Sources:

Metro-North New Haven Line schedule downloaded 1/28/09.

Travel times based on 45 mph average speed on transitway. Google Maps travel times used to estimate travel times in mixed traffic conditions. 2030 travel times assume travel times will increase at same rate as employment growth in the Waterbury Branch travelshed.

During the midday, only Route 1 would be in operation, providing an average headway of approximately 30 minutes. This is consistent with the frequency of midday trains and anticipated levels of demand for midday service.

Stations and Facilities

Dedicated bus bays would be provided at each of the stations currently served by the Waterbury Branch. Additional parking spaces at Derby-Shelton might be required.

Vehicles

It was assumed that the Express Bus Alternative would use a standard 40-foot coach with capacity for 40 seated and 30 standing passengers. A total of nine buses would be needed to operate the service: four for peak operations of Route 1, three for peak operations of Route 2, and two buses to provide a 20 percent spare ratio.

Capital and Operating Costs

The conceptual capital cost for constructing this alternative would be $11 million (2008 dollars).

Based on CT Transit-Hartford Division operations and maintenance costs per hour of revenue service in 2007, the conceptual annual operating cost for this alternative would be approximately $3.3 million.

2.4 SHORT LIST OF ALTERNATIVES – NEW CANAAN BRANCH

The New Canaan Branch Short List of Alternatives included a No Build Alternative and four build alternatives. The descriptions below detail the improvements and anticipated outcomes associated with each alternative. As with the Waterbury Branch, some of these Short List alternative descriptions, estimated capital costs, and right-of-way acquisition requirements differ from their Long List counterparts (and from the information presented at the March 2010 Public Information Meetings), reflecting the ongoing refinement of alternatives based on input from the SAC and the public. The cost estimates reported in this section are based on the final May 2010 revision, presented in Appendix A.

All build alternatives proposed improving existing commuter rail service on the New Canaan Branch. Though alternatives that proposed double tracking some or all of the New Canaan Branch were screened out during the first phase of this study, no remaining Short List alternatives would preclude future double tracking of the branch.

Like the Waterbury Branch alternatives, the New Canaan build alternatives were developed to improve frequency and reliability of service. Therefore, the descriptions below are limited to improvements that directly affect operations on the branch. Station improvements that improve the customer experience but have no operational implications—for instance, amenities like canopies, benches, bicycle storage, real-time train information—were reflected in the final study recommendations described in Chapter 7 but were not considered during the screening process because they to do not help differentiate alternatives in terms of service frequency and

reliability. Amenity improvements, along with station upgrades related to Americans with Disabilities Act (ADA) compliance, will be developed in more detail during later Phases III through V of the project.

Similarly, these alternatives did not propose any specific transit oriented development (TOD) projects. While opportunities for TOD in the station areas factored into whether alternatives passed or failed the Land Use criterion during Screen 1, implementation of such projects would be up to local municipalities in coordination with CTDOT. Potential TOD opportunities along the branch were identified in a separate *New Canaan Branch Transit Oriented Development Report* in September 2009 and are summarized in Chapter 4.

2.4.1 No Build Alternative

As with the Waterbury Branch No Build Alternative, this alternative establishes the base case condition for the New Canaan Branch if no substantive improvements were implemented. The impacts of the various build alternatives under consideration were compared to the No Build Alternative, helping to define the resulting benefit anticipated from the construction and financial investment for the recommended project(s). The No Build scenario for the New Canaan Branch reflects population and employment changes that are anticipated to occur independently of any transportation improvements. This alternative also assumes that other planned projects with committed funds will be constructed.

Existing New Canaan Branch Passenger Service Operations

Metro-North currently operates eight weekday southbound trains from New Canaan through to GCT – six in the AM peak period and two in the PM reverse peak. Seven trains operate northbound to New Canaan from GCT – one in the AM reverse peak and six in the PM peak period. The branch is served by Stamford shuttles for the remainder of the day, with 12 southbound and 14 northbound shuttles scheduled.

The only storage on the branch is at New Canaan Station, which has a ten-car main track, a ten-car middle track, and a four-car bulk track. The signal system ends south of New Canaan Station, so all movements between the three tracks at New Canaan are by manually operated switches.

The evening peak period is the most constrained, and Metro-North is unable to serve a recognized demand for evening peak reverse commute service. Under the current schedule, the trains arriving in New Canaan at 5:53 PM and 6:11 PM pull onto the middle and bulk tracks and wait until the train leaving Stamford at 6:11 PM arrives on the main track at 6:29 PM, so that by 6:29 PM there are three trains in New Canaan that must be cleared before the next northbound train can enter the branch. At 6:31 PM, the trains that arrived at 5:53 PM and 6:11 PM both dead-head (operate without passengers) back to Stamford, and at 6:35 PM, the train that arrived at New Canaan at 6:29 PM also dead-heads to Stamford.

The need to clear trains out of New Canaan results in a 41-minute gap in northbound service from GCT that is the subject of many customer complaints, according to Metro-North. Without adding a passing siding somewhere along the branch, there is no way to mitigate this gap, although it could be reduced to 30 to 35 minutes if the New Canaan Station lead switch were reversed and the middle track extended south to just above the CP-307 holding (“head block”) signal, which would allow Metro-North to pull trains out of the station and onto the branch.

There are currently no platforms on the middle or bulk tracks at New Canaan, so passengers cannot be loaded or unloaded from these tracks. Adding platforms on one or both of these tracks would improve operations.

With the exception of the five-car platform at New Canaan, station platforms along the branch are four car lengths each. Although most train consists are five or six cars long, platform length is not considered a major problem.

Metro-North has considered running midday New Canaan trains as an extension of Stamford local service. However, it doesn't provide the necessary time to clean cars at New Canaan Station. Additionally, it would potentially downgrade existing New Canaan Branch service quality; while it would save passengers a transfer at Stamford, it would add approximately 20 minutes to their travel time. Metro-North has observed that in general, it matters little to passengers whether midday trains from New Canaan run directly to New York or operate as a shuttle to Stamford, as long as travel time is maintained.

Existing New Canaan Branch Freight Service Operations

Currently there is no freight service or customers on the New Canaan Branch. The CSX Corporation has the rights to move freight on the branch; however, because of the land use patterns along the branch, freight customers are not anticipated in the future and therefore freight service is not likely to occur.

Metro-North's 2030 Operating Plan

The 2030 Metro-North operating plan includes three additional New Haven Line trains departing in the AM peak period from New Haven to GCT. The operating plan anticipates implementation of hourly Acela train service and hourly Regional train service in each direction throughout the day. It also anticipates that Metro-North will operate at 3-minute headways on the New Haven Line between New Haven and CP 112 (where the New Haven Line diverges from the Harlem Line, north of Woodlawn Station in the Bronx), and at 2 ½-minute headways from CP 112 to GCT. The plan includes new stations on the New Haven Line at West Haven, Orange, Georgetown, and Fairfield-Metro.

Planned Transit Improvements

New Canaan Track Extension Project. Separate from the Waterbury and New Canaan Branch Lines Needs and Feasibility Study, CTDOT is currently pursuing a New Canaan Track Extension Project to rebuild the station's third "bulk" track, raising it several feet to be level with the other two station tracks, and extending the track and catenary approximately 170 feet to accommodate two additional cars. The project is currently under design, with construction expected to last from August to November 2010.

Positive Train Control. The Railroad Safety Enhancement Act of 2008 (RSEA), passed by the U.S. Congress in November 2008 (H.R. 2095), requires implementation of Positive Train Control (PTC) on all mainline Class I railroad, intercity rail passenger, and commuter rail passenger lines by December 31, 2015. PTC systems, which integrate command, control, communications, and information systems for regulating train movements with safety, security, and efficiency, can be used in conjunction with a signal system or as a stand-alone system. On-board computers have the ability to automatically enforce movement and continually update operating data systems with information on the location of other trains. While conventional

signal systems use electrical circuits in track blocks to determine train location by block occupancy, PTC systems use Global Positioning System (GPS) or transponders augmented by odometers to determine train location.

It is assumed that PTC would be implemented on the New Canaan Branch as part of this federal mandate, separate from the Waterbury and New Canaan Branch Lines Needs and Feasibility Study. A signal system overlay using Amtrak's Advanced Civil Speed Enforcement System (ACSES) on the New Canaan Branch would satisfy PTC requirements.

Planned Roadway Improvements

While there are no major roadway improvements planned or under construction in the New Canaan Branch corridor at this time, two studies are currently underway that may result in changes to the roadway network prior to the implementation of any Waterbury and New Canaan Branch Lines Needs and Feasibility Study improvements.

Darien Route 1 Corridor Study (State Project 35-189). The South Western Regional Planning Agency (SWRPA) is developing an updated transportation improvements implementation plan for the Route 1 Corridor between I-95 exit 11 and Brookside Road. It is anticipated that the study may have a second phase. Subject to funding, Phase 2 would extend the study's termini south to Nearwater Lane and north to Old Kings Highway North, evaluate a downtown bypass option and circulation changes, examine downtown parking needs, and develop detailed curb cut and access management plans on aerials for the expanded study area. The 18- to 24-month study was scheduled to begin in summer 2009.

Route 1 Greenwich/Stamford Operational Improvements Plan (State Project 56-297). SWRPA is developing a plan to improve traffic operations and safety on Route 1 while at the same time improving pedestrian facilities, managing access, maintaining traffic flow, minimizing congestion, and accommodating transit in relation to land use. The plan will be developed over a period of approximately 18 months. The completed plan will identify and analyze locations with operation deficiencies, project and evaluate future conditions, and recommend short- and long-term strategies to improve the safety and operation of Route 1 for all users. The study limits are Route 1 from the vicinity of the Greenwich-New York State Line east to Washington Boulevard (Route 137) in Stamford.

2.4.2 Transportation Systems Management Alternative

As described in Section 2.4.2, a TSM alternative consists of transportation improvements designed to achieve as many of the goals and objectives of the project as possible while keeping costs to a minimum. It represents the "best that can be done" to optimize facilities and operations while stopping short of major capital investment, through operational upgrades to existing transit services and small physical improvements such as bus lanes on existing highways or expanded park-and-ride facilities. A TSM alternative is included among those considered for all projects funded by the FTA.

The Project Team determined that none of the Short List Alternatives was consistent with the purpose of a TSM alternative. Rail service is already reasonably fast and frequent, but also operating at capacity. Likewise, most potential low cost improvements with operational implications (e.g., bus service) would either be less attractive than current service or would not increase overall ridership unless accompanied by expensive infrastructure improvements to increase frequency. If federal funding were pursued for New Canaan Branch improvements in

later phases of this project, a new TSM alternative that satisfies FTA requirements would be developed by the Project Team and evaluated alongside the no build and build alternatives.

