2.11-1 INTRODUCTION

This section of Chapter 2 examines the potential air quality impacts of Project 1, Shaft and Bypass Tunnel Construction. As detailed below, air quality could be affected by emissions from on-site construction equipment, emissions from on-road construction-related vehicles, and from these vehicles' effects on traffic congestion in both the west of Hudson and east of Hudson study areas.

This analysis of potential impacts on air quality from Project 1 construction includes a quantitative analysis of both on-site and on-road sources of air emissions, the overall cumulative impact of both sources where applicable, and potential cumulative impacts from construction at both study areas. Appendix 2.11, "Air Quality," provides additional support data.

In general, most construction engines are diesel-powered, and produce relatively high levels of nitrogen oxides (NO_x) and particulate matter (PM). Construction activities also generate fugitive dust emissions. Although diesel engines emit much lower levels of carbon monoxide (CO) than gasoline engines, the stationary nature of construction emissions and the large quantity of engines could lead to elevated CO concentrations, and impacts on traffic could increase mobile source-related emissions of CO as well. As a result, the air pollutants analyzed for the proposed Project 1 construction activities include nitrogen dioxide (NO_2), particles with an aerodynamic diameter of less than or equal to 10 micrometers (PM_{10}), particles with an aerodynamic diameter of less than or equal to 2.5 micrometers ($PM_{2.5}$), and CO. Since ultra-low-sulfur diesel (ULSD) fuel would be used for all diesel engines in the construction of Project 1(as would be stipulated in the specifications for the contractor), sulfur oxides (SO_x) emitted from construction activities would be negligible.

DEP would require the contractors for Project 1 to use ULSD for all diesel engines throughout the construction period and to reduce PM emissions to the extent practicable by installing diesel particulate filters (DPFs) as emissions controls on diesel equipment greater than 50 horsepower (hp). If the implementation of the DPF would interfere with the operation of the equipment (diesel equipment greater than 50 hp), diesel oxidation catalysts (DOCs) would be required. Diesel equipment less than 50 hp would not be required to implement controls. The construction activities would be subject to New York City Local Law 77, which would require the use of best available technology (BAT) for equipment at the commencement of the construction.[1] All construction equipment at both study areas would need to meet at least EPA Tier 2 emission standards.

In addition, the west connection site concrete batch plant's cement weigh hopper, gathering hopper, and mixing loading operations would be required to vent to a baghouse or filter sock. Storage silo chutes would be required to vent to a baghouse. Baghouses and filter socks should have at least 99.9 percent control efficiency. Grading activities, roadways at the concrete batch plant, and all unloading and loading material handling operations would be required to have a dust control plan, and include adequate wet suppression for fugitive dust. Aggregate stockpiles above the feeding hopper would be required to be enclosed on top and three sides. If open stockpiling is used, the stockpiles would be required to be enclosed on three sides, with the enclosure wall sufficiently higher than the top of the stockpile to prevent wind whipping. The air quality analyses described in this section and undertaken for this EIS reflect the benefits of such pollution reduction measures. The non-emergency diesel engine would be required to meet Tier 4 New Source Performance Standards (NSPS), which is anticipated to include a DPF.

This section is organized as follows:

- Section 2.11-2, "Pollutants for Analysis," describes the various air pollutants examined as part of Project 1's air quality assessment
- Section 2.11-3, "Air Quality Regulations, Standards, and Benchmarks," discusses the pertinent regulations and guidance for the assessment,
- Section 2.11-4, "Methodology," describes how the air quality analysis was conducted.
- Sections 2.11-5 and 2.11-6 detail the existing air quality conditions in the two study areas and analyze projected future conditions both with and without Project 1 in both study areas.
- Section 2.11-7, "Conclusions," summarizes the findings of this air quality analysis.

2.11-2 POLLUTANTS FOR ANALYSIS

Ambient air quality is affected by air pollutants produced by both motor vehicles and stationary sources. Emissions from motor vehicles are referred to as mobile source emissions, while emissions from fixed facilities are referred to as stationary source emissions. Ambient concentrations of CO are predominantly influenced by mobile source emissions. PM, volatile

[1] New York City Administrative Code § 24-163.3, adopted December 22, 2003, also known as Local Law 77, requires that any diesel-powered non-road engine with a power output of 50 hp or greater that is owned by, operated by or on behalf of, or leased by a city agency shall be powered by ultra low sulfur diesel fuel (ULSD), and utilize the best available technology (BAT) for reducing the emission of pollutants, primarily particulate matter and secondarily nitrogen oxides. DEP is charged with defining and periodically updating the definition of BAT.

organic compounds (VOCs), and nitrogen oxides (nitric oxide, NO, and nitrogen dioxide, NO_2, collectively referred to as NO_x) are emitted from both mobile and stationary sources. Fine PM is also formed when emissions of NO_x, SO_x, ammonia, organic compounds, and other gases react or condense in the atmosphere. Emissions of SO_2 are associated mainly with stationary sources and sources utilizing non-road diesel, such as diesel trains, marine engines, and non-road vehicles (e.g., construction engines). However, diesel vehicles (both non-road and on-road) currently contribute very little to SO_2 emissions since the sulfur content of diesel fuel, which is federally regulated, is extremely low. Ozone is formed in the atmosphere by complex photochemical processes that include NO_x and VOCs.

2.11-2.1 CARBON MONOXIDE

CO, a colorless and odorless gas, is produced in the urban environment primarily by the incomplete combustion of gasoline and other fossil fuels. In urban areas, approximately 80 to 90 percent of CO emissions are from motor vehicles. Since CO is a reactive gas that does not persist in the atmosphere, CO concentrations can vary greatly over relatively short distances; elevated concentrations are usually limited to locations near crowded intersections, heavily traveled and congested roadways, parking lots, and garages. Consequently, CO concentrations must be predicted on a local, or microscale, basis.

Project 1 construction would result in a temporary increase in traffic volume in the two study areas. Therefore, a mobile source analysis was conducted at critical intersections in both study areas to evaluate future CO concentrations with and without Project 1. CO concentrations were also determined for construction activities on the west and east connection sites, and cumulative impacts from on on-site and on-road sources were developed.

2.11-2.2 NITROGEN OXIDES, VOCS, AND OZONE

NO_x are of principal concern because of their role, together with VOCs, as precursors in the formation of ozone. Ozone is formed through a series of reactions that take place in the atmosphere in the presence of sunlight. Because the reactions are slow, and occur as the pollutants are transported downwind, elevated ozone levels are often found many miles from sources of the precursor pollutants. The effects of NO_x and VOC emissions from all sources are therefore generally examined on a regional basis. The contribution of any action or project to regional emissions of these pollutants would include any added stationary or mobile source emissions; the change in regional mobile source emissions of these pollutants would be related to the total vehicle miles traveled added or subtracted on various roadway types throughout the New York metropolitan area, which is designated as a moderate non-attainment area for ozone by the EPA.

Project 1 would not have a significant effect on the overall volume of vehicular travel in the metropolitan area; therefore, no measurable impact on regional NO_x and VOC emissions or on ozone levels is predicted. An analysis of Project 1-related emissions of these pollutants from mobile sources is therefore not warranted.

In addition to being a precursor to the formation of ozone, NO_2 (one component of NO_x) is also a regulated pollutant. Since NO_2 is mostly formed from the transformation of NO in the atmosphere, it has mostly been of concern farther downwind from large stationary point sources and not a local concern from mobile sources.

Potential impacts on annual local NO_2 concentrations from fuel combustion for on-site construction activities were determined. With the promulgation of the 2010 1-hour average standard for NO_2, local sources, such as vehicular and stationary source emissions, may become of greater concern for this pollutant. U.S. Environmental Protection Agency (EPA) guidance on modeling 1-hour NO_2 discusses the treatment of intermittent emissions. EPA states that "*the intermittent nature of the actual emissions…in many cases, when coupled with the probabilistic form of the standard, could result in modeled impacts being significantly higher than actual impacts would realistically be expected to be for these emission scenarios*" Furthermore, EPA "*recommend[s] that compliance demonstrations for the 1-hour NO_2 NAAQS be based on emission scenarios that can logically be assumed to be relatively continuous or which occur frequently enough to contribute significantly to the annual distribution of daily maximum 1-hour concentrations.*"

The monthly/annual variation in the types of equipment needed on the construction site, and the utilization of the equipment would fluctuate on an hourly basis. Likewise, the yearly NO_2 emission would fluctuate and there would be no sustained 3-year average with which to calculate the 1-hour NO_2 in accordance with EPA guidelines. In addition, the average NO_2 emissions over the construction periods are very low.

2.11-2.3 LEAD

Airborne lead emissions are currently associated principally with industrial sources. Effective January 1, 1996, the Clean Air Act (CAA) banned the sale of the small amount of leaded fuel that was still available in some parts of the country for use in on-road vehicles, concluding a 25-year effort to phase out lead in gasoline. Even at locations in the New York area where traffic volumes are very high, atmospheric lead concentrations are far below the 3-month average national standard of 0.15 micrograms per cubic meter ($\mu g/m^3$).

No significant sources of lead are associated with Project 1 and, therefore, analysis is not warranted.

2.11-2.4 RESPIRABLE PARTICULATE MATTER—PM_{10} AND $PM_{2.5}$

PM is a broad class of air pollutants that includes discrete particles of a wide range of sizes and chemical compositions, as either liquid droplets (aerosols) or solids suspended in the atmosphere. The constituents of PM are both numerous and varied, and they are emitted from a wide variety of sources (both natural and man-made). Natural sources include the condensed and reacted forms of naturally occurring VOC; salt particles resulting from the evaporation of sea spray; wind-borne pollen, fungi, molds, algae, yeasts, rusts, bacteria, and material from live and decaying plant and animal life; particles eroded from beaches, soil, and rock; and particles emitted from volcanic and geothermal eruptions and from forest fires. Naturally occurring PM is generally greater than 2.5 micrometers in diameter. Major anthropogenic sources include the combustion of fossil fuels (e.g., vehicular exhaust, power generation, boilers, engines, and home heating), chemical and manufacturing processes, all types of construction, agricultural activities, as well as wood-burning stoves and fireplaces. PM also acts as a substrate for the adsorption (accumulation of gases, liquids, or solutes on the surface of a solid or liquid) of other pollutants, often toxic and some likely carcinogenic compounds.

As described below, PM is regulated in two size categories: particles with an aerodynamic diameter of less than or equal to 2.5 micrometers ($PM_{2.5}$) and particles with an aerodynamic diameter of less than or equal to 10 micrometers (PM_{10}, which includes $PM_{2.5}$). $PM_{2.5}$ has the ability to reach the lower regions of the respiratory tract, delivering with it other compounds that adsorb to the surfaces of the particles, and is also extremely persistent in the atmosphere. $PM_{2.5}$ is mainly derived from combustion material that has volatilized and then condensed to form primary PM (often soon after the release from a source exhaust) or from precursor gases reacting in the atmosphere to form secondary PM.

Diesel-powered vehicles, especially heavy duty trucks and buses, are a significant source of respirable PM, most of which is $PM_{2.5}$; PM concentrations may, consequently, be locally elevated near roadways with high volumes of heavy diesel-powered vehicles. An analysis was conducted to assess the reasonable worst-case PM impacts due to the increased traffic and on-site construction sources associated with the construction of Project 1.

2.11-2.5 SULFUR DIOXIDE

SO_2 emissions are primarily associated with the combustion of sulfur-containing fuels (oil and coal). Monitored SO_2 concentrations in the New York area are lower than the current national standards. Due to the federal restrictions on the sulfur content in diesel fuel for on-road vehicles, no significant quantities are emitted from vehicular sources. Vehicular sources of SO_2 are not significant and, therefore, an analysis of SO_2 from mobile sources is not warranted. Additionally, during the construction of Project 1, all on-site non-road engines would use ULSD fuel and emit insignificant amounts of SO_2. (SO_2 emissions are orders of magnitude lower than the estimated $PM_{2.5}$ emissions for the reasonable worst-case scenario; therefore impacts are expected to be insignificant.) Therefore, an analysis of SO_2 from on-site construction sources is not warranted.

2.11-3 AIR QUALITY REGULATIONS, STANDARDS, AND BENCHMARKS

2.11-3.1 NATIONAL AND STATE AIR QUALITY STANDARDS

As required by the CAA, primary and secondary NAAQS have been established for six major air pollutants: CO, NO_2, ozone, respirable PM (both $PM_{2.5}$ and PM_{10}), SO_2, and lead. The primary standards represent levels that are requisite to protect the public health, allowing an adequate margin of safety. The secondary standards are intended to protect the nation's welfare and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. The primary and secondary standards are the same for ozone, lead, and PM, and there is no secondary standard for CO and the 1-hour NO_2 standard. The NAAQS are presented in **Table 2.11-1**. The NAAQS for CO and annual NO_2 have also been adopted as the ambient air quality standards for New York State, but are defined on a running 12-month basis rather than for calendar years only. New York State also has standards for total suspended particulate matter (TSP), settleable particles, non-methane hydrocarbons (NMHC), and ozone, which correspond to federal standards that have since been revoked or replaced, and for beryllium, fluoride, and hydrogen sulfide (H_2S).

