Appendix 3.2-C

Hockomock Trestle Memorandum

Transportation
Land Development
Environmental
Services

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Memorandum

To: File

Date: May 10, 2012

Project No.: 10111

From: Kristofer Kretsch, P.E.

Re: South Coast Rail
Hockomock Swamp Trestle

EXECUTIVE SUMMARY

This document specifically responds to the requirements of the Secretary's Certificate on the DEIR which states: "The FEIR should evaluate the engineering feasibility of constructing the proposed trestle in wetland soils … The FEIR should also discuss how access will be achieved for any maintenance or emergency situations along portions of the rail ROW, including sections of the rail located in the Hockomock and Pine Swamps." This report summarizes the concepts evaluated for constructing a trestle structure through the Hockomock Swamp between Foundry Street (MP 11.8) in Easton, MA and Race track Crossing (MP 14.10) in Raynham, MA. The proposed trestle is to be constructed through the swamp on the existing MBTA right-of way. Consideration of the trestle type and materials included evaluation to impacts to the sensitive areas adjacent to the right-of-way as well as construction cost and maintenance.

A subsurface soil exploration was performed as part of the evaluation to identify appropriate foundation types. Driven steel H-piles are suitable to the site, and steel pile pier bents are recommended to minimize impacts associated with excavation and hauling.

The superstructure types considered consisted of common steel and concrete structures and prefabricated concrete arch units. Steel deck beam and through girders and prestressed concrete box beams and Northeast Extreme (NEXT) beams were evaluated for cost, ease of construction and maintenance. Consideration was also given to maximizing span lengths to minimize the number of piers to be constructed. Prestressed concrete boxes were found to be the most cost effective, offered a range of workable span lengths, and require the least amount of maintenance. Steel structures offer longer span lengths, but they are more costly and require more maintenance. The concrete arch option is more costly than the prestressed beams, and physical limitations with the arch design would require the trestle to be constructed at an excessively higher elevation than the other alternatives resulting in more impacts associated with constructing longer approaches.

Additional consideration was given to prefabricated superstructure and substructure elements. Using prefabricated elements reduces construction time and impact associated with forming, trucking and placing cast-in-place concrete.

Access for construction would be from the north at Foundry Street and from the south from Race track Crossing. Construction of the trestle would require equipment working at grade within the right-of-way as the piles are installed. As the superstructure is erected, all work can be completed with equipment working from the superstructure as it is installed.

INTRODUCTION

Purpose of This Technical Report

This technical report was prepared to address the requirements of the Secretary's Certificate on the Draft Environmental Impact Report concerning the design, construction, and operations of the proposed Hockomock Swamp trestle.

Requirements of the Secretary's Certificate

The Certificate required that the Final Environmental Impact Report specifically address the impacts of the trestle related to infrastructure, access roads, construction, and on-going maintenance.

Comments on the DEIS/DEIR

Other comments on the DEIS/DEIR related to the Hockomock Trestle concerned engineering and construction methods, the design of the trestle, the relationship of subsurface soil conditions to the design, and the feasibility and cost of construction. In addition, commentors were concerned with the width of canopy clearing, on-going vegetation management, and emergency access.

TRESTLE DESIGN AND CONSTRUCTION

Soil Conditions

A subsurface exploration program was conducted by Jacobs Engineering Group, Inc. in February 2012 for the purposes of providing preliminary geotechnical recommendations for the trestle structure. Jacobs issued a design geotechnical memorandum presenting the findings of the program and resulting foundation recommendations. As part of the program, nine borings were drilled along the proposed trestle alignment, with an additional three borings drilled along the approaches.

The subsurface conditions encountered generally consisted of a layer of granular fill with thickness of about 0 to 3 feet, underlain by natural, loose to dense stratified silt and sand deposits, and very dense glacial till. A thin 2 to 7-foot thick layer of organic silt was encountered in the upper 5 to 10 feet of soil in almost all of the trestle borings. The top of bedrock was typically encountered at depths ranging from 39 to 66.5 feet depth along the trestle borings. Groundwater level readings at termination of drilling were consistently at 3.5 to 6 feet depth along the trestle borings.

Various alternatives were investigated to support the trestle foundations. Preliminary foundation type selection took into account soil conditions and shear strength of near surface soils, and depth to bedrock. Spread footing foundations were discounted due to the loose to medium dense strength consistency of the upper overburden soils. Due to the high groundwater level and variable depth to bedrock, it does not appear that drilled shafts are a cost effective alternative compared to driven piles. The proposed trestle bents are recommended to be founded on driven steel H-piles bearing on the underlying bedrock.