2.4.3 Springdale Siding (NC-1)

This alternative would add a passing siding of approximately 4,000 feet in the vicinity of Springdale Station, beginning just south of the Stamford-Darien town line and continuing south past Springdale Station to Riverbend Drive South. The passing siding would be fully interlocked, requiring new interlockings on both the north and south ends. The passing siding would be of sufficient length that trains could enter and leave the siding at speeds up to 30 MPH. Under this alternative, Springdale Station would retain its one-platform configuration (Figure 2-21a and 2-21b).

Constructing a passing siding at Springdale, roughly halfway along the corridor, would enable multiple trains to operate on the branch at the same time, increasing operational flexibility. By shifting existing trains such that they meet at the siding, it would be possible to operate two extra AM peak inbound trains and two extra PM peak outbound trains. Peak-direction service intervals in both peaks would be smoothed, with gaps eliminated. However, the lack of a second Springdale platform would mean that no reverse-peak trains could stop at Springdale Station during peak periods while the siding was in use.

It should be noted that the use of a passing siding for scheduled “meets” would introduce a new reliability risk to operations: if one train is late, it would make the opposing direction train late as well. This situation could be partially mitigated by scheduling the reverse-peak train to reach the siding in advance of the peak direction train so that it would be fully clear of the mainline by the time the peak direction train arrived.

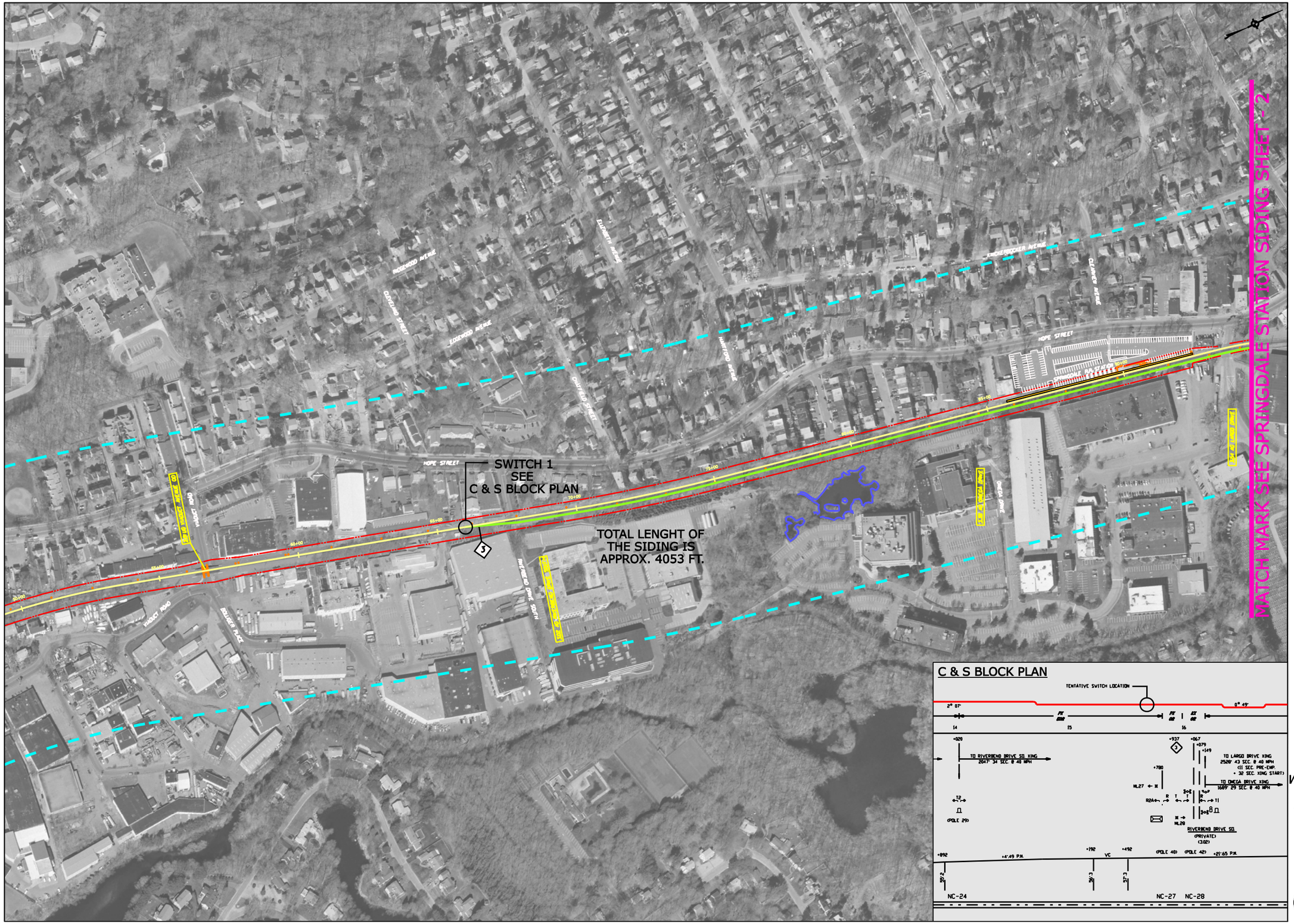
In order to both increase capacity on the branch and retain or improve reverse-peak service, a second platform would need to be constructed at Springdale Station in addition to the passing siding. That alternative is described later in this section.

The conceptual capital cost for constructing this alternative would be $17 million (2008 dollars).

2.4.4 Full Signalization (NC-2)

Currently, the Centralized Traffic Control (CTC) system on the New Canaan Branch does not continue all the way to the northern terminus of branch, ending just south of Grove Street in New Canaan. Under this alternative, the signal system, which is controlled by rail traffic controllers at the GCT Dispatch Center, would be extended all the way to New Canaan Station, and the switches that allow trains to move between tracks at New Canaan Station would be automated. Extending the signal system the full length of the branch and providing remote switch operations would reduce the time required to enter and leave the station. Combined with other improvements, full signalization could allow increased service frequency. As discussed above, PTC is expected to be implemented on the branch regardless of the outcome of this study.

The conceptual capital cost for constructing this alternative would be $4 million (2008 dollars).



LEGEND

- EXISTING R.R. TRACK
- R.O.W.
- RAIL STUDY CORRIDOR
- XX — MILE POST MARKER
- R.R. STRUCTURES, PLATFORMS
- WATERCOURSE
- CHANNEL ENCROACHMENT LINE
- R.R. STATION PARKING
- SIDING/NEW R.R. TRACK

Figure 2-21a:
Springdale Siding

CROSSING DATA

MILE — CROSSING STREET/FEATURE

6J6 UG STAMFORD RD. OD

AG - AT GRADE
UG - UNDERGRADE
OH - OVERHEAD
OPEN DECK

SCALE IN FEET
0 160 320

WATERBURY AND NEW CANAAN
BRANCH LINES
NEEDS & FEASIBILITY STUDY
PROJECT NO. 170-2562

NEW CANAAN BRANCH LINE
SPRINGDALE STATION
SIDING SHEET - 1

CONNECTICUT
DEPARTMENT OF TRANSPORTATION

PARSONS

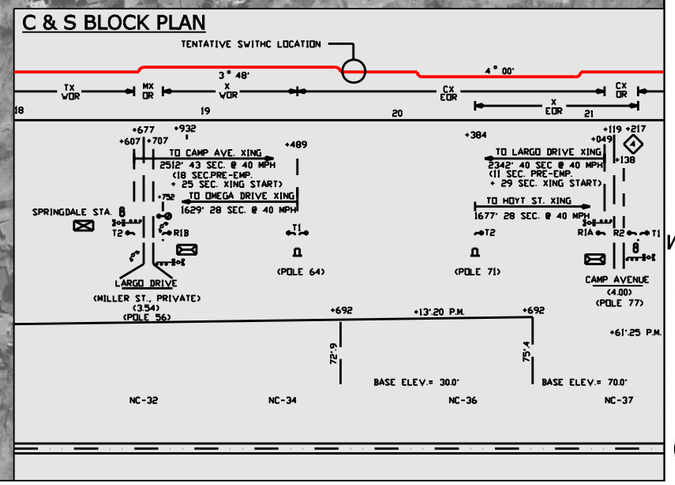
MATCH MARK SEE SPRINGDALE STATION SIDING SHEET - 1

SWITCH 2
SEE
C & S BLOCK PLAN

HOPE STREET
OSBORNE STREET
WESTLE STREET
FIRST STREET
LARGO DRIVE
NORWICH AVENUE
NORWICH RIVER
ST. JOHNS CEMETERY
STAMFORD BRANCH
95+00
100+00
105+00
110+00
115+00
120+00
125+00
130+00
135+00

PLAN SHEET PLN-4

C & S BLOCK PLAN



LEGEND

- EXISTING R.R. TRACK
- R.O.W.
- RAIL STUDY CORRIDOR
- XX MILE POST MARKER
- R.R. STRUCTURES, PLATFORMS
- WATERCOURSE
- CHANNEL ENCROACHMENT LINE
- R.R. STATION PARKING
- SIDING/NEW R.R. TRACK

Figure 2-21b:
Springdale Siding

CROSSING DATA

MILE — CROSSING STREET/FEATURE

6J6 UG STAMFORD RD. OD

AG - AT GRADE
UG - UNDERGRADE
OH - OVERHEAD

OPEN DECK

SCALE IN FEET
0 160 320

WATERBURY AND NEW CANAAN BRANCH LINES
NEEDS & FEASIBILITY STUDY
PROJECT NO. 170-2562

NEW CANAAN BRANCH LINE
SPRINGDALE STATION
SIDING SHEET - 2

CONNECTICUT DEPARTMENT OF TRANSPORTATION

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2.4.5 Full Signalization + Siding + 2nd Platform at Springdale (NC-5)

This alternative would add the 4,000-foot Springdale passing siding and full signalization described for Alternatives NC-1 and NC-2 above, plus a second platform at Springdale Station. A plan and section of the proposed two-platform Springdale Station are shown in Figures 2-22 and 2-23.

A RAILSIM TPC run performed for this alternative found that by adding a siding and platform at Springdale Station, and by shifting existing revenue and non-revenue trains such that they meet at the siding, it would be possible to operate two extra AM peak inbound trains and two extra PM outbound trains, with service intervals in both peaks smoothed and schedule gaps eliminated. Unlike Alternative NC-1, adding a second platform at Springdale would allow reverse-peak trains to pick up and discharge passengers at Springdale while waiting on the passing siding.