EPA revised the NAAQS for PM, effective December 18, 2006. The revision included lowering the level of the 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ and retaining the level of the annual standard at 15 $\mu g/m^3$. The PM_{10} 24-hour average standard was retained, and the annual average PM_{10} standard was revoked.

EPA also revised the 8-hour ozone standard, lowering it from 0.08 to 0.075 parts per million (ppm), effective in May 2008. On January 6, 2010, EPA proposed a change in the 2008 ozone NAAQS, lowering the primary NAAQS from the current 0.075 ppm level to within the range of 0.060-0.070 ppm. EPA is also proposing a secondary standard, measured as a cumulative concentration within the range of 7-15 ppm-hours aimed mainly at protecting sensitive vegetation.

EPA lowered the primary and secondary standards for lead to 0.15 $\mu g/m^3$, effective January 12, 2009. EPA revised the averaging time to a rolling 3-month average and the form of the standard to not-to-exceed across a 3-year span.

EPA established a new 1-hour average NO_2 standard of 0.100 ppm, effective April 12, 2010, in addition to the annual standard. The statistical form is the 3-year average of the 98th percentile of daily maximum 1-hour average concentration in a year.

On June 2, 2010, EPA established a new 1-hour average SO_2 standard at a level of 75 parts per billion (ppb), replacing the 24-hour and annual primary standards. The statistical form is the 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour concentrations (the fourth highest daily maximum corresponds approximately to 99th percentile for a year).

Table 2.11-1
National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary		Secondary	
	ppm	μg/m^3	Ppm	μg/m^3
Carbon Monoxide (CO)				
8-Hour Average [(1)]	9	10,000	None	
1-Hour Average [(1)]	35	40,000		
Lead				
Rolling 3-Month Average [(2)]	NA	0.15	NA	0.15
Nitrogen Dioxide (NO_2)				
1-Hour Average [(3)]	0.100	188.1	None	
Annual Average	0.053	100	0.053	100
Ozone (O_3)				
8-Hour Average [(4,5)]	0.075	150	0.075	150
Respirable Particulate Matter (PM_{10})				
24-Hour Average [(1)]	NA	150	NA	150
Fine Respirable Particulate Matter ($PM_{2.5}$)				
Annual Mean	NA	15	NA	15
24-Hour Average [(6,7)]	NA	35	NA	35
Sulfur Dioxide (SO_2) [(8)]				
1-Hour Average [(9)]	0.075	196.3	NA	NA
Maximum 3-Hour Average [(1)]	NA	NA	0.50	1,300

Notes: ppm – parts per million
μg/m^3 – micrograms per cubic meter
NA – not applicable
All annual periods refer to calendar year.
PM concentrations (including lead) are in μg/m^3 since ppm is a measure for gas concentrations.
Concentrations of all gaseous pollutants are defined in ppm and approximately equivalent concentrations in μg/m^3 are presented.
(1) Not to be exceeded more than once a year.
(2) EPA has lowered the NAAQS down from 1.5 μg/m^3, effective January 12, 2009.
(3) 3-year average of the annual 98th percentile daily maximum 1-hr average concentration. Effective April 12, 2010.
(4) 3-year average of the annual fourth highest daily maximum 8-hr average concentration.
(5) EPA has proposed lowering this standard further to within the range 0.060-0.070 ppm.
(6) Not to be exceeded by the annual 98th percentile when averaged over 3 years.
(7) EPA has lowered the NAAQS down from 65 μg/m^3, effective December 18, 2006.
(8) EPA revoked the 24-hour and annual primary standards, replacing them with a 1-hour average standard. Effective August 2, 2010.
(9) 3-year average of the annual 98th percentile daily maximum 1-hr average concentration. Effective August 2, 2010.
Source: 40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards.

2.11-3.2 NAAQS ATTAINMENT STATUS AND STATE IMPLEMENTATION PLANS

The CAA, as amended in 1990, defines non-attainment areas (NAA) as geographic regions that have been designated as not meeting one or more of the NAAQS. When an area is designated as non-attainment by EPA, the state is required to develop and implement a State Implementation Plan (SIP), which delineates how a state plans to achieve air quality that meets the NAAQS under the deadlines established by the CAA.

Orange and Dutchess Counties are in attainment for CO, PM_{10}, SO_2, and lead.

On December 17, 2004, EPA took final action designating the five New York City counties, Nassau, Suffolk, Rockland, Westchester, and Orange Counties as a $PM_{2.5}$ non-attainment area under the CAA due to exceedance of the annual average standard. Based on recent monitoring data (2006-2009), annual average concentrations of $PM_{2.5}$ in these counties no longer exceed the annual standard. EPA has determined that the area has attained the 1997 annual $PM_{2.5}$ NAAQS, effective December 15, 2010.

As described above, EPA has revised the 24-hour average $PM_{2.5}$ standard. In October 2009, EPA finalized the designation of the New York City metropolitan area (including Orange County) as nonattainment with the 2006 24-hour $PM_{2.5}$ NAAQS, effective in November 2009. The nonattainment area includes the same 10-county area originally designated as nonattainment with the 1997 annual $PM_{2.5}$ NAAQS. By November 201, New York State will be required to submit a SIP demonstrating attainment with the 2006 24-hour standard by November 2014 (EPA may grant attainment date extensions for up to five additional years).

Dutchess County is in attainment for $PM_{2.5}$.

Nassau, Rockland, Suffolk, Westchester, Lower Orange County Metropolitan Area (LOCMA), and the five New York City counties had been designated as a severe non-attainment area for ozone (1-hour average standard). Dutchess County and the rest of Orange County in the Poughkeepsie area were designated as a moderate non-attainment area for the 1-hour average ozone standard. In November 1998, New York State submitted its *Phase II Alternative Attainment Demonstration for Ozone*, which was finalized and approved by EPA effective March 6, 2002, addressing attainment of the 1-hour ozone NAAQS by 2007. These SIP revisions included additional emission reductions that EPA requested to demonstrate attainment of the standard, and an update of the SIP estimates using the latest versions of the mobile source emissions model, MOBILE6.2, and the nonroad emissions model, NONROAD—which have been updated to reflect current knowledge of engine emissions and the latest mobile and nonroad engine emissions regulations.

On April 15, 2004, EPA designated Nassau, Rockland, Suffolk, Westchester, LOCMA, and the five New York City counties as moderate non-attainment for the 1997 8-hour average ozone standard. Dutchess County and the rest of Orange County in the Poughkeepsie area are also designated as moderate non-attainment areas for the 8-hour average ozone standard. EPA revoked the 1-hour standard on June 15, 2005; however, some control measures for the 1-hour standard included in the SIP are required to stay in place until the 8-hour standard is attained. On February 8, 2008, the New York State Department of Environmental Conservation (NYSDEC) submitted final revisions to a new SIP for the ozone to EPA. On June 16, 2011, New York State petitioned EPA to determine that the NYMA has attained both the 1990 1-hour ozone NAAQS (0.12 ppm) and the 1997 8-hour ozone NAAQS (0.08 ppm).

In March 2008, EPA strengthened the 8–hour ozone standards. SIPs will be due 3 years after the final designations are made. On March 12, 2009, NYSDEC recommended that the counties of Suffolk, Nassau, Bronx, Kings, New York, Queens, Richmond, Rockland, and Westchester be designated as a non-attainment area for the 2008 ozone NAAQS (New York portion of the New York–Northern New Jersey–Long Island, NY-NJ-CT nonattainment area). On December 7, 2009, EPA determined that the Poughkeepsie nonattainment area (Dutchess, Orange, Ulster, and Putnam Counties) has attained the 2008 1-hour and 8-hour NAAQS for ozone. It is unclear at this time what the attainment status of these areas will be under the newly proposed standard due to the range of concentrations proposed.

New York State is currently in attainment of the annual-average NO_2 standard. EPA has promulgated a new 1-hour standard. The existing monitoring data for downstate New York indicates background concentrations below the standard. NYSDEC has determined that the present monitoring does not meet the revised EPA requirements in all respects and has recommended a designation of "unclassifiable" for the entire state. Therefore, it is likely that New York State will be designated by EPA as "unclassifiable" at first (January 2012), and then classified once 3 years of monitoring data are available (2016 or 2017).

EPA has established a new 1-hour SO_2 standard effective August 2, 2010, replacing the 24-hour and annual standards. Based on the available monitoring data, all New York State counties currently meet the 1-hour standard. Additional monitoring will be required. EPA plans to make final attainment designations in June 2012, based on 2008 to 2010 monitoring data and refined modeling. SIPs for nonattainment areas will be due by June 2014.

2.11-3.3 DETERMINING THE SIGNIFICANCE OF AIR QUALITY IMPACTS

Any action predicted to permanently increase the concentration of a criteria air pollutant to a level that would exceed the concentrations defined by the NAAQS would be deemed to have a potential significant adverse impact. In addition, to maintain concentrations lower than the NAAQS in attainment areas, or to ensure that concentrations are not significantly increased in non-attainment areas, threshold levels have been defined for certain pollutants; any action predicted to permanently increase the concentrations of these pollutants above the thresholds would be deemed to have a potential significant adverse impact, even in cases where violations of the NAAQS are not predicted.

2.11-3.4 DE MINIMIS CRITERIA REGARDING CO IMPACTS

New York City has developed *de minimis* criteria to assess the significance of the increase in CO concentrations that would result from proposed projects or actions, as set forth in the *CEQR Technical Manual* (January 2012). These criteria set the minimum change in CO concentration that defines a significant environmental impact. Significant increases of CO concentrations are defined as: (1) an increase of 0.5 ppm or more in the maximum 8-hour average CO concentration at a location where the predicted No Action 8-hour concentration is equal to or between 8 and 9 ppm, or (2) an increase of more than half the difference between No Action concentrations and the 8-hour standard, when No Action concentrations are below 8.0 ppm.

2.11-4 METHODOLOGY

Guidelines from *CEQR Technical Manual* (January 2012) were followed for the technical methodologies and procedures required to perform the air quality analyses. This methodology was adopted because the established guidelines are recognized to be conservative and provide consistency in evaluating potential impacts at the various locations examined in the west of Hudson and east of Hudson study areas. This section presents details relevant to the stationary source and mobile source construction air quality analysis methodology at both study areas.

2.11-4.1 STATIONARY SOURCES

A stationary source air quality analysis was conducted to evaluate Project 1's potential construction impacts at the west and east connection sites. For air quality analysis purposes, stationary sources were considered all on-site sources of pollutants, such as non-road construction equipment and trucks that enter and exit the connection sites for loading and unloading operations. Construction at both the west and east connection sites would and entail a number of activities, such as materials handling, grading, excavation, concrete pouring, and blasting. Air emission sources would include exhausts from fuel-burning equipment, fugitive dust from materials handling, grading, excavation activities, and entrained road dust.

The air quality analysis was performed following EPA- and *CEQR Technical Manual*-suggested procedures and analytical tools, as further discussed below, to determine source emission rates. The estimated emission rates were then used as input to an air quality dispersion model to determine the potential impacts.

CONSTRUCTION ACTIVITY ASSESSMENT

Overall, construction of Project 1 is expected to occur over a period of approximately 7½ years and is separated into four distinct phases: Phase 1: Site Preparation; Phase 2: Shaft Construction; Phase 3: Bypass Tunnel Excavation; and Phase 4: Bypass Tunnel Lining, Project 1 Demobilization, and Preparation for Project 2B. To determine which construction phases would constitute the most conservative analysis phases for the pollutants of concern, construction-related emissions were calculated throughout the duration of construction on an annual and short term (24-hour) basis for $PM_{2.5}$.

$PM_{2.5}$ was selected as the representative pollutant because, compared with other pollutants, it has the highest ratio of emissions to the relative impact criteria. Initial estimates of $PM_{2.5}$ emissions throughout the construction years were used for determining the worst-case phases for analysis of all pollutants. Generally, emission patterns of other pollutants would follow $PM_{2.5}$ emissions, since both NO_2 and $PM_{2.5}$ are proportional to diesel engines by horsepower. CO emissions may have a somewhat different pattern, but generally would also be highest during periods when the most activity would occur.

Based on the resulting multi-phase profiles of annual average and peak-day average emissions of $PM_{2.5}$, the most conservative 12-month period and the most conservative short-term phases at each study area were identified for the modeling of annual and short-term (i.e., 24-hour, 8-hour, 3-hour, and 1-hour) averaging periods.

DEVELOPMENT OF EMISSIONS AND SELECTION OF ANALYSIS PHASES

West and East Connection Sites

The construction analyses for Project 1 uses an emission estimation method and a modeling approach that have been previously used for evaluating air quality impacts of construction projects in New York. Because the level of construction activities would vary from phase to phase, the approach includes a determination of the reasonable worst-case scenario emission phases based on an estimated monthly construction work schedule, the number of each equipment type, the rated horsepower of each unit, and the equipment emission rate. The periods of highest emissions are expected to be the period of greatest impacts.

