SOUTHEAST TO DANBURY
RAIL LINK FEASIBILTY STUDY

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PREPARED FOR:

PREPARED BY:

WSP

AKRF

K Engineering and Land Surveying, P.C.

Responsive Translation

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INTRODUCTION

The 48-mile Beacon Line was completed in 1882 between Beacon, New York, on what is now Metro-North Railroad's (MNR) Hudson Line, and Danbury, Connecticut, as a link between the Hudson River and the railroads throughout New England. From the Hudson Line at Beacon, the Beacon Line provides rail access to; a) Metro-North's Harlem Line at Dykeman's Corner, b) from Danbury, using connections within the Danbury Yard by reversing direction to South Norwalk on Metro-North's Danbury Branch, and c) east via the Housatonic Railroad's Maybrook Line to Derby on Metro-North's Waterbury Branch, and north via the Housatonic Railroad to Pittsfield, Massachusetts.

In the early 20th century, the section of the Beacon Line from Hopewell Junction east into Connecticut became part of the New Haven Railroad's Maybrook Line, a significant freight artery across the former Poughkeepsie Bridge. The 41-mile portion of the line from Beacon to the Connecticut state line was purchased by Metro-North in 1995. In addition, Metro-North has trackage rights on the portion of the line east of the Connecticut border, now owned by the Housatonic Railroad, as far east as Danbury. Scheduled passenger service has not run on the Beacon Line since 1927 and now, apart from limited non-revenue Metro-North activity, freight movements are rare. In 2006, Putnam County and MNR began the development of the Maybrook Bikeway, the scenic rail trail within the same corridor. The first portion of the bikeway was constructed in 2018, and opened in 2020, with the remainder slated for completion in 2022.

The Southeast to Danbury Rail Link Feasibility Study (the "Study") evaluates the restoration of passenger rail service on the southern Beacon Line, an approximate 11-mile rail corridor between the Southeast and/or Brewster Stations on the MNR Harlem Line in New York and the Danbury Station on the State of Connecticut/Metro-North Danbury Line in Connecticut (Figure 1). Approximately five miles of the existing rail corridor is located within New York and six miles are located within Connecticut. Proposed rail service would operate alongside sections of the almost complete Maybrook Bikeway and generally parallel to Interstate I-84. The Study undertook assessments of existing physical conditions, land use, environmental, economic and community sensitive sections as well as other factors that could affect development of the rail corridor.

While there are existing track connections between the Beacon Line, the Harlem and Danbury Lines, these connections are either operationally infeasible for timely passenger service, or geometrically deficient. Resolving the connection problems at the two ends is essential to initiating a successful service and this Study undertook development of various potential alternative connection configurations for each end of the corridor. The benefits, pitfalls, impacts and feasibility of each were also defined.

Station locations and their operations are equally critical, both for the two terminal points and intermediate stations at Danbury Fair and State Line, to provide a successful service. Proposed station operating concepts and supporting railroad infrastructure between them were developed for each alternative. Four distinct service alternatives were formulated into train service schedules, evaluated for ridership potential, and assessed regarding economic benefits and potential impacts. Capital and Operating costs for each alternative were then developed.

Assuming certain environmental concerns can be successfully addressed though future, more detailed analysis, the Southeast to Danbury Rail-Link was found to be technically feasible and could operate without degrading other Metro-North services. The Proposed Rail-Link Project as defined by this Study would provide an improved transit option between Southeast, New York and Danbury, Connecticut, carrying substantive numbers of existing and new riders, reducing commute times and traffic congestion on I-684 and I-84, and improving opportunities to enhance the local economies through the creation of jobs, new housing, and destination retail/ experiences.

This document encapsulates the various tasks and task specific memoranda developed for the Study. These are:

- Community and Stakeholder Engagement
- Assessment of Existing Conditions
- Definition/Development of Alternatives
- Ridership Forecasting
- Feasibility Assessment

COMMUNITY AND STAKEHOLDER ENGAGEMENT

Overview of Community and Stakeholder Engagement

Community and stakeholder involvement is an integral part of the transportation planning process. Gaining input from the residents and businesses that rely on, manage, and/or are affected by the transportation network is key to developing an effective transportation system. At the onset of the Study, Putnam County formed a Study Advisory Group that included local and regional transportation and municipal stakeholders. The Study Advisory Group served as a sounding board for project-related proposals and provided valuable insight into the needs of the transportation system and the community. Putnam County also held two community engagement meetings to brief the residents and businesses within and around the Project corridor. This stakeholder and community input helped guide the development and assessment of conceptual project alternatives.

Stakeholder Coordination

Study Advisory Group

The Study Advisory Group served as a working committee to provide direction and guidance in developing Study goals, objectives, alternatives, and recommendations. The group comprised representatives from transportation agencies with expertise in highway and rail operations, and representatives from local municipalities the project would serve. Members of the Study Advisory Group and their roles are summarized in Table 1 below.

TABLE 1: STUDY ADVISORY GROUP MEMBERSHIP AND ROLES

Member	Role
Putnam County	Project sponsor.
Metropolitan Transportation Authority Metro-North Railroad	Owner of New York portion of Beacon Line; potential operator of future rail service along this rail line.
Housatonic Railroad	Owner of Connecticut portion of Beacon Line; long-range plan contemplates possible extension of rail service north of Danbury.
Connecticut Department of Transportation	Maintains I-84 in Connecticut, which experiences heavy traffic congestion that could be alleviated by expanded rail service.
New York State Department of Transportation	Maintains I-84 and I-684 in New York, which experiences heavy traffic congestion that could be alleviated by expanded rail service.
City of Danbury, CT	Community potentially served by expanded rail service.

The Study Advisory Group met six times at key milestones throughout the course of the approximately one-year Study timeline. At these meetings, the Project Team presented and solicited input on the purpose and the scope of the Study, preliminary environmental considerations, conceptual project alternatives, and technical analyses (such as service planning and travel demand forecasts). The Study Advisory Group advised on various near-term highway and transit initiatives, as well as long-range visions, in the project corridor that might affect or relate to the Study and its alternatives.

Other Stakeholder and Agency Engagement

On November 30, 2021, Putnam County held an executive briefing to provide an update on the Study to transportation leaders and elected officials. Putnam County presented the development of conceptual project alternatives and provided an overview of the Study's technical analyses. On February 10, 2022, Putnam County presented the Study findings to a broader regional transportation audience at a briefing for the New York Metropolitan Transportation Council's (NYMTC's) Program, Finance and Administration Committee (PFAC). NYMTC serves as the Metropolitan Planning Organization (MPO) for New York City, the Lower Hudson Valley, and Long Island and is responsible for guiding regional transportation planning and managing federal transportation funds in the region. NYMTC also was the regional transportation agency sponsor for the Study.

Public Outreach

Putnam County held two community engagement meetings during development of the Study. The first meeting was held on December 6, 2021, to provide an overview of and obtain community feedback on the Study's conceptual alternatives and preliminary environmental, social, and economic considerations. The second meeting was held on March 30, 2022, to provide an

update on and obtain input from the community on the Study's advancement of the conceptual project alternatives and technical analyses. Copies of the presentation materials are in Appendix A. Due to the ongoing COVID-19 pandemic, each meeting was held virtually via Zoom.

Community meetings were advertised in multiple publications in Putnam County and the Danbury area, as well as the City of Danbury's website and social media outlets. Publications where the meeting notice appeared included:

- Putnam County News and Recorder
- Putnam County Courier
- Putnam County Times
- Danbury News-Times
- Danbury's HamletHub
- Tribuna Newspaper

To ensure language accessibility for the community meetings, Putnam County conducted an assessment to identify people in the project corridor with Limited English Proficiency (LEP). LEP persons are individuals who do not speak English as their primary language and who have a limited ability to read, speak, write, or understand English. Based on information published by the U.S. Census Bureau, the LEP analysis found that substantial populations of LEP persons with Spanish or Portuguese as their primary languages reside in the project corridor. Therefore, community meeting advertisements in each publication were provided in English, Spanish, and Portuguese. Additionally, each community meeting included real-time Spanish and Portuguese interpretation with live interpreters on designated channels on the Zoom platform.

A project email address (SE2D@akrf.com) was established to allow for the community to submit comments on the Study. Commenters asked for clarification on the cost-benefit of implementing new rail service between Southeast and Danbury, potential travel time savings, potential interface, and redundancy with other transportation initiatives in the project corridor, and potential impacts to the Maybrook Rail Trail. Commenters also suggested other alternatives, such as expanding parking and improving roadway access to the existing Southeast Station. "Frequently Asked Questions" in Appendix A provides further discussion of comments received and responses to those comments.

ASSESSMENT OF EXISTING CONDITIONS

The study area boundary for the Study varied depending on the resource under consideration but generally buffered the lower Beacon Line corridor at a ¼ mile radius. Project Team members collected various data for the corridor using desktop geographic information systems (GIS), online database research, and visual field photo cataloguing. The following subsections summarize the existing conditions research, investigations, and analysis.

SUMMARY OF EXISTING PLANS AND STUDIES

To better understand the state of corridor conditions, relevant area planning studies, certified Environmental Impact Statements, and other development reports completed within the past decade were collected and reviewed to better inform corridor conditions analyses as part of this Study. .Project Team members collected various reports for the corridor using database searches, outreach to Study Advisory Group members, and the internet. As part of that collection it was discovered that the Federal Highway Administration (FHWA) had recently published a Rails With Trails Guidebook, which was very pertinent to the project The following is a summary of the plans and studies reviewed, with a more detailed look at the Rails with Trails Guidebook.

Downtown Danbury – Transit Orientated Development Study – 2019

The transportation and infrastructure analyses in the Downtown Danbury – Transit Orientated Development Study focused on the feasibility of co-location of the rail and bus transit service facilities, with the potential benefit of improving passenger rail connections to the Metro-North Harlem Line to the west of Danbury. The study determined that the existing HARTransit bus hub and Peter Pan bus service could be relocated to a site adjacent to the existing Danbury Train Station. The study considered the extension of passenger rail service over existing rail lines in a westerly direction providing a connection to the Metro-North Harlem Line for its potential benefits.

The study listed "Participate in, expand, and support opportunities for rail connections to the Metro-North Railroad Harlem Line" as a one of its high priority initiatives. It also identified possible funding sources for expanded service to include, in addition to State funding opportunities, federal options as the CMAQ and TIGER programs as well as Capital Investment Grants, Urbanized Area Formula Grants, and Surface Transportation Block Grants.

Danbury & Fairfield Route 37 Corridor Study – 2021

The purpose of the Danbury & Fairfield Route 37 Corridor Study is to develop a conceptual plan for current and long-range intermodal travel, economic development, and sustained quality-of-life along Route 37 in the municipalities of Danbury and New Fairfield, Connecticut. The study selected as its preferred alternative a conceptual alignment that would maintain a multi-use path along the Route 37 right-of-way where feasible. In locations where a side path along Route 37 is not feasible, the multi-use path would use reservoir property, but maintain as much distance to the reservoir as possible. Scenic overlooks are proposed. The study did not address service connection to Metro-North's Harlem Line.

Danbury Branch Improvement Program Transit Oriented Development – 2010

The Danbury Branch Improvement Program Transit Oriented Development Study outlined what transit-oriented development (TOD) plans are underway for each of the existing rail stations along the Branch, as well as the TOD opportunities that could result if improvements to the Branch are implemented. The study identified two potential sites for a North Danbury station but did not address service connection to Metro-North's Harlem Line.

Danbury Branch Line Final Implementation Plan – 2016

The study evaluated the Danbury Branch Rail Line to determine the current and future needs of this corridor and to identify potential improvements to address those needs. Two major improvements were evaluated as part of the Danbury Branch study: extend service from Danbury to New Milford and electrify the existing passenger service line between the South Norwalk and Danbury Stations. These improvements would allow for extended one-seat ride service on the New Haven Line. The study did not address service connection to Metro-North's Harlem Line.

Danbury's Plan of Conservation and Development – 2013

The Plan of Conservation and Development constitutes the planning component of the Comprehensive Planning Program for the State of Connecticut. The plan is composed of goals, policies and recommendations designed to promote the coordinated development of the City and includes strategies and recommendations for its implementation. The study supported commuter rail service to New York and expansions in service to meet growing demand; extending service to New Milford from Danbury.

Envision Brewster: Village of Brewster Opportunity Area Implementation Plan– 2013

The Village of Brewster embarked on a new community revitalization effort known as "Envision Brewster" in late June 2013. The effort examined the changing demographic and economic trends and contemplated strategies to develop the Village in a sustainable manner. This plan focused on the Main Street Corridor, leveraging the Metro North Commuter Rail station to provide opportunities for residential, commercial, and mixed-use development to create a pedestrian friendly, transit-oriented Village. The study did not address a service connection to Metro-North's Harlem Line from Danbury, but a connection would support the goals of the plan.

Documents that were developed to realize the vision:

- Envision Brewster Development Overview – potential development plans for Main Street
- Resolution No: 031721-2 – authorizing eminent domain for several parcels
- Resolution No: 071713-1 – memorandum of understanding designating Covington Development as the approved developer
- 2013 Opportunity Area Application

2019 Housatonic Valley MPO Long-Range Transportation Plan

The Long-Range Transportation Plan (the Plan) is the metropolitan transportation plan for the Housatonic Valley Metropolitan Planning Organization (HVMPO) for the 2019 - 2045 timeframe. The Plan reflects the region's current conditions, identifies future transportation needs, and recommends projects that meet those needs.

The strategies of the plan include:

- Optimize use of the region's rail system for passenger and freight movement
- Expand passenger rail service to additional communities and reactivate former freight and passenger rail lines for passenger rail service, including the extension of passenger rail service on the Danbury Branch Line north into New Milford, and connections between Brewster, NY and Danbury, CT and connections between Derby and Newtown, just east of Danbury on the Beacon Line.
- Promote clean air initiatives to encourage smart growth and TOD; use of alternative fuels; expand effective travel demand management programs such as telecommuting, flexible work weeks and various forms of ridesharing; support public transit, rail freight, traffic flow improvements, and incident management programs.

Putnam County Main Street Partnership Planning Study – 2009

The Putnam County Main Street Partnership Planning Study was a partnership between Putnam County and its towns and villages to address issues of community revitalization in the County's hamlets, villages, and traditional commercial centers. The study's recommendations aimed to fill vacant retail space with businesses that will not only compliment those which already exist, but draw people from elsewhere in the County and along the Metro North Harlem Line into Brewster. The study did not address service connection to Metro-North's Harlem Line from Danbury.

Putnam County Commercial Corridors Planning and Feasibility Study – 2017

The purpose of the study was to establish recommendations towards the revitalization and improvements for 10 commercial corridors. The study recommended extending the more developed City of Danbury end of the U.S. Route 6 Corridor into Southeast, fortifying the viability of the existing and proposed development with the expectation of inviting new and larger development options to the New York side of the corridor. The study did not address a service connection to Metro-North's Harlem Line from Danbury.

Vision 2010: Guiding Putnam into the Next Decade – 2010

The Vision 2010 Committee's task was to create a portrait of what Putnam County could and should be in the first decade of the 21st Century. The study analyzed past, current, and projected growth trends, gathered community input to determine community values, and interviewed key community leaders to gather local expertise and ascertain goals for the future. The study recommended a continuation of work with MNR to improve service and expand ridership through projects related to signalization, rolling stock, stations, track, walkways, parking, and beautification. The study did not address service connection to Metro-North's Harlem Line from Danbury.

Moving Forward: Your Region Connected – 2021

NYMTC developed its next draft regional transportation plan which is currently in public review. The plan identifies Vision Goal 4.4 - Planning for Changing Demand. The goal seeks to ensure the efficiency of the transportation system by identifying and funding, to the extent possible, feasible and cost-effective investments. The goal states that public transit in the NYMTC planning area will need to continue to grow, innovate, and integrate to efficiently serve the current and growing population and employment projected for the planning period. The plan does not identify service connection to Metro-North's Harlem Line from Danbury as a project.

RAILS WITH TRAILS GUIDEBOOK

In May of 2021, FHWA published its Rails With Trails Guidebook, focusing on best practices and lessons learned in the development, operation, and maintenance of trails within active rail rights-of-way. The guidebook notes that at the end of 2018, there were 343 identified rails-with-trails in the United States, totaling 917 miles of rails with-trails in 47 States. The majority of rails-with-trails (68 percent) are located along Class I, II, or III freight railroads. Of the 8 largest Class I railroads, half of them have some form of written policy regarding trails with rails, largely their prohibition if not delineating limited acceptable means.[1]

Given the close presence of existing and planned bike trails adjacent to the proposed rail line, considerable attention was spent evaluating similar situations in other parts of the nation as well as to consider the improvements that made to provide a safe and compatible co use of the right-of-way. Some examples of trails within freight rails are:

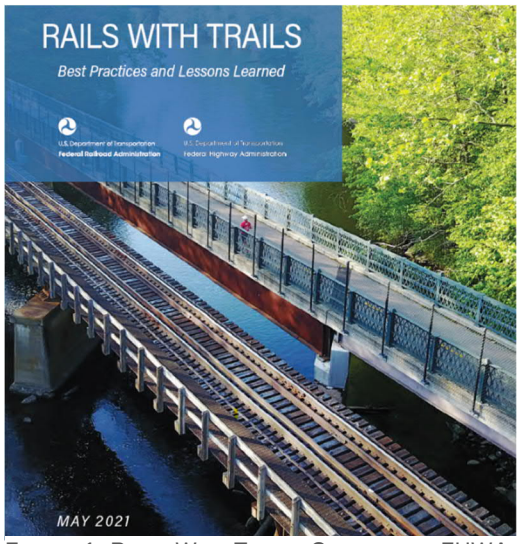


FIGURE 1: RAILS WITH TRAILS GUIDEBOOK, FHWA 2021

- Island Line Greenway, Burlington VT, is adjacent to the Vermont Railway in downtown Burlington VT
- Camp Chase Trail, Columbus OH, is adjacent to the Camp Chase Industrial Railway in southwestern Columbus OH
- 5 Star Trail, Greensburg PA, is adjacent to the Southwestern Pennsylvania Railroad in the town of Greensburg, Westmoreland County PA
- Schuylkill River Trail, Philadelphia section, is adjacent to the CSX Philadelphia division on the eastern bank of the Schuylkill River in center city Philadelphia PA.

However, since 2000 there has been an increasing trend of building rails-with-trails along passenger rail and rail transit lines with adequate separation distances (including heavy rail and light rail) that are more analogous to the Maybrook/Beacon Line.

Some examples of such facilities are:

- Schuylkill River Trail, Norristown to Spring Mill Section, is adjacent to the SEPTA Norristown/Manayunk Commuter Rail Line
- Metropolitan Branch Trail, Washington DC, roughly paralleling the WMATA Metro Red Line from Union Station to Silver Spring, MD.
- Porter Rockwell Trail, Draper and Sandy, UT, paralleling the UTA Light Rail Blue Line
- Parleys Trail, South Salt Lake City, UT, paralleling the UTA Light Rail S Line
- Hiawatha Blue Line Trail, Minneapolis, MN, paralleling the MetroTransit Blue Line

[1] FHWA-HEP-21-017, *Rails With Trails*, May 2021, FHWA, pp 1-4.

- Denton Branch Rail Trail, Denton, TX, paralleling the DCTA A Line commuter train line from Denton to Lewisville Lake Station

The following is a brief write-up on each example.

Schuylkill River Trail, Norristown to Spring Mill Section and Center City Philadelphia Section

The Schuylkill River Trail is a 120-mile greenway from Philadelphia, PA, to Frackville in Schuylkill County, PA. The majority of the paved/crushed gravel trail is located on abandoned rail lines, however from Norristown, PA to the former Shawmont Station the trail largely follows the corridor of the Southeast Pennsylvania Transportation Authority (SEPTA) Norristown/Manayunk Commuter Rail Line.

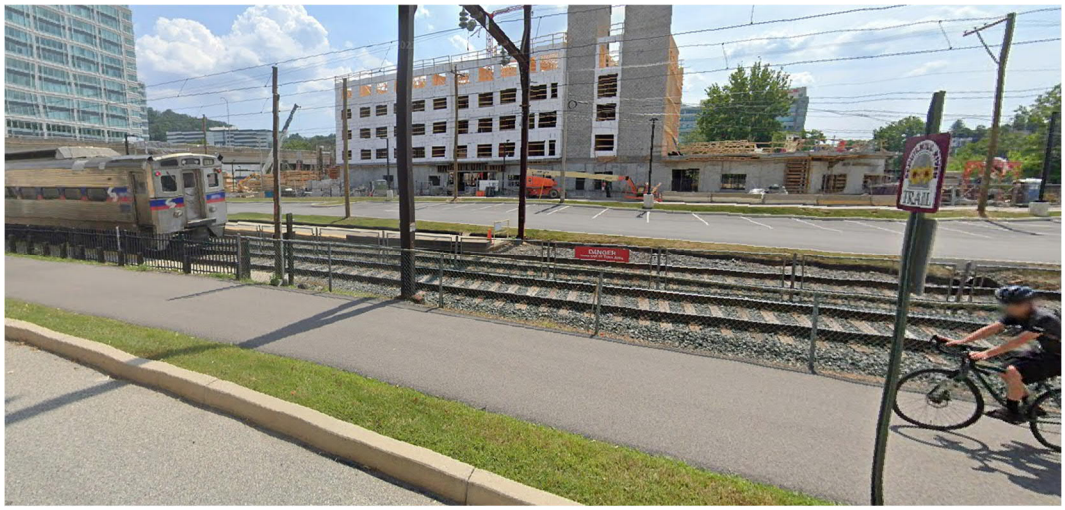


FIGURE 2: SCHUYLKILL RIVER TRAIL AT CONSHOCKEN STATION OF SEPTA NORRISTOWN/MANAYUNK COMMUTER RAIL LINE (SOURCE GOOGLE MAPS)

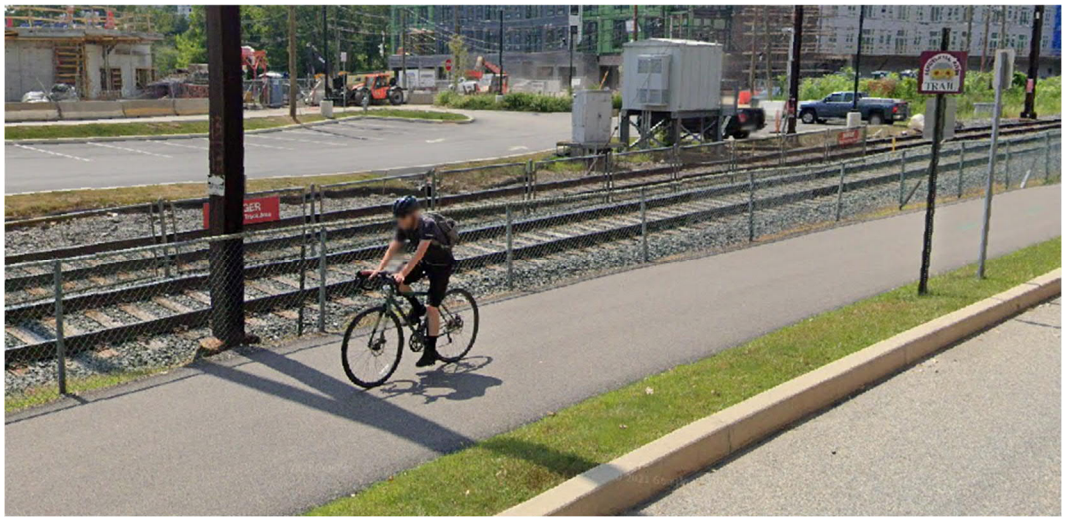


FIGURE 3: SCHUYLKILL RIVER TRAIL AT CONSHOCKEN STATION OF SEPTA NORRISTOWN/MANAYUNK COMMUTER RAIL LINE ALTERNATE VIEW (SOURCE GOOGLE MAPS)

Note the presence of 6-foot-high chain link fence between the trail and rails, at a fairly close distance. The Norristown/Manayunk Commuter Service operates two trains an hour in the peak periods, and one train an hour in the off peak to/from center city Philadelphia and Norristown.

The Schuylkill River Trail also travels alongside the Philadelphia division of CSXT freight railroads in center city Philadelphia. While freight service is less frequent, the rails are in close proximity to the trail immediately adjacent to the Schuylkill River and only separated by a 6-foot chain link fence.

FIGURE 4: SCHUYLKILL RIVER TRAIL IN CENTER CITY PHILADELPHIA ADJACENT TO CSXT TRACKS LOOKING SOUTH (SOURCE GOOGLE MAPS)

Metropolitan Branch Trail, Washington DC.

The Metropolitan Branch Trail is an 8-mile rail trail that runs from Union Station, Washington DC to Silver Spring, Maryland loosely following the former Baltimore and Ohio Railroad's Metropolitan Branch. The trail moves on and off the right of way depending on available space. The right-of-way is owned by the Washington Metropolitan Area Transit Authority (WMATA), CSX, and Amtrak, and has the WMATA Red Line operating within it. For the section of the right-of-way nearest Union Station,

FIGURE 5: METROPOLITAN BRANCH TRAIL, NOMA-GALLAUDET STATION TO UNION STATION SEGMENT (SOURCE: GOOGLE MAPS)

the trail is directly adjacent to the Red Line, as shown in Figure 5.

Note the 8-foot fence with intrusion protection at the top, separating the Red Line from the trail. The Red Line operates on a 12-minute headway, and is a 6 car, 3rd Rail DC heavy rail transit car making passbys of pedestrians quite frequent.

Porter Rockwell Trail, Draper and Sandy, UT

FIGURE 6: PORTER ROCKWELL TRAIL, IN UTA TRAX BLUE LINE RIGHT-OF-WAY (SOURCE GOOGLE MAPS)

The Porter Rockwell Trail is a 4.8-mile paved multi-use trail in the Utah Transit Authority (UTA) Trax Blue Line (LRT), running from Draper to Sandy, UT. The right-of-way is substantial, with significant separation between the trail and train tracks as it was the former Union Pacific Railway right-of-way between Provo and Salt Lake City, UT before UTA took ownership.

Looking at Figure 6, the trail is separated from the rails by a 4-foot-high fence. The UTA Trax blue line LRT operates at a 20-minute headway, typically in 4 car train configurations.

Parleys Trail, South Salt Lake City, UT

The Parleys Trail is a 8-mile paved multi-use trail that partly parallels the UTA Trax S Line (Streetcar), in South Salt Lake and Sugar House neighborhoods of Salt Lake City, UT. The UTA S Line connects the various north-south Trax Rail Stations in South Salt Lake by a streetcar service that operates at 25 mph over a 2-mile corridor at a 15-minute headway.

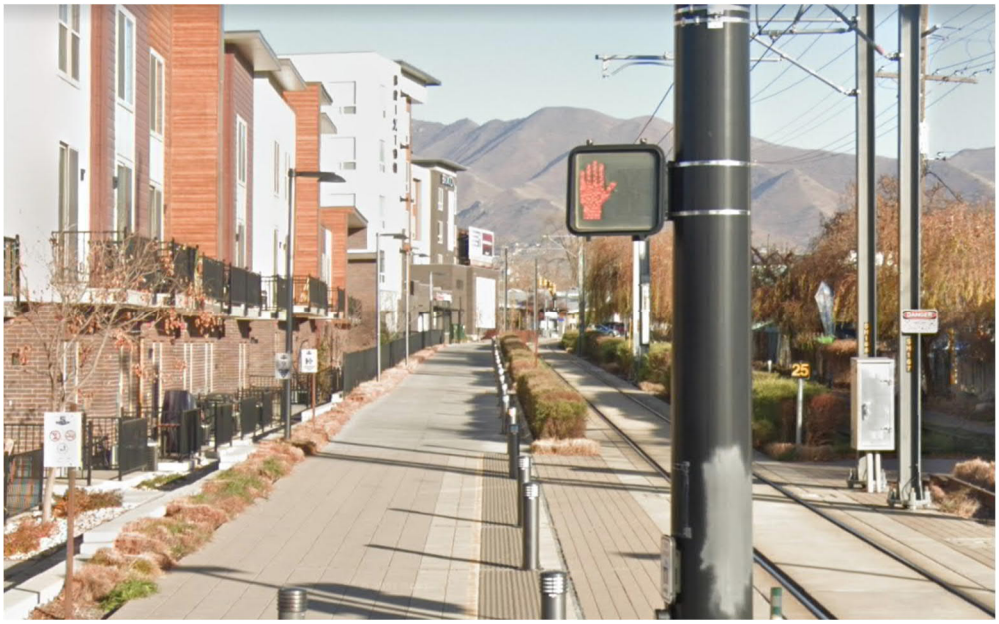


FIGURE 7: PARLEY'S TRAIL S LINE GREENWAY SECTION SOUTH SALT LAKE, UT (SOURCE: GOOGLE MAPS)

Looking at Figure 7, there are a series of 3-foot bollards and modest plantings separating the trail and rails.

Hiawatha Blue Line Trail, Minneapolis MN

The Hiawatha Blue Line Trail is a 4.7-mile paved multi-use trail partially in the MetroTransit Blue Line (LRT) right-of-way in the south of Minneapolis. MetroTransit' s Blue line operates to the Minneapolis/St Paul International Airport to Target Field in Downtown Minneapolis on a 10–15-minute headway utilizing 2-3 car LRT trainsets. For the segment of trail directly parallel to the Blue Line tracks, there is only a 4-foot-high barbed wire fence separating the trail from the tracks.

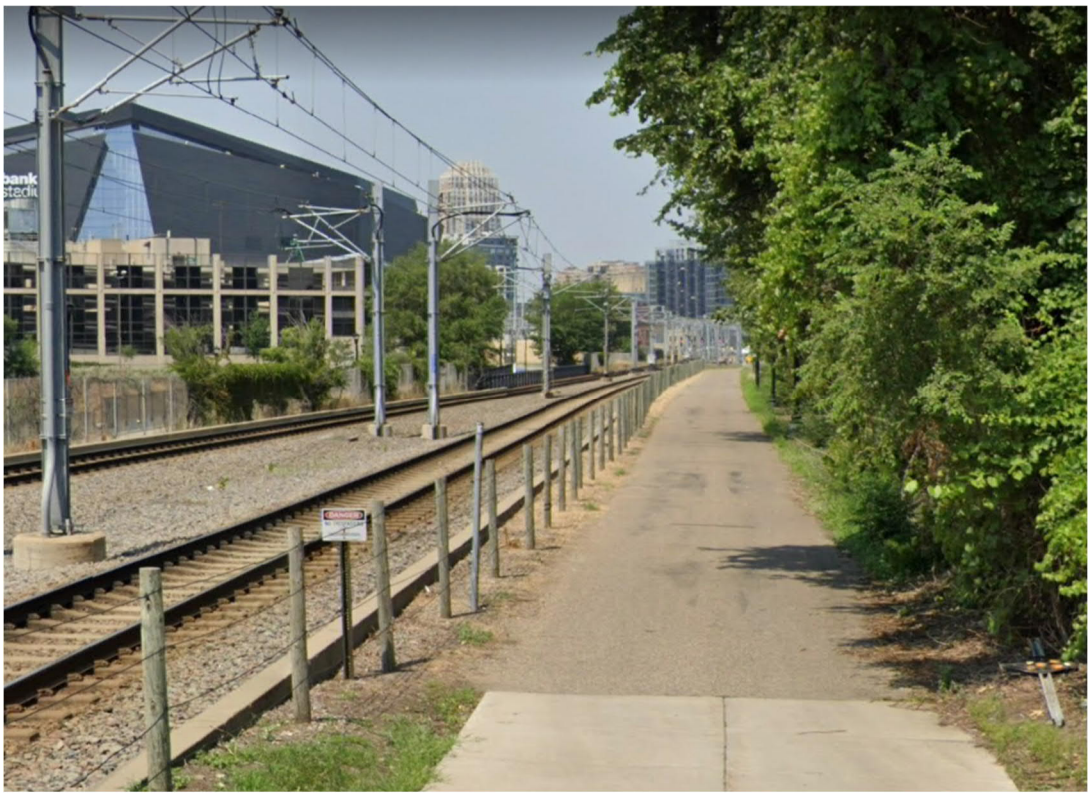


FIGURE 8: HIAWATHA BLUE LINE TRAIL, MINNEAPOLIS MN (SOURCE: GOOGLE MAPS)

Denton Branch Rail Trail, Denton, TX

FIGURE 9: A LINE TRAIL, DENTON TX (SOURCE: GOOGLE MAPS)

Also known as the A Train Rail Trail, the Denton Branch Rail Trail is a 19-mile paved multi-use trail mostly paralleling the Denton County Transportation Authority's (DCTA) A train commuter rail line from Denton to Lewisville Lake Station, TX. DCTA's A line operates to the Trinity Mills Dallas Area Rapid Transit (DART) Green Line station from the downtown Denton Transit Center on a 30-minute headway utilizing 4 car diesel multiple unit trainsets.

The trail is separated from the tracks by a 4-foot-high chain link fence, as shown in Figure 9.

Review Considerations

It is important that as the Proposed Project continues to be developed that both education for the active community and security for the railroad be further investigated.

Future project designers should consult with the Maybrook trail managers and the railroad operators to determine whether trail user education related to the adjacent railroad activities is necessary. In many cases, railroads and trail managers may agree that signage, adequate setback, and separation between the trail and tracks is sufficient to protect each other's interests.

In many cases, the presence of a rail-with-trail channelizes would-be trespassers onto the trail, reducing trespassing and vandalism. In the case of the Maybrook Trail some form of high fencing separating the trail from the rails is a must to ensure both trail and rail user protection. As the Proposed Project develops further, a variety of materials/interventions should be evaluated to best suit the immediate separation in the various landscapes the route passes through.

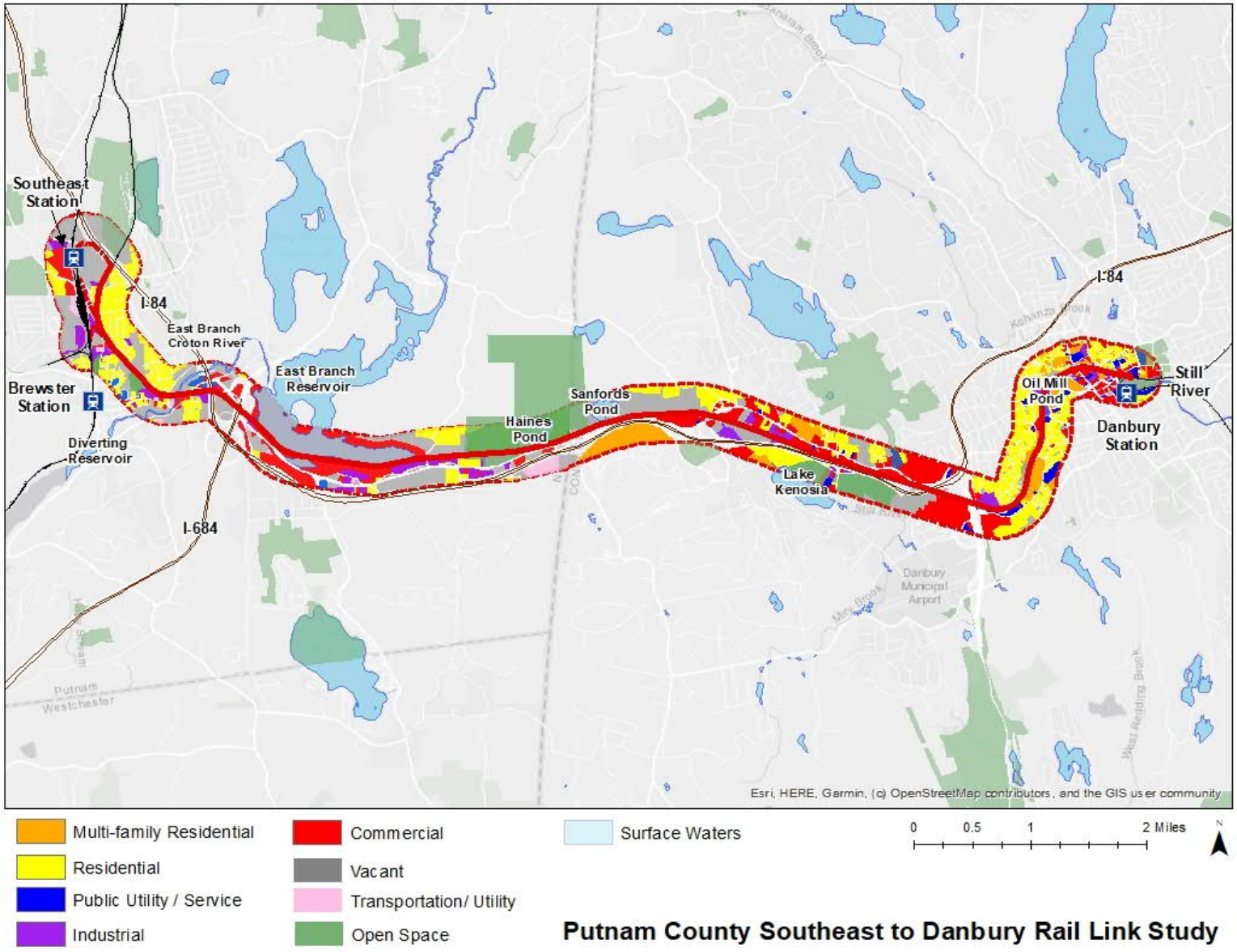
SOCIOECONOMIC CONDITIONS

Within this section is a discussion of the social environment in the vicinity of the project corridor. The Study evaluated the existing rail corridor between the City of Danbury in Fairfield County, Connecticut, and the Village of Brewster in Putnam County, New York. The study corridor generally parallels I-84 and includes a 0.25-mile radius surrounding the rail corridor. The study corridor is anchored to the east by the City of Danbury, which contains primarily low to medium density residences and mixed uses. To the west the study corridor is anchored by the Village of Brewster, which contains primarily low-density residences and commercial uses. The study corridor between Danbury and Brewster is characterized by a mix of low-density uses including residences, open space, community facilities, and industrial warehouse facilities. The Proposed Project would be expected to occur primarily within the existing railway right-of-way, except in the locations of the possible new rail line connections. While this would make the project unlikely to result in the relocation of homes or businesses or changes to existing land uses adjacent to existing railway, there may be potential impacts existing land uses and populations adjacent to the rail line and connection points.

Land Use

The study area for the assessment of land use is the same as the project corridor, a 0.25-mile radius surrounding the existing rail corridor and the three (3) contemplated connections. As shown in Figure 10, the study area includes a variety of uses and densities. The areas closest to the Danbury, Southeast, and Brewster Stations contain primarily single and multi-family residences and commercial uses. The portion of the study area between the anchoring municipalities is lower density and contains residences, industrial warehouse uses, open spaces, and community facilities. Rural suburban residential and low density, single-family homes are the most common dwellings located within the study area. There are also vacant parcels of land dispersed throughout the study area.

FIGURE 10: LAND USE MAP



Social Groups Benefited or Harmed

Low Income, Minority and Ethnic Groups (Environmental Justice)

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, directs federal agencies to take the appropriate and necessary steps to identify and address disproportionately high and potentially adverse effects of federal projects on the health or environment of minority and/or low-income populations to the greatest extent practicable and permitted by law.

- *Minority Communities*: The FHWA's *Guidance on Environmental Justice and NEPA* defines minorities as those who identify as Black or African American, Hispanic, Asian American, American Indian/Alaskan Native, and Native Hawaiian or Pacific Islander. The assessment should also include persons who identified themselves as being "some other race" as minority populations. Following the CEQ *Environmental Justice Guidance Under the National Environmental Policy Act*, minority communities are identified where either 1) the minority population of the affected area exceeds 50 percent of the total population, or 2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate units of geographic analysis.

- *Low-Income Communities*: According to the USDOT order, low-income population means any readily identifiable group of low-income persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient persons (such as migrant workers) who would be similarly affected by a proposed USDOT program, policy, or activity. In accordance with CEQ guidance and USEPA's *Promising Practices for EJ Methodologies in NEPA Reviews*, low-income populations should be identified with the annual statistical poverty levels from the Census Bureau.

The project corridor passes through several Environmental Justice Areas as identified by both the New York State Department of Environmental Conservation (NYSDEC) and the Connecticut Department of Economic and Community Development (DECD). To assess the Proposed Project's potential to affect Environmental Justice, a study area based on U.S. Census Bureau census tracts was established. For this Study, it is all census tracts within a quarter mile of the study corridor (see Figure 11).

In New York State, Potential Environmental Justice Areas (PEJAs) are Census block groups of 250 to 500 households each that, in the Census, had populations that met or exceeded at least one of the following statistical thresholds[2]:

- At least 52.42% of the population in an urban area reported themselves to be members of minority groups; or
- At least 26.28% of the population in a rural area reported themselves to be members of minority groups; or
- At least 22.82% of the population in an urban or rural area had household incomes below the federal poverty level.

In Connecticut, Environmental Justice Block Groups are determined by weighing the following statistics[3]:

- Per capita income for 2018;
- % of poverty in population for 2018;
- Unemployment rate for 2019;
- % change in population from 2000 to 2010;
- % change in employment from 2009 to 2019;
- % change in per capita income from 2000 to 2018;
- % of house stock built before 1939 in 2018;
- % population with high school degree and higher in 2018; and,
- Per Capita Adjusted Equalized Net Grand List in 2020-2021.

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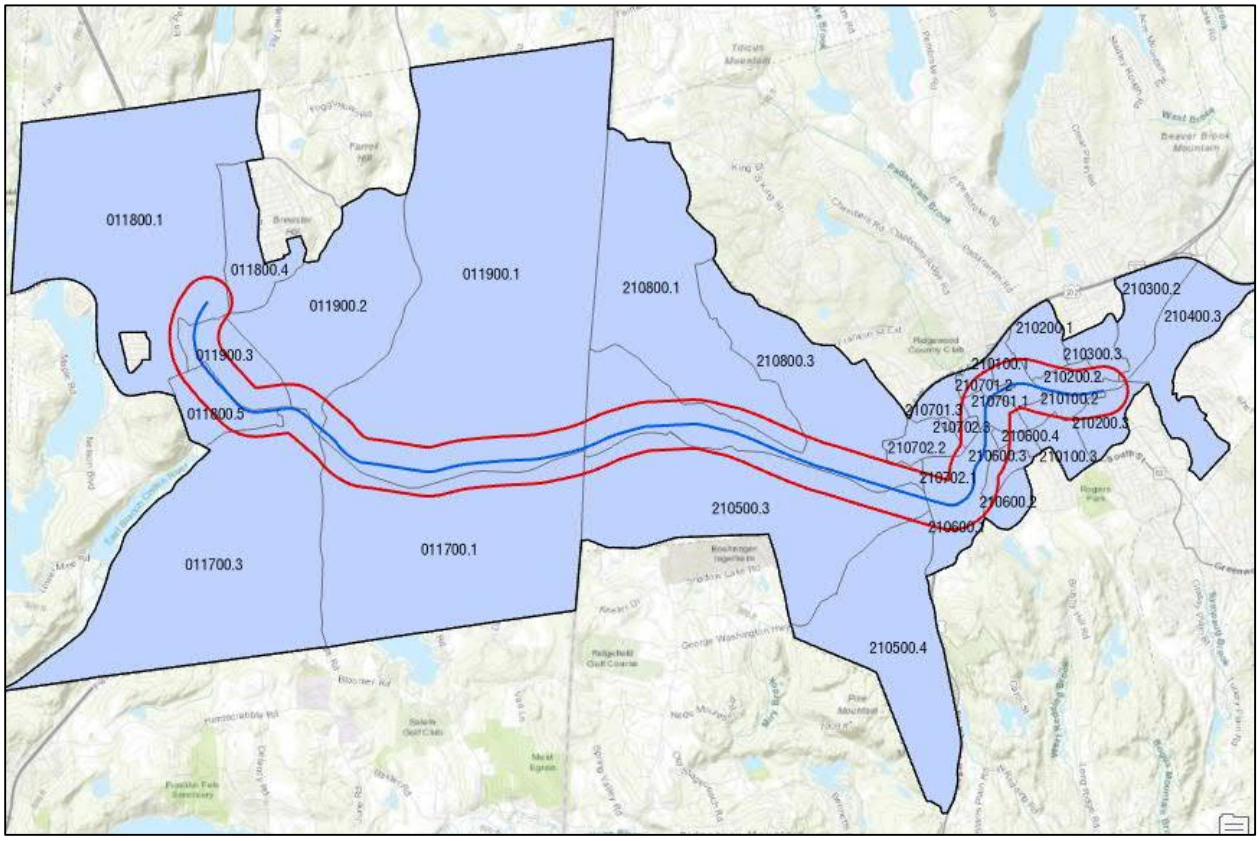
[2] https://www.dec.ny.gov/public/911.html

[3] https://portal.ct.gov/DEEP/Environmental-Justice/Environmental-Justice-Communities

FIGURE 11: SOCIOECONOMIC STUDY AREA



The study area contains NYSDEC defined PJEAs 15000US360790118005 and 15000US360790119002, and DECD defined EJ Block Groups 090012107021, 090012106001, 090012107022, 090012107013, 090012107023, 090012107011, 090012106004, 090012101003, and 090012101002.