Trestle Design

As discussed above, the recommended foundation type for the trestle is driven steel H-piles bearing on the underlying bedrock. Jacobs' geotechnical memorandum recommends that two rows of piles be used at each pier, which results in a roughly 10-foot wide pier cap.

The structure would be approximately 20 feet wide at single track locations to accommodate the track and walkway. The structure would be wider at one location (between stations 1462+00 and 1468+00) to accommodate a track turnout with a second parallel track to accommodate maintenance vehicles. Per MBTA requirements, the minimum lateral clearance from centerline of track to continuous obstruction is 8.5 feet, while the minimum lateral clearance between track centerlines at two-track locations is 13 feet. The structure would be 37 feet wide in this two-track section. In order to allow large mammal passage under the trestle, the minimum vertical clearance above the existing grade would be 5 feet.

Preliminary superstructure type selection took into account potential environmental impacts, construction cost, and overall constructability. The analysis assumed that the structure would have a ballasted deck and carry one track along the majority of the structure. The trestle would be designed to carry Cooper E-80 loading.

The trestle would need to accommodate catenary supports as well, which can be spaced at a maximum of 200 feet on center. The simplest way of supporting these poles would be at the pile cap, which would require that some piers be lengthened by 3 to 4 feet.

Precast or prefabricated elements are desirable for construction in the swamp to minimize impacts associated with forming, delivering and placing cast-in place concrete construction. Precast/prefabricated elements include pile caps, superstructure elements, deck slab panels and ballast retainers.

Several different superstructure alternatives were investigated for the trestle including prestressed concrete NEXT beams, adjacent prestressed concrete box beams, prestressed concrete arches, steel plate deck girders, and steel plate thru girders.

It is desirable to maximize span lengths in order to minimize the number of piers. Of the alternatives considered, steel plate girders and thru girders can be used to achieve the longest span lengths, but at significantly higher construction costs when compared to the concrete alternatives. The steel girders would also have much higher life cycle costs and possible future environmental impacts due to deterioration of the steel. Prestressed concrete box beams can achieve longer spans and are more cost effective than concrete NEXT beams or prestressed concrete arches. The box beams can be used for span lengths up to 50 feet.

Considering environmental impact, cost, and constructability, the recommended alternative is adjacent prestressed concrete box beams with 50-foot spans. The overall construction cost for this alternative is roughly $50,900,000.

Trestle Construction

Due to the sensitivity of the surrounding environment, construction methods should be used which minimize impacts outside the existing railroad bed. The construction activities would be performed within the constraints of a set boundary either side of the working area. This boundary would be defined by the installation of sedimentation and erosion controls along the existing railroad embankment.

The construction site can be accessed from the north through Foundry Street and from the south through Raynham Park. Raynham Park to the south is a likely candidate for a laydown area. To the north, there is a possible limited laydown area along the right-of-way, outside the limits of the swamp (adjacent to the Southeast Regional Vocational-Technical High School). Throughout construction, the site would be accessed only from the north and south ends, within the construction boundaries defined along the existing railroad right of way.

Construction Sequencing

Generally, the sequence of construction would utilize at least two crews per operation, working on the north and south halves of the trestle concurrently. Precast concrete elements including pile caps, deck slabs, and box beams can be utilized in order to expedite the construction process and minimize trucking and clean out areas associated with cast-in-place operations. The envisioned construction sequencing would consist of:

- Install erosion controls and selective trimming of vegetation
- Earthwork and construction of infiltration trenches
- Install piles and pile caps: Starting from the center of the Trestle and working back to

both ends, piles would be driven and pile caps installed by two separate work crews. Construction equipment would be working from existing grade within the erosion controls constructed at the right-of-way limits. Each crew would work from a separate laydown area on each end of the Trestle. In order to expedite the installation, the pile caps can be precast concrete, set on the piles and grouted into place. Each pile cap would be installed prior to the driving of piles at the next pier in order to avoid obstructing the movement of construction equipment on the embankment.

- Install trestle box girders: Once pile and pile cap construction is completed, the concrete box beams can be installed. This can also be done using two separate crews starting at both ends of the structure. Transverse post-tensioning of the box beams would be performed at this time to allow construction traffic access over the trestle. After the first span superstructure is erected, the beams in each subsequent span can be lifted in place using a crane located on top of the new structure.
- Install concrete deck: Once the box beams are installed, the contractor can install the concrete deck. This can be done either as the beam erection progresses, or once all beams of the trestle are erected. Precast deck panels may be used to expedite the process.
- Install ballast, track, signal cables, and power

The final step would be to install the ballast, track, signal cables, catenary wire and supports, and any ancillary items. The deck drain system would be installed prior to the ballast and linked to the infiltration trenches.