As such, two construction phases were analyzed at both the west and east connection sites: the site preparation phase and the tunnel excavation phase. Peak periods within these reasonable worst-case construction phases were analyzed for the potential for significant impacts.

West Connection Site Phases
At the west connection site, stage 3 of the site preparation phase was analyzed for the short-term period since $PM_{2.5}$ emissions during this stage are predicted to be higher than emissions during other stages of the site preparation phase. Stages 1 through 6 of the site preparation phase were analyzed for the annual period (see Section 2.1, "Description of Project 1 Construction Program," for construction phase details). During the tunnel excavation phase, the inundation plug construction and the TBM tunnel excavation and initial lining activities were analyzed for the short-term period since $PM_{2.5}$ emissions during the overlap from these activities would be higher than emissions during other activities during the tunnel excavation phase. For the annual period, the inundation plug construction and the TBM excavation and initial lining activities were also analyzed with the erection of the TBM underground.

East Connection Site Phases
At the east connection site, the peak period selected for the short-term analysis was the period when stage 4 of site preparation would overlap with stages 2 and 3 of shaft construction since $PM_{2.5}$ emissions would be higher during these activities than during other stages of site preparation or shaft construction. For the annual period, stages 2, 3, 4, and 5 of site preparation and stages 1, 2, and 3 of shaft construction were analyzed (see Section 2.1, "Description of Project 1 Construction Program," for construction phase details). In addition, a second peak

period was analyzed during the tunnel excavation phase. For both the short-term and annual analyses, this second peak period would consist of the construction of the inundation plugs.

Construction activities at the west connection site would also include material handling activities from the concrete batch plant during the tunnel lining phase and exhaust emissions from stationary diesel engine generators during the site preparation and shaft excavation phases. The reasonable worst-case scenario during the site preparation phase at the west connection site would include the maximum emissions from the stationary diesel engine generators for both the short-term and annual analyses. The reasonable worst-case scenario during the tunnel excavation phase at the west connection site would include the maximum emissions from the concrete batch plant for both the short-term and annual analyses. Construction activities at the east connection site would not include a concrete batch plant or non-emergency stationary diesel engine generators; therefore, analysis of this equipment was not included at the east connection site.

These phases were chosen as the reasonable worst-case analysis periods for the pollutants of concern. Dispersion of the relevant air pollutants from both the west connection site and east connection site during these phases were quantified using computer models, and the highest resulting concentrations for each analysis phase are presented in sections below discussing air quality impacts (i.e., section 2.11-5.3). Broader conclusions regarding potential concentrations during other construction phases, which were not dispersion modeled explicitly, are discussed as well, based on the multi-phase emissions profiles and the modeling results. Impacts during these other phases and periods of construction during Project 1 would be less than those determined from the peak periods.

Tables 2.11-2 and 2.11-3 present the construction schedules for the reasonable worst-case scenarios at the west and east connection sites.

Table 2.11-2
Construction Schedule for Reasonable Worst-Case Scenarios at the West Connection Site

	Shifts/Day	Hours/Shift	Days/Week
Site Preparation			
Stage 1	1	12	6
Stage 2	1	12	6
Stage 3[(1)]	2	8	6
Stage 4	2	8	6
Stage 5	2	8	6
Stage 6	1	12	6
Tunnel Excavation			
Inundation Plug Construction[(1)]	2	8	5
Tunnel Excavation and Initial Lining[(1)]	3	8	5
TBM Erection Underground	3	8	5

Notes: [(1)] Activities selected for the short-term analyses. All other activities listed were selected for the annual analyses.

Table 2.11-3
Construction Schedule for Reasonable Worst-Case Scenarios at the East Connection Site

	Shifts/Day	Hours/Shift	Days/Week
Site Preparation			
Stage 2	1	8	5
Stage 3	1	8	5
Stage 4[1]	1	8	5
Stage 5	1	8	5
Shaft Construction			
Stage 1	2	8	5
Stage 2[1]	2	8	5
Stage 3[1]	2	8	5
Tunnel Excavation			
Inundation Plug Construction[2]	1 ~~2~~	12 ~~8~~	5

Notes: [1] Activities selected for the short-term analyses. All other activities listed were selected for the annual analyses.
[2] Inundation plug construction activities were modeled for both the short-term and annual analyses.

A list of the equipment that would likely be operated during either the modeled short-term or annual periods for each phase is provided below in **Tables 2.11-4 and 2.11-5,** with the estimated horsepower for each type of equipment. (The equipment list for all phases is in Appendix 2.11.) In some instances, there is more than one engine size listed on the tables for a particular type of equipment since there could be differently sized equipment employed at the connection sites.

In summary, the specific construction information used to calculate emissions generated from the likely construction process includes, but is not limited to, the following:

- The number of units and fuel-type of construction equipment to be used;
- Rated horsepower for each piece of equipment;
- Hours of operation on-site;
- The maximum material processing rates on a typical peak day;
- Average speed of heavy vehicles; and
- Average vehicle miles traveled by heavy vehicles.

Water Main Extension and Dewatering Pipeline Route

There would also be construction work for the construction of the water main extension and dewatering pipeline in the west of Hudson study area. Since there would be less intensive construction equipment than construction equipment at the west connection site, the location of work would be limited in time at any one particular location, and only minimal overlap of activity during the beginning of the pipeline's construction with shaft construction at the west connection site, an analysis of the water main extension and dewatering pipeline construction is not warranted.

Table 2.11-4
Estimated Construction Equipment Data for Site Preparation and Tunnel Excavation at the West Connection Site

Equipment for Peak Stages	Engine Size (hp)
Site Preparation Phase	
Bulldozers	310
Backhoes	124
Loaders	188/197
Graders	245
Rollers	46
Compressors	275
Generators	96
Rock Breakers/Rock Drills/Excavators	348
Crane	500
Driver	200
Hydroseeder	35
Log Haulers	500
Concrete Mixer	455
Asphalt Flow Boy	425
Crawler Dozer	115
Harvester	247
Chippers	440
Rock Crusher	350
Rock Cutter	415
Paver	224
Pump	11
Heavy trucks (water tankers, pick-up trucks, dump trucks, boom trucks, box trucks, flat trucks, fuel trucks, and rack trucks)	NA
Tunnel Excavation Phase	
Drill Rigs	760
Tunneling Locomotives	100
Cranes	367/496
Compressors	275
Generators	426
Loaders	197
Pumps	8
Fork Lifts	148
Excavators	195
TBM	Electric
Ventilation System	Electric
Heavy Trucks (Surface Trucks, Concrete Trucks, Fuel Trucks, Water Trucks)	NA

Table 2.11-5
Estimated Construction Equipment Data for Site Preparation/Shaft Construction and Tunnel Excavation at the East Connection Site

Equipment for Peak Stages	Engine Size (hp)
Site Preparation Phase	
Bulldozers	310
Backhoes	124
Loaders	188/197
Rollers	46
Compressors	275
Generators	96/426
Excavators	195/348
Cranes	496/500
Hydroseeder	35
Concrete Mixer	455
Asphalt Flow Boy	425
Paver	224
Pump	8/11
Piling Rig	205
Concrete Pumps	131
Fork Lift	148
Grader	245
Drill Jumbo	228
Winches	Electric
Ventilation System	Electric
Heavy trucks (pick-up trucks, dump trucks, boom trucks, flat trucks, rack trucks, surface trucks, concrete trucks, fuel trucks, water trucks)	NA
Tunnel Excavation Phase	
Drill Rigs	760
Heavy Trucks (Surface Trucks)	NA

ENGINE EXHAUST EMISSIONS

Non-Road and Mobile Equipment

The sizes, the types, and the number of construction equipment were estimated based on the construction activities schedule. Emission factors for NO_X, CO, PM_{10}, and $PM_{2.5}$ from the combustion of ULSD fuel for on-site construction equipment were developed using the latest EPA NONROAD Emission Model (Version 2008). The model is based on source inventory data accumulated for specific categories of off-road equipment. The emission factors for each type of equipment were calculated from the output files for the NONROAD model (i.e., calculated from regional emissions estimates). However, these emission factors were not applied to trucks. Emission rates for NO_x, CO, $PM_{10,}$ and $PM_{2.5}$ from combustion of fuel for heavy trucks on-site (e.g., dump trucks, concrete trucks) and construction worker vehicles were developed using the EPA MOBILE6.2 Emission Model. A maximum of 5-minute idle time was employed for the heavy trucks. For analysis purposes, it was assumed that the concrete trucks would operate for 45 minutes per hour.

NO_2 concentrations were estimated using a NO_2 to NO ratio of 0.60, which is based on the ambient annual average NO_2 to NO_x ratio measured at New York City monitoring stations in the most recent years available (2007-2009), as described in EPA's *Guideline on Air Quality Models* at 40 CFR part 51 Appendix W, Section 5.2.4.[2]

Detailed examples of the peak hour engine exhaust emission rate calculations for the analysis are included in Appendix 2.11. Short-term and annual emission rates were adjusted from the peak hour emissions by applying daily and annual average usage factors for each piece of equipment during each phase of construction. Usage factors were determined using the construction equipment schedule and account for the fact that certain pieces of equipment are not used continuously over the course of the construction workday. Daily usage factors were determined based on the amount of time the equipment would operate per day (i.e., a compressor may be on-site, but it is anticipated to only be operational for 8 hours over the 16-hour work-day; therefore, the daily usage factor is 50 percent). Annual usage factors were determined based on the amount of time the equipment would operate per task (usage over task) multiplied by the amount of time the equipment would be operated per day (i.e., if a compressor would only be operational for 20 days over a 40-day task and for 8 hours of the 16-hour workday, the annual usage factor is 25 percent).

The air quality analysis also took into account the application of available pollutant control technologies. DEP has determined in the past that all construction equipment greater than 50 hp would likely be able to implement DPFs. In the rare case that diesel equipment greater than 50 hp in size that would likely not be able to implement DPFs, diesel oxidation catalysts (DOCs) would be required. Diesel equipment less than 50 hp would not be required to implement controls. Estimated PM emission rates for off-road equipment were therefore reduced to account for this add-on control technology. The control efficiency assumed for the DPFs is 90 percent, although a much higher percentage of control is likely.[3] Based on Project 1's commitments, emission factors for the construction of Project 1 were calculated assuming the use of ULSD, diesel engines of Tier 2 or cleaner certification, and the application of DPFs or DOCs on all non-road diesel engines 50 hp or greater and on concrete delivery and pumping trucks. For all other engines, MOBILE6 and NONROAD fleet-average emissions were used based on the first year of construction (2013), with the exception of the drill rigs, which are based on 2015 fleet-average emissions, since that is the earliest year in which they would be employed. The fleet-average emissions during the first year of construction are higher than the fleet-average emissions during subsequent years of construction as older equipment gets replaced by newer equipment with lower emissions standards.

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[2] http://www.epa.gov/scram001/guidance/guide/appw_05.pdf

[3] USEPA Verified Technologies List, http://epa.gov/cleandiesel/verification/verif-list.htm accessed on November 16, 2011.

Stationary Engine Generator

Up to 1.135 megawatts (MW) of power would also be generated on the west connection site by a stationary diesel engine generator to provide power during the site preparation phase and the first beginning of the shaft construction phase (for a total of 12 to 15 months). This generator would likely remain on-site during the remaining phases of Project 1 and through the connection phases but would be used only for emergency backup in case there is a loss of power on-site. Emission factors for NO_X, CO, PM_{10}, and $PM_{2.5}$ are based on federal New Source Performance Standards (NSPS) limits under 40 CFR 60 Part IIII and assume Tier 4 (2014 model year) engines. The regulatory limits the engine needs to meet as well as the particulate add-on control efficiency would be stipulated in the specifications for the contractor.

Detailed examples of the peak hour and annual engine exhaust emission rate calculations for the analysis are included in Appendix 2.11. Annual emission rates are based on the maximum number of shifts and days per year of operation.

Fugitive Emission Sources

Road dust emissions from vehicle travel on the on-site roadways were calculated using equations from EPA's AP-42, Section 13.2 for paved roads. PM_{10} emissions were estimated for concrete trucks, dump trucks, and other heavy trucks traveling into and from the connection sites. Truck trips and average vehicle weights used in the analysis were estimated. A reasonably conservative round trip distance of 5,500 feet at the west connection site and 1,820 feet at the east connection site on paved roads was used in the analysis. In addition, the analysis accounted for a three-sided enclosure around the aggregate stockpiles to provide a minimum of 75 percent reduction in particulate emissions and a dust control plan that the contractor would be required to implement at the concrete batch plant at the west connection site; this dust control method would provide at least a 50 percent reduction in particulate emissions from fugitive dust through wet suppression.