Based on the American Community Survey (ACS) 5-year estimates (2015-2019), the study area has a population of approximately 59,592. Of the study area population, approximately 52.27 percent are minority populations, and 47.73 percent are white. As shown in Figure 12, the minority populations are concentrated in Danbury and with a small grouping near the Brewster Station. The median annual household income of the study area is approximately $77,664, and approximately 12.9 percent of households within the study area live below the poverty line, again concentrated at Danbury and Brewster (see Figure 13). The study area contains a higher proportion of both minority populations and individuals living below the poverty line compared to Putnam County, New York and Fairfield County, Connecticut overall.

Additionally, the study area population includes individuals with Limited English Proficiency (LEP). Accommodating individuals with LEP is a requirement of Title VI of the Civil Rights Act of 1964 and Executive Order 13166, “Improving Access to Services for Persons with Limited English Proficiency (LEP).” These regulations ensure that individuals with LEP should have meaningful access to federal programs and activities. New York Executive Order 26, issued in October 2011 and amended with Executive Order 26.1 in March 2021, further directs New York State agencies to provide language assistance services to LEP persons. In accordance with the United States Department of Transportation (USDOT) guidance, written translation of vital documents is generally required for LEP language groups that constitute five percent or 1,000 persons, whichever is less, of the total study area population. The most recently available data of detailed language-speaking categories for the LEP population were provided in the 2011-2015 ACS 5-year estimates. Based on this data and the above thresholds, it is recommended that Spanish and Portuguese translation materials and services be provided as part of the public outreach efforts for the Proposed Project.

FIGURE 12: STUDY AREA MINORITY POPULATIONS

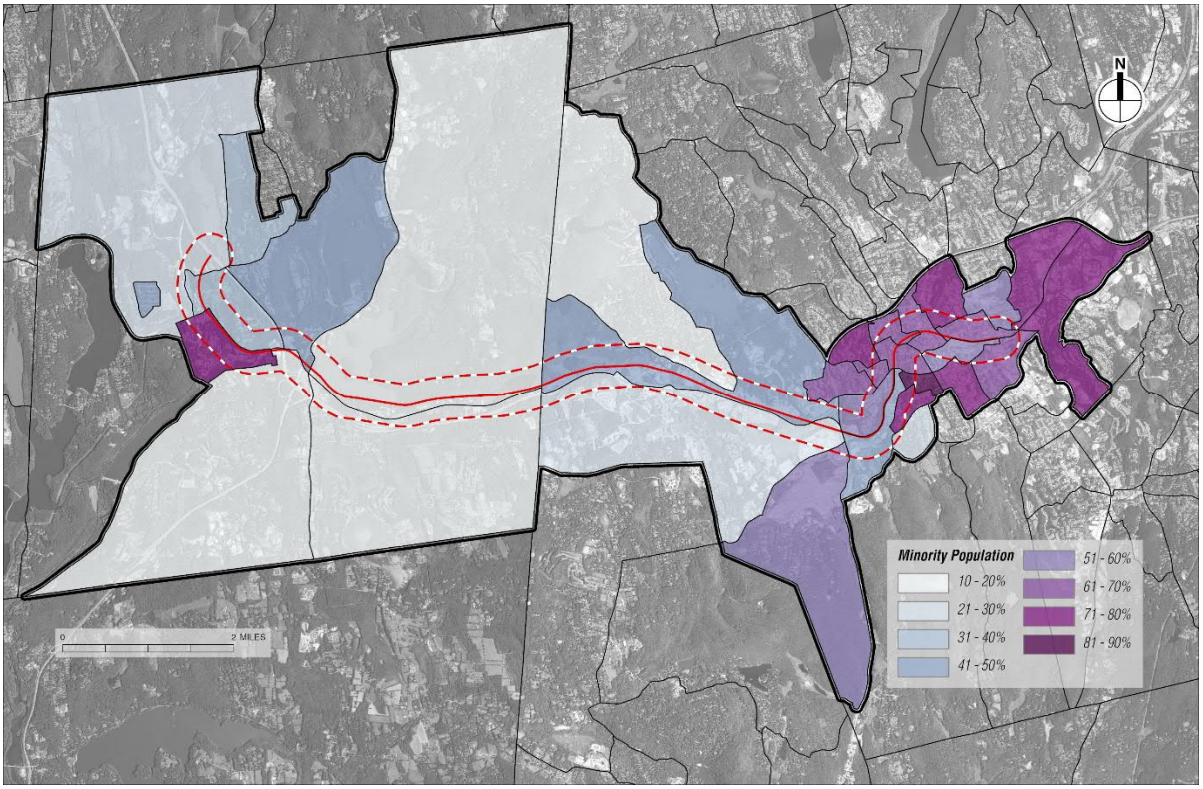
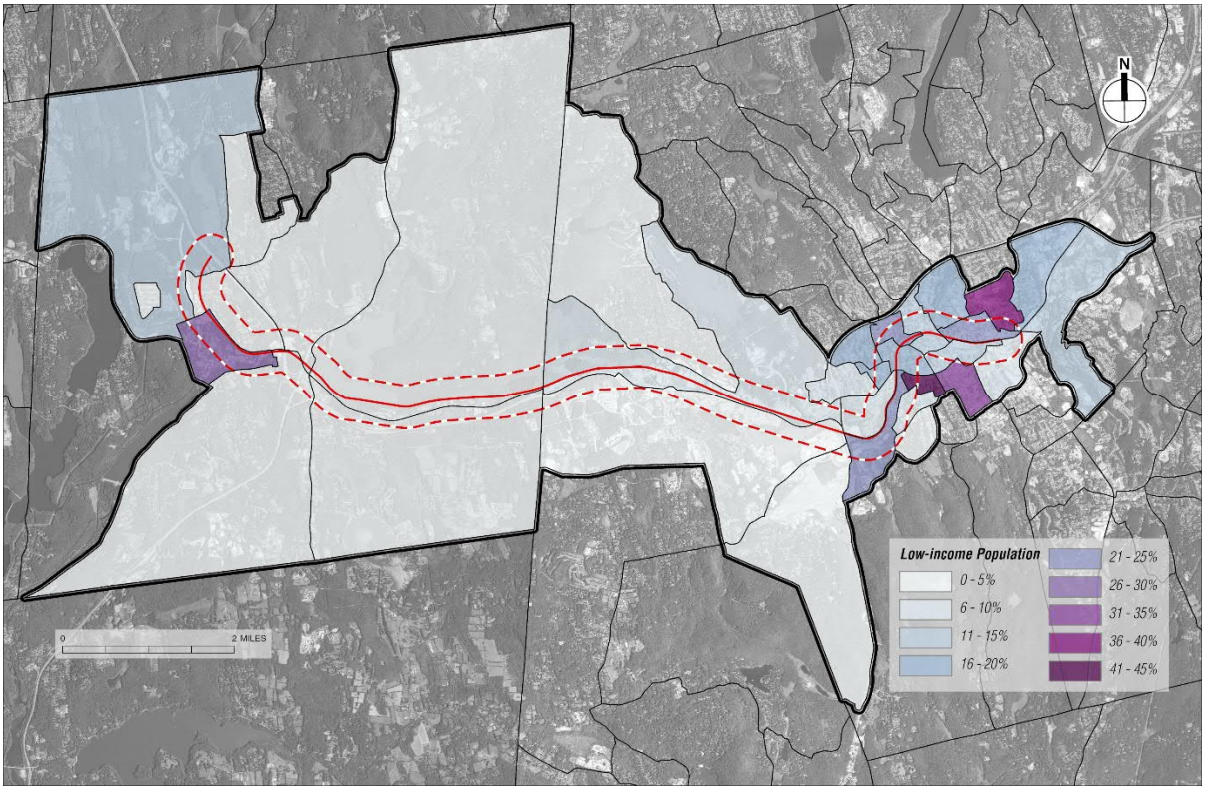


FIGURE 13: STUDY AREA LOW-INCOME POPULATIONS



ENVIRONMENTAL CONDITIONS

Wetlands

State Freshwater Wetlands

Based on a review of NYSDEC and Connecticut Department of Energy and Environmental Protection (CTDEEP) freshwater wetlands inventory maps for Putnam and Fairfield Counties, there are NYSDEC and CTDEEP regulated freshwater wetlands in or adjacent to the study corridor (see Figure 14). A full wetland delineation will be required to confirm the type, size, and boundaries of the wetlands if the Proposed Project progresses.

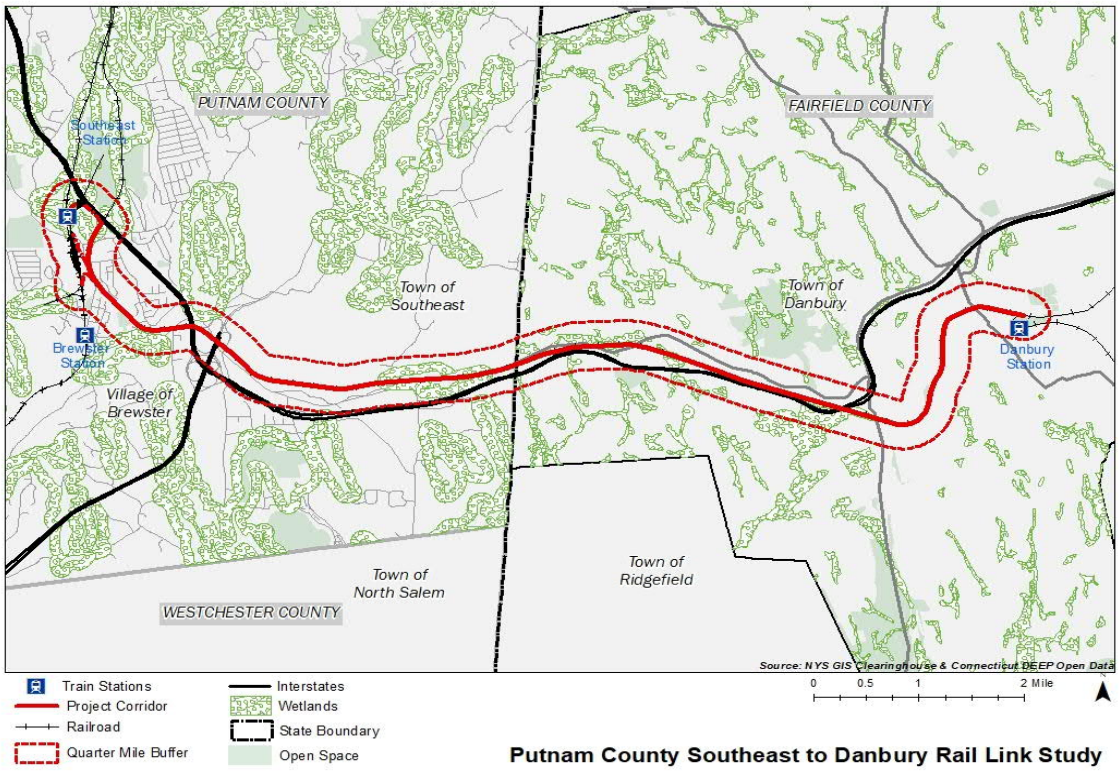
State Tidal Wetlands

In New York State, NYSDEC administers a permit program regulating activities in tidal wetlands and their adjacent areas as described in Article 25, of the Environmental Conservation Law (ECL). In Connecticut, DEEP administers the regulation of activities occurring within tidal wetlands as described in Connecticut General Statutes (CGS) sections 22a-28 – 22a-35a and the Tidal Wetlands Regulations. A review of the NYSDEC and CTDEEP wetland data files indicates that there are no state jurisdictional tidal wetlands or regulated adjacent areas within the study corridor. Based on this information, ECL Article 25 and CGS sections 22a-28 – 22a-35a and associated Tidal Wetlands Regulations would not apply to the Proposed Project.

Federal Jurisdiction Wetlands

Based on a review of the U.S. Fish and Wildlife Service National Wetlands Inventory, federal jurisdictional wetlands exist within the study corridor. It is anticipated that the Proposed Project would result in impacts to wetlands and additional analysis, including a wetland delineation, would be needed to determine the extent of such impacts. . However, all practicable measures to minimize impacts to wetlands will be utilized. Depending on the extent of wetlands impacts, mitigation may be required and work will adhere to all permit conditions. An Individual Section 401 Water Quality Certification (WQC) and/or an Individual Section 404/Section 10 Permit from the U.S. Army Corps of Engineers (USACE) may be required for the Proposed Project, depending on the ultimate project definition.

FIGURE 14: PROJECT CORRIDOR STATE WETLANDS



Surface Waterbodies and Watercourses

Surface Waters

There are multiple surface waterbodies that either cross the study corridor or are immediately adjacent to the corridor (see Figure 15).

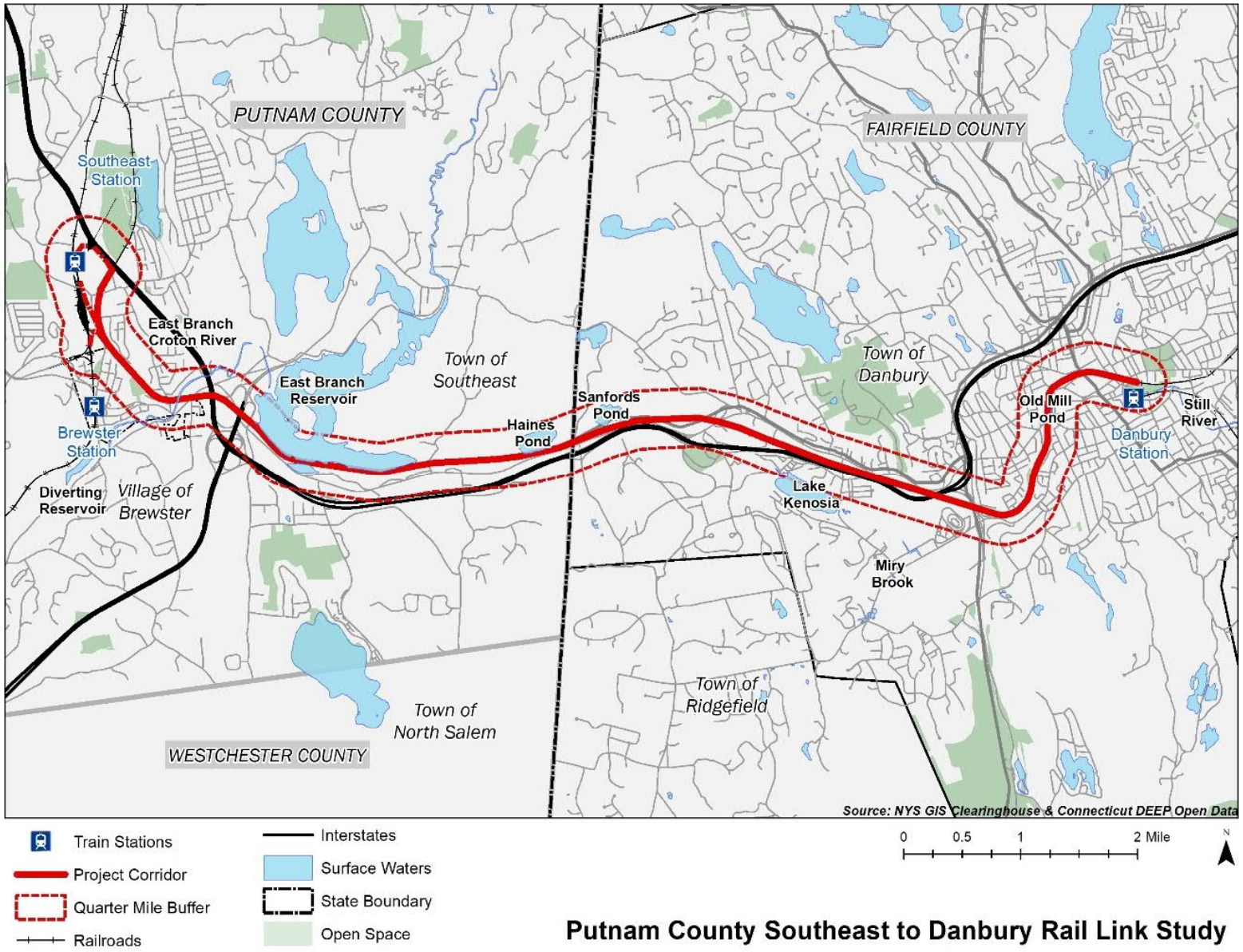
- East Branch Croton River and Tributaries, 12.8 miles in length, is located within the western portion of the study corridor. These water bodies intersect with the study corridor and connect the Diverting Reservoir and the East Branch Reservoir.
- East Branch Reservoir, a 462-acre lake, is adjacent to and intersects with the existing rail line within the study corridor.
- Diverting Reservoir, a 124.8-acre lake, is located approximately 0.55 miles south of the study corridor.
- East Branch Reservoir Tributaries, length unknown, is located within the western portion of the study corridor. These water bodies intersect with the study corridor and connect East Branch Reservoir, Haines Pond, and Peach Lake.
- Haines Pond, a 30.5-acre pond, is located within the study corridor and intersects with the existing rail line.
- Lake Kenosia, a 56-acre lake, is located within the study corridor about 400 meters south of the existing rail line.
- Sanfords Pond, a 16.7-acre pond, is located entirely within the study corridor just north of the existing rail line.
- Still River, about 19 miles long, is located to the northeast of the study corridor just south of Danbury Station. This section of the Still River is contained by concrete to prevent flooding.
- Miry Brook, about 3.4 miles long, is located just south of the study corridor, running through Danbury Municipal Airport
- Old Mill Pond, a 1.28-acre pond, is located entirely within the study corridor adjacent to the existing rail line.

The Proposed Project may impact surface waters directly, from construction activities within the water to improve the existing rail infrastructure, or indirectly from runoff from increase impervious surfaces entering nearby water bodies. The project activities may require temporary fills in Waters of the U.S, that would require Nationwide Permits authorized under the USACE Section 404: Nationwide Permit #3 - Maintenance Activities in All Waters of the U.S., Nationwide Permit #14 – Linear Transportation Projects, or Nationwide Permit #33 - Temporary Construction, Access, and Dewatering.

The Proposed Project may also be authorized under an Individual Permit. The permits would be obtained once the location and the extent of the impacts are ascertained. Mitigation to minimize impacts may be required. Work will not commence until the permit(s) are acquired and will adhere to any conditions set forth by the permit requirements.

In addition, National Pollutant Discharge Elimination System (NPDES) permitting will be required for construction activities and potentially for the post-construction stormwater management.

FIGURE 15: SURFACE WATERS



Surface Water Classification and Standards

Based upon a review of the NYSDEC and CTDEEP data for regulated surface water bodies, there are four (4) regulated streams (brook, creek, river), and six (6) regulated water bodies within the study corridor (see Table 2).

TABLE 2: SURFACE WATER CLASSIFICATIONS

WATERBODY NAME	TOWN	CLASSIFICATION	DESCRIPTION
East Branch Croton River	Southeast	A(T)	Indicates a best usage for a source of water supply for drinking; culinary or food processing purposes; primary and secondary contact recreation; and fishing - Trout Waters
Diverting Reservoir	Southeast	AA	Indiciates a best usage for a source of water supply for drinking; culinary or food processing purposes; primary and secondary contact recreation; and fishing.
East Branch Reservoir	SouthEast	AA	Indiciates a best usage for a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing.
East Branch Reservoir Tributaries	Southeast	Unassessed	N/A
Haines Pond	Southeast	Unassessed	N/A
Lake Kenosia	Danbury	AA	Indicates a best usage for existing and proposed drinking water supplies; habitat for fish and other aquatic life and wildlife; recreation; and industry and agriculture
Sanfords Pond	Danbury	AA	Indicates a best usage for existing and proposed drinking water supplies; habitat for fish and other aquatic life and wildlife; recreation; and industry and agriculture
Still River	Danbury	A (4303-00_02 and 03); B (4303-00_04)	A: Indicates a best usage for habitat for fish and other aquatic life and wildlife; potential drinking water supplies; recreation; navigation; and water supply for industry and agriculture B: Indicates a best usage for habitat for fish and other aquatic life and wildlife; recreation; navigation; and industrial and agricultural water supply.
Miry Brook	Danbury	A	Indicates a best usage for habitat for fish and other aquatic wildlife; potential drinking water supplies; recreation; navigation; and water supply for industry and agriculture
Old Mill Pond	Danbury	A	Indicates a best usage for habitat for fish and other aquatic wildlife; potential drinking water supplies; recreation; navigation; and water supply for industry and agriculture

The Clean Water Act Section 303(d) requires states to identify waterbodies that are not fully supporting their best uses. These waterbodies are then listed on the Clean Water Act 303(d) "impaired waters" list. The Clean Water Act further requires states to develop total maximum daily load plans (TMDLs) for waterbodies on the 303(d) list to reduce the amount of pollutants entering impaired waterbodies to meet water quality standards.

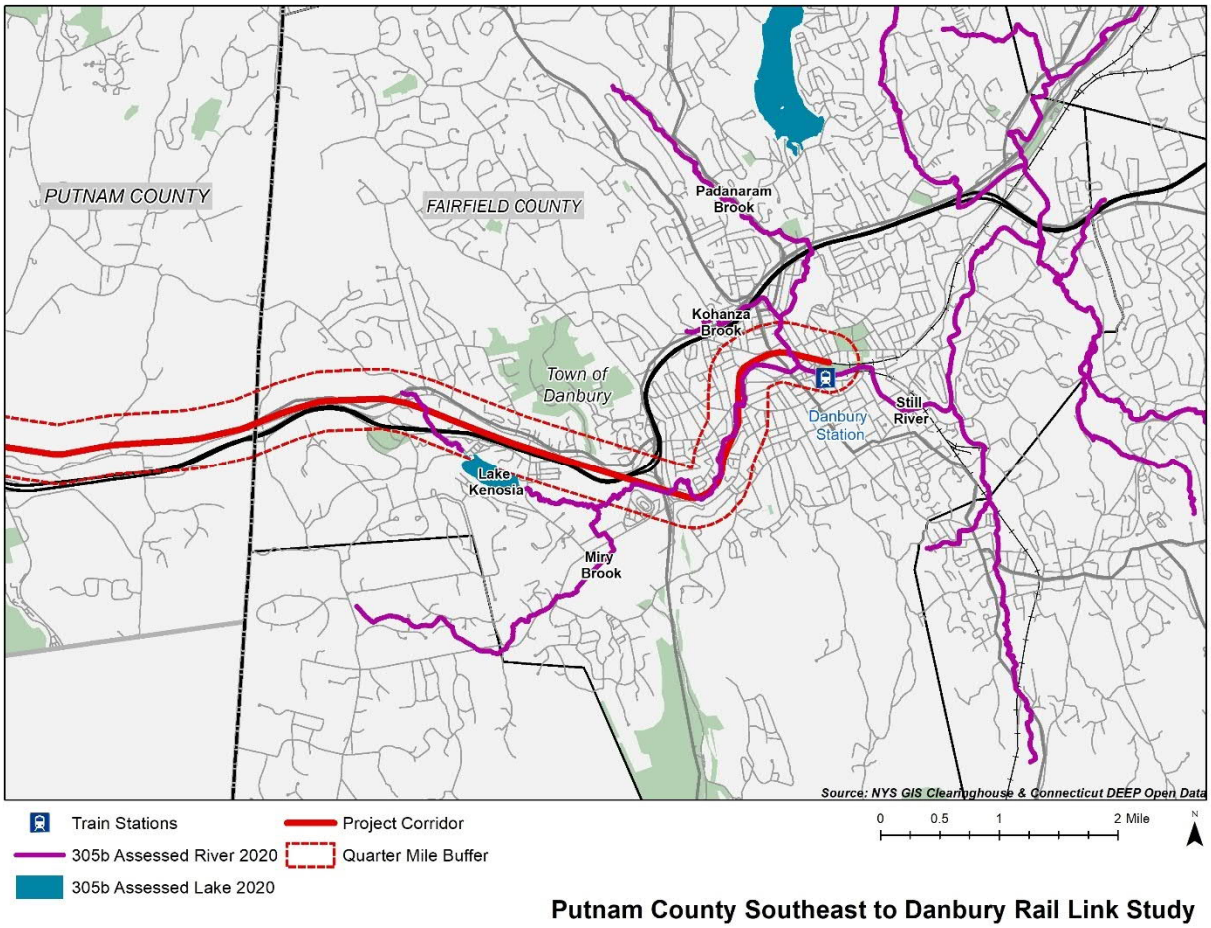
The study corridor falls within the Croton Watershed TMDL, the Still River Watershed TMDL, and the Kenosia Lake TMDL. The study corridor also falls within an area that contributes to New York City's water supply, and the Limekiln Brook Watershed.

Section 305(b) of the Clean Water Act requires each State to monitor, assess and report on the quality of its waters relative to designated uses established in the State water quality standards. As shown in Figure 16, Lake Kenosia, Miry Brook, Padanaram Brook, Still River, and Kohanza Brook, are designated Section 305(b) waterbodies that require assessment of water quality.

State Regulated Waters

The previously described surface waters are state regulated navigable waters located within the study corridor. These waterways are used for recreational traffic (canoes, kayaks, and small, one to two-person electric vessels), as well as sources of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The Proposed Project may require placement of fill in these waters, and further analysis would be required to determine the effect on navigability. A NYSDEC Protection of Waters Permit for Excavation or Placement of Fill in Navigable Waters may be required, pursuant to ECL Article 15, Title 5. Additionally, permits may be required from CTDEEP's Land and Water Resources Division (LWRD).

FIGURE 16: CONNECTICUT 305B ASSESSED WATER BODIES



Putnam County Southeast to Danbury Rail Link Study

Wild, Scenic, and Recreational Rivers

State Wild, Scenic and Recreational Rivers

No rivers within the study area appear in the New York State Wild, Scenic and Recreational River System. Connecticut utilizes the National Wild and Scenic Rivers System classification to determine state wild, scenic, and recreational rivers, and none of the rivers within the study corridor are classified as wild, scenic, and recreational rivers.

National Wild and Scenic Rivers

The study corridor does not contain National Wild and Scenic Rivers as determined by the National Wild and Scenic Rivers System. No further review is required.

Wildlife and Waterfowl Refuges

The Proposed Project would not involve work in or adjacent to a wildlife or waterfowl refuge.

Floodplains

State Flood Insurance Compliance Program

The study corridor, in some locations, is within the 100 and 500-year floodplain, as determined by the Federal Emergency Management Agency (FEMA) (see Figures 17 to 20). There is also an existing regulatory floodway between the East Branch Reservoir and The Diverting Reservoir. The areas within the 100-year floodplain can be distinguished further by the FEMA Flood Hazard Zone designation. Of the areas within the 100-year floodplain, portions of the study area fall within three classifications: Zone A, Zone AE, and Zone AO. Areas within Zone A do not have a determined Base Flood Elevation (BFE) – the anticipated water-surface elevation of the one-percent annual chance flood. Conversely, areas within Zone AE have a determined BFE, and areas within Zone AO have average flood depths of one to three feet (typically in the form of sheet flow on sloping terrain). Accordingly, as the Proposed Project is further developed, the project team will consider and evaluate the practicality of alternatives to any floodplain encroachments. If necessary, a floodplain hydraulic analysis would be performed during the advance detail plan phase.

FIGURE 17: STUDY AREA FLOODPLAINS

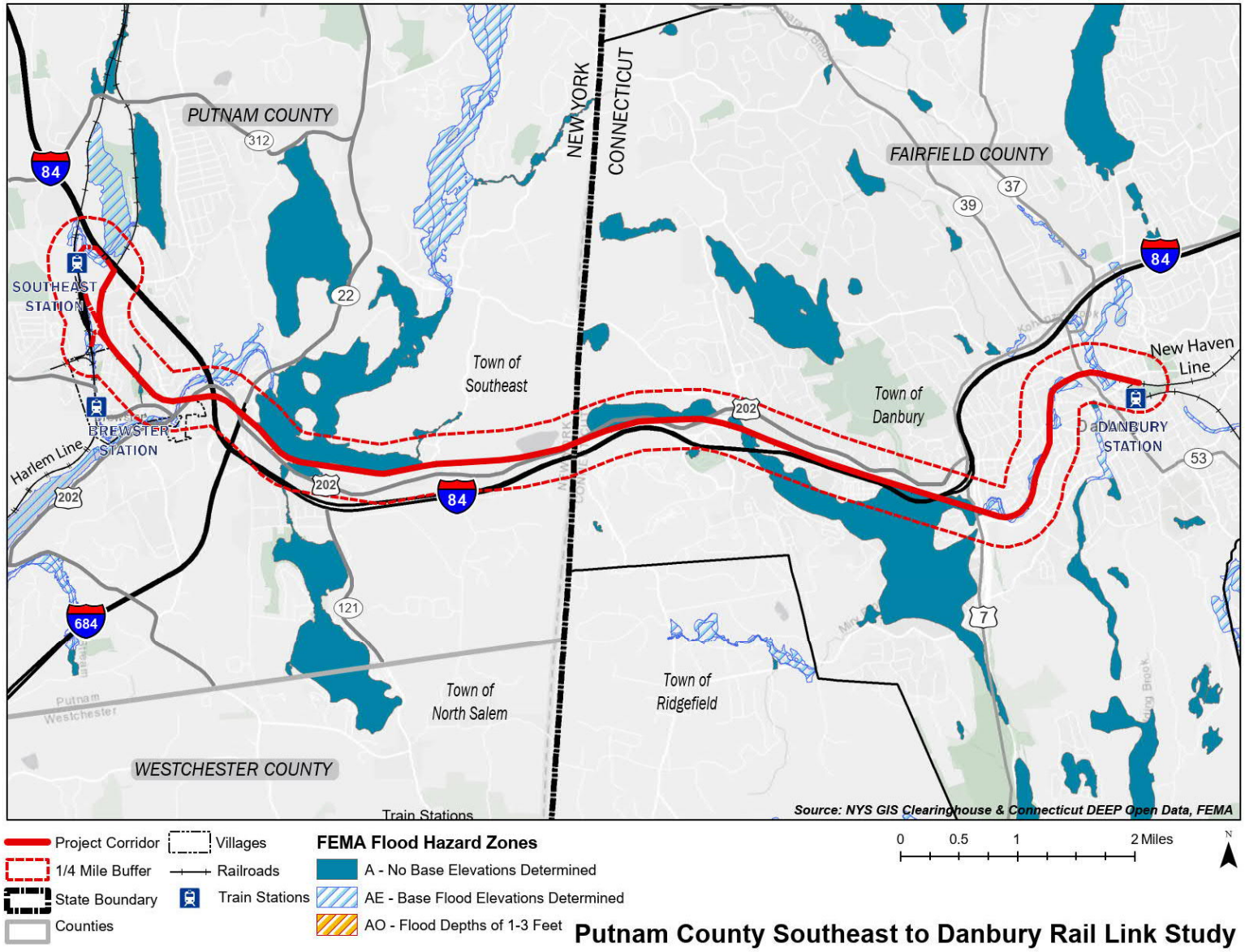


FIGURE 18: FLOOD HAZARD ZONES, SEGMENT 1

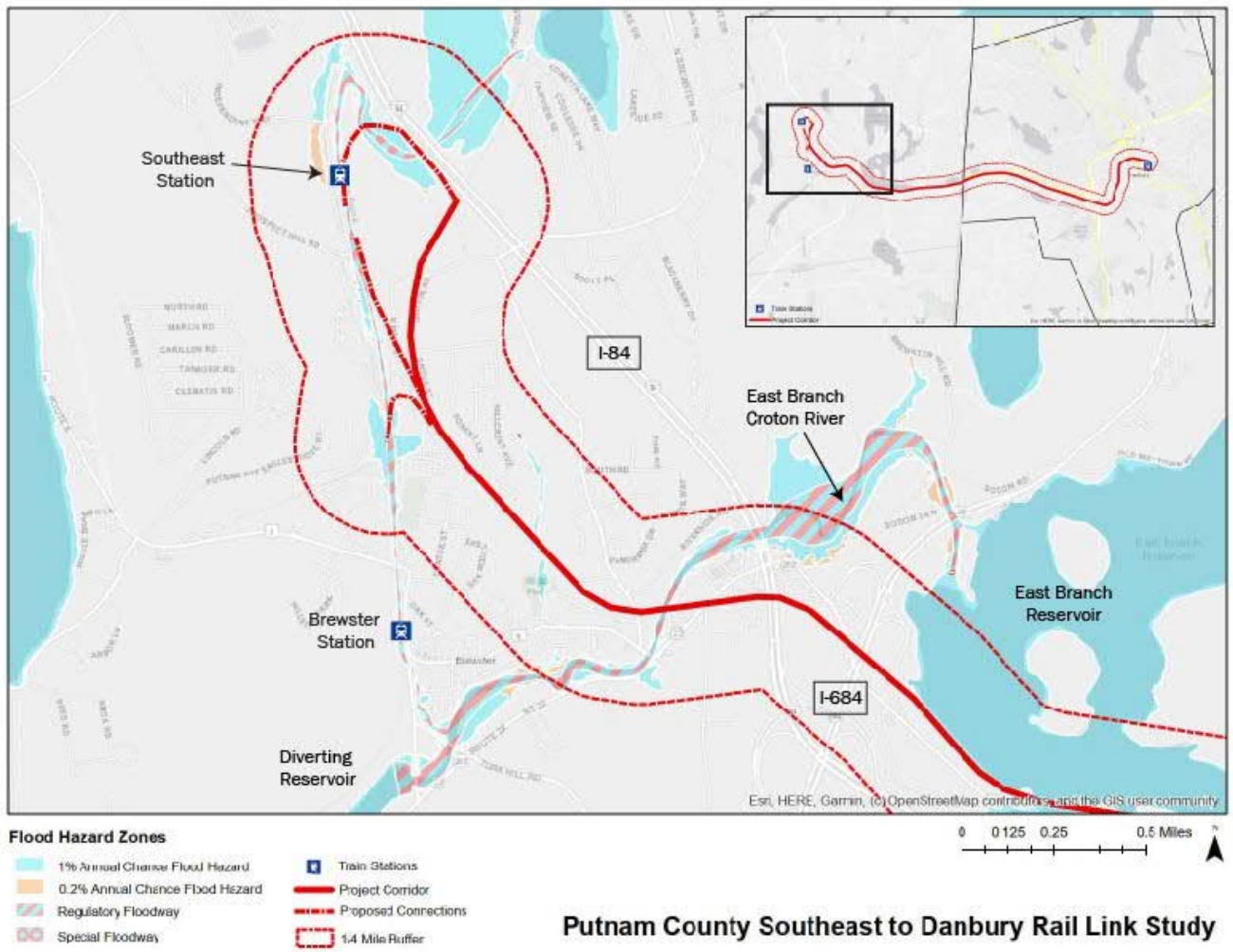


FIGURE 19: FLOOD HAZARD ZONES, SEGMENT 2

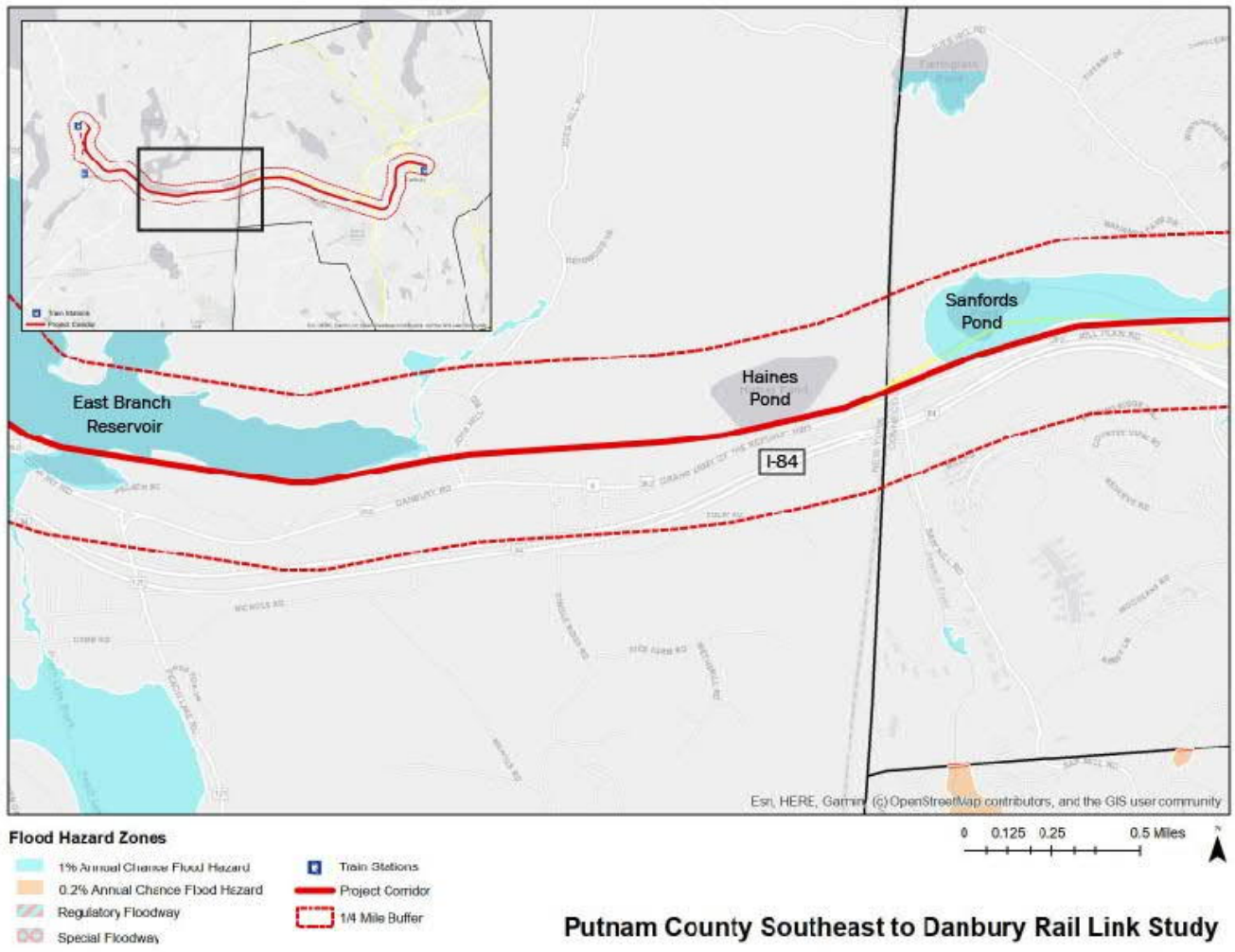
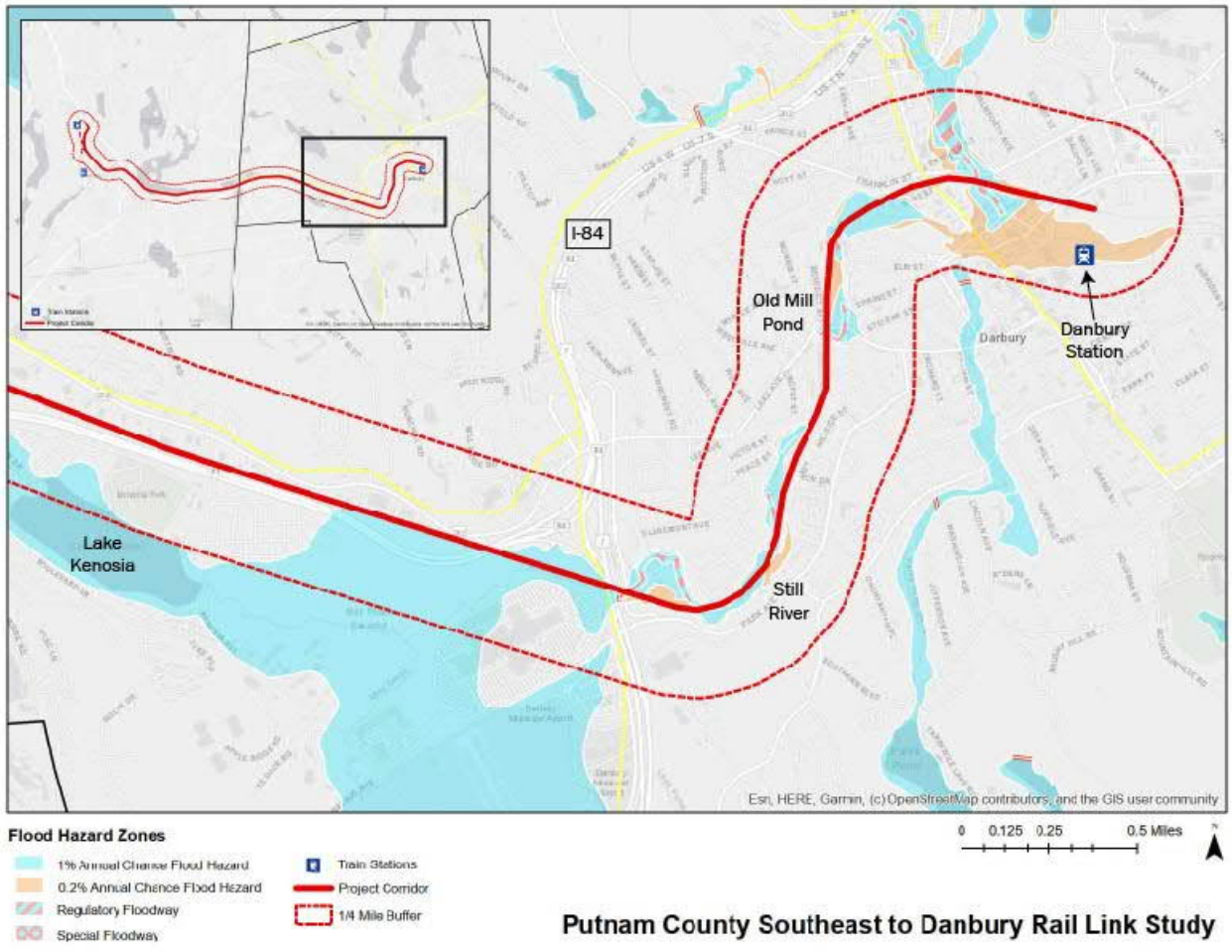


FIGURE 20: FLOOD HAZARD ZONES, SEGMENT 3



Coastal Resources

State Coastal Zone Management Program

The study corridor is not within a State Coastal Zone Management (CZM) area, according to the Coastal Zone Area Map from the NYS Department of State's Coastal Zone Management Unit and the CTDEEP Coastal Area Map.

