Appendix H
Technical Report: Air Quality

Draw One Bridge Replacement

Environmental Assessment

Air Quality Technical Report

December 4, 2024

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TABLES

APPENDICES

List of Acronyms and Abbreviations

40 CFR	Chapter 40 of the Code of Federal Regulations
310 CMR	Title 310 of the Code of Massachusetts Regulations
BRMPO	Boston Region Metropolitan Planning Organization
CAA	Clean Air Act
CAFÉ	Corporate Average Fuel Economy
CFR	Code of Federal Regulations
CH4	methane
CO	carbon monoxide
CO2	carbon dioxide
CPA	Comprehensive Plan Application
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GHG	greenhouse gas
HFC	hydrofluorocarbons
hp	horsepower
LMP	Limited Maintenance Plan
LPA	Limited Plan Application
LRTP	Long Range Transportation Plan
MAAQS	Massachusetts ambient air quality standards
MassDEP	Massachusetts Department of Environmental Protection
MBTA	Massachusetts Bay Transportation Authority
MMBtu/hr	million British Thermal Units per hour
MPO	Metropolitan planning organization
MOVES	Motor Vehicle Emission Simulator
MSAT	Mobile source air toxic
NAA	Nonattainment area
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NSR	New Source Review
NO2	nitrogen dioxide
NOX	nitrogen oxides
NSR	New Source Review
N2O	nitrous oxide
O3	ozone
Pb	lead
PM	particulate matter
PM10	particulate matter with a diameter ≤ 10 microns
PM2.5	particulate matter with a diameter ≤ 2.5 microns
ppb	parts per billion
ppm	parts per million
PSD	Prevention of Significant Deterioration
SF6	sulfur hexafluoride
SIP	State Implementation Plan
SO2	sulfur dioxide
TIP	Transportation Improvement Plan

TPY	tons per year
µg/m3	micrograms per cubic meter
U.S.	United States
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USEPA	U.S. Environmental Protection Agency
VMT	Vehicle Miles Traveled
VOC	volatile organic compound(s)

1.0 Introduction

The MBTA is seeking funds to be provided through the Federal Transit Administration (FTA) and the Federal Railroad Administration (FRA) to demolish and replace the superstructure and substructures of the two North Station Draw One Bridge spans and approach spans over the Charles River, as well as the adjoining Signal Tower A, and upgrade the track network, communications and signaling systems. The two remaining operational bridges are rolling lift bridges and each carry two tracks. Portions of two additional bridges that were partially demolished are located to the west of the operational bridges. The Proposed Project includes the replacement of the original four bridges with three vertical lift bridge structures. Each vertical lift bridge will support two tracks (for a total of six tracks) over the Charles River.

This Air Quality Technical Report has been prepared in support of the National Environmental Policy Act (NEPA) Environmental Assessment (EA) being prepared for the Proposed Project.

2.0 Applicable Regulations

The Federal Clean Air Act (CAA) is the overarching statute regulating air quality in the United States. Among other things, it requires the U.S. Environmental Protection Agency (USEPA) to set the National Ambient Air Quality Standards (NAAQS), designate areas that are not in attainment of the NAAQS, and subsequently approve State Implementation Plans (SIP) for achieving those standards. The CAA Amendments of 1990 and the Final Transportation Conformity Rule [40 code of federal regulations (CFR) Parts 51 and 93] direct the USEPA to implement environmental policies and regulations that ensure acceptable levels of air quality. In addition to the CAA, other major regulations within the Project Site (shown on **Figure 2-1**) that apply to the potential air quality impacts of transportation projects include:

- The General Conformity Rule, 40 CFR Part 93 Subpart B; and
- Air Pollution Control, Code of Massachusetts Regulations (CMR) 310 CMR 7.00.

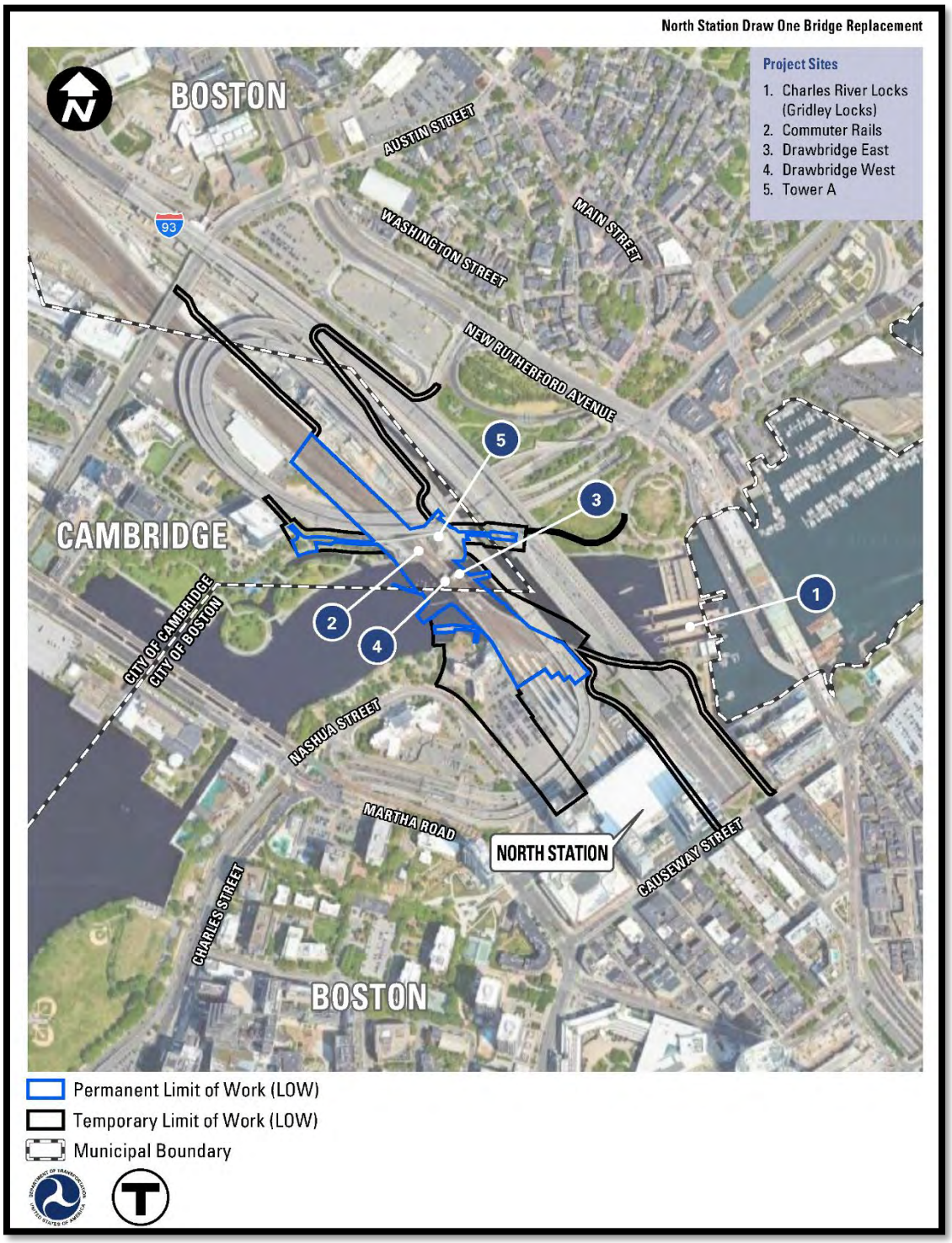

Figure 2-1. Project Site Boundary

2.1 Massachusetts

The Massachusetts Department of Environmental Protection (MassDEP) is the primary authority for ensuring that federal (and state) air quality regulations are met in Massachusetts. MassDEP is responsible for air quality monitoring throughout the state as well as the development and implementation of the SIP. MassDEP also has jurisdiction over the permitting of stationary emission sources, the regulation of mobile source emissions, and air programs related to criteria pollutants.

The management of air quality conditions in Massachusetts is the responsibility of federal, state, regional, and local governmental air quality regulatory agencies. The Commonwealth of Massachusetts administers the Federal Prevention of Significant Deterioration (PSD) program under 40 CFR 52.21 pursuant to a delegation agreement with USEPA. MassDEP also administers its New Source Review (NSR) program under 310 CMR 7.00 Appendix A.

Any facility or emission unit with the potential to increase the emissions of any single air contaminant by 10 tons per year (TPY) or more is required to submit a Comprehensive Plan Application (CPA) under 310 CMR 7.02(5)(a)1. Any natural gas-fired fuel utilization equipment, excluding internal combustion machinery such as reciprocating engines, with the potential to increase emissions of any single air contaminant by an amount equal to or greater than 1 TPY, and with a rated maximum heat input capacity of greater than or equal to 40 million British Thermal Units per Hour (MMBtu/hr), is also required to obtain CPA approval prior to construction under 310 CMR 7.02(5)(a)2. However, emissions from units installed in accordance with the Industry Performance Standards in 310 CMR 7.26 are not included when calculating an increase in potential emissions for purposes of determining applicability under 310 CMR 7.02(5)(a)1 and 2.

Any fuel utilization equipment, excluding internal combustion engines such as reciprocating engines, with a rated maximum heat input capacity of less than 10 MMBtu/hr and utilizing gas, is exempt from Massachusetts Plan Approval requirements in accordance with 310 CMR 7.02(2)(b)15.

2.2 Federal Agencies

Under the Federal CAA, the USEPA establishes the guiding principles and policies for protecting air quality conditions throughout the United States. The USEPA's primary responsibilities in this area include promulgating the NAAQS and approving SIPs, plans that demonstrate compliance with the NAAQS. The CAA requires states to develop, update and maintain SIPs that define attainment timeframes or milestones, area-wide emissions inventories, budgets, control strategies, and mitigation strategies.

The FRA is the primary agency involved in, and responsible for, ensuring that air quality impacts associated with proposed railroad projects adhere to the reporting and disclosure requirements of the National Environmental Policy Act (NEPA) as well as the General Conformity rule of the CAA. However, projects funded and approved by the FTA are subject to the transportation conformity regulations at Subpart A of 40 CFR Part 93. A transportation conformity applicability analysis is provided in **Section 3.0**.

General Conformity may also apply for transportation projects when non-road (i.e., construction equipment) emissions are excluded from an applicable SIP. A General Conformity applicability analysis is required for the Proposed Project under Section 176(c) of the CAA, since federal permits will be issued for the Proposed Project by the United States Coast Guard (USCG) and United States Army Corps of Engineers (USACE) and funding is being sought from FRA. An applicability analysis determines whether a Federal action (such as issuing a permit) must be supported by a General Conformity determination. As described in 40 CFR 93.153, the applicability analysis may find that a conformity determination is not required if, among other things, the Federal action:

- is part of a continuing response to an emergency or disaster;
- is covered by an existing transportation conformity determination;
- will result in no emissions increase or an increase in emissions that is clearly de minimis;
- is presumed to conform (e.g., based on comparisons with other projects); or
- will result in total direct and indirect emissions of the criteria pollutants or precursors below the de minimis rates contained in 40 CFR 93.153(b).

An applicability analysis has been undertaken for the Proposed Project in **Section 3.0**. Based on that analysis, the Proposed Project's emissions will be de minimis, and a General Conformity determination will therefore not be required.

2.3 Metropolitan Planning Organizations

Federally designated Metropolitan Planning Organizations (MPO) are required by law to demonstrate that the Long-Range Transportation Plan (LRTP) and Transportation Improvement Plan (TIP) conform to the transportation emission budgets set forth in the SIP for each state. Conformity requirements are met if emissions generated from the projects included in the TIP and LRTP are equal to or less than the emission budgets in the SIPs.

The Boston Region Metropolitan Planning Organization (BRMPO) is the MPO for the Project Site. The BRMPO routinely performs air quality conformity determinations before it endorses a Long-Range Transportation Plan or Transportation Improvement Program, and at other times, as required by State and Federal regulations under the CAA Amendments of 1990.

MassDEP reviews all BRMPO plans, programs, and projects annually for consistency with the SIP for meeting Federal air quality standards—as required under both Federal (40 CFR Part 93) and Massachusetts (310 CMR 60.03) regulations. This ensures that Federal funds are going only to those transportation activities consistent with air quality goals under the CAA.

2.4 National and Massachusetts Ambient Air Quality Standards

Pursuant to CAA requirements, the USEPA establishes, enforces, and periodically reviews the NAAQS. NAAQS are set to safeguard public health and environmental welfare against the detrimental impacts of outdoor air pollution and are defined as primary and/or secondary standards. Primary NAAQS are health-based standards geared toward protecting sensitive or at-risk portions of the population such as asthmatics, children, and the elderly. Secondary NAAQS

are welfare oriented and are designed to prevent decreased visibility and damage to animals, vegetation, and physical structures. NAAQS have been established for six common air pollutants, referred to as criteria pollutants: carbon monoxide (CO), lead, nitrogen dioxide (NO_2), ozone, particulate matter (PM), and sulfur dioxide (SO_2). PM includes particulate matter with a diameter of 10 microns or less (PM_{10}) and a diameter of 2.5 microns or less (PM2.5). Nitrogen oxides (NO_x) and volatile organic compound (VOC) emissions are precursors to ozone formation. The NAAQS are summarized in **Table 1-1**. **Table 1-1** also summarizes the current Ambient Air Quality Standards for the Commonwealth of Massachusetts as promulgated in Section 6, Title 310 of the Code of Massachusetts Regulations (310 CMR) because the standards are identical with the exception of annual PM2.5, which was recently updated by USEPA with an effective date of May 6, 2024.

Table 1-1. National Ambient Air Quality Standards (NAAQS) and Massachusetts Ambient Air Quality Standards (MAAQS)

Pollutant	Primary/Secondary	Averaging Time	Level
Carbon Monoxide (CO)[a]	Primary	8-hour	9 ppm
	Primary	1-hour	35 ppm
Lead (Pb)[b]	Primary and Secondary	Rolling 3-month average	0.15 µg/m^3
Nitrogen Dioxide (NO_2)[c]	Primary	1-hour	100 ppb
	Primary and Secondary	Annual	53 ppb[d]
Ozone (O_3)[e]	Primary and Secondary	8-hour	0.070 ppm[f]
$PM_{2.5}$[g]	Primary	Annual	9 µg/m^3
	Primary (MAAQS only)	Annual	12 µg/m^3
	Secondary	Annual	15 µg/m^3
	Primary and Secondary	24-hour	35 µg/m^3
PM_{10}[h]	Primary and Secondary	24-hour	150 µg/m^3
Sulfur Dioxide (SO_2)[i]	Primary	1-hour	75 ppb[j]
	Secondary	3-hour	0.5 ppm

Sources: USEPA, National Ambient Air Quality Standards (NAAQS), 2024, https://www.epa.gov/criteria-air-pollutants/naaqs-table and Code of Massachusetts Regulations, 2024, https://www.mass.gov/doc/310-cmr-6-ambient-air-quality-standards-for-the-commonwealth-of-massachusetts/download.

Notes: ppb = parts per billion, ppm = parts per million, and µg/m^3 = micrograms per cubic meter of air.

[a] CO 1-hour and 8-hour standard not to be exceeded more than once per year.

[b] Lead rolling 3-month average standard not to be exceeded. Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m^3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

[c] NO_2 1-hour standard represents the 98th percentile of 1-hour daily maximum concentrations, averaged over three years.

[d] The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is presented for the purpose of clearer comparison to the 1-hour standard.

[e] Ozone 8-hour standard represents the annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years.

Table 1-1. National Ambient Air Quality Standards (NAAQS) and Massachusetts Ambient Air Quality Standards (MAAQS)

Pollutant	Primary/Secondary	Averaging Time	Level
[f] Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.			
[g] $PM_{2.5}$ annual standards represent annual mean, averaged over three years. $PM_{2.5}$ 24-hour standard represents 98th percentile, averaged over three years.			
[h] PM_{10} 24-hour standard not to be exceeded more than once per year on average over three years.			
[i] SO_2 1-hour standard represents 99th percentile of 1-hour daily maximum concentrations, averaged over three years. SO_2 3-hour standard not to be exceeded more than once per year.			
[j] The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 CFR 50.4(3)).			

2.4.1 Attainment Status

The USEPA designates areas as either meeting (attainment) or not meeting (nonattainment) the NAAQS. An area with measured pollutant concentrations which are lower than the NAAQS is designated as an attainment area and an area with pollutant concentrations that exceed the NAAQS is designated as a nonattainment area. Once a nonattainment area meets the NAAQS and the additional re-designation requirements in the CAA, the USEPA will designate the area as a maintenance area. Ozone nonattainment areas are further classified as extreme, severe, moderate, or marginal. An area is designated as unclassifiable when there is a lack of sufficient data to form the basis of an attainment status determination. The CAA requires states to develop a general plan to attain and/or maintain the primary and secondary NAAQS in all areas of the country and to develop a specific plan to attain the standards for each area designated nonattainment area (NAA) for a NAAQS.