Particulate matter emissions would also be generated by material handling activities (i.e., loading/drop operations for fill materials and excavate), site grading, and concrete batching at the west connection site. Estimates of air emissions from these activities were developed based on EPA procedures delineated in AP-42 Table 13.2.3-1. The analysis of material handling activities also accounted for a dust control plan with at least a 50 percent reduction in PM_{10} and $PM_{2.5}$ emissions from fugitive dust through wet suppression. In addition, the hoppers, storage silos, and batch drop points at the concrete batch plant would be controlled through baghouses or filter socks (as would be stipulated in the specifications for the contractor). Detailed examples of peak hour fugitive dust emission rate calculations used for the analysis are presented in Appendix 2.11.

DISPERSION MODELING

Potential impacts were evaluated using the EPA/AMS AERMOD dispersion model (version 11103). This model is applicable to rural and urban areas, flat and complex terrain, surface and elevated releases, and multiple sources (including point, area, and volume sources). AERMOD is a steady-state plume model that incorporates current concepts about flow and dispersion in complex terrain, including updated treatments of the boundary layer theory, understanding of turbulence and dispersion, and includes handling of terrain interactions. The AERMOD model calculates pollutant concentrations based on hourly meteorological data and has the capability of calculating pollutant concentrations at locations when the plume from an exhaust stack is affected by the aerodynamic wakes and eddies (downwash) produced by nearby structures.

A study of land uses within a 3-kilometer radius of both connection sites indicated that the land use for each site would be rural. Therefore, rural coefficients were used as model input. Building downwash was considered but not used in the air dispersion model since it would not be expected to be a significant factor in determining maximum ground level concentrations off-site.

Source Simulation

During construction, various types of construction equipment would be used at different locations throughout the connection sites. Some of the equipment would be mobile and operate throughout specified areas, while some would remain stationary at distinct locations for short-term and even annual periods. The locations of specific work tasks during the different phases of construction are presented in **Figures 2.11-1 and 2.11-2** for the west connection site and **Figures 2.11-3 and 2.11-4** for the east connection site for the quantified analysis phases discussed above.

Stationary emission sources would include boom trucks, concrete trucks, cranes, compressors, generators, pumps, drill/piling rigs, rock crushers, and concrete/shotcrete mixers. For the analysis, these sources were considered to be point sources and were assumed to be placed at fixed locations during each phase of Project 1. The input data for point sources include stack heights equivalent to the height of engine exhaust points or tailpipes, with the exception for sources below ground within the shaft and tunnel. Equipment within the shaft and tunnel at the west connection site would include the TBM (electric), tunnel locomotives, tunnel pipe transporters (pulled by the locomotives), drill jumbos, compressors used to power small hand tools within the tunnel, generators used for backup, bobcats, and water pumps. Equipment within the shaft and tunnel at the east connection site would include the same equipment as the west connection site, with the exception of the TBM and tunnel pipe transporters.

Sources within the tunnel were modeled together as a volume source at the point of shaft ventilation. An exhaust temperature of 250° C (a temperature within the normal operating range of most diesel engines) was used for both the above-ground and below-ground sources. Based on estimated fuel consumption rates per 100 hp and potential pressure drops with diesel particulate filters on the exhaust, a stack velocity of 17.2 feet per second (or 5.24 meters per second) per 100 hp was used for each exhaust point along with a diameter of 6 inches (or 0.1524 meters) for sources above ground. For sources below ground, the ventilation system was modeled as a volume source, with a release height or 2.4 meters and an initial vertical dimension of 5 meters.

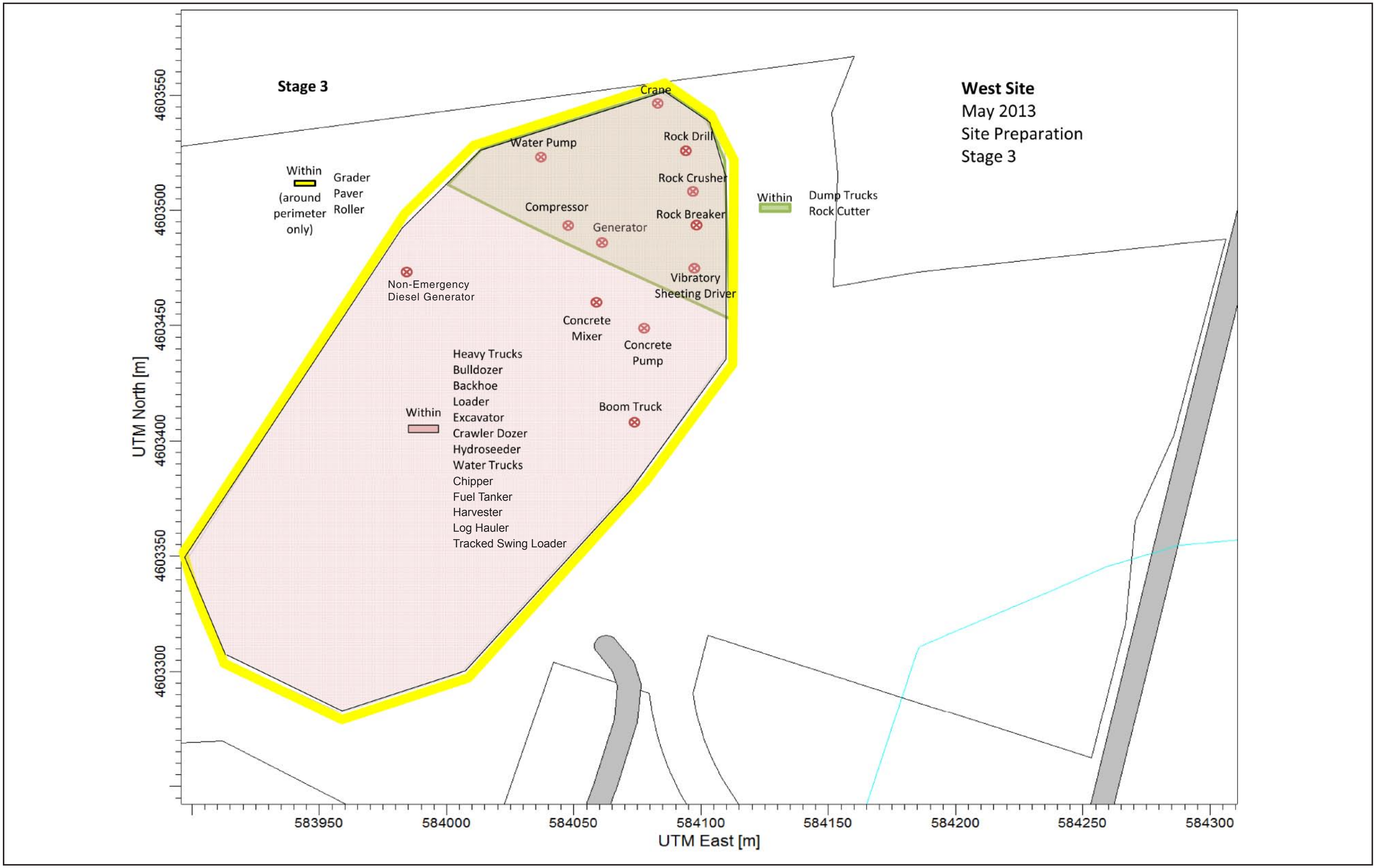


Figure 2.11-1

West Connection Site: Phase 1 Site Preparation Locations of Equipment

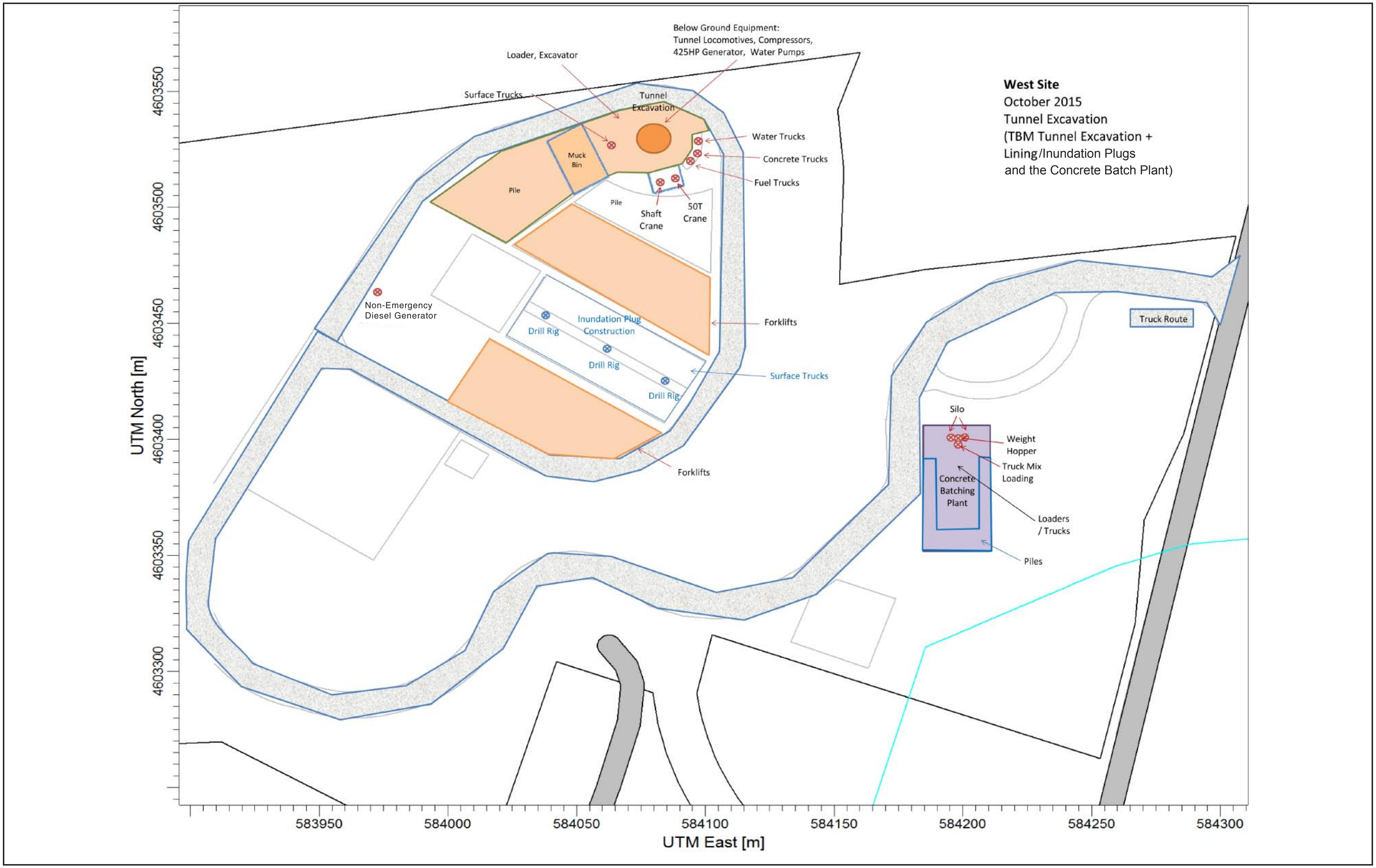


Figure 2.11-2

West Connection Site: Phase 3 Tunnel Excavation and Concrete Batch Plant Locations of Equipment

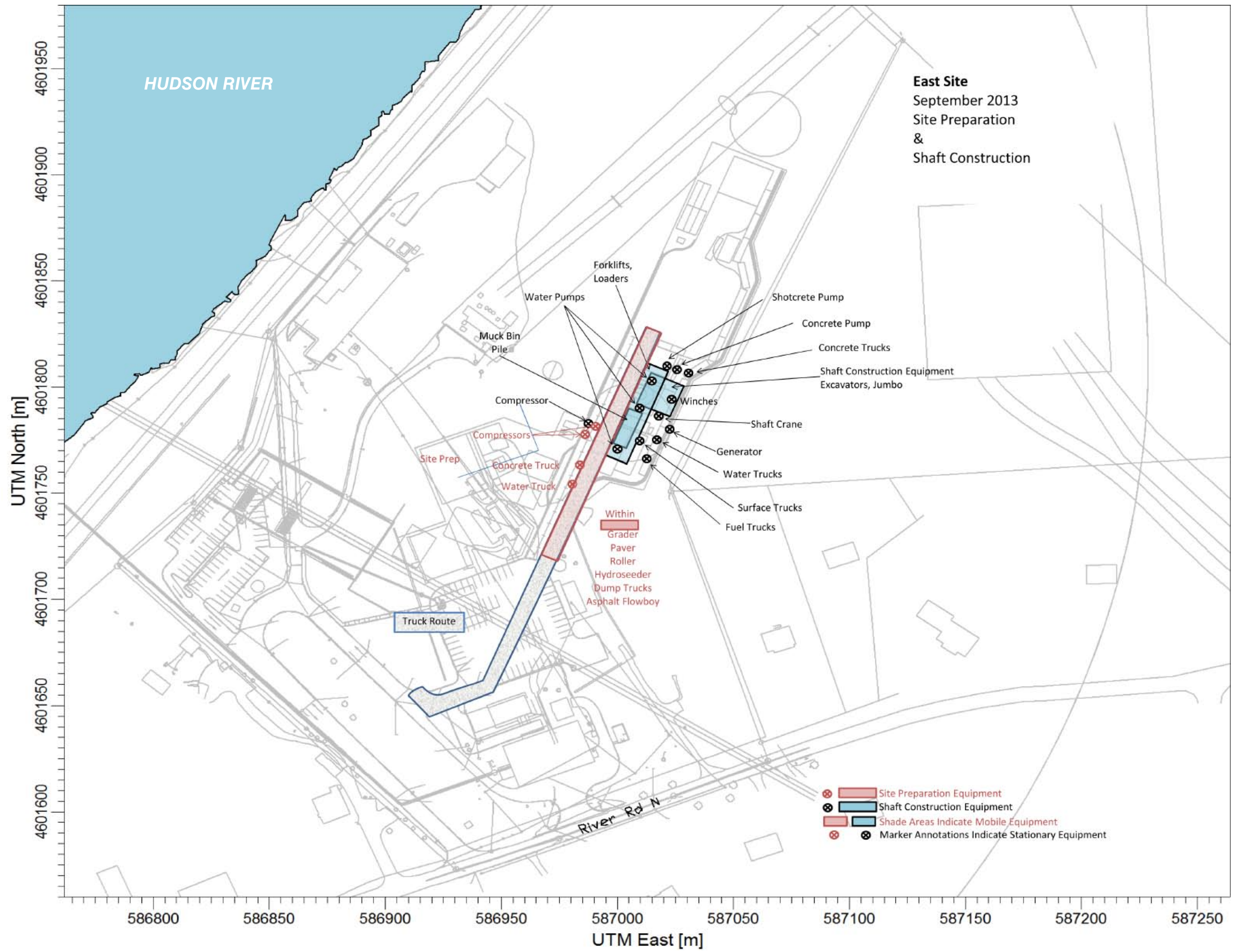


Figure 2.11-3

East Connection Site: Phase 1 Site Preparation and Phase 2 Shaft Construction Locations of Equipment