State Coastal Erosion Hazard Area

The study area is not located in or near a Coastal Erosion Hazard Area.

Federal Coastal Barrier Resources Act (CBRA) and Coastal Barrier Improvement Act (CBIA)

The study corridor is not located in, or near a coastal area under the jurisdiction of the Coastal Barrier Resources Act (CBRA) or the Coastal Barrier Improvement Act (CBIA).

Groundwater Resources, Aquifers, and Reservoirs

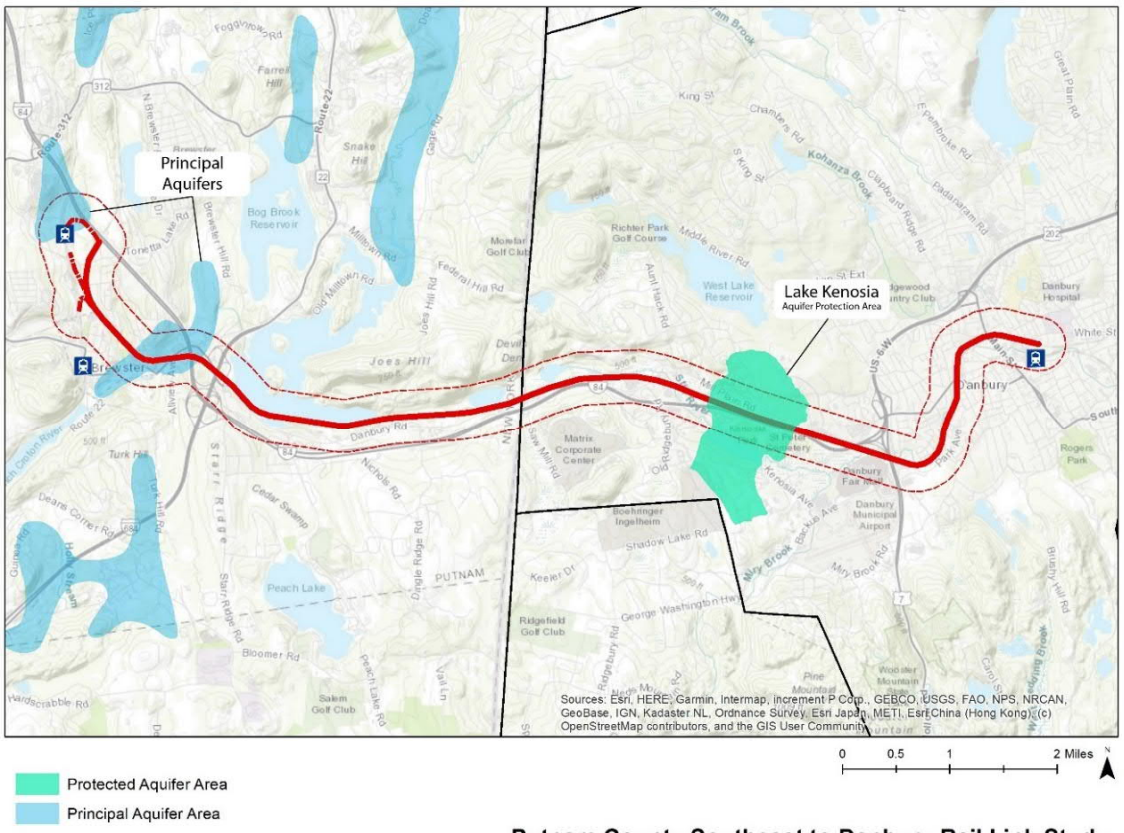
Aquifers

According to the NYSDEC aquifer data, the study corridor is not located in an identified primary water supply but might exist within two principal aquifer areas on the Putnam County side (see Figure 21). In addition, CTDEEP indicates that a Level A Aquifer Protection Area

(APA) associated with Lake Kenosia exists within the study corridor and intersects with a portion of the existing rail line (see Figure 21). APAs are delineated for active public wells in stratified drift that serve more than 1,000 people, in accordance with Sections 22a-345c and 22a-354z of the Connecticut General Statutes.

A review of the EPA-designated Sole Source Aquifer Areas Federal Register Notices, Maps, and Fact Sheets indicates the study corridor is not located within any sole source aquifers. The closest sole source aquifer is the Pootatuck Aquifer, located over five miles east of the study corridor.

FIGURE 21: AQUIFERS



General Ecology and Wildlife Resources

Fish, Wildlife, and Waterfowl

Based on the adjacent waterbodies and forested/natural areas, it is likely that the study corridor contains habitat and/or breeding area for certain species of plants or animals. Field visits by specialists with familiarity with the local ecology will take place when the project is further defined.

Habitat Areas, Wildlife Refuges, and Wildfowl

The Proposed Project would not involve work in, or adjacent to, a wildlife or waterfowl refuge.

Endangered and Threatened Species

According to the NYSDEC GIS database, there is a possibility that a state-protected, threatened, and endangered plant and animal species is located within or near the study corridor. See Appendix B for a report from the New York Natural Explorer, through NYSDEC's Natural Heritage Program, of threatened, endangered and species of concern within Putnam County. There was no formal consultation

with CTDEEP; however, based on critical habitats data the study corridor does not appear to contain any state-listed threatened or endangered species.

According to the U.S. Fish and Wildlife Service (USFWS) iPaC database, the following Federally protected, threatened, or endangered species are located in or near (within ½ mile) the study corridor (see Appendix B):

- Indiana Bat (Endangered)
- Northern Long-eared Bat (Threatened)
- Bog Turtle (Threatened)

If appropriate, NYSDEC and CTDEEP will be contacted to identify species in the area and a site-specific species assessment will be performed to confirm their presence. The lead agency will take appropriate measures during design and construction to ensure that impacts to any protected species and their habitat is avoided or minimized.

Critical Environmental Areas

State Critical Environmental Areas

According to information obtained from NYSDEC, the Proposed Project would not involve work in or near a Critical Environmental Area (CEA). The closest CEAs are the Great Swamp Area in the Towns of Southeast and Patterson, located approximately two miles northeast of Brewster, and County & State Park Lands in the Town of North Salem, located approximately three miles south of Brewster.

Information obtained from CTECO, or Connecticut Environmental Conditions Online, a collaboration between CTDEEP and UCONN's Center for Land Use Education Research (CLEAR), indicates that the Proposed Project would not involve work in or near a Critical Habitat, a designation somewhat analogous to NYSDEC's Critical Environmental Area classification. The closest Critical Habitat, Limekiln Brook, is about two miles east of the study corridor.

State Forest Preserve Lands

According to information obtained from NYSDEC, the Proposed Project would not involve work in or near state forest preserve lands. Information for Connecticut was not available without formal consultation.

Historic and Cultural Resources

National Heritage Areas Program

A section of the study corridor within Putnam County is located in the Maurice D. Hinchey Hudson River Valley National Heritage Area. Stretching from Troy to New York City, the Natural Heritage Area contains a rich assemblage of natural features and nationally significant cultural and historical sites. There are more than 100 designated Heritage Sites of the Hudson River Valley National Heritage Area. The area was designated by Congress in 1996 and is managed by the Hudson River Valley Greenway. The Executive Director should be contacted to ensure that the Proposed Project is consistent with the Heritage Area Management Plan.

National Historic Preservation Act – Section 106

Section 106 of the National Historic Preservation Act (NHPA) requires federal agencies to consider the effects on historic properties of projects they carry out, assist, fund, permit, license, or approve throughout the country. If a federal (or federally assisted) project has the potential to affect historic properties, a Section 106 review must occur. Section 106 gives the Advisory Council on Historic Preservation (ACHP), interested parties, and the public the chance to weigh in on these matters before a final decision is made.

In New York State, the Environmental Review program is a planning process that helps protect New York's historic cultural resources from the potential impacts of projects that are funded, licensed, or approved by state or federal agencies. Under Section 106 of the National Historic Preservation Act and Section 14.09 of the New York State Historic Preservation Act, the New York State Historic Preservation Office's (SHPO) role in the review process is to ensure that effects or impacts on eligible or listed properties are considered and avoided or mitigated during the project planning process.

Connecticut does not have an analogous state-level process parallel to Section 106, but through Connecticut's state-level NEPA, the Connecticut Environmental Policy Act (CEPA), the state's SHPO has a similar role in the review process.

Information regarding historic resources is derived from the National Parks Service's National Register of Historic Places (NRHP), the New York State SHPO's Cultural Resources Information System (CRIS), and the Connecticut State Historic Preservation Office. As shown below in Table 3, Figure 22, and Figure 23 there are five listed and three eligible historic resources within the study corridor.

TABLE 3: PROPERTIES LISTED OR ELIGIBLE FOR LISTING ON THE NATIONAL REGISTER OF HISTORIC PLACES

MAP REFERENCE NUMBER	NAME - STREET ADDRESS	NRHP STATUS	MUNICIPALITY
1	Philip Beal House (P.F. Beal & Sons) – 4 Putnam Avenue	Eligible	Village of Brewster
2	2624 Carmel Avenue	Eligible	Village of Brewster
3	Saint Andrew's Episcopal Church – 26 Prospect Street	Listed	Village of Brewster
4	Brewster Railroad Station	Eligible	Village of Brewster
5	Octagon House – 21 Spring Street, Danbury, CT 06810	Listed	Danbury
6	Meeker's Hardware – 88-90 White Street, Danbury, CT 06810	Listed	Danbury
7	P. Robinson Fur Cutting Company – 55 Oil Mill Road, Danbury, CT 06810	Listed	Danbury
8	Ball and Roller Bearing Company – 22 Maple Avenue, Danbury, CT 06810	Listed	Danbury

Historic Bridges

In 1999, the New York State Department of Transportation (NYSDOT), in coordination with FHWA and the New York SHPO, initiated a statewide inventory of historic bridges. To-date, six bridges along the study corridor within Putnam County have been identified that are 50 years or older. There are three bridges listed on NYSDOT's Historic Bridge Inventory that are located the rail line, though none has been determined to be listed or eligible for listing on the NRHP (see Table 4 and Figure 22).

TABLE 4: NYSDOT HISTORIC BRIDGES

MAP REFERENCE	BIN	FEATURE CARRIED/CROSSED	YEAR BUILT	S/NR
A	2224040	6 6 84041121 / Metro No Commuter	1910	Not Eligible
B	7345730	Metro No Commuter / County Road 53	1947	Undetermined
C	7003530	Metro No Commuter / Route 22	1934	Undetermined

FIGURE 22: NRHP LISTED OR ELIGIBLE SITES MAP, BREWSTER

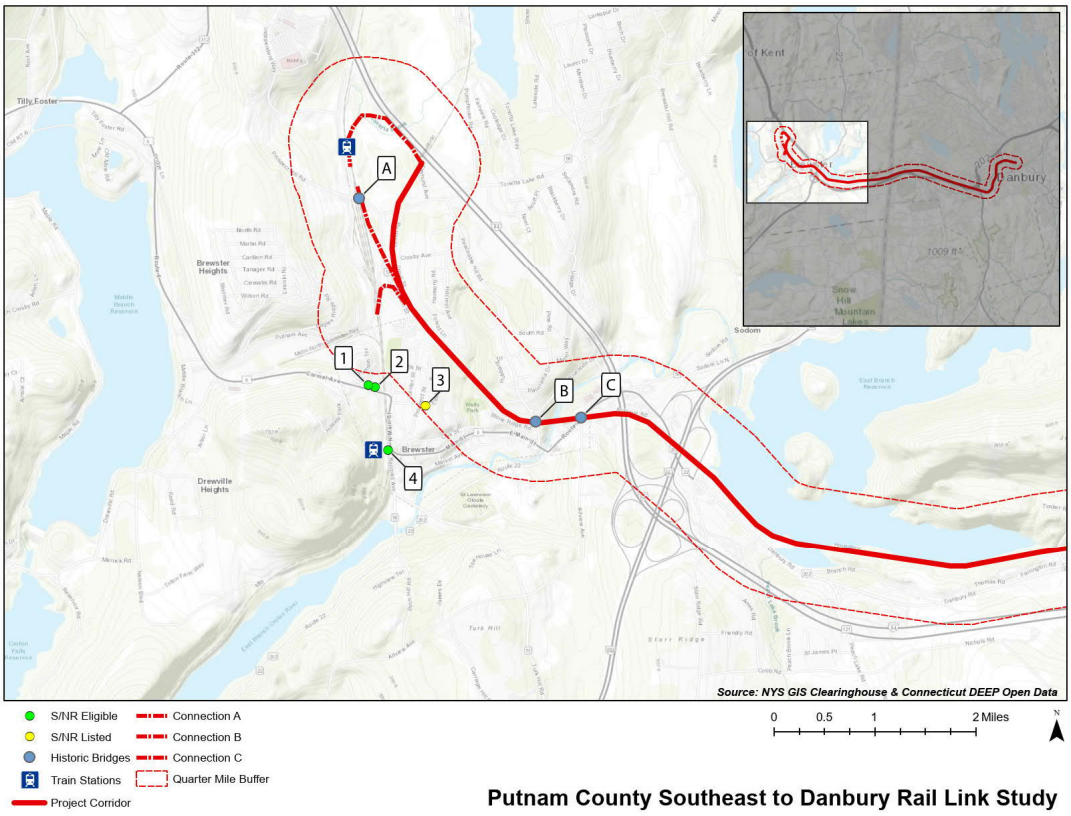
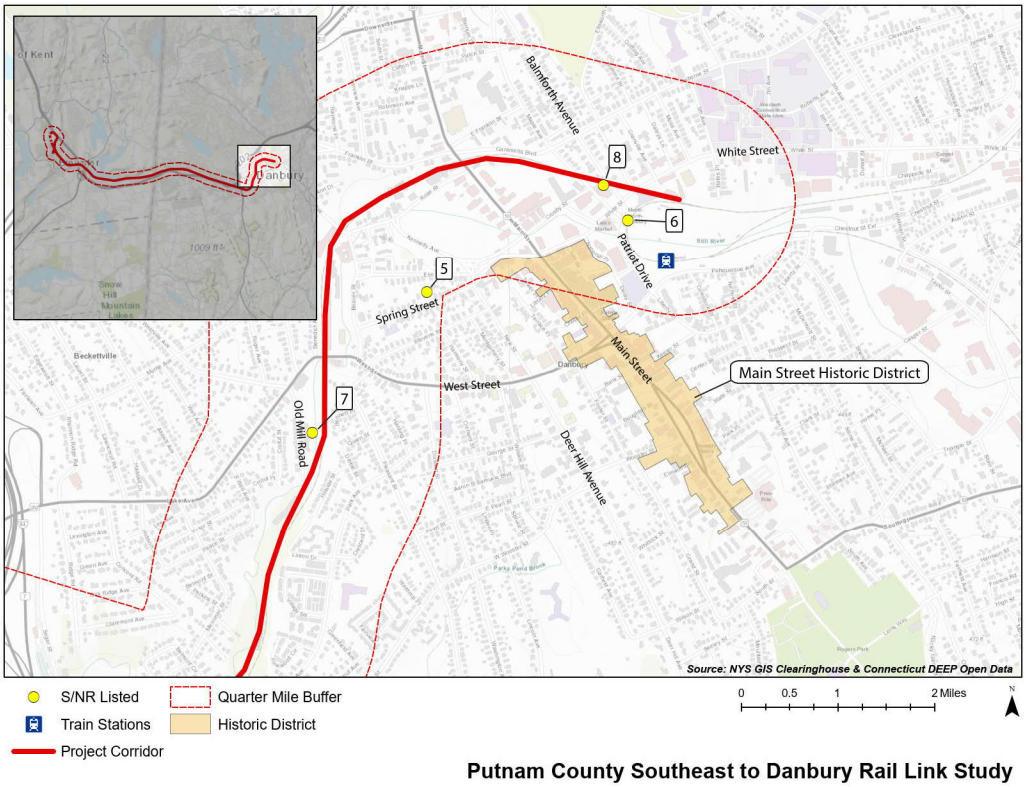


FIGURE 23: NRHP LISTED OR ELIGIBLE SITES MAP, DANBURY



Historic Parkways

The Proposed Project would not have the potential to impact any Historic Parkways.

Native American Involvement

As part of compliance with the Section 106 Process of the NHPA (36 CFR 800), consultation with tribal nations that may have an interest in the project is required. While it is known that tribal nations may have an interest in lands in proximity to the study corridor, additional consultation will be required to determine applicability to the Proposed Project. [4]

Parks and Recreational Resources

State Heritage Area Program

The Proposed Project would not impact areas identified as State Heritage Areas.

National Registry of Natural Landmarks

There are no listed nationally significant natural areas within, or adjacent to, the study corridor.

Section 4(f) Involvement

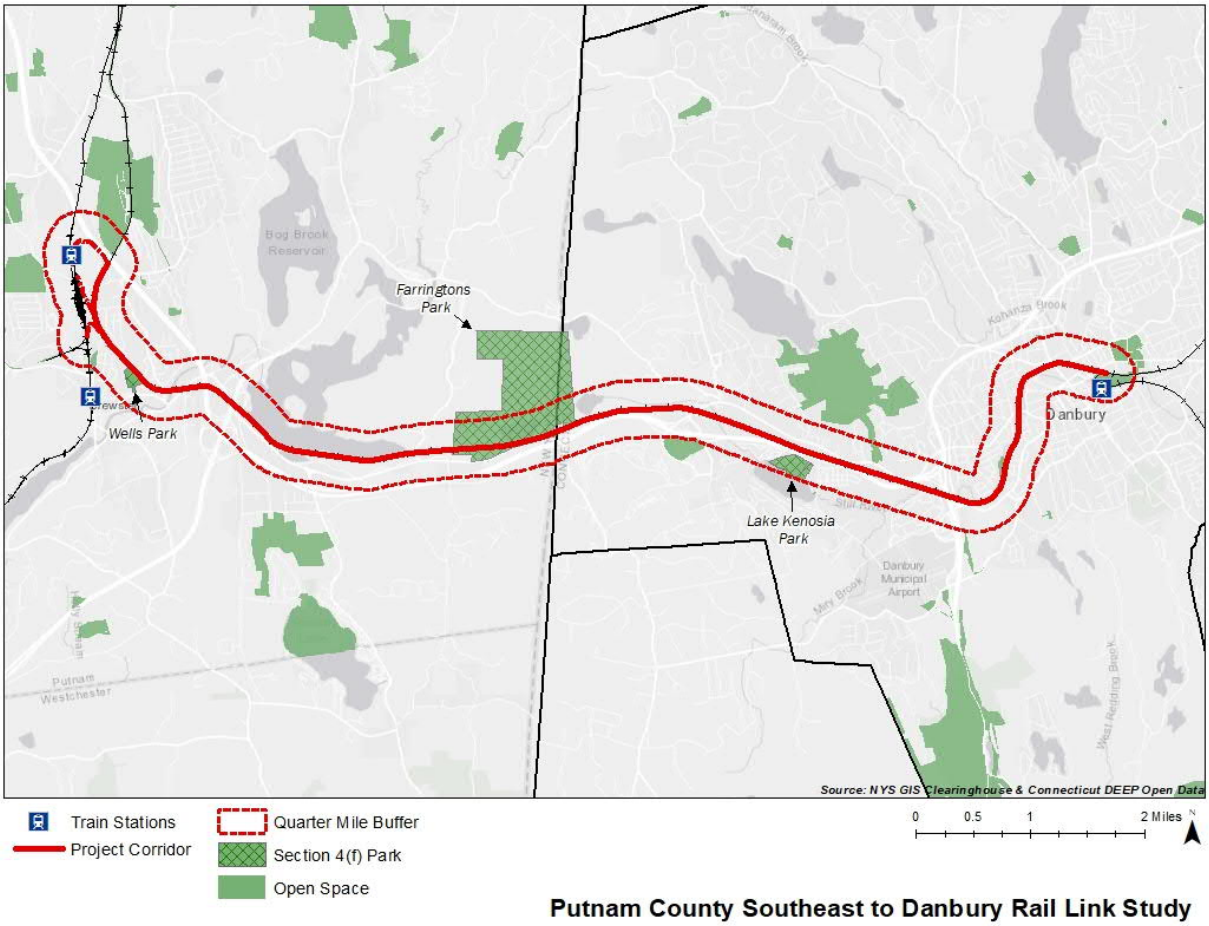
Section 4(f) of the USDOT Act of 1966, as amended (23 CFR Part § 774, codified in 49 U.S.C. 303 and generally referred to as "Section 4(f)") prohibits the Secretary of Transportation from approving any program or project that requires the "use" of the following:

[4] https://www.dec.ny.gov/public/974.html

- Any publicly owned parkland, recreation area, or wildlife and waterfowl refuge of national, state, or local significance; or
- Any land from a historic site of national, state, or local significance (collectively, "Section 4(f) properties"), unless there is no feasible and prudent alternative to the use of such land and such program or project includes all possible planning to minimize harm to the Section 4(f) properties.

The study corridor is located adjacent to several parks and recreation areas, including Wells Park, Farrington's Park, and Lake Kenosia Park (see Figure 24). Wells Park is a 10.64-acre park adjacent to the existing rail corridor containing a picnic shelter, multipurpose field, playgrounds, and tennis courts owned by the Town of Southeast. Farrington's Park is an approximately 190-acre park adjacent to the existing rail corridor located on the New York and Connecticut state boundary containing hiking and biking trails that is privately owned. Lake Kenosia Park is a seasonal 25-acre park adjacent to the existing rail corridor containing benches, a playground, a Spray Park, four soccer fields, and tables owned by the City of Danbury. In addition, in 2006, Putnam County and MNR began the development of the Maybrook Bikeway, a scenic rail trail that runs parallel to the existing rail line from Southeast to the US Route 202/I-84 overpass. The first portion of the bikeway was constructed in 2018, and opened in 2020, with the remainder slated for completion in 2022.

FIGURE 24: PARKS AND RECREATION AREAS



Section 6(f) Involvement

Consultation with New York State Office of Parks, Recreation and Historic Preservation and CTDEEP is needed to determine if any Section 6(f) lands are located within the study corridor.

Visual Resources

The study corridor covers two counties, through developed commercial areas, wetlands, and waterbodies including the East Branch Reservoir, Sanfords Pond, and Haines Pond. Exhibits 1 to 7 present visual resources along the corridor from west to east. The Existing Right-of-Way Conditions section below also addresses potential visual resources within the corridor. Along the proposed route are existing stations including the Southeast (Exhibit 1), Brewster (Exhibit 2) and Danbury (Exhibit 7) train stations.

EXHIBIT 1. SOUTHEAST TRAIN STATION

EXHIBIT 2. BREWSTER TRAIN STATION

EXHIBIT 3. MAIN STREET, BREWSTER, NY

EXHIBIT 4. I-684, EXIT 10

EXHIBIT 5. EAST BRANCH RESERVOIR

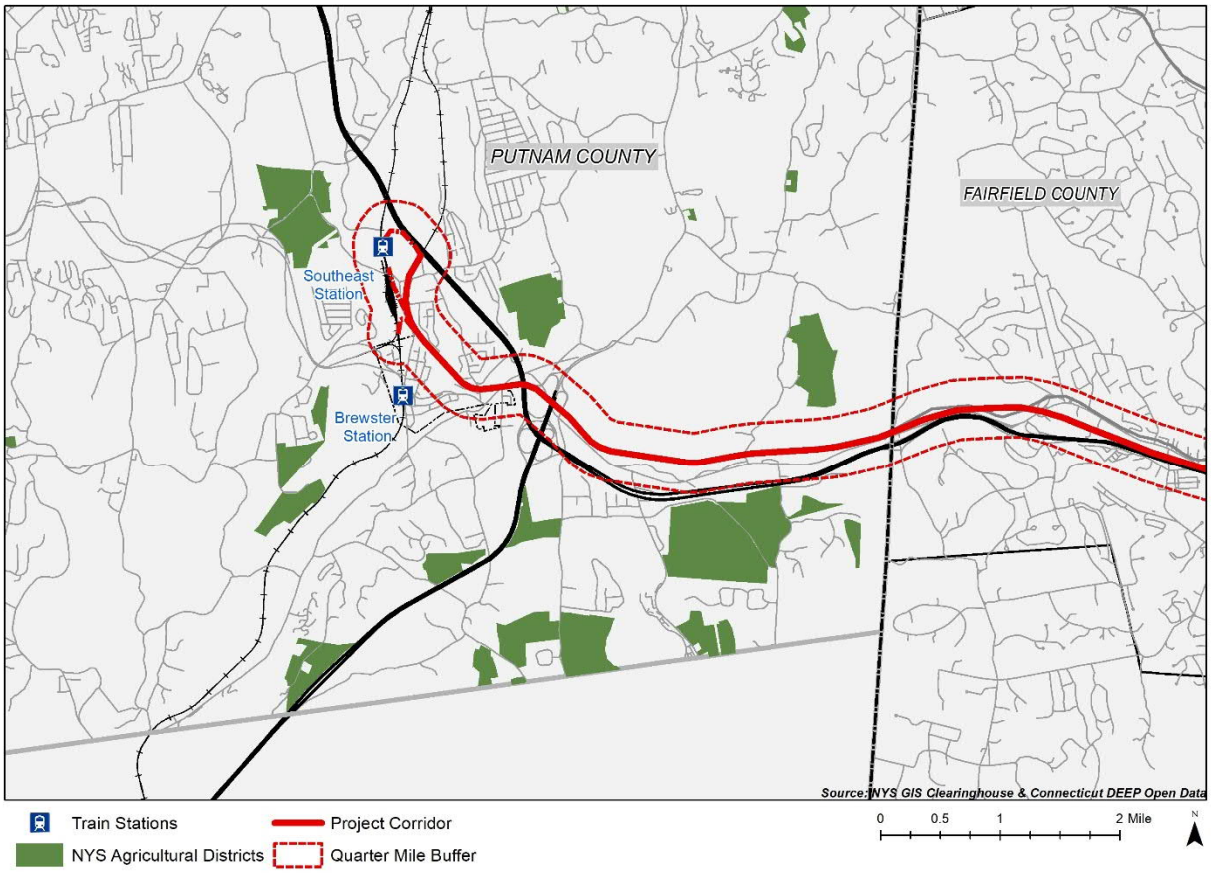
EXHIBIT 6. MILL PLAIN ROAD (US 202)

EXHIBIT 7. DANBURY TRAIN STATION

Farmlands

Based on a review of the NYS Agricultural District Maps for Putnam County, the study corridor is located adjacent to but not through portions of NYS Agricultural Districts (see Figure 25). Connecticut farmland data was not available. If the Proposed Project would not acquire more than one acre from an actively operated farm within any of the Agricultural Districts, or more than ten acres within any of the individual Agricultural Districts, the notification requirements of the NYS Agriculture and Markets Law will not apply.

FIGURE 25: NEW YORK AGRICULTURAL DISTRICTS



Putnam County Southeast to Danbury Rail Link Study

Federal Prime and Unique Farmland

Further evaluation of prime and unique farmland, or farmland of state or local importance, as defined by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), is required to determine if there is the potential for impact as a result of the Proposed Project.

If necessary, the U.S. Department of Agriculture Farmland Conversion Rating (Form AD 1006) will be completed and submitted to the NRCS, followed by consultation with the NRCS and a review of alternatives that do not require farmland acquisition.

Air Quality

Regulatory Framework

The Clean Air Act (CAA) sets forth the framework and goals for improving air quality to protect public health and the environment. It requires the U.S. Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS) for the following "criteria" pollutants: ozone (O3), carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO2), particulate matter with an aerodynamic diameter smaller than or equal to 10 micrometers (PM10), particulate matter with an aerodynamic diameter smaller than or equal to 2.5 micrometers (PM2.5), and lead (Pb). Table 5 shows the current NAAQS. Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb) by volume, or micrograms per cubic meter of air (µg/m3).

TABLE 5: NATIONAL AMBIENT AIR QUALITY STANDARDS

POLLUTANT		PRIMARY/ SECONDARY	AVERAGING TIME	LEVEL	FORM
Carbon Monoxide		Primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead		Primary and secondary	Rolling 3-month average	0.15 µg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide		Primary	1-hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary and secondary	Annual	53 ppb (2)	Annual Mean
Ozone		Primary and secondary	8-hour	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particulate Matter	$PM_{2.5}$	Primary	Annual	12 µg/m^3	Annual mean, averaged over 3 years
		Secondary	Annual	15 µg/m^3	Annual mean, averaged over 3 years
		Primary and secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary and secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide		Primary	1-hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

Source: USEPA Office of Air and Radiation, https://www.epa.gov/criteria-air-pollutants/naaqs-table;
New York State Department of Environmental Conservation, http://www.dec.ny.gov/chemical/8542.html

Footnotes:

(1) Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 year, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

(2) The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

(4) The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a State Implementation Plan (SIP) call under the previous SO_2 standards (40 CFR 50.4(3)). A SIP call is a USEPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

The NAAQS are divided into two types of criteria: primary standards, which are intended to protect the public health with an adequate margin of safety, and secondary standards, which are intended to protect the public welfare from any known or anticipated adverse effect of a pollutant (e.g., soiling, vegetation damage, material corrosion).

Areas with measured air quality concentrations lower than the NAAQS are designated "attainment" for that standard. Areas that exceed the NAAQS are designated "nonattainment." An area can be attainment for one pollutant and nonattainment for others. Areas that previously did not meet one of the NAAQS but have since attained the standard are subject to a State Implementation Plan (SIP) for air quality "maintenance." Such areas are commonly referred to as "maintenance areas." Maintenance areas can also be classified as attainment, maintenance, or nonattainment for other pollutants.

The study corridor is located within Putnam County, which is not designated as a nonattainment or maintenance area for any pollutant, and Fairfield County, which is designated as nonattainment area for O_3 and a maintenance area for CO and $PM_{2.5}$.

Noise and Vibration

The Federal Transit Administration Transit Noise and Vibration Impact Assessment Manual (FTA Report No. 0123, September 2018) presents the basic concept of transit noise and vibration, methods for assessment, and criteria for evaluating the extent and severity of noise and vibration impacts from transit operations. Transit noise impacts from future operation of the proposed service is based on land-use categories and sensitivity to noise from transit sources under the FTA guidelines. TABLE shows FTA land-use categories and required noise descriptors used for impact assessment.

TABLE 6. LAND-USE CATEGORIES AND NOISE METRICS

LAND-USE CATEGORY	NOISE METRIC	DESCRIPTION
1	Leq(h)	Tracts of land set aside for serenity and quiet, such as outdoor amphitheaters, concert pavilions and historic landmarks.
2	Ldn	Buildings used for sleeping such as residences, hospitals, hotels, and other areas where nighttime sensitivity to noise is of utmost importance.
3	Leq(h)	Institutional land uses with primarily daytime and evening uses including schools, libraries, churches, museums, cemeteries, historic sites, parks, and certain recreational facilities used for study or meditation.

Source: Federal Transit Administration, 2018

Land uses along the study corridor are presented in Figure 10. The figure shows residential and park land uses along the existing rail line that would be sensitive to noise and vibration increases as a result of increase train service, although much of the corridor is near I-84, which would provide a high level of existing background noise.

Based on the preliminary screening analysis, the study area includes many sensitive receptors that could be impacted by the Proposed Project. As a result, a detailed noise study would be required.

Hazardous Waste and Contaminated Materials

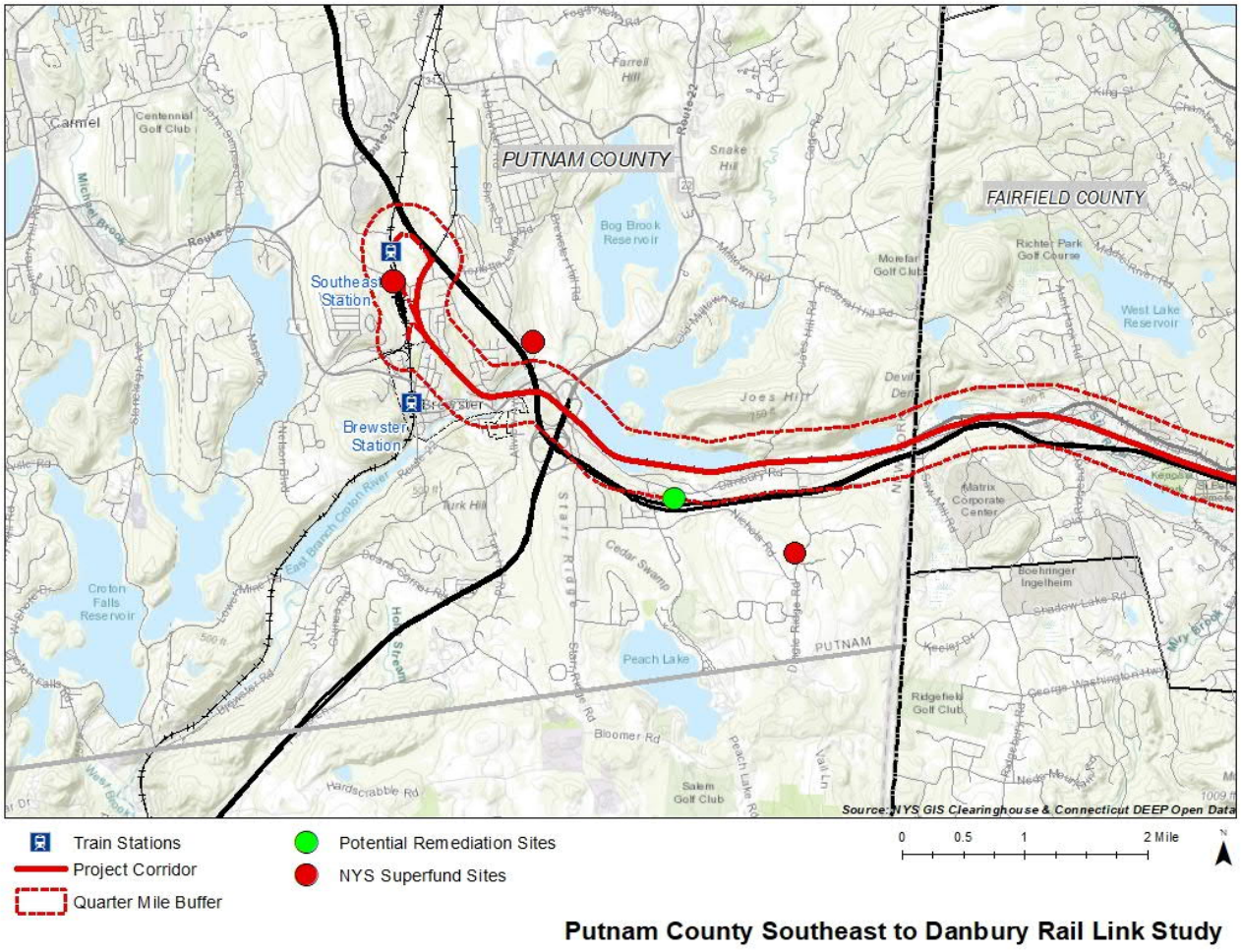
The potential project sites are primarily within the existing railroad right-of-way and have historically been used as a part of railroad operations. The potential locations consist of soils, fill, and ballast that could possibly be contaminated due to this historical railroad association. Possible contaminants include polychlorinated biphenyls (PCBs), pesticides and herbicides, heavy metals, and petroleum constituents, including polycyclic aromatic hydrocarbons (PAHs).

A review of NYSDEC online databases found that there are four open remediation sites within a one-half mile radius of the study corridor (see Figure 26). CTDEEP maintains a list of contaminated or potentially contaminated sites within Connecticut.[5] This list represents the "Hazardous Waste Facilities," as defined in CGS Section 22a-134f. Additional consultation with CTDEEP is required to identify potentially hazardous sites within a half mile radius of the study corridor.

[5] https://portal.ct.gov/-/media/DEEP/site_clean_up/sites/contaminatedsitesafpdf.pdf

When the Proposed Project is further developed, site reconnaissance and review of Sanborn fire insurance maps, local directories, state and federal databases, and readily available information (internet resources) regarding contaminated sites should be performed to determine the level of environmental contamination anticipated and identify best practices to minimize risk to workers and the adjacent community.

FIGURE 26: NEW YORK OPEN REMEDIATION SITES



Existing Right-Of-Way Conditions

In the fall of 2021, site investigations were performed on the length of the Beacon Line corridor noting significant line infrastructure, and conditions. The majority of the Beacon Line consists of a single railroad track (from Segar Street just east of Route 7 in Connecticut, westward through New York); however, the right-of-way historically was built with two or more tracks (albeit to 19th Century track-center standards) throughout the study territory. As previously noted, the Maybrook Bikeway has been developed alongside the existing track, within New York state (the last trail segment from I-684 to the Connecticut state line is currently under construction). The rail line track generally has continuous welded rail on wooden ties, with hand thrown switches. The line conditions range from poor to fair, with the rail visually observed to be in fair condition and many wooden ties in poor condition due to environmental degradation. Ultrasonic testing of the rail was not performed, and its metallurgic integrity is not known. Train operations are dispatched via a track warrant system. Historic signal systems that were in place have been removed and the line was never equipped with either a 3rd Rail traction power system as found on the Harlem Line or with an overhead catenary system as used on the Metro-North New Haven Line. All operations were powered by steam or diesel locomotives. Grade crossing warning systems ranged from active to passive systems with a broad range of operation and condition. In the site investigation, there were 24 bridges noted (15 of which were undergrade, or below rails, and 9 of which were overhead), three culverts for drainage under the right-of-way, and eight at-grade roadway crossings along the length of the Line. The locations of these are shown in Figure 27 and conditions summarized by identification number in Table 7 below.

FIGURE 27. SIGNIFICANT BEACON LINE INFRASTRUCTURE

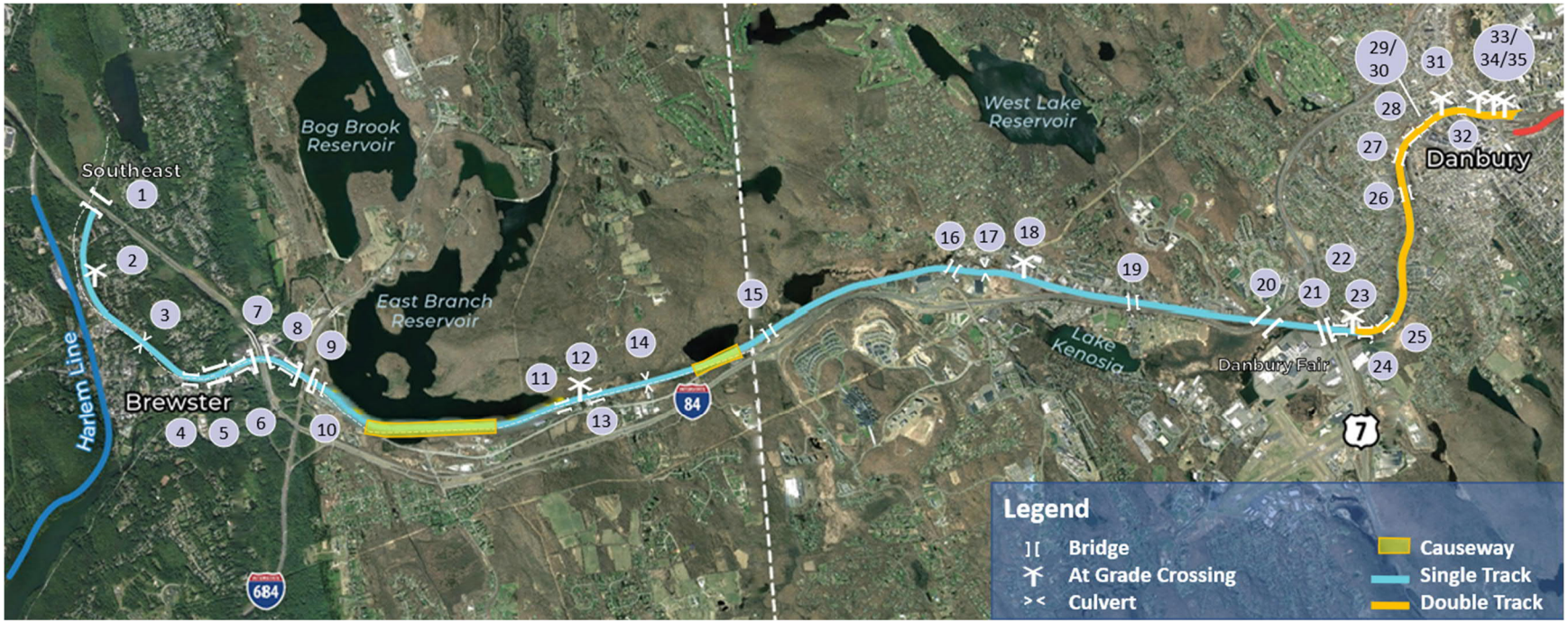


TABLE 7: SIGNIFICANT BEACON LINE INFRASTRUCTURE

Map ID Number	Item	Position	Name/Location	Physical Details	Apparent Condition	Additional Notes
1	Bridge	Overhead (OH)	I-84 EB/WB in Southeast	Concrete Deck, Steel Girder, Concrete Piers	Good	Fenced Bikeway is west of track here
2	Crossing		Crosby Ave in Southeast	Signed only	Poor	Fenced Bikeway is west of track here
3	Culvert	Undergrade (UG)	Near Wells Park, Brewster	4' concrete	Good	Fenced Bikeway is west of track here
4	Bridge	UG	Peaceable Hill Road, Brewster	25' span, Concrete slab, I beam supported two track bays	Fair	Fenced Bikeway occupies southern track bay
5	Bridge	UG	East Branch of Croton River	267' two spans, Wooden open deck steel truss, 30' above river two track bays	Fair	Requires renovation to accommodate train and bikeway (currently not useable)
6	Bridge	UG	US 202/6 East Main Street, Brewster	128' span through girder steel bridge	Good	Rehabbed for bikeway. Fenced Bikeway occupies southern track bay
7	Bridge	OH	I-84 EB/WB in Brewster near Allview Ave	Concrete Deck, Steel Girder, Concrete Piers	Good	Fenced Bikeway is south of track here
8	Bridge	UG	US 202/6 near I-684, Brewster	90' span through girder steel bridge two track bays	Good	Rehabbed for bikeway. Fenced Bikeway occupies southern track bay
9	Bridge	OH	I-684 SB/NB interchange with I-84	Concrete Deck, Steel Girder, Concrete Piers	Good	Fenced Bikeway is south of track here
10	Bridge	OH	I-684 NB on/off ramp to US 202	Concrete Deck, Steel Girder, Concrete Piers	Good	Fenced Bikeway is south of track here
11	Bridge	UG	West of Joe's Hill Road over wetlands	10' span open wood deck, steel girder single track bay	Track is Poor, bikeway is Good	New wood deck bridge built for bikeway using existing abutments south of tracks
12	Crossing		Joes's Hill Road	Signed Only	Poor	No Stop lines. Limited sight distance.
13	Bridge	UG	West of Joe's Hill Road over wetlands	10' span open wood deck, steel girder single track bay	Track is Poor, bikeway is Good	New wood deck bridge built for bikeway using existing abutments south of tracks

Map ID Number	Item	Position	Name/Location	Physical Details	Apparent Condition	Additional Notes
14	Culvert	UG	Box culvert in the vicinity of 3874 Danbury Rd (US 202/6) and Haines Pond	8' concrete box culvert with wing walls	Good	Rehabbed for bikeway; right-of-way limited here
15	Bridge	OH	Farrington's Park Road	43' span concrete deck slab.	Fair	NY/CT State Line
16	Bridge	OH	Route 202/6 (near 102 Mill Plain Road)	159' three span concrete deck slab steel girder	Good	
17	Culvert	UG	Box culvert in the vicinity of 5 Prindle Lane	5' concrete box culvert	Fair	
18	Crossing		Private Crossing at 82 Mill Plain Road	Signed. Gated at property	Poor	Private property access from easement of Dandy Foods; property has additional access via Prindle Lane
19	Bridge	OH	Kenosia Avenue	288' three span concrete deck slab steel girder	Good	
20	Bridge	OH	I-84 EB/WB interchange with Route 7	288' three span concrete deck slab steel girder	Good	
21	Bridge	OH	Route 7 SB/NB interchange with I-84	322' four span concrete deck slab steel girder	Good	
22	Bridge	UG	West of Segar Street over Still River, Danbury	10' span wooden truss single track bay	Poor	Leads directly to crossing
23	Crossing		Segar Street, Danbury	Directionally Gated signals	--	Switch to double track section immediately east of here
24	Bridge	UG	Still River in the vicinity of Belmont Circle, Danbury	20' span wooden open deck steel girder two track bays	Poor	
25	Bridge	UG	Still River in the vicinity of Belmont Lane, Danbury	40' span wooden open deck steel girder two track bays	Fair	Girders and decking appear in better condition than 24
26	Bridge	UG	Still River and West Street, Danbury	100' two span (interior piers) wooden open deck steel truss two track bays	--	First span goes over Still River, second crosses West Street. Only 10'7" road clearance Steel is corroded and has utilities being carried on it

Map ID Number	Item	Position	Name/Location	Physical Details	Apparent Condition	Additional Notes
27	Bridge	UG	Still River in the vicinity of 70 Beaver Street	90' span wooden open deck steel girder two track bays	--	Behind Kingswood Kitchens Co. Inaccessible.
28	Bridge	UG	Rose Hill Avenue	165' span (2 larger for roads, plus 4 small stone pier spans) wooden open deck steel girder two track bays	--	First span goes over Rose Hill Avenue, second private lot. Multiple piers for deck to the east
29	Bridge	UG	Still River in the vicinity of Rose/Kennedy Streets	20' span concrete box steel girder two track bays	Good	Abandoned steel deck bridge to the southeast, appears to have served past tenants
30	Bridge	UG	Still River in the vicinity of 25 Rose Street	50' span open wood deck steel truss two track bays	Good	
31	Crossing		Main Street, Danbury	Full signals and gates for roadway	Good	Double track section with rail protection. Main Street AADT is 17,000.
32	Bridge	UG	Still River in the vicinity of 47 Garamela Blvd	100' span open wood deck steel truss two track bays	--	Inaccessible.
33	Crossing		Maple Avenue, Danbury	Directional signal gate only	Good	Double Track. Road is one way; signal only exists on one side. 9,100 AADT one block from Balmforth Ave Crossing
34	Crossing		Balmforth Avenue, Danbury	Directional signal gate only	Good	Double Track. Road is one way; signal only exists on one side. 9,100 AADT; 300' from Maple Ave Crossing, 150' from White Street Crossing
p	Crossing		White Street, Danbury	Full signals and gates	Good	Double Track. Complicated Road Geometry, with property driveway directly adjacent. 15,000 AADT; 150' from Balmforth Ave Crossing. Danbury Station Museum immediately to the East.