When the USEPA designates an NAA, states are required to develop and implement a SIP. The SIP outlines how the state will achieve air quality that meets the NAAQS under the deadlines established by the CAA, followed by a plan for maintaining attainment status once the area has achieved attainment (and is then classified as a "maintenance area"). The SIP also compiles the state's air quality control plans and rules that are approved by USEPA. Section 176(c) of the CAA provides that federal agencies cannot engage, support, or provide financial assistance for licensing, permitting, or approving any project unless the project conforms to the applicable SIP.

The attainment classifications for each of the USEPA-designated areas[1] in the Project Site[2] are provided in **Table 1-2**.

[1] USEPA, Green Book for Middlesex and Suffolk Counties, MA, https://www.epa.gov/green-book.
[2] The state of dispersion science and health effects of GHG emissions have not sufficiently advanced to accurately consider the microscale level of mobile sources. For this reason, this analysis does not determine a Local Study Area for GHG emissions for mobile sources and only considered them on a regional scale. GHG emissions from the Proposed Project would be due to fossil fuel combustion of vehicles, diesel trains, potential change in GHG emissions

Table 1-2. Middlesex County and Suffolk County Attainment Classifications for Project Site

NAAQS	Attainment	Nonattainment	Maintenance
Ozone (1-hour, 1979) - Revoked			X
Ozone (8-hour, 1997) - Revoked			X
Ozone (8-hour, 2008) - Revoked	X		
Ozone (8-hour, 2015)	X		
PM10 (1987)	X		
PM2.5 (2012)	X		
CO (1971)			X
Source: USEPA Greenbook, 2024. Note: Classifications are identical for Middlesex and Suffolk Counties.			

Table 1-3 presents the background concentrations of pollutants for the Project Site based on air quality monitoring from 2020 to 2022. The values describe the air quality status of a given location relative to the NAAQS. These values provide a way to designate and classify nonattainment areas and to assess progress toward meeting the NAAQS. The monitoring locations were selected for the most conservative representation of background levels for each of the NAAQS within the Project Site.

Table 1-3. Regional Background Air Quality Concentrations, 2020-2022

Pollutant	Units	Averaging Period	2020	2021	2022	Monitoring Location	NAAQS
CO	ppm	8-hour	1.1	1.0	1.0	Boston[1], MA	9
CO	ppm	1-hour	1.6	1.5	1.6	Boston[1], MA	35
Pb	μ/m^3	3-month	0.0072	0.0042	0.0091	Boston[1], MA	0.15
NO_2	ppb	1-hour	42	44	46	Boston[1], MA	100
NO_2	ppb	Annual	9.3	9.6	10.0	Boston[1], MA	53
O_3	ppm	8-hour	0.057	0.060	0.060	Boston[1], MA	0.070

from implementation of the project is calculated for the same sources and categories as identified for the analysis of local operational emissions.

Table 1-3. Regional Background Air Quality Concentrations, 2020-2022

Pollutant	Units	Averaging Period	2020	2021	2022	Monitoring Location	NAAQS
$PM_{2.5}$	μ/m^3	Annual	5.8	7.9	6.5	Boston[1], MA	9
$PM_{2.5}$	μ/m^3	24-hour	14.3	18.2	14.7	Boston[1], MA	35
PM_{10}	μ/m^3	24-hour	25	30	31	Boston[1], MA	150
SO_2	ppb	1-hour	2.0	2.1	3.1	Boston[1], MA	75

Source: Massachusetts Air Quality Reports from 2019-2021, Massachusetts Department of Environmental Protection – Air Assessment Branch.

[1]Boston, MA Monitor, Harrison Avenue (EPA ID 25-025-0042)

Note: (ppm) – parts per million; (ppb) parts per billion; (μ/m^3) micrograms per meter cubed

As shown in **Table 1-3**, the monitored regional background concentrations are below the NAAQS.

3.0 Conformity

The CAA requires that a SIP be prepared for each nonattainment area and a maintenance plan be prepared for each former nonattainment area that subsequently demonstrated compliance with the standards. The SIP includes the state's air quality control plans and rules approved by USEPA. Under Section 176(c) of the CAA, Federal agencies cannot engage, support, or provide financial assistance for licensing, permitting, or approving any project unless the project conforms to the applicable SIP. This is intended to eliminate or reduce the severity and number of NAAQS violations and to achieve expeditious attainment. The CAA defines conformity as:

A. Conformity to an implementation plan's purpose of eliminating or reducing the severity and number of NAAQS violations and achieving expeditious attainment of such standards; and

B. that such activities will not:

   i. cause or contribute to any new violation of any NAAQS in any area;

   ii. increase the frequency or severity of any existing violation of any NAAQS in any area; and

   iii. delay timely attainment of any NAAQS, any required interim emission reductions, or other milestones in any area.

The conformity requirements of the CAA and regulations promulgated thereunder limit the ability of Federal agencies to assist, fund, permit, and approve projects in non-attainment areas or maintenance areas that do not conform to the applicable SIP. Conformity is regulated under two categories—Transportation Conformity and General Conformity.

3.1 Transportation Conformity

Section 176(c) of the CAA of 1977, as amended (42 USC § 7506) forbids any department, agency, or instrumentality of the Federal government from engaging in, supporting in any way or providing financial assistance for, licensing or permitting, or approving any activity which does not conform to a SIP after the activity has been approved or promulgated. As defined in Section 176(c)(1), conformity to an implementation plan means conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards.

Projects funded and approved by the FTA are subject to the transportation conformity regulations of Subpart A, 40 CFR Part 93. The BRMPO is the MPO for the Project Site. The Project Site is within the area subject to the Boston Metropolitan Area Carbon Monoxide Limited Maintenance Plan (LMP). An LMP is a maintenance plan that USEPA has determined meets its LMP policy criteria for a given NAAQS and pollutant. To qualify for a LMP an area must, for example, have a design value that is significantly below a given NAAQS, and it must be reasonable to expect that a NAAQS violation will not result from any level of future motor vehicle emissions growth.

With the LMP in place, the Project Site is within an area classified as CO maintenance. No regional air quality analysis is required in LMP areas, as emissions may be treated as essentially not constraining for the length of the maintenance period because it is unreasonable to expect that such areas will experience enough growth during the 10-year LMP duration to trigger a violation of the carbon monoxide NAAQS. Therefore, in areas with approved LMPs, Federal actions requiring conformity determinations under the transportation conformity rule are considered to satisfy the "budget test." All other transportation conformity requirements under 40 CFR 93.109(b) continue to apply in limited maintenance areas, including conformity determinations based on carbon monoxide hot spot analyses under 40 CFR 93.116. Under the USEPA guidance document for LMP, Federal actions in the LMP area requiring conformity determinations under the Transportation Conformity rule satisfy the emissions "budget test" required in the conformity rule in 40 CFR sections 93.118, 93.119, and 93.120.11. Therefore, the Proposed Project is presumed to conform with the CO LMP, and thus CO de minimis levels will not apply for the Proposed Project under Transportation Conformity.

The Federal transportation conformity rule in 40 CFR 93.123(a) includes the following requirements for demonstrating compliance with CO "hot spot" assessments:

1. The demonstrations required by 40 CFR 93.116 ("Localized CO, PM_{10}, and $PM_{2.5}$ violations") must be based on quantitative analysis using the applicable air quality models, databases, and other requirements specified in 40 CFR part 51, Appendix W (Guideline on Air Quality Models). These procedures shall be used in the following cases, unless different procedures developed through the interagency consultation process required in § 93.105 and approved by the USEPA Regional Administrator are used:
    i. For projects in or affecting locations, areas, or categories of sites which are identified in the applicable implementation plan as sites of violation or possible violation;

ii. For projects affecting intersections that are at Level-of-Service D, E, or F, or those that will change to Level-of-Service D, E, or F because of increased traffic volumes related to the project;

iii. For any project affecting one or more of the top three intersections in the nonattainment or maintenance area with highest traffic volumes, as identified in the applicable implementation plan; and

iv. For any project affecting one or more of the top three intersections in the nonattainment or maintenance area with the worst level of service, as identified in the applicable implementation plan.

2. In cases other than those described in paragraph (a)(1) of this section, the demonstrations required by § 93.116 may be based on either:

   i. Quantitative methods that represent reasonable and common professional practice; or

   ii. A qualitative consideration of local factors, if this can provide a clear demonstration that the requirements of § 93.116 are met.

The Project is rail-only and does not include construction on any roadway intersections. As such, the requirements of 40 CFR 93.123(a) are not applicable. Thus, the Proposed Project requires a qualitative demonstration of local factors per 40 CFR 93.123(2)(ii).

As demonstrated in **Section 4**, the results of the local scale emissions for the Build Alternative are below the federal Transportation Conformity de minimis levels for CO. No construction will occur on local roadways or public parking spaces as part of the Proposed Project. The Proposed Project has the potential to reduce future regional vehicle miles traveled (VMT) compared with existing conditions, as upgrades to the rail system may cause vehicular users to switch to rail. Since the Proposed Project does not include at-grade railroad crossings of roadways, walkways, or bike paths in the Project Site, there will be no permanent impacts to vehicular traffic, pedestrians, or cyclists.

For the 2040 No Action and Build Alternatives, localized Project-related emissions will be substantially reduced from existing conditions due to implementation of USEPA's vehicle and fuel regulations[3]. Additionally, the Build Alternative will decrease regional CO emissions compared to existing conditions, as discussed in **Section 4.2**. Therefore, MBTA expects any local CO impacts to be minor and the requirements of 40 CFR 93.123(a) are met.

3.2 General Conformity

If construction equipment non-road emissions are considered to not be included in the SIP (transportation conformity covers on-road emissions), General Conformity may also apply. As the Proposed Project would require a bridge permit from the USCG, a waterway permit from the USACE, and is seeking funding from the FRA, a General Conformity applicability analysis is required under Section 176(c) of the CAA since the Proposed Project would require Federal permits from agencies other than the FTA. An applicability analysis is the process of determining

[3]https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-greenhouse-gas-emissions-passenger-cars-and

whether a Federal action (such as issuing a permit) must be supported by a General Conformity determination. As described in 40 CFR Part 93.153, the applicability analysis may find that a conformity determination is not required if, among other things, the Federal action:

- Is part of a continuing response to an emergency or disaster;
- Is covered by an existing transportation conformity determination;
- Will result in no emissions increase or an increase in emissions that is clearly de minimis;
- Is presumed to conform (e.g., based on comparisons with other projects); or
- Will result in total direct and indirect emissions of the criteria pollutants or precursors that is less than the de minimis rates contained in 40 CFR § 93.153(b). For the Project Site, the applicable de minimis emission thresholds are 100 tons per year of carbon monoxide.

Actions taken by FRA, USACE, and USCG, including a decision to fund or approve the Proposed Project, are subject to General Conformity; therefore, General Conformity would apply to the Proposed Project. A General Conformity Applicability Analysis determines whether emissions (e.g., CO, NO_x, SO_2, PM_{10}, $PM_{2.5}$) from a Federal action will exceed certain thresholds and be subject to General Conformity requirements. If General Conformity applies, then a separate analysis, referred to as a Conformity Determination, is required to document that the Federal action conforms to the applicable SIP for the nonattainment or maintenance area.

As part of the General Conformity Applicability Analysis, the total of direct and indirect emissions of nonattainment pollutants or designated precursors from a proposed Federal action is calculated and compared to annual general conformity applicability emissions thresholds in 40 CFR Part 93.153. The General Conformity applicability thresholds are listed in 40 CFR Part 93.153(b)(1) for nonattainment areas and 40 CFR Part 93.153(b)(2) for maintenance areas. If emissions are below the applicability thresholds, then the emissions are considered de minimis, General Conformity requirements do not apply, and a General Conformity Determination is not required.

The Project Site is located in an area that is part of the Boston Metropolitan Area Carbon Monoxide maintenance area. The CO emissions were calculated in Section 4.2.6 for comparison to the General Conformity applicability thresholds listed in 40 CFR Part 93.153(b)(2). **Table 1-8** provides a detailed summary of the estimated annual emissions with comparisons to the General Conformity de minimis emissions thresholds. As shown, the annual CO emissions are well below de minimis emission thresholds. As such, a General Conformity determination is not required.

4.0 Air Quality Assessment

4.1 No Action Alternative

Under the No Action Alternative, the Proposed Project would not occur and interstate highway traffic along the I-93 corridor would presumably continue to increase based on population growth. Existing air quality as discussed in Section 2.4.1, compared to future predicted air quality without the Project, would be affected by two key factors: regional growth and air quality regulatory actions. Regional growth, such as increased residential development and density, along with additional industry, results in more and greater sources of air emissions. These increases in air emissions are offset by transportation projects as discussed in Section 4.2 for the Project, which

generally reduce traffic congestion, thus minimizing local effects for emissions, as well as vehicle regulatory programs that control the level of emissions from on-road and non-road vehicles.

4.2 Build Alternative

The existing Draw 1 Bridges form a critical physical bottleneck for daily train movements into and out of North Station. The bridges are subject to malfunction, while the four tracks carry limited capacity and constrain operational resiliency in the wake of service disruptions. A February 2023 MBTA ridership report estimated existing ridership for the train lines at North Station at approximately 37,300 passengers per day and projected that it would increase to 46,100 passengers per day by the year 2040 with the Build scenario.

No construction is proposed on local roadways or public parking spaces as part of the Proposed Project. The Proposed Project has the potential to reduce future regional VMT compared with existing conditions by creating a more reliable rail system that could convert current vehicular users to rail. The Build Alternative will not increase or expand rail capacity until other infrastructure improvements are implemented by MBTA. As such, the Build Alternative will not result in any new or additional train engine emissions.

4.2.1 Criteria and Toxic Air Pollutants

This section examines the impact of criteria and toxic air pollutants at both the local and regional levels. Pollutants that can be traced principally to motor vehicles, construction equipment, and diesel locomotives are relevant to the evaluation of the Project's impacts. These pollutants include CO, VOC, NO_x, O_3, SO_2, PM_{10}, $PM_{2.5}$. Transportation sources account for a small percentage of regional emissions of Pb; thus, a detailed analysis is not required. The Proposed Project's direct and indirect impacts on air quality are considered, including post-construction operations mobile sources and construction emissions. While mobile source air toxics (MSAT) and greenhouse gases (GHG) are not criteria pollutants and are not subject to conformity requirements, they are also considered in this section. Potential operational air quality effects of the Proposed Project include:

- Changes in rail-related emissions due to an increase in daily ridership from the existing condition; and
- Changes in the overall regional emissions due to travelers shifting from one mode of transportation to another (i.e., from vehicles to commuter rail).

Regional effects on air quality were evaluated based on both the direct and indirect emissions from the operation of the Proposed Project. The proposed improvements have the potential to affect regional air quality by direct emissions. Railroad activity releases emissions, primarily from diesel combustion during train operations. Emissions of CO, NO_x and $PM_{2.5}$ from diesel combustion contribute to ambient concentrations of CO, NO_2, and $PM_{2.5}$. Per USEPA fuel regulations, emissions of SO_2 from diesel combustion are negligible due to their very low sulfur content. As such, SO_2 emissions from diesel trains are typically not expected to significantly contribute to ambient concentrations of SO_2. A localized adverse effect occurs if a project causes a localized air emission increase that has the potential to cause violation of the NAAQS or causes or contributes to a substantial air toxic emission increase that exposes sensitive

populations to a high level of air toxic concentrations. The local emissions assessment for the Proposed Project considered the comparison of operational emissions from the Build Alternative to the Existing conditions and No Action Alternative, as described below. Emissions from diesel engine locomotives were compared using existing and predicted train schedules provided by MBTA.

Operation of the Build Alternative would generally result in a long-term net benefit to air quality by reducing emissions of criteria pollutants and air toxics. Several factors would contribute to the potential long-term effect on air quality. These include the forecasted ridership volume of the rail system and the subsequent vehicle emission change due to the shift of commuter travel mode from on-road vehicles to trains. Long-term regional effects of the Build Alternative were evaluated based on the total direct and indirect emissions associated with the operation of the Proposed Project.

4.2.2 Locomotive Emissions

USEPA established a comprehensive program (40 CFR Part 93) to reduce emissions from locomotives, including line-haul, switch, and passenger engines. The program set emission standards with applicability dependent on the date a locomotive is first manufactured. For switch engine locomotives, the first set of standards (Tier 0) applies to most locomotives originally manufactured before 2001. The most stringent set of standards (Tier 4) applies to locomotives manufactured in 2015 and later. Additional passenger locomotives that would operate as a result of the Proposed Project will, at a minimum, meet the emissions standards set by USEPA.

Direct emissions resulting from the Proposed Project relate to the change in locomotive volume from the No Action to the Build condition. The No Action operation of the rail corridor for the analysis year 2040, including train characteristics and maximum average daily locomotive frequency, was provided by MBTA. Comparing the 2040 estimates for the Build and No Action Alternatives, there would be no increases in scheduled trains with the Proposed Project. The MBTA projects that ridership on the train lines would increase to 46,100 passengers per day by the year 2040 for the No Action and the Build scenarios as compared to 37,100 for the existing conditions.