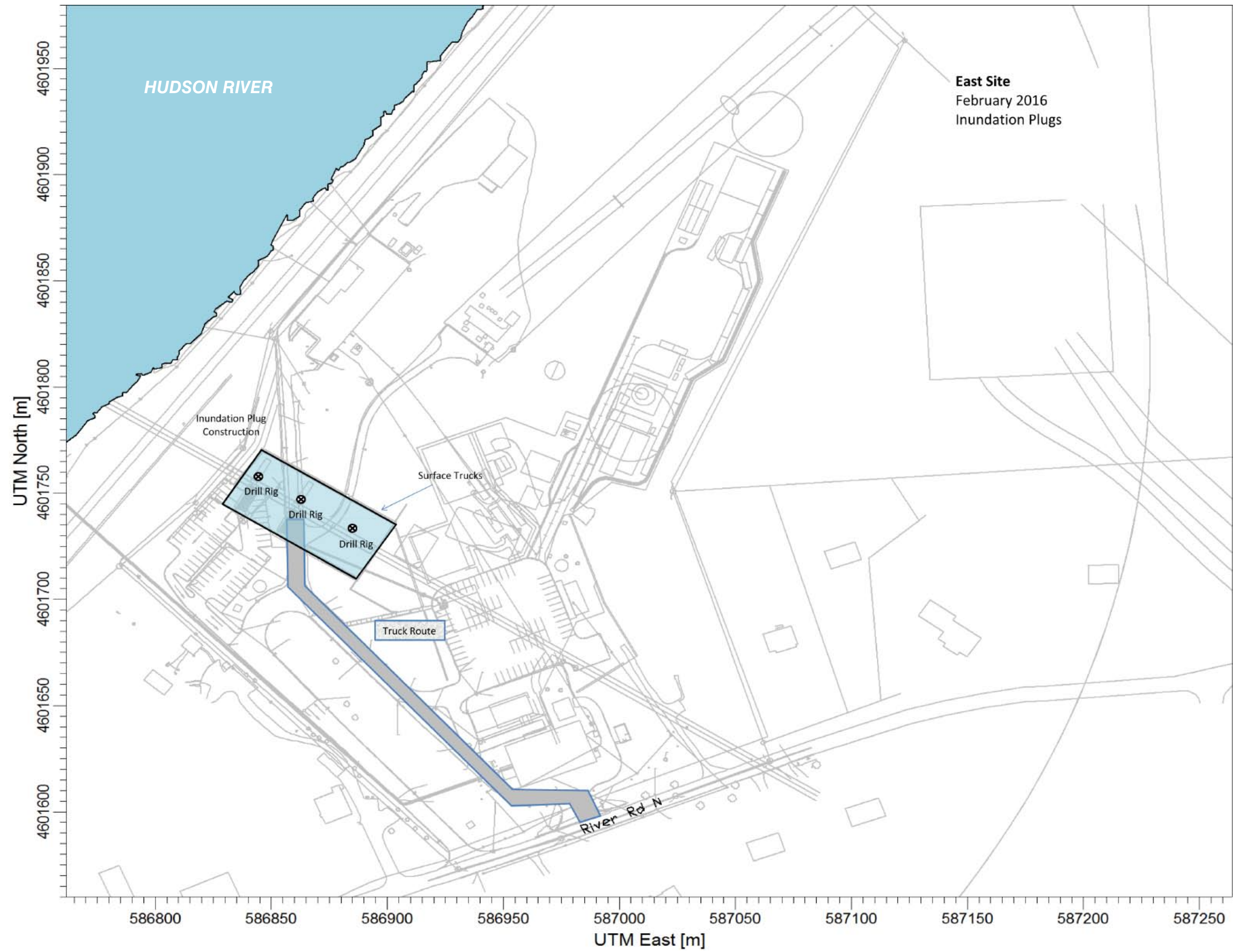


Figure 2.11-4
East Connection Site: Phase 3 Tunnel Excavation Locations of Equipment

Blasting

Blasting could also occur intermittently during the site preparation and shaft construction phases at the west connection site and during the shaft construction phase at the east connection site. Section 2.1, "Description of Project 1Construction Program," details the number of blasts and the typical timeframes when blasting would occur. Potential emissions from blasting include combustion by-products from explosive charges, such as NO_x, CO, and PM. The relative contribution of emissions from blasting was estimated based on the anticipated quantity of explosives and emission factors from AP-42. During potential blasting times, non-blast-related construction equipment (i.e., air compressors, loaders, rock drills, etc.) would not be operated in the same location as the blast site and at the same time; thus, predicted short-term concentrations from blasting operations are not expected to have a cumulative impact with predicted concentrations from non-blast construction operations. The volume and concentration of the blasting emissions would be comparable or less than the potential emissions from the non-blast construction equipment analyzed in the reasonable worst-case scenarios. Therefore, blasting operations at either the west or the east connection sites would not result in a significant adverse impact.

Construction Generators

Exhaust parameters for the stationary diesel engine generator at the west connection site were estimated based on similar engines in industry. A stack height of 15 feet was used as a typical height for trailer mounted engine generators. A stack diameter of 24 inches, an exhaust flowrate of 12,800 acfm, and an exhaust temperature of 443° C was used. It was assumed for this analysis that one, 1.135MW diesel engine generator would be utilized and operated continuously during the site preparation and shaft construction phases. This generator would likely remain on-site during subsequent phases of Project 1 to provide backup emergency power. For the east connection site, since there is already power at the site and additional power would be supplied by a new supply feeder from CHG&E, this type of non-emergency engine generator is not required and is therefore, not analyzed. There would also be several other emergency generators at both the west and east connection sites used throughout the construction of Project 1. These emergency generators would be used on an intermittent basis depending on the phase of construction. Exhaust parameters would be similar to the exhaust parameters described above for non-road engines.

The loaders, backhoes, dozers, graders, rollers, excavators, hydroseeders, log haulers, asphalt flow boys, harvesters, rock cutters, pavers, finishers, chippers, tunnel locomotives, fork lifts, jumbos, and heavy trucks would operate as mobile equipment and were simulated as area sources for the short-term periods of the modeling analysis. Emissions associated with this equipment were distributed evenly across the defined work areas by task. For the modeled annual period, all sources of air emissions, with the exception of the stationary diesel engine generators, drill rigs during the construction of the inundation plugs at both connection sites, cranes during the west connection site tunnel excavation phase and east connection site shaft construction phase, and compressors during the east connection site shaft construction phase, were assumed to be area sources.

Cruise emissions from the trucks entering and exiting the connection sites were simulated along the truck route using a series of volume sources representing a line source for both the short-term and annual analyses.

Emissions from the generators, compressors, water pumps, and tunneling locomotive equipment within the tunnel during tunnel excavation were added together and modeled as a volume source at the point of shaft ventilation. The tunnel would likely be ventilated by a series of surface fans, exhausting through the opening of the shaft.

Receptor Locations

Receptors (locations in the model where concentrations are predicted) were placed along the fence line surrounding the construction sites, at residential and other sensitive uses at both ground-level and elevated locations (e.g., residential windows), and at publicly accessible open spaces. In addition, two ground-level receptor grids were placed in the model. The first is a fine ground-level receptor grid out to a distance of 1 kilometer from each connection site with 25 meter receptor spacing. The second is a coarse receptor grid at locations out to a distance of 3 kilometers from each site with 100-meter receptor spacing to enable extrapolation of concentrations throughout the entire area and encompassing each site.

All receptors were referenced to Universal Transverse Mercator (UTM) coordinates. Seven-Minute digital elevation model (DEM) files were utilized for the off-site receptor grid area. Since the connection sites would be graded as part of the construction analysis, topographical terrain maps of the Project 1 sites were utilized for the on-site sources, structures, and roadways. A terrain pre-processor program (AERMAP) was used to determine the representative elevations and hill-height scales for each receptor. **Figures 2.11-5 and 2.11-6** show the receptors in the west of Hudson and east of Hudson study areas, respectively.

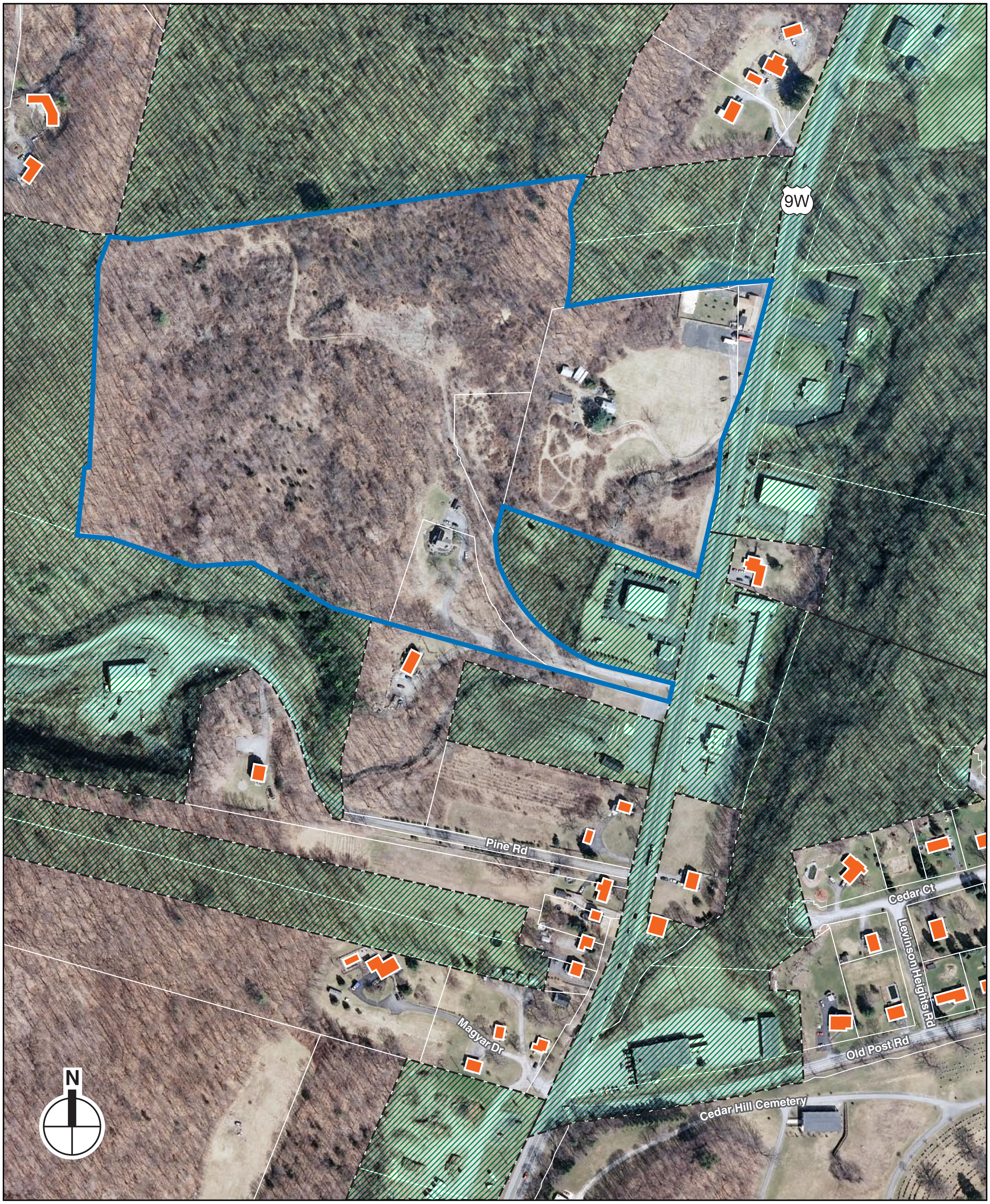
Meteorological Data

The meteorological data set consisted of the latest 5 years of meteorological surface data from the nearest national weather service station at Dutchess County Airport in Poughkeepsie, New York (2006-2010) and concurrent upper air data collected from Albany, New York.