OPERATIONS AND MAINTENANCE

Access

Access for operations and maintenance would be from the trestle structure. There is a track turnout proposed on the superstructure for maintenance vehicles. Areas below the superstructure can be accessed from each of the piers with a ladder. There is no need for vehicular access at ground level.

Maintenance Activities

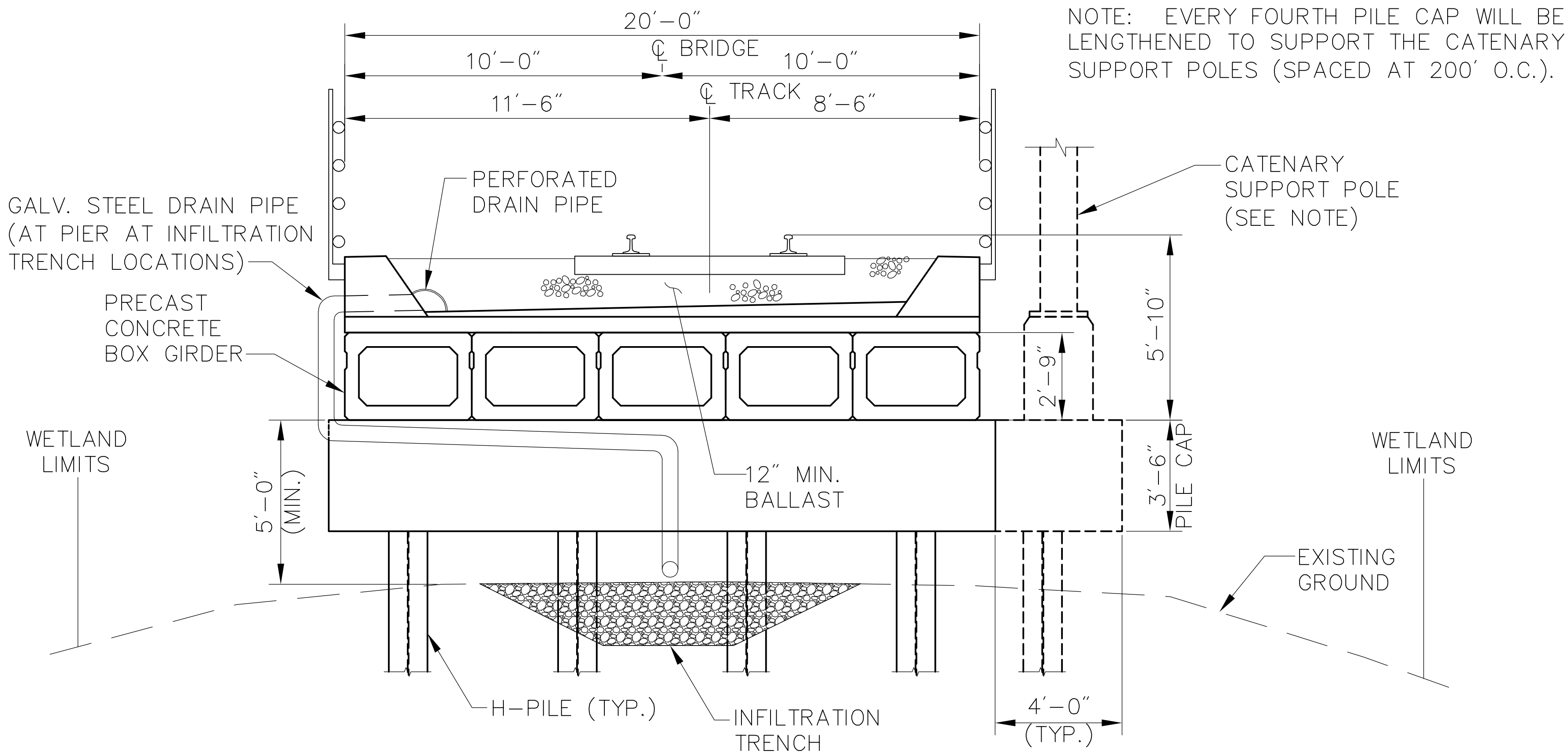
Routine maintenance for the trestle structure includes bi-annual bridge inspections in accordance with AREMA inspection guidelines, using ladders. All concrete and masonry structures and components should be given thorough, detailed inspections at scheduled intervals. A record of physical conditions should be kept. A special inspection may be required when the structure is subjected to abnormal conditions which may affect the capacity of the structure such as: floods, storms, fires, overloads and evidence of recent movement.