Table 1-4 presents the emissions inventory of expected Project-generated locomotive emissions under the, No Action and Build Alternatives.

Table 1-4: Locomotive Emissions: No Action and Build Alternatives - Year 2040

Alternative	Annual Number of Passengers	Gallons of Diesel Fuel[1]	NOx Emissions[2] (Tons/Year)	VOC Emissions[2] (Tons/Year)	CO Emissions[2] (Tons/Year)
No Action	16,826,500	710,078	18.0	0.4	20.8
Build	16,826,500	710,078	18.0	0.4	20.8

Table 1-4: Locomotive Emissions: No Action and Build Alternatives - Year 2040

Alternative	Annual Number of Passengers	Gallons of Diesel Fuel[1]	NOx Emissions[2] (Tons/Year)	VOC Emissions[2] (Tons/Year)	CO Emissions[2] (Tons/Year)
Net Change (Build minus No Action)	0.0	0.0	0.0	0.0	0.0
De minimis Threshold	N/A	N/A	100	50	100

Notes:
[1]Represents the number of gallons of diesel fuel used to transport passengers along the 2.0-mile distance from North Station to Union Square Station (i.e., minimum distance from North Station to MBTA Station). The MBTA average number of gallons per passenger mile traveled (PMT) is 0.0211 gal/PMT (Sources: https://www.transit.dot.gov/ntd/data-product/2019-metrics and https://www.transit.dot.gov/ntd/data-product/2019-fuel-and-energy)
[2]EPA has published expected fleet average pollutant emission rates for commuter rail in 2040 in their Technical Highlights: Emission Factors for Locomotives USEPA-420-F-09-025. NOx – 23 grams/gallon, VOC – 0.5 grams/gallon, CO – 26.6 grams/gallon.

Table 1-4 shows Project-generated predicted annual pollutant emissions by the Proposed Project, which are all below General Conformity de minimis threshold values. Pursuant to its Conformity Rules, USEPA considers project-generated emissions below these de minimis values to be minimal. The General Conformity de minimis thresholds applicable to the Project Site are 100 tons per year of NO_x, CO, and $PM_{2.5}$ and 50 tons per year of VOC. The Project-generated predicted emissions are considered conservatively high because they do not account for any reduction in automobile emissions related to travelers diverting from auto to rail travel. These emission reductions are accounted for in the regional passenger vehicle emissions assessment below.

4.2.3 Passenger Vehicle Emissions

Carbon monoxide (CO) emissions are associated with large volumes of slow-moving traffic, such as highly congested intersections. Areas experiencing high levels of CO are referred to as CO "hot spots." The purpose of a CO hot-spot analysis is to determine if CO emissions generated by a proposed project would cause or contribute to an exceedance of the USEPA air quality standard for CO.

The 2040 No Action and Build Alternatives will decrease total regional VMT and CO emissions compared to existing conditions based on MBTA projection that ridership on the train lines would increase by the year 2040. Under the 2040 No Action and Build Alternatives, the increased annual MBTA commuter rail trips could otherwise occur by other transportation modes; therefore, the availability of improved commuter rail service is expected to reduce the number of regional vehicle trips. Also, in 2040 with the No Action and Build Alternatives, CO emissions from regional traffic are expected to be less than in the existing conditions as a result of increased annual MBTA ridership.

The Build Alternative is not predicted to increase the roadway VMT of traffic local to the Project Site as compared to the No Action Alternative because it includes no construction on local roadways or additional public parking spaces. As shown in **Tables 1-5 and 1-6**, CO emissions in the local Project Site (i.e., those along the 2.0-mile railway from North Station to the nearest MBTA Station and adjacent I-93 Bridge) will be reduced as a result of the Proposed Project as compared to the existing conditions and will be the same as the No Action alternative. The distance between emissions sources and receptors will change only by the separation distance between rails, since only the number of tracks is increasing. Based on the emissions provided in **Table 1-4**, the amount of locomotive air pollutant emissions that would be dispersed to a local receptor along the railroad on an hourly, daily, or annual basis is anticipated to be minor. With the improvement in local air quality anticipated from the removal of passenger vehicles from the I-93 Bridge as compared to the existing conditions, the overall local air quality condition will improve with the Build Alternative. As such, a local hot-spot analysis would be expected to show an overall improvement in local CO concentrations with the Build Alternative.

Table 1-5. Net Change in Regional Vehicle Emissions - Year 2040

Alternative	Annual Number of Passengers[1]	Annual VMT	NOx Emissions[2] (Tons/Year)	VOC Emissions[2] (Tons/Year)	CO Emissions[2] (Tons/Year)
Net Change (Build minus Existing)	**(3,212,000)**	**6,424,000**	**(0.05)**	**(0.29)**	**(5.9)**
Net Change (Build minus No Action)	0.0	0.0	0.0	0.0	0.0

Notes:
1. Represents the net change in the number of passengers for the Build minus No Action Alternative and Build minus Existing Conditions.
2. Emission factors based on the USEPA MOVES4 mobile source emission model for the Project Site in 2040 and the current fleet of passenger vehicles and trucks per the BRMPO Memo: *MOVES Emission Factors and Travel Demand Model Application* (August 2021). NOx – 0.0074 grams/VMT, VOC – 0.0407 grams/VMT, CO – 0.833 grams/VMT.

Table 1-6. Change in Projected NOx, VOC, and CO Emissions in the Project Site Compared to the Existing conditions and No Action Alternative (tons per year) – Year 2040

Alternative	Annual Number of Rail Passengers	Annual Number of Personal Vehicles	NOx Emissions (Tons/Year)	VOC Emissions (Tons/Year)	CO Emissions (Tons/Year)
Net Change (Build minus Existing)	**3,212,000**	**(3,212,000)**	**(0.05)**	**(0.29)**	**(5.9)**
Net Change (Build minus No Action)	0.0	0.0	0.0	0.0	0.0

4.2.4 Climate Change and Greenhouse Gas Emissions

Climate change refers to long-term changes in temperature, precipitation, wind patterns, and other elements of the earth's climate system. An ever-increasing body of scientific research attributes these climatological changes to GHG emissions, particularly those generated from the production and use of fossil fuels. While climate change has been a concern for several decades, the establishment of the Intergovernmental Panel on Climate Change by the United Nations and World Meteorological Organization in 1988 led to increased efforts devoted to GHG emissions reduction and climate change research and policy. These efforts are primarily concerned with GHG emissions generated by human activity, including CO_2, methane (CH_4), nitrous oxide (N_2O), tetrafluoromethane, hexafluoroethane, sulfur hexafluoride (SF_6), and various hydrofluorocarbons (HFCs). CO_2 is the most abundant GHG; while it is a naturally occurring component of Earth's atmosphere, fossil-fuel combustion is the main source of additional human- generated CO_2.

To date, no national standards have been established for nationwide mobile-source GHG reduction targets, nor have any regulations or legislation been enacted specifically to address climate change and GHG emissions reduction at the project level. NEPA (42 USC Part 4332) requires Federal agencies to assess the environmental effects of their proposed actions prior to making a decision on the action or project.

The Federal government has established various programs to address climate change and its associated effects. The most important of these was the Energy Policy and Conservation Act of 1975 (42 USC Section 6201) as amended by the Energy Independence and Security Act of 2007, and Corporate Average Fuel Economy (CAFÉ) Standards. This act establishes fuel economy standards for on-road motor vehicles sold in the United States. Compliance with Federal fuel economy standards is determined through the CAFE program based on each manufacturer's average fuel economy for the portion of its vehicles produced for sale in the United States. The USEPA, with the National Highway Traffic Safety Administration, is responsible for setting GHG emission standards to significantly increase the fuel economy of all new passenger cars and light trucks sold in the United States. Fuel efficiency standards directly influence GHG emissions. USEPA calculates average fuel economy levels for manufacturers and sets related GHG emissions standards under the CAA.

USEPA published a final rulemaking on December 30, 2021 that raised Federal GHG emissions standards for passenger cars and light trucks for model years 2023 through 2026, increasing in stringency each year. This rulemaking revised lower emissions standards that had been previously established for model years 2021 through 2026 in the Safer Affordable Fuel-Efficient Vehicles Rule Part 2 in June 2020. The updated standards will avoid more than 3 billion tons of GHG emissions through 2050.

The state of atmospheric dispersion science and health effects of GHG emissions have not sufficiently advanced to accurately consider the microscale level of mobile sources. For this reason, this analysis only considered GHG emissions on a regional scale. For the consideration of the Proposed Project, GHG emissions are a result of fossil fuel combustion in vehicles and diesel trains. Any potential change in GHG emissions from implementation of the Project is calculated from the same sources and categories that are identified in the analysis of local operational emissions.

GHG emissions from railway projects can be divided into those produced during operation of the railroad (i.e., locomotive emissions) and those produced during construction. The primary GHG produced by the transportation sector is CO_2, a product of the combustion of petroleum-based products, like gasoline or diesel, in internal combustion engines.

The projected change in 2040 CO_2 emissions for the Build Alternative relative to the No Action Alternative is shown in **Table 1-7**. Increases in CO_2 emissions associated with additional MBTA passenger rail service is expected to be more than offset by reductions in CO_2 emissions due to reduced use of passenger vehicles.

Table 1-7. Change in Projected CO_2 Emissions in the Project Site Compared to the Existing Conditions (tons per year) - Year 2040

Annual Number of Rail Passengers	Annual Number of Passenger Vehicles	Rail Travel CO_2 Emissions (Tons/Year)	Passenger Vehicle Travel CO_2 Emissions (Tons/Year)	Net Change CO_2 Emissions (Tons/Year)
3,212,000	(3,212,000)	699	1,144	(445)

Source:
1.Emission based on136.1 grams CO_2 per rail passenger mile traveled (US Congressional Budget Office, Emissions of Carbon Dioxide in the Transportation Sector (December, 2022)), https://www.cbo.gov/file-download/download/private/165572
2. Emission based on 223.0 grams CO2 per passenger vehicle mile traveled (USEPA MOVES4 Model for Metropolitan Boston MPO)

While the Proposed Project would result in GHG emissions during construction, as summarized in **Table 1-8** and detailed in **Appendix A**, it is anticipated that the Proposed Project would not result in any increase in operational GHG emissions. The Proposed Project will not conflict with any currently applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

4.2.5 Mobile Source Air Toxics

A qualitative Mobile Source Air Toxics (MSAT) assessment was conducted and followed the Federal Highway Administration (FHWA) guidelines on air toxics, and the Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents. Technical shortcomings of emissions and dispersion models, and uncertain science with respect to health effects, prevent meaningful or reliable estimates of MSAT emissions and effects of this Project. However, even though reliable methods do not exist to estimate accurately the health impacts of MSATs at the project level, it is possible to qualitatively assess future MSAT emissions with the Project. Although a qualitative analysis cannot identify and measure health impacts from MSATs, it can give a basis for identifying and comparing the potential differences in MSAT emissions, if any, with the Build and No Action Alternatives.

The regional MSAT effects associated with the Proposed Project were assessed based on FHWA *Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents,* released January 18, 2023, and in part from an FHWA study entitled *A Methodology for Evaluating*

Mobile Source Air Toxic Emissions among Transportation Project Alternatives, as applicable to the Proposed Project. The FHWA's guidance was utilized as neither FTA, FRA, nor USEPA have guidelines for MSAT analysis, including hot-spot analyses. A hot-spot analysis is known as a "microscale" analysis as it focuses on a small geographic area in the immediate vicinity of the Project Site. FHWA's interim guidance groups projects into the following categories: Exempt Projects and Projects with No Meaningful Potential MSAT Effects; Projects with Low Potential MSAT Effects; and Projects with Higher Potential MSAT Effects.

4.2.5.1 Regional MSAT Effects

In 2040, MBTA projects that the Build Alternative will result in 3.212 million more rail passenger trips annually to/from/within North Station (compared to existing conditions). By shifting this travel to rail, MBTA expects that up to 8,800 vehicles per day and 17,600 vehicle miles per day will be removed from the parallel roads of I-93 and U.S. Route 1 in the 2.0-mile one -way distance from North Station to the nearest MBTA Station in the year 2040.

With an average fuel efficiency of 25.7 miles per gallon in the BRMPO and a typical passenger rail trip traveling 2.0 miles, this equates to a reduction of approximately 250,000 gallons of fuel per year. In comparison, the MBTA commuter trains that will operate more efficiently with higher ridership per train with the Proposed Project are estimated to consume the same number of gallons of fuel per year as in existing conditions. Therefore, overall fuel consumption will be reduced with the Build Alternative.

The Build Alternative will decrease the total regional VMT and MSAT emissions compared to existing conditions and will result in the same total regional VMT and MSAT emissions compared to the No Action Alternative. Under existing conditions, the approximately 3.212 million annual MBTA commuter rail trips from the Build Alternative could otherwise occur by other transportation modes; therefore, the availability of improved commuter rail service will reduce the number of vehicle trips on a regional basis. Because the Build Alternative will not substantially change the regional traffic mix, the amount of MSAT emissions emitted from highways and other roadways along the Project Site corridor would be proportional to the VMT. Because the regional VMT estimated for the Build Alternative will be less than the existing conditions and the same as the No Action Alternative in 2040, MSAT emissions from regional vehicle traffic will also be less than the existing conditions and identical with the Build Alternative compared to the No Action Alternative in 2040. Emissions for the Build Alternative will also likely be lower than current levels in 2040 because USEPA's national control programs are projected to reduce annual MSAT emissions by over 90 percent from 2010 to 2050.

The Build Alternative is not predicted to increase roadway VMT of traffic local to the Project Site as compared to the No Action Alternative because the Project includes no construction on local roadways or additional public parking spaces. As such, based on the recommended tiering approach detailed in the FHWA methodology, the operational impact of the Proposed Project falls within the Tier 1 category as a project with no meaningful potential MSAT effects.

4.2.5.2 Local MSAT Effects

The potential MSAT emission sources directly related to Proposed Project operation will be from trains operating along the Project Site corridor and passenger vehicles traveling to and from train stations. Localized changes in MSAT emissions will occur as a result of all of these activities.

The Proposed Project includes no construction on local roadways or public parking spaces. It has the potential to reduce future regional VMT compared with existing conditions. Since there are no at-grade railroad crossings of roadways, walkways, or bike paths in the Study Area, there will be no permanent impacts to vehicular traffic, pedestrians, or cyclists.

For the 2040 Build Alternative, localized Project-related emissions will be substantially reduced from existing conditions due to implementation of USEPA's vehicle and fuel regulations. The Build Alternative will also decrease regional MSAT emissions compared to existing conditions. Therefore, local MSAT effects with the Proposed Project are expected to be minor.

4.2.6 Construction

Construction effects on air quality are generally short-term and attributable to emissions from construction equipment and fugitive dust from ground-level disturbances. Potential construction impacts on air quality are evaluated based on the intensity of the construction activities and duration.

The potential air quality effects of the Build Alternative will be short-term, occurring only while demolition and construction work is in progress and local conditions are conducive. The potential for fugitive dust emissions typically is associated with building demolition, ground clearing, site preparation, grading, stockpiling of materials, onsite movement of equipment, and transportation of materials.

Air pollutant emissions from construction of the Proposed Project include emissions from diesel and gasoline-powered construction equipment, diesel-powered generators, diesel trucks, marine-based diesel equipment and tugboats, and heavy-duty trucks transporting excavated material and delivering construction materials. The construction equipment usage factors, sizes, types, and number of construction equipment were estimated based on preliminary construction activity plans developed by MBTA and are provided in **Appendix A**. Emission factors for NOx, VOC, CO, SO2, and PM2.5 from on-site construction engines were developed using USEPA's NONROAD Emissions Model. For on-road heavy duty truck engines, emissions rates for NOx, VOC, CO, SO2, and PM2.5 were developed using USEPA's Motor Vehicle Emission Simulator (MOVES4) model. Estimates of emissions from tugboats were based on the USEPA Ports Emissions Inventory Guidance.

Total emissions were calculated based on the methodology described above for on-site and on-road emissions. The calculated construction emissions are designed to be conservative estimates and likely overestimate the expected emissions for several reasons, including that the emission factors for nonroad engines made use of underlying default distributions in the NONROAD model and do not account for the greater availability of newer and lower-emitting construction equipment.

An analysis of construction emissions determined the peak year of construction (e.g., 2027 as provided in **Table 1-8**), defined as the year in which the largest amount of pollutant emissions occurs. The assessment then compares the emissions inventory of the peak year of construction to the de minimis thresholds to evaluate whether a General Conformity determination, if required, would indicate that there was a potential for adverse air quality impacts to the attainment of the NAAQS. **Table 1-8** provides a detailed summary of the estimated annual construction emissions with comparisons to the General Conformity de minimis emissions thresholds. As shown, the annual construction emissions are all well below de minimis emission thresholds, and thus anticipated construction air quality impacts are minor.