Background Concentrations

Where needed to determine potential air quality impacts from the construction of Project 1, background ambient air quality data for criteria pollutants were added to the predicted off-site concentrations. The background data was obtained from NYSDEC monitoring stations. The most representative monitoring data was used for the analysis. Since there are no representative background air quality monitors in either Orange or Dutchess Counties for NO_2, PM_{10}, or CO, background data was obtained from the I.S. 52 monitoring station located at 681 Kelly Street in Bronx, NY for NO_2 and PM_{10} and from the New York Botanical Gardens located at 2900 Southern Boulevard also located in Bronx, NY, for CO. These monitors were chosen as the most representative monitoring stations due to similar land use and zoning in the areas surrounding

12.16.11



West Connection Site

Sensitive Receptor Locations

Areas of Discrete Receptor Locations

Figure 2.11-5

West Connection Site:
Air Quality Receptor Network

12.16.11

Figure 2.11-6
East Connection Site: Air Quality Receptor Network

them. Background data for $PM_{2.5}$ was obtained from the Newburgh monitoring station. Background concentrations are provided below in **Table 2.11-6**.

Table 2.11-6
Background Air Quality Data for Analyses

Pollutant	Monitoring Station	Averaging Period	Background Concentration (μg/m^3)
NO_2	I.S. 52	Annual	54.6
		1-hour	134.7
PM_{10}	I.S. 52	24-hour	48
CO	Botanical Gardens	1-hour	3.5 (ppm)
		8-hour	2.2 (ppm)
$PM_{2.5}$	Newburgh	24-hour	26
		Annual	10.6

Notes: Background concentrations for short-term standards represent second-highest concentrations except for the NO_2 1-hour, which is the maximum daily 98th percentile background concentration, averaged over three years, and $PM_{2.5}$ 24-hour, which is the maximum 98th percentile background concentration averaged over three years, in accordance with the form of the standards; latest five years of data for CO and latest three years of data for PM_{10} and $PM_{2.5}$.
Background concentrations for annual standards represent the five-year highest concentration.
Sources: New York State Ambient Air Quality Report, NYSDEC 2009.

Existing Monitored Air Quality Conditions

The most recent concentrations of all criteria pollutants at NYSDEC air quality monitoring stations nearest the study areas are presented in **Table 2.11-7**. Representative monitored ambient air quality data are the same for both the west connection site and east connection site. All data statistical forms and averaging periods are consistent with the definitions of the NAAQS. It should be noted that these values are somewhat different from the background concentrations presented in Table 2.11-6, above, that are used in the air quality analyses for comparison to the NAAQS. These existing concentrations are based on recent published measurements, averaged according to the NAAQS (e.g., $PM_{2.5}$ concentrations are averaged over 3 years for both 24-hour and annual concentrations); the background concentrations are the highest values in past years, and are used as a conservative estimate of the highest background concentrations for future conditions and in the subsequent modeling analyses.

Table 2.11-7
Representative Monitored Ambient Air Quality Data

Pollutant	Location	Units	Averaging Period	Concentration	NAAQS
CO	Botanical Gardens, Bronx	ppm	8-hour	1.9	9
			1-hour	2.8	35
SO_2	Mt. Ninham, Putnam County	μg/m^3	1-hour	45.0	197
			3-hour	39	1,300
PM_{10}	I.S. 52, Bronx	μg/m^3	24-hour	43	150
$PM_{2.5}$	Newburgh, Orange County	μg/m^3	Annual	9.4	15
			24-hour	26	35
NO_2	I.S. 52, Bronx	μg/m^3	1-hour	134.7	188
			Annual	47	100
Lead	Walkill, Orange County	μg/m^3	3-month	0.069	0.15
Ozone	Valley Central, Orange County	ppm	8-hour	0.076	0.075

Notes:
Based on the NAAQS definitions, the CO and SO_2 concentrations for short-term averages are the second-highest from the year. $PM_{2.5}$ annual concentrations are the average of 2007, 2008, and 2009, and the 24-hour concentration is the average of the annual 98th percentiles in 2007, 2008 and 2009. 8-hour average ozone concentrations are the average of the 4th highest-daily values from 2007 to 2009.
Source: NYSDEC, New York State Ambient Air Quality Data.

There were no monitored violations of the NAAQS for the pollutants at these monitored sites in 2009 with the exception of the 8-hour ozone standard of 0.075 $\mu g/m^3$ (based on the fourth highest daily maximum 8-hour average).

To determine if there are any significant sources of stationary air pollutants near the connection sites that are not already accounted for in the monitored background levels of air pollutants for analysis, data from land use and field surveys was examined and a search of the NYSDEC's permit databases[4] and the USEPA Envirofacts[5] database was undertaken. An assessment of large emission sources (e.g. power plants, concrete plants) within 1,000 feet of the study area and commercial, institutional, or large-scale residential developments within 400 feet of the study areas was undertaken. Based on the field surveys and data searches, there are no significant sources of stationary air pollutants near the connection sites that would need to be added to the monitored background levels. For example, the Dynegy power plant is approximately 4,000 feet from the west connection site and approximately 5,000 feet from the east connection site.

2.11-4.2 MOBILE SOURCES

The prediction of vehicle-generated CO emissions and their dispersion incorporates meteorological phenomena, traffic conditions, and physical configurations (e.g., street widths, sidewalk locations). Air pollutant dispersion models mathematically simulate how traffic, meteorology, and source-receptor geometry combine to affect pollutant concentrations. The mathematical expressions and formulations contained in the various models attempt to describe an extremely complex physical phenomenon as closely as possible. However, because all models contain simplifications and approximations of actual conditions and interactions and since it is necessary to predict the reasonable worst-case scenarios, most of these dispersion models predict conservatively high concentrations of pollutants, particularly under adverse meteorological conditions.

The mobile source analyses for Project 1 employ models approved by EPA that have been widely used for evaluating air quality impacts of projects in New York City, Orange and Dutchess Counties, and throughout the country. The modeling approach includes a series of conservative assumptions relating to meteorology, traffic, and background concentration levels, resulting in a conservatively high estimate of anticipated CO and PM concentrations that could result from mobile sources associated with Project 1.

This section provides an overview of the analytical tools used to determine Project 1's on-road mobile source construction impacts.

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[4] NYSDEC, Title V and State Facility Permit databases, http://www.dec.ny.gov/dardata/boss/afs/issued_atv.html, *[8/30/2011]*.and http://www.dec.ny.gov/dardata/boss/afs/issued_asf.html, *[8/30/2011]*.

[5] EPA, Envirofacts Data Warehouse, http://oaspub.epa.gov/enviro/ef_home2.air, *[8/30/2011]*.

DISPERSION MODEL FOR MICROSCALE ANALYSES

Maximum CO concentrations adjacent to streets near the connection sites from vehicle emissions were predicted using the CAL3QHC model Version 2.0. The CAL3QHC model employs a Gaussian (normal distribution) dispersion assumption and includes an algorithm for estimating vehicular queue lengths at signalized intersections. CAL3QHC predicts emissions and dispersion of CO from idling and moving vehicles. The queuing algorithm includes site-specific traffic parameters, such as signal timing and delay calculations (from the *2000 Highway Capacity Manual* traffic forecasting model), saturation flow rate, vehicle arrival type, and signal actuation (i.e., pre-timed or actuated signal) characteristics to accurately predict the number of idling vehicles. The CAL3QHC model has been updated with an extended module, CAL3QHCR, which allows for the incorporation of hourly meteorological data into the modeling, instead of worst-case assumptions regarding meteorological parameters. This refined version of the model, CAL3QHCR, is employed if maximum predicted future CO concentrations are greater than the applicable ambient air quality standards or when *de minimis* thresholds are exceeded using the first level of CAL3QHC modeling.

To determine motor vehicle-generated PM concentrations adjacent to streets near the connection sites, the CAL3QHCR model was applied. This refined version of the model can utilize hourly traffic and meteorology data, and it is therefore more appropriate for calculating 24-hour and annual average concentrations. The meteorological data consists of surface data collected at Dutchess County Airport and upper air data collected at Albany, New York, for the period 2006-2010. All hours in the 5-year data set were modeled, and the highest resulting concentration for each averaging period is presented in this EIS.

Meteorology

In general, the transport and concentration of pollutants from vehicular sources are influenced by three principal meteorological factors: wind direction, wind speed, and atmospheric stability. Wind direction influences the accumulation of pollutants at a particular location (receptor), and atmospheric stability accounts for the effects of vertical mixing in the atmosphere.

Analysis Year

An air quality analysis was performed for 2015, the worst-case analysis year for mobile source impacts (see Section 2.10, “Transportation”). The analysis was performed for future conditions both without Project 1 and with Project 1.

VEHICLE EMISSIONS DATA

Engine Emissions

Vehicular CO and PM engine emission factors were computed using the EPA mobile source emissions model, MOBILE6.2 (MOBILE 6 version 6.2). This emissions model is capable of calculating engine emission factors for various vehicle types, based on the fuel type (gasoline, diesel, or natural gas), meteorological conditions, vehicle speeds, vehicle age, roadway types, number of starts per day, engine soak time, and various other factors that influence emissions, such as inspection maintenance programs. Idle emission factors were used when vehicles would be queuing, and free flow emission factors were based on vehicle travel speeds when traffic would be moving. The inputs and use of MOBILE6.2 for Project 1 are consistent with the most current guidance available from NYSDEC.

Vehicle classification data are based on field studies outlined in Section 2.10, "Transportation" (including project-generated traffic). Appropriate credits were used to accurately reflect the New York State inspection and maintenance program. The inspection and maintenance programs require inspections of automobiles and light trucks to determine if pollutant emissions from the vehicles' exhaust systems are below emission standards. Vehicles failing the emissions test must undergo maintenance and pass a repeat test to be registered in New York State. All construction-worker-generated vehicles were simulated as hot stabilized for arrivals and cold starts for departures. An ambient temperature of 30° Fahrenheit was used for the analysis.

TRAFFIC DATA

Traffic data for the air quality analysis were derived from existing traffic counts, projected future growth in traffic, and other information developed as part of the construction traffic analysis for Project 1 (see Section 2.10). Traffic data for the future with and without Project 1 were employed in the respective air quality modeling scenarios.

The weekday AM (7:15 to 8:15 AM) and PM (4:30 to 5:30 PM) construction worker peak hours were used for microscale CO analysis. These time periods were selected because they would produce the maximum anticipated project-generated traffic (see Section 2.10, "Transportation") and therefore have the greatest potential for significant air quality impacts. Similar to the traffic analysis in Section 2.10, the peak construction worker volumes were applied to the peak commuter hours to develop conservative estimates of air quality impacts from construction related vehicles. Construction traffic from Project 1 on non-commuter peak hours, predicted air quality impacts would be less than those presented in this section. For the 24-hour baseline traffic used in the analysis of PM, the traffic volumes were based on ATR data.

BACKGROUND CONCENTRATIONS

Background concentrations for mobile sources are those pollutant concentrations not accounted for through the modeling analysis, which directly accounts for vehicle-generated emissions on the streets within 1,000 feet and line-of-sight of the receptor location. Background concentrations must be added to mobile source modeling results to obtain total pollutant concentrations at a study location.

The 8-hour average background CO concentration used in this analysis is 2.2 ppm and the 1-hour background CO concentration employed in the analysis is 3.5 ppm (see Table 2.11-4). For PM_{10}, the 24-hour average background concentration used in this analysis is 48 $\mu g/m^3$.

MOBILE SOURCE ANALYSIS SITES

For the west of Hudson study area, the intersections listed in **Table 2.11-8** and presented in **Figure 2.11-7** were used in the analysis. For the east of Hudson study area, the intersections listed in **Table 2.11-9** and presented in **Figure 2.11-8** were used in the analysis. These locations were selected because they are intersections where the largest levels of project-generated (incremental) traffic in the study areas are expected and/or they are in close proximity to sensitive receptor locations, such as residential buildings and schools, and, therefore, where the greatest air quality impacts and maximum changes in concentrations would be anticipated. Each of these intersections was analyzed for CO and two of the three intersections at each connection site were analyzed for PM.