Bridge overall conditions were observed as at least fair, while the rail deck conditions varied significantly. No structural or rating analysis were undertaken for this study and would be required to determine the action needed on each structure. In many locations where the Bikeway had been constructed, existing bridge structure had been refurbished and reused (for example the various bridges over US 202).

In some cases existing bridge abutments (deck supports) had been used to carry a new pedestrian bridge, while leaving the existing railroad bridge untouched. In a majority of these cases, it is anticipated the railroad bridge will require replacement. Overhead road bridges are typically in good condition, as they are inspected and maintained by their respective State Transportation Departments. At-grade crossing conditions vary significantly based upon the roadway crossed and number of tracks. It is likely that all grade crossings will require upgrade to fully signaled gates, rail protection, and traffic improvements. In the specific case of the private crossing at 82 Mill Plain Road, it may be necessary to alter the easement that allows this crossing. The parcel does have road access south of the railroad right-of-way via Prindle Lane, albeit at a larger distance to Mill Plain Road (US 202). Future phases of the project should determine if the access can be changed or if the parcel needs to be acquired. The grade crossings in downtown Danbury are in close proximity of one another, indicating their simultaneous operation. These should be evaluated in various operational configurations in future phases of the project to determine the larger roadway transportation impacts when a train is operating in that area. For this to be feasible the project team is assuming that crossings are protected sequentially, depending on direction of train travel, so it is possible that some crossings are cleared immediately after a train passes. Further discussion and documentation of each line element can be found in Appendix C.

Existing Transportation and Transit

The transportation network within the study area is a mix of major interstate highways, routes, local roads, commuter and freight railways, and local public transit systems. These are each discussed below.

Area Roadway Network

The major roadways within the study area are I-84, I-684, US Route 202/Route 6 and US Route 7. I-84 is a four-lane east/west expressway, with two travel lanes in each direction. I-684 is primarily a six-lane expressway, running north/south with three travel lanes in each direction, starting from I-84. US Route 202/Route 6, largely parallels I-84 (or overlaps) through the study area, and is principal arterial with variable travel lanes in each direction. US Route 7 runs roughly north/south, overlapping a portion of I-84 until it separates at the Danbury Fair Mall and has two lanes in each direction.

The interstates in the area serve as daily commuter routes, commercial truck routes, and seasonal recreational routes according to NYSDOT; over 90 percent of the traffic traveling along them are single occupancy vehicles. Commuter use results in significant levels of congestion on weekdays; congestion is particularly pronounced where the two interstates meet. The interstates are considered part of the New York State Freight Core Highway Network, increasing their demand.

Traffic Volumes

As reported by NYSDOT[6] and CTDOT[7], existing (2019) Average Annual Daily Traffic (AADT) volumes on I-84 east of the I-684 interchange are approximately 69,000 vehicles per day (vpd), while volumes along I-684 just to the south of the I-84 Interchange, are over 76,000 vpd. On US-202/Route 6 just east of the I-684 interchange, AADT is 17,000 vpd (roughly 5% trucks) while US Route 7 south of the Danbury Fair Mall has volumes of roughly 35,000 vpd.

During the morning, there is congestion at the merge from I-84 onto southbound I-684. Similarly, westbound I-84 also experiences congestion just east of the I-684 interchange. During the evening there is congestion on I-684 leading to the single lane off-ramp to eastbound I-84. Eastbound I-84 also experiences congestion east of the I-684 interchange, continuing past the New York State Line into Connecticut during the peak morning and evening time periods, owing to the high level of commuter traffic. US Route 7 follows a similar pattern, with peak period traffic going to/from I-84. US Route 202/Route 6 experiences more variability owing to the mix of land uses nearby. Within the study area, on the eastern end, it can become congested going to/from Western Connecticut State University during peak times, but at the western end traffic only becomes problematic as the route enters downtown Brewster, NY.

[6] NYSDOT Traffic Data Viewer, https://www.dot.ny.gov/tdv , using AADT for 2019.
[7] CTDOT Traffic Monitoring Station Viewer, https://portal.ct.gov/DOT/PP_SysInfo/Traffic-Monitoring, using AADT for 2019.

Area Public Transit Network

A number of different public transit services exist in the study area, principally commuter rail and local network buses. The information below describes schedules in effect prior to the onset of the COVID pandemic.

Metro-North Railroad Harlem Line

The Metro North Railroad Harlem Line provides commuter rail service from the western portion of the study area to Grand Central Terminal (GCT) in New York City via White Plains to Brewster and Southeast stations. Service between Southeast station (including Brewster) and GCT is electrified and operated by electric multiple unit cars using and under-running 3rd rail system for traction power. An extension from Southeast to Wassaic station is diesel powered. Trains take between 85 and 95 minutes between Southeast and GCT depending upon the number of stops. There are 38 trains per day in each direction on a typical weekday. The service is frequent and direct and attracts many commuters from Fairfield County in Connecticut and Putnam and Dutchess Counties in New York. Before the COVID pandemic hit, approximately 75,000 passengers a day rode the line[8]. At the Southeast station, approximately 1,200 passengers board at the station on average during the weekday. Most commuters drive to commuter rail stations. Typical parking utilization at the two Harlem Line stations within the study area ranges from 85 percent to 100 percent on an average weekday; parking usage represents a mix of daily metered parking and permit parking. Demand for permit parking exceeds the number of available permit parking spaces, which are largely handled by each municipality.

Metro-North Railroad Danbury Line

The Metro North Railroad Danbury Line provides commuter rail service from the eastern portion of the study area to Grand Central Terminal in New York City via South Norwalk and Stamford. During peak hours, service is operated through to Grand Central Terminal using dual mode (diesel and third rail) locomotives pushing or pulling seven can sets of coaches. A small number of peak period trains operate between Danbury and Stamford. During off peak hours, diesel locomotives push or pull three car sets of coaches between Danbury and South Norwalk only. Passengers transfer there to electric multiple unit trains to GCT. Trains take between 120 and 150 minutes to travel between Danbury and GCT depending upon the number of stops and whether there is a connection at South Norwalk or not. There are four (4) through trains and 10 shuttle trains in each direction to and from GCT on a typical weekday. Before the COVID pandemic hit, approximately 2,200 passengers a day rode the line[9]. At the Danbury station, approximately 200 passengers board at the station on average during the weekday. Parking utilization at the Danbury station is roughly 60 percent on an average weekday. There is no backlog of demand for permitted spaces here. A recent bill approved by the Connecticut State Legislature requires the CT Department of transportation to study restoration of an overhead catenary system to replace diesel locomotive operation with all-electric operations. A study on this change has not been initiated.

HART

Housatonic Area Regional Transit (HART) operates transit service in 12 communities in Connecticut and four in New York, centered on downtown Danbury. The network is made up of eight CityBus local transit routes, three loop routes, and three shuttles, as well as SweetHART paratransit service. The CityBus routes provide comprehensive service to the Danbury area and operate between 6 a.m. and 6 p.m. Monday through Friday and 8 a.m. to 6 p.m. on Saturday. There is no Sunday service on CityBus routes. Most operate every 30 to 60 minutes. Route 3 serves the Brewster train station on the Harlem Line. Loop routes operating during the evening and on Sundays, usually every 60 minutes, and cover the core service area in Danbury. Average daily ridership for the entire HART system is roughly 2,500 trips [10].

Danbury Brewster Shuttle

Shuttle routes are operated by HART and serve various stations on the Harlem Line including routes from New Fairfield, Connecticut to Southeast station, Danbury to Brewster station, and Ridgefield, Connecticut to Katonah station. Schedules are coordinated to minimize waiting time between the bus and train. Service on the Danbury to Brewster route, which closely parallels the study area, operates 24 westbound trips to Brewster and 22 trips eastbound toward Danbury. These typically handle less than 200 people per day[11]. Buses stop at the Exit 1 park and ride which is proposed to be a station on the new Danbury to Southeast rail link. The trip from Danbury to Brewster takes between 27 and 37 minutes depending upon the time of day and number of stops. Service is provided Monday through Friday only.

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[8] MTA Metro-North Railroad Annual Ridership Report (2019); web.mta.info/news/books
[9] MTA Metro-North Railroad Annual Ridership Report (2019); web.mta.info/news/books
[10] HARTransit Public Bus Efficiency Study, Western Connecticut Council of Governments, 2020.
[11] HARTransit Public Bus Efficiency Study.

Putnam County Transit

Putnam Area Rapid Transit (PART) operates a five-route local bus transit system in Putnam County. Four routes radiate from Putnam Plaza in Carmel and operate Monday through Friday with limited Saturday service. All routes are operated using minibuses. Two routes serve the study corridor, Route 1 that links the Brewster MNR Station with Putnam Plaza in Carmel and with Putnam Lake, and Route 3 that links the Southeast MNR Station with Patterson and Putnam Plaza in Carmel. Most routes operate hourly from approximately 6 a.m. to approximately 7 p.m. The PART system averages 400 riders per day.[12]

[12] National Transit Database, 2019 Transit Agency Profile for Putnam County Rapid Transit. https://www.transit.dot.gov/ntd/transit-agency-profiles.

DEFINITION/DEVELOPMENT OF ALTERNATIVES

Track Layouts

Because the rail lines did not historically have connections that are suitable for a competitive service, various alternative track layouts were sketch-level designed to assess the feasibility of connecting the Beacon Line with the Metro-North Harlem Line in Southeast, NY and with the Metro-North Danbury Line in Danbury, CT via the Housatonic Railroad's Beacon Line. Using Metro-North Railroad Track Design Standards,[13] aerial photography, site investigations, corridor valuation maps, and track alignment CAD files from the participant railroads, alternatives were developed sequentially for the connections, starting with the most direct connections for each existing line. The connections fall into two general categories for each end: allowing a unidirectional "through" train operation or providing a connection requiring the train to reverse direction to continue its trip. The following summarizes each connection developed, its' track components, and its' disposition, starting with the Beacon Line connections alternatives for the Harlem Line.

Beacon-Harlem Line Connector Alignment Alternatives

Alternative A

The alignment proposed in Alternative A is the shortest connection between the existing Harlem and Beacon Lines. It provides a route for trains from the Beacon Line connect on to the Harlem Line in a southward direction. As shown in Figure 28, a No.8[14] Right-Hand Turnout (switch that connects one track to another) on the easternmost track on the existing Harlem Line leads to the proposed connector paralleling the Harlem Line for several hundred feet, before starting into a lengthy curve connecting two tangent (straight) track sections separated by almost 135 degrees. The maximum speed on this curve is 20 miles per hour (MPH). This curve passes over the Tonetta Brook, through a forested area between Longview School and Brewster Baseball Garage, crossing Route 53/N Main St (requiring a new grade crossing), the Maybrook Bikeway, before running parallel to the existing Beacon Line and ultimately tying into the track via a Left-Hand No.8 Turnout. Trains would traverse the entire connection section at 15-20 mph due to the sharp curvature and slow-speed track switches that are necessary to fit in the limited space available. Some form of overpass would be required for the Maybrook Bikeway that runs parallel to the rail line here. Operating from Danbury on Alternative A, service would run southbound into Brewster Station, bypassing the Southeast Station entirely. As a result, any trains heading to GCT during the peak periods would need to compete for the already very limited platform availability at Brewster. Further, a majority of existing Harlem Line services originate/terminate at Southeast station (see Existing Transportation and Transit), making extension of those services to/from Danbury highly difficult. Evaluation of the Brewster Station site determined it was not feasible to add an additional station platform in the area to accommodate the additional trains. Because of the very slow speed connection operations, insufficient platform space and by-passing of Southeast Station, Alternative A was dropped from further consideration.

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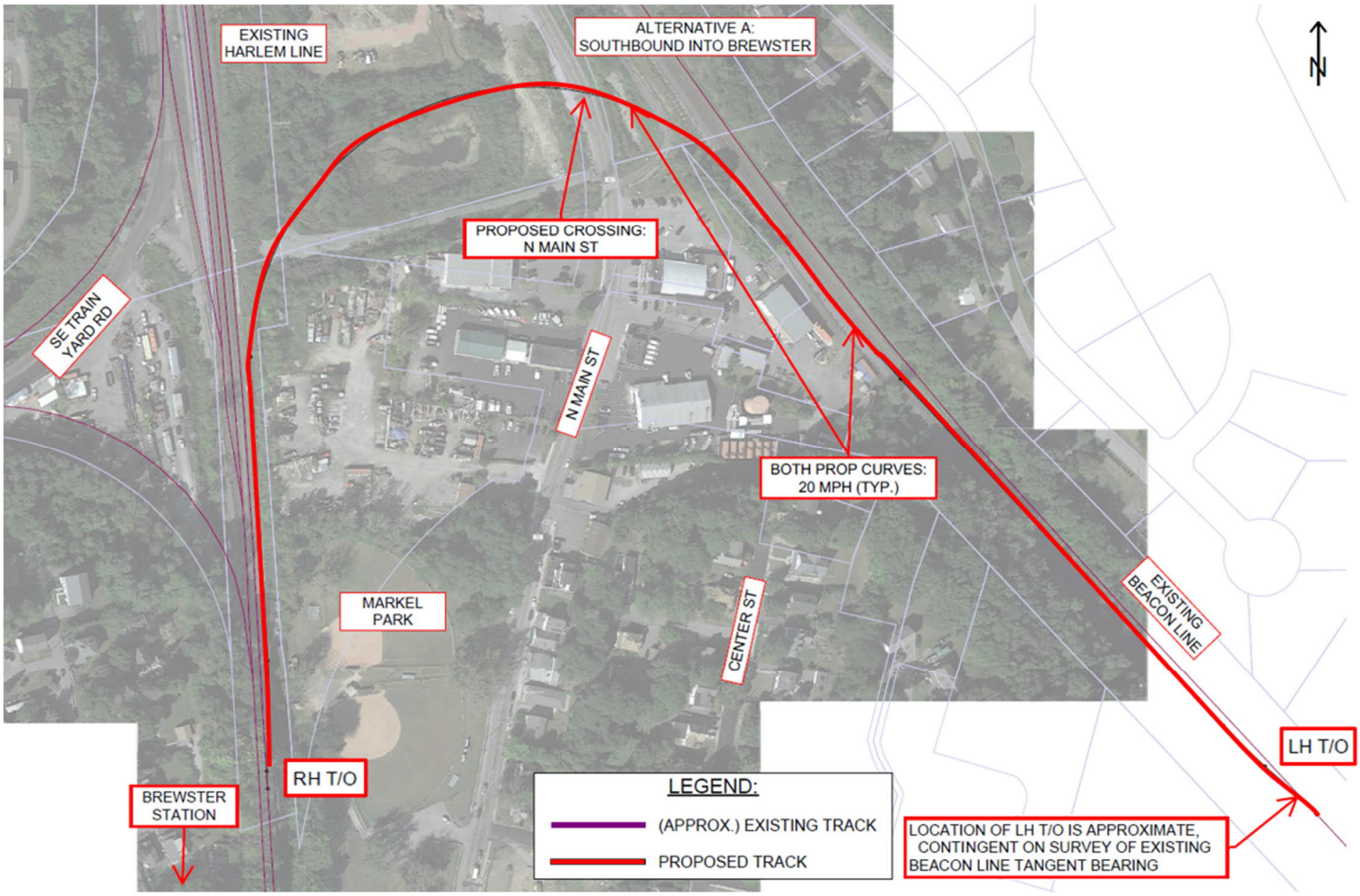
[13] Metro-North Railroad MW-4: *Metro-North Railroad Recommended Practice for the Inspection, Maintenance and Construction of Track*, 2010

[14] The number associated with a track switch or turnout is indicative of the size of the switch and the speed that may be operated through it on the diverging route side. A No.8 turnout, the shortest found in main line tracks in the NYC area, can accept diverging route operations no greater than 15mph. In contrast, a No.32, the longest switch currently found in the area, is approved for 80mph operation through the diverging route.

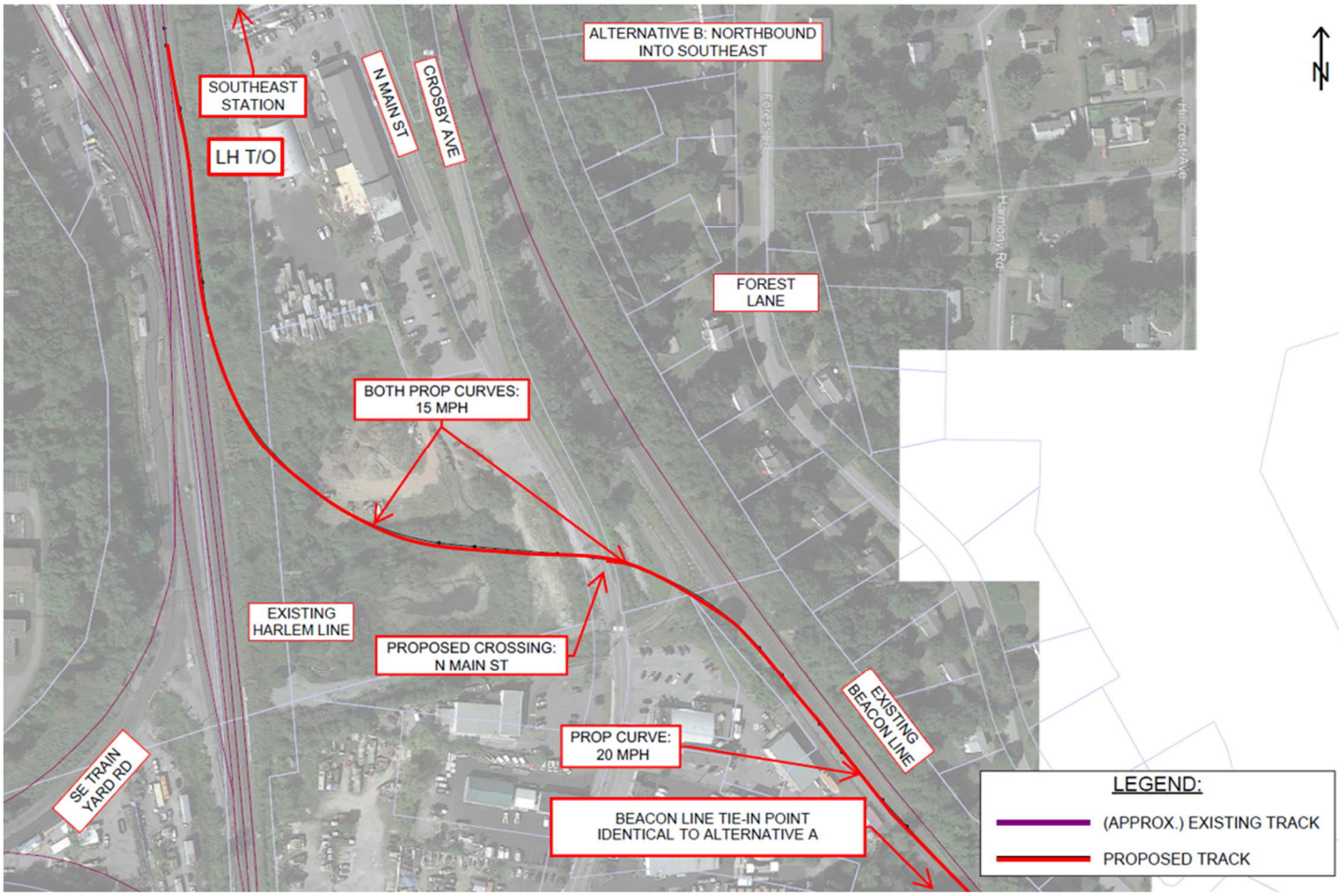
FIGURE 28. BEACON-HARLEM LINE CONNECTOR - ALTERNATIVE A



Alternative B

Alignment B shares the same track connection point on the Beacon Line as Alternative A, but ties into the Harlem Line in the northbound direction with a No.8 Left-Hand Turnout farther north along the easternmost Harlem Line track (see Figure 29). This brings the train operating on the connection into the Southeast Station on either of the two existing main tracks. The connector alignment has the same grade crossings (including the bikeway) and same slow-speed operation as Alternative A. Alternative B also encroaches on several additional private property limits. Trains operating from Danbury would arrive heading northbound into the Southeast Station and would need to perform a change in operational direction to continue south to GCT. Shuttle trains could terminate at Southeast in lieu of a direct operation as an alternative. Passengers would transfer to a connecting Harlem Line train. However, both the direct train, while reversing, and shuttle operations would consume critical track capacity at the very busy two-track Southeast Station. This constraint is considered substantial enough to jeopardize reliable operation of Harlem Line trains. (see Existing Transportation and Transit). The inability to resolve the combination of very slow-speed operations and platform capacity constraints in Alternative B led to superseding it with Alternative BB.

FIGURE 29. BEACON-HARLEM LINE CONNECTOR - ALTERNATIVE B



Alternative BB

Alternative BB supports the same operational move (northbound into Southeast Station) as Alternative B, but features a more streamlined track geometry that allows for a Maximum Authorized Speed of 25 MPH (10 MPH greater than Alternative B). Like Alternative B, the track layout requires adjacent grade crossings over Route 53/N Main St and the bike lane directly adjacent to the Beacon Line (see Figure 30). Alternative BB requires an additional grade crossing at Crosby Ave, encroaches on several additional private property limits, and may require the expansion of the Prospect Hill Rd bridge (which crosses the railroad right-of-way) to accommodate an additional track below. The principal difference between Alternatives B and BB is that BB does not utilize the existing Harlem Line tracks and station platform, rather it parallels the existing track north into Southeast Station to an additional platform between the new and existing station track for either transfer to Harlem line trains or to provide sufficient time to change a train's operational direction. This change is expected to provide much more stable operations for both the Harlem and Beacon Lines This is shown schematically in Figure 31.

FIGURE 30. BEACON-HARLEM LINE CONNECTOR - ALTERNATIVE BB

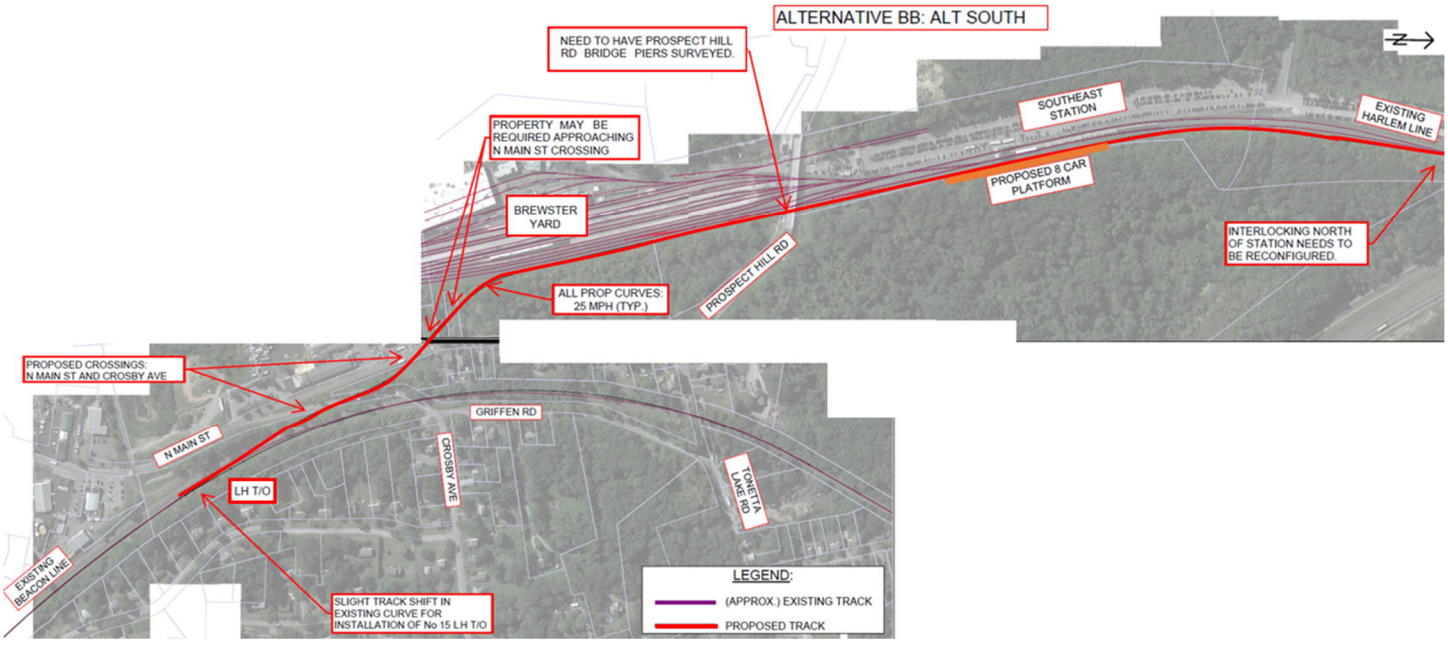
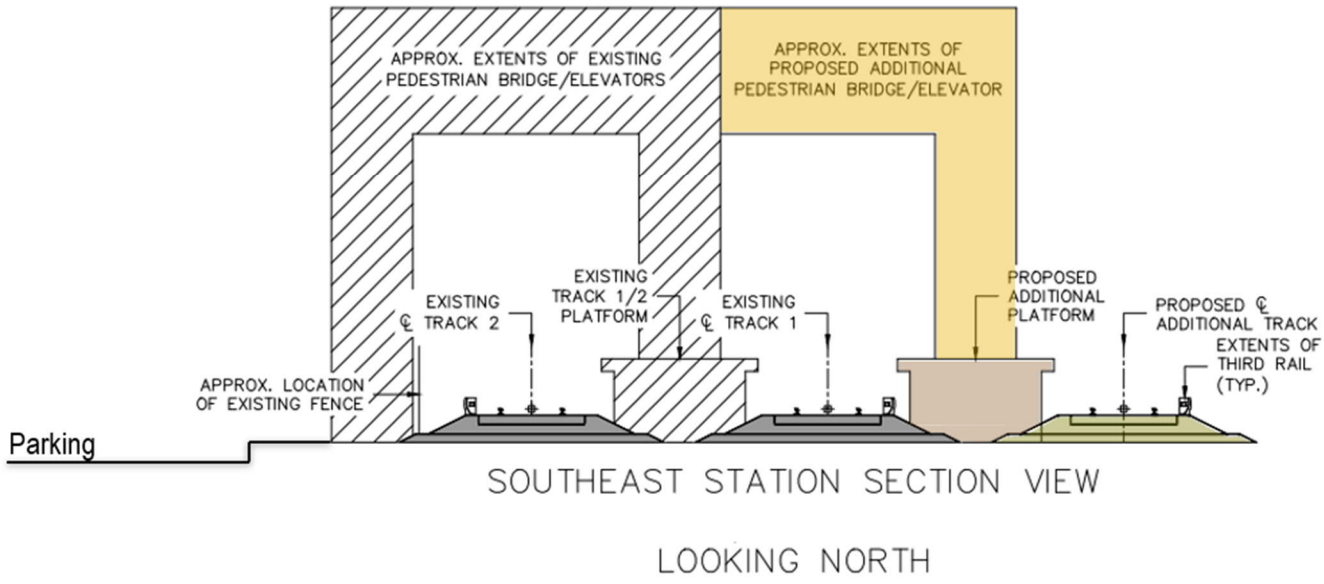


FIGURE 31. ALTERNATIVE BB, SOUTHEAST STATION SECTION VIEW

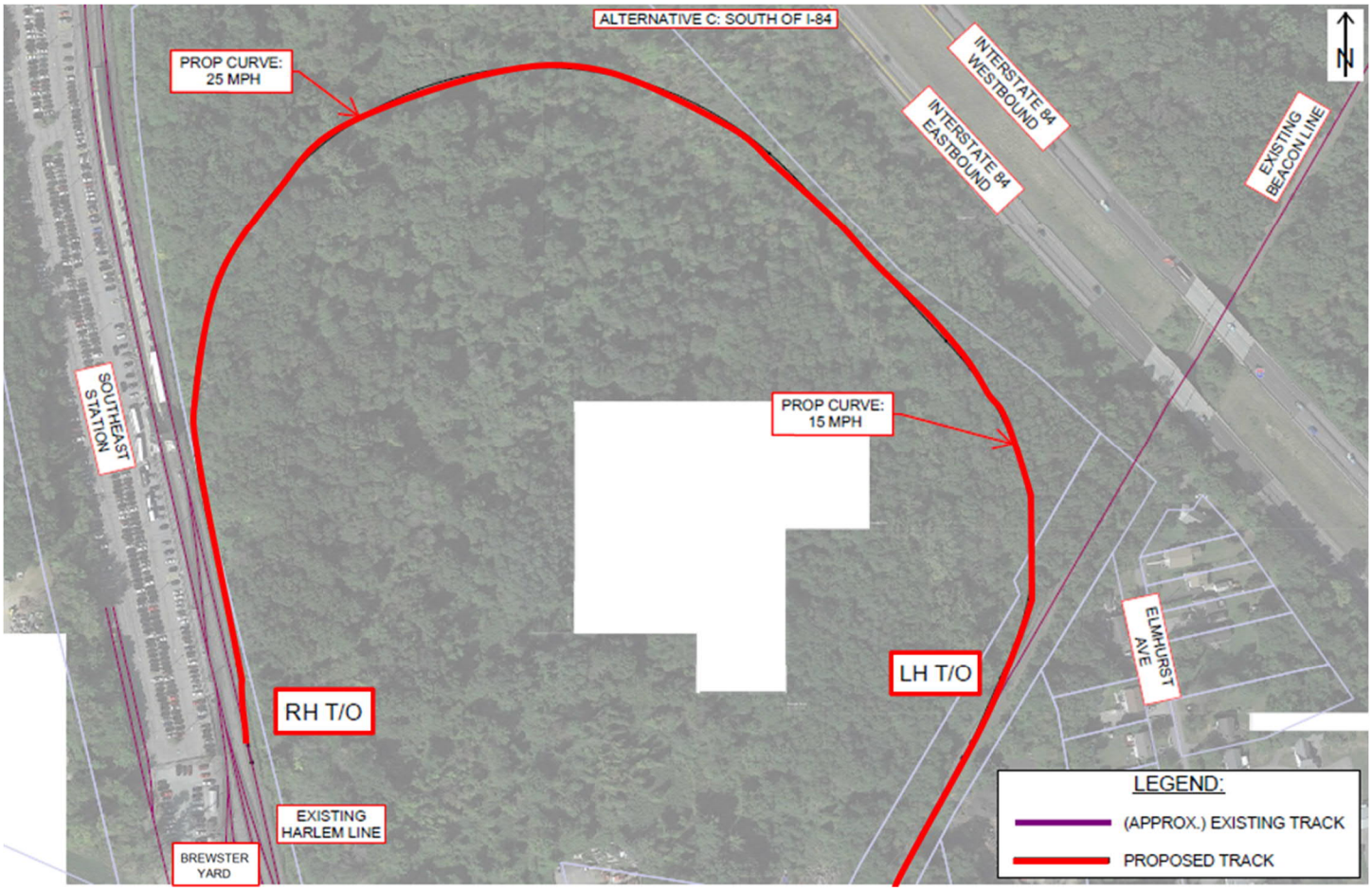


Alternative C

The alignment for Alternative C runs through almost entirely undeveloped land south of I-84 in the vicinity of the Tonetta Brook just northeast of the Southeast Station (see Figure 32). Alignment C diverges off the existing Beacon Line with a Left-Hand No.10 Turnout, crossing the Maybrook Bikeway. Like the other alternatives, some form of protected grade crossing (or overpass) would be needed. The proposed connector track has two curves that restrict operating speeds to 25 and 15 MPH to keep the rail alignment out of the I-84 right-of-way. This alignment forces the location of the switch to tie into the existing Harlem Line south of the Southeast Station platform, forcing an additional change in operating direction to serve the station (not serving the station would make this alternative no better than Alternative

A). The sharply curved alignment also precludes construction of an additional station platform as it would be entirely non-compliant with Americans with Disabilities (ADA) and safety standards. Compound this with an additional operational change at the Station platform to continue service to GCT, and this alternative was dropped from further consideration.

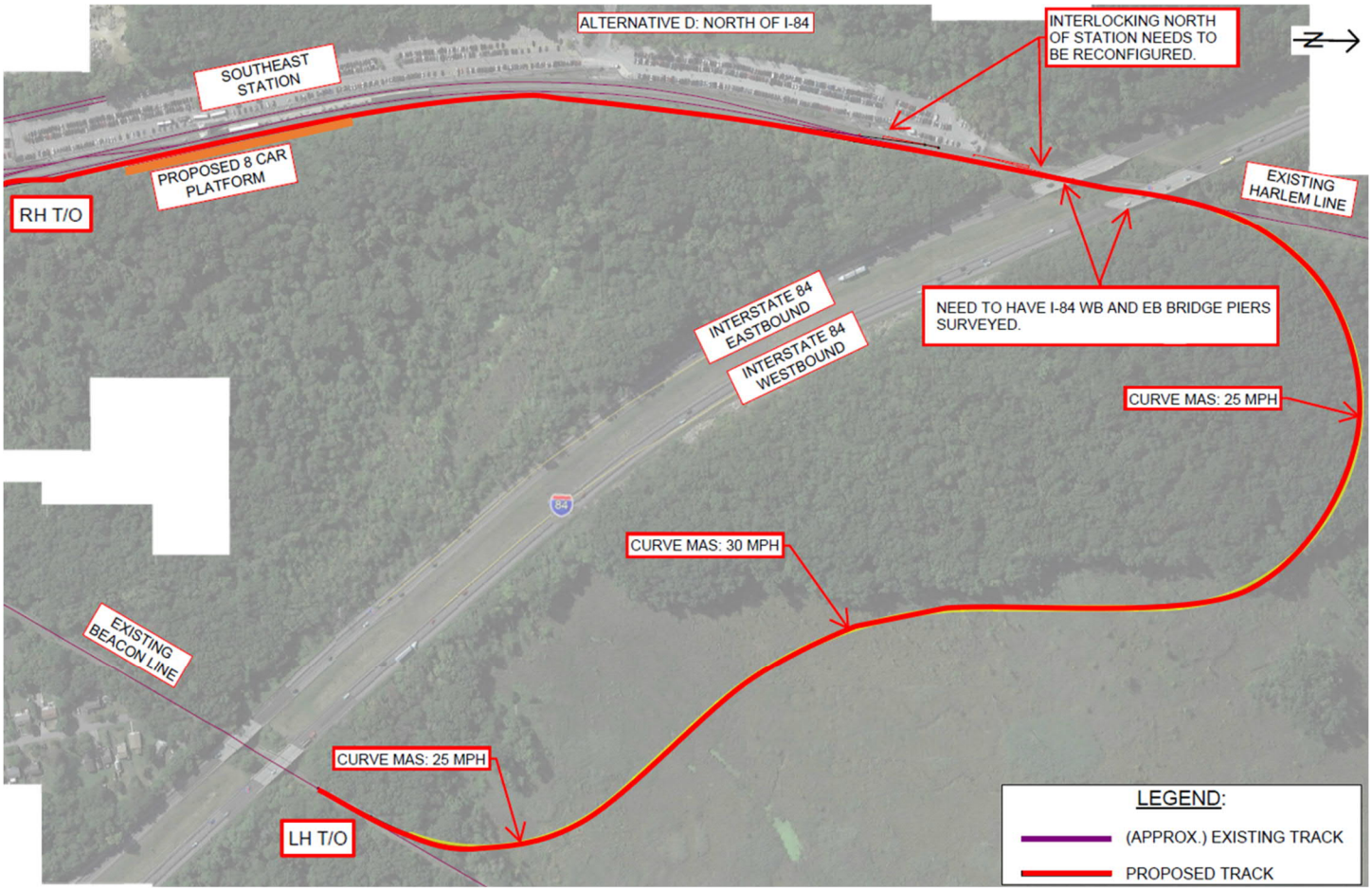
FIGURE 32. BEACON-HARLEM LINE CONNECTOR - ALTERNATIVE C



Alternative D

Alternatives D's alignment diverges from the existing Beacon Line north of I-84 with a No.15 Left-Hand Turnout (similar to all other alignments some form of protected crossing for the Maybrook Bikeway would be necessary) (see Figure 33). A series of curves allow for a 25 – 30 MPH operation on the track before it runs parallel to the existing Harlem Line, under the I-84 bridge and into Southeast Station. The connection traverses a portion of the Southeast Park open space, some of which have been identified as wetlands associated with the Tonetta Brook. Unlike Alternative C, Alternative D can operate southbound into Southeast Station and utilize the entire exiting station platform without a large reconfiguration of existing Harlem line switches. However, this operation will utilize platform track capacity and compete for the space in the same manner as Alternative B. Existing shuttle services to Wassaic, (typically waiting on the southbound Harlem Line track) could be especially affected by this type of operation. (see Existing Transportation and Transit). Similar to Alternative BB, construction of an additional platform edge and station track is recommended. The additional platform would virtually eliminate the scheduling conflicts that simultaneous northbound/southbound arrivals would produce.