Table 1-8. Build Alternative Construction Emissions

Construction Year	Emission Totals (tons/year)				
	CO	NOx	VOC	PM2.5	CO_2
2026	7.5	16.5	1.7	0.7	4,978.5
2027	12.4	27.3	2.9	1.1	9,173.9
2028	9.7	24.9	2.6	0.9	8,263.2
2029	7.2	24.2	2.5	1.0	7,585.7
2030	9.5	27.8	2.9	1.1	8,496.1
2031	8.1	27.6	2.9	1.1	8,718.2
2032	9.0	26.7	2.8	1.1	8,271.0
2033	7.8	26.6	2.7	1.0	8,418.3
2034	3.1	5.7	0.6	0.2	2,004.4
***De Minimis* Thresholds**	**100.0**	**100.0**	**50.0**	**100.0**	**NA**

Based on this analysis, MBTA estimates that fewer than 10,000 tons per year of CO_2 will be generated from construction activities. The USEPA major source threshold for CO_2 is 100,000 tons per year. As such, Proposed Project construction emissions are well below the USEPA major source thresholds for GHGs. Given this relatively small contribution, the construction of the Proposed Project will have a negligible impact on climate change due to GHG emissions.

4.2.6.1 Minimization Strategies

Although the Build Alternative would not cause any major adverse impacts during construction, compliance with all applicable laws and regulations would reduce pollutant emissions from construction activity. To mitigate these emissions, construction activities would be performed in accordance with construction level best management practices (BMPs). Strategies that could be considered during construction include:

- apply water suppression at least twice a day to all active construction areas to minimize dust;

- tarp all trucks hauling soil, sand, and other loose materials or require that all trucks maintain at least two feet of freeboard;
- pave, apply water daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites;
- use water sweepers to sweep all paved access roads, parking areas and staging areas at construction sites daily, use water sweepers to sweep all streets daily if visible soil material is carried onto adjacent public streets;
- hydroseed or apply (non-toxic) soil stabilizers to inactive construction areas (previously graded areas inactive for ten days or more);
- enclose, cover, water twice daily or apply (non-toxic) soil binders to exposed stockpiles (dirt, sand, etc.);
- limit traffic speeds on unpaved roads to 15 miles per hour;
- comply with MassDEP's idling regulations [310 CMR 7.11(1) (b)], requiring that engines idle for no more than five minutes. Post idling restriction signage on project construction sites;
- comply with MassDEP's Diesel Retrofit Program (DRP), which promotes the use of such engine emission controls as oxidation catalysts or particulate filters for diesel engines to the maximum extent practicable. In January 2008, MassDEP amended the retrofit applicability requirement to include engines of 50 horsepower or greater that would be on-site for 30 days or more;
- comply with the State's Low Sulfur Diesel standards (301 CMR 7.05) and USEPA's Clean Air Non-road Diesel Rule; and
- replant vegetation as quickly as possible to minimize erosion in disturbed areas.

4.3 Conclusion

The Proposed Project is not expected to cause any air quality impacts as result of operational emissions since there would be no projected increase in diesel passenger train operations.

The Build Alternative is expected to decrease total regional VMT and emissions compared to the existing conditions, and is not expected to change the total regional VMT and emissions compared to the No Action Alternative. With the Build Alternative, the increased annual MBTA commuter passenger trips could otherwise occur by other transportation modes; therefore, the availability of improved commuter rail service will reduce the number of regional vehicle trips. In 2040, the level of emissions from the Build Alternative from regional traffic is expected to be less than in existing conditions as a result of the increased annual MBTA ridership that would otherwise occur by other transportation modes.

As such, the operational phase of the project is not predicted to have any negative impact on regional air quality, or cause or contribute to any new violation of any NAAQS. Locally, the operation of the Build Alternative would not cause adverse impact or increase the frequency or severity of any existing violation of any NAAQS in any area, since the operational condition of the corridor is to remain unchanged with both the Build and No Action alternatives.

Emissions from construction activity are expected to be minimal and are not expected to substantially affect ambient air quality. The construction phase emissions of the Project are not predicted to exceed the General Conformity Rule's de minimis emission thresholds and thus, anticipated construction air quality impacts are minor. The Project will comply with the Transportation Conformity Rule, and therefore the anticipated operational air quality impacts are minor.

Appendix A: Construction Period Emission Estimates

Table A-1
MBTA Draw 1 Project
Construction Equipment Estimates
Construction activity in Boston, MA

Construction Equipment	Type of Fuel	Equipment Rated Engine HP	Average Daily Utilization Rate	Source Classification Code (SCC)	Average Daily Load Factor	Construction Activity Duration		Monthly average number of units in operation	Total Equipment Utilization (hp-hrs)	NONROAD Model Emission Factor (g/hp-hr)					2026 Emission Totals (tons)				
						Average Days/Week	Average hrs/day	2026	2026	CO	NOx	VOC	PM2.5	CO2	CO	NOx	VOC	PM2.5	CO2
Land Based Equipment																			
Air Compressor (185 CFM)	Diesel	55	0.85	2270006015	0.43	5	8	6	250,879	0.49	3.07	0.14	0.05	589.91	0.13	0.85	0.040	0.014	163.13
Back Hoe (Cat 325 or equivalent)	Diesel	190	0.25	2270002066	0.21	5	4	3	31,122	0.72	1.31	0.24	0.12	625.79	0.02	0.05	0.008	0.004	21.47
Ballast Grader	Diesel	270	0.60	2270002048	0.59	2	4	0	0	0.12	0.30	0.13	0.01	536.41	0.00	0.00	0.000	0.000	0.00
Crane (Crawler, 150 Ton)	Diesel	225	0.65	2270002045	0.43	5	4	2	130,806	0.10	0.39	0.13	0.01	530.61	0.01	0.06	0.019	0.002	76.51
Crane (Crawler, 200 Ton)	Diesel	250	0.80	2270002045	0.43	5	4	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Crane (RT, 60 Ton)	Diesel	190	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Drill Rig (Tieback)	Diesel	225	0.85	2270002033	0.43	5	6	0	0	0.40	1.65	0.19	0.08	530.45	0.00	0.00	0.000	0.000	0.00
Dozer (Cat D7 or equivalent)	Diesel	180	0.35	2270002069	0.59	5	6	2	115,970	0.12	0.31	0.13	0.01	536.41	0.02	0.04	0.017	0.001	68.57
Drill Rig (Soilmec 622)	Diesel	410	0.80	2270002033	0.43	5	6	0	0	0.51	1.84	0.17	0.08	530.49	0.00	0.00	0.000	0.000	0.00
Forklift (10000 lb)a	Diesel	105	0.55	2270002057	0.59	2	4	6	85,045	0.21	0.46	0.14	0.03	536.39	0.02	0.04	0.013	0.003	50.28
Generator (150 kWh)	Diesel	200	0.90	2270006005	0.43	5	8	6	965,952	0.43	1.76	0.19	0.09	530.42	0.46	1.87	0.207	0.093	564.77
Generator (350 kWh)	Diesel	475	0.90	2270006005	0.43	5	8	6	2,294,136	0.48	1.73	0.17	0.07	530.50	1.22	4.38	0.432	0.184	1341.52
Hoe Ram	Diesel	250	0.55	2270002006	0.43	5	6	2	184,470	4.45	4.33	0.56	0.35	588.58	0.91	0.88	0.114	0.072	119.68
Light Plant	Diesel	55	0.25	2270002027	0.43	5	2	3	9,224	1.05	3.39	0.20	0.14	589.72	0.01	0.03	0.002	0.001	6.00
Paver	Diesel	224	0.45	2270002009	0.43	1	6	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Roller	Diesel	135	0.45	2270002009	0.43	3	4	2	32,601	2.34	4.46	0.45	0.35	588.94	0.08	0.16	0.016	0.013	21.16
Slurry Plant (75 HP Pump)	Diesel	75	0.90	2270006010	0.43	5	6	0	0	1.20	2.04	0.25	0.19	589.57	0.00	0.00	0.000	0.000	0.00
Tamping Machine	Diesel	130	0.60	2270002006	0.43	2	4	0	0	4.45	4.33	0.56	0.35	588.58	0.00	0.00	0.000	0.000	0.00
Track Loader (Cat 973 or equivalent)	Diesel	210	0.20	2270002066	0.21	3	4	2	11,007	0.72	1.31	0.24	0.12	625.79	0.01	0.02	0.003	0.002	7.59
Welding Machine	Diesel	350	0.25	2270006025	0.21	2	2	6	22,932	1.25	1.92	0.28	0.16	625.66	0.03	0.05	0.007	0.004	15.82
Dynamic Soil Compaction	Diesel	250	0.55	2270002009	0.43	5	4	1	61,490	2.34	4.46	0.45	0.35	588.94	0.16	0.30	0.030	0.024	39.92
Pile driving hammer	Diesel	150	0.55	2270006005	0.43	5	6	1	55,341	0.53	1.86	0.21	0.12	530.38	0.03	0.11	0.013	0.007	32.35
Marine Based Equipment																			
Sheetpile vibratory hammer	Diesel	300	0.55	2270006005	0.43	5	6	1	110,682	0.48	1.73	0.17	0.07	530.50	0.06	0.21	0.021	0.009	64.72
Barge mounted 200 Ton Crane	Diesel	340	0.80	2270002045	0.43			0	0	0.21	0.83	0.14	0.03	530.60	0.00	0.00	0.000	0.000	0.00
Barge mounted 100 Ton Crane	Diesel	230	0.65	2270002045	0.43	5	6	2	200,569	0.10	0.39	0.13	0.01	530.61	0.02	0.09	0.030	0.003	117.31
Pile driving hammer – 800 kJ	Diesel	1500	0.55	2270006005	0.43	5	6	2	1,106,820	0.48	1.73	0.17	0.07	530.50	0.59	2.12	0.208	0.089	647.23
Rock Socket Drilling Rig	Diesel	209	0.85	2270002033	0.43	5	6	0	0	0.40	1.65	0.19	0.08	530.45	0.00	0.00	0.000	0.000	0.00
Tugboats (1500 HP)- Main Engine	Diesel	1500	0.6	-	0.50	2	2	6	561,600	0.69	4.21	0.22	0.11	506.69	0.42	2.60	0.136	0.066	313.66
Delivery Barges	Diesel	1500	0.6	-	0.50	1	4	4	374,400	0.69	4.21	0.22	0.11	506.69	0.28	1.74	0.091	0.044	209.11
Compressors - surface tools	Diesel	275	0.75	2270006015	0.43	5	8	6	1,106,820	0.12	0.54	0.14	0.02	530.60	0.15	0.65	0.167	0.025	647.36
Concrete pump - general	Diesel	250	0.75	2270006010	0.43	2	4	0	0	0.44	1.76	0.19	0.09	530.42	0.00	0.00	0.000	0.000	0.00
Excavator - long reach, tracked	Diesel	203	0.25	2270002036	0.59	5	4	0	0	0.12	0.29	0.13	0.01	536.41	0.00	0.00	0.000	0.000	0.00
Telescopic boom - self-propelled	Diesel	75	0.55	2270002045	0.43	5	4	0	0	0.35	0.44	0.14	0.03	589.93	0.00	0.00	0.000	0.000	0.00
On-Road and Marine Sources																			
Construction Dirt Handling, Marine Vessels, Material Deliveries and Removals	**Units**	**Total Miles per Round Trip within Boston Metro**		**Vehicle Category Code**		**Construction Activity Duration**		**Monthly average number of units**	**Total Vehicle Miles Traveled**	**MOVES Model Emission Factor (g/VMT)**					**2026 Emission Totals (tons)**				
						Average Days/Week	**Average hrs/day**	**2024**	**2024**	**CO**	**NOx**	**VOC**	**PM2.5**	**CO2**	**CO**	**NOx**	**VOC**	**PM2.5**	**CO2**
Worker Commutes	Number of Workers per Day	40		LDT/LDC		5	NA	96	998,400	2.44	0.10	0.08	0.01	334.57	2.69	0.11	0.093	0.010	368.20
Trucks - Delivery, Removal, Worker, Dirt Handling, etc.	Number of Vehicles per Day	40		HDDV		5		4	41,600	2.13	1.17	0.23	0.04	928.52	0.10	0.05	0.011	0.002	42.58
Dump Truck	Number of Vehicles per Day	5		HDDV		2	4	6	12,480	2.13	1.17	0.23	0.04	928.52	0.03	0.02	0.003	0.001	12.77
Tractor Trailer	Number of Vehicles per Day	5		HDDV		2	4	6	12,480	2.59	4.42	0.16	0.09	1716.62	0.04	0.06	0.002	0.001	23.61
Truck Mixer	Number of Vehicles per Day	5		HDDV		3	4	1	3,120	2.13	1.17	0.23	0.04	928.52	0.01	0.00	0.001	0.000	3.19
Flat deck barges (materials transport)	Number of Vessels per Day	30		MARINE		1	4	2	Included in NonRoad Estimates										
Pile delivery barges	Number of Vessels per Day	30		MARINE		1	4	2											
														TOTAL	**2.86**	**0.25**	**0.11**	**0.01**	**450.36**

Notes - Includes total estimates for all three stages of construction as outlined in EA.

Stage 1: constructing the new bridge to the west along with new Station Tracks 11 and 12, the associated platform, and a new Tower A, and modifying the North Bank Bridge.

Stage 2 consists of the replacement of the existing west bridge. During this phase of work, the North and South Trestle will be constructed to the limits that are available without impacting active tracks.

Table A-2
MBTA Draw 1 Project
Construction Equipment Estimates
Construction activity in Boston, MA