Table 2.11-8
Mobile Source Analysis Intersection Locations in the West of Hudson Study Area

Analysis Site	Location
1	Route 9W (N-S) & Fostertown Road
2	Route 9W (N-S) & N. Plank Rd./I-84 WB Off Ramp
3	Route 9W (N-S) & Site Driveway
Note: Analysis Sites 2 and 3 were analyzed for PM.	

Table 2.11-9
Mobile Source Analysis Intersection Locations in the East of Hudson Study Area

Analysis Site	Location
4	Route 9D (N-S) & I-84 WB Ramps
5	Route 9D (N-S) & Chelsea Road/Baxtertown Road
6	River Road North (E-W) & East Connection West Driveway
Note: Analysis Sites 4 and 6 were analyzed for PM.	

Receptor Locations

Multiple receptors (i.e., precise locations at which concentrations are predicted by the model) were modeled along the approach and departure links of the selected intersection at spaced intervals. The receptor locations include sidewalks (where present) and roadside locations near intersections with continuous public access. In addition, receptors were placed on residential and school locations near the selected intersections. Receptors in the analysis models for predicting annual average neighborhood-scale $PM_{2.5}$ concentrations were placed at a distance of 15 meters, from the nearest moving lane at each analysis location, based on the DEP procedure for neighborhood-scale corridor $PM_{2.5}$ modeling.

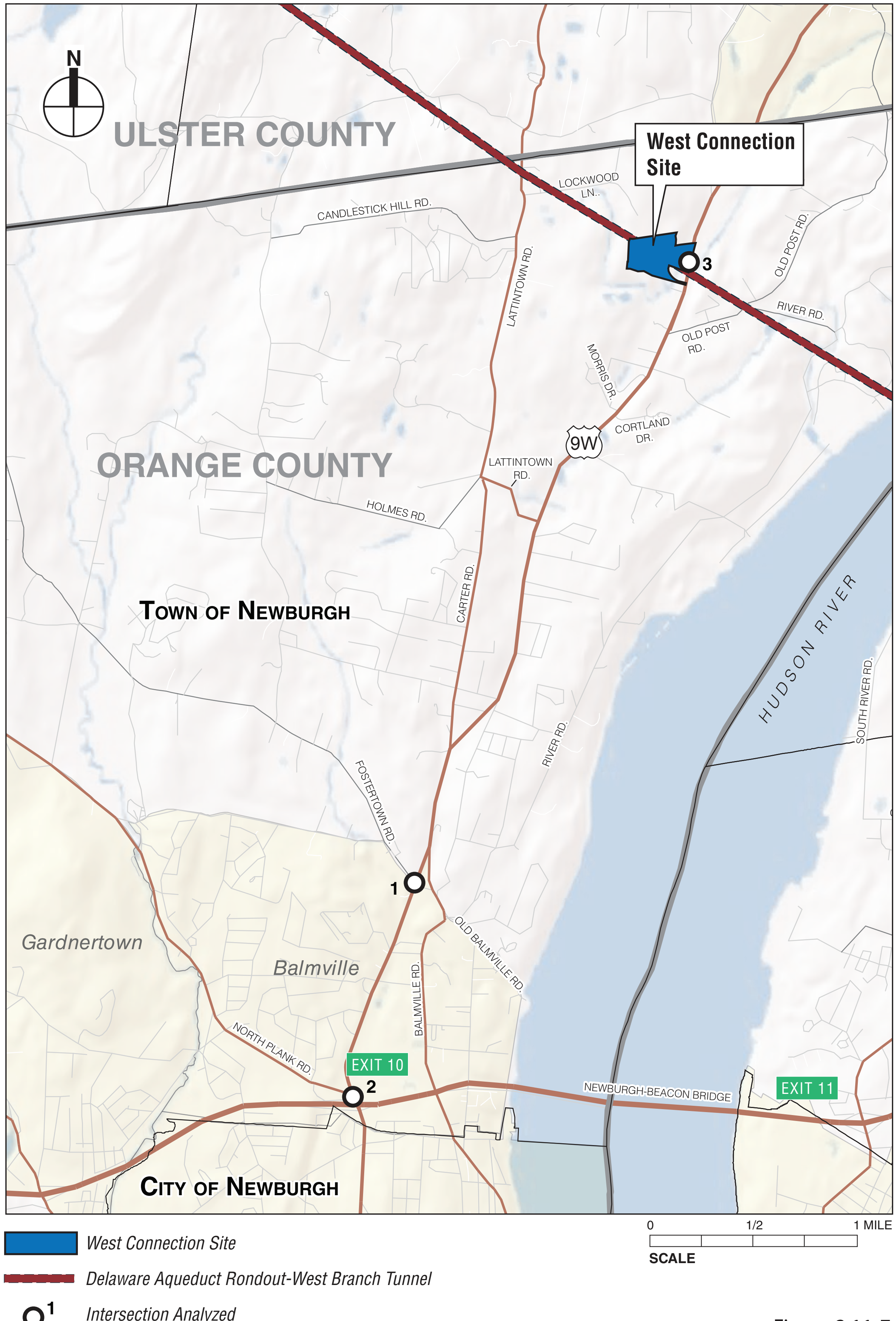
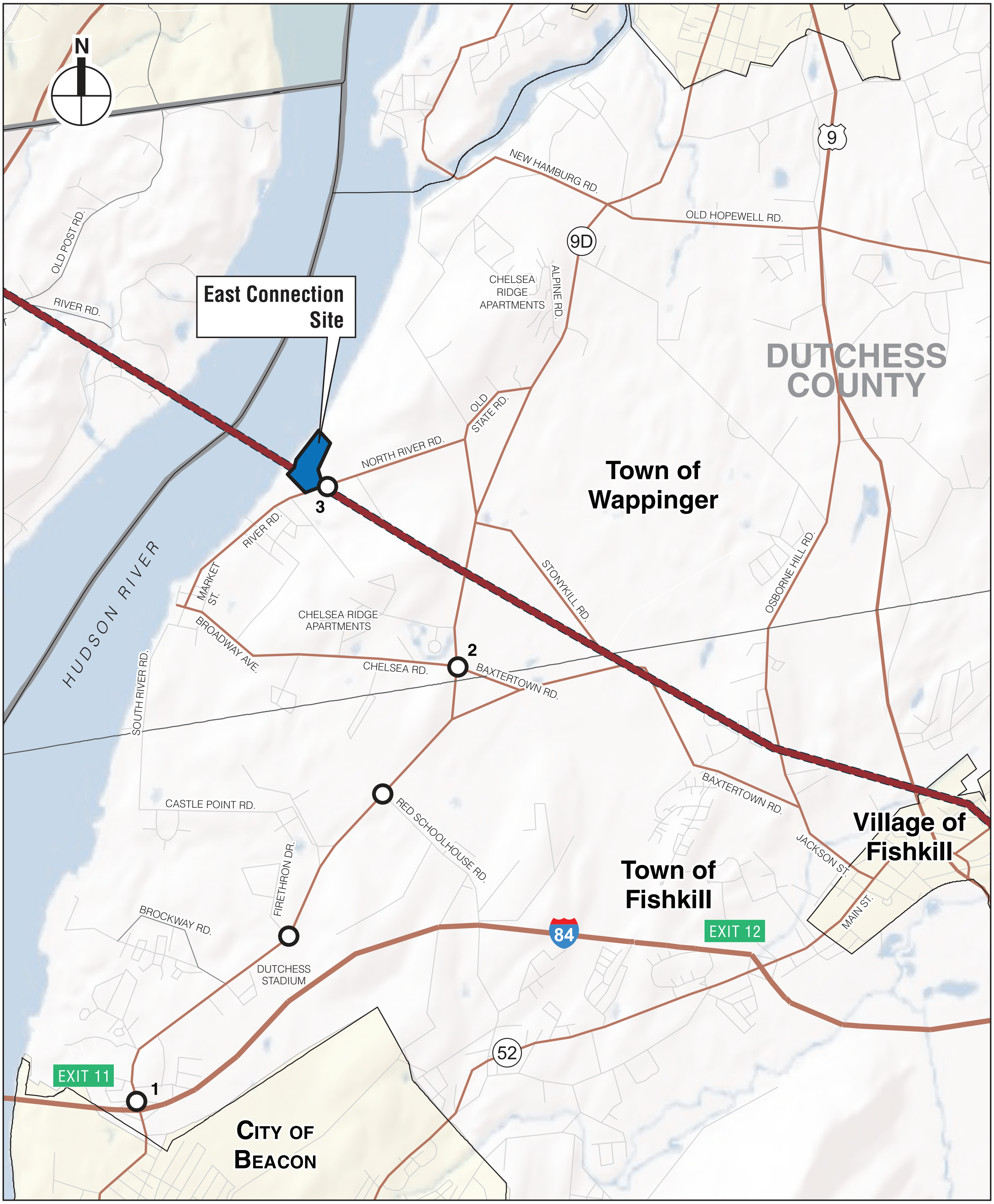


Figure 2.11-7

West Connection Site:
Air Quality Analysis Intersection Locations

12.16.11



East Connection Site

Delaware Aqueduct Rondout-West Branch Tunnel

Intersection Analyzed

Figure 2.11-8

East Connection Site:
Air Quality Analysis Intersection Locations

2.11-5 WEST OF HUDSON

2.11-5.1 EXISTING CONDITIONS—WEST OF HUDSON

EXISTING SIMULATED POLLUTANT CONCENTRATIONS IN THE STUDY AREA

The monitored concentrations (presented above in Table 2.11-7) represent general air quality in the study area. However, this section presents the existing concentrations adjacent to the mobile-source analysis sites in the existing condition. These concentrations may be higher than at the monitoring stations due to the adjacent vehicular emissions. The highest simulated existing 8-hour average CO concentrations at the mobile-source analysis sites plus monitored background concentrations are presented in **Table 2.11-10**. (One-hour average values are not shown since predicted values are much lower than the 1-hour standard of 35 ppm.)

Table 2.11-10
Maximum Predicted Existing 8-Hour Average
CO Concentrations for 2010, West of Hudson Study Area

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)
1	Route 9W (N-S) & Fostertown Road	AM	3.3
2	Route 9W (N-S) & N. Plank Rd./I-84 WB Off Ramp	PM	4.6
3	Route 9W (N-S) & Site Driveway	PM	3.0
Note: 8-hour standard is 9 ppm.			

2.11-5.2 FUTURE WITHOUT PROJECT 1, SHAFT AND BYPASS TUNNEL CONSTRUCTION—WEST OF HUDSON

STATIONARY SOURCE CONSTRUCTION IMPACTS

In the future without Project 1, air quality is anticipated to be similar to that described for existing conditions. While there is a possibility for some limited redevelopment activity to occur within the study area, no significant changes in land use are anticipated in the area surrounding the west connection site. Since air quality regulations mandated by the Clean Air Act are expected to maintain or improve air quality in the region, it can be expected that air quality conditions in the future without Project 1 would similar or better than those that presently exist.

MOBILE SOURCE CONSTRUCTION IMPACTS

A mobile source air quality analysis was conducted for the future without Project 1 scenario for the peak construction traffic year, 2015. Localized pollutant impacts from the vehicles queuing at the selected intersection were analyzed for CO for the 1-hour and 8-hour averaging times. Impacts for PM were also considered in the analysis. PM_{10} was analyzed for the 24-hour averaging period and $PM_{2.5}$ for the 24-hour and annual averaging periods.

CO

As indicated in **Table 2.11-11**, the predicted total concentrations of CO (including background) for the future year without Project 1 (2015) would be below the corresponding ambient air quality standards at each of the three intersections analyzed. Both the 1-hour and 8-hour averaging periods for the modeled intersection would be in compliance with their respective standards.

Table 2.11-11
Future Without Project 1
Mobile Source CO Concentrations (ppm), West of Hudson Study Area

Analysis Site	Intersection	Averaging Period	Ambient AQ Background (ppm)	Model Results (ppm)		Total Modeled Conc. (ppm) *		NAAQS (ppm)
				AM	PM	AM	PM	
Analysis Year 2015								
1	Route 9W (N-S) & Fostertown Road	1-hour	3.5	1.3	1.5	4.8	5.0	35
		8-hour	2.2	0.9	1.1	3.1	3.3	9
2	Route 9W (N-S) & N. Plank Rd./I-84 WB Off Ramp	1-hour	3.5	3.0	3.1	6.5	6.6	35
		8-hour	2.2	2.1	2.2	4.3	4.4	9
3	Route 9W (N-S) & Site Driveway	1-hour	3.5	0.9	1.0	4.4	4.5	35
		8-hour	2.2	0.6	0.7	2.8	2.9	9
Note: * Ambient AQ background + model results = total predicted concentration.								

PM

Concentrations of PM_{10} and $PM_{2.5}$ from mobile sources without Project 1 were also determined for the 2015 analysis year. As indicated in **Tables 2.11-12 and 2.11-13**, the predicted 24-hour concentrations of PM_{10} and the predicted 24-hour and annual concentrations of $PM_{2.5}$, including background, would be below the corresponding ambient air quality standards at the two intersections analyzed.