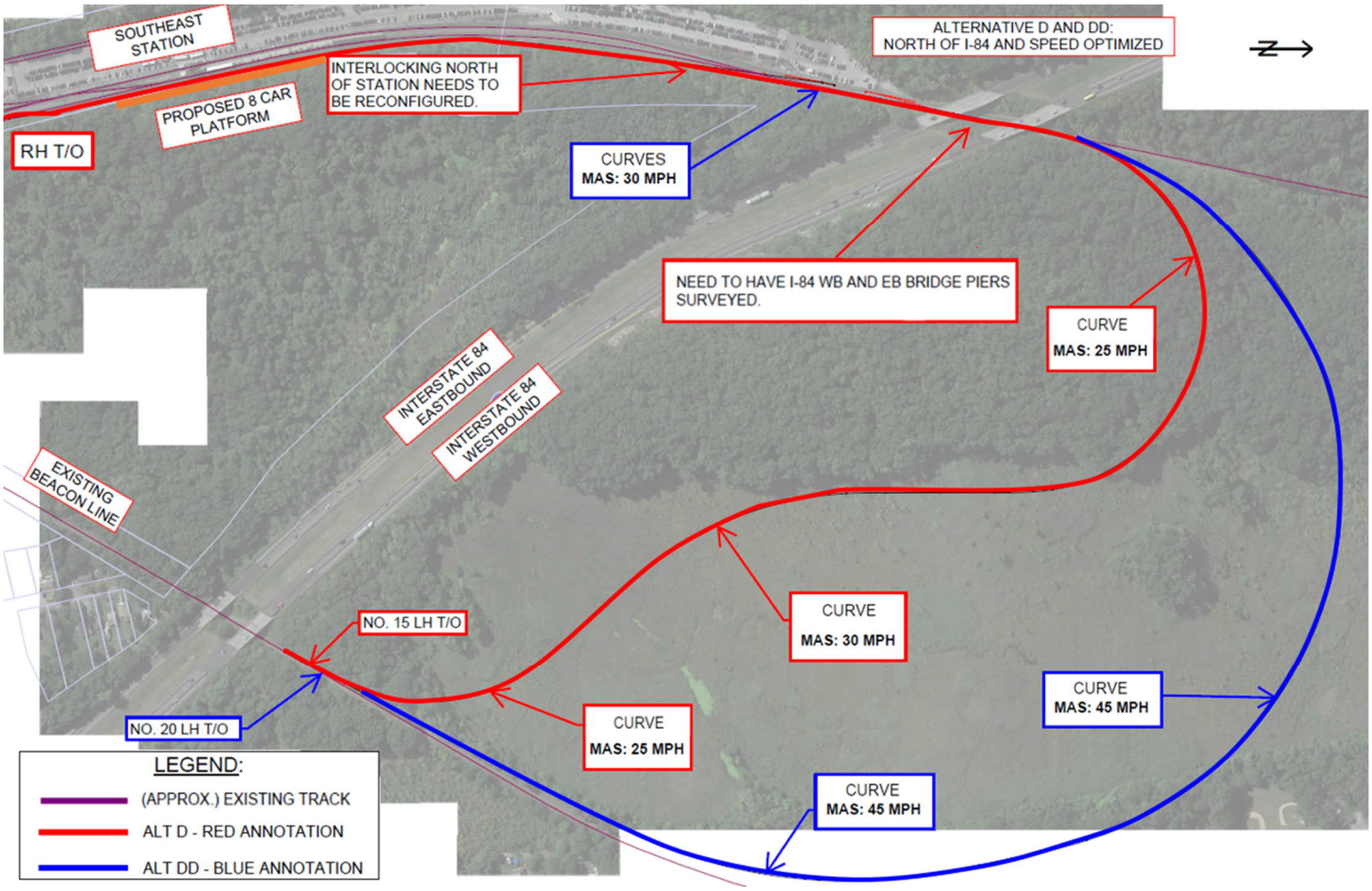
FIGURE 33. BEACON-HARLEM LINE CONNECTOR - ALTERNATIVE D



Alternative DD

The longest alignment proposed, Alternative DD is a refinement of Alternative D that has improved operating speeds for the connection (both shown in Figure 34). It features a No.20 Left-Hand Turnout off the existing Beacon Line and two extremely long curves with Maximum Authorized Speed of 45 MPH. The connector alignment then matches the same geometry as Alterative D when paralleling the existing Harlem Line under I-84 and into Southeast Station. However, the added speed comes with increased spatial requirements. The eastern most curve runs adjacent to Castle Park on Pumphouse Rd, and the entire alignment will have a greater impact on the Southeast Park open space wetlands conditions than Alternative D. The alignment may have less wetlands impacts than Alternative D, but further investigations are required to confirm this.

FIGURE 34. BEACON-HARLEM LINE CONNECTOR - ALTERNATIVE DD



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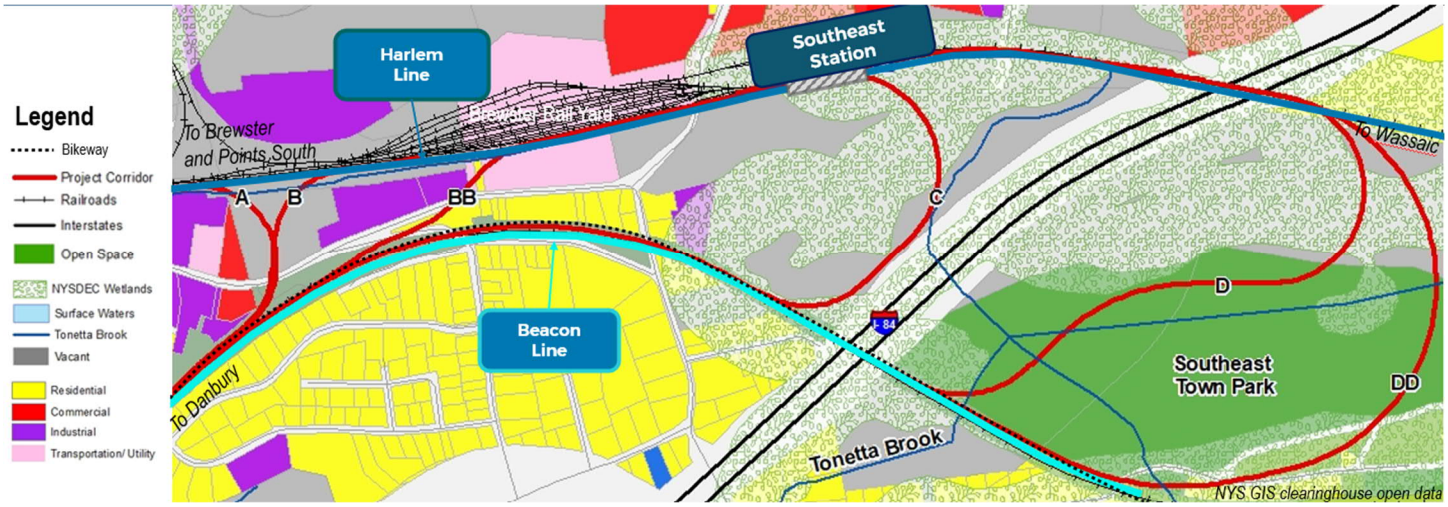
Beacon-Harlem Line Connector Alignment Alternatives Summary

Overlaying the proposed alignments on NY GIS land use data (see Figure 35), its readily apparent that each of the alternatives have some form of property and grade crossing impact.

FIGURE 35. LAND USE IMPACTS OF BEACON-HARLEM LINE CONNECTOR ALTERNATIVES



Alternatives A, B, and C are not recommended for further development due to physical and operational limitations.

Alternatives BB, D and DD are recommended for further investigation in subsequent phases to determine the full extent of wetlands/parklands impacts. It is also recommended they should be evaluated with an additional platform edge/track at Southeast Station to provide flexibility in operations.

Beacon-Danbury Line Connector Alignment Alternatives

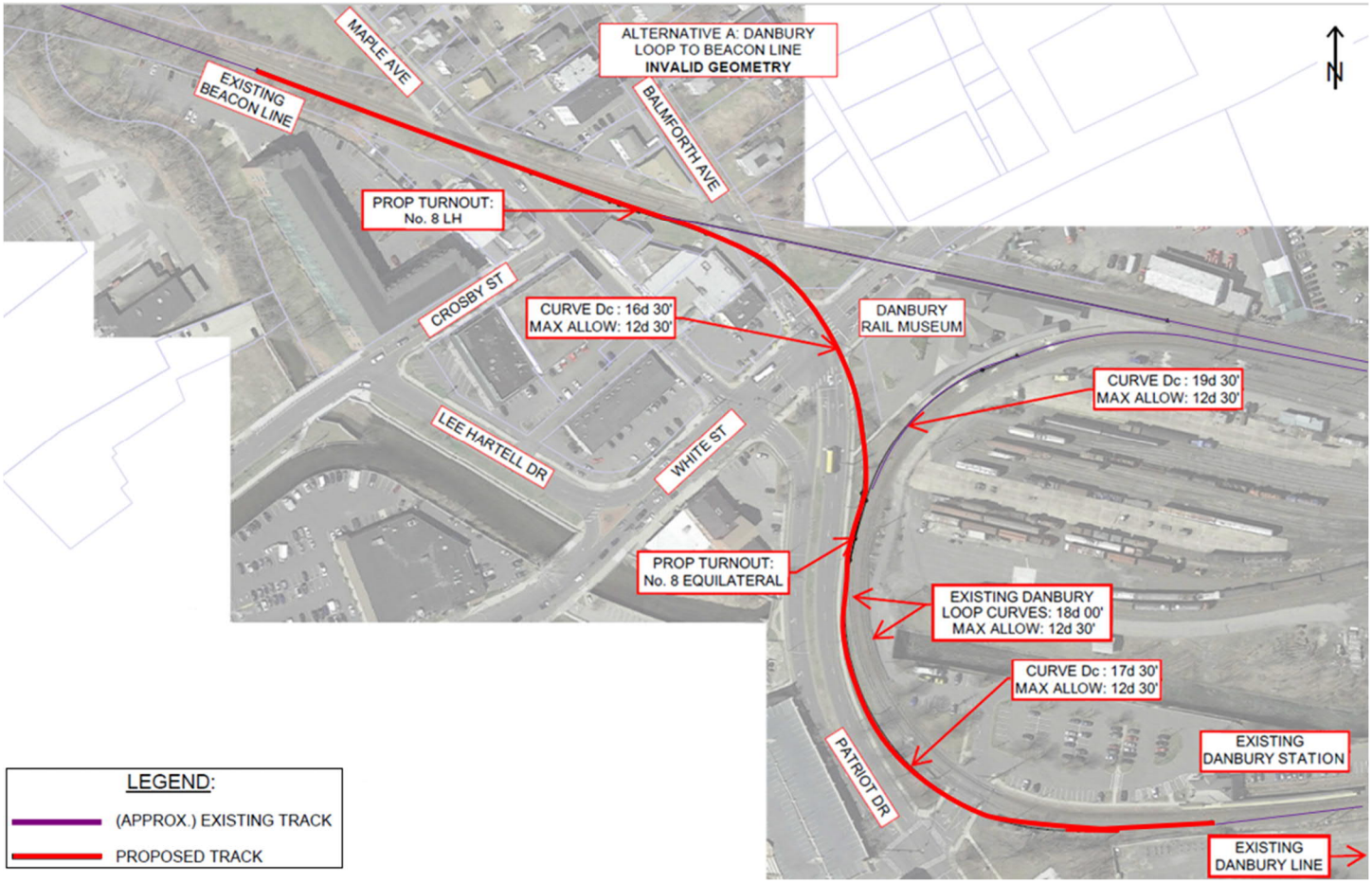
Initially, the investigations for connecting the Beacon Line to the active Metro-North Danbury Line attempted to minimize the amount of trackwork required to make a connection. While there is an existing switchback track connecting the Beacon Line to the Danbury Line via the Danbury Rail Museum, it would require trains to make a change in operating direction to operate into/out of the existing Metro-North station, all at very slow speeds (10-15mph). The project team evaluated if the existing route could be improved in terms of operational speed (to minimize the impact of changes in operation) and found that the required track geometry would either eliminate the existing yard and loop track connections or move further east into neighboring commercial properties, making that option fatally flawed. The project team then concentrated on new alignments that involved limited trackwork. However, the simplest connections proved problematic as is discussed further below.

Alternative A: Danbury Museum Loop to Beacon Line (Invalid Geometry)

Alternative A is deceptively straightforward in its design. A direct connection between the Beacon and Danbury lines (shown in Figure 36) starts with a No.8 Left Hand Turnout on the Beacon Line. The connection continues through a curved grade crossing over White St, continuing alongside Patriot Dr to a No.8 Equilateral Turnout (a switch that merges two curves into one). Directly following the Equilateral Turnout, the alignment curves alongside Patriot Dr to tie into the existing Metro-North Danbury Line. While this design connects both lines directly, the resultant curve geometry required for the track is not capable of carrying modern trains, nor meeting current design standards. The maximum value for a track's curve is 12.5 degrees[15], which allows for the tightest possible curve for a train to follow without risk of a rail climb derailment for most equipment designs in service. The curves shown in Alternative A are 16.5 degrees, 17.5 degrees and 19 degrees, conforming to the existing balloon loop tracks around the Danbury Railroad Museum (former New Haven Railroad Station), well beyond the maximum standard. Alternative A was dropped from further consideration for this reason.

[15] Railroad design standards use degree of curvature instead of radius to describe rail curves. The degree of curvature is customarily defined in the United States as the central angle D subtended by a chord of 100 feet. As an example, a 12.5 degree curve has a radius of approximately 350 ft.

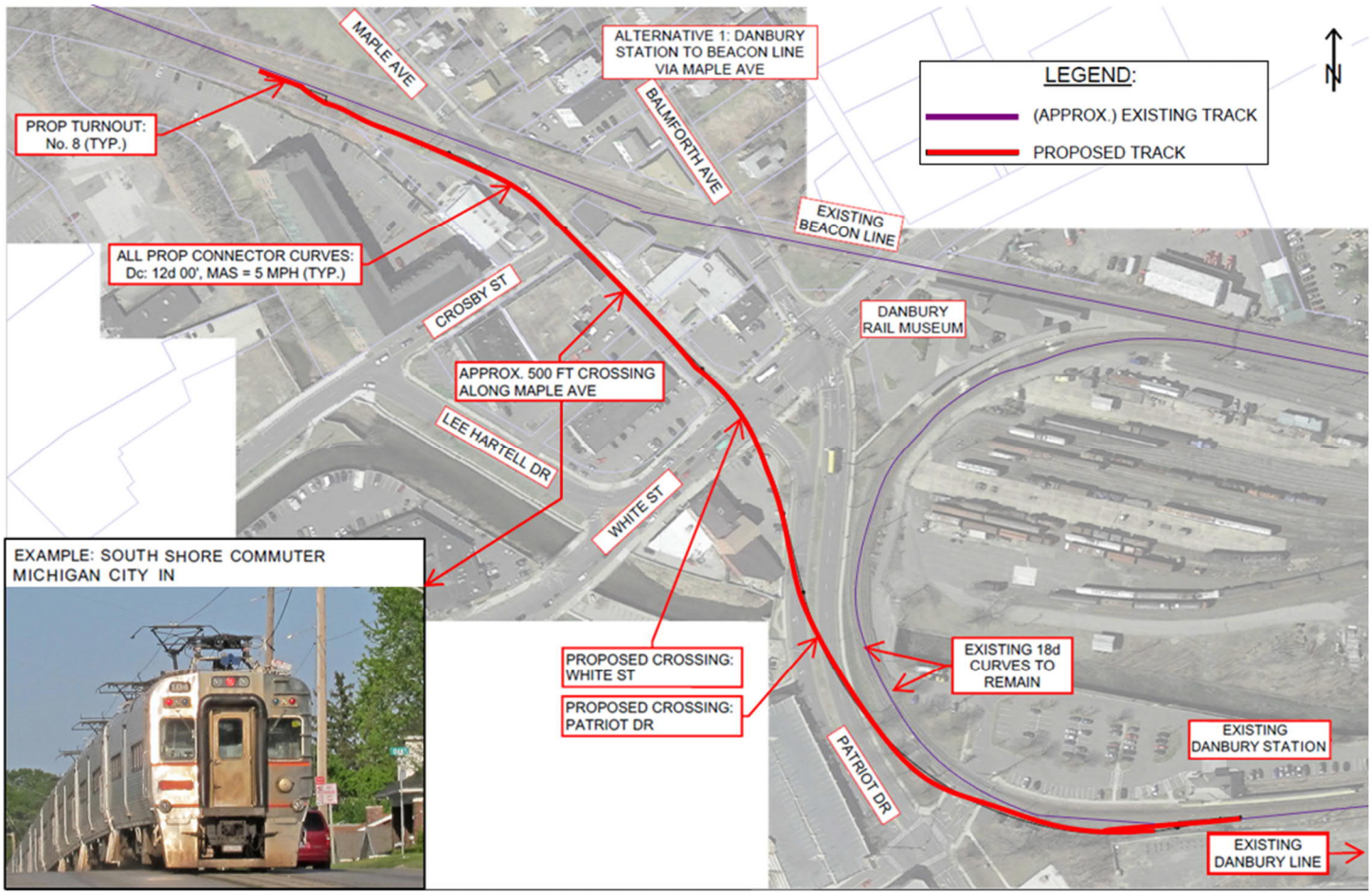
FIGURE 36. BEACON-DANBURY LINE CONNECTOR - ALTERNATIVE A



Alternative A-1 (Maple Ave)

Alternative 1 (Figure 37) is the shortest of the routes conforming to standards. As proposed, it ties into the Beacon line with a No.8 Right-Hand Turnout cut into the tangent portion of the inside Beacon Line track west of Maple Ave. The proposed connector track then parallels the existing Beacon Line for approximately 200 ft before curving onto Maple Ave and running within the center of the roadway travel lanes for about 500 ft. After following the roadway, the alignment then crosses the intersection of Maple Ave and White St. A final grade crossing over the Patriot Dr. divided four-lane road leads to the connection point with the existing Danbury Line, with a Left-Hand No.8 Turnout on the outside track leading to the Danbury Metro-North Station. While somewhat unconventional, “street running operations” exist throughout the nation, principally in urbanized areas, e.g., Caltrain on Jack London Square in Oakland California, South Shore Commuter in Michigan City Indiana (to be retired in 2024) where roadways share the same right-of-way with the track. Typically, these operations reserve the roadway space by preempting signals along the length of shared roadway space, to ensure the path is clear. In this alternative, the length of Maple Ave from the Beacon Line grade crossing through Patriot Drive would be protected when a train is approaching or departing the station. While the alignment is geometrically feasible, the operation along it is limited to 5 MPH and would require significant grade crossing/signalization to maintain. It is also unlikely that the population in the core of Danbury would want the increased limitation placed on the immediate roadway network. For these reasons, this alternative is not recommended for further evaluation.

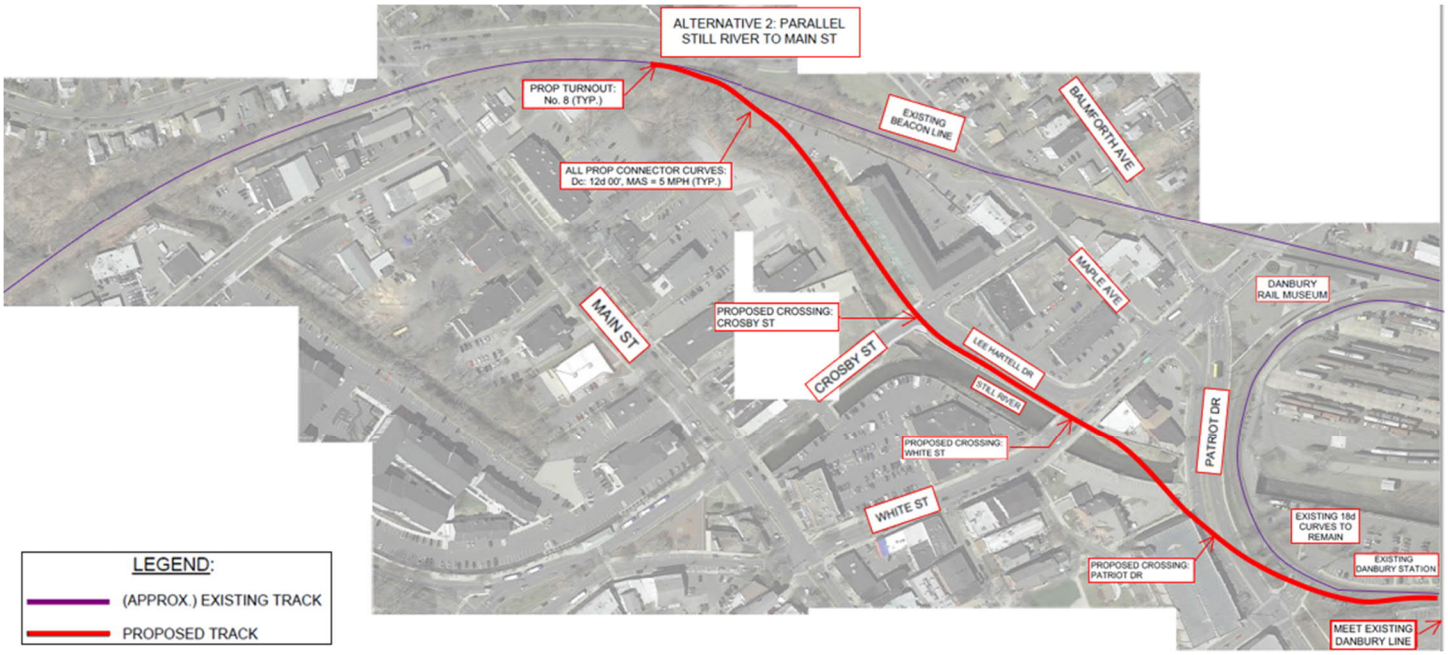
FIGURE 37. BEACON-DANBURY LINE CONNECTOR - ALTERNATIVE A-1



Alternative A-2 (Lee Hartell Dr)

Alternative 2 (Figure 38) involves shifting the existing Beacon Line inside curve between Maple Ave and Main St southward to allow for a No.8 Right-Hand Turnout to be installed. The proposed track diverging from the turnout would need to bridge the Kohanza Brook before running parallel to the southwest face of Brookview Commons Apartment Complex. The alignment proceeds to curve through a grade crossing on Crosby St and run along the green space between Lee Hartell Dr, and the Still River. It then crosses White St and bridges the Still River before a final 150 ft grade crossing over Patriot Dr. to meet existing track at the same Danbury Line connection proposed in Alternative 1. This alternative involves three grade crossings, two river crossings, and would remove the local green space that remains along the Still River. While the speeds would be limited to 5 MPH operation, it would pass directly adjacent to residences and eliminate access to a portion of the river. The community impacts, riverside impacts, and increased construction impacts (grade crossings and bridges) preclude this alternative from being recommended for further development.

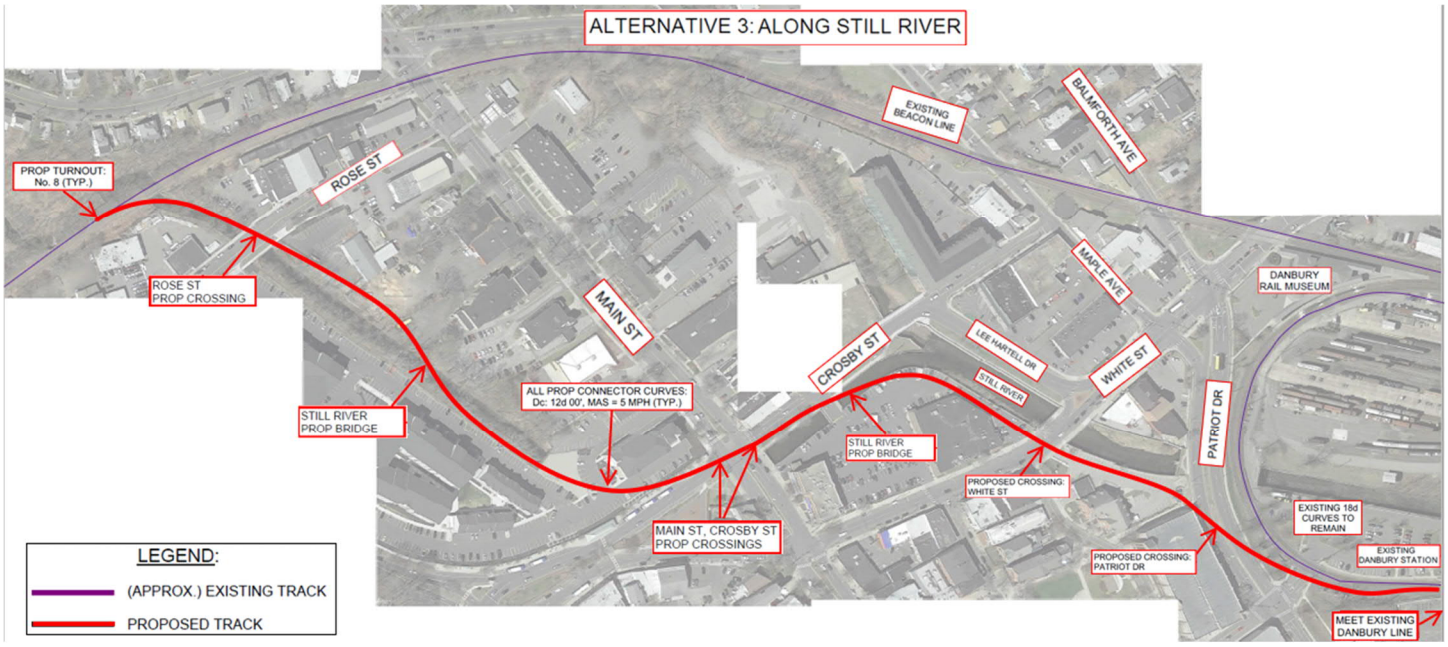
FIGURE 38. BEACON-DANBURY LINE CONNECTOR – ALTERNATIVE A- 2



Alternative A-3 (Still River)

The Still River alignment (Alternative 3; Figure 39) is the most complicated/longest alternative considered for connecting the Beacon Line to the Danbury Line. It roughly follows the banks of the river and traversers an area that has grown and developed around the railroad right-of-way for the past 100 years; including a neighborhood zoned as an Historic District just south of the proposed alignment. The alternative ties into the Beacon Line south of the Still River, behind the Danbury Auto Group building at 33 Rose St, with a No.8 Right-Hand Turnout cut into the existing track. A curve diverging off the turnout would bridge over the Still River and then cross Rose St before running adjacent to the Still River's north bank. The alignment proceeds to bridge the Still River again for 100 feet before landing on the southern bank adjacent to the Kennedy Flats Apartment Complex to better utilize the intersection of Kennedy Avenue. The alignment would require reconfiguration of the Apartment's parking lot and potentially the relocation of the HARTransit Pulse Point on Kennedy Avenue. After clearing the apartment complex parking areas, several grade crossings through the intersection of Crosby St and Main St, the Still River, the Advance Auto Parts parking area, White St, the City of Danbury Parking Areas and Patriot Dr are required before the alignment meets the existing Danbury Line using the same means as the previous alternatives. The result is a track alignment that "fish-tails" through several different property limits, requires several new bridges above an already redirected river and uses horizontal curvature that restricts all train movements to 5 MPH. The extensive number of grade crossings required for this alignment and property impacts are fatal flaws and prevent this alternative from further development.

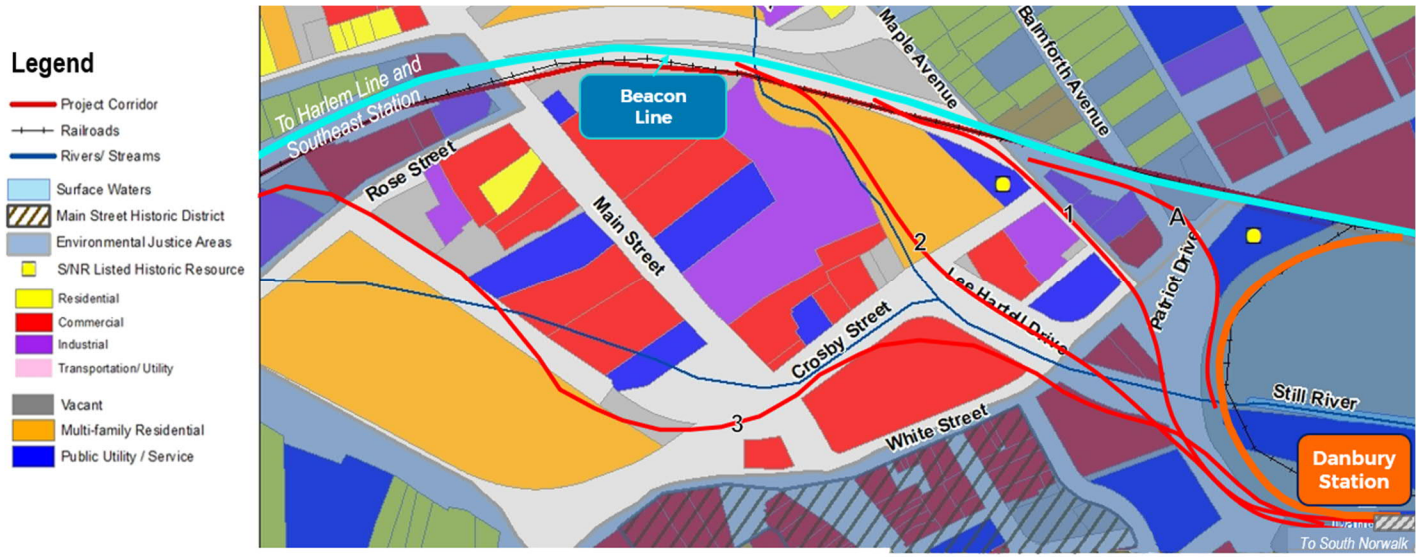
FIGURE 39. BEACON-DANBURY LINE CONNECTOR - ALTERNATIVE A-3



Beacon-Danbury Line Connector Initial Alignment Alternatives Summary

Overlaying the proposed alignments on CT GIS land use data (Figure 40), it is readily apparent that each of the initial alternatives have significant property, and grade crossing impacts. None are reasonably feasible.

FIGURE 40. LAND USE IMPACTS OF BEACON-DANBURY LINE CONNECTOR ALTERNATIVES

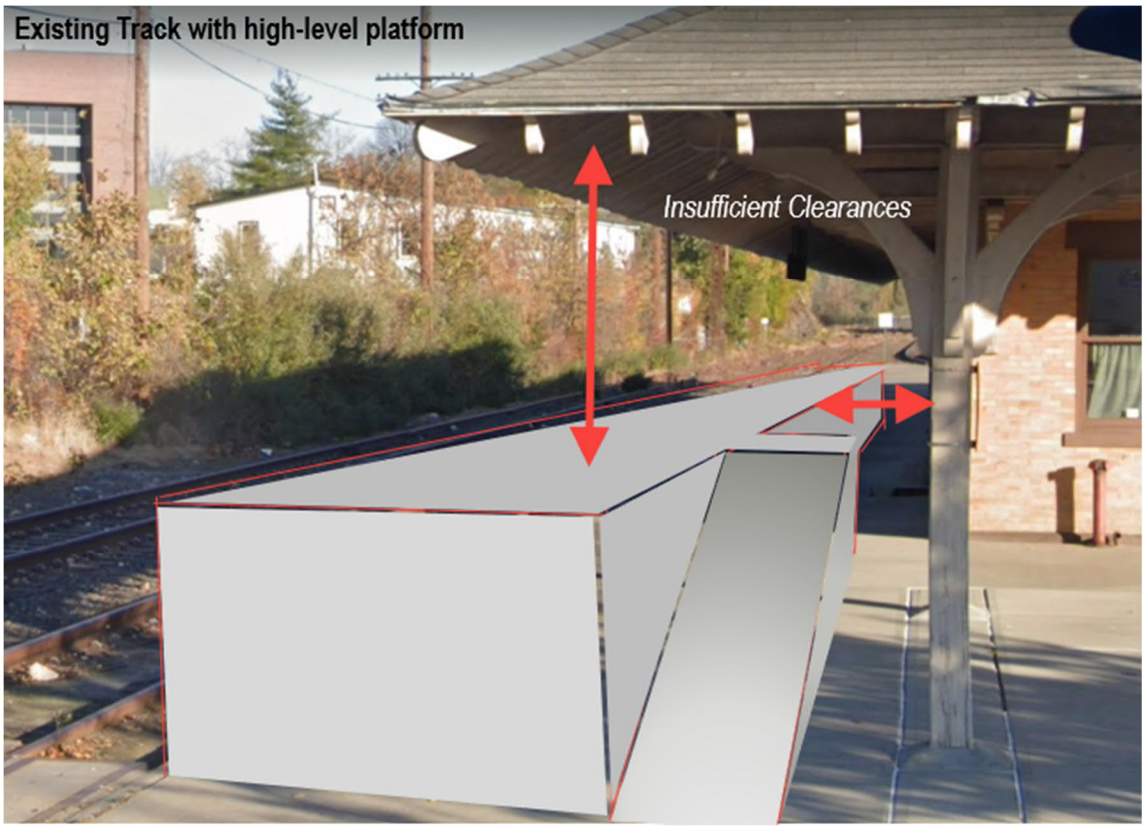


Revised Approach: Station Reactivation

Despite an interest in developing an alignment allowing a connection to the existing Danbury train station, none of the prior alternatives were deemed fully feasible. As an alternative, the project team looked at reactivation of the former station location for use as a new terminal station (Alternative B). While not directly connecting to the Danbury Station, the proximity of the Museum site is not far from the

existing Metro-North station. Initial investigation in the site identified that the existing low-level platform could not be easily modified to accommodate a high-level Americans with Disabilities Act (ADA) accessible platform without affecting the historic canopy structure (see Figure 41). This prompted the development of Alternative BB.

FIGURE 41. DANBURY RAILWAY MUSEUM TRACK WITH HIGH-LEVEL PLATFORM



Alternative BB: Beacon Line Historic Station Location

With a streamlined approach, Alternative BB is the least impactful design to reactivate the Beacon Line in Danbury, CT (Figure 42). A No.15 Left-Hand Turnout west of Maple Ave combines the existing double track into one, for a length of over 1,500 ft. The removal of the inside track will make room for a 400 ft, high-level platform for passengers to arrive at a station adjacent to the Danbury Railroad Museum building (Figure 43). Another No.15 Right-Hand Turnout on the eastern side of the platform resumes double track operation on the existing Beacon Line. Because of their increased length, the No.15 turnouts allow for 30 MPH operations, mimicking the existing conditions on the original Beacon Line. Unlike all the previous alternatives, this one is completely self-contained within the existing right of way with no property impacts expected (subject to more detailed investigations). However, it does require that passengers wishing to continue on Metro-North Danbury Line services transfer on foot to the nearby station. The travel time of this is estimated at a roughly four-minute walk, following the sidewalks in the area.

FIGURE 42. BEACON-DANBURY LINE CONNECTOR - ALTERNATIVE BB

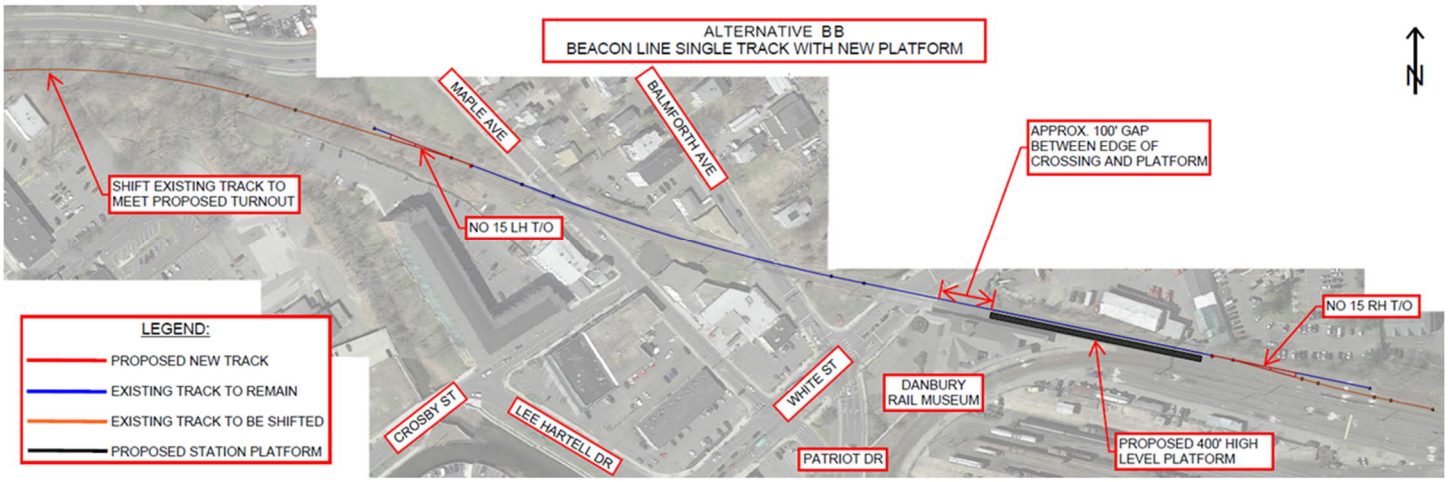
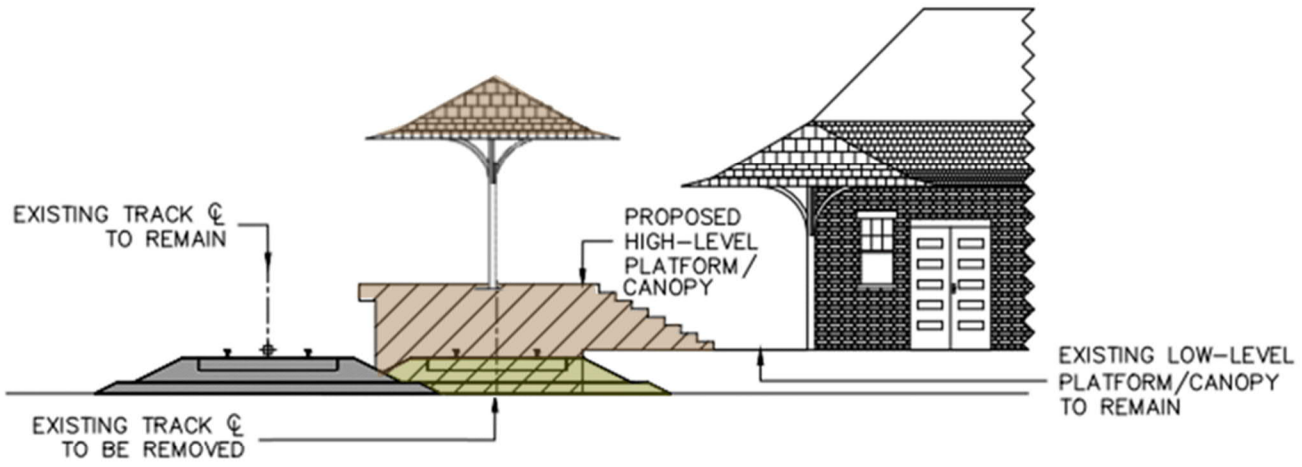


FIGURE 43. PROPOSED HIGH-LEVEL PLATFORM AT DANBURY RAIL MUSEUM (ALTERNATIVE BB)



SE2D

Beacon-Danbury Line Connector Preferred Alignment Alternative Summary

The project team recommends Alternative BB as meeting all service requirements and as the least impactful design to reactivate the Beacon Line in Danbury, CT. Additional track to the east of the proposed platform could be redeveloped as a holding track, for services that require additional trains as needed. Also, should service to points further east to Brookfield, CT and other locations be considered, this alternative would best accommodate such a future development.

Service Planning

This section describes the service plan alternatives that were used to develop ridership estimates, operating costs, capital programs and costs and other aspects of the feasibility study plan.

As discussed in the previous section, the Beacon Line passes a short distance to the east of Southeast station on the Metro-North Harlem Line and would require a new link between the two lines. The overall route distance between Southeast and Danbury is approximately 11 – 12.5 miles, depending upon what alternative is chosen to connect the Beacon Line to the Harlem Line.

Metro-North provides frequent service to Grand Central Terminal in Manhattan from Southeast Station. New York City bound travel, especially peak-period peak-direction commuter travel, has historically been the primary market that the line serves. The Harlem Line provides a direct and fast trip to New York City and many commuters are attracted to Southeast station due to its ample parking and ease of access from NY Route 312 to the north and I-84 to the east toward Danbury. Commuters can also get to White Plains via the Harlem Line, home to many companies and the nexus of Westchester County. In recent history, Metro-North has seen a growth of commuters traveling outbound from New York City to White Plains as employment has shifted, such that the railroad has adapted their scheduled to address the change (see Existing Transportation and Transit for greater details).

Southeast station is also the end of electrified territory for the Harlem Line, with the majority of trains for the line terminating here to be service/stored in Brewster Yard. Less frequent service continues north to Wassaic station, typically in the form of a connecting shuttle train that operates between Southeast and Wassaic.

Danbury is located on the Metro North Danbury Line which provides service to Grand Central Terminal via through trains during the rush hour and connecting shuttles to South Norwalk station on the New Haven Line during other times. The trip is less frequent and less direct than the Harlem Line and can take longer than driving to Southeast or other park-and-ride stations on the Harlem Line and continuing from there.

It is likely that implementing passenger service on the Beason Line between Southeast and Danbury would result in a faster trip to New York City than currently available via the Danbury Line, which in turn could lead to reductions in auto traffic on area roadways including I-84 and I-684. Further, if the proposed service is competitive with driving, people may choose the train from Danbury instead of driving to intermediate points that would now be accessible directly via the train. Service alternatives set out to improve the operational and travel time performance as compared to existing services to Danbury. Additionally, potential intermediate station locations at Danbury Fair and State Line identified previously were reviewed for suitability in overall rail operations.

Vehicle Options for Service

Determining the most appropriate vehicle for the service is a critical element to designing the overall system. Inadequate performance or insufficient seat capacity or too much performance can lead to wrong outcomes.

The following are the five different types of vehicles that are being considered for use in service of the project:

- Federal Railroad Administration (FRA) compliant Diesel Multiple Unit (DMU) vehicles
- FRA compliant Zero-emission multiple unit (ZEMU) vehicles: Hydrogen and Battery Powered Multiple Unit
- FRA compliant Push-pull operation with locomotive and coach cars
- FRA compliant Electric Multiple Unit (EMU) vehicles
- Light Rail Vehicles (LRV)

FRA Compliant Diesel Multiple Unit (DMU)

A Diesel Multiple Unit (DMU) is a multiple-unit train powered by on-board diesel engines. It does not require a separate locomotive, as the engines are incorporated into one or more of the coaches. DMUs are typically used for commuter rail applications and are placed in urban and rural settings as well as operating in city centers. DMUs currently sold in the U.S. may have better acceleration capabilities than locomotive hauled trainsets as their power to weight ratio and percentage of driven axles is uniform. This makes them well-suited for routes with frequent closely spaced stops. Present day DMU vehicles are light weight FRA compliant vehicles that can accelerate and decelerate nearly as fast as electric vehicles. The vehicles do not require electrical power from overhead or third rail sources which may result in savings on infrastructure costs of electrification. However, incremental maintenance costs for DMUs tend to be higher than for EMUs

because of the added fueling, lubrication, replacement and maintenance of engine parts and systems in every car. DMUs may have further disadvantages compared to locomotive hauled equipment as some designs are manufactured in fixed trainsets and cannot be swapped out if one car is needed for maintenance and repair.

Self-propelled diesel-powered railcars first became popular in the United States at the start of the 20th Century – predominantly as gas-electric variants of popular trolley car designs. The modern-day design was introduced with the Budd Rail Diesel Car (RDC) car in 1949. RDC DMUs were sold to 58 customers in five countries. However, due to higher maintenance costs, especially as their propulsion systems began to age, their popularity began to wane in the mid 1960's. Beginning in 2004 there has been a resurgence of modern DMUs in the United States and Canada with 11 new DMU systems being built in North America. Even with this level of interest, however, the market for DMUs is small. Today there is only one supplier (Stadler) of DMUs in the United States. There are other suppliers who have designs that meet the FRA requirements, but they have not gone through the USDOT approval process and are not readily available in the United States.

One of the most recent DMUs in the United States is the FRA compliant 2-car Stadler FLIRT DMUs for Arrow service in Redlands, California ordered by San Bernardino County Transportation Authority (SBCTA). These vehicles are scheduled to enter service in late 2022. The diesel generator units are low-emission, clean diesel engines which meet the Environmental Protection Agency (EPA) Tier 4 Final standard. Each vehicle provides 116 seats and room for an additional 112 standees, with a total capacity of 228. Figure 44 shows the general arrangement drawings for this DMU. The power pack (diesel engine) is located between two coaches as shown in Figure 44 and Figure 45. The vehicles are also scalable, allowing the option to easily add an additional passenger car as ridership increases in the future.

As this vehicle type does not exist within the Metro-North fleet, it would require a new maintenance and storage facility.