As with Alternative NC-1, use of the passing siding for scheduled "meets" would introduce a reliability risk to operations: if one train is late, it would make the opposing direction train late as well. This could be partially mitigated by scheduling the reverse-peak direction train to reach the siding in advance of the peak direction train so that it would be fully clear of the mainline by the time the peak direction train arrives.

The conceptual capital cost for constructing this alternative would be $34 million (2008 dollars).

2.4.6 Springdale Platform Extension (NC-13)

This alternative would extend the existing high-level platform on the west side of the track from its current 360 feet to 680 feet to accommodate an eight-car consist (Figure 2-24). Currently, only four cars are able to open their doors at the station. The 680-foot platform would fit between the Largo Drive and Omega Drive grade crossings north and south of the station without affecting traffic at these crossings.

Springdale Station improvements associated with the creation of a passing siding and a second platform described in NC-5 could be combined with this alternative. Opportunities for TOD and associated parking improvements in the Springdale Station area are discussed in the September 2009 *New Canaan Branch TOD Report*.

The conceptual capital cost for constructing this alternative would be $3 million (2008 dollars).

2.4.7 Talmadge Hill Pedestrian / Parking / Platform Improvements (NC-14)

This alternative would add a second platform at Talmadge Hill Station, improving platform access from the surrounding parking area by enabling boarding from both sides of the track. The existing 300-foot platform would not be lengthened under this alternative, as it is constrained by the Merritt Parkway to the north and a grade crossing to the south.

The alternative would also expand parking capacity at Talmadge Hill Station by adding surface or structured parking on the west side of the track, along Old Stamford Road, on a site previously occupied by a commuter lot (Figure 2-25). If necessary, additional spaces could be added by restriping portions of the existing surface lots to more efficiently distribute spaces.

In addition to parking expansion, this alternative would include improvements to pedestrian facilities within the station property. A sidewalk would be added along the north side of

Talmadge Hill Road from Old Stamford Road to the easternmost parking lot, and a crosswalk would be added at the Talmadge Hill Road/Old Stamford Road intersection.

The conceptual capital cost for constructing this alternative would be $6 million (2008 dollars).

2.4.8 New Canaan Station Platform Extension (NC-15)

This alternative would extend the existing platform at New Canaan Station 243 feet so that all train car doors could open at the station (Figure 2-26). Currently, New Canaan already has the longest platforms on the branch, allowing five cars to open their doors at the station. This alternative would extend current platforms to allow eight cars to open their doors. This alternative would not have any impact on existing parking facilities, grade crossings, or adjacent development.

The conceptual capital cost for constructing this alternative would be $2 million (2008 dollars).

LEGEND

- EXISTING R.R. TRACK
- R.O.W.
- RAIL STUDY CORRIDOR
- XX — MILE POST MARKER
- CATENARY POLE
- R.R. STRUCTURES
- PLATFORM, EXISTING
- PLATFORM, PROPOSED
- WATERCOURSE
- R.R. STATION PARKING

Figure 2-22: Two-Platform Springdale Station

CROSSING DATA

MILE — CROSSING STREET/FEATURE

6J6 UG STAMFORD RD. OD

OPEN DECK

AG - AT GRADE
UG - UNDERGRADE
OH - OVERHEAD

SCALE IN FEET
0 40 80

WATERBURY AND NEW CANAAN BRANCH LINES
NEEDS & FEASIBILITY STUDY
PROJECT NO. 170-2562

NEW CANAAN BRANCH LINE

TWO-PLATFORM SPRINGDALE STATION PROPOSED PLAN

CONNECTICUT DEPARTMENT OF TRANSPORTATION

PARSONS

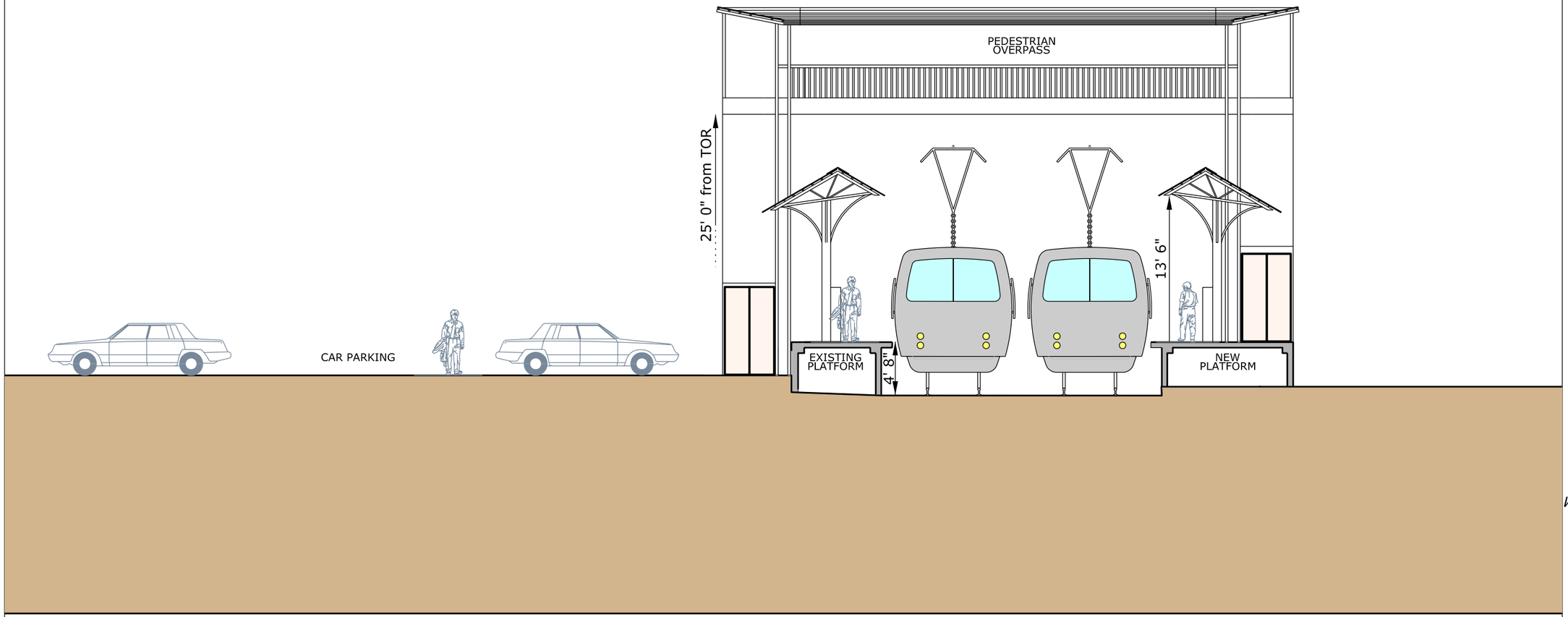

Figure 2-23:
Two-Platform
Springdale Station
Section

SECTION A-A

SCALE IN FEET
0 5 10

WATERBURY AND NEW CANAAN BRANCH LINES
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PROJECT NO. 170-2562

NEW CANAAN BRANCH LINE

TWO-PLATFORM SPRINGDALE STATION PROPOSED SECTION

CONNECTICUT DEPARTMENT OF TRANSPORTATION

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LEGEND

- EXISTING R.R. TRACK
- R.O.W.
- RAIL STUDY CORRIDOR
- XX — MILE POST MARKER
- CATENARY POLE
- R.R. STRUCTURES
- PLATFORM, EXISTING
- PLATFORM, PROPOSED
- WATERCOURSE
- R.R. STATION PARKING

Figure 2-24: Springdale Station Platform Extension

CROSSING DATA

MILE — CROSSING STREET/FEATURE

6J6 UG STAMFORD RD. OD

OPEN DECK

AG - AT GRADE
UG - UNDERGRADE
OH - OVERHEAD

SCALE IN FEET
0 40 80

WATERBURY AND NEW CANAAN BRANCH LINES
NEEDS & FEASIBILITY STUDY
PROJECT NO. 170-2562

NEW CANAAN BRANCH LINE

EXTENDED SPRINGDALE STATION PLATFORM PROPOSED PLAN

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PROPOSED CAR PARKING

PLATFORM

RESTRIPE EXISTING SURFACE LOTS

MERRITT PARKWAY (ROUTE 15)

OLD STAMFORD RD

TALMADGE HILL RD

SIDEWALKS

300' 00"

210+00

LEGEND

- EXISTING R.R. TRACK
- R.O.W.
- RAIL STUDY CORRIDOR
- XX — MILE POST MARKER
- CATENARY POLE
- R.R. STRUCTURES
- PLATFORM, EXISTING
- PLATFORM, PROPOSED
- WATERCOURSE
- R.R. STATION PARKING
- SIDING/NEW R.R. TRACK