Construction Equipment	Type of Fuel	Equipment Rated Engine HP	Average Daily Utilization Rate	Source Classification Code (SCC)	Average Daily Load Factor	Construction Activity Duration		Monthly average number of units in	Total Equipment Utilization (hp-hrs)	NONROAD Model Emission Factor (g/hp-hr)					2027 Emission Totals (tons)				
						Average Days/Week	Average hrs/day	2027	2027	CO	NOx	VOC	PM2.5	CO2	CO	NOx	VOC	PM2.5	CO2
Land Based Equipment																			
Air Compressor (185 CFM)	Diesel	55	0.85	2270006015	0.43	5	8	12	501,758	0.49	3.07	0.14	0.05	589.91	0.27	1.70	0.080	0.028	326.27
Back Hoe (Cat 325 or equivalent)	Diesel	190	0.25	2270002066	0.21	5	4	4	41,496	0.72	1.31	0.24	0.12	625.79	0.03	0.06	0.011	0.006	28.62
Ballast Grader	Diesel	270	0.60	2270002048	0.59	2	4	1	39,761	0.12	0.30	0.13	0.01	536.41	0.01	0.01	0.006	0.000	23.51
Crane (Crawler, 150 Ton)	Diesel	225	0.65	2270002045	0.43	5	4	6	392,418	0.10	0.39	0.13	0.01	530.61	0.04	0.17	0.058	0.006	229.52
Crane (Crawler, 200 Ton)	Diesel	250	0.80	2270002045	0.43	5	4	11	983,840	0.10	0.39	0.13	0.01	530.61	0.11	0.43	0.145	0.016	575.44
Crane (RT, 60 Ton)	Diesel	190	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Drill Rig (Tieback)	Diesel	225	0.85	2270002033	0.43	5	6	1	128,291	0.40	1.65	0.19	0.08	530.45	0.06	0.23	0.026	0.012	75.01
Dozer (Cat D7 or equivalent)	Diesel	180	0.35	2270002069	0.59	5	6	2	115,970	0.12	0.31	0.13	0.01	536.41	0.02	0.04	0.017	0.001	68.57
Drill Rig (Soilmec 622)	Diesel	410	0.80	2270002033	0.43	5	6	2	440,045	0.51	1.84	0.17	0.08	530.49	0.25	0.89	0.084	0.040	257.32
Forklift (10000 lb)a	Diesel	105	0.55	2270002057	0.59	2	4	12	170,090	0.21	0.46	0.14	0.03	536.39	0.04	0.09	0.026	0.006	100.57
Generator (150 kWh)	Diesel	200	0.90	2270006005	0.43	5	8	12	1,931,904	0.43	1.76	0.19	0.09	530.42	0.92	3.74	0.413	0.185	1129.55
Generator (350 kWh)	Diesel	475	0.90	2270006005	0.43	5	8	12	4,588,272	0.48	1.73	0.17	0.07	530.50	2.45	8.77	0.864	0.367	2683.04
Hoe Ram	Diesel	250	0.55	2270002006	0.43	5	6	1	92,235	4.45	4.33	0.56	0.35	588.58	0.45	0.44	0.057	0.036	59.84
Light Plant	Diesel	55	0.25	2270002027	0.43	5	2	6	18,447	1.05	3.39	0.20	0.14	589.72	0.02	0.07	0.004	0.003	11.99
Paver	Diesel	224	0.45	2270002009	0.43	1	6	1.5	20,285	2.34	4.46	0.45	0.35	588.94	0.05	0.10	0.010	0.008	13.17
Roller	Diesel	135	0.45	2270002009	0.43	3	4	2	32,601	2.34	4.46	0.45	0.35	588.94	0.08	0.16	0.016	0.013	21.16
Slurry Plant (75 HP Pump)	Diesel	75	0.90	2270006010	0.43	5	6	2	90,558	1.20	2.04	0.25	0.19	589.57	0.12	0.20	0.025	0.019	58.85
Tamping Machine	Diesel	130	0.60	2270002006	0.43	2	4	1	13,953	4.45	4.33	0.56	0.35	588.58	0.07	0.07	0.009	0.005	9.05
Track Loader (Cat 973 or equivalent)	Diesel	210	0.20	2270002066	0.21	3	4	2	11,007	0.72	1.31	0.24	0.12	625.79	0.01	0.02	0.003	0.002	7.59
Welding Machine	Diesel	350	0.25	2270006025	0.21	2	2	6	22,932	1.25	1.92	0.28	0.16	625.66	0.03	0.05	0.007	0.004	15.82
Dynamic Soil Compaction	Diesel	250	0.55	2270002009	0.43	5	4	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Pile driving hammer	Diesel	150	0.55	2270006005	0.43	5	6	5	276,705	0.53	1.86	0.21	0.12	530.38	0.16	0.57	0.063	0.035	161.77
Marine Based Equipment																			
Sheetpile vibratory hammer	Diesel	300	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Barge mounted 200 Ton Crane	Diesel	340	0.80	2270002045	0.43			0	0	0.21	0.83	0.14	0.03	530.60	0.00	0.00	0.000	0.000	0.00
Barge mounted 100 Ton Crane	Diesel	230	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Pile driving hammer – 800 kJ	Diesel	1500	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Rock Socket Drilling Rig	Diesel	209	0.85	2270002033	0.43	5	6	2	238,335	0.40	1.65	0.19	0.08	530.45	0.10	0.43	0.049	0.021	139.36
Tugboats (1500 HP)- Main Engine	Diesel	1500	0.6	-	0.50	2	2	12	1,123,200	0.69	4.21	0.22	0.11	506.69	0.85	5.21	0.273	0.133	627.33
Delivery Barges	Diesel	1500	0.6	-	0.50	1	4	4	374,400	0.69	4.21	0.22	0.11	506.69	0.28	1.74	0.091	0.044	209.11
Compressors - surface tools	Diesel	275	0.75	2270006015	0.43	5	8	12	2,213,640	0.12	0.54	0.14	0.02	530.60	0.30	1.31	0.335	0.050	1294.71
Concrete pump - general	Diesel	250	0.75	2270006010	0.43	2	4	4	134,160	0.44	1.76	0.19	0.09	530.42	0.06	0.26	0.029	0.013	78.44
Excavator - long reach, tracked	Diesel	203	0.25	2270002036	0.59	5	4	3	93,421	0.12	0.29	0.13	0.01	536.41	0.01	0.03	0.014	0.001	55.24
Telescopic boom - self-propelled	Diesel	75	0.55	2270002045	0.43	5	4	3	55,341	0.35	0.44	0.14	0.03	589.93	0.02	0.03	0.008	0.002	35.99
On-Road and Marine Sources																			
Construction Dirt Handling, Marine Vessels, Material Deliveries and Removals	**Units**	**Total Miles per Round Trip within Boston Metro**		**Vehicle Category Code**		**Construction Activity Duration**		**Monthly average number**	**Total Vehicle Miles Traveled**	**MOVES Model Emission Factor (g/VMT)**					**2027 Emission Totals (tons)**				
						Average Days/Week	**Average hrs/day**	**2025**	**2025**	**CO**	**NOx**	**VOC**	**PM2.5**	**CO2**	**CO**	**NOx**	**VOC**	**PM2.5**	**CO2**
Worker Commutes	Number of Workers per Day	40		LDT/LDC		5	NA	190	1,976,000	2.44	0.10	0.08	0.01	334.57	5.32	0.22	0.183	0.020	728.73
Trucks - Delivery, Removal, Worker, Dirt Handling, etc.	Number of Vehicles per Day	40		HDDV		5		5	52,000	2.13	1.17	0.23	0.04	928.52	0.12	0.07	0.013	0.003	53.22
Dump Truck	Number of Vehicles per Day	5		HDDV		2	4	12	24,960	2.13	1.17	0.23	0.04	928.52	0.06	0.03	0.006	0.001	25.55
Tractor Trailer	Number of Vehicles per Day	5		HDDV		2	4	12	24,960	2.59	4.42	0.16	0.09	1716.62	0.07	0.12	0.004	0.002	47.23
Truck Mixer	Number of Vehicles per Day	5		HDDV		3	4	7	21,840	2.13	1.17	0.23	0.04	928.52	0.05	0.03	0.006	0.001	22.35
Flat deck barges (materials transport)	Number of Vessels per Day	30		MARINE		1	4	3	Included in NonRoad Estimates										
Pile delivery barges	Number of Vessels per Day	30		MARINE		1	4	1											
														TOTAL	**5.62**	**0.47**	**0.21**	**0.03**	**877.08**

Notes - Includes total estimates for all three stages of construction as outlined in EA.
Stage 1: constructing the new bridge to the west along with new Station Tracks 11 and 12, the associated platform, and a new Tower A, and modifying the North Bank Bridge.
Stage 2 consists of the replacement of the existing west bridge. During this phase of work, the North and South Trestle will be constructed to the limits that are available without impacting active tracks.
Stage 3 consists of the replacement of the existing east bridge.

Table A-3
MBTA Draw 1 Project
Construction Equipment Estimates
Construction activity in Boston, MA

Construction Equipment	Type of Fuel	Equipment Rated Engine HP	Average Daily Utilization Rate	Source Classification Code (SCC)	Average Daily Load Factor	Construction Activity Duration		Monthly average number of units in operation	Total Equipment Utilization (hp-hrs)	NONROAD Model Emission Factor (g/hp-hr)					2028 Emission Totals (tons)				
						Average Days/Week	Average hrs/day	2028	2028	CO	NOx	VOC	PM2.5	CO2	CO	NOx	VOC	PM2.5	CO2
Land Based Equipment																			
Air Compressor (185 CFM)	Diesel	55	0.85	2270006015	0.43	5	8	12	501,758	0.49	3.07	0.14	0.05	589.91	0.27	1.70	0.080	0.028	326.27
Back Hoe (Cat 325 or equivalent)	Diesel	190	0.25	2270002066	0.21	5	4	1	10,374	0.72	1.31	0.24	0.12	625.79	0.01	0.02	0.003	0.001	7.16
Ballast Grader	Diesel	270	0.60	2270002048	0.59	2	4	4	159,045	0.12	0.30	0.13	0.01	536.41	0.02	0.05	0.023	0.002	94.04
Crane (Crawler, 150 Ton)	Diesel	225	0.65	2270002045	0.43	5	4	3	196,209	0.10	0.39	0.13	0.01	530.61	0.02	0.08	0.029	0.003	114.76
Crane (Crawler, 200 Ton)	Diesel	250	0.80	2270002045	0.43	5	4	12	1,073,280	0.10	0.39	0.13	0.01	530.61	0.11	0.46	0.158	0.017	627.75
Crane (RT, 60 Ton)	Diesel	190	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Drill Rig (Tieback)	Diesel	225	0.85	2270002033	0.43	5	6	0	0	0.40	1.65	0.19	0.08	530.45	0.00	0.00	0.000	0.000	0.00
Dozer (Cat D7 or equivalent)	Diesel	180	0.35	2270002069	0.59	5	6	3	173,956	0.12	0.31	0.13	0.01	536.41	0.02	0.06	0.025	0.002	102.86
Drill Rig (Soilmec 622)	Diesel	410	0.80	2270002033	0.43	5	6	0	0	0.51	1.84	0.17	0.08	530.49	0.00	0.00	0.000	0.000	0.00
Forklift (10000 lb)a	Diesel	105	0.55	2270002057	0.59	2	4	12	170,090	0.21	0.46	0.14	0.03	536.39	0.04	0.09	0.026	0.006	100.57
Generator (150 kWh)	Diesel	200	0.90	2270006005	0.43	5	8	12	1,931,904	0.43	1.76	0.19	0.09	530.42	0.92	3.74	0.413	0.185	1129.55
Generator (350 kWh)	Diesel	475	0.90	2270006005	0.43	5	8	12	4,588,272	0.48	1.73	0.17	0.07	530.50	2.45	8.77	0.864	0.367	2683.04
Hoe Ram	Diesel	250	0.55	2270002006	0.43	5	6	1	92,235	4.45	4.33	0.56	0.35	588.58	0.45	0.44	0.057	0.036	59.84
Light Plant	Diesel	55	0.25	2270002027	0.43	5	2	6	18,447	1.05	3.39	0.20	0.14	589.72	0.02	0.07	0.004	0.003	11.99
Paver	Diesel	224	0.45	2270002009	0.43	1	6	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Roller	Diesel	135	0.45	2270002009	0.43	3	4	2	32,601	2.34	4.46	0.45	0.35	588.94	0.08	0.16	0.016	0.013	21.16
Slurry Plant (75 HP Pump)	Diesel	75	0.90	2270006010	0.43	5	6	0	0	1.20	2.04	0.25	0.19	589.57	0.00	0.00	0.000	0.000	0.00
Tamping Machine	Diesel	130	0.60	2270002006	0.43	2	4	1	13,953	4.45	4.33	0.56	0.35	588.58	0.07	0.07	0.009	0.005	9.05
Track Loader (Cat 973 or equivalent)	Diesel	210	0.20	2270002066	0.21	3	4	0	0	0.72	1.31	0.24	0.12	625.79	0.00	0.00	0.000	0.000	0.00
Welding Machine	Diesel	350	0.25	2270006025	0.21	2	2	6	22,932	1.25	1.92	0.28	0.16	625.66	0.03	0.05	0.007	0.004	15.82
Dynamic Soil Compaction	Diesel	250	0.55	2270002009	0.43	5	4	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Pile driving hammer	Diesel	150	0.55	2270006005	0.43	5	6	3	166,023	0.53	1.86	0.21	0.12	530.38	0.10	0.34	0.038	0.021	97.06
Marine Based Equipment																			
Sheetpile vibratory hammer	Diesel	300	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Barge mounted 200 Ton Crane	Diesel	340	0.80	2270002045	0.43			0	0	0.21	0.83	0.14	0.03	530.60	0.00	0.00	0.000	0.000	0.00
Barge mounted 100 Ton Crane	Diesel	230	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Pile driving hammer – 800 kJ	Diesel	1500	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Rock Socket Drilling Rig	Diesel	209	0.85	2270002033	0.43	5	6	0	0	0.40	1.65	0.19	0.08	530.45	0.00	0.00	0.000	0.000	0.00
Tugboats (1500 HP)- Main Engine	Diesel	1500	0.6	-	0.50	2	2	12	1,123,200	0.69	4.21	0.22	0.11	506.69	0.85	5.21	0.273	0.133	627.33
Delivery Barges	Diesel	1500	0.6	-	0.50	1	4	4	374,400	0.69	4.21	0.22	0.11	506.69	0.28	1.74	0.091	0.044	209.11
Compressors - surface tools	Diesel	275	0.75	2270006015	0.43	5	8	12	2,213,640	0.12	0.54	0.14	0.02	530.60	0.30	1.31	0.335	0.050	1294.71
Concrete pump - general	Diesel	250	0.75	2270006010	0.43	2	4	1	33,540	0.44	1.76	0.19	0.09	530.42	0.02	0.07	0.007	0.003	19.61
Excavator - long reach, tracked	Diesel	203	0.25	2270002036	0.59	5	4	1	31,140	0.12	0.29	0.13	0.01	536.41	0.00	0.01	0.005	0.000	18.41
Telescopic boom - self-propelled	Diesel	75	0.55	2270002045	0.43	5	4	9	166,023	0.35	0.44	0.14	0.03	589.93	0.06	0.08	0.025	0.005	107.96

On-Road and Marine Sources																			
Construction Dirt Handling, Marine Vessels, Material Deliveries and Removals	**Units**	**Total Miles per Round Trip within Boston Metro**	**Vehicle Category Code**	**Construction Activity Duration**		**Monthly average number of units in**	**Total Vehicle Miles Traveled (VMT)**	**MOVES Model Emission Factor (g/VMT)**					**2028 Emission Totals (tons)**				
				Average Days/Week	**Average hrs/day**	**2026**	**2026**	**CO**	**NOx**	**VOC**	**PM2.5**	**CO2**	**CO**	**NOx**	**VOC**	**PM2.5**	**CO2**
Worker Commutes	Number of Workers per Day	40	LDT/LDC	5	NA	120	1,248,000	2.44	0.10	0.08	0.01	334.57	3.36	0.14	0.116	0.013	460.25
Trucks - Delivery, Removal, Worker, Dirt Handling, etc.	Number of Vehicles per Day	40	HDDV	5		4	41,600	2.13	1.17	0.23	0.04	928.52	0.10	0.05	0.011	0.002	42.58
Dump Truck	Number of Vehicles per Day	5	HDDV	2	4	12	24,960	2.13	1.17	0.23	0.04	928.52	0.06	0.03	0.006	0.001	25.55
Tractor Trailer	Number of Vehicles per Day	5	HDDV	2	4	12	24,960	2.59	4.42	0.16	0.09	1716.62	0.07	0.12	0.004	0.002	47.23
Truck Mixer	Number of Vehicles per Day	5	HDDV	3	4	3	9,360	2.13	1.17	0.23	0.04	928.52	0.02	0.01	0.002	0.000	9.58
Flat deck barges (materials transport)	Number of Vessels per Day	30	MARINE	1	4	3	Included in NonRoad Estimates										
Pile delivery barges	Number of Vessels per Day	30	MARINE	1	4	1											
												TOTAL	**3.61**	**0.36**	**0.14**	**0.02**	**585.19**

Notes - Includes total estimates for all three stages of construction as outlined in EA.
Stage 1: constructing the new bridge to the west along with new Station Tracks 11 and 12, the associated platform, and a new Tower A, and modifying the North Bank Bridge.
Stage 2 consists of the replacement of the existing west bridge. During this phase of work, the North and South Trestle will be constructed to the limits that are available without impacting active tracks.
Stage 3 consists of the replacement of the existing east bridge.

Table A-4
MBTA Draw 1 Project
Construction Equipment Estimates
Construction activity in Boston, MA