FIGURE 44. GENERAL ARRANGEMENT DRAWINGS OF STADLER FLIRT DMU

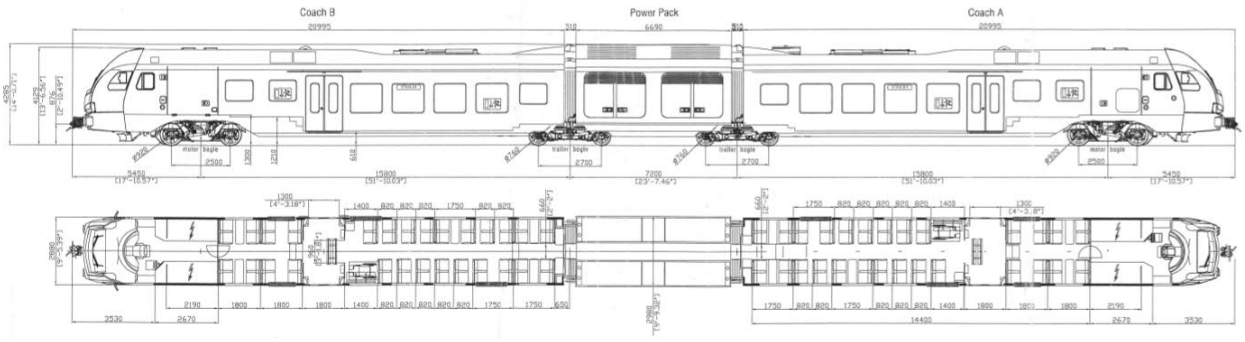


FIGURE 45. STADLER FLIRT DMU

The size of the maintenance facility required will depend on the size of the fleet, the length of the vehicle, and the maintenance philosophy (outsource component repair or rebuild in-house). Typically, the maintenance for DMUs is performed in consist, therefore, the consist length should be used as the basis of design for the yard maintenance needs. Extra track space should be considered for a truck working area and storage.

FRA Compliant Zero-Emission Multiple Unit (ZEMU)

Zero-Emission Multiple Unit (ZEMU) rail vehicle with hydrogen fuel cell/battery technology to propel vehicle could offer potential greenhouse gas reductions without electrification infrastructure and power substations.

Hydrogen Multiple Unit

In November 2019, SBCTA ordered one Stadler FLIRT H2 that is powered by a hydrogen fuel cell. This vehicle will be used to augment their DMU fleet and is the first hydrogen powered train in the United States. The vehicle is expected to enter service in 2024. Fuel cell technology combines hydrogen and oxygen in a chemical reaction to make energy. The FLIRT H2 has its on-board fuel cell and hydrogen tanks located in the power pack between two passenger cars. The hydrogen ZEMU emits only water vapor when in operation, meaning cleaner air, contributing less to global warming and healthier environment. Eliminating the need for an internal combustion engine, the hydrogen fueled passenger train is much quieter than a standard DMU. The FLIRT H2 will have a maximum speed of 79 mph (130 km/h), with a full complement of 108 seated passengers.

The maintenance facility for hydrogen multiple units will be very similar to that of DMUs except that a hydrogen, rather diesel, storage and fueling facility is needed for refueling and no roof exhausts would be required inside the maintenance building. The hydrogen storage facility is designed and located to be in compliance with all fire regulations.

Battery Powered Multiple Unit

Battery powered vehicles, as another type of ZEMU, use rechargeable batteries to drive their traction motors, thus providing propulsion. Like the fuel cell vehicle, operations will be much quieter than with diesel propulsion vehicles. Only sounds from cooling blowers or from drive train components when in motion are generally present. Emissions are produced through the commercial power grid generating electricity for recharging, but these are generally much less than from diesel engines due to the variety of generation technologies in use. Operational costs can be lower when the price of electricity is less than buying the equivalent energy value of diesel fuel and through the avoidance of diesel engine maintenance. This reduction may be offset through periodic maintenance and replacement of the batteries themselves. Drawbacks to battery vehicles are higher purchase price (to include the batteries for each vehicle and infrastructure of charging stations), limited range of operation with slower speeds while in battery mode, and vehicle weight. Depending on the operational route and number of batteries on the vehicle, the vehicle may require multiple recharges throughout the day which can remove it from revenue service during these periods. The Brookville Liberty Modern Streetcar is the most common U.S. manufactured battery powered ZEMU.

If the length of the run for the operation is limited (such as with a potential Rail-Link service), the service can be scheduled to permit some time for recharging the batteries between runs. While this limits the overall amount of time the vehicle operates in revenue service, it would still be able to provide an operation with multiple frequencies throughout the day, Recharging facilities would be established at the terminals either with conventional plug-in facilities or with short installations of overhead catenary or third rail at the terminals for recharging the vehicle batteries. Depending upon the specific amount of time needed to recharge the batteries, additional vehicles could be acquired that would operate on alternate schedule times to permit higher frequency operations and still provide sufficient time for battery recharging.

One innovative idea under consideration by some transit systems is to place a catenary wire or third rail for several hundred feet on either side of every station. Once the vehicle is under the wire or in third rail territory, the vehicle's pantograph (the mechanical arm that contacts the overhead wire) or third rail shoe automatically extends, and the batteries commence charging. Charging continues while the vehicle is in the station. Upon leaving the station, the vehicle is powered via the catenary/3rd rail during acceleration phase until the vehicle reaches operating speed. The batteries are only required to power the auxiliary power and to keep the vehicle traveling at speed. This concept has the potential to significantly increase the operating distance of a battery-powered vehicle as it provides a small charge at every station and eliminates the large power draw to accelerate the vehicle out of the station. It also has the potential to reduce the number of substations needed compared with fully powered systems.

In the United States, battery powered vehicles are currently limited to streetcar applications, and are often operated in combination with catenary. In Detroit and Oklahoma City, there are several bridges where low clearance prevented the installation of an overhead catenary system used to power their systems. At these locations, the streetcar lowers its pantograph, and operates under battery power until it reaches the next section of overhead catenary. In Dallas, there is a historic bridge that straddles the DART right-of-way. DART was prohibited from installing catenary connecting to this structure. The Dallas streetcar lowers its pantograph at the station just prior to the bridge. It traverses the 1-mile-long bridge under battery power; and at the next station the pantograph is raised. The vehicle then continues utilizing the overhead catenary as a primary power source. In Milwaukee, almost one third of the HOP streetcar line is not equipped with overhead wires; the vehicles batteries are charged when the vehicles are on the wired portions of the line. All of these systems use the Brookfield Liberty Streetcar.

Amtrak and NYSDOT are acquiring a technically advanced fleet of diesel-battery locomotives that will replace the current fleet of diesel-third rail locomotives used for Empire Service trains serving Upstate NY, Vermont, and Canadian destinations. The locomotives will switch to battery operation while operating in Manhattan and in Queens through the many tunnels and underground Penn Station that constitutes the intercity rail network in New York City. The locomotive platform is a derivative of the Siemens Charger design and will share many internal components with the new diesel-3rd rail locomotives currently being acquired by Metro-North and Long Island Rail Road. The Empire Service units are currently in the design stage and are expected to be delivered by the end of this decade.

Maintenance shop designs are expected to be very similar to that of DMUs for ZEMUS, except charging stations and maintenance for batteries would be necessary instead of fuel storage. Amtrak will maintain its fleet of diesel battery locomotives at the existing facility in Rensselaer, NY which is undergoing modifications to accommodate the new locomotives and new passenger cars.

Similar to the DMU, ZEMUs do not operate anywhere in the Metro-North service territory, so would require additional institutional supports, if developed.

FRA Compliant Push Pull Equipment

The second option is to have a trainset with diesel or diesel/electric hauled push-pull configuration that typically has a locomotive at one end and an unpowered control cab at the other end of the train to allow movement in both directions. This configuration is the same as the existing trainsets operated on the Danbury and Waterbury Lines. Currently Metro-North Railroad owns Bombardier Shoreliner Series (Figure 46) and Alstom Comet V (Figure 47) as push-push coaches. One of the greatest benefits of this alternative is its lower initial capital investment since it does not require electrification of rail line. Additionally, it offers flexibility in the sense that different passenger cars can be easily added to or removed from a train, which is not so easy for some multiple unit designs to accommodate. Higher operational cost is a disadvantage if all train consists are very short, Push-Pull operation is more cost effective over DMUs with longer trains but may have slower acceleration than DMUs although this difference has been reduced with the introduction of very high horsepower diesel locomotives now in service on many transit systems. Fully electrified systems continue to provide the best acceleration performance and shortest travel times.

Existing maintenance facilities[16] can be used with minimum changes since Metro North already owns these types of vehicles. Certain expansion of the yard might be needed for storage purposes if additional trains beyond the existing fleet are needed.

[16] Using existing Metro-North maintenance/train storage facilities is expected to involve the "deadheading" of the trains (operation of trains not in revenue service) to and from the yard location to position the equipment for its daily assignments. The practice is common throughout the industry and can be cost effective by avoiding the expense and operation of new train storage and train crew facilities at a new location.

FIGURE 46. SHORELINER IV

FIGURE 47. COMET V

FRA Compliant Electric Multiple Unit (EMU)

An EMU typically has a small cab at the end of a cab car and integrates the propulsion and braking equipment into the coaches and, therefore, does not require a separate locomotive. Electric traction motors and individual brake units are incorporated within the coaches. EMUs are popular on commuter and suburban rail networks around the world due to their fast acceleration and reduced emission operation. EMUs tend to be quieter and cause less vibration than experienced with DMUs. The main drawback of EMU is its initial investment and on-going maintenance costs of an electrified rail line. Since the Beacon Line is a non-electrified rail line, EMUs would not be able to operate between Southeast and Danbury unless it is electrified up front. EMUs typically provide much greater acceleration capability than DMUs, especially in the upper speed ranges where total available horsepower becomes a key factor.

Currently, M3As and M7As are usually used on the electrified portion of the Harlem Line (750 VDC third rail south of Southeast). These two types of vehicles along with newly built M9s could be the most appropriate vehicle for this project. M3As (Figure 48), M7As (Figure 49), and M9s (Figure 50) have the same length (85 ft) and have 229, 213, and 217 seats per married pair, respectively. They all collect power using a contact shoe from a 750VDC third rail traction power system.

FIGURE 48. METRO-NORTH M3A EMU

FIGURE 49. METRO-NORTH M7A EMU

FIGURE 50. METRO-NORTH M9 EMU

Similar to the push-pull train, the existing maintenance facility at Brewster Yard would be expected to continue to be the location to service these trainsets. Certain expansion might be needed for storage purposes if additional fleet beyond the current is added to the service.

Light Rail Vehicle (LRV)

Similar to EMUs, Light Rail Vehicles (LRVs) are typically operated as self-propelled multiple-unit trains powered by electricity but with lighter weight and less passenger capacity. They are well-suited to serve larger markets with many short-distance trips or smaller markets where total demand does not require operation of long trains able to carry hundreds of passengers per trip. There are many suppliers including Siemens, Alstom, Kinki Sharyo, and Breda, to name a few. It is most used in urban areas characterized by a combination of tram (runs on tramway track on public urban streets) and separate rights-of-way. Although LRVs have less passenger capacity, they tend to have reduced labor costs and can be operated frequently the total capacity per unit of the line can remain high. The main benefits are lower operational costs and smaller visual profiles of the vehicles and supporting infrastructure compared to commuter equipment. The main drawback of LRVs is that they are non-compliant with respect to meeting crash-worthiness standards established by the Federal Railroad Administration (FRA). Physical separation or temporal separation of operations is generally required. Light rail vehicles also typically operate to different platform heights and lengths making compatibility with commuter rail operations difficult. This also means that any station constructed for LRV use cannot be easily repurposed if a change in vehicle type is desired for the line.

Since currently there are no LRVs operated on Metro-North Railroad, a new maintenance facility would be needed. The general requirements would be very similar to DMUs but at a smaller scale to accommodate smaller and lower vehicles.

Vehicle Recommendations

For the Southeast to Danbury Rail Link, each vehicle type has its' merits for service. However, the project team believes that vehicles compatible with the existing fleet may provide advantages over vehicles that are not currently within regional operations. This approach offers the opportunity to extend Rail-Link service directly to GCT during high-demand times and would best serve the largest projected passenger market identified (Danbury to GCT). It likely reduces the need to construct new maintenance and train crew facilities and takes advantage of economies of scale for procuring approved equipment designs. Also, to facilitate future service flexibility, using commuter rail vehicle options allows for an easier transition from a potential start-up service using shuttle trains only to a later phase of service that includes extensions of through trains operating from GCT to Southeast and then on to Danbury. Similarly, conversion of diesel-powered push-pull operations to fully electrified EMU service, if so required/desired, becomes more simplified than conversion from a completely different vehicle technology.

Service Plan Development Overview

The alternative service plan options assessed for this study were based on typical patterns that the MTA has employed on other lines in its' commuter rail systems. The selection of these patterns was made after determining the potential passenger market that would most likely be served by the Rail-Link service would have similar characteristics to the regional commuter rail market. This includes:

- Connecting shuttle service (comparable to the Waterbury Line on Metro-North or Greenport Line on Long Island Rail Road): Service Alternative 1,
- Peak hour dual-mode locomotive hauled coaches operating through to GCT with connecting shuttle in the off-peak hours (similar to service provided to Wassaic or the New Canaan and Danbury Lines): Service Alternative 2,
- Full Service, using EMU's direct from the proposed Danbury station to GCT (as is in operation to Southeast station): Service Alternative 3.

A fourth service plan option was also considered consisting of electric LRT service between Southeast and Danbury stations operating on a frequent headway (similar to the NJ TRANSIT Hudson Bergen Light Rail system in northern New Jersey): Service Alternative 4.

The service plan option's assumptions are described in more detail in subsequent sections. Each have operating characteristics, headway expectations, and general vehicular assumptions (to determine travel time). A timetable for each alternative was developed using a spreadsheet model that replicated the existing Metro-North Harlem Line schedule. A key assumption made was that any proposed through Rail-Link service would operate as an extension of existing Harlem Line service to avoid adding new trains to the already capacity-filled GCT. Similarly, shuttle trains would connect with the existing Harlem Line service and not require adjustments to its schedule between Southeast and GCT. Within the spreadsheet model, arrival and departure times from terminals were modified to test various service plan travel times and determine potential operational conflicts. The model also provided "stringline" (space and time) diagrams which provide graphic representations of the trains scheduled. The graphics are a key tool used to identify schedule conflicts between trains and help identify locations and scale for required infrastructure (i.e., passing sidings, station platforms, switches, etc.). The process was used on both existing and future operations.

Service Plan Development Assumptions

The heavily traveled Harlem Line's complex service plan including frequent service, zoned stopping patterns, multiple train origin points (that are for shorter runs), and deadheads (trains not in revenue service) to and from maintenance facilities were assumed to be sacrosanct and were left in place. No modification of existing services was included. New Southeast to Danbury trains were assumed to be connections to or extension of existing Southeast to Grand Central trains.

To develop service alternative travel times, a review of select existing rail operations was performed to inform the developing model (see Table 8).

TABLE 8. DETAILS OF EXISTING RAIL OPERATIONS

	Existing Danbury Line Operations	Existing Wassaic Extension Operations	Existing Upper Harlem Line (White Plains to Southeast) Operations	Example LRT Operations (Denver RTA Littleton to Alameda)
Propulsion Type	Diesel	Diesel	DC 3rd Rail	Diesel
Route Miles	24	29	31	24
Number of Stations	8	7	7	8
Average Station Spacing (miles)	3.4	4.8	5.2	3.4
Scheduled Time	54	40	43	54
Average operating speed (mph)	26.7	43.5	43.3	26.7

Note that each of the comparison services have a similar route length, a similar number of stations along them, but a variance in schedule time and average operating speed.

For deriving travel time of the connecting shuttle services, it was assumed these would be short locomotive hauled coach trains or some form of DMU (as discussed in the previous section). For the peak-hour dual mode service, trains were assumed to be made up of a diesel/third rail locomotive similar to current operations while the full-service EMUs are assumed to be the same as currently used on the Harlem Line.

Initial schedule headway targets for the connecting service plans were established to have a train operate approximately every 30 minutes during peak period hours and every 120 minutes at other times of day. The off-peak goal was subsequently modified to evaluate a 60-minute frequency as well for some alternatives. A frequent transit service alternative, using LRV equipment, established a 15-minute service headway.

Running time estimates for the proposed service plans assumed the track configuration serving the Danbury Museum location and the physical track connection alternatives at Southeast station with the fewest development requirements relative to their service type: Track Plan Alternative BB for the Shuttle and LRT options, Track Plan Alternative DD for the direct peak and full-service options.

Potential intermediate station locations identified previously were considered for their impact to a service alternatives' overall schedule. Proposed station spacing was in keeping with the nature of regional commuter rail stations, to support a fast and efficient operation.

Using the average speeds from Table 8 as a guideline and including two intermediate stations (three for the LRT), the one-way corridor travel time assumption ranges between 19 and 22 minutes. for service alternatives 1, 2 (principally diesel operation for the Beacon Line), and 4 (LRT diesel or electric) and a 19-minute running time assuming third rail electrification is constructed for the full-day service alternative. While an Electric LRT system has better acceleration characteristics than diesel, the runtime was set to 22 minutes as there was an additional intermediate station stop.

Service Alternative 1: Shuttle Connecting Service

Alternative 1 would operate Rail-Link train service as a shuttle connection to/from Harlem Line trains at Southeast. The peak service schedules were developed to connect with the through trains from Wassaic or to the faster express trains originating at Southeast. Off peak shuttles connect to regularly scheduled Harlem Line trains from Southeast to GCT but are also arranged in such a manner to connect with the Wassaic shuttles as well, thus giving a passenger from Danbury the choice of traveling south or north. Optimal connecting times at Southeast can be established with the additional platform constructed at Southeast. Substantively longer connecting times are required without it.

One-way runtime is estimated at 22 minutes based on the average speeds noted previously. To meet the target headway of 30 minutes during the peak period, and 120 minutes in the off-peak, a minimum of two new trainsets are needed in service. One spare is assumed in the cost estimates but it could also potentially be drawn from the existing Metro-North pool. During peak periods, under this alternative a train would be operating in both directions on the Beacon Line at once, passing somewhere near the midpoint of the line, necessitating a passing track to allow the trains to get by one another.

For a passenger travelling to Manhattan, the running time would be roughly 111 minutes (including transfer at Southeast) as compared to 122 minutes on the Danbury Branch today.

This alternatives' full schedule is shown in Appendix D, and its stringline diagrams are in Figures 51 and 52. Each line represents a train in the schedule of the Harlem Line. They are color-coded by service zone. The stations are organized on the Y Axis, from the North (Wassaic, top of the diagram) to South (GCT, bottom of the diagram). Time is arrayed from left to right on the X axis. As a line angles left to right, it shows the relative location of the train as time passes. Lines that angle up to the right are trains that started in GCT, or other stations, and travel north. Lines that angle down to the right are trains that started in Wassaic, Southeast, White Plains or other points along the Line heading south. The Purple colored lines represent the Rail-Link service proposed in Alternative 1. There are several locations with intersecting lines and circles depict times when two trains are scheduled to "meet" or pass each other. The Beacon Line currently transitions from a single track to double track near Danbury Fair The double track section continues into Danbury and its length

allows some flexibility in timing the meets. A preferred infrastructure option identified would extend the double track section further west and provide even more flexibility in establishing the schedules of the opposing trains.

Service Alternative 2: Peak Trough Service and Off-peak Shuttle Connecting Service

Alternative 2 extends four trains currently originating/terminating in Southeast and runs them through from Danbury to/from Grand Central Terminal during peaks hours. During the off-peak hours, the service would operate as a shuttle as in Alternative 1. This is a similar service pattern to the Wassaic, and Danbury Lines on Metro-North today. Through trains would consist of a dual-mode locomotive push-pulling a trainset with seven coaches replacing the EMUs previously scheduled for operation. Shuttle trains would be in the same configuration as in Alternative 1.

For a passenger travelling to Manhattan, the running time would be approximately 107 minutes (direct) to 111 minutes (with connection) as compared to 122 minutes on the Danbury Branch today.

Similar to Alternative 1, to maintain the target headway of 120 minutes in the off-peak, 3 new shuttle trainsets (2 working, 1 spare) were assumed. Additionally, four 7-car through train sets are operated to/from GCT. This equipment is assumed to be new as well although it is replacing existing trains originating in Southeast since it requires push-pull cars. It does release an equivalent number of EMU cars for redeployment in other electrified services. Alternative 2 was subsequently revised with a frequency of 60 minutes during the off-peak to evaluate sensitivity in ridership forecasting (dubbed Alternative 2a). It was determined the equipment needed to support the 120 min headway would also be sufficient to support the 60 min. headway. Thus, no additional shuttle trains are identified for the more frequent off-peak service (22-minute runtime one way, 6-minute transfer at each end, 1 minute dwell at intermediate station, for 60-minute round trip).

This alternatives' full schedule is shown in Appendix D, and its stringline diagrams are in Figures 53 and 54. It is constructed using the same procedures as described for Alternative 1. A new passing siding is recommended to be placed in the vicinity of Joe's Hill Road. It will permit a more convenient afternoon peak schedule for travel from GCT to Danbury.

Service Alternative 3: Full Service to GCT all day

Alternative 3 provides the most convenient and highest level of service to riders in the corridor with direct, one-seat, service to GCT for the line for both the peak and off-peak time periods. This service would require full 3rd rail electrification to operate. Equipment is assumed to be MNR EMUs, that currently terminate/originate in Southeast, which would be extended to operate over the Beacon Line to/from the Danbury Museum station alternative. As such, no new trainsets are assumed needed to operate this proposed service. Trains are typically eight cars long like those currently in service. If the service is operated using the Southeast Track Alternative DD, construction of the additional platform and station track at Southeast is not required. Because the trains are running through to Danbury, their short dwell times and track occupancies at Southeast would not create operational conflicts. This service alternative would be slightly faster than the dual-mode push pull through service in Alternative 2, due to better performance of the EMUs. This would provide a level of service frequencies similar of that to the current Metro-North New Canaan branch of the New Haven Line but is enhanced compared to the New Canaan service which operates only shuttles during the off-peak periods, (See appendix D for full schedule).

Looking at the stringline diagrams (Figures 55 and 56), Alternative 3 can be supported by the same infrastructure identified in Alternative 2. As with all alternatives, the greater the amount of double track or passing sidings that can be installed, the greater the flexibility in establishing schedules is provided and the greater the likelihood of improved on-time performance.

FIGURE 51. ALTERNATIVE 1 STRINGLINE DIAGRAM – 12AM TO 12 PM

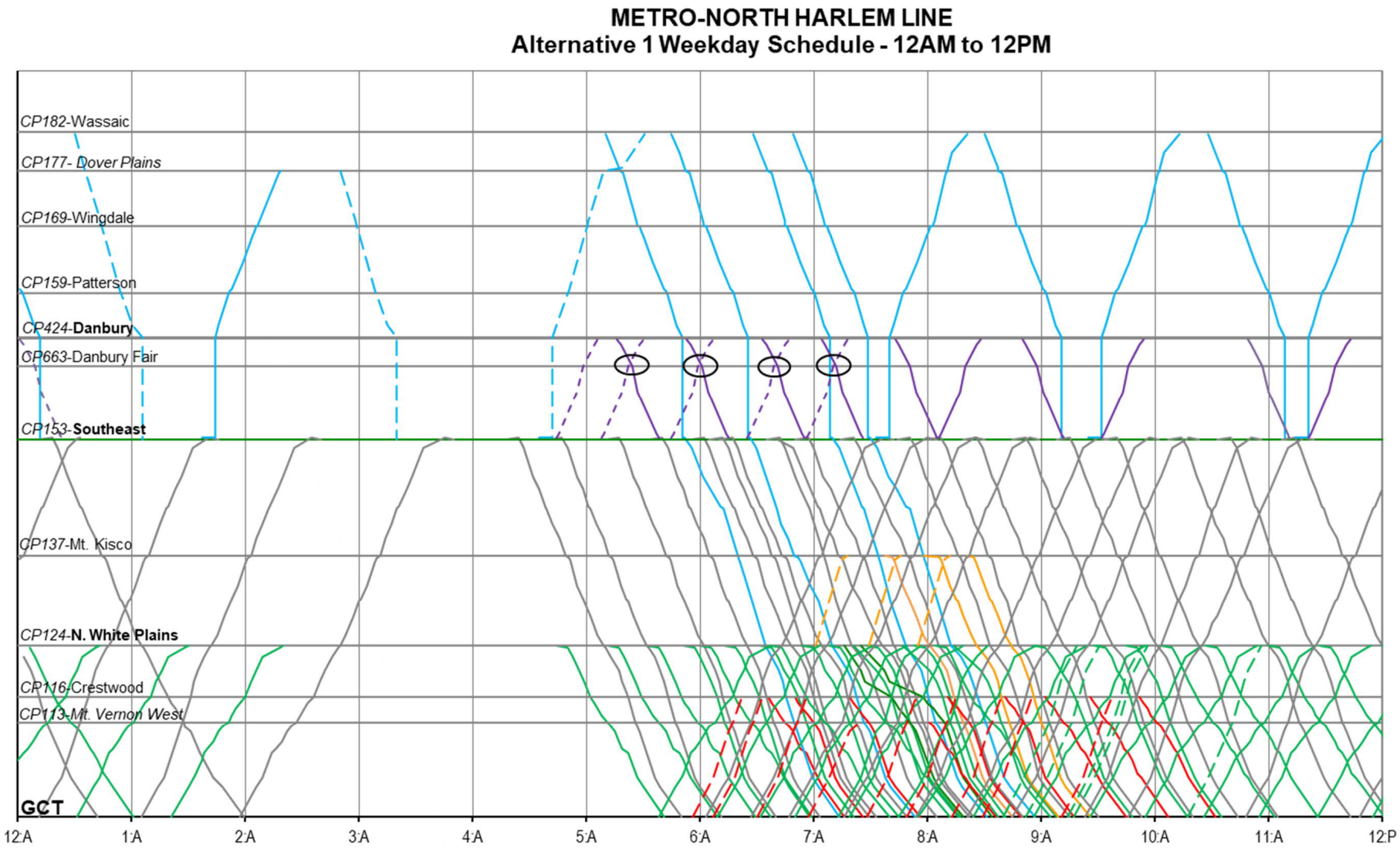


FIGURE 52. ALTERNATIVE 1 STRINGLINE DIAGRAM – 12PM TO 12 AM

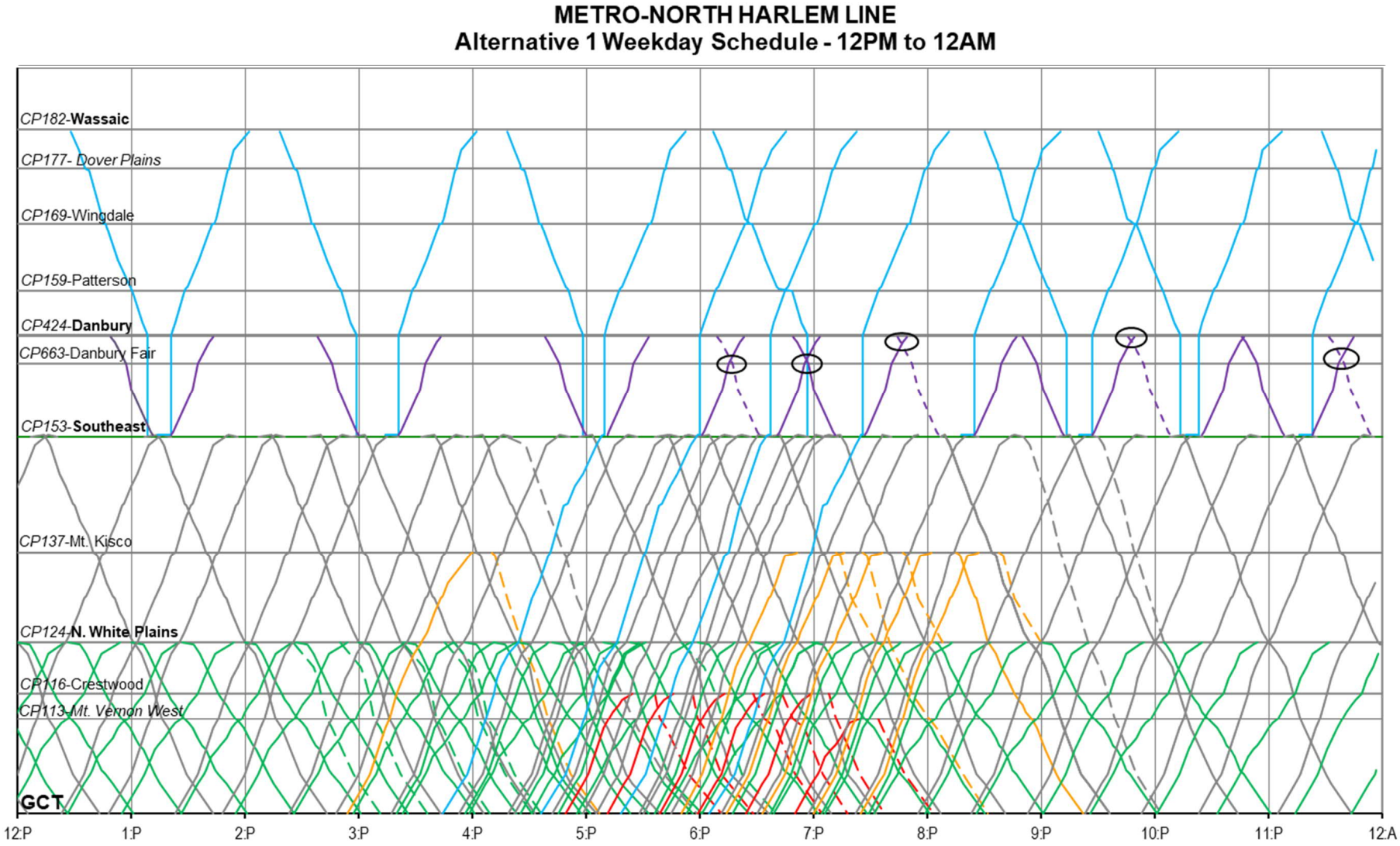


FIGURE 53. ALTERNATIVE 2 STRINGLINE DIAGRAM – 12AM TO 12 PM

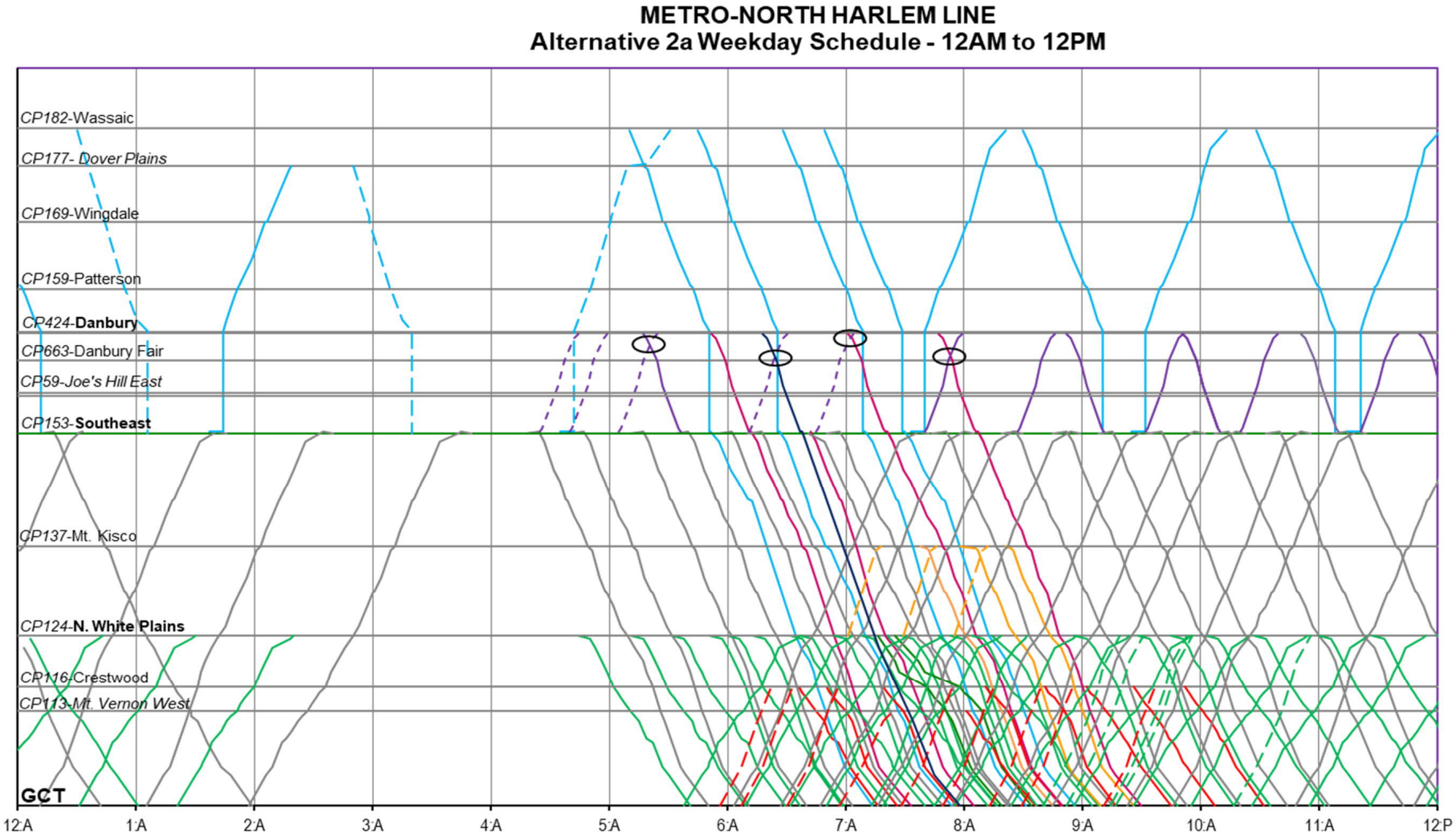


FIGURE 54. ALTERNATIVE 2 STRINGLINE DIAGRAM – 12PM TO 12 AM

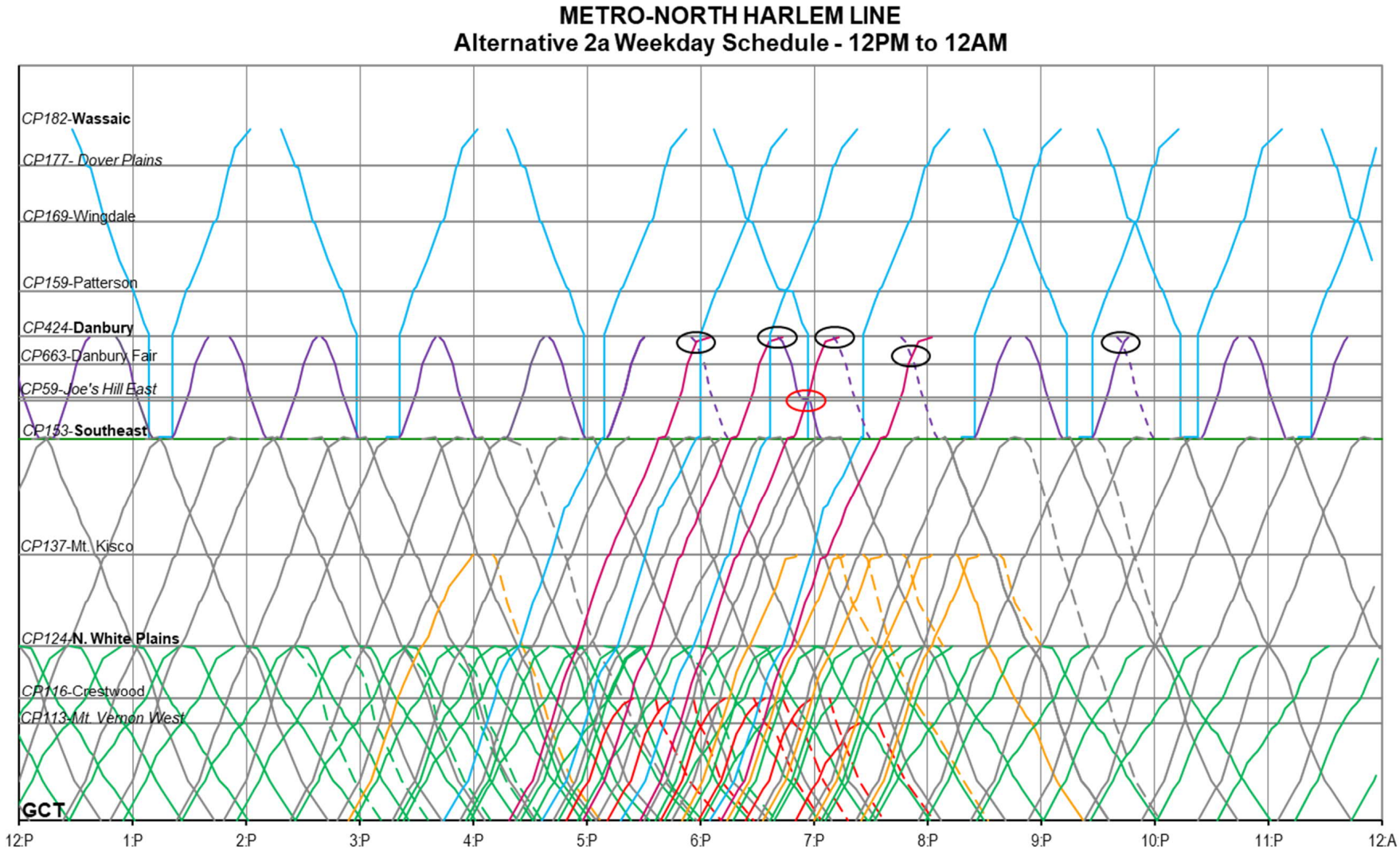


FIGURE 55. ALTERNATIVE 3 STRINGLINE DIAGRAM – 12AM TO 12 PM

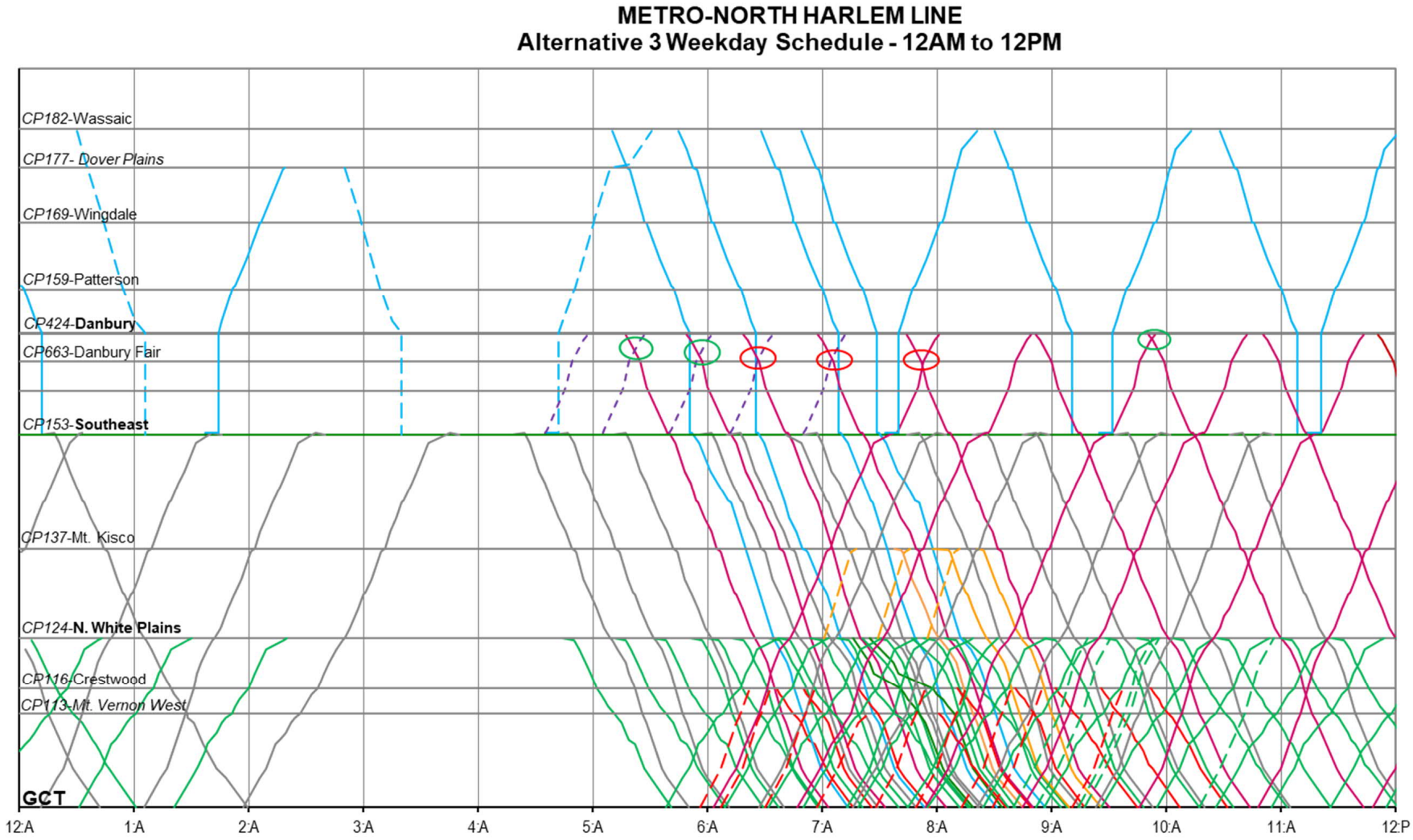
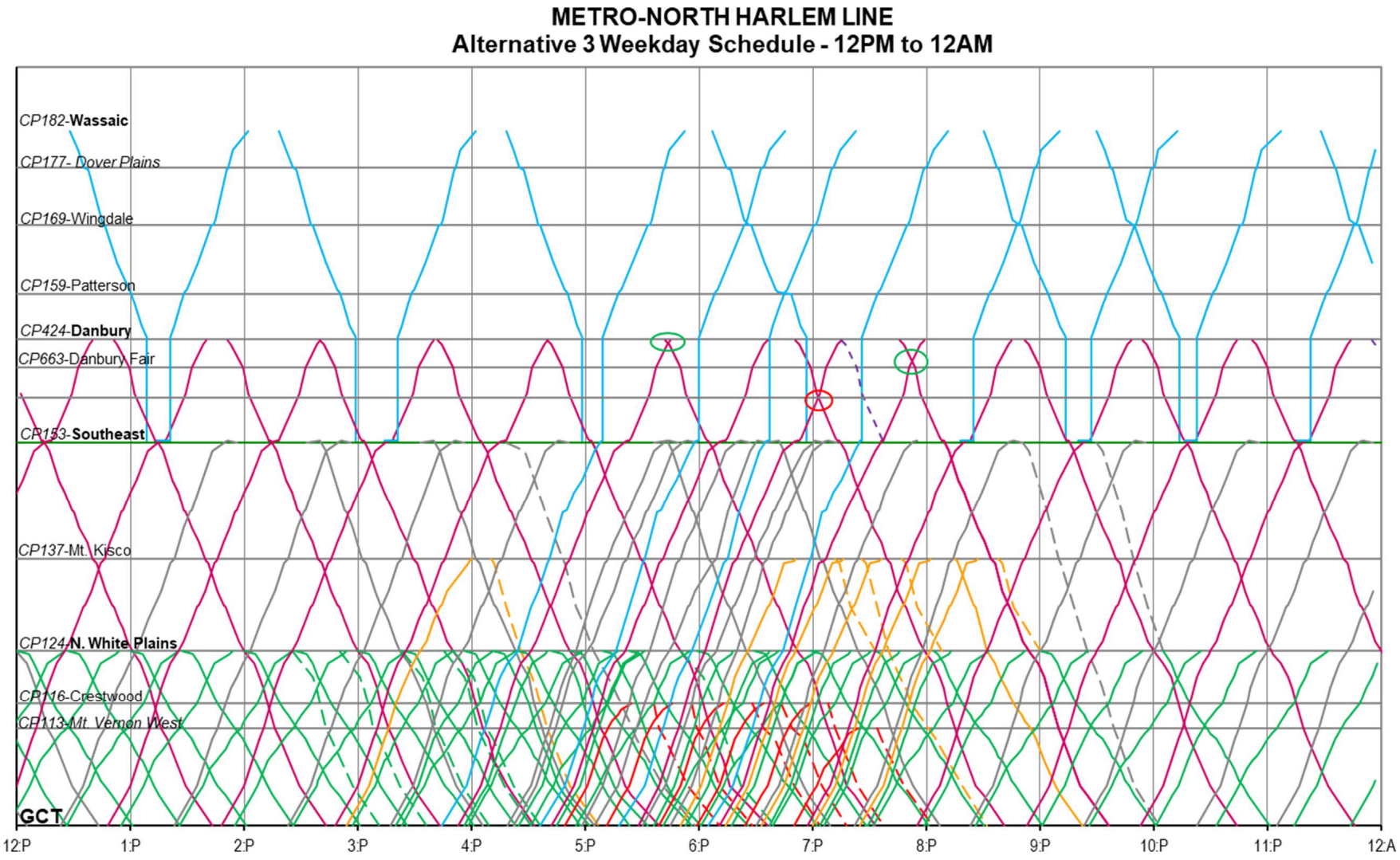


FIGURE 56. ALTERNATIVE 3 STRINGLINE DIAGRAM – 12PM TO 12 AM



Service Alternative 4: Frequent Transit (Light Rail Transit) all-day

Alternative 4 tests the idea of a rapid transit style service that provides a high level of service in terms of speed and frequency in the Danbury to Southeast corridor. This alternative considers the use of light rail vehicles rather than commuter rail trains to provide service between Danbury and Southeast. Service would operate at a regular 15-minute headways for most of the day except in the evening and on weekends when demand is lower (Note: No schedule or stringlines are included as this is a headway based alternative and not a set schedule). As noted in Vehicle Options for Service, light rail trains and commuter or freight trains cannot operate at the same time on the same track because most LRVs do not meet FRA crashworthiness requirements. The proposed service would be limited to only being a connector, with independent platforms in Southeast and Danbury to allow commuters to transfer to other service (to/from GCT). Trains were assumed to be typical light rail vehicles operating in two car sets using overhead catenary that accommodates approximately 120 seated passengers. Use of diesel-powered light rail vehicles (DLRV) is an option that would avoid the cost of installing catenary, but the vehicles are not as quiet and do require fossil fuels for operation. It may also be technically feasible to utilize battery or fuel cell technology vehicles instead. More detailed analysis of operating and energy demand requirements is necessary to determine their suitability. Five trainsets (four for service, 1 spare) would be required to maintain the 15-minute headway. Similar to the commuter rail options, a combination of passing sidings/ double track extensions would be necessary to eliminate operating conflicts. Unlike the other alternatives, an additional intermediate station (at Peaceable Hill Road) is included to benefit local Brewster area travel.