Figure 2-25: Two-Platform Talmadge Hill Station

CROSSING DATA

MILE — CROSSING STREET/FEATURE

6J6 UG STAMFORD RD. OD

OPEN DECK

AG - AT GRADE
UG - UNDERGRADE
OH - OVERHEAD

SCALE IN FEET

0 40 80

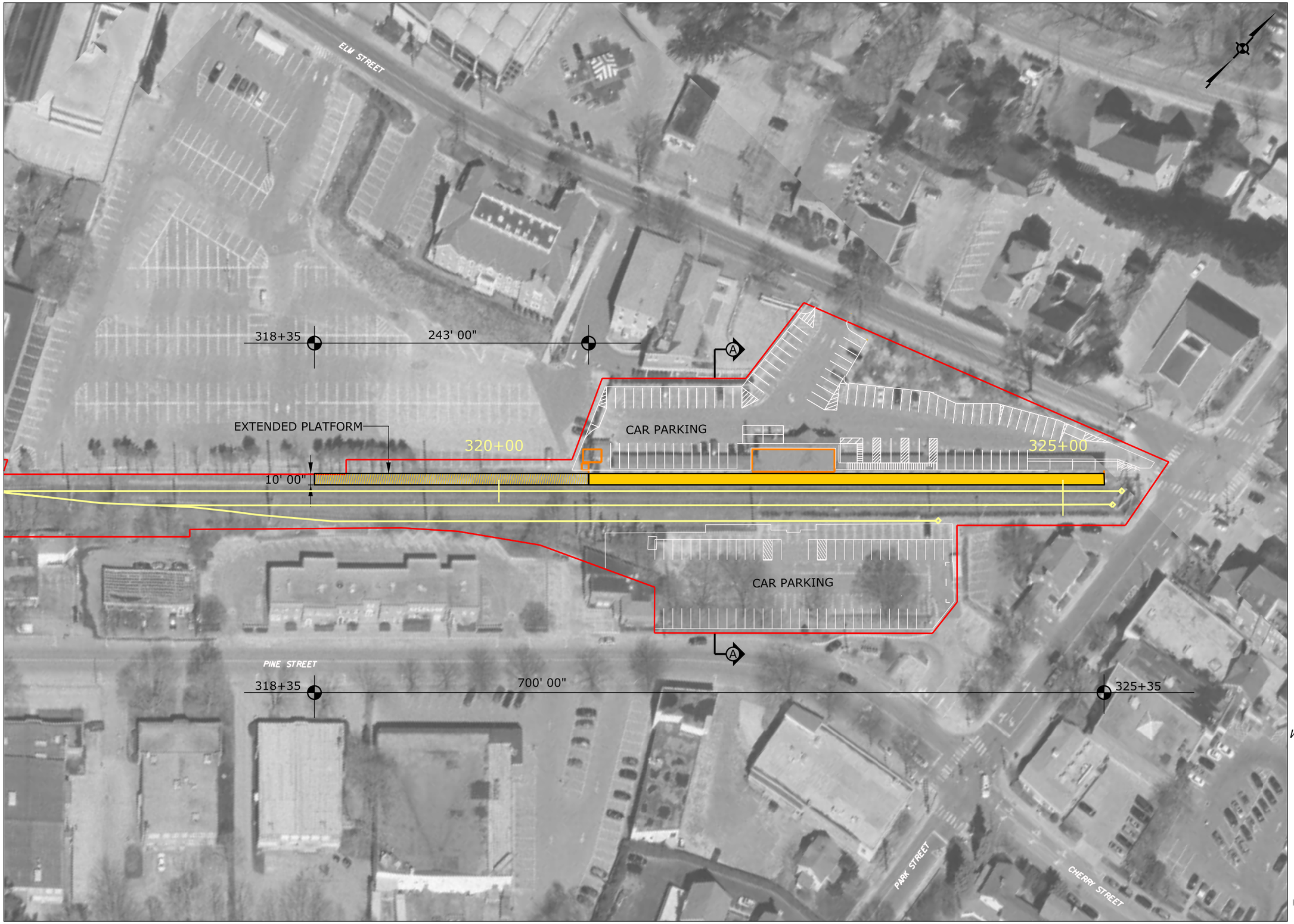
WATERBURY AND NEW CANAAN BRANCH LINES
NEEDS & FEASIBILITY STUDY
PROJECT NO. 170-2562

NEW CANAAN BRANCH LINE

TWO-PLATFORM
TALMADGE HILL STATION
PROPOSED PLAN

CONNECTICUT DEPARTMENT OF TRANSPORTATION

PARSONS



LEGEND

- EXISTING R.R. TRACK
- R.O.W.
- RAIL STUDY CORRIDOR
- XX — MILE POST MARKER
- CATENARY POLE
- R.R. STRUCTURES
- PLATFORM, EXISTING
- PLATFORM, PROPOSED
- WATERCOURSE
- R.R. STATION PARKING
- SIDING/NEW R.R. TRACK

Figure 2-26: New Canaan Station Platform Extension

CROSSING DATA

MILE — CROSSING STREET/FEATURE

6J6 UG STAMFORD RD. OD

AG - AT GRADE
UG - UNDERGRADE
OH - OVERHEAD

OPEN DECK

SCALE IN FEET

0 — 40 — 80

WATERBURY AND NEW CANAAN BRANCH LINES
NEEDS & FEASIBILITY STUDY
PROJECT NO. 170-2562

NEW CANAAN BRANCH LINE

NEW CANAAN STATION PLATFORM EXTENSION PROPOSED PLAN

CONNECTICUT DEPARTMENT OF TRANSPORTATION

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3.0 SCREEN 2: EVALUATION OF THE SHORT LIST OF ALTERNATIVES

This chapter describes the second stage of the two-step screening process used to narrow the alternatives developed at the outset of the project to a set of recommended improvements for each branch. Starting with the Short List of Alternatives and incorporating extensive public and agency input, Screen 2 helped the Project Team determine which alternatives should be advanced for implementation or further study.

3.1 SCREEN 2 CRITERIA

Upon completion of Screen 1, the Project Team developed a second set of screening criteria for the remaining Short List alternatives. The purpose of Screen 2 was to apply a more in-depth level of analysis to a short list of alternatives that are defined in more detail. Screen 2 included two types of evaluation criteria: 1) ***quantitative criteria*** to gauge those aspects of the alternatives that were easily defined and measured; and 2) ***qualitative criteria*** to describe those aspects of the alternatives that were not able to be represented by a single number. These criteria are listed and described in Tables 3-1 and 3-2.

TABLE 3-1: QUANTITATIVE SCREEN 2 EVALUATION CRITERIA

Criteria	Description
Potential AM Peak Direction Frequency	Number of trains able to depart Waterbury/New Canaan 5am-9am
Potential AM Reverse Peak Frequency	Number of trains able to arrive at Waterbury/New Canaan 5am-9am
Potential Non-Peak Frequency	Number of possible train trips per hour per direction on each branch
Estimated Cost	Conceptual capital cost in 2008 dollars of all improvements included in the alternative (March 2010 revision, as reported in the *Short List Alternatives Screening Report* and presented at the March 2010 Public Information Meetings)
Potential AM Peak Direction Ridership Capacity	Number of passengers able to be carried on each branch from 5am-9am in the peak direction based on potential frequencies and train lengths
ROW Requirements	Additional acreage required for all improvements included in the alternative

TABLE 3-2: QUALITATIVE SCREEN 2 EVALUATION CRITERIA

Criteria	Description
Storage Capacity	Impact on train storage at each branch's terminal station
Parking Capacity	Impact of the alternative on parking conditions along the branch and/or at individually affected stations
Station Access	Length (number of cars) and height (low- or high-level) of station platforms
Platform Crowding/Safety	Safety issues related to pedestrian crossing of tracks and boarding
Service Flexibility	Impact on overall service flexibility
Travel Time	Impact on travel time along the branch or between specific station pairs
Environmental Impact	Impact on the existing natural and built environments

RAILSIM Train Performance Calculator (TPC) runs were conducted to determine potential impacts on service frequency and travel time, taking into account conditions like curves, grades, track speeds, bridge locations, grade crossing locations, and station locations. Full network simulations were also performed to analyze the ability of any potential service increases to fit within New Haven Line constraints. This effort is documented in the April 2010 *Train Performance Model and Simulations Report* found in Appendix D and summarized in Chapter 6 of this report.

Ridership capacity figures were calculated by combining an alternative's potential frequency with its potential train length based on proposed platform upgrades associated with that alternative.

Conceptual cost estimates, in 2008 dollars, were revised as necessary to reflect any refinements to the Short List alternatives since the initial cost estimates were developed at the Long List stage. The cost estimates used for Screen 2 are based on the March 2010 revision, as reported in the *Short List Alternatives Screening Report* and presented at the March 2010 Public Information Meetings.

Estimates of horizontal and vertical right-of-way requirements were also revised to reflect refinements to the Short List alternatives. Appendix E provides detailed breakdowns of the horizontal right-of-way requirements for each alternative. There are no vertical clearance issues with any of the Short List alternatives.

Information on existing environmental conditions that was compiled during Phase I of the study was used to assess the environmental impact of the Short List alternatives on environmental and community resources. The February 12, 2010 *Environmental Rating of Alternatives* memorandum, provided in Appendix F, evaluated alternatives' effect on the following:

- Air quality
- Aesthetic/visual setting

- Coastal resources
- Cultural and historic resources
- Environmental justice and compliance with Title VI
- Environmental risk sites
- Floodplains
- Land use
- Noise-sensitive areas
- Prime Farmland soils and Soils of Statewide Importance
- Public water supply reservoirs
- Section 4(f) and Section 6(f) lands
- Surface and groundwater resources
- Threatened and endangered species
- Wetlands

In addition, alternatives NC-13 (Springdale Platform Extension), NC-14 (Talmadge Hill Pedestrian/Parking/Platform Improvements), and NC-15 (New Canaan Platform Extension) were combined into a single station alternative prior to the Screen 2 exercise.

3.2 SCREEN 2 METHODOLOGY AND RESULTS

Screen 2 was conducted in two parts: first, the actual quantitative and qualitative results for each criterion were assembled for the Short List alternatives, and second, these values were translated into "scores" to more clearly highlight differences among the alternatives. Table 3-3 presents the rubric used to assign scores on a scale of 1 to 5. In most cases, a score of 3 indicated that the alternative was consistent with the No Build with regard to that criterion. Scores of 4 and 5 indicated a benefit relative to the No Build, and scores of 1 and 2 indicated a detriment.

Tables 3-4 through 3-7 display the quantitative and qualitative values of the Screen 2 criteria for each alternative. Tables 3-8 through 3-11 display the scores for each alternative according to the scoring key outlined in Table 3-3.

TABLE 3-3: EVALUATION CRITERIA SCORING KEY

	1	2	3	4	5
Potential AM Peak Direction Frequency	More than one fewer trip compared to No Build	One fewer trip compared to No Build	No change from No Build	One more trip compared to No Build	More than one more trip compared to No Build
Potential AM Reverse Peak Frequency	More than one fewer trip compared to No Build	One fewer trip compared to No Build	No change from No Build	One more trip compared to No Build	More than one more trip compared to No Build
Potential Non-Peak Frequency	More than one fewer trip compared to No Build	One fewer trip compared to No Build	No change from No Build	One more trip compared to No Build	More than one more trip compared to No Build
Estimated Cost	More than $100M	$26-100M	$11-25M	$6-10M	$0-5M
Potential AM Peak Direction Ridership Capacity	Half or less than half the capacity of No Build	Lower capacity than No Build	No change from No Build	Higher capacity than No Build	Double or more than double the capacity of No Build
ROW Requirements	More than 3 acres	2-2.999 acres	1-1.999 acres	Less than 1 acre	No ROW acquisition
Storage Capacity	Half or less than half the capacity of No Build	Lower capacity than No Build	No change from No Build	Higher capacity than No Build	Double or more than double the capacity of No Build
Parking Capacity	Half or less than half the capacity of No Build	Lower capacity than No Build	No change from No Build	Higher capacity than No Build	Double or more than double the capacity of No Build
Station Access	Platforms and facilities degraded at more than one station	Platforms and facilities degraded at one station	No change from No Build	Platforms and facilities improved at one station	Platforms and facilities improved at more than one station
Platform Crowding/Safety	Platform crowding increased and/or pedestrian track crossing added at more than one station	Platform crowding increased and/or pedestrian track crossing added at one station	No change from No Build	Platform crowding reduced and/or pedestrian track crossing removed at one station	Platform crowding reduced and/or pedestrian track crossings removed at more than one station
Service Flexibility	Service flexibility degraded substantially	Service flexibility degraded moderately	No change from No Build	Service flexibility improved moderately	Service flexibility improved substantially
Travel Time	Travel time increased by more than 2 minutes	Travel time increased by 1-2 minutes	No change from No Build	Travel time decreased by 1-2 minutes	Travel time decreased by more than 2 minutes
Environmental Impact	Significant negative impacts that cannot be mitigated	Potential negative impacts; add'l permitting and/or environmental review req'd	Potential minor negative impacts	No impacts on environmental and community resources	Benefits/protects environmental and community resources