It is not anticipated that major equipment would be required. Long term maintenance to the trestle could consist of concrete repairs which would require working in localized, contained areas with small to moderate sized equipment working from the trestle. Maintenance of the track and ties and overhead catenary system would be done from the trestle.

Vegetation Management

The MBTA's program of annual vegetation maintenance on the ROW would control invasive species that may be established on the railbed or ballast. The Yearly Operating Plan for the Hockomock Swamp ACEC section of the track would be expanded to include a more specific protocol for the removal of invasive species. VMP staff would walk the track alignment on an annual basis, in July or August of each year and remove (pull) all individual plants of the invasive species listed above. Manual removal of invasive plants would be done within the railbed and within the adjacent wetlands or uplands, to a distance of 15 feet from the limit of clearing. An annual report would be prepared that documents the abundance and distribution of the species found. All removed invasive plant material would be placed in plastic bags and disposed of at a landfill. The VMP would be modified to prohibit the use of herbicide along the trestle and within the Hockomock Swamp.

Attachments
Figure 1: Trestle Through Hockomock Swamp – Typical Section
Figure 2: Trestle Through Hockomock Swamp – Typical Elevation
Figure 3: Trestle Through Hockomock Swamp – Construction Sequence



TYPICAL CROSS SECTION AT PIER

SCALE: 3/16" = 1–0'

FIGURE 1
TRESTLE THROUGH HOCKOMOCK SWAMP

TYPICAL SECTION

SOURCE

PREPAREDBY VHB

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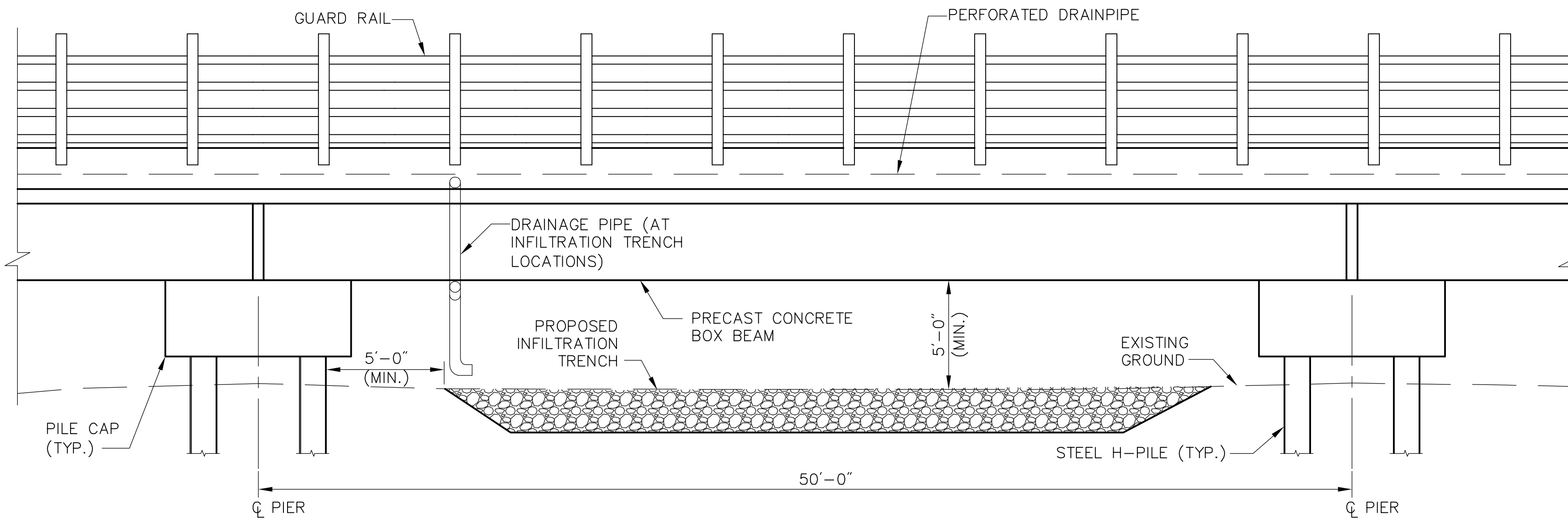

ELEVATION
SCALE: 1/8" = 1'-0"

FIGURE 2
TRESTLE THROUGH HOCKOMOCK SWAMP

TYPICAL ELEVATION
SOURCE
PREPAREDBY VHB

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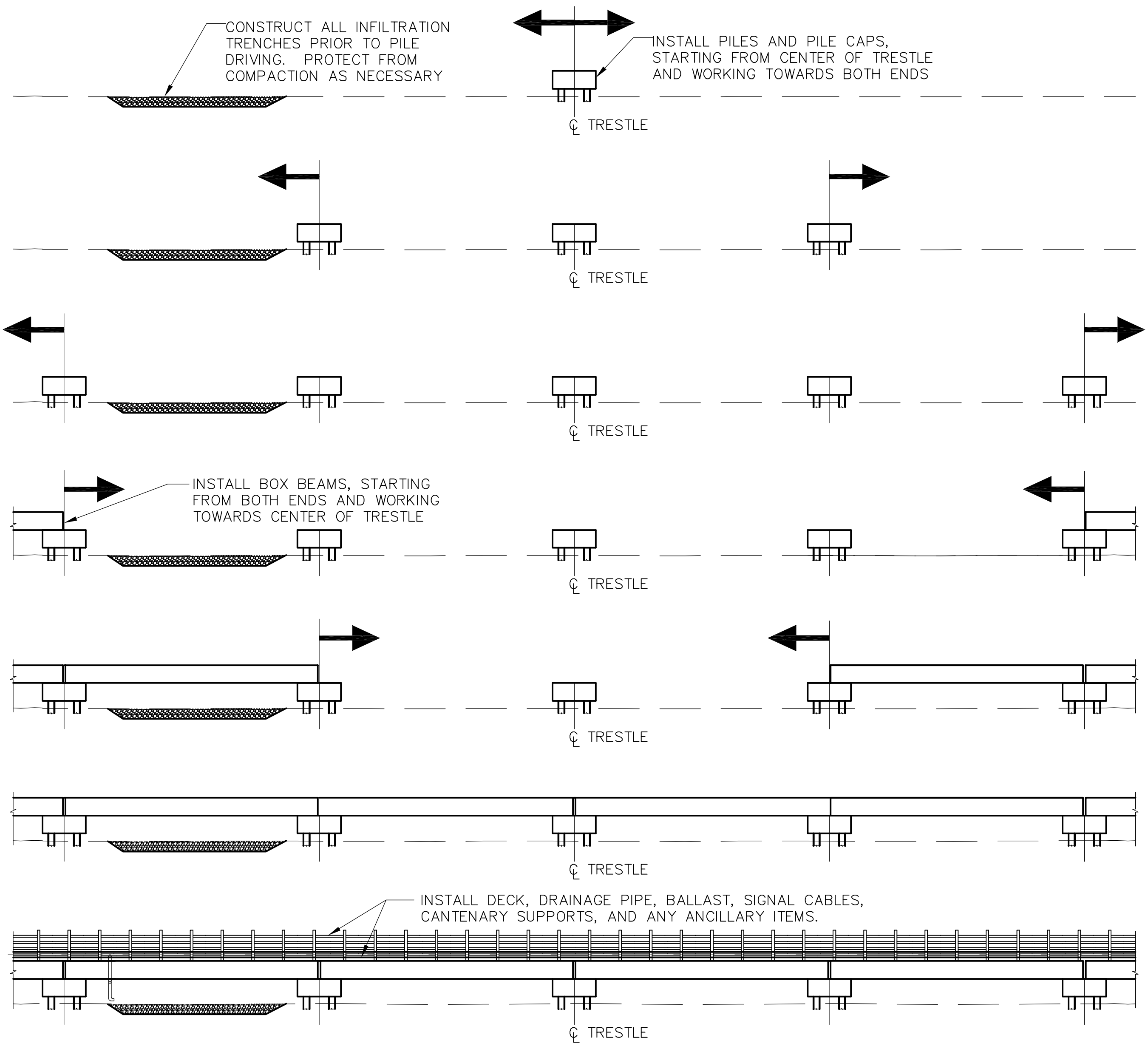

CONSTRUCTION STAGING

SCALE: N.T.S.

Moving Massachusetts Forward. massDOT

FIGURE 3

TRESTLE THROUGH HOCKOMOCK SWAMP

CONSTRUCTION SEQUENCE

SOURCE

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