Service Planning Summaries

The four alternatives are summarized in Table 9. The four service alternatives were then employed in forecasting ridership using the Federal Transit Administration's STOPS model as further discussed in Ridership Forecasting.

TABLE 9: ALTERNATIVE SERVICE PLAN SUMMARIES

	EXISTING CONDITION	ALTERNATIVE 1	ALTERNATIVE 2A	ALTERNATIVE 3	ALTERNATIVE 4
	Danbury Line	Shuttle	Peak Through	Full Service	Frequent Transit
Running Time (Line only)	54	22	22	19	22
Running Time to GCT Peak	122	111	107	104	111
Frequency AM Peak Period	30	30	30	30	15
Frequency PM Peak Period	60	60	30	30	15
Frequency Off Peak	120-180	120	60	60	15
Harlem Line Integration	N/A	Transfer at Southeast	Peak Through Transfer Off-Peak via Southeast	Through service via Southeast	Transfer at Southeast
Eastern Terminus	Existing Danbury Station	Proposed Danbury Station (Museum site)	Proposed Danbury Station (Museum site)	Proposed Danbury Station (Museum site)	Proposed Danbury Station (Museum site)
Equipment Type	Locomotive hauled push pull	DMU or Locomotive hauled push pull	Dual-Mode Locomotive hauled push pull Peak – Diesel push pull Off-Peak	EMU	ELRV, DLRV, Fuel cell LRV, Battery LRV,
New trainsets required (inc. 1 spare)	N/A	4	4*	None	5
Maintenance Facility Required?	N/A	TBD	TBD	N**	Y
Line Stations (including terminals)	8	4	4	4	5
FRA Compliant	Y	Y	Y	Y	N***

*For off-peak service, otherwise comes from existing fleet **Assumes use of Brewster Yard ***requires time separation from Housatonic Railroad operations to be compliant

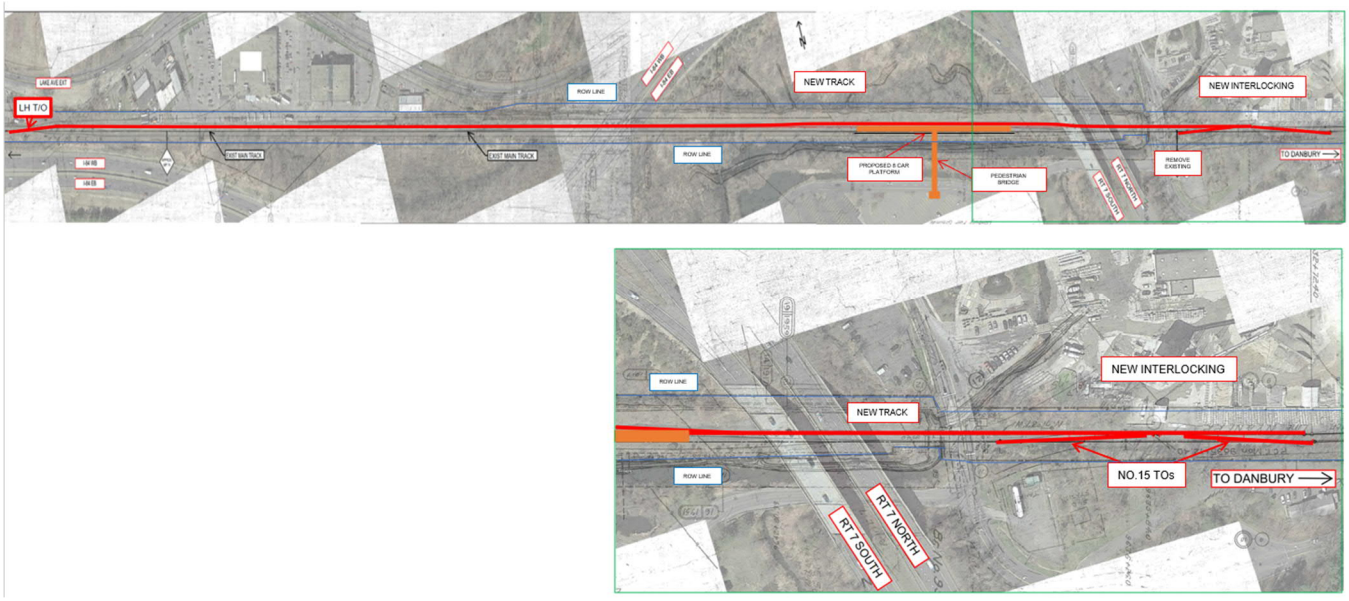
Beacon Line Track Improvements

After identifying the operational requirements with service planning, the Beacon Line track and additional track improvements were sketch-level designed to assess the feasibility of the right-of-way to accommodate the additional trackwork needed. The primary elements include:

- Danbury to Southeast: Complete upgrade of existing track to bring it to Class IV standards with a maximum speed of 80 mph. Includes existing double track section between Danbury Fair and Danbury. Upgrade or replacement of undergrade bridges, culverts and at-grade crossing and warning systems. Installation of new signal system, interlockings (signals, turnouts and crossovers) and Positive Train Control system (ACSES). Installation of new overhead catenary or 3rd Rail electrification as required by Alternative. Total length of upgraded territory and number of interlocking improvements varies by the alternative selected (Southeast Track Plan Alternatives BB or DD recommended).
- Danbury Station: New paired turnback tracks east of the station, new station shelter and platform (Museum site), new interlocked turnout to double track west of the Maple Ave crossing (MP 76.84).
- Danbury Fair Station: New station with shelter and platform(s), near Segar St (MP 75) or potential new TOD station site approximately one-half mile west. (not recommended to construct both)
- Double Track Extension: New main track extension from Danbury Fair to MP 74.0 (approximate 1 mile extension)
- State Line Station: New station and platform adjacent to Farrington Park and existing park and ride facility
- Joe's Hill Rd. Passing Siding: New passing siding approximately from MP 39.8 to MP 40.1 (1,800 ft.)
- Peaceable Hill Station: New station shelter and platform adjacent to the Peaceable Hill Rd. underpass (Alternative 4 only)
- Harlem Line Connector: New track connection between the Beacon Line and the Harlem Line. Improvements include right-of-way, drainage, track, structures, signals, electric traction as needed by alternative. Location and design of the connection varies depending upon the alternative selected (Southeast Track Plan Alternatives BB or DD recommended).
- Southeast Station: New station overhead access extension, shelter, and platform (recommended. New track connection, switches, signals 3rd Rail improvements. Track connection varies by alternative selected (Southeast Track Plan Alternatives BB or DD recommended).

Danbury Fair Double Track Extension

FIGURE 57: SCHEMATIC LAYOUT OF DANBURY FAIR DOUBLE TRACK EXTENSION

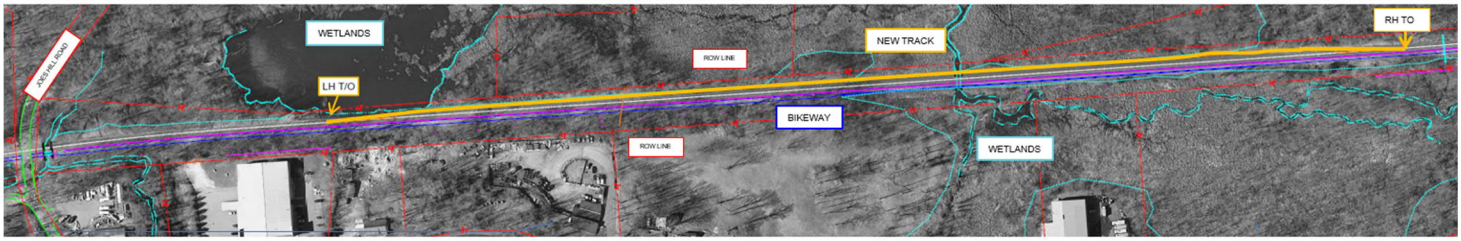


The Beacon Line currently transitions from a single track to a double track alignment at Milepost 74.9, just east of US Route 7 in Danbury. To better accommodate a potential intermediate station (Danbury Fair or TOD option), and provide infrastructure better able to facilitate scheduling of trains operating in opposing directions, an approximate one-mile track extension and new interlocking is proposed. This study has assumed use of No.15 switch geometry (consistent with current Metro-North practices for its branch lines) but there is sufficient space to accommodate a higher speed diverging operation. Use of No.20 switch geometry, as an example, would provide for 45 mph

diverging route speeds vs. 30 mph diverging route speeds allowed with No.15 switch geometry. While the larger turnout is more costly to maintain, it would help to reduce overall travel times and the faster speeds will also facilitate smoother meets between opposing trains. While the right-of-way appears sufficient to accommodate the additional track, some encroachment by commercial uses has occurred at the western end of the proposed extension. Future phases of the project should seek to fully survey the property limits.

Joe's Hill Road Passing Siding

FIGURE 58: LOCATION AND SCHEMATIC LAYOUT OF JOE'S HILL ROAD PASSING SIDING



As noted in Service Planning, service alternatives 2 and 3 have trains consistently meet near Joe's Hill Road while operating. Looking at the conditions in this area, the rail right-of-way largely straddles wetlands, and has the Maybrook bikeway under construction to the south of the existing track. It appears possible to create, a new passing siding, roughly 1,800 feet long comprised of No.15 Turnouts, in the tangent (straight) portion of the line before the major wetlands directly abut the right-of-way at either end. This would require the modification or replacement of a newly constructed culvert (under the right-of-way for the bikeway drainage) and some wetlands protection (cofferdams, and silt protection) to accommodate the additional track. While the right-of-way spacing appears sufficient to accommodate the additional track, a full wetlands delineation should be undertaken in Future phases of the project, to ascertain the extent of protection improvements that may be required.

RIDERSHIP FORECASTING

As noted previously, to develop ridership forecast estimates, the four service alternatives were programmed within an FTA STOPS model of the NYMTC forecasting area. The Federal Transit Administration (FTA) Simplified Trips-on-Project Software (STOPS) model is a stand-alone software package that applies a set of travel models to forecast transit person trips, travel patterns, and trips-on-project measures for all travelers and computes the change in transit ridership between the No-Build and Build scenarios needed for further use in the FTA's New Starts evaluation and rating. The primary analysis tool employed in the effort was the incremental (transit survey based) version of FTA's STOPS v2.50.

STOPS is described by the FTA as a fundamentally conventional "four-step" model set that considers zone-to-zone travel markets stratified by household auto ownership, employs a conventional mode-choice model to predict zone-to-zone transit travel based on the zone-to-zone travel characteristics of the transit and roadway networks, and then assigns the trips predicted to use transit to the facilities (including the proposed project) in the transit network.

STOPS is designed to estimate transit trips on a project using readily available data and procedures that are calibrated to match both local and national experience. The travel patterns associated with the Project Corridor were identified using a combination of regional datasets and larger models in the region.

Model Calibration

The model uses data from the Census Transportation Planning Products (CTPP) Program, the American Community Survey (ACS), and Survey data from the 2017 Metro-North Origin Destination Survey, for trip tables and daily boardings. Focusing on the Metro-North 2017 rider survey, the survey indicated that there is a significant number of Southeast Station riders that travelled from far away as Waterbury, indicating the latent desire for a potential project. Population and employment estimates at the Transportation Analysis Zone (TAZ) level of detail and TAZ-to-TAZ congested highway travel time estimates were obtained from the 2012 New York Best Practice Model (NYBPM), provided by New York Metropolitan Transportation Council (NYMTC). Additional information for area Park-and-Ride locations were identified and incorporated. The intent was to be able to evaluate changes in three principal markets: Travel to New York City, Travel to White Plains, and immediate project area.

The STOPS model was calibrated for a 2019 base year using Metro-North Railroad (MNR), NY Waterway, Shore Line East, MNR Hudson Rail Link, MTA New York City Transit Subway, and HARTransit Danbury Shuttle 2019 General Transit Feed Specification (GTFS) data following the FTA's incremental implementation method in STOPS. Calibration for the STOPS model followed a process that starts with a high-level regional assessment of how well the model matches observed ridership. Refinements were then made to the model parameters with region-wide impacts until the model results matched observed values. Then, the refinements focused on geographic sub-areas (represented by groups of stops) and individual routes, each with more localized adjustments. Sensitivity tests were performed to assess what impacts may occur if a service headway reduction or operational change occurs. Once satisfactory, this leads to a calibrated model that the service alternatives can be coded into for forecasting.

Project Forecasts

The four service plan alternatives were developed in the STOPS model: Connecting Shuttle, Peak Through, Full Service, and Frequent Transit (LRT). Two new intermediate stations were included (State Line Park and Ride, Danbury Fair) in the initial coding for direct comparisons. Each alternative was coded according to the type, schedule, and mode specified in Section 4. As previously noted, the Frequent Transit alternative differs from the others in both mode (LRT) and frequency (headway and not schedule based service).

The forecast results are shown in Table 10.

TABLE 10: RIDERSHIP FORECAST BY SERVICE ALTERNATIVE

SERVICE ALTERNATIVE	Boardings at new Danbury, Danbury Fair and State Line Stations (typical weekday to Points South)			
	Total Riders	New Riders	Changing from Drive to the Harlem Line	Decrease in Person Miles Travelled
1 Shuttle	630	270	360	-15,340
2 Peak Through	840	400	440	-24,310
3 Full Service	970	550	420	-31,700
4 Frequent Transit (LRT)	650	270	380	-15,550

Forecasts indicate that riders put a high value on through trains to New York City during the peak hours (traditional commuting times) but less so during off-peak times. Alternative 2 had almost as high a level of total ridership as Alternative 3, even though it provides less direct service. While a much smaller market, the above travel preferences and sensitivities were also observed for trips to/from the White Plains commercial district and Beacon Line stations.

Not unexpectedly, forecasted ridership increases in the alternatives with reduced overall travel times along with a reduction in the number of required transfers at Southeast Station. The importance of a direct, one-seat ride to GCT in the peak periods is underscored by the lower ridership forecasted results for Alternative 4. Even though it operated with a frequency approximately four times greater between Danbury and Southeast than the other alternatives, forecasted overall demand was reduced by the required passenger transfer at Southeast. As a comparison, pre-pandemic 2019 daily ridership at MNR Danbury Station was 180 passengers; and 1,150 passengers at Southeast, indicating that every service alternative is largely an improvement.

Projected daily person miles travelled show significant reductions for area roadway network, with more service providing greater benefit: This is an indication a Rail-Link service can provide direct, measurable contributions to reducing congestion on some of the areas busiest and most congested roads. The impact of these reductions should be evaluated further in future phases of project development.

To further test the sensitivity of the forecasts, an evaluation of the midday schedule for Alternative 2 was developed in which the off-peak shuttle service headway was reduced to 30 minutes (from one hour). This resulted in a negligible change in use (90 passengers). A similar test to reduce the running time on the line (essentially making the Beacon Line a full two-track operation) by three minutes, also resulted in little change (60 passengers). Lastly, a test of station visibility was performed on the alternative 4 forecasts. STOPS includes parameters to influence usage of local transit by a visibility parameter, which one would expect would be more important to a frequent LRT service, that people may access by foot (unlike commuter rail options that are largely accessed by driving to a station). Increasing the visibility of the LRT stations had minimal effect (20 passengers) to the ridership demand, implying the market for local service is not as strong as the typical commute travel.

Overall, a service on the Beacon Line operating to New York City will perform nearly as well as existing services from the Harlem Line, while reducing area roadway congestion. Later project phases should examine the balance of service that can be achieved (through versus connecting) while achieving similar ridership gains.

FEASIBILITY ASSESSMENT

Capital Cost Estimates

To help assess the feasibility of implementing the Southeast to Danbury Rail Link, Capital Costs were developed in 2021 dollars for the construction cost of Track, Stations, Train Control, Traction Power and Special Conditions of the various proposed physical and service alternatives using industry standard unit costs for materials and labor. Soft Costs associated with construction (i.e. design, management, permitting) and contingencies are added to complete the estimate.

In general, designers developed quantities estimates for each physical alternative's necessary work activities, starting with track elements. Quantities for new construction, track relocation, track removal, and resurfacing were developed. Then, the amount of special trackwork needed, including track switches, were quantified for an alternative. For example, the Harlem Line connection alternatives have varying numbers of switches, and type of switch (depending on design speed) leading to large differences in estimates. The individual work activities then were aggregated to define a unit "Track" cost per mile. Some service alternatives require double tracking and passing sidings, depending on the service alternative, these elements are also included within the "Track Cost" for that alternative. Shuttle service alternatives and light rail transit service alternatives would not require the loop connection of Harlem Line Alternative DD, so are only included for consideration within Alternative BB. Also, note that there is only one-track layout considered for the Danbury Line end of the corridor, so that configuration has been assumed for all other alternatives. Quantities estimates are included in Appendix E.

The costing of stations occurs in a similar manner, with each station being defined as a sum of individual parts to collectively define a "station cost" per station. Stations varied in complexity, from full scale 8-car ADA accessible high-level platforms with elevator overpasses (for commuter rail service alternatives), to 4 car low level light-rail transit stops with fare vending machines. Each defined a "station" cost, usable as per unit cost to test various combinations of services. In the case of alternatives with a new platform at Southeast Station, the cost of modifying the existing overpass was determined as part of the overall unit price used only in those alternatives. Most alternatives have 4 stations included in the cost estimate (Southeast, State Line or TOD, Danbury Fair, and Danbury), while the light rail transit alternative has 5 (additional stop at Peaceable Hill Road).

Train Control systems were developed at a very conceptual level, extending the existing Metro-North Harlem Line signal system, including the Positive Train Control overlay. The existing system on the Beacon line is not appropriate for passenger service. Included as part of Train Control, were the costs of adding new interlockings to the signal system, the installation of new signal huts, and the overall wiring. This equated to a per mile cost for signalization, and a lump-sum total for centralized control of any new interlockings included to operate an alternative. While a light rail transit alternatives' centralized train control would be independent of the existing Metro-North Harlem Line system, it was assumed that it would need to be operated in conjunction with the existing system, so the lump sum cost would proxy for inclusion of a new parallel system.

Traction power cost categories were developed in a similar manner, with an estimate of the number of electrical substations made based on the miles of electrified track required and the type of electrification needed. For the estimates, it was assumed that Full Service was to be provided by EMUs, and would require 3rd rail electrification with DC substations, while light rail transit could be an overhead catenary system typically served by AC substations. Both types assumed a lump sum for connection to the greater power grid. For services provided by diesel equipment, no electrification cost is included.

Special Conditions are construction elements that address particular conditions yet occur with all alternatives. Bridges, drainage, environmental mitigation, and bikeway improvements are examples of construction elements that are included within special conditions. As noted in Existing Conditions, there are 16 bridges throughout the study corridor, including the high-span over the Croton River. For the purposes of the estimates this study assumes that each of these require replacement and likely have some form of drainage improvement necessary. These bridges are also assumed to carry some form of the bikeway with the rail line, so have been estimated to include that configuration and load. Similarly, as there are potential wetlands in all alternatives, a cost for environmental mitigation has been included as a percentage of the construction cost of all other elements (2.5%). Further, a cost for bikeway fencing has been included to address the safety need of full separation along the length of the corridor.

For the labor cost of the construction cost estimate, most construction activities were assumed to be by 3rd party contractors except in the cases where work would need to be performed in active rail right-of-way. This essentially means that the Harlem Line connections work was assumed to be performed by MTA force account labor, while all other locations were third parties.

All of these items summed together comprise the total estimated construction cost, shown in Table 11.

TABLE 11: CAPITAL COST ESTIMATE FOR PROJECT ALTERNATIVES BY MAJOR CONSTRUCTION COST CATEGORY

Major Construction Cost Category	Southeast Alt BB and Danbury Alt BB			Southeast Alt DD and Danbury Alt BB	
	3rd Rail Electrified	w/o electrification	LRT	3rd Rail Electrified	w/o electrification
Trackwork	$21.2	$21.2	$19.7	$22.8	$22.8
Stations	$64.9	$64.9	$57.5	$64.9	$64.9
Train Control/Signals	$69.4	$69.4	$62.7	$69.7	$69.7
Electrification	$202		$91.5	$202.5	
Special Sitework: Bridges/Drainage	$71.2	$71.2	$71.2	$73	$73
Special Sitework: Environmental Mitigation	$3.8	$3.8	$3.6	$3.9	$3.9
Special Sitework: Bikeway Fencing	$2	$2	$2.	$2.3	$2.3
Total Estimated Construction Costs (2021 $M)	$434.5	$232.5	$308.2	$439.1	$236.6

Cost in Millions

The largest construction costs come from electrification, train control, and bridge replacements. Electrification costs for DC 3rd rail are more than double AC overhead catenary (shown in the LRT alternative) largely due to the cost of third rail itself. The cost difference between the Harlem Line Connection alternatives overall is relatively minor, simply higher in Alternative DD due to increased trackwork and special site work. Any of these construction costs will likely change as the project moves into design and detailed survey occurs.

Excluded from the construction cost estimates were the cost for right-of-way acquisition, vehicles, equipment shops/yards, and employee facilities. As the alignments are preliminary, acquisition of a parcel may or may not be fully required to develop an alignment, so it has been excluded from consideration at this time. Also, the other excluded items typically are part of a larger fleet plan and equipment allocation that would are performed for the whole of the agency, so aren't directly attributable to this specific project, hence them not being included.

In cost estimating, soft costs are calculated as a percentage of the construction cost. Soft costs include the administrative and final design efforts needed to compete the construction specified. For the Southeast to Danbury Rail Link the following soft costs were applied as shown in Table 12, resulting in the costs shown in Table 13.

TABLE 12: SOFT COSTS INCLUDED WITHIN CAPITAL COST ESTIMATES

Soft Cost Category	As a part of Construction Cost	Notes
Preliminary, Final Design and Engineering Support During Construction	12%	Design is required for all constructed items
Project Management for Design and Construction	3%	3rd Party expertise to validate design during construction
Construction Management, Inspection, Survey, Testing	10%	3rd Party expertise to validate contractor work during construction
MNR Engineering and Administration	5%	Operating Agency coordination of project during construction
Legal, Permits, Review Fees	2%	Dependent on items necessary, in the case of this project Wetlands permitting will likely be required
Insurance	5%	For construction efforts
Start-up/Commissioning/Testing	Lump sum	Cost for agency efforts to validate rail operating conditions of the project
Total Soft Costs	~39%	Of Total Construction Cost

TABLE 13: CAPITAL SOFT COST ESTIMATE FOR PROJECT ALTERNATIVES BY MAJOR CAPITAL SOFT COST CATEGORY

Soft Cost Category	Southeast Alt BB and Danbury Alt BB			Southeast Alt DD and Danbury Alt BB	
	3rd Rail Electrified	w/o electrification	LRT	3rd Rail Electrified	w/o electrification
Preliminary, Final Design and Engineering Support During Construction	$52.2	$27.8	$37	$52.7	$28.4
Project Management for Design and Construction	$13	$7	$9.2	$13.2	$7.1
Construction Management, Inspection, Survey, Testing	$43.5	$23.3	$30.8	$43.9	$23.7
MNR Engineering and Administration	$21.7	$11.6	$15.4	$22	$11.8
Legal, Permits, Review Fees	$8.7	$4.7	$6.2	$8.8	$4.7
Insurance	$21.7	$11.6	$15.4	$22	$11.8
Start-up/Commissioning/Testing	$10	$10	$10	$10	$10
Total Estimated Soft Costs (2021 $M)	$170.7	$96	$124	$172.6	$97.5

Cost in Millions

Note that any of these costs will change in line with a change in construction cost and as the alternatives develop further.

The last portion of capital cost is contingency. Contingencies come in two primary forms: allocated contingencies for design development and unallocated contingency for the construction phase and reserve. Both are to address unknown elements that occur in future phases. As this is a feasibility study, and no formal design engineering has taken place, the allocated contingency for design is set relatively high (25% of total costs) as there could be issues that come up in design that were not accounted for. The unallocated contingency for the construction phase is set nominally, 10% of total costs, as principally a reserve for issues uncovered during construction. Contingency is

determined by the total of construction costs and soft costs, and typically tracks to the level of uncertainty of a project. The contingency for the study alternatives in shown in Table 14.

TABLE 14: CAPITAL CONTINGENCY ESTIMATE FOR PROJECT ALTERNATIVES BY CONTINGENCY TYPE

Contingency Category	Southeast Alt BB and Danbury Alt BB			Southeast Alt DD and Danbury Alt BB	
	3rd Rail Electrified	w/o electrification	LRT	3rd Rail Electrified	w/o electrification
Allocated Contingency	$151.3	$82.1	$108.1	$152.9	$83.5
Unallocated Contingency	$60.5	$32.9	$43.2	$61.1	$33.4
Total Estimated Contingency (2021 $M)	$211.8	$115	$151.3	$214	$116.9

Cost in Millions

Similar to soft costs, any of these contingency costs will change as the alternatives develop further.

Bringing the separate elements together, the total estimated capital cost by alternative, is shown in Table 15.

TABLE 15: TOTAL CAPITAL COST ESTIMATE FOR PROJECT ALTERNATIVES BY MAJOR COST CATEGORY

Cost Category	Southeast Alt BB and Danbury Alt BB			Southeast Alt DD and Danbury Alt BB	
	3rd Rail Electrified	w/o electrification	LRT	3rd Rail Electrified	w/o electrification
Total Estimated Construction Costs	$434.5	$232.5	$308.2	$439.1	$236.6
Total Estimated Soft Costs	$170.7	$ 96	$124	$172	$ 97.5
Total Estimated Contingency	$211.8	$115	$151.3	$214	$116.9
Total Estimated Capital Costs (2021 $M)	$817	$443.5	$583.5	$825.1	$451

Cost in Millions

The total capital cost is largely influenced by the included elements, specifically electrification, which almost doubles the cost of an alternative. That said, the variance between similar alternatives (electrified SE BB / electrified DD or Unelectrified BB / Unelectrified DD) is modest. Any of these alternative construction costs will likely change as the project moves into design and detailed survey occurs, which in turn will change the associated soft costs and contingencies.

Operating Cost Estimates

Operating Costs were developed in 2021 dollars for service/physical alternatives in terms of vehicle operations and maintenance, propulsion, right-of-way maintenance, stations maintenance, stations security, and administration using industry standard unit costs for materials and labor. The Unit costs were generally in terms of the number miles travelled by a vehicle by the number of hours of operation.

In general, estimates for each service alternative's necessary operations were derived from the service planning efforts discussed previously (see Service Planning) to derive a number of trains and train cars needed for a daily service. This was used then used to estimate the hours worked to operate the service, and the amount of new revenue miles travelled by equipment types. The number of employees per train varies depending on the type of equipment, number of cars in a train and labor Agreement terms. For example: a shuttle train, which is locomotive hauled, would typically have an engineer and a conductor and an Assistant Conductor to operate a 4-car

long train. A through train, of 8-cars would typically have an engineer, a conductor and two Assistant Conductors to staff the train. Some exceptions to reduce crew size are possible, depending upon the explicit conditions defined in the Agreements. Light Rail Transit trains (usually made up of two-cars) typically have only a Motorman. The above conditions will guide adjustments to the number of hours worked for a service alternative. Note that although train equipment could operate "around-the clock" the train crew is governed by Federal Statute providing for Hours-of-Service regulations that limit the amount of time a defined employee may be on duty. Typically train crews operates in shifts, with three shifts typical for a working day.

The number of trains estimate was then multiplied by the incremental change in route mileage (new distance traveled over the Beacon Line from/to Southeast to/from Danbury) to develop an estimate of incremental operated train mileage. This was done for each physical alternative, as they have different route lengths. Finally, the estimates were annualized, based on the number of days an operation was expected within a year. The quantities estimates can be found in Appendix E. Propulsion costs are dependent on the type of equipment operated, and if these are diesel or electrically powered for the distance computed. Similarly, vehicle maintenance is dependent on the vehicle type (whether locomotive hauled coaches, EMU cars or LRT cars) and the needs of each.

For physical right-of-way maintenance of an alternative, an annualized cost per new track mile was used to estimate the cost of maintaining track. Additional costs for annual maintenance of stations (routine and major), and security was included. These costs are per station, so the light rail transit alternative is slightly higher as compared to other alternatives because it has 5 stations included.

Finally, administration cost of an alternative was developed as a percentage (10%) of all other total operating and maintenance cost for an alternative.

Some service alternatives align best with specific physical alternatives, so their operations have been estimated for only those configurations. Specifically, Shuttle service alternatives and Light Rail Transit service alternatives align best with the Southeast connection alternative BB, which limits the amount of track infrastructure upgrades to accomplish transfers to existing Harlem Line service (as a through track connection isn't required). In the case of Peak-Through service, or Full service, these could be accomplished by either physical alternative, so costs have been determined for both.

The operating and maintenance cost for service alternatives, grouped by physical alternative, is summarized in Table 16.

TABLE 16: TOTAL OPERATING / MAINTENANCE COST ESTIMATE FOR PROJECT ALTERNATIVES BY MAJOR COST CATEGORY

	Southeast Alt BB and Danbury Alt BB				Southeast Alt DD and Danbury Alt BB	
	Shuttle	Peak-Through	Full		Peak-Through	Full
Cost Category	Locomotive Hauled	Locomotive Hauled	EMU	LRT	Locomotive Hauled	EMU
Vehicular Operations, Maintenance	$1.2	$3.7	$5.6	$2.7	$4	$5.7
Propulsion	$0.1	$0.3	$0.8	$0.2	$0.3	$0.9
Right-of-way Maintenance	$1.3	$1.3	$1.3	$1	$1.3	$1.3
Administration	$0.3	$0.5	$0.8	$0.4	$0.6	$0.8
Total Estimated Operating & Maintenance Costs (2021 $M)	$2.9	$5.8	$8.5	$4.3	$6.2	$8.7

Cost in Millions

The costs within Table 16 are before deductions would be made for fare revenue collected and have no consideration for any volatility in the cost of fuel or labor. As should be expected, higher frequency, direct service costs more to operate and maintain. Any of these elements could potentially change as future service plans and vehicle choices are refined in later project phases.

Revenue Estimate

For each of the service alternatives forecasted (see Ridership Forecast), an estimate of the potential annual revenue was derived using an average fare to/from GCT and the annual projected ridership.

Metro-North fares for Southeast, Danbury, and Appalachian Train (same service distance from GCT as Danbury on the Harlem Line) were compared for their relative costs, during peak and off-peak for travel to GCT. These are summarized in Table 17. Peak and off-peak fares vary by roughly $5 dollars for each station, with the average daily fare between $15 to $20 dollars for travel to/from GCT. Comparing the fare to Danbury in 2019 to the fare of Appalachian Trail, the fares are significantly higher for the Harlem Line, versus the Danbury Line. Metro-North is subject to negotiation for its' fares in Connecticut with the state department of transportation, which has typically led to lower relative fares. For the purposes of developing this study's estimate, the daily average fare for Appalachian Trail has been used, as it is slightly higher than the Southeast Peak fare, but not as low as the Danbury peak fare (while travelling as similar distance).

TABLE 17: COMPARISON OF EXISTING METRO-NORTH FARES BY STATION DISTANCE, AND PROPOSED PROJECT FARE

MNR Station	Peak Fare ($	Off-Peak Fare ($)	Daily Average Fare ($)	Fare increase for Transferring Riders	Notes
Southeast (53 mi to GCT)	$20	$15	$17.50		2019 Published Fares
Danbury (65 mi to GCT)	$17.75	$13.25	$15.50		2019 Published Fares
Appalachian Trail (66 mi to GCT)	$23	$17.50	$20.25		2019 Published Fares
Zonal Cost Increase	$3	$2.5	$2.75		Difference between Harlem Line Zone 7 & 8
Proposed New Service Fare			$20.25	$2.75	

The difference in fare for a passenger based on changing their zone of travel (taking a trip from Appalachian Trail versus Southeast), is roughly $3 dollars. This difference was used as proxy to represent the incremental revenue gained by riders transferring their station of origin from the Harlem line to the study's proposed stations. The resultant annual revenue for a service alternative is shown in Table 18.

TABLE 18: ESTIMATED ANNUAL REVENUE BY SERVICE ALTERNATIVE

Service Alternative	Annual Revenue from New Riders	Annual Incremental Transfer Rider Revenue	Estimated Total Annual Revenue
Shuttle	$1.4	$.3	$1.7
Peak Through	$2.1	$.3	$2.4
Full Service	$2.9	$.3	$3.2
Frequent Transit (LRT)	$1.4	$.3	$1.7

Revenue in Millions

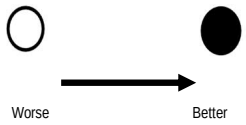
Note that these projections are based on an average fare and ridership for service to/from GCT. The actual fare policy for a service from proposed stations and associated period specific forecasts would need to be developed in subsequent phases of design and environmental analysis.

Operating Evaluation

Comparing the operating costs of a service alternative to the revenue estimates and new ridership gives an indication of the performance of an alternative as summarized in Table 19 below:

TABLE 19: ANNUAL OPERATIONS / MAINTENANCE COST VERSUS ANNUAL REVENUE BY ALTERNATIVE

Comparison	Southeast Alt BB and Danbury Alt BB				Southeast Alt DD and Danbury Alt BB	
	Shuttle Locomotive Hauled	Peak-Through Locomotive Hauled	Full EMU	LRT	Peak-Through Locomotive Hauled	Full EMU
Annual Operations & Maintenance Cost per new rider	$40.27	$55.71	$59.10	$61.30	$59.72	$60.94
Annual Revenue versus Annual Operations & Maintenance Cost	.60	.41	.38	.40	.39	.37
Relative O&M cost per rider						
Relative Revenue Recovery						



Relatively, the locomotive hauled shuttle Alternative BB alignment alternative performs the best, with the lower cost per new rider and higher revenue as compared to operating cost. The remaining alternatives all performed similarly, with modest differences between each other in terms of revenue recovery Either the costs or the revenue could potentially change as future service plans, period specific forecasts and vehicle choices are refined in later project phases further differentiating the alternatives.

Funding

While a preferred alternative has not been selected for the project, the potential alternatives include the possibility of passenger rail service that would include the extension of Metro-North's Harlem Line to the Danbury Branch or further northeast. Sources outlined in analysis include federal, state, regional, local, and project-specific funding sources, and potential funding mechanisms.

This section is structured with the following subsections:

- Federal funding options
- Existing state funding options
- New funding options
- Possible financing strategies
- Project-specific funding
- Operating revenue

Each subsection is further organized by funding agency or level of government (if applicable). Subsections for each individual funding/financing option begin by summarizing the following:

- Funding Source (the name of the funding source)
- Type (Discretionary Grant/Formula/Tax/Fee/Financing)

- Agency (administering agency/level of government)
- Project Eligibility (Yes/No for Capital, Operating, or Both)
- Funding Potential (the relative magnitude of funding)
- Recent Regional Uses (examples of projects in New York, Connecticut, and New Jersey that have utilized the option)

This summary is followed by a qualitative evaluation of the funding/financing option, including a discussion of whether the source is a viable funding or financing option for the proposed project, based on the following criteria, as applicable:

- Requirements to apply matching funds for eligibility
- Eligible uses of funds and the applicability to capital, operating, or both
- The relative magnitude, stability, and potential future growth of funding
- Long-term and near-term historic funding trends
- Legal and administrative feasibility
- Equity
- Economic consequences, including impact on tax rates, tax burdens, and expenditure requirements
- The extent to which funds may be leveraged through various finance instruments

Federal Funding Options

This subsection documents and describes potential federal funding and financing sources for which the project could be eligible. Funding programs covered in this subsection include US Department of Transportation (USDOT), Federal Rail Administration (FRA), Federal Transit Administration (FTA), and Federal Highway Administration (FHWA). Detailed information about each Federal Funding Option can be found in Appendix E.

The Bipartisan Infrastructure Law

The Infrastructure Investment and Jobs Act (Public Law 117-58, also known as the "Bipartisan Infrastructure Law") was enacted into law on November 15, 2021. The Infrastructure Law reauthorizes federal surface transportation programs for FY 2022-2026 and provides advance appropriations for certain programs. The Bipartisan Infrastructure Law (BIL) authorizes up to $108 billion to support federal public transportation programs, including $91 billion in guaranteed funding.[17] The BIL further includes $102 billion in total rail funding, including $66 billion from advanced appropriations, and $36 billion in authorized funding.[18] Based on formula funds alone, New York State will receive $11.2 billion over five years to improve public transportation across the state, a 42% increase in 2022 over 2021 levels, and Connecticut will receive $1.3 billion over five years, a 39% increase.[19]

Reference is made throughout this section to the Infrastructure Law, including funding provided by the BIL for existing competitive grant programs, as well as competitive grant programs newly established by the BIL, including USDOT's National Infrastructure Project Assistance program and the FRA's Railroad Crossing Elimination Program.

A note to the reader regarding these funding totals: advance appropriations are guaranteed funds, to be available until fully expended; however, advance authorizations are subject to annual appropriations action by the U.S. Congress and are not "guaranteed."

[17] Source: https://www.transit.dot.gov/BIL
[18] Source: https://railroads.dot.gov/BIL
[19] Source: https://www.transportation.gov/briefing-room/usdot-releases-state-state-fact-sheets-highlighting-benefits-bipartisan

USDOT

This section provides further detail regarding USDOT programs for which the project may be eligible, including the Local and Regional Project Assistance program (RAISE) and National Infrastructure Project Assistance (NIPA) program.

Local and Regional Project Assistance (RAISE)

The Local and Regional Project Assistance program, formerly known as the Rebuilding American Infrastructure with Sustainability and Equity (RAISE) grant program (formerly BUILD/TIGER), is a highly competitive USDOT discretionary grant program which supports the capital costs of road, rail, transit, port, and intermodal projects that have a significant local or regional impact. In addition to capital awards, a portion of program funds are made available for eligible planning, preparation, or design of projects. The maximum award for all projects is $25 million, and no more than $225 million will be awarded to a single State. In FY2021, $1 billion in total funding was available through the RAISE program; the deadline to apply for the program closed on July 12, 2021. The FY2022 NOFO has been released, and the deadline to apply is April 14, 2022. The DOT intends to award 50% of available funding for rural projects.

During the 2021 RAISE cycle, the New York, New Jersey, and Connecticut region had four projects which were awarded capital funding grants[20] and one project awarded for a planning grant[21]:

- The CT Department of Transportation received $12.6 million for multimodal upgrades to the **Derby-Shelton Multimodal Transportation Center** in Derby, including a high-level rail platform, new bus and rail passenger amenities, rehabilitation of the existing train station building, electric vehicle charging infrastructure, and improved vehicle, bus, and pedestrian access throughout the site. The total project cost is $24.5 million.
- The City of Atlantic City, NJ received $21.3 million for the **Atlantic City Corridor Revitalization & Safety Project**, which will bring 2.7 miles of complete streets improvements. The total project cost is $21.3 million.
- The NY MTA was awarded $15 million for **ADA Accessibility and Circulation Improvements at Broadway Junction Complex** in Brooklyn, NY, which will make the station complex fully ADA compliant. The total project cost is $212.9 million.
- The City of New Rochelle, NY received $11.9 million for **The LINC: Safety, Mobility & Economic Opportunity** project, which will create a new multimodal connection through Downtown by reconfiguring streets, adding pedestrian and bicycle paths, and adding green space. The total project cost is $26.3 million.
- The NYC Department of Transportation received a $2 million planning grant for the **Reimagining the Cross Bronx Expressway** project. The total planning project cost is $3.7 million.

The Bipartisan Infrastructure Law authorized $1.5 billion a year for FY2022 to FY2026 and renamed the program to the Local and Regional Project Assistance program. The project may be eligible for funding under the program, but since the funds are limited, the funding would likely apply to a small portion of the project. Given significant competition for funding from this program, the limited pool of funds available for projects nationwide, and the relatively small dollar value of grants awarded, the Local and Regional Project Assistance program is not likely to provide a significant contribution towards this project. See Appendix E, Table 1 for a summary of the program.