TABLE 3-4: WATERBURY – QUANTITATIVE CRITERIA RESULTS

	No Build	TSM (W-23 Shuttle Bus)	W-1 Increased Train Length (includes high-level platforms)	W-3 Full Signalization	W-10 Beacon Falls Siding	W-11 Four Passing Sidings	W-13 Devon Alternative 2 (includes 3 passing sidings)	W-15 Derby-Shelton Multi-Modal Alternative 1	W-18 Waterbury Multi-Modal Station (includes 5 storage tracks)	W-19 Relocated Naugatuck Platform	W-22 Express Bus
Potential AM Peak Direction Frequency (Trains/Buses Departing Waterbury 5am-9am)	3	15[1]	3	3	4	4	4	3	3	3	16[2]
Potential AM Reverse Peak Frequency (Trains/Buses Arriving Waterbury 5am-9am)	1	1	1	1	4	4	4	1	1	1	16[2]
Potential Non-Peak Frequency (Train/Bus Trips Per Hour Per Direction)	<1	<1	<1	<1	<1	1	1	<1	<1	<1	2
Estimated Cost[3]	--	$10M	$48M	$128M	$20M	$64M	$85M	$3M	$40M	$21M	$17M
Potential AM Peak Direction Ridership Capacity[4]	1,200	2,040	2,400	1,200	3,200[5]	3,200[5]	3,200[5]	1,200	1,200	1,200	1,120[2]
ROW Requirements (acres)[6]	0	0	0.8	0	0.073	1.535	3.633	0	1.45	0.03	0

1 Three train trips plus twelve bus trips

2 Represents combined frequency/capacity of two routes serving Derby/Shelton to Bridgeport; frequency/capacity for Waterbury to Bridgeport would be half

3 From March 2010 revision, as reported in the *Short List Alternatives Screening Report* and presented at the March 2010 Public Information Meetings

4 Assumes 4 car trains (100 passengers/train car) with current platforms, 8 car trains with platforms in W-1; assumes 70 passengers/bus (40 seated, 30 standing)

5 If combined with Alternative W-1 and W-3

6 See Appendix E for ROW calculations

TABLE 3-5: WATERBURY – QUALITATIVE CRITERIA RESULTS

	No Build	**TSM (W-23 Shuttle Bus)**	**W-1 Increased Train Length (includes high-level platforms)**	**W-3 Full Signalization**	**W-10 Beacon Falls Siding**	**W-11 Four Passing Sidings**	**W-13 Devon Alternative 2 (includes 3 passing sidings)**	**W-15 Derby-Shelton Multi-Modal Alternative 1**	**W-18 Waterbury Multi-Modal Station (includes 5 storage tracks)**	**W-19 Relocated Naugatuck Platform**	**W-22 Express Bus**
Storage Capacity	Single track	Single track	Single Track	Single Track	Single Track	Single Track	Single Track	Single Track	Five storage tracks	Single Track	Single Track
Parking Capacity	Parking available at most stations	Parking available at most stations	Parking available at most stations	Parking available at most stations	Parking available at most stations	Parking available at most stations	Parking available at most stations	Increased parking at Derby-Shelton	Increased parking at Waterbury	Parking available at most stations	Parking available at most stations
Station Access	All low-level boarding areas for 4-car trains except at Waterbury	Trips served by bus only stop at Bridgeport, Derby-Shelton and Naugatuck or Waterbury	All high-level platforms, most allowing 6-car trains	All low-level boarding areas for 4-car trains except at Waterbury	All low-level boarding areas for 4-car trains except at Waterbury	All low-level boarding areas for 4-car trains except at Waterbury	High-level 6-car platforms at Devon	High-level 6-car platforms at Derby/ Shelton	High-level 6-car platforms at Waterbury	High-level 6-car platforms at Naugatuck	Half of all trips only serve Derby-Shelton and Bridgeport
Platform Crowding/Safety	Passengers on same level as tracks except at Waterbury	Passengers on same level as tracks except at Waterbury	Passengers removed from tracks	Passengers on same level as tracks except at Waterbury	Passengers on same level as tracks except at Waterbury	Passengers on same level as tracks except at Waterbury	Passengers also removed from tracks at Devon	Passengers also removed from tracks at Derby-Shelton	Passengers also removed from tracks at Waterbury	Passengers also removed from tracks at Naugatuck	All trips served by bus

TABLE 3-5: WATERBURY – QUALITATIVE CRITERIA RESULTS

	No Build	**TSM (W-23 Shuttle Bus)**	**W-1 Increased Train Length (includes high-level platforms)**	**W-3 Full Signalization**	**W-10 Beacon Falls Siding**	**W-11 Four Passing Sidings**	**W-13 Devon Alternative 2 (includes 3 passing sidings)**	**W-15 Derby-Shelton Multi-Modal Alternative 1**	**W-18 Waterbury Multi-Modal Station (includes 5 storage tracks)**	**W-19 Relocated Naugatuck Platform**	**W-22 Express Bus**
Service Flexibility	Only one train allowed on branch at a time	Only one train allowed on branch at a time supplemented by shuttle buses	Only one train allowed on branch at a time	Multiple trains allowed to follow each other on the branch	One train allowed to operate in each direction; multiple trains with W-3	One train allowed to operate in each direction; multiple trains with W-3	One train allowed to operate in each direction; multiple trains with W-3	Only one train allowed on branch at a time	Only one train allowed on branch at a time	Only one train allowed on branch at a time	No trains; all travel subject to traffic conditions on Route 8
Travel Time	Travel time unchanged	Buses subject to traffic conditions on Route 8	Station dwell time shortened	Travel time unchanged	Travel time unchanged	Travel time unchanged	Added station stop; decreased travel time toward New Haven	Dwell time shortened at Derby-Shelton	Travel time unchanged	Dwell time shortened at Naugatuck	Buses subject to traffic conditions on Route 8
Environmental Impact	No increased transit capacity with potential negative impact on air quality	Increased transit capacity with potential positive impact on air quality	Potential minor impacts to visual setting, soil, water and wildlife	No increased transit capacity with potential negative impact on air quality	Further env'l review and permitting required	Further env'l review and permitting required	Further env'l review and permitting required	Further env'l review and permitting required	Further env'l review and permitting required	Potential minor impacts to visual setting and water	Decrease in transit capacity with potential negative impact on air quality

TABLE 3-6: NEW CANAAN – QUANTITATIVE CRITERIA RESULTS

	No Build	NC-1 Springdale Siding	NC-2 Full Signalization	NC-5 Full Signalization + Siding + 2nd Platform at Springdale	NC-13 Springdale Platform Extension NC-14 Talmadge Hill Pedestrian/Parking/Platform Improvements NC-15 New Canaan Platform Extension
Potential AM Peak Direction Frequency (Trains Departing New Canaan 5am-9am)	6	8	6	8	6
Potential AM Reverse Peak Frequency (Trains Arriving New Canaan 5am-9am)	1	2	1	2	1
Potential Non-Peak Frequency (Train Trips Per Hour Per Direction)	1	1	1	2	1
Estimated Cost[1]	--	$19M	$8M	$31M	$9M
Potential AM Peak Direction Ridership Capacity	4,800	6,400	4,800	6,400	4,800
ROW Requirements (acres)[2]	0	0.238	0	0.242	2.192

1 From March 2010 revision, as reported in the *Short List Alternatives Screening Report* and presented at the March 2010 Public Information Meetings

2 See Appendix E for ROW calculations

TABLE 3-7: NEW CANAAN – QUALITATIVE CRITERIA RESULTS

	No Build	**NC-1** **Springdale Siding**	**NC-2** **Full Signalization**	**NC-5** **Full Signalization + Siding + 2nd Platform at Springdale**	**NC-13 Springdale Platform Extension** **NC-14 Talmadge Hill Pedestrian/Parking/Platform Improvements** **NC-15 New Canaan Platform Extension**
Storage Capacity	10-car main track, 10-car middle track, 6-car bulk track	10-car main track, 10-car middle track, 6-car bulk track	10-car main track, 10-car middle track, 6-car bulk track	10-car main track, 10-car middle track, 6-car bulk track	10-car main track, 10-car middle track, 6-car bulk track
Parking Capacity	Long waiting lists for parking permits at all stations; open to local residents only	Long waiting lists for parking permits at all stations; open to local residents only	Long waiting lists for parking permits at all stations; open to local residents only	Long waiting lists for parking permits at all stations; open to local residents only	Improvements to parking capacity at Talmadge Hill Station; open to local residents only
Station Access	Single side platforms at all stations; 5 cars open doors at New Canaan, 4 cars open doors at all other stations	Single side platforms at all stations; 5 cars open doors at New Canaan, 4 cars open doors at all other stations; reverse peak trains don't stop at Springdale Station	Single side platforms at all stations; 5 cars open doors at New Canaan, 4 cars open doors at all other stations	Single side platforms at all stations; 5 cars open doors at New Canaan, 4 cars open doors at all other stations	Introduction of two platforms at Talmadge Hill; 8 cars open doors at New Canaan and Springdale, 4 cars open doors at Talmadge Hill and Glenbrook
Platform Crowding/Safety	Some at-grade pedestrian track crossings necessary for boarding; crowded platforms	Some at-grade pedestrian track crossings necessary for boarding; crowded platforms	Some at-grade pedestrian track crossings necessary for boarding; crowded platforms	Passengers can board on either side of the tracks at Springdale, but might have to cross tracks to access existing parking lot	No need for passengers to cross tracks at Talmadge Hill; less crowding at New Canaan and Springdale
Service Flexibility	Only one train allowed on branch at a time	Multiple trains allowed to operate on branch; some reverse peak trains unable to stop at Springdale	Only one train allowed on branch at a time; automation of switch at New Canaan	Multiple trains allowed to operate on branch; all reverse peak trains stop at all stations	Only one train allowed on branch at a time
Travel Time	Travel time unchanged	Travel time unchanged	Travel time unchanged	Travel time unchanged	Travel time unchanged
Environmental Impact	No increased transit capacity with potential negative impact on air quality	Increased transit capacity with potential positive impact on air quality	No increased transit capacity with potential negative impact on air quality	Increased transit capacity with potential positive impact on air quality	Potential minor impacts to soil and water