Table 2.11-12
Future Without Project 1
Mobile Source PM_{10} 24-Hour Concentrations ($\mu g/m^3$),
West of Hudson Study Area

Analysis Site	Intersection	Averaging Period	Ambient AQ Background ($\mu g/m^3$)	Model Results ($\mu g/m^3$)	Total Modeled Conc. ($\mu g/m^3$) *	NAAQS ($\mu g/m^3$)
Analysis Year 2015						
2	Route 9W (N-S) & N. Plank Rd./I-84 WB Off Ramp	24-hour	48	32	80	150
3	Route 9W (N-S) & Site Driveway	24-hour	48	12	60	150
Notes: * Ambient AQ background + model results = total predicted concentration.						

Table 2.11-13
Future Without Project 1
Mobile Source $PM_{2.5}$ 24-Hour and Annual Concentrations (μg/m³),
West of Hudson Study Area

Analysis Site	Intersection	Averaging Period	Ambient AQ Background (μg/m³)	Model Results (μg/m³)	Total Modeled Conc. (μg/m³) *	NAAQS (μg/m³)
Analysis Year 2015						
2	Route 9W (N-S) & N. Plank Rd./I-84 WB Off Ramp	24-hour	26	8.5	34.5	35
3	Route 9W (N-S) & Site Driveway	24-hour	26	3.0	29.0	35
2	Route 9W (N-S) & N. Plank Rd./I-84 WB Off Ramp	Annual	10.6	0.4	11.0	15
3	Route 9W (N-S) & Site Driveway	Annual	10.6	0.2	10.8	15

Notes: * Ambient AQ background + model results = total predicted concentration.

2.11-5.3 PROBABLE IMPACTS OF PROJECT 1, SHAFT AND BYPASS TUNNEL CONSTRUCTION—WEST OF HUDSON

This section summarizes the potential air quality impacts that could result from Project 1's construction activities at the west connection site. The most likely effects on local air quality during construction activities would result from:

- Engine emissions generated by on-site construction equipment and from trucks entering and leaving the connection site during construction;
- Fugitive dust emissions generated by soil excavation and other material processing activities; and
- Mobile source emissions generated by Project 1-related construction trucks and worker vehicles traveling to and from the connection site on local roads.

An analysis of the potential for air quality impacts from on-site construction sources was performed using the methodology described above under "Stationary Sources." As discussed in the methodology, the peak phases of construction from the $PM_{2.5}$ emissions profile were used to analyze maximum short-term and annual impacts in the modeling analysis. For the west connection site, the peak construction phases are site preparation and tunnel excavation. In addition, maximum short-term and annual impacts from material handling operations, loading unloading, and transfer operations, fugitive emissions from the storage piles, and engine exhaust emissions from non-road equipment at the concrete batch plant were also analyzed together with the tunnel excavation phase for a reasonable worst-case scenario. The modeling analysis conservatively assumes that maximum peak emissions during the tunnel excavation phase would occur simultaneously with the maximum peak emissions from the concrete batch plant.

An analysis of the potential for air quality impacts from Project 1-induced traffic was also performed using the methodology described above under "Mobile Sources." The peak period used in the modeling analysis for mobile sources is for the year 2015. Potential cumulative impacts from on-site and on-street sources were also determined. Maximum impacts from the mobile source analysis were added to the maximum impacts from the stationary source analysis for a conservative cumulative impact.

The results of both stationary and mobile source modeling analyses are summarized below. ~~Since~~ The predicted concentrations were modeled for periods that represent the highest expected site-wide air quality impacts by construction phase since these were the periods with the highest potential emissions. Since emissions from other phases of construction (for example, during blasting operations) are expected to be comparable or less than emissions from the reasonable worst-case scenario phases, the increments and total predicted concentrations during other phases of construction and at other locations are expected to be less. Furthermore, since (as demonstrated below) no significant adverse air quality impacts were predicted for the peak emission periods and phases of construction, significant adverse impacts would not be predicted from other phases of construction. The volume and concentration of blasting emissions would be comparable or less than the potential emissions from the non-blast construction equipment analyzed in the reasonable worst-case scenarios. Therefore, blasting operations at either the west or the east connection sites would also not result in predicted significant adverse impacts on air quality. ~~also not expected to result in any predicted significant adverse impacts. As indicated, the modeling analyses demonstrated that no significant adverse impacts from construction sources are expected during the peak emission periods and phases of construction.~~

STATIONARY SOURCE CONSTRUCTION IMPACTS

A dispersion modeling analysis was performed to estimate the maximum off-site pollutant concentrations associated with emissions produced by on-site construction activities at the west connection site. The modeling analysis was conducted using the AERMOD dispersion model and performed in accordance with EPA and DEP guidance regarding the use of dispersion models for regulatory purposes described above. The predicted ambient concentrations of criteria pollutants have been used to demonstrate compliance with applicable air quality standards and interim guidance values.

Site Preparation

Table 2.11-14 presents the maximum predicted concentrations of criteria pollutants due to the proposed construction activities at the west connection site during one of the most conservative analysis construction phases: site preparation, which includes emissions from the stationary diesel engine generator. The maximum concentrations from on-site construction sources were predicted at receptors near the site. This was true for all averaging periods, both short-term and annual, and for all pollutants modeled in the analysis. The maximum predicted total concentrations including background are also presented in the table.

Table 2.11-14
Maximum Predicted Total Concentrations for Construction Activities During Site Preparation, West of Hudson Study Area

Pollutant	Averaging Period	Background Conc. (µg/m^3)	Predicted Impact (µg/m^3)	Total Max Predicted Conc. (µg/m^3)	NAAQS (µg/m^3)
NO_2	Annual	54.6	14.8	69.4	100
PM_{10}	24-hour	48	12	60	150
CO	1-hour	3.5 ppm	3.0 ppm	6.5 ppm	35 ppm
	8-hour	2.2 ppm	0.7 ppm	2.9 ppm	9 ppm
$PM_{2.5}$	24-hour	26	4.7	30.7	35
	Annual	10.6	0.2	10.8	15

As indicated in Table 2.11-14, the maximum predicted total concentrations of NO_2, PM_{10}, CO, and $PM_{2.5}$ would not exceed the NAAQS. Therefore, no significant adverse air quality impacts are predicted from the on-site construction sources.

Shaft Construction

Emissions from the shaft construction phase at the west connection site would be less than emissions during the site preparation or tunnel excavation phases; therefore, impacts from the shaft construction phase would be expected to be less than impacts during other phases of Project 1.

Bypass Tunnel Excavation

Table 2.11-15 presents the maximum predicted concentrations of criteria pollutants due to the proposed construction activities at the west connection site during bypass tunnel excavation. Similar to the site preparation phase, the maximum concentrations from on-site construction sources were predicted at receptors near the site and for all averaging periods, both short-term and annual, and for all pollutants modeled in the analysis. The maximum predicted total concentrations including background are also presented in the table.

Table 2.11-15
Maximum Predicted Total Concentrations for Construction Activities During Bypass Tunnel Excavation, West of Hudson Study Area

Pollutant	Averaging Period	Background Conc. (µg/m^3)	Predicted Impact (µg/m^3)	Total Max Predicted Conc. (µg/m^3)	NAAQS (µg/m^3)
NO_2	Annual	54.6	10.6	65.2	100
PM_{10}	24-hour	48	16.7	64.7	150
CO	1-hour	3.5 ppm	16.2 ppm	19.7 ppm	35 ppm
	8-hour	2.2 ppm	2.2 ppm	4.4 ppm	9 ppm
$PM_{2.5}$	24-hour	26	3.4	29.4	35
	Annual	10.6	0.3	10.9	15

As indicated in Table 2.11-15, the maximum predicted total concentrations of NO_2, PM_{10}, CO, and $PM_{2.5}$ would not exceed the NAAQS. Therefore, no significant adverse air quality impacts are predicted from the on-site construction sources.

Bypass Tunnel Lining, Project 1Demobilization, and Preparation for Project 2B (Bypass Tunnel Lining)

Emissions from construction activities during the bypass tunnel lining phase at the west connection site would be less than emissions during the site preparation or tunnel excavation phases; therefore, impacts from the bypass tunnel lining phase would be expected to be less than impacts during other phases of Project 1.

Concrete Batch Plant

Table 2.11-16 presents the maximum predicted concentrations of criteria pollutants due to the proposed concrete batch plant to be located at the west connection site. For maximum worst-case impacts, the concrete batch plant was modeled with the plant in the lower southeastern corner of the site near New York State (NYS) Route 9W. If the concrete batch plant is sited closer to the shaft site, there would be lesser impacts on the residences near NYS Route 9W. Maximum particulate matter concentrations from the operations at the batch plant were predicted at receptors south and east of the west connection site. The maximum predicted total concentrations including background are presented in the table.

Table 2.11-16
Maximum Predicted Total Concentrations for the Concrete Batch Plant, West of Hudson Study Area

Pollutant	Averaging Period	Background Conc. (µg/m^3)	Predicted Impact (µg/m^3)	Total Max Predicted Conc. (µg/m^3)	NAAQS (µg/m^3)
NO_2	Annual	54.6	NA	NA	100
PM_{10}	24-hour	48	31.3	79.3	150
CO	1-hour	3.5 ppm	NA	NA	35 ppm
	8-hour	2.2 ppm	NA	NA	9 ppm
$PM_{2.5}$	24-hour	26	4.9	30.9	35
	Annual	10.6	0.02	10.62	15

Notes: NA = not applicable. Only particulate matter emissions were analyzed for the concrete batch plant.

As indicated in Table 2.11-16 the maximum predicted total concentrations of PM_{10} and $PM_{2.5}$ would not exceed the NAAQS. Therefore, no significant adverse air quality impacts are predicted from the concrete batch plant.

As indicated in **Table 2.11-17,** below, the maximum predicted cumulative concentrations from both the bypass tunnel excavation and the concrete batch plant would also not exceed the NAAQS, and, therefore, no significant adverse air quality impacts are predicted.

Based on the multi-phase analyses described above and the relative emissions for other time periods of construction, construction of Project 1 at the west connection site would not result in predicted significant adverse air quality impacts from the on-site construction sources.

Table 2.11-17
Maximum Predicted Total Cumulative Concentrations for the Bypass Tunnel Excavation and the Concrete Batch Plant, West of Hudson Study Area

Pollutant	Averaging Period	Background Conc. ($\mu g/m^3$)	Predicted Impact ($\mu g/m^3$)	Total Max Predicted Conc. ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2	Annual	54.6	11.2	65.8	100
PM_{10}	24-hour	48	32.7	80.7	150
CO	1-hour	3.5 ppm	16.2 ppm	19.7 ppm	35 ppm
	8-hour	2.2 ppm	2.2 ppm	4.4 ppm	9 ppm
$PM_{2.5}$	24-hour	26	5.2	31.2	35
	Annual	10.6	0.3	10.9	15

Notes: NA = not applicable. Only particulate matter emissions were analyzed for the concrete batch plant.

MOBILE SOURCE CONSTRUCTION IMPACTS

A mobile source air quality analysis was conducted for Project 1during construction activities at the west connection site for the peak construction traffic year, 2015. Localized pollutant impacts from the vehicles queuing at the selected intersections were analyzed for CO for the 1-hour and 8-hour averaging times. Impacts for PM were also considered in the analysis. PM_{10} was analyzed for the 24-hour averaging period and $PM_{2.5}$ for the 24-hour and annual averaging periods.

CO

As indicated in **Table 2.11-18**, the predicted total concentrations of CO (including background) for the peak year for construction-related traffic (2015) would be below the corresponding ambient air quality standards. Both the 1-hour and 8-hour averaging periods for the modeled intersections would be in compliance with their respective standards.

Table 2.11-18
Future with Project 1
Mobile Source CO Concentrations (ppm) for Construction Activities, West of Hudson Study Area

Intersection	Averaging Period	Ambient AQ Background (ppm)	Model Results (ppm)		Total Modeled Conc. (ppm)*		NAAQS (ppm)
			AM	PM	AM	PM	
Analysis Year 2015							
Route 9W (N-S) & Fostertown Road	1-hour	3.5	1.4	1.6	4.9	5.1	35
	8-hour	2.2	1.0	1.1	3.2	3.3	9
Route 9W (N-S) & N. Plank Rd./I-84 WB Off Ramp	1-hour	3.5	3.1	3.1	6.6	6.6	35
	8-hour	2.2	2.1	2.1	4.4	4.4	9
Route 9W (N-S) & Site Driveway	1-hour	3.5	0.9	1.1	4.4	4.6	35
	8-hour	2.2	0.6	0.8	2.8	3.0	9

Note: * Ambient AQ background + model results = total predicted concentration.

In addition, the CEQR *de minimis* criteria were calculated for the 8-hour averaging period. As indicated in **Table 2.11-19**, the predicted incremental CO concentrations at the modeled intersections would not exceed the CEQR *de minimis* criteria (incremental value) for the 8-hour period.

Table 2.11-19
Mobile Source 8-Hour CO Concentrations (ppm) and CEQR *De Minimis* Criteria, West of Hudson Study Area

Intersection	Averaging Period	Without Project 1 Conc. (