Construction Equipment	Type of Fuel	Equipment Rated Engine HP	Average Daily Utilization Rate	Source Classification Code (SCC)	Average Daily Load Factor	Construction Activity Duration		Monthly average number of units in operation	Total Equipment Utilization (hp-hrs)	NONROAD Model Emission Factor (g/hp-hr)					2029 Emission Totals (tons)				
						Average Days/Week	Average hrs/day	2029	2029	CO	NOx	VOC	PM2.5	CO2	CO	NOx	VOC	PM2.5	CO2
Land Based Equipment																			
Air Compressor (185 CFM)	Diesel	55	0.85	2270006015	0.43	5	8	12	501,758	0.49	3.07	0.14	0.05	589.91	0.27	1.70	0.080	0.028	326.27
Back Hoe (Cat 325 or equivalent)	Diesel	190	0.25	2270002066	0.21	5	4	0	0	0.72	1.31	0.24	0.12	625.79	0.00	0.00	0.000	0.000	0.00
Ballast Grader	Diesel	270	0.60	2270002048	0.59	2	4	3	119,284	0.12	0.30	0.13	0.01	536.41	0.02	0.04	0.017	0.001	70.53
Crane (Crawler, 150 Ton)	Diesel	225	0.65	2270002045	0.43	5	4	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Crane (Crawler, 200 Ton)	Diesel	250	0.80	2270002045	0.43	5	4	12	1,073,280	0.10	0.39	0.13	0.01	530.61	0.11	0.46	0.158	0.017	627.75
Crane (RT, 60 Ton)	Diesel	190	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Drill Rig (Tieback)	Diesel	225	0.85	2270002033	0.43	5	6	0	0	0.40	1.65	0.19	0.08	530.45	0.00	0.00	0.000	0.000	0.00
Dozer (Cat D7 or equivalent)	Diesel	180	0.35	2270002069	0.59	5	6	3	173,956	0.12	0.31	0.13	0.01	536.41	0.02	0.06	0.025	0.002	102.86
Drill Rig (Soilmec 622)	Diesel	410	0.80	2270002033	0.43	5	6	0	0	0.51	1.84	0.17	0.08	530.49	0.00	0.00	0.000	0.000	0.00
Forklift (10000 lb)a	Diesel	105	0.55	2270002057	0.59	2	4	12	170,090	0.21	0.46	0.14	0.03	536.39	0.04	0.09	0.026	0.006	100.57
Generator (150 kWh)	Diesel	200	0.90	2270006005	0.43	5	8	12	1,931,904	0.43	1.76	0.19	0.09	530.42	0.92	3.74	0.413	0.185	1129.55
Generator (350 kWh)	Diesel	475	0.90	2270006005	0.43	5	8	12	4,588,272	0.48	1.73	0.17	0.07	530.50	2.45	8.77	0.864	0.367	2683.04
Hoe Ram	Diesel	250	0.55	2270002006	0.43	5	6	2	184,470	4.45	4.33	0.56	0.35	588.58	0.91	0.88	0.114	0.072	119.68
Light Plant	Diesel	55	0.25	2270002027	0.43	5	2	6	18,447	1.05	3.39	0.20	0.14	589.72	0.02	0.07	0.004	0.003	11.99
Paver	Diesel	224	0.45	2270002009	0.43	1	6	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Roller	Diesel	135	0.45	2270002009	0.43	3	4	2	32,601	2.34	4.46	0.45	0.35	588.94	0.08	0.16	0.016	0.013	21.16
Slurry Plant (75 HP Pump)	Diesel	75	0.90	2270006010	0.43	5	6	2	90,558	1.20	2.04	0.25	0.19	589.57	0.12	0.20	0.025	0.019	58.85
Tamping Machine	Diesel	130	0.60	2270002006	0.43	2	4	1	13,953	4.45	4.33	0.56	0.35	588.58	0.07	0.07	0.009	0.005	9.05
Track Loader (Cat 973 or equivalent)	Diesel	210	0.20	2270002066	0.21	3	4	0	0	0.72	1.31	0.24	0.12	625.79	0.00	0.00	0.000	0.000	0.00
Welding Machine	Diesel	350	0.25	2270006025	0.21	2	2	6	22,932	1.25	1.92	0.28	0.16	625.66	0.03	0.05	0.007	0.004	15.82
Dynamic Soil Compaction	Diesel	250	0.55	2270002009	0.43	5	4	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Pile driving hammer	Diesel	150	0.55	2270006005	0.43	5	6	2	110,682	0.53	1.86	0.21	0.12	530.38	0.06	0.23	0.025	0.014	64.71
Marine Based Equipment																			
Sheetpile vibratory hammer	Diesel	300	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Barge mounted 200 Ton Crane	Diesel	340	0.80	2270002045	0.43			0	0	0.21	0.83	0.14	0.03	530.60	0.00	0.00	0.000	0.000	0.00
Barge mounted 100 Ton Crane	Diesel	230	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Pile driving hammer – 800 kJ	Diesel	1500	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Rock Socket Drilling Rig	Diesel	209	0.85	2270002033	0.43	5	6	0	0	0.40	1.65	0.19	0.08	530.45	0.00	0.00	0.000	0.000	0.00
Tugboats (1500 HP)- Main Engine	Diesel	1500	0.6	-	0.50	2	2	12	1,123,200	0.69	4.21	0.22	0.11	506.69	0.85	5.21	0.273	0.133	627.33
Delivery Barges	Diesel	1500	0.6	-	0.50	1	4	2	187,200	0.69	4.21	0.22	0.11	506.69	0.14	0.87	0.045	0.022	104.55
Compressors - surface tools	Diesel	275	0.75	2270006015	0.43	5	8	12	2,213,640	0.12	0.54	0.14	0.02	530.60	0.30	1.31	0.335	0.050	1294.71
Concrete pump - general	Diesel	250	0.75	2270006010	0.43	2	4	1	33,540	0.44	1.76	0.19	0.09	530.42	0.02	0.07	0.007	0.003	19.61
Excavator - long reach, tracked	Diesel	203	0.25	2270002036	0.59	5	4	1	31,140	0.12	0.29	0.13	0.01	536.41	0.00	0.01	0.005	0.000	18.41
Telescopic boom - self-propelled	Diesel	75	0.55	2270002045	0.43	5	4	0	0	0.35	0.44	0.14	0.03	589.93	0.00	0.00	0.000	0.000	0.00

On-Road and Marine Sources

Construction Dirt Handling, Marine Vessels, Material Deliveries and Removals	Units	Total Miles per Round Trip within Boston Metro	Vehicle Category Code	Construction Activity Duration		Monthly average number of units	Total Vehicle Miles Traveled (VMT)	MOVES Model Emission Factor (g/VMT)					2029 Emission Totals (tons)				
				Average Days/Week	Average hrs/day	2027	2027	CO	NOx	VOC	PM2.5	CO2	CO	NOx	VOC	PM2.5	CO2
Worker Commutes	Number of Workers per Day	40	LDT/LDC	5	NA	20	208,000	2.44	0.10	0.08	0.01	334.57	0.56	0.02	0.019	0.002	76.71
Trucks - Delivery, Removal, Worker, Dirt Handling, etc.	Number of Vehicles per Day	40	HDDV	5		1	10,400	2.13	1.17	0.23	0.04	928.52	0.02	0.01	0.003	0.001	10.64
Dump Truck	Number of Vehicles per Day	5	HDDV	2	4	12	24,960	2.13	1.17	0.23	0.04	928.52	0.06	0.03	0.006	0.001	25.55
Tractor Trailer	Number of Vehicles per Day	5	HDDV	2	4	12	24,960	2.59	4.42	0.16	0.09	1716.62	0.07	0.12	0.004	0.002	47.23
Truck Mixer	Number of Vehicles per Day	5	HDDV	3	4	6	18,720	2.13	1.17	0.23	0.04	928.52	0.04	0.02	0.005	0.001	19.16
Flat deck barges (materials transport)	Number of Vessels per Day	30	MARINE	1	4	1	Included in NonRoad Estimates										
Pile delivery barges	Number of Vessels per Day	30	MARINE	1	4	1											
												TOTAL	**0.76**	**0.21**	**0.04**	**0.01**	**179.29**

Notes - Includes total estimates for all three stages of construction as outlined in EA.
Stage 1: constructing the new bridge to the west along with new Station Tracks 11 and 12, the associated platform, and a new Tower A, and modifying the North Bank Bridge.
Stage 2 consists of the replacement of the existing west bridge. During this phase of work, the North and South Trestle will be constructed to the limits that are available without impacting active tracks.
Stage 3 consists of the replacement of the existing east bridge.

Table A-5
MBTA Draw 1 Project
Construction Equipment Estimates
Construction activity in Boston, MA

Construction Equipment	Type of Fuel	Equipment Rated Engine HP	Average Daily Utilization Rate	Source Classification Code (SCC)	Average Daily Load Factor	Construction Activity Duration		Monthly average number of units in operation	Total Equipment Utilization (hp-hrs)	NONROAD Model Emission Factor (g/hp-hr)					2030 Emission Totals (tons)				
						Average Days/Week	Average hrs/day	2030	2030	CO	NOx	VOC	PM2.5	CO2	CO	NOx	VOC	PM2.5	CO2
Land Based Equipment																			
Air Compressor (185 CFM)	Diesel	55	0.85	2270006015	0.43	5	8	12	501,758	0.49	3.07	0.14	0.05	589.91	0.27	1.70	0.080	0.028	326.27
Back Hoe (Cat 325 or equivalent)	Diesel	190	0.25	2270002066	0.21	5	4	0	0	0.72	1.31	0.24	0.12	625.79	0.00	0.00	0.000	0.000	0.00
Ballast Grader	Diesel	270	0.60	2270002048	0.59	2	4	4	159,045	0.12	0.30	0.13	0.01	536.41	0.02	0.05	0.023	0.002	94.04
Crane (Crawler, 150 Ton)	Diesel	225	0.65	2270002045	0.43	5	4	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Crane (Crawler, 200 Ton)	Diesel	250	0.80	2270002045	0.43	5	4	12	1,073,280	0.10	0.39	0.13	0.01	530.61	0.11	0.46	0.158	0.017	627.75
Crane (RT, 60 Ton)	Diesel	190	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Drill Rig (Tieback)	Diesel	225	0.85	2270002033	0.43	5	6	0	0	0.40	1.65	0.19	0.08	530.45	0.00	0.00	0.000	0.000	0.00
Dozer (Cat D7 or equivalent)	Diesel	180	0.35	2270002069	0.59	5	6	4	231,941	0.12	0.31	0.13	0.01	536.41	0.03	0.08	0.034	0.003	137.14
Drill Rig (Soilmec 622)	Diesel	410	0.80	2270002033	0.43	5	6	2	440,045	0.51	1.84	0.17	0.08	530.49	0.25	0.89	0.084	0.040	257.32
Forklift (10000 lb)a	Diesel	105	0.55	2270002057	0.59	2	4	12	170,090	0.21	0.46	0.14	0.03	536.39	0.04	0.09	0.026	0.006	100.57
Generator (150 kWh)	Diesel	200	0.90	2270006005	0.43	5	8	12	1,931,904	0.43	1.76	0.19	0.09	530.42	0.92	3.74	0.413	0.185	1129.55
Generator (350 kWh)	Diesel	475	0.90	2270006005	0.43	5	8	12	4,588,272	0.48	1.73	0.17	0.07	530.50	2.45	8.77	0.864	0.367	2683.04
Hoe Ram	Diesel	250	0.55	2270002006	0.43	5	6	5	461,175	4.45	4.33	0.56	0.35	588.58	2.26	2.20	0.285	0.180	299.20
Light Plant	Diesel	55	0.25	2270002027	0.43	5	2	6	18,447	1.05	3.39	0.20	0.14	589.72	0.02	0.07	0.004	0.003	11.99
Paver	Diesel	224	0.45	2270002009	0.43	1	6	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Roller	Diesel	135	0.45	2270002009	0.43	3	4	2	32,601	2.34	4.46	0.45	0.35	588.94	0.08	0.16	0.016	0.013	21.16
Slurry Plant (75 HP Pump)	Diesel	75	0.90	2270006010	0.43	5	6	0	0	1.20	2.04	0.25	0.19	589.57	0.00	0.00	0.000	0.000	0.00
Tamping Machine	Diesel	130	0.60	2270002006	0.43	2	4	1	13,953	4.45	4.33	0.56	0.35	588.58	0.07	0.07	0.009	0.005	9.05
Track Loader (Cat 973 or equivalent)	Diesel	210	0.20	2270002066	0.21	3	4	0	0	0.72	1.31	0.24	0.12	625.79	0.00	0.00	0.000	0.000	0.00
Welding Machine	Diesel	350	0.25	2270006025	0.21	2	2	6	22,932	1.25	1.92	0.28	0.16	625.66	0.03	0.05	0.007	0.004	15.82
Dynamic Soil Compaction	Diesel	250	0.55	2270002009	0.43	5	4	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Pile driving hammer	Diesel	150	0.55	2270006005	0.43	5	6	3	166,023	0.53	1.86	0.21	0.12	530.38	0.10	0.34	0.038	0.021	97.06
Marine Based Equipment																			
Sheetpile vibratory hammer	Diesel	300	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Barge mounted 200 Ton Crane	Diesel	340	0.80	2270002045	0.43			0	0	0.21	0.83	0.14	0.03	530.60	0.00	0.00	0.000	0.000	0.00
Barge mounted 100 Ton Crane	Diesel	230	0.65	2270002045	0.43	5	6	2	200,569	0.10	0.39	0.13	0.01	530.61	0.02	0.09	0.030	0.003	117.31
Pile driving hammer – 800 kJ	Diesel	1500	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Rock Socket Drilling Rig	Diesel	209	0.85	2270002033	0.43	5	6	2	238,335	0.40	1.65	0.19	0.08	530.45	0.10	0.43	0.049	0.021	139.36
Tugboats (1500 HP)- Main Engine	Diesel	1500	0.6	-	0.50	2	2	12	1,123,200	0.69	4.21	0.22	0.11	506.69	0.85	5.21	0.273	0.133	627.33
Delivery Barges	Diesel	1500	0.6	-	0.50	1	4	4	374,400	0.69	4.21	0.22	0.11	506.69	0.28	1.74	0.091	0.044	209.11
Compressors - surface tools	Diesel	275	0.75	2270006015	0.43	5	8	12	2,213,640	0.12	0.54	0.14	0.02	530.60	0.30	1.31	0.335	0.050	1294.71
Concrete pump - general	Diesel	250	0.75	2270006010	0.43	2	4	2	67,080	0.44	1.76	0.19	0.09	530.42	0.03	0.13	0.014	0.007	39.22
Excavator - long reach, tracked	Diesel	203	0.25	2270002036	0.59	5	4	1	31,140	0.12	0.29	0.13	0.01	536.41	0.00	0.01	0.005	0.000	18.41
Telescopic boom - self-propelled	Diesel	75	0.55	2270002045	0.43	5	4	0	0	0.35	0.44	0.14	0.03	589.93	0.00	0.00	0.000	0.000	0.00

On-Road and Marine Sources

Construction Dirt Handling, Marine Vessels, Material Deliveries and Removals	Units	Total Miles per Round Trip within Boston Metro	Vehicle Category Code	Construction Activity Duration		Monthly average number of units in	Total Vehicle Miles Traveled (VMT)	MOVES Model Emission Factor (g/VMT)					2030 Emission Totals (tons)				
				Average Days/Week	Average hrs/day	2028	2028	CO	NOx	VOC	PM2.5	CO2	CO	NOx	VOC	PM2.5	CO2
Worker Commutes	Number of Workers per Day	40	LDT/LDC	5	NA	36	374,400	2.44	0.10	0.08	0.01	334.57	1.01	0.04	0.035	0.004	138.08
Trucks - Delivery, Removal, Worker, Dirt Handling, etc.	Number of Vehicles per Day	40	HDDV	5		1	10,400	2.13	1.17	0.23	0.04	928.52	0.02	0.01	0.003	0.001	10.64
Dump Truck	Number of Vehicles per Day	5	HDDV	2	4	12	24,960	2.13	1.17	0.23	0.04	928.52	0.06	0.03	0.006	0.001	25.55
Tractor Trailer	Number of Vehicles per Day	5	HDDV	2	4	12	24,960	2.59	4.42	0.16	0.09	1716.62	0.07	0.12	0.004	0.002	47.23
Truck Mixer	Number of Vehicles per Day	5	HDDV	3	4	6	18,720	2.13	1.17	0.23	0.04	928.52	0.04	0.02	0.005	0.001	19.16
Flat deck barges (materials transport)	Number of Vessels per Day	30	MARINE	1	4	3	Included in NonRoad Estimates										
Pile delivery barges	Number of Vessels per Day	30	MARINE	1	4	1											
												TOTAL	**1.21**	**0.23**	**0.05**	**0.01**	**240.66**

Notes - Includes total estimates for all three stages of construction as outlined in EA.
Stage 1: constructing the new bridge to the west along with new Station Tracks 11 and 12, the associated platform, and a new Tower A, and modifying the North Bank Bridge.
Stage 2 consists of the replacement of the existing west bridge. During this phase of work, the North and South Trestle will be constructed to the limits that are available without impacting active tracks.
Stage 3 consists of the replacement of the existing east bridge.