TABLE 3-8: WATERBURY – QUANTITATIVE CRITERIA SCORING

	No Build	TSM (W-23 Shuttle Bus)	W-1 Increased Train Length (includes high-level platforms)	W-3 Full Signalization	W-10 Beacon Falls Siding	W-11 Four Passing Sidings	W-13 Devon Alternative 2 (includes 3 passing sidings)	W-15 Derby-Shelton Multi-Modal Alternative 1	W-18 Waterbury Multi-Modal Station (includes 5 storage tracks)	W-19 Relocated Naugatuck Platform	W-22 Express Bus
Potential AM Peak Direction Frequency (Trains/Buses Departing Waterbury 5am-9am)	3	5	3	3	4	4	4	3	3	3	5
Potential AM Reverse Peak Frequency (Trains/Buses Arriving Waterbury 5am-9am)	3	3	3	3	5	5	5	3	3	3	5
Potential Non-Peak Frequency (Train/Bus Trips Per Hour Per Direction)	3	3	3	3	3	4	4	3	3	3	5
Estimated Cost	5	4	2	1	3	2	2	5	2	3	3
Potential AM Peak Direction Ridership Capacity	3	4	5	3	5	5	5	3	3	3	2
ROW Requirements	5	5	4	5	4	3	1	5	3	4	5

TABLE 3-9: WATERBURY – QUALITATIVE CRITERIA SCORING

	No Build	TSM (W-23 Shuttle Bus)	W-1 Increased Train Length (includes high-level platforms)	W-3 Full Signalization	W-10 Beacon Falls Siding	W-11 Four Passing Sidings	W-13 Devon Alternative 2 (includes 3 passing sidings)	W-15 Derby-Shelton Multi-Modal Alternative 1	W-18 Waterbury Multi-Modal Station (includes 5 storage tracks)	W-19 Relocated Naugatuck Platform	W-22 Express Bus
Storage Capacity	3	3	3	3	3	3	3	3	5	3	3
Parking Capacity	3	3	3	3	3	3	3	3	4	3	3
Station Access	3	1	5	3	3	3	4	4	4	4	1
Platform Crowding/Safety	3	3	5	3	3	3	4	4	4	4	5
Service Flexibility	3	4	3	4	5	5	5	3	3	3	2
Travel Time	3	1	4	3	3	3	5	4	3	4	1
Environmental Impact	3	5	3	3	2	2	2	3	2	3	3

TABLE 3-10: NEW CANAAN – QUANTITATIVE CRITERIA SCORING

	No Build	NC-1 Springdale Siding	NC-2 Full Signalization	NC-5 Full Signalization + Siding + 2nd Platform at Springdale	NC-13 Springdale Platform Extension NC-14 Talmadge Hill Pedestrian/Parking/Platform Improvements NC-15 New Canaan Platform Extension
Potential AM Peak Direction Frequency (Trains Departing New Canaan 5am-9am)	3	5	3	5	3
Potential AM Reverse Peak Frequency (Trains Arriving New Canaan 5am-9am)	3	4	3	4	3
Potential Non-Peak Frequency (Train Trips Per Hour Per Direction)	3	3	3	4	3
Estimated Cost	5	3	4	2	4
Potential AM Peak Direction Ridership Capacity	3	4	3	4	3
ROW Requirements	5	4	5	4	2

TABLE 3-11: NEW CANAAN – QUALITATIVE CRITERIA SCORING

	No Build	NC-1 Springdale Siding	NC-2 Full Signalization	NC-5 Full Signalization + Siding + 2nd Platform at Springdale	NC-13 Springdale Platform Extension NC-14 Talmadge Hill Pedestrian/Parking/Platform Improvements NC-15 New Canaan Platform Extension
Storage Capacity	3	3	3	3	3
Parking Capacity	3	3	3	3	4
Station Access	3	2	3	3	5
Platform Crowding/Safety	3	3	3	4	5
Service Flexibility	3	4	4	5	3
Travel Time	3	3	3	3	3
Environmental Impact	3	5	3	5	3

4.0 TRANSIT ORIENTED DEVELOPMENT OPTIONS

Phase II of the Waterbury and New Canaan Branch Lines Needs and Feasibility Study included an investigation of opportunities for Transit Oriented Development (TOD) around existing station areas on the Waterbury and New Canaan branches to encourage ridership and promote redevelopment along the branches. TOD is typically defined as compact development within easy walking distance of transit stations (typically a half mile) that contains a mix of uses such as housing, jobs, shops, restaurants and entertainment. TOD offers the opportunity for infill development and redevelopment in underutilized areas and can include a variety of housing types and prices. Concentrating employment, residential, retail, and leisure activities near transit stations and providing a walkable environment can make transit service more viable, at the same time reducing the number of automobile trips and improving mobility. There are also secondary economic and social benefits associated with TODs, which have the potential to generate value for community in terms creating and retaining jobs.

The September 2009 Waterbury Branch and New Canaan Branch TOD reports, provided in Appendix G, describe station area zoning and land use policies along the branches, discuss ongoing TOD initiatives in the corridors, and identify other potential TOD sites. Potential TOD sites were identified within a quarter mile radius of the station, based on the State of Connecticut's Plan of Conservation and Development, local municipalities' development plans, local land use and zoning, and information gathered during a series of stakeholder meetings hosted by South Western Regional Planning Agency (SWRPA), the Council of Governments of the Central Naugatuck Valley (COGCNV), and the Valley Council of Governments (VCOG) in July 2009.

The potential TOD sites identified offer the opportunity for infill development and redevelopment in communities along the branch and promote the goals of the Waterbury and New Canaan Branch Lines Study by improving mobility, environmental quality, and land use planning along the corridor. They include both "Ongoing TOD Initiatives" – sites that have already been identified by the town or by private developers and are at various stages of development or construction – and "Other Potential TOD Sites" identified based on their potential for development or redevelopment. Sites identified for conservation or preservation by the Connecticut DEP or in communities' Plans for Conservation and Development were avoided.

The potential TOD sites identified in these reports are summarized below. Maps showing the locations of these sites are included in Appendix G.

4.1 WATERBURY BRANCH TOD

As summarized in Table 4-1, 33 sites were identified as existing or potential locations for transit oriented development along the Waterbury Branch.

TABLE 4-1: SUMMARY OF EXISTING AND POTENTIAL TOD SITES

Site Name/Location	Size (Acres)	# of Parcels	Zoning	Existing Use
Waterbury Station				
226-228 Meadow Street	0.77	1	Residential Office District (RO)	Surface parking
Freight Street Area Potential Development	N/A	N/A	General Industrial District (IG)	Industrial
West Main Street Corridor	N/A	N/A	Arterial Commercial District (CA); General Industrial District (IG)	Various
Bender Plumbing Supplies Company	3.90	N/A	Industrial Park District (IP); High Density Residence District (RH)	Unknown
Loyola Development Project	33.70	N/A	Industrial Park District (IP); High Density Residence District (RH); Central Business District (CBD); General Commercial District (CG)	Various
70 Bank Street	0.50	1	Central Business District (CBD	Unknown
Site 1	0.16	1	General Industrial District (IG)	Vacant land
Site 2	0.04	1	High Density Residence District (RH)	Residential
Site 3	0.07	1	High Density Residence District (RH)	Residential
Site 4	0.12	1	High Density Residence District (RH)	Residential
Site 5	0.18	1	High Density Residence District (RH)	Residential
Site 6	1.40	8	General Industrial District (IG)	Vacant
Site 7	0.30	1	General Industrial District (IG)	Surface parking
Site 8	0.70	5	Central Business District (CBD)	Surface parking
Site 9	0.60	2	Residential Office District (RO); High Density Residence District (RH)	Open space
Site 10	1.00	2	Central Business District (CBD); High Density Residence District (RH)	Surface parking; vacant industrial
Site 11	0.20	1	General Industrial District (IG)	Vacant

TABLE 4-1: SUMMARY OF EXISTING AND POTENTIAL TOD SITES

Site Name/Location	Size (Acres)	# of Parcels	Zoning	Existing Use
Naugatuck Station				
Renaissance Place	60	N/A	Renaissance Place Special Zone	Various
Beacon Falls Station				
Site 1	0.50	2	Industrial District (I-1)	Vacant land
Site 2	14.70	1	Industrial Park District (IPD)	Industrial
Seymour Station				
Haynes Development Site	260	N/A	N/A	Various
Site 1	0.25	N/A	CBD1	Surface parking
Site 2	0.33	1	CBD1	Surface parking
Site 3	0.45	N/A	CBD1	Surface parking
Site 4	1.14	1	CBD1	Surface parking
Ansonia Station				
Site 1 (West Main Street Parking Lot)	0.90	N/A	Commercial (C)	Surface parking
Site 2	0.20	1	Commercial (C)	Unknown
Site 3 (Railroad Depot Parking Lot)	0.35	1	Commercial (C)	Surface parking
Site 4 (East Main Street Parking Lot)	3.02	1	Industrial (HI)	Surface parking
Site 5	1.50	3	Industrial (HI)	Various
Derby-Shelton Station				
Site 1	3.80	1	Business Zone (B1)	Vacant
Site 2	5.60	1	Business Zone (B1)	Concrete factory
Site 3	19.80	N/A	CDD (Center Design District)	Various

4.2 NEW CANAAN BRANCH TOD

Table 4-2 lists the 24 sites that were identified as existing or potential locations for transit oriented development along the New Canaan Branch.

