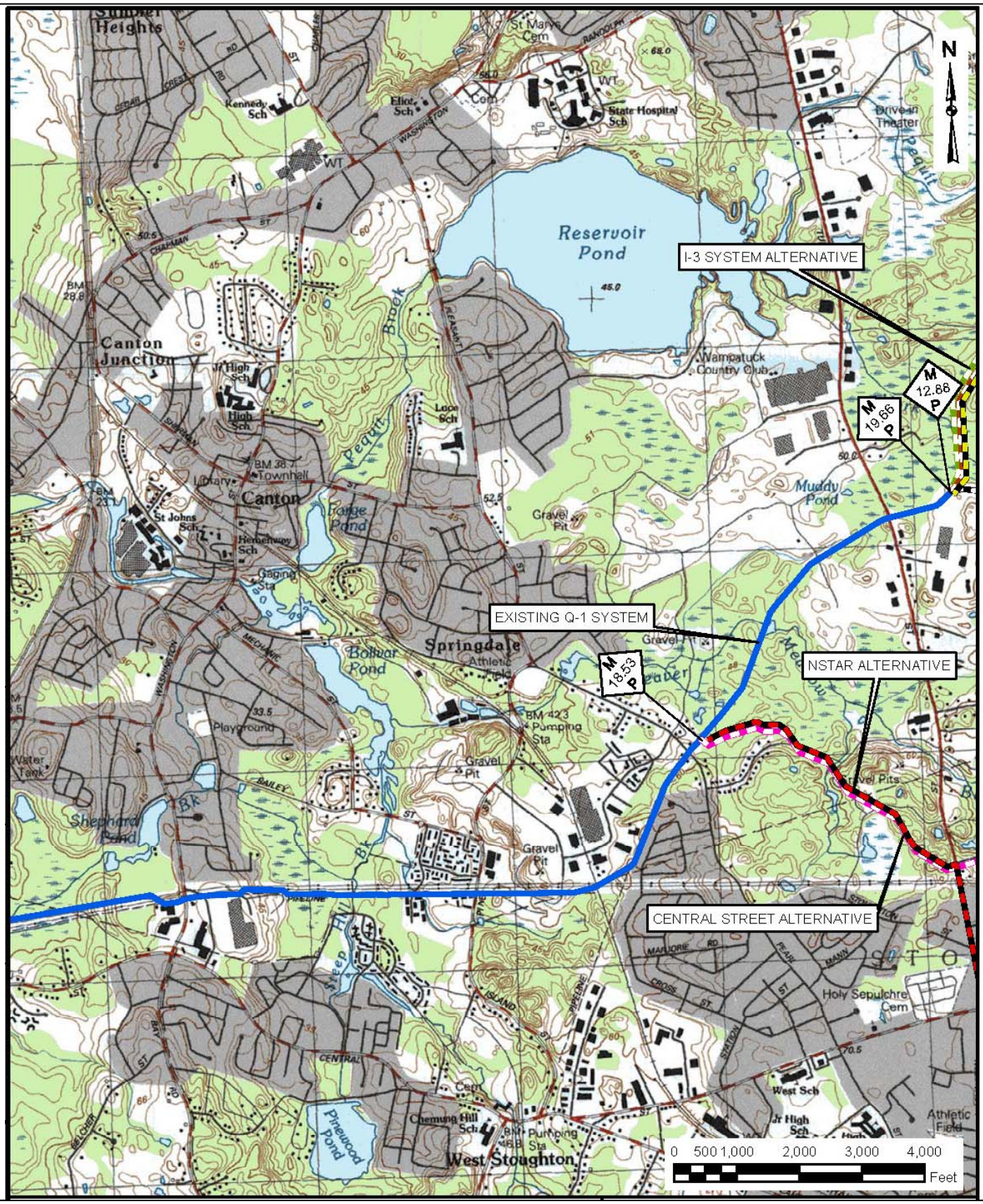

Figure 3.3.2-1
HubLine/East to West Project
Pipeline System and Route Alternatives to the Proposed I-10 Extension
Sheet 6 of 6