Table A-6
MBTA Draw 1 Project
Construction Equipment Estimates
Construction activity in Boston, MA

Construction Equipment	Type of Fuel	Equipment Rated Engine HP	Average Daily Utilization Rate	Source Classification Code (SCC)	Average Daily Load Factor	Construction Activity Duration		Monthly average number of units in operation	Total Equipment Utilization (hp-hrs)	NONROAD Model Emission Factor (g/hp-hr)					2031 Emission Totals (tons)				
						Average Days/Week	Average hrs/day	2031	2031	CO	NOx	VOC	PM2.5	CO2	CO	NOx	VOC	PM2.5	CO2
Land Based Equipment																			
Air Compressor (185 CFM)	Diesel	55	0.85	2270006015	0.43	5	8	12	501,758	0.49	3.07	0.14	0.05	589.91	0.27	1.70	0.080	0.028	326.27
Back Hoe (Cat 325 or equivalent)	Diesel	190	0.25	2270002066	0.21	5	4	4	41,496	0.72	1.31	0.24	0.12	625.79	0.03	0.06	0.011	0.006	28.62
Ballast Grader	Diesel	270	0.60	2270002048	0.59	2	4	3	119,284	0.12	0.30	0.13	0.01	536.41	0.02	0.04	0.017	0.001	70.53
Crane (Crawler, 150 Ton)	Diesel	225	0.65	2270002045	0.43	5	4	3	196,209	0.10	0.39	0.13	0.01	530.61	0.02	0.08	0.029	0.003	114.76
Crane (Crawler, 200 Ton)	Diesel	250	0.80	2270002045	0.43	5	4	12	1,073,280	0.10	0.39	0.13	0.01	530.61	0.11	0.46	0.158	0.017	627.75
Crane (RT, 60 Ton)	Diesel	190	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Drill Rig (Tieback)	Diesel	225	0.85	2270002033	0.43	5	6	6	769,743	0.40	1.65	0.19	0.08	530.45	0.34	1.40	0.157	0.069	450.08
Dozer (Cat D7 or equivalent)	Diesel	180	0.35	2270002069	0.59	5	6	1	57,985	0.12	0.31	0.13	0.01	536.41	0.01	0.02	0.008	0.001	34.29
Drill Rig (Soilmec 622)	Diesel	410	0.80	2270002033	0.43	5	6	4	880,090	0.51	1.84	0.17	0.08	530.49	0.50	1.78	0.168	0.079	514.64
Forklift (10000 lb)a	Diesel	105	0.55	2270002057	0.59	2	4	12	170,090	0.21	0.46	0.14	0.03	536.39	0.04	0.09	0.026	0.006	100.57
Generator (150 kWh)	Diesel	200	0.90	2270006005	0.43	5	8	12	1,931,904	0.43	1.76	0.19	0.09	530.42	0.92	3.74	0.413	0.185	1129.55
Generator (350 kWh)	Diesel	475	0.90	2270006005	0.43	5	8	12	4,588,272	0.48	1.73	0.17	0.07	530.50	2.45	8.77	0.864	0.367	2683.04
Hoe Ram	Diesel	250	0.55	2270002006	0.43	5	6	2	184,470	4.45	4.33	0.56	0.35	588.58	0.91	0.88	0.114	0.072	119.68
Light Plant	Diesel	55	0.25	2270002027	0.43	5	2	6	18,447	1.05	3.39	0.20	0.14	589.72	0.02	0.07	0.004	0.003	11.99
Paver	Diesel	224	0.45	2270002009	0.43	1	6	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Roller	Diesel	135	0.45	2270002009	0.43	3	4	3	48,901	2.34	4.46	0.45	0.35	588.94	0.13	0.24	0.024	0.019	31.75
Slurry Plant (75 HP Pump)	Diesel	75	0.90	2270006010	0.43	5	6	0	0	1.20	2.04	0.25	0.19	589.57	0.00	0.00	0.000	0.000	0.00
Tamping Machine	Diesel	130	0.60	2270002006	0.43	2	4	1	13,953	4.45	4.33	0.56	0.35	588.58	0.07	0.07	0.009	0.005	9.05
Track Loader (Cat 973 or equivalent)	Diesel	210	0.20	2270002066	0.21	3	4	0	0	0.72	1.31	0.24	0.12	625.79	0.00	0.00	0.000	0.000	0.00
Welding Machine	Diesel	350	0.25	2270006025	0.21	2	2	6	22,932	1.25	1.92	0.28	0.16	625.66	0.03	0.05	0.007	0.004	15.82
Dynamic Soil Compaction	Diesel	250	0.55	2270002009	0.43	5	4	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Pile driving hammer	Diesel	150	0.55	2270006005	0.43	5	6	4	221,364	0.53	1.86	0.21	0.12	530.38	0.13	0.45	0.050	0.028	129.42
Marine Based Equipment																			
Sheetpile vibratory hammer	Diesel	300	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Barge mounted 200 Ton Crane	Diesel	340	0.80	2270002045	0.43			0	0	0.21	0.83	0.14	0.03	530.60	0.00	0.00	0.000	0.000	0.00
Barge mounted 100 Ton Crane	Diesel	230	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Pile driving hammer – 800 kJ	Diesel	1500	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Rock Socket Drilling Rig	Diesel	209	0.85	2270002033	0.43	5	6	0	0	0.40	1.65	0.19	0.08	530.45	0.00	0.00	0.000	0.000	0.00
Tugboats (1500 HP)- Main Engine	Diesel	1500	0.6	-	0.50	2	2	12	1,123,200	0.69	4.21	0.22	0.11	506.69	0.85	5.21	0.273	0.133	627.33
Delivery Barges	Diesel	1500	0.6	-	0.50	1	4	2	187,200	0.69	4.21	0.22	0.11	506.69	0.14	0.87	0.045	0.022	104.55
Compressors - surface tools	Diesel	275	0.75	2270006015	0.43	5	8	12	2,213,640	0.12	0.54	0.14	0.02	530.60	0.30	1.31	0.335	0.050	1294.71
Concrete pump - general	Diesel	250	0.75	2270006010	0.43	2	4	1	33,540	0.44	1.76	0.19	0.09	530.42	0.02	0.07	0.007	0.003	19.61
Excavator - long reach, tracked	Diesel	203	0.25	2270002036	0.59	5	4	1	31,140	0.12	0.29	0.13	0.01	536.41	0.00	0.01	0.005	0.000	18.41
Telescopic boom - self-propelled	Diesel	75	0.55	2270002045	0.43	5	4	6	110,682	0.35	0.44	0.14	0.03	589.93	0.04	0.05	0.017	0.003	71.97

On-Road and Marine Sources

Construction Dirt Handling, Marine Vessels, Material Deliveries and Removals	Units	Total Miles per Round Trip within Boston Metro	Vehicle Category Code	Construction Activity Duration		Monthly average number of units in	Total Vehicle Miles Traveled (VMT)	MOVES Model Emission Factor (g/VMT)					2031 Emission Totals (tons)				
				Average Days/Week	Average hrs/day	2029	2029	CO	NOx	VOC	PM2.5	CO2	CO	NOx	VOC	PM2.5	CO2
Worker Commutes	Number of Workers per Day	40	LDT/LDC	5	NA	22	228,800	2.44	0.10	0.08	0.01	334.57	0.62	0.03	0.021	0.002	84.38
Trucks - Delivery, Removal, Worker, Dirt Handling, etc.	Number of Vehicles per Day	40	HDDV	5		1	10,400	2.13	1.17	0.23	0.04	928.52	0.02	0.01	0.003	0.001	10.64
Dump Truck	Number of Vehicles per Day	5	HDDV	2	4	12	24,960	2.13	1.17	0.23	0.04	928.52	0.06	0.03	0.006	0.001	25.55
Tractor Trailer	Number of Vehicles per Day	5	HDDV	2	4	12	24,960	2.59	4.42	0.16	0.09	1716.62	0.07	0.12	0.004	0.002	47.23
Truck Mixer	Number of Vehicles per Day	5	HDDV	3	4	5	15,600	2.13	1.17	0.23	0.04	928.52	0.04	0.02	0.004	0.001	15.97
Flat deck barges (materials transport)	Number of Vessels per Day	30	MARINE	1	4	1	Included in NonRoad Estimates										
Pile delivery barges	Number of Vessels per Day	30	MARINE	1	4	1											
												TOTAL	**0.81**	**0.21**	**0.04**	**0.01**	**183.77**

Notes - Includes total estimates for all three stages of construction as outlined in EA.
Stage 1: constructing the new bridge to the west along with new Station Tracks 11 and 12, the associated platform, and a new Tower A, and modifying the North Bank Bridge.
Stage 2 consists of the replacement of the existing west bridge. During this phase of work, the North and South Trestle will be constructed to the limits that are available without impacting active tracks.
Stage 3 consists of the replacement of the existing east bridge.

Table A-7
MBTA Draw 1 Project
Construction Equipment Estimates
Construction activity in Boston, MA

Construction Equipment	Type of Fuel	Equipment Rated Engine HP	Average Daily Utilization Rate	Source Classification Code (SCC)	Average Daily Load Factor	Construction Activity Duration		Monthly average number of units in operation	Total Equipment Utilization (hp-hrs)	NONROAD Model Emission Factor (g/hp-hr)					2032 Emission Totals (tons)				
						Average Days/Week	Average hrs/day	2032	2032	CO	NOx	VOC	PM2.5	CO2	CO	NOx	VOC	PM2.5	CO2
Land Based Equipment																			
Air Compressor (185 CFM)	Diesel	55	0.85	2270006015	0.43	5	8	12	501,758	0.49	3.07	0.14	0.05	589.91	0.27	1.70	0.080	0.028	326.27
Back Hoe (Cat 325 or equivalent)	Diesel	190	0.25	2270002066	0.21	5	4	2	20,748	0.72	1.31	0.24	0.12	625.79	0.02	0.03	0.005	0.003	14.31
Ballast Grader	Diesel	270	0.60	2270002048	0.59	2	4	5	198,806	0.12	0.30	0.13	0.01	536.41	0.03	0.07	0.029	0.002	117.55
Crane (Crawler, 150 Ton)	Diesel	225	0.65	2270002045	0.43	5	4	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Crane (Crawler, 200 Ton)	Diesel	250	0.80	2270002045	0.43	5	4	12	1,073,280	0.10	0.39	0.13	0.01	530.61	0.11	0.46	0.158	0.017	627.75
Crane (RT, 60 Ton)	Diesel	190	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Drill Rig (Tieback)	Diesel	225	0.85	2270002033	0.43	5	6	0	0	0.40	1.65	0.19	0.08	530.45	0.00	0.00	0.000	0.000	0.00
Dozer (Cat D7 or equivalent)	Diesel	180	0.35	2270002069	0.59	5	6	5	289,926	0.12	0.31	0.13	0.01	536.41	0.04	0.10	0.042	0.003	171.43
Drill Rig (Soilmec 622)	Diesel	410	0.80	2270002033	0.43	5	6	0	0	0.51	1.84	0.17	0.08	530.49	0.00	0.00	0.000	0.000	0.00
Forklift (10000 lb)a	Diesel	105	0.55	2270002057	0.59	2	4	12	170,090	0.21	0.46	0.14	0.03	536.39	0.04	0.09	0.026	0.006	100.57
Generator (150 kWh)	Diesel	200	0.90	2270006005	0.43	5	8	12	1,931,904	0.43	1.76	0.19	0.09	530.42	0.92	3.74	0.413	0.185	1129.55
Generator (350 kWh)	Diesel	475	0.90	2270006005	0.43	5	8	12	4,588,272	0.48	1.73	0.17	0.07	530.50	2.45	8.77	0.864	0.367	2683.04
Hoe Ram	Diesel	250	0.55	2270002006	0.43	5	6	5	461,175	4.45	4.33	0.56	0.35	588.58	2.26	2.20	0.285	0.180	299.20
Light Plant	Diesel	55	0.25	2270002027	0.43	5	2	6	18,447	1.05	3.39	0.20	0.14	589.72	0.02	0.07	0.004	0.003	11.99
Paver	Diesel	224	0.45	2270002009	0.43	1	6	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Roller	Diesel	135	0.45	2270002009	0.43	3	4	2	32,601	2.34	4.46	0.45	0.35	588.94	0.08	0.16	0.016	0.013	21.16
Slurry Plant (75 HP Pump)	Diesel	75	0.90	2270006010	0.43	5	6	0	0	1.20	2.04	0.25	0.19	589.57	0.00	0.00	0.000	0.000	0.00
Tamping Machine	Diesel	130	0.60	2270002006	0.43	2	4	1	13,953	4.45	4.33	0.56	0.35	588.58	0.07	0.07	0.009	0.005	9.05
Track Loader (Cat 973 or equivalent)	Diesel	210	0.20	2270002066	0.21	3	4	0	0	0.72	1.31	0.24	0.12	625.79	0.00	0.00	0.000	0.000	0.00
Welding Machine	Diesel	350	0.25	2270006025	0.21	2	2	6	22,932	1.25	1.92	0.28	0.16	625.66	0.03	0.05	0.007	0.004	15.82
Dynamic Soil Compaction	Diesel	250	0.55	2270002009	0.43	5	4	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Pile driving hammer	Diesel	150	0.55	2270006005	0.43	5	6	2	110,682	0.53	1.86	0.21	0.12	530.38	0.06	0.23	0.025	0.014	64.71
Marine Based Equipment																			
Sheetpile vibratory hammer	Diesel	300	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Barge mounted 200 Ton Crane	Diesel	340	0.80	2270002045	0.43			2	0	0.21	0.83	0.14	0.03	530.60	0.00	0.00	0.000	0.000	0.00
Barge mounted 100 Ton Crane	Diesel	230	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Pile driving hammer – 800 kJ	Diesel	1500	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Rock Socket Drilling Rig	Diesel	209	0.85	2270002033	0.43	5	6	5	595,838	0.40	1.65	0.19	0.08	530.45	0.26	1.08	0.122	0.054	348.39
Tugboats (1500 HP)- Main Engine	Diesel	1500	0.6	-	0.50	2	2	12	1,123,200	0.69	4.21	0.22	0.11	506.69	0.85	5.21	0.273	0.133	627.33
Delivery Barges	Diesel	1500	0.6	-	0.50	1	4	2	187,200	0.69	4.21	0.22	0.11	506.69	0.14	0.87	0.045	0.022	104.55
Compressors - surface tools	Diesel	275	0.75	2270006015	0.43	5	8	12	2,213,640	0.12	0.54	0.14	0.02	530.60	0.30	1.31	0.335	0.050	1294.71
Concrete pump - general	Diesel	250	0.75	2270006010	0.43	2	4	4	134,160	0.44	1.76	0.19	0.09	530.42	0.06	0.26	0.029	0.013	78.44
Excavator - long reach, tracked	Diesel	203	0.25	2270002036	0.59	5	4	1	31,140	0.12	0.29	0.13	0.01	536.41	0.00	0.01	0.005	0.000	18.41
Telescopic boom - self-propelled	Diesel	75	0.55	2270002045	0.43	5	4	0	0	0.35	0.44	0.14	0.03	589.93	0.00	0.00	0.000	0.000	0.00
On-Road and Marine Sources																			
Construction Dirt Handling, Marine Vessels, Material Deliveries and Removals	**Units**	**Total Miles per Round Trip within Boston Metro**		**Vehicle Category Code**		**Construction Activity Duration**		**Monthly average number of units in**	**Total Vehicle Miles Traveled (VMT)**	**MOVES Model Emission Factor (g/VMT)**					**2032 Emission Totals (tons)**				
						Average Days/Week	**Average hrs/day**	**2030**	**2030**	**CO**	**NOx**	**VOC**	**PM2.5**	**CO2**	**CO**	**NOx**	**VOC**	**PM2.5**	**CO2**
Worker Commutes	Number of Workers per Day	40		LDT/LDC		5	NA	28	291,200	2.44	0.10	0.08	0.01	334.57	0.78	0.03	0.027	0.003	107.39
Trucks - Delivery, Removal, Worker, Dirt Handling, etc.	Number of Vehicles per Day	40		HDDV		5		1	10,400	2.13	1.17	0.23	0.04	928.52	0.02	0.01	0.003	0.001	10.64
Dump Truck	Number of Vehicles per Day	5		HDDV		2	4	12	24,960	2.13	1.17	0.23	0.04	928.52	0.06	0.03	0.006	0.001	25.55
Tractor Trailer	Number of Vehicles per Day	5		HDDV		2	4	12	24,960	2.59	4.42	0.16	0.09	1716.62	0.07	0.12	0.004	0.002	47.23
Truck Mixer	Number of Vehicles per Day	5		HDDV		3	4	5	15,600	2.13	1.17	0.23	0.04	928.52	0.04	0.02	0.004	0.001	15.97
Flat deck barges (materials transport)	Number of Vessels per Day	30		MARINE		1	4	1	Included in NonRoad Estimates										
Pile delivery barges	Number of Vessels per Day	30		MARINE		1	4	1											
														TOTAL	**0.97**	**0.22**	**0.04**	**0.01**	**206.78**

Notes - Includes total estimates for all three stages of construction as outlined in EA.
Stage 1: constructing the new bridge to the west along with new Station Tracks 11 and 12, the associated platform, and a new Tower A, and modifying the North Bank Bridge.
Stage 2 consists of the replacement of the existing west bridge. During this phase of work, the North and South Trestle will be constructed to the limits that are available without impacting active tracks.
Stage 3 consists of the replacement of the existing east bridge.