TABLE 4-2: SUMMARY OF EXISTING AND POTENTIAL TOD SITES

Site Name/Location	Size (Acres)	# of Parcels	Zoning	Existing Use
New Canaan Station				
Lumberyard Parking Lot	2.91	1	Business A Zone (BA)	Surface parking
45 Grove Street	1.77	3	Business B Zone (BB)	Unknown

TABLE 4-2: SUMMARY OF EXISTING AND POTENTIAL TOD SITES

Site Name/Location	Size (Acres)	# of Parcels	Zoning	Existing Use
Merritt Apartment Site	3.25	6	Apartment Zone	Multi-family residential
Cross and Vitti Streets	4.50	16	Business B Zone (BB)	Service-related businesses
Bank of America Site	0.84	1	Business A Zone (BA)	Bank
Parking Lot on Locust Avenue	1.00	1	Retail B Zone (RB)	Surface parking
New Canaan Site 1	0.60	1	One-Half Acre Residence Zone	Surface parking
New Canaan Site 2	0.44	1	Business A Zone (BA)	Surface parking
New Canaan Site 3	0.42	1	Business A Zone (BA)	Surface parking
New Canaan Site 4	1.40	1	B Residence Zone (partial) and Business A Zone (BA) (partial)	Surface parking
Springdale Station				
Springdale Station Parking Lot	1.65	1	Village Commercial District (V-C)	Surface parking
Springdale Site 1	0.40	N/A	Multiple Family, Medium Density Design District (R-5)	Surface parking
Springdale Site 2	0.84	1	General Industrial District (M-G)	Unknown
Springdale Site 3	0.20	1	Village Commercial District (V-C)	Surface parking
Glenbrook Station				
East of Station	N/A	1	Village Commercial District (V-C)	Surface parking
Gas Station Site	N/A	1	Village Commercial District (V-C)	Gas station site
South of Glenbrook Road	N/A	N/A	Multiple Family, Medium Density Design District (R-5)	Residential
Townhouses East of Glenbrook Station Parking	N/A	N/A	One Family Residence District (R-7½)	Residential
Glenbrook Site 1	0.80	5	Village Commercial District (V-C)	Varied uses
Glenbrook Site 2	0.90	1	Village Commercial District (V-C)	Surface parking
Glenbrook Site 3	0.23	N/A	Village Commercial District (V-C)	Surface parking

TABLE 4-2: SUMMARY OF EXISTING AND POTENTIAL TOD SITES

Site Name/Location	Size (Acres)	# of Parcels	Zoning	Existing Use
Glenbrook Site 4	0.20	1	Village Commercial District (V-C)	Unknown
Glenbrook Site 5	0.24	1	One Family, Two Family Residence District (R-6)	Unknown
Glenbrook Site 6	0.26	1	Village Commercial District (V-C)	Surface parking

In addition, 12 sites were identified in the vicinity of the proposed East Main Street Station, which was one of the alternatives under consideration at the time the TOD reports were developed but was not among the Short List of alternatives that advanced through Phase II.

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5.0 INNOVATIVE TECHNOLOGIES

Phase II of the Waterbury and New Canaan Branch Lines Needs and Feasibility Study also included an investigation of the availability, cost, and applicability of innovative technologies that could benefit passengers on the two branches. Innovative technologies are new ideas or methods in transit technology that have the potential to improve service, provide greater efficiencies, and potentially increase customer satisfaction, including methods proven through use by other transportation providers as well as advanced rail technologies currently in the research and development phase.

The April 2010 *Innovative Technologies Report*, provided in Appendix H, contains a review of potentially applicable technologies and identifies improvements that merit further study for implementation on the Waterbury and New Canaan branches. This review included rail vehicle technologies, track and grade crossing improvements, train control technologies, and information-based applications to improve customer information and convenience. The recommendations for further study on the Waterbury and New Canaan branches are summarized in the following sections.

5.1 RAIL VEHICLES

The Connecticut Department of Transportation (CTDOT) and Metro-North Railroad (MNR) are already making technological progress through the procurement of new M8 electric multiple unit (EMU) rail cars for use on Connecticut's electrified lines. Because the New Canaan Branch already has the electric infrastructure to allow EMU operation, the features of these cars (more legroom, LED displays, automated public address system, etc.) will more directly benefit riders on that branch, although Waterbury Branch riders who transfer to mainline trains will also enjoy these new benefits. A secondary benefit of the new vehicles for Waterbury Branch riders will be the increase in the overall size of Connecticut's passenger rail fleet, freeing up diesel rolling stock currently utilized along the Shore Line East corridor for use on the Waterbury Branch. The availability of additional equipment, if combined with one or more of the operational improvements proposed for the Waterbury Branch, would allow an increase in service frequency along the branch.

Although CTDOT and MNR have no immediate plans to invest in new diesel locomotives for the Waterbury Branch, adding either dual-mode locomotives – which would allow the possibility of a one-seat ride from Waterbury to Grand Central Terminal – or hybrid locomotives – which can reduce noise, environmental impacts, and overall operating costs by generating some of the locomotive's energy through a rechargeable battery, could provide benefits in the future. Also looking to the future, CTDOT might consider the possibility of adding bi-level EMUs to their fleet to reduce overcrowding on Stamford shuttles or in the event that is made feasible through the initiation of Penn Station service from the New Haven Line.

5.2 TRACK AND GRADE CROSSINGS

Since the track along the Waterbury and New Canaan Branches is currently in operating condition, it would not be cost-effective to remove the existing ties and install new concrete ties. At such a time when they do have to be replaced, however, it would be worth revisiting the possibility of concrete. Concrete ties might also be considered in the event that new sidings are added to either branch. While concrete times are more expensive than wood ties, they have lower life cycle costs because they are more durable.

There is good reason to consider the implementation of improved grade crossing protection along both branches. Such projects improve safety and allow communities establish quite zones. The Town of New Canaan has explored the use of four-quadrant gates, though it does not currently have funding available to cover the approximately $500,000 per crossing cost.

5.3 TRAIN CONTROL

The Rail Safety Improvement Act (RSIA) of 2008 mandated the installation of positive train control (PTC) systems on all commuter, intercity passenger, and Class I railroads by December 2015. Certain PTC upgrades must be incorporated into future plans for the Waterbury and New Canaan Branches. These federally mandated improvements will increase safety. The New Canaan Branch would be well served to add the switch at New Canaan Station to the signalization system that monitors and controls the rest of the branch. The Waterbury Branch, which is currently dark territory, would need signals installed to support the ultimate desired increase in service frequency. The appropriate technology for that project would require further review, although it is likely that the same cab signaling technology utilized on MNR's other lines would be used on the Waterbury Branch.

5.4 CUSTOMER INFORMATION AND CONVENIENCE

Several communications fare collection technologies already used successfully by other transit systems are potentially applicable to both the Waterbury and New Canaan branches. Providing real-time travel information at stations and through web or mobile applications would enhance the passenger experience. WiFi connections at stations and on trains would increase the attractiveness of transit as a travel option. New electronic fare collection technologies could decrease crew workload and increase customer convenience.

6.0 TRAIN PERFORMANCE MODEL AND SIMULATIONS

This chapter presents the modeling and simulation results for the various commuter rail build alternatives for the Waterbury and New Canaan Branch Lines Needs and Feasibility Study. This analytical work was based on RAILSIM computer simulations using the Train Performance Calculator (TPC), the Network Simulator, and Load Flow Analyzer (LFA). It included calibration of RAILSIM to existing Waterbury and New Canaan Branch operations, simulations of baseline conditions, and simulations of various capital improvement scenarios. These capital improvement scenarios corresponded with the Short List of Alternatives evaluated in Screen 2. As summarized below, the analytical work examined the potential effects on both train performance and traction power systemwide. Additional details are located in the *Train Performance and Model Simulations Report* (April 2010) and the *Traction Power Report* (April 2010) provided in Appendix D.

6.1 TRAIN PERFORMANCE MODEL AND SIMULATIONS

All improvements included in the Short List of Alternatives had previously undergone single train performance simulation during Phase I of the Waterbury and New Canaan Branch Lines Needs and Feasibility Study to evaluate potential service benefits (speed, frequency, etc.) along each branch without regard for New Haven Line mainline slot constraints. During Phase II of the study, the Short List alternatives were subjected to further scrutiny, evaluating the ability of the mainline to support the potential additional services on/off of the branch lines. Phase II also examined how various "perturbations" might impact operations within the context of each improvement scenario.

All Short List alternatives for both branches were found to be operationally feasible in the context of mainline operations. Train runs were found to be able to operate as intended with the physical improvements associated with each scenario.

Perturbation simulations test how the delay of a single train might ripple through the rest of the system. As the network recovers from a perturbation, its impact is measured by the sum total of delay experienced by all trains affected by the event. Each scenario was assigned a PM and an AM peak perturbation event with potential to cause delay across the network. However, in every case, simulations demonstrated the system's ability to recover in a reasonable amount of time. The increased levels of service associated with the various build scenarios resulted in a net increase in propagated delay. But this delay was within tolerable limits for all scenarios, with scenarios NC-5 (Full Signalization + Siding + 2nd Platform at Springdale) and W-11 (Four Passing Sidings) supporting the most service with the least propagated delay. W-13 (Devon Alternative 2) had very little impact on mainline operations.

6.2 TRACTION POWER MODEL AND SIMULATIONS

The Project Team used RAILSIM LFA to simulate the ability of the New Haven Line traction power system (including the New Canaan Branch) to reliably handle the projected train services in the year 2030.

The simulation results showed the following:

- The traction power system would be sufficiently robust to support train voltages that achieve the desired on-time performance.
- Each supply substation would have sufficient capacity to supply the projected load.
- Cos Cob West would need to have both transformers on line. If one transformer unit were taken out of service during peak periods, the remaining unit would be overloaded.
- The supply substations would have significant levels of reverse power feeding back to the supply grid. The maximum instantaneous reverse power is over 5 MW for all supply substations except at NH 1086. The present reverse power relay settings of 5 MW would need to be adjusted in order to avoid frequent nuisance trips. Such nuisance trips would severely disrupt the normal functioning of the traction power system and the reliability of train operations.

Based on these findings, the following steps were recommended:

- Study engineering solutions to ensure that Cos Cob West has sufficient capacities to support projected services.
- Study engineering solutions for accommodating the reverse power flows at all the supply substations. This would be an essential step to fully utilize the regenerative braking power that would be afforded by the new M-8 vehicles. As an added advantage, the regenerative power limit of 4.8 MW on Amtrak's Acela Express trains (due to the same reverse power protection relays in the supply substations) could be removed, which would result in further energy savings in the system.

7.0 RECOMMENDATIONS

This chapter describes the concepts recommended for implementation or further environmental study during Phases III through V of the project. In developing these recommendations, the Project Team considered all information gathered throughout Phases I and II, including the goals and objectives developed for each branch at the outset of the project, existing conditions and future no build data, input from agency and public stakeholders, and the results of the two-step screening process.

Only one Short List alternative – W-22 Full Express Bus – was eliminated at the conclusion of Screen 2; all other Short List alternatives were carried forward as recommendations for implementation or further study, as described below. The Full Express Bus Alternative, which would have *replaced* commuter rail service with express bus routes serving the existing rail stations, did not offer enough of a benefit in terms of increased service frequency to justify eliminating commuter rail service in lieu of a conventional bus service that would decrease overall transit capacity in the corridor. It is also likely that travel time for many Waterbury Branch customers would have increased under this alternative, as express bus trips would be subject to uncertain – and often congested – traffic conditions on Route 8.

For the remaining Short List alternatives, the various improvement components were refined after Screen 2 and repackaged as a series of phased recommendations that could be implemented in a step-by-step, cumulative fashion. For each branch, the Project Team first identified a single, initial investment that would measurably improve service on the branch at a relatively low cost. Then, building on that initial investment, additional improvements that would further improve service and/or increase capacity along the branches were added in a logical sequence.