National Infrastructure Project Assistance (NIPA)

The National Infrastructure Project Assistance (NIPA) discretionary grant program is a newly established USDOT program to support multi-modal, multi-jurisdictional projects generating national or regional economic, mobility, or safety benefits. USDOT will rate a project's eligibility based on the plausibility and magnitude of the safety, mobility, or economic benefits to the region or nation, the impact on the project scope or schedule if federal funding is not available, the benefits and costs, the stability and dependability of non-federal financial commitments, and the applicant's capacity to carry out the project. Eligible projects include highways and bridges, intercity passenger rail, and public transportation. The Bipartisan Infrastructure Law provided $5 billion in advance appropriations between FY2022 and FY2026, as well as $10 billion in advance authorizations[22], and the Law sets aside 50% of program funds for projects with a cost between $100 million and $500 million.

The project may be eligible for funding under the program. NIPA could provide a significant contribution towards this project, but significant competition for funding from this program is expected. See Appendix E, Table 1 for a summary of the program.

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[20] Source: https://www.transportation.gov/sites/dot.gov/files/2021-11/RaiseGrants_Capital%20Fact%20Sheets.pdf
[21] Source: https://www.transportation.gov/sites/dot.gov/files/2021-11/RaiseGrants%20Planning_Fact%20Sheets.pdf

FRA

This section provides further detail regarding FRA programs for which the project may be eligible, including the Consolidated Rail Infrastructure/Safety improvements (CRISI) and Railroad Crossing Elimination Program.

Note that these programs would only be applicable to Alternatives One, Two, and Three; Alternative Four (light rail transit) would not be eligible.

Consolidated Rail Infrastructure and Safety Improvements (CRISI)

The Consolidated Rail Infrastructure and Safety Improvements (CRISI) Program funds a wide range of projects to improve the safety, efficiency, and reliability of intercity passenger and freight rail. Eligible projects include improvement to grade crossings, new rail corridors, rail line relocations and improvements, and deployment of safety technology. The Bipartisan Infrastructure Law expanded eligibility to projects that prevent trespassing, incorporate innovative rail technologies, and procure or overhaul locomotives. In FY2021, $360 million in total funding was available through the CRISI program; the deadline to apply for the program closed on November 29, 2021.

The New York, New Jersey, and Connecticut region had no projects awarded funding grants in 2020. During the 2019 CRISI cycle, one project was awarded a funding grant:[23]

- The CT Department of Transportation received a $17.4 million grant for construction and other improvements at the new **Windsor Locks Hartford Line Station**. The project will replace the existing station with a new, fully accessible intercity passenger rail station in a more central downtown location, alongside improvements to adjacent tracks, roadways, and grade crossings. The total cost of the new station is $64.9 million.

The Bipartisan Infrastructure Law authorized $1 billion a year for the program for FY2022 to FY2026. The project may be eligible for funding under the program. However, given significant competition for funding from the program and the size of grants (generally averaging $8 million, with the largest award amount $47.5 million in 2020), the Program is not likely to provide a significant contribution towards this project. See Appendix E, Table 1 for a summary of the program.

Railroad Crossing Elimination Program

The Railroad Crossing Elimination Program is a newly established FRA discretionary grant program to support projects that make improvements to highway and pathway rail crossings, such as eliminating at-grade crossings that are frequently blocked by trains, adding gates or signals, relocating track, or installing a bridge. The Bipartisan Infrastructure Law provided $3 billion in advance appropriations between FY2022 and FY2026, as well as $2.5 billion in advance authorizations.[24] 3% of annual program funds are set aside for planning projects, and 0.25% is for safety information and education programs. Project components may be eligible for funding under the program. See Appendix E, Table 1 for a summary of the program.

FTA

This subsection provides further detail regarding the FTA Capital Investment Grant (CIG) Program (New Starts, Small Starts, and Expedited Project Delivery Pilot), for which the project may be eligible.

Capital Investment Grants: Small Starts and New Starts

The Capital Investment Grant (CIG) discretionary grant program funds transit capital investments, including heavy rail, commuter rail, light rail, streetcars, and bus rapid transit. Small Starts projects must be new fixed guideway projects, extensions to existing fixed guideway systems, or corridor-based bus rapid transit projects, have a total estimated capital cost of $400 million or less, and be seeking less than $150 million in CIG program funds. New Starts projects are new fixed guideway projects or extensions to existing fixed guideway systems with a total estimated capital cost of $400 million or more, or that are seeking $150 million or more in CIG program funds.

[23] Source: https://railroads.dot.gov/sites/fra.dot.gov/files/2020-09/FY19%20CRISI%20Project%20Selections_0.pdf

CIG Small Starts and New Starts Projects in various stages of development in FY2022 in the New York, New Jersey, and Connecticut region include[25]:

- The GDC, NJ Transit, PANYNJ, and Amtrak, are requesting $5.5 billion for the **Hudson Tunnel** project, which will construct a new Hudson River rail tunnel and rehabilitate the existing North River tunnel. The total project cost is $12.4 billion. The project is in the New Starts Project Development phase.
- The Capital District Transportation Authority (CDTA) is requesting $60.9 million in Small Starts funding for the **Washington/Western Bus Rapid Transit** (BRT) project in Albany, NY, which will implement transit signal priority, queue bypass bus lanes, and a one-mile exclusive busway along a new 8.5-mile BRT line and purchase 16 buses. The total project cost is $81.1 million. The project is in the Small Starts Project Development phase.
- The NY MTA is requesting $2 billion for the **Second Avenue Subway Phase 2** project, which will extend subway service from 96th Street to 125th Street along the Upper East Side of Manhattan. The total project cost is $6.4 billion. The project is in the New Starts Project Development phase.
- The NYC DOT is requesting $97.2 million for the **Woodhaven Boulevard Select Bus Service** project. The project includes dedicated bus lanes, enhanced stations, and roadway improvements along a 6.1-mile corridor. The total project cost is $259 million. The project is in the Small Starts Project Development phase.

FTA's FY2022 Annual Report on Funding Recommendations includes $1.56 billion for 17 CIG projects with existing grant agreements, and $461.1 million for eight new CIG projects estimated to be ready for grants in FY2022, of which $158 million is for New Starts Projects and $303 million for Small Starts.[26] An additional $427.2 million is recommended for other projects that may become ready for funding during FY 2022. The Bipartisan Infrastructure Law provided $8 billion in advance appropriations between FY2022 and FY2026, of which $1.2 billion is for Small Starts projects and $4.4 billion is for New Starts, as well as $15 billion in advance authorizations for the full program.[27]

The project would be eligible for CIG funding, and the funding could apply to a large portion of the project. However, competition for funding from the program is intense, and project sponsors must follow a multi-step, multi-year process defined in law, including developing the information needed by FTA to review the project's justification and local financial commitment. For New Starts projects, this process includes three phases: Project development (PD), engineering, and construction. For Small Starts projects, this process includes two phases: PD and construction. See Appendix E, Table 1 for a summary of the program.

Capital Investment Grants: Expedited Project Delivery Pilot Program

The Bipartisan Infrastructure Law reauthorized an Expedited Project Delivery (EPD) for the Capital Investment Grant (CIG) Pilot Program. The EPD CIG Pilot Program allows up to eight projects to be selected for grant awards over the course of the authorization. The selected projects must at least in part be supported through a public-private partnership and operated and maintained by employees of an existing provider of public transportation. In order to receive a grant, the project must meet a number of requirements specified in law, including demonstration of project justification, local financial commitment, technical capacity, and a certification that the existing transit system is in a state of good repair.

FTA's FY2022 Annual Report on Funding Recommendations includes $100 million for EPD projects.[28] The Bipartisan Infrastructure Law provided $800 million in advance appropriations for EPD projects between FY2022 and FY2026, as well as $15 billion in advance authorizations for the full CIG program.[29] The EPD program will fund up to 25 percent of the total project capital cost. See Appendix E, Table 1 for a summary of the program.

FHWA

This subsection provides further detail regarding FHWA funding for which the project may be eligible, including flexible Federal Aid Highway Program formula funding earned by the state and region, including the Congestion Mitigation and Air Quality (CMAQ) program and Surface Transportation Block Grant (STBG) funds.

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[25] Source: https://www.transit.dot.gov/sites/fta.dot.gov/files/2021-05/FY22-Annual-Report-on-Funding-Recommendations.pdf
[26] Source: https://www.transit.dot.gov/sites/fta.dot.gov/files/2021-05/FY22-Annual-Report-on-Funding-Recommendations.pdf

[28] Source: https://www.transit.dot.gov/sites/fta.dot.gov/files/2021-05/FY22-Annual-Report-on-Funding-Recommendations.pdf

Congestion Mitigation and Air Quality (CMAQ)

The Congestion Mitigation and Air Quality (CMAQ) program provides funding for transportation projects and programs to reduce congestion and improve air quality in designated air quality maintenance or non-attainment areas for carbon monoxide and/or ozone. Eligible uses for CMAQ funding include capital costs of transit projects and up to three years of operations and maintenance (O&M) costs of new transit service. The FHWA apportions funding as a lump sum for each state, based on the state's share of the population of air quality non-attainment areas and severity of air pollution, with 2% of funds set aside for State Planning and Research. States then use this funding for their own CMAQ programs, allocating funds through their DOTs and local Municipal Planning Organizations (MPOs) for eligible projects with air quality benefit for the state.

Both Putnam County and Fairfield County are located in non-attainment areas for ozone and/or attainment/maintenance areas for particulate matter and are thus eligible for CMAQ funds. The CMAQ solicitation process for Putnam County is handled by the New York Metropolitan Transportation Council, and for Fairfield County by the Connecticut DOT.

In FY2022, the CMAQ program apportioned $48.2 million for Connecticut and $199.6 million for New York.[30] The Bipartisan Infrastructure Law provided $13.2 billion in advance appropriations for the program between FY2022 and FY2026. The project could be eligible for funding, but there is significant competition for funding and a relatively low amount of funding available. See Appendix E, Table 1 for a summary of the program.

Surface Transportation Block Grants (STBG/STP)

Surface Transportation Block Grants (STBG), also known as the Surface Transportation Program (STP), are distributed by the FHWA to states and metropolitan planning organizations (MPOs) using a highway-based funding formula. It is a flexible funding source for a range of transportation projects including transit safety infrastructure improvements for existing services and transit capital funding for new projects. The FHWA apportions funding as a lump sum for each state, and a percentage of a state's apportionment is then sub-allocated to urbanized and non-urbanized areas based on their relative share of the state's population. 2% of funds are set aside for State Planning and Research.

In FY2022, the STBG program apportioned $170.6 million for Connecticut and $555.6 million for New York.[31] The Bipartisan Infrastructure Law provided $64.8 billion in advance appropriations for the program between FY2022 and FY2026. The project could be eligible for funding, but there is significant competition for funding and a relatively low amount of funding available. See Appendix E, Table 1 for a summary of the program.

Existing State Funding Options

This subsection provides further detail regarding existing New York and Connecticut state funding for which the project may be eligible. Detailed information about each Existing State Funding Option can be found in Appendix E.

New York State Funding Sources

The New York State Department of Transportation's capital program (NYSDOT) is supported by Federal aid, State capital projects funds, financial settlement funds, dedicated taxes and fees deposited in the Dedicated Highway and Bridge Trust Fund, and the State's General Fund. State and local transportation fees and funds, including those dedicated for the MTA, include the following[32]:

- Petroleum Business Tax
- The MTA Corporate Tax Surcharge
- Mortgage Recording Taxes
- Real Property Transfer Tax

[30] Source: https://www.fhwa.dot.gov/legsregs/directives/notices/n4510858/n4510858_t1.cfm
[31] Source: https://www.fhwa.dot.gov/legsregs/directives/notices/n4510858/n4510858_t1.cfm
[32] Sources: https://www.dot.ny.gov/divisions/policy-and-strategy/public-transportation/funding-sources/STOA, https://new.mta.info/budget/dedicated-taxes

- For-hire Vehicle Surcharge (applicable to trips in sections of Manhattan only)
- Payroll Taxes
- Driver license fees
- Vehicle registration fees
- Taxicab taxes
- Auto Rental Tax

The State of New York provides specific funding opportunities, as described in the subsections below.

State Omnibus and Transit Purpose Appropriation

NYSDOT provides 50% of the non-federal share (not to exceed 10% of the project cost) of transit capital projects financed in part through apportioned federal-aid programs (e.g. Surface Transportation Block Grants), with local sponsors required to provide the remaining 10% share of total project costs. The State Omnibus and Transit Appropriation is authorized every five years as part of the New York State multi-year plan for capital funding for transportation.

$18.5 million has been appropriated annually from the state budget each fiscal year between 2015 and 2022, with appropriations expected to remain constant.[33] These funds could be used to satisfy up to 10% of the project costs if the project were to receive federal funding. The table below provides a summary of the funding source. See Appendix E, Table 2 for a summary of the program.

Multi-Modal Program

As part of the state Multi-Modal Program, NYSDOT provides reimbursement funding for five specifically authorized transportation capital project modes, including projects costs for construction, reconstruction, improvement, reconditioning and preservation of rail freight facilities, and for the project costs of intercity rail passenger facilities and equipment where the service life is at least 10 years. Funding comes from New York State Thruway Authority State Personal Income Tax Revenue Bonds.[34]

Capital projects are identified for funding in schedules agreed upon between the Governor and the Legislature in a Memorandum of Understanding and/or documented on an individually approved Universal Multi-Modal (MM) Project Request and Nomination Form.[35] These funds could be used for some project components but awarded fund amounts are generally small (in the hundreds of thousands of dollars), and the project's sponsors would require support from state legislators and/or the governor. See Appendix E, Table 2 for a summary of the program.

Passenger And Freight Rail Assistance Program (PFRAP)

NYSDOT's Passenger and Freight Rail Assistance Program (PFRAP) provides reimbursement funding for rail and port capital investments which preserve and enhance the State's major trade and passenger corridors. A related program, the Section 130 Railway-Highway Grade Crossing Program (Section 130), targets improvement for rail grade crossings. Eligible projects include:

- Track construction and rehabilitation
- Bridge construction and rehabilitation
- Elimination of clearance obstructions
- Yard, terminal and siding construction and rehabilitation
- Signal and train control systems
- Rolling stock acquisition and rehabilitation
- Capital projects that will reduce carbon footprint of railroad facilities

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[33] Sources: https://www.dot.ny.gov/divisions/policy-and-strategy/public-transportation/funding-sources/omnibus, https://www.budget.ny.gov/pubs/archive/fy22/ex/agencies/appropdata/TransportationDepartmentof.pdf, https://www.budget.ny.gov/pubs/archive/fy23/ex/agencies/appropdata/TransportationDepartmentof.pdf

[34] Source: https://www.thruway.ny.gov/about/financial/bond/index.html

[35] Source: https://www.dot.ny.gov/divisions/operating/opdm/local-programs-bureau/multi-modal

- Rail grade crossings

The 2021-2022 Enacted State Budget provided $85.5 million for the PFRAP, and $1.5 million for Section 130. Applications for funding closed on April 22, 2021. Funds are appropriated from general state revenues annually.[36] Project components could be eligible for funding, but any funding would be limited in size. See Appendix E, Table 2 for a summary of the program.

Public Transportation Modernization and Enhancement Program (MEP)

Administered by NYSDOT, the Public Transportation Modernization and Enhancement Program (MEP) apportions $41 million in State funding to counties, cities, and regional authorities to upgrade and enhance public transportation services.

Program sponsors may submit a program of eligible capital projects that, in combination, have a minimum service life of no less than ten years. Eligible projects include any FTA activity, including vehicle rehabilitation and/or replacement, fleet enhancement, deployment of new technologies, and passenger amenities and maintenance facilities. Preference is given to projects that help reduce the carbon footprint/harmful emissions within the service area as well as direct infrastructure investments to Environmental Justice communities. Program funds may be used to supplement and enhance a federally aided project (e.g., by adding buses to an existing federally aided contract). However, funding provided under this program may not be used to supplant or otherwise displace the required local share of a federally aided project.

The NYSDOT awarded $41.4 million for counties, cities, and regional authorities to upgrade and enhance their public transportation services in 2021. This 100% State funding was included in the enacted State Fiscal Year 2021-22 State Budget. The application deadline closed on December 3, 2021.[37]

Recent projects funded by the Program include electric bus charging stations, bus shelter replacements, transit facility state of good repair projects, bus replacements, and park and ride facility construction, with funding grant sizes generally in the hundreds of thousands or single digit millions of dollars.[38]

While its unlikely to be a major source of funding for this project, this program is a potential source of funds for individual project components, or other improvements related to the project. However, the program cannot be used to satisfy a local share requirement for federal funds.

Connecticut State Funding Sources

The Connecticut Department of Transportation (CTDOT) issues Special Tax Obligation (STO) bonds as part of the biennial budgeting process in order to fund infrastructure improvements including mass transportation and transit facilities. These bonds are the main source of state funding for the CTDOT Capital Budget. Debt Service on STO bonds is repaid from the dedicated revenue stream of the Special Transportation Fund (STF)[39]. These sources of funds include:

- Motor Fuels Tax
- Sales & Use Tax
- DMV Motor Vehicle Receipts
- Licenses, permits & fees
- DMV Sales Tax (Used Cars)
- Oil Companies Tax

In addition to the STF Fund, the State of Connecticut provides additional funding opportunities as described in the subsections below.

[36] Source: https://www.dot.ny.gov/main/business-center/railgrants
[37] Source: https://www.dot.ny.gov/divisions/policy-and-strategy/public-transportation/funding-sources/modernization-enhancement
[38] Source: https://www.dot.ny.gov/programs/stip/files/R8.pdf
[39] Source: https://buyctbonds.com/bond-program-summaries/

Urban Act Grant Program

The Urban Act Grant program provides funding to municipalities that are designated as economically distressed, public investment communities, or urban centers[40]. Funds are provided to improve and expand state activities that promote community conservation and development and improve the quality of life for urban residents of the state. Eligible project sponsors include municipalities, nonprofits, and for-profit including sole proprietorship, partnership, or corporation.

Urban Act funds can be used to finance a wide array of projects, including:

- Economic and community development
- Transportation
- Housing
- Recreation development
- Solid waste disposal
- Public safety
- Social-services-related projects (e.g., child day care projects, elderly centers, and shelter facilities for domestic violence victims).

This grant program is not likely to be a major source of funding for the project.

New Funding Options

New local, state, and regional funding for transportation services could be used to contribute to the near- and longer-term capital needs for the project. Potential sources of funding established or otherwise studied for funding similar rail projects throughout the US include:

- Property Taxes
- Income and Payroll Taxes
- Vehicle Taxes
- Sales Taxes
- Parking and Fuel Taxes
- Utility Taxes
- Business Activity Taxes
- License and User Fees
- Head Tax (# of employees)
- Tolls/Congestion Fees
- Fee on Taxis/TNCs (e.g., Uber)
- Development Impact Fees
- Lottery
- Hotel/Bed Tax
- Excise Tax on Alcohol, Cigarettes, Cannabis
- Rental Car Tax
- Parking Fees
- Vehicle Miles Traveled Tax

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[40] Source: https://portal.ct.gov/DECD/Content/Community-Development/03_Funding_Opportunities/Capital-Infrastructure-Grants/Urban-Act-Grant-Program

The project sponsor would need to work with each state, local municipalities, counties, and/or taxing districts to identify a program of potential new taxes and fees to contribute to the capital expenditures or debt service for the project. Each potential new tax and fee would need to be evaluated relative to ease of implementation and economic, political, and administrative conditions. Criteria could include:

- Revenue Potential: Amount of funding source may yield for the project annually
- Keeping Pace with Inflation: Funding received keeps pace or is correlated with general price inflation
- Equity: Source has a proportionate impact across income levels (is it progressive or regressive?)
- Nexus with Beneficiaries: Source impacts current or future beneficiaries of new service
- Stability/predictability: Revenues are stable and predictable across years
- Administration: Costs of administration, collection, and enforcement (is a costly new administration and collection mechanism needed?)
- Political Feasibility: Overall feasibility/support for using funding source to support the project (is a referendum or change in law needed?)

Financing Options

This subsection evaluates financing options for which the project may be eligible, including traditional financing strategies, federal financing sources, and short-term financing sources. These are not additional types of funding, but rather ways to convert (borrow against) the revenue streams discussed later in Revenue to Support Operations and Maintenance, to provide funding for up-front capital expenditures. In each case, borrowing would need to be tied to a revenue stream that would be pledged to repaying the debt.

A variety of public, quasi-public, and private financing options exist to help develop and construct large transportation projects in the U.S.

Detailed information about each Federal Financing Option can be found in Appendix E, Table 3.

Traditional Financing Strategies

Tax Exempt and Taxable Municipal Bonds

Municipal bonds are a fixed-income security issued by a state or local government, including public authorities, cities, and counties. Bonds are one of the lowest-cost methods of government borrowing and are the most common way of financing public works in the United States.

Federal statute permits municipal issuers to issue tax-exempt debt when any income derived from the project is exempt from federal tax. The interest earnings of tax-exempt debt are typically income tax-free to the bond holder, yielding a lower financing cost for the debt issuer.

Bonds are taxable when the income derived from the project is not exempt from federal tax. Taxable municipal bonds are generally issued to finance a project that provides major benefit to the public but is not eligible for tax-exempt debt.

Private Activity Bonds

Private activity bonds (PABs) are bonds issued by a conduit issuer, such as a state or local government, on behalf of a private entity for highway and freight transfer projects. They allow a private project sponsor or public project sponsor employing a public-private partnership (P3) to benefit from lower financing costs of tax-exempt municipal bonds[41]. Section 11143 of Title XI of SAFETEA-LU amended Section 142(a) of the Internal Revenue Code to add highway and freight transfer facilities to the types of PABs eligible privately developed and operated projects. The law initially limited the total amount of the bonds to $15 billion, however the Infrastructure Investment and Jobs Act (IIJA) increased the available PAB authority to $30 billion. As of November 23, 2021, approximately $13.81 billion in PABS had been issued since inception of the program.

Qualified projects include the following[42]:

- Any surface transportation project which receives Federal assistance under Title 23, United States Code (as in effect on August 10, 2005, the date of the enactment of section 142(m)

[41] Source: https://www.fhwa.dot.gov/ipd/finance/tools_programs/federal_debt_financing/private_activity_bonds/
[42] Source: https://www.transportation.gov/buildamerica/financing/private-activity-bonds

- Any project for an international bridge or tunnel for which an international entity authorized under Federal or State law is responsible and which receives Federal assistance under Title 23, United States Code (as so in effect)
- Any facility for the transfer of freight from truck to rail or rail to truck (including any temporary storage facilities directly related to such transfers) which receives Federal assistance under Title 23 or Title 49.

Since projects that receive TIFIA credit assistance are Title 23 projects, all TIFIA projects are also eligible to receive this tax-exempt bonding authority. Therefore, TIFIA-assisted public transportation, intercity bus or rail facilities and vehicles projects, among others, are also eligible. See the following subsection, Federal Financing Sources, for more information on TIFIA eligibility.

Federal Financing Sources

TIFIA

The Transportation Infrastructure Finance and Innovation Act (TIFIA) provides federal credit assistance in the form of direct loans, loan guarantees, and standby lines of credit to finance surface transportation projects of national and regional significance. TIFIA leverages federal funds by attracting private and non-federal investment to projects that critically improve the nation's surface transportation program. TIFIA credit assistance provides improved access to capital markets, flexible repayment terms, and potentially more favorable interest rates than can be found in private capital markets for similar instruments. TIFIA financing enables the applicant to receive more favorable interest rates for the project's share of non-federal borrowing due to lowered investment risk. Each dollar of Federal funds can provide up to $10 in TIFIA credit assistance - and leverage $30 in transportation infrastructure investment[43].

An eligible project must be included in the applicable State Transportation Improvement Program (STIP).

Credit assistance is limited to 33 percent of reasonably anticipated eligible project costs (unless the sponsor provides a compelling justification for up to 49 percent)[44]. The combined share of TIFIA proceeds and other federal funding for a given project may not exceed 80 percent of the total project cost. It is common for projects to combine TIFIA financing and funding from FTA's New Starts program making project financing more manageable by providing up-front grant funding to cover a share of project costs, and low-cost federal loans to leverage each project's local match.

The program permits repayment over a term of up to 35 years after a project's substantial completion and gives borrowers the flexibility to defer principal and capitalize interest payments for up to 5 years. Principal payments may be structured to ramp up with projected growth in revenues pledged to service TIFIA debt.

The New York, New Jersey, and Connecticut region has received federal credit assistance for several significant infrastructure projects, summarized below:

- The Port Authority of New York & New Jersey received a $473.7 million TIFIA loan for the Goethals Bridge Replacement project, which includes a complete replacement of the existing 85-year-old bridge. The total eligible project cost is $1.436 billion.
- The New York State Thruway Authority received a $1.6 billion loan for the Governor Mario M. Cuomo Bridge (Tappan Zee Bridge Replacement) project which replaced the nearly 60-year-old Tappan Zee Bridge. The bridge was designed to accommodate future transit plans including bus rapid transit, light rail, or commuter rail. The total project cost was $4.979 billion.
- The Empire State Development Corporation (ESD) received a $526.1 million TIFIA loan for the Moynihan Train Hall project, which included the West End Concourse improvements and construction of Moynihan Train Hall. The total eligible project cost was $1.85 billion.
- The New York City Department of transportation (NYCDOT), New York City Economic Development Corporation (EDC), and TSASC, Inc received a $159.2 million TIFIA loan for the Staten Island Ferries and Terminals project, which included construction and acquisition of three ferry boats and redevelopment of two ferry terminals. The total eligible project cost was $482.2 million.

Advantages of the program include low cost of financing and flexibility of repayment terms. Challenges of the program include competitiveness of the program, lengthy negotiations and structuring process, and the cap on the percentage of TIFIA financing. See Appendix E, Table 3 for a summary of the program.

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[43] Source: https://www.fhwa.dot.gov/ipd/finance/tools_programs/federal_credit_assistance/tifia/
[44] Source: https://www.transportation.gov/buildamerica/financing/tifia/tifia-credit-program-overview

RRIF

Please note that this program would only be applicable to Alternatives One, Two, and Three; Alternative Four (light rail transit) would not be eligible.

The Railroad Rehabilitation and Improvement Financing (RRIF) program provides federal credit assistance in the form of direct loans, loan guarantees, and lines of credit to finance rail projects throughout the nation. RRIF offers direct loans for up to 100 percent of the project cost. The highly competitive program allows a repayment period of up to 35 years from substantial completion of the financed project, rather than from loan execution, which extends the potential term of the loan. The RRIF program is authorized to provide up to $35 billion in direct loans and loan guarantees to finance development of railroad infrastructure, with $7 billion reserved for freight railroads other than Class I carriers (railroads with operating revenue of less than $272.0 million annually).

Eligibility for RRIF financing include railroads, state and local governments, government-sponsored authorities and corporations, limited option freight shippers that intend to construct a new rail connection, and joint ventures that include at least one of the preceding categories.

The FRA notes RRIF financing may be used to:

- Acquire, improve, or rehabilitate intermodal or rail equipment or facilities, including track, components of track, bridges, yards, buildings, and shops, and including the installation of positive train control systems;
- Develop or establish new intermodal or railroad facilities;
- Reimburse planning and design expenses relating to activities listed above; and
- Refinance outstanding debt incurred for the purposes listed above.

See Appendix E, Table 3 for a summary of the program.

Short-term Sources

Short-term financing options include revenue anticipation notes, construction financing, and commercial paper. These options are summarized below.

Revenue Anticipation Notes

Revenue anticipation notes (RANs) are a form of short-term borrowing against the expected receipt of a variety of near-term proceeds (e.g., taxes, fees, grants, bonds, or TIFIA/RRIF loans). RANs can be used to fill small gaps between project needs and receipt of dedicated revenues, grants, or long-term financing. Debt typically matures in less than one year. Notes are issued by state governments, local governments, and transit agencies that collect the identified source of near-term proceeds. RANs could be used to facilitate the financing of the project. Like other forms of municipal bonds, the interest income that RANs generate is typically tax-exempt at the federal level.

Tax-Exempt Commercial Paper

Tax-exempt commercial paper is short-term, unsecured debt of states and municipalities usually issued to finance short-term liabilities and backed by the issuer's financial health and credit. Maturities of tax-exempt commercial paper generally range from 30 to 90 days, though maturities of up to 270 days are possible. States and municipalities can continue rolling over maturing commercial paper as long as they need to borrow funds, so it can be used to fund long-term projects. Tax-exempt commercial paper is beneficial for the issuer, as they are able to access funds at lower rates than they might have to pay if they had borrowed the money from a traditional financial institution, such as a bank.[45] Commercial paper could be available as an additional tool if the project sponsor were to issue debt on capital markets.

Construction Financing

Construction financing is a short-term debt issuance designed to address up-front funding or financing gaps during construction. The debt may be issued by project sponsors or construction contractors. When issued by contractors, construction companies assume short-term financing risk to secure the project.

[45] Source: https://www.richmondfed.org/-/media/RichmondFedOrg/publications/research/special_reports/instruments_of_the_money_market/pdf/chapter_08.pdf

Project-Specific Funding Options

This subsection provides further detail regarding project-specific funding along the corridor, including methods of value capture and public private partnerships.

Value Capture

"Economic value capture" refers to an innovative public infrastructure financing mechanism increases in private land values generated by a new public investment are all or in part "captured" through a land-related tax to help pay for that investment, typically by financing against these future property value gains. The potential for the project to receive this type of financing is generally low.

Tax Increment Financing (TIF)

TIF is a mechanism for capturing all or part of the increased property tax paid by properties within a designated area. TIF is not an additional tax, nor does it deprive governments of existing property tax revenues up to a set base within the TIF district. Instead, part of or all of future property taxes (above the set base level) resulting from increased property values or new development are dedicated to paying for the public improvement that caused the value increases and additional development.

TIF is most commonly used by local governments to promote housing, economic development, and urban redevelopment in established neighborhoods, but in some cases has been used to finance transportation projects, mainly public transit. TIF revenues can be used as they accrue on a pay-as-you-go basis or can be bonded against. A public agency may also issue a general obligation (GO) bond to finance improvements and use future TIF district revenue to replenish the general fund. This GO approach usually provides better debt terms than if the TIF revenue is the only stream dedicated to repay the bonds, though it usually has undesirable impacts on the credit of the parent entity making the GO pledge by increasing its overall debt levels.

The typically stable growth and minimal long-term volatility of property values makes TIF a reliable stream of revenues to bond against. Both New York and Connecticut have enables TIF funding.

Development Impact Fee (DIF)

Development impact fees are one-time charges collected from developers and/or property owners to fund public infrastructure and services made necessary by new development. Impact programs are most successfully implemented in areas poised for significant growth with little or no existing development. Generally, fees are based on a formula taking into consideration the number of new dwelling units or square feet of non-residential space and the relative benefit the infrastructure provides the property. For transportation projects, relative benefit is usually determined by the distance a development is located from the improvement.

Fees that are higher than one or two percent of the cost of a property could impact that property's competitiveness relative to a similar property with no fee, as fees are usually passed through from developers to buyers in the form of higher home prices or commercial rents.

Revenue streams from development impact fees tend to be more volatile and unpredictable relative to tax increment financing and special assessments. This is because the revenue is contingent entirely upon new real estate development, which can be heavily cyclical and extremely sensitive to regional and national economic conditions.

Special Tax Assessment Districts

Special tax assessments are additional taxes paid within defined geographic areas where parcels receive a direct and unique benefit from a public improvement. Generally, the cost of the improvement is allocated to property owners within the defined benefit zone and collected in conjunction with property or sales taxes over a predetermined number of years. Once the annual assessment collections cover the cost of the improvement (or debt issued to pay for the improvement), the assessment is removed.

Implementation of special tax districts can be challenging relative to other value capture mechanisms, as increases in taxes are politically sensitive and highly visible to affected property owners, businesses, and local consumers. Before this mechanism becomes politically feasible, it will require additional effort to convince local landowners and businesses that the tax is worth the value of the infrastructure improvement. Once in place, however, they are relatively easy to administer, and the additional taxes are collected along with current property tax. Special tax districts are one of the most common forms of value capture for transit projects.

Because special taxes represent additional taxes on existing property, the revenue stream tends to begin at a higher level compared to TIF. However, because it is typically limited to a certain maximum percentage, the upside growth potential of special tax is more limited relative to TIF revenues.

Public Private Partnership

Public-Private Partnerships (P3s) have the potential to support a significant share of project costs and could facilitate lower project costs as part of a comprehensive program delivery strategy. However, P3s includes a transfer of associated risk to the private sector, meaning program sponsors will have less direct control of the program.

There are two major types of P3 financing:

1. P3 equity is an ownership stake in an enterprise with an aim of making a profitable return. This may include investment from commercial developers, financial investors, pension funds, sovereign wealth funds, insurance companies, and private equity funds. A P3 equity stake is just one component of an overall project delivery strategy.
2. P3 debt can be coupled with equity to finance the initial investment and may include Private Activity Bonds (PABs), taxable bonds, bank loans, and other debt instruments. See Traditional Financing Strategies for more information about PABs.

Revenue to Support Operations and Maintenance

This subsection provides detail regarding revenues which support long term operations and maintenance (O&M) costs of the project. These include federal formula funding programs and state transportation operating assistance funding, as well as local and private funding options, which would cover O&M expenses not covered by any operating and non-operating revenues that come from the operation of service along the project corridor.

These operating and non-operating revenues from the operation of service could include a combination of revenues from passenger fares, fees to park at stations and park-and-rides, real estate or concession leases, and the licensing of advertising rights at stations and/or on rolling stock. One of the primary operating revenues for transit agencies is the revenue from passenger fares, although the impact can vary. "Farebox recovery ratios", the fraction of operating expenses which are met by fares paid by passengers or other directly generated revenues, vary system-to-system. Regionally, in 2019, the MTA Metro-North Commuter Railroad had a recovery ratio of 60.8%, and the Long Island Railroad a ratio of 53.4%.[46]

Federal Funding Options

This subsection documents and describes potential federal funding sources which could contribute to the project's O&M costs. Federal funding options are more limited for O&M support than for capital support; however, the project could receive nominal support for O&M costs from FTA formula funding programs or FHWA's CMAQ program (as mentioned previously).

FTA

This subsection documents FTA programs which could potentially provide O&M support for the project. FTA funding sources covered in this section include Section 5307 Urbanized Area Formula Grants (Section 5307) and Section 5337 State of Good Repair Grants (Section 5337).

Section 5307

The Urbanized Area Formula Funding program (49 U.S.C. 5307) makes federal resources available to urbanized areas and to governors for transit capital and operating assistance in urbanized areas (UZA) and for transportation-related planning. Each year, FTA uses a formula which considers both demographic information and service factors for transit agencies serving the UZA to determine each UZA's apportionment of Section 5307 funding. For urbanized areas with 200,000 population and over, funds are apportioned and flow directly to a designated recipient selected locally to apply for and receive Federal funds. For these areas, operating assistance is not an eligible expense.

Eligible uses of funds include planning, engineering, design, and evaluation of transit projects and other technical transportation-related studies, and capital investments in new and existing fixed guideway systems including rolling stock, vehicle overhaul/rebuilding, track, signals, communications, and computer hardware and software. All preventive maintenance costs are considered capital costs. The federal share is limited to 80% of the total project cost for capital expenditures.[47]

[46] Source: https://www.transit.dot.gov/sites/fta.dot.gov/files/2020-11/2019%20Full%20Reporters%20Profiles%20Report.pdf
[47] Source: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/funding/grants/37961/fast-act-section-5307-fact-sheet_0.pdf

In New York, NYSDOT provides 10% of the local share for these projects. Designated Section 5307 recipients in Putnam County include the New York Metropolitan Transportation Council (the region's MPO), the NY MTA Metro-North Railroad, Putnam Area Rapid Transit, and the Westchester Bee-Line.[48] The Connecticut segment of the project is located within the Bridgeport-Stamford Urbanized Area, for which Section 5307 funds are distributed for the urbanized area in accordance with annual agreements prepared by the region's MPOs, transit operators, and the Connecticut DOT.[49]

In FY2021, $959 million in Section 5307 funds were apportioned to the New York-Newark Urbanized Area, with $609 million for New York State and $6,000 for Connecticut. The Bridgeport-Stamford Urbanized Area received $29.5 million, with $28.3 million for Connecticut and $1.2 million for New York.[50] Select long-term maintenance costs of the project could be eligible for a portion of Section 5307 funding apportionments for these regions. However, given the demand for funds from this program to support other transit capital investment in the region, this program is not likely to provide a funding contribution to the capital costs of the project.

Section 5337

The State of Good Repair Grants Program (49 U.S.C. 5337) provides capital assistance for maintenance, replacement, and rehabilitation projects of high-intensity fixed guideway and bus systems to help transit agencies maintain assets in a state of good repair. Additionally, State-of-Good-Repair (SGR) grants are eligible for developing and implementing Transit Asset Management plans.[51] Each year, FTA uses a formula that considers overall service factors for the system as well as service factors for segments of the system that are seven years or older to distribute funds to MPOs and transit agencies.

Eligible uses of funds include capital projects that maintain a fixed guideway or a high intensity motorbus system in a state of good repair, including projects to replace and rehabilitate rolling stock, track, line equipment and structures, signals and communications, power equipment and substations, passenger stations and terminals, security equipment and systems, maintenance facilities and equipment, and operational support equipment. The federal share of eligible capital costs is 80 percent of the net capital project cost.

In FY2021, the New York Metropolitan Area received $734 million in High Intensity Fixed Guideway State of Good Repair funds, and Southwestern Connecticut received $61.5 million.[52] Select long-term maintenance costs of the project could be eligible for a portion of Section 5307 funding apportionments for these regions.

FHWA

This subsection documents FHWA programs which could potentially provide O&M support for the project. The only funding source covered in this section is FHWA's CMAQ program, which is described previously in Federal Funding Options: FHWA.

CMAQ

The CMAQ program provides funding to transportation projects and programs to reduce congestion and improve air quality in designated air quality maintenance or non-attainment areas for carbon monoxide and/or ozone. Eligible uses for CMAQ funding include capital costs of transit projects and up to three years of operations and maintenance (O&M) costs of new transit service.

Both Putnam County and Fairfield County are located in non-attainment areas for ozone and/or attainment/maintenance areas for particulate matter and are thus eligible for CMAQ funds. The CMAQ solicitation process for Putnam County is handled by the New York Metropolitan Transportation Council, and for Fairfield County by the Connecticut DOT.

In FY2022, the CMAQ program apportioned $48.2 million for Connecticut and $199.6 million for New York.[53] The Bipartisan Infrastructure Law provided $13.2 billion in advance appropriations for the program between FY2022 and FY2026. The first three years of O&M costs of the project could be eligible for a portion of Section 5307 funding apportionments for these regions.

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[48] Source: https://www.dot.ny.gov/divisions/policy-and-strategy/public-transportation/urban-programs/5307
[49] Source: https://westcog.org/wp-content/uploads/2015/09/MPOBRST-UZA-Agreement-103102-final.pdf
[50] Source: https://www.transit.dot.gov/funding/apportionments/table-3-fy-2021-section-5307-and-5340-urbanized-area-formula-appropriations
[51] Source: https://www.transit.dot.gov/funding/grants/state-good-repair-grants-5337
[52] Source: https://www.transit.dot.gov/funding/apportionments/table-11-fy-2021-section-5337-state-good-repair-apportionments
[53] Source: https://www.fhwa.dot.gov/legsregs/directives/notices/n4510858/n4510858_t1.cfm

State Funding Options

New York

Subject to annual appropriation, transit agencies and operators in New York State receive operating, capital, and debt service funding assistance from the Dedicated Mass Transportation Trust Fund (MTTF) and the Metropolitan Mass Transportation Operating Assistance Fund (MMTOA), a subsidy program specifically for downstate transit providers. The MTTF receipts consist of a portion of the revenues derived from certain business privilege taxes imposed by the State on petroleum businesses, a portion of the motor fuel tax on gasoline and diesel fuel, and a portion of certain motor vehicle fees, including registration and non-registration fees. MMTOA receipts are comprised of a 0.375% regional sales tax, regional franchise tax surcharge, a portion of taxes on certain transportation and transmission companies, and an additional portion of the business privilege tax imposed on petroleum businesses.

In the case of the NY MTA, operating subsidies are also received from city and county governments in the MTA commuter district and from the State of Connecticut. These subsidies for 2021 and 2020 totaled $1.5 billion and $1.2 billion, respectively.[54]

Connecticut

The State of Connecticut DOT (CTDOT) provides subsidies to bus and rail operations throughout the state, including the Metro-North Commuter Rail, bus and rail systems directly owned by CTDOT, and non-CTDOT owned bus systems. For systems owned by CTDOT, the state is fully responsible for covering O&M costs not covered by operating and non-operating revenues. For non-CTDOT owned systems, CTDOT enters into operating assistance contracts to cover operating deficits up to a predetermined amount, with the State covering approximately 90% of the deficit funding in the urban systems, and the state and federal government providing 83% of the deficit funding in the rural systems. Funding from local municipalities accounts for the remainder of deficit funding. [55]

Local Funding Options

Locally raised and administered taxes and fees could be used to cover a share of the project's O&M costs. Throughout the US, there are numerous examples of local taxes and fees used to defray the operations and maintenance costs of transit services beyond fares including municipal contributions, student activity fees at local colleges and universities, advertising, station concessions, and contributed services such as vehicle cleaning and landscaping.[56]

The project sponsor would need to work with local municipalities, counties, and other organizations that would benefit from the restoration of rail services to determine if local funding sources could be available. It must be noted that local funding sources at the scale envisioned for the project likely represent a small portion of the transportation funding needed to operate the proposed system.

Private Funding Options

Partnerships or agreements with private stakeholders could provide limited funding to support rail operations along the corridor.

[54] Source: https://new.mta.info/document/49826
[55] Source: https://portal.ct.gov/DOT/Publictrans/Bureau-of-Public-Transportation/Office-of-Transit-and-Ridesharing
[56] Texas DOT, A Study of Sources Used for Local Revenue for Transit, 2012, https://ftp.dot.state.tx.us/pub/txdot-info/ptn/matching-funds-resource-guide.pdf

Funding Summary

As the full project elements have not been finalized and the project delivery timeline is unknown, so it is difficult to determine which existing funding options will be available to fund the project.

The project sponsor must establish a capital and O&M program that accesses a tapestry of federal, state, and local grants, loans, taxes, and fees to address both short- and long-term needs. Long-term replacement capital costs should also be considered, since SGR needs lead to significant, lumpy costs after the system reaches mid-life.

Local funding sources such as partnerships and agreements with private stakeholders are likely to represent a small portion of needed capital and operating funds. Some federal funding sources could support initial capital costs and a small portion of O&M and SGR costs. However, it is likely that a state or local, sustainable long-term funding source will be needed to cover regular O&M costs as well as state of good repair needs.

After the full project scope, final costs, and construction timeline are defined, the next steps for this analysis may include:

- Review and refine the funding and financing options to include only those that are applicable to the defined project.
- Develop a financial plan that will examine the funding needs and estimate the magnitude of funds required to fund this project.

SUMMARY

Assuming certain environmental concerns can be successfully addressed though future, more detailed analysis, the Southeast to Danbury Rail-Link is technically feasible and could operate without degrading other Metro-North services. The project should proceed with a full NEPA EA and conceptual engineering, to better understanding the remaining issues.