Table A-8
MBTA Draw 1 Project
Construction Equipment Estimates
Construction activity in Boston, MA

Construction Equipment	Type of Fuel	Equipment Rated Engine HP	Average Daily Utilization Rate	Source Classification Code (SCC)	Average Daily Load Factor	Construction Activity Duration		Monthly average number of units in operation	Total Equipment Utilization (hp-hrs)	NONROAD Model Emission Factor (g/hp-hr)					2033 Emission Totals (tons)				
						Average Days/Week	Average hrs/day	2033	2033	CO	NOx	VOC	PM2.5	CO2	CO	NOx	VOC	PM2.5	CO2
Land Based Equipment																			
Air Compressor (185 CFM)	Diesel	55	0.85	2270006015	0.43	5	8	12	501,758	0.49	3.07	0.14	0.05	589.91	0.27	1.70	0.080	0.028	326.27
Back Hoe (Cat 325 or equivalent)	Diesel	190	0.25	2270002066	0.21	5	4	1	10,374	0.72	1.31	0.24	0.12	625.79	0.01	0.02	0.003	0.001	7.16
Ballast Grader	Diesel	270	0.60	2270002048	0.59	2	4	1	39,761	0.12	0.30	0.13	0.01	536.41	0.01	0.01	0.006	0.000	23.51
Crane (Crawler, 150 Ton)	Diesel	225	0.65	2270002045	0.43	5	4	3	196,209	0.10	0.39	0.13	0.01	530.61	0.02	0.08	0.029	0.003	114.76
Crane (Crawler, 200 Ton)	Diesel	250	0.80	2270002045	0.43	5	4	12	1,073,280	0.10	0.39	0.13	0.01	530.61	0.11	0.46	0.158	0.017	627.75
Crane (RT, 60 Ton)	Diesel	190	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Drill Rig (Tieback)	Diesel	225	0.85	2270002033	0.43	5	6	2	256,581	0.40	1.65	0.19	0.08	530.45	0.11	0.47	0.052	0.023	150.03
Dozer (Cat D7 or equivalent)	Diesel	180	0.35	2270002069	0.59	5	6	1	57,985	0.12	0.31	0.13	0.01	536.41	0.01	0.02	0.008	0.001	34.29
Drill Rig (Soilmec 622)	Diesel	410	0.80	2270002033	0.43	5	6	2	440,045	0.51	1.84	0.17	0.08	530.49	0.25	0.89	0.084	0.040	257.32
Forklift (10000 lb)a	Diesel	105	0.55	2270002057	0.59	2	4	12	170,090	0.21	0.46	0.14	0.03	536.39	0.04	0.09	0.026	0.006	100.57
Generator (150 kWh)	Diesel	200	0.90	2270006005	0.43	5	8	12	1,931,904	0.43	1.76	0.19	0.09	530.42	0.92	3.74	0.413	0.185	1129.55
Generator (350 kWh)	Diesel	475	0.90	2270006005	0.43	5	8	12	4,588,272	0.48	1.73	0.17	0.07	530.50	2.45	8.77	0.864	0.367	2683.04
Hoe Ram	Diesel	250	0.55	2270002006	0.43	5	6	0	0	4.45	4.33	0.56	0.35	588.58	0.00	0.00	0.000	0.000	0.00
Light Plant	Diesel	55	0.25	2270002027	0.43	5	2	6	18,447	1.05	3.39	0.20	0.14	589.72	0.02	0.07	0.004	0.003	11.99
Paver	Diesel	224	0.45	2270002009	0.43	1	6	1	13,523	2.34	4.46	0.45	0.35	588.94	0.03	0.07	0.007	0.005	8.78
Roller	Diesel	135	0.45	2270002009	0.43	3	4	3	48,901	2.34	4.46	0.45	0.35	588.94	0.13	0.24	0.024	0.019	31.75
Slurry Plant (75 HP Pump)	Diesel	75	0.90	2270006010	0.43	5	6	2	90,558	1.20	2.04	0.25	0.19	589.57	0.12	0.20	0.025	0.019	58.85
Tamping Machine	Diesel	130	0.60	2270002006	0.43	2	4	1	13,953	4.45	4.33	0.56	0.35	588.58	0.07	0.07	0.009	0.005	9.05
Track Loader (Cat 973 or equivalent)	Diesel	210	0.20	2270002066	0.21	3	4	0	0	0.72	1.31	0.24	0.12	625.79	0.00	0.00	0.000	0.000	0.00
Welding Machine	Diesel	350	0.25	2270006025	0.21	2	2	6	22,932	1.25	1.92	0.28	0.16	625.66	0.03	0.05	0.007	0.004	15.82
Dynamic Soil Compaction	Diesel	250	0.55	2270002009	0.43	5	4	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Pile driving hammer	Diesel	150	0.55	2270006005	0.43	5	6	4	221,364	0.53	1.86	0.21	0.12	530.38	0.13	0.45	0.050	0.028	129.42
Marine Based Equipment																			
Sheetpile vibratory hammer	Diesel	300	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Barge mounted 200 Ton Crane	Diesel	340	0.80	2270002045	0.43			4	0	0.21	0.83	0.14	0.03	530.60	0.00	0.00	0.000	0.000	0.00
Barge mounted 100 Ton Crane	Diesel	230	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Pile driving hammer – 800 kJ	Diesel	1500	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Rock Socket Drilling Rig	Diesel	209	0.85	2270002033	0.43	5	6	2	238,335	0.40	1.65	0.19	0.08	530.45	0.10	0.43	0.049	0.021	139.36
Tugboats (1500 HP)- Main Engine	Diesel	1500	0.6	-	0.50	2	2	12	1,123,200	0.69	4.21	0.22	0.11	506.69	0.85	5.21	0.273	0.133	627.33
Delivery Barges	Diesel	1500	0.6	-	0.50	1	4	4	374,400	0.69	4.21	0.22	0.11	506.69	0.28	1.74	0.091	0.044	209.11
Compressors - surface tools	Diesel	275	0.75	2270006015	0.43	5	8	12	2,213,640	0.12	0.54	0.14	0.02	530.60	0.30	1.31	0.335	0.050	1294.71
Concrete pump - general	Diesel	250	0.75	2270006010	0.43	2	4	2	67,080	0.44	1.76	0.19	0.09	530.42	0.03	0.13	0.014	0.007	39.22
Excavator - long reach, tracked	Diesel	203	0.25	2270002036	0.59	5	4	0	0	0.12	0.29	0.13	0.01	536.41	0.00	0.00	0.000	0.000	0.00
Telescopic boom - self-propelled	Diesel	75	0.55	2270002045	0.43	5	4	9	166,023	0.35	0.44	0.14	0.03	589.93	0.06	0.08	0.025	0.005	107.96
On-Road and Marine Sources																			
Construction Dirt Handling, Marine Vessels, Material Deliveries and Removals	**Units**	**Total Miles per Round Trip within Boston Metro**		**Vehicle Category Code**		**Construction Activity Duration**		**Monthly average number of units in**	**Total Vehicle Miles Traveled (VMT)**	**MOVES Model Emission Factor (g/VMT)**					**2033 Emission Totals (tons)**				
						Average Days/Week	**Average hrs/day**	**2031**	**2031**	**CO**	**NOx**	**VOC**	**PM2.5**	**CO2**	**CO**	**NOx**	**VOC**	**PM2.5**	**CO2**
Worker Commutes	Number of Workers per Day	40		LDT/LDC		5	NA	42	436,800	2.44	0.10	0.08	0.01	334.57	1.18	0.05	0.040	0.004	161.09
Trucks - Delivery, Removal, Worker, Dirt Handling, etc.	Number of Vehicles per Day	40		HDDV		5		2	20,800	2.13	1.17	0.23	0.04	928.52	0.05	0.03	0.005	0.001	21.29
Dump Truck	Number of Vehicles per Day	5		HDDV		2	4	12	24,960	2.13	1.17	0.23	0.04	928.52	0.06	0.03	0.006	0.001	25.55
Tractor Trailer	Number of Vehicles per Day	5		HDDV		2	4	12	24,960	2.59	4.42	0.16	0.09	1716.62	0.07	0.12	0.004	0.002	47.23
Truck Mixer	Number of Vehicles per Day	5		HDDV		3	4	8	24,960	2.13	1.17	0.23	0.04	928.52	0.06	0.03	0.006	0.001	25.55
Flat deck barges (materials transport)	Number of Vessels per Day	30		MARINE		1	4	3	Included in NonRoad Estimates										
Pile delivery barges	Number of Vessels per Day	30		MARINE		1	4	1											
														TOTAL	**1.41**	**0.26**	**0.06**	**0.01**	**280.70**

Notes - Includes total estimates for all three stages of construction as outlined in EA.
Stage 1: constructing the new bridge to the west along with new Station Tracks 11 and 12, the associated platform, and a new Tower A, and modifying the North Bank Bridge.
Stage 2 consists of the replacement of the existing west bridge. During this phase of work, the North and South Trestle will be constructed to the limits that are available without impacting active tracks.
Stage 3 consists of the replacement of the existing east bridge.

Table A-9
MBTA Draw 1 Project
Construction Equipment Estimates
Construction activity in Boston, MA

Construction Equipment	Type of Fuel	Equipment Rated Engine HP	Average Daily Utilization Rate	Source Classification Code (SCC)	Average Daily Load Factor	Construction Activity Duration		Monthly average number of units in operation	Total Equipment Utilization (hp-hrs)	NONROAD Model Emission Factor (g/hp-hr)					2034 Emission Totals (tons)				
						Average Days/Week	Average hrs/day	2034	2034	CO	NOx	VOC	PM2.5	CO2	CO	NOx	VOC	PM2.5	CO2
Land Based Equipment																			
Air Compressor (185 CFM)	Diesel	55	0.85	2270006015	0.43	5	8	3	125,440	0.49	3.07	0.14	0.05	589.91	0.07	0.43	0.020	0.007	81.57
Back Hoe (Cat 325 or equivalent)	Diesel	190	0.25	2270002066	0.21	5	4	2	20,748	0.72	1.31	0.24	0.12	625.79	0.02	0.03	0.005	0.003	14.31
Ballast Grader	Diesel	270	0.60	2270002048	0.59	2	4	2	79,523	0.12	0.30	0.13	0.01	536.41	0.01	0.03	0.012	0.001	47.02
Crane (Crawler, 150 Ton)	Diesel	225	0.65	2270002045	0.43	5	4	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Crane (Crawler, 200 Ton)	Diesel	250	0.80	2270002045	0.43	5	4	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Crane (RT, 60 Ton)	Diesel	190	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Drill Rig (Tieback)	Diesel	225	0.85	2270002033	0.43	5	6	0	0	0.40	1.65	0.19	0.08	530.45	0.00	0.00	0.000	0.000	0.00
Dozer (Cat D7 or equivalent)	Diesel	180	0.35	2270002069	0.59	5	6	2	115,970	0.12	0.31	0.13	0.01	536.41	0.02	0.04	0.017	0.001	68.57
Drill Rig (Soilmec 622)	Diesel	410	0.80	2270002033	0.43	5	6	0	0	0.51	1.84	0.17	0.08	530.49	0.00	0.00	0.000	0.000	0.00
Forklift (10000 lb)a	Diesel	105	0.55	2270002057	0.59	2	4	3	42,522	0.21	0.46	0.14	0.03	536.39	0.01	0.02	0.006	0.001	25.14
Generator (150 kWh)	Diesel	200	0.90	2270006005	0.43	5	8	3	482,976	0.43	1.76	0.19	0.09	530.42	0.23	0.94	0.103	0.046	282.39
Generator (350 kWh)	Diesel	475	0.90	2270006005	0.43	5	8	3	1,147,068	0.48	1.73	0.17	0.07	530.50	0.61	2.19	0.216	0.092	670.76
Hoe Ram	Diesel	250	0.55	2270002006	0.43	5	6	0	0	4.45	4.33	0.56	0.35	588.58	0.00	0.00	0.000	0.000	0.00
Light Plant	Diesel	55	0.25	2270002027	0.43	5	2	3	9,224	1.05	3.39	0.20	0.14	589.72	0.01	0.03	0.002	0.001	6.00
Paver	Diesel	224	0.45	2270002009	0.43	1	6	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Roller	Diesel	135	0.45	2270002009	0.43	3	4	2	32,601	2.34	4.46	0.45	0.35	588.94	0.08	0.16	0.016	0.013	21.16
Slurry Plant (75 HP Pump)	Diesel	75	0.90	2270006010	0.43	5	6	0	0	1.20	2.04	0.25	0.19	589.57	0.00	0.00	0.000	0.000	0.00
Tamping Machine	Diesel	130	0.60	2270002006	0.43	2	4	1	13,953	4.45	4.33	0.56	0.35	588.58	0.07	0.07	0.009	0.005	9.05
Track Loader (Cat 973 or equivalent)	Diesel	210	0.20	2270002066	0.21	3	4	0	0	0.72	1.31	0.24	0.12	625.79	0.00	0.00	0.000	0.000	0.00
Welding Machine	Diesel	350	0.25	2270006025	0.21	2	2	0	0	1.25	1.92	0.28	0.16	625.66	0.00	0.00	0.000	0.000	0.00
Dynamic Soil Compaction	Diesel	250	0.55	2270002009	0.43	5	4	0	0	2.34	4.46	0.45	0.35	588.94	0.00	0.00	0.000	0.000	0.00
Pile driving hammer	Diesel	150	0.55	2270006005	0.43	5	6	0	0	0.53	1.86	0.21	0.12	530.38	0.00	0.00	0.000	0.000	0.00
Marine Based Equipment																			
Sheetpile vibratory hammer	Diesel	300	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Barge mounted 200 Ton Crane	Diesel	340	0.80	2270002045	0.43			0	0	0.21	0.83	0.14	0.03	530.60	0.00	0.00	0.000	0.000	0.00
Barge mounted 100 Ton Crane	Diesel	230	0.65	2270002045	0.43	5	6	0	0	0.10	0.39	0.13	0.01	530.61	0.00	0.00	0.000	0.000	0.00
Pile driving hammer – 800 kJ	Diesel	1500	0.55	2270006005	0.43	5	6	0	0	0.48	1.73	0.17	0.07	530.50	0.00	0.00	0.000	0.000	0.00
Rock Socket Drilling Rig	Diesel	209	0.85	2270002033	0.43	5	6	0	0	0.40	1.65	0.19	0.08	530.45	0.00	0.00	0.000	0.000	0.00
Tugboats (1500 HP)- Main Engine	Diesel	1500	0.6	-	0.50	2	2	3	280,800	0.69	4.21	0.22	0.11	506.69	0.21	1.30	0.068	0.033	156.83
Delivery Barges	Diesel	1500	0.6	-	0.50	1	4	0	0	0.69	4.21	0.22	0.11	506.69	0.00	0.00	0.000	0.000	0.00
Compressors - surface tools	Diesel	275	0.75	2270006015	0.43	5	8	3	553,410	0.12	0.54	0.14	0.02	530.60	0.07	0.33	0.084	0.012	323.68
Concrete pump - general	Diesel	250	0.75	2270006010	0.43	2	4	0	0	0.44	1.76	0.19	0.09	530.42	0.00	0.00	0.000	0.000	0.00
Excavator - long reach, tracked	Diesel	203	0.25	2270002036	0.59	5	4	0	0	0.12	0.29	0.13	0.01	536.41	0.00	0.00	0.000	0.000	0.00
Telescopic boom - self-propelled	Diesel	75	0.55	2270002045	0.43	5	4	3	55,341	0.35	0.44	0.14	0.03	589.93	0.02	0.03	0.008	0.002	35.99
On-Road and Marine Sources																			
Construction Dirt Handling, Marine Vessels, Material Deliveries and Removals	**Units**	**Total Miles per Round Trip within Boston Metro**		**Vehicle Category Code**		**Construction Activity Duration**		**Monthly average number of units in**	**Total Vehicle Miles Traveled (VMT)**	**MOVES Model Emission Factor (g/VMT)**					**2034 Emission Totals (tons)**				
						Average Days/Week	**Average hrs/day**	**2032**	**2032**	**CO**	**NOx**	**VOC**	**PM2.5**	**CO2**	**CO**	**NOx**	**VOC**	**PM2.5**	**CO2**
Worker Commutes	Number of Workers per Day	40		LDT/LDC		5	NA	58	603,200	2.44	0.10	0.08	0.01	334.57	1.62	0.07	0.056	0.006	222.45
Trucks - Delivery, Removal, Worker, Dirt Handling, etc.	Number of Vehicles per Day	40		HDDV		5		2	20,800	2.13	1.17	0.23	0.04	928.52	0.05	0.03	0.005	0.001	21.29
Dump Truck	Number of Vehicles per Day	5		HDDV		2	4	3	6,240	2.13	1.17	0.23	0.04	928.52	0.01	0.01	0.002	0.000	6.39
Tractor Trailer	Number of Vehicles per Day	5		HDDV		2	4	3	6,240	2.59	4.42	0.16	0.09	1716.62	0.02	0.03	0.001	0.001	11.81
Truck Mixer	Number of Vehicles per Day	5		HDDV		3	4	0	0	2.13	1.17	0.23	0.04	928.52	0.00	0.00	0.000	0.000	0.00
Flat deck barges (materials transport)	Number of Vessels per Day	30		MARINE		1	4	0	Included in NonRoad Estimates										
Pile delivery barges	Number of Vessels per Day	30		MARINE		1	4	0											
														TOTAL	**1.70**	**0.13**	**0.06**	**0.01**	**261.94**

Notes - Includes total estimates for all three stages of construction as outlined in EA.
Stage 1: constructing the new bridge to the west along with new Station Tracks 11 and 12, the associated platform, and a new Tower A, and modifying the North Bank Bridge.
Stage 2 consists of the replacement of the existing west bridge. During this phase of work, the North and South Trestle will be constructed to the limits that are available without impacting active tracks.
Stage 3 consists of the replacement of the existing east bridge.

Table A10
MBTA Draw 1 Project
Construction Equipment Estimates
Construction activity in Boston, MA

Construction Year	Emission Totals (tons/year)				
	CO	NOx	VOC	PM2.5	CO2
2026	7.5	16.5	1.7	0.7	4,978.5
2027	12.4	27.3	2.9	1.1	9,173.9
2028	9.7	24.9	2.6	0.9	8,263.2
2029	7.2	24.2	2.5	1.0	7,585.7
2030	9.5	27.8	2.9	1.1	8,496.1
2031	8.1	27.6	2.9	1.1	8,718.2
2032	9.0	26.7	2.8	1.1	8,271.0
2033	7.8	26.6	2.7	1.0	8,418.3
2034	3.1	5.7	0.6	0.2	2,004.4
Conformity DeMinimis Thresholds	100.0	100.0	50.0	100.0	NA