The proposed order of recommendations for each branch reflects corridor needs and priorities, attempting to address the most pressing operational needs first. The sequence also takes into account the fact that some improvements must be implemented in a certain order for their benefits to be realized. For example, it would not make sense to invest in a new Waterbury Branch station at Devon without first constructing sidings and signalizing the branch, as the frequency of service that the Devon alternative is intended to achieve would be impossible without these other improvements.

However, the recommendations for each branch can, to some extent, be separated and/or phased differently than the packages described in the following sections. For instance, on the Waterbury Branch, high-level platforms (Recommendation 5) could be added before sidings (Recommendations 1 and 4), signalization (Recommendation 2), or a Waterbury storage yard (Recommendation 3) without affecting the ability to implement the other recommendations in the future. These recommendations, then, present one possible phasing scenario for each branch

and are intended to form the basis for future discussion and analysis of proposed improvements on the two branches.

7.1 WATERBURY BRANCH RECOMMENDATIONS

The various components of the Short List alternatives for the Waterbury Branch described in Chapter 2 were separated into three categories: operational improvements like sidings or signalization, station improvements that do not have a substantial impact on operations, and the Shuttle Bus transportation system management (TSM) alternative, which is intended to fill gaps in existing rail service and improve mobility in the corridor until funding becomes available for implementing the more capital-intensive operational and station improvements.

These recommendations are summarized in Table 7-1 and described below.

TABLE 7-1: DRAFT STUDY RECOMMENDATIONS – WATERBURY BRANCH

Recommendation	Cost (millions)[1]
OPERATIONAL IMPROVEMENTS	
Recommendation 1: Beacon Falls Passing Siding (W-10)	$6
Recommendation 2: Full Signalization (W-3)	$128
Recommendation 3: Waterbury Storage Yard (W-18)	$16
Recommendation 4: Three Additional Passing Sidings (W-11)	$26
Recommendation 5: Increased Train Length with High-Level Platforms (W-1)	$20
Recommendation 6: Devon Station (W-13)	$49
STATION IMPROVEMENTS[2]	
Station Improvements Package 1 (W-15, W-18 (no yard), W-19 + amenity improvements at all stations)	$35
Station Improvements Package 2 (W-1, W-15, W-18 (no yard), W-19 + amenity improvements at all stations)	$55
RECOMMENDED TSM ALTERNATIVE	
Shuttle Bus Service (W-23)	$6

1 Cost estimates based on the final May 2010 revision – see Appendix A

2 Assumes $0.5 million per station for amenity improvements

7.1.1 Waterbury Branch – Operational Recommendations

Constructing a passing siding in the vicinity of Beacon Falls Station (**Recommendation 1**) would immediately improve operations on the branch by enabling more than one train to operate on the branch at a time, even without signalizing the branch. Although Metro-North Railroad (MNR) has indicated that it would not increase service on the branch based on the addition of an unsignalized passing siding alone, a Beacon Falls siding would still provide a benefit by improving operational flexibility in case of breakdown. Because the construction of a Beacon Falls siding would have a minimal effect on environmental and community resources and would not require extensive documentation in an Environmental Impact Statement (EIS) or Environmental Assessment (EA), it could also be implemented in a relatively short timeframe, and at a relatively low cost (approximately $6 million).

Although both the north and south options described in Chapter 2 would provide a similar benefit on their own, it is recommended that the southern location be selected. If a new Waterbury Branch station at Devon (Recommendation 6) were eventually constructed, the hourly shuttle service that the Devon Station is intended to support would only be possible with a siding in the southern location, as the north option would shift the meet location three to four minutes closer to Waterbury in each direction, resulting in turn times at Devon that are operationally infeasible. In addition, the south option would be advantageous if the Seymour Station were to be relocated to this location in the future, a proposal which has been endorsed by the Town of Seymour.

Constructing a Beacon Falls siding *and* fully signalizing the Waterbury Branch (**Recommendation 2**) would provide an even greater operational benefit, allowing MNR to schedule more than one train on the branch at a time. By signalizing the branch, the corridor could be divided into a series of blocks, where a second train could enter a new block once the train ahead of it pulled onto the next block. This would allow, for example, two trains traveling north from Bridgeport to depart closer together, rather than forcing the second train to wait for the first train to reach Waterbury before departing, which could reduce Waterbury Branch headways.

Recommendation 3 would create a five-track storage yard at Waterbury Station so that multiple trains could be stored at the northern end of the branch, ensuring that equipment is located where it needs to be and minimizing the number of non-revenue trips required to move equipment along the branch, which take schedule slots away from revenue trains carrying passengers. The limited storage capacity at the northern end of the branch was identified as a critical operational need during Phase I of the study, and substantial increases in Waterbury Branch service will not be possible without a place to store and service trains overnight.

Recommendation 4 would add three additional sidings along the branch: one that would begin at the Devon wye and continue two miles north; one starting in Waterbury and continuing two miles south; and a 300-foot siding in the vicinity of Derby-Shelton Station. These sidings could be added together or one at a time. With four passing sidings, full signalization, and a Waterbury storage yard, additional peak-period revenue trips could be added along the branch compared to present day.

While capacity is not currently an issue along the under-utilized branch, it is likely that ridership would grow in response to the service improvements that could be implemented if Recommendations 1 through 4 were constructed. **Recommendation 5**, which would add

longer, high-level platforms at all stations, would enable MNR to increase capacity on each trip by running longer train consists. High-level platforms also have safety benefits and decrease boarding time. Chapter 2 provides more detail on the length and location of proposed high-level-platforms at each station.

However, capacity on the branch, even if Recommendations 1 through 5 were implemented, is still limited by the fact that all Waterbury Branch trains also travel on a portion of the New Haven Line, which is nearing capacity. Train trips can be added to the branch line between Waterbury and the Devon wye, but these trains still need an open slot to enter the mainline and complete the trip to Bridgeport (or beyond). Ultimately, therefore, the way to substantially increase service on the branch without degrading mainline service is to construct a new station at Devon that provides Waterbury Branch customers frequent access to New Haven Line trains in both directions (**Recommendation 6**). Frequent shuttle service could be introduced between Waterbury and the new station, where transfers would be timed to meet mainline trains in both directions. The new service would especially benefit passengers heading northbound (towards New Haven) on the mainline, who currently have to travel southbound to Bridgeport before transferring to a northbound train. These new shuttle trips would be *in addition to* existing through service to Bridgeport and Stamford; the shuttle service with mainline transfer would supplement these trips, not replace them.

7.1.2 Waterbury Branch – Station Recommendations

Two station improvement packages were developed for the branch – one that includes multi-modal improvements at Derby-Shelton and Waterbury, a relocated Naugatuck platform, and amenity improvements at all Waterbury Branch stations; and one that includes all of these improvements plus the high-level platforms from Recommendation 5 (Increased Train Length). Both packages would improve connections between train, bus, and automobile at key transfer points and enhance passenger comfort, convenience, and safety along the branch.

7.1.3 Waterbury Branch – TSM Recommendation

Until funding is available for the more extensive capital improvements required to increase frequency on the branch, shuttle bus service can be implemented to expand travel options for passengers, especially during the evening peak period. Chapter 2 provides a description of this proposed service, which would include stops at Bridgeport, Derby-Shelton, and either Naugatuck or Waterbury.

7.2 NEW CANAAN BRANCH RECOMMENDATIONS

Like the Waterbury Branch recommendations, the various components of the New Canaan Branch Short List alternatives described in Chapter 2 were separated into operational improvements and station improvements that do not have a substantial impact on operations. Because transit service on the branch is already frequent, a TSM alternative like the Waterbury Branch shuttle bus option was not identified for this branch.

Recommendations for the New Canaan Branch are summarized in Table 7-2 and described below.

TABLE 7-2: DRAFT STUDY RECOMMENDATIONS – NEW CANAAN BRANCH

Recommendation	Cost (millions)[1]
OPERATIONAL IMPROVEMENTS	
Recommendation 1: New Canaan Station Signalization (NC-2)	$4
Recommendation 2: Springdale Passing Siding (NC-1)	$17
Recommendation 3: New Canaan Station Signalization + Springdale Siding + Two-Platform Springdale Station (NC-5)	$34
STATION IMPROVEMENTS[2]	
Station Improvements Package (NC-13, NC-14, NC-15 + amenity improvements at all stations)	$13

1 Cost estimates based on the final May 2010 revision – see Appendix A

2 Assumes $0.5 million per station for amenity improvements

7.2.1 New Canaan Branch – Operational Recommendations

Recommendation 1 would involve fully signalizing the branch, eliminating the need for manual switching at New Canaan Station. Extending the signal system to the station and providing remote switching operations from MNR's operations control center at Grand Central Terminal would reduce the amount of time required to enter and leave New Canaan Station, which would immediately improve operational efficiency along the branch. This recommendation was identified as the best initial investment to provide operational benefit at a relative low cost.

Constructing a passing siding at Springdale (**Recommendation 2**) in addition to completing the signal system would allow trains to pass each other along the branch. Even with the existing single-platform configuration at Springdale, adding a siding and shifting existing trains such that they meet at the siding would enable two extra AM peak inbound trains and two extra PM peak outbound trains to be operated on the branch, although the lack of a second platform would mean that no reverse-peak trains could stop at Springdale Station during peak periods while the siding was in use.

Recommendation 3 would extend the signal system to New Canaan Station and add both a siding and a second platform at Springdale, introducing the ability to load and unload Springdale passengers from both tracks. This would enable more robust reverse peak service, in addition to the two new AM peak inbound trips and two new PM peak outbound trips that could be added along the branch. Passengers approaching the station from the parking lot or elsewhere from the west side of the tracks would access the northbound platform via an elevator or stairs to a pedestrian overpass linking the two side platforms.

7.2.2 New Canaan Branch – Station Recommendation

One station improvement package was developed for the branch. This recommendation combines the various components of alternatives NC-13, NC-14, and NC-15 and includes the following:

- Amenity improvements at all stations, including longer canopies where they do not currently exist
- Longer platforms at New Canaan and Springdale
- Second platform at Talmadge Hill
- Pedestrian improvements within Talmadge Hill Station, including sidewalks along Talmadge Hill Road and a cross walk at Talmadge Hill Road/Old Stamford Road intersection. The addition of sidewalks along Old Stamford Road is outside the scope of this study but will be explored separately.
- Restoration of the former surface parking lot at the bottom of the hill along OId Stamford Road at Talmadge Hill. Additional spaces could be added if necessary by restriping portions of the existing surface lots to more efficiently distribute spaces.

These recommendations would have no bearing on station improvements being advanced separately (i.e., raising and lengthening bulk track at New Canaan Station, construction of a new canopy at Springdale, passenger information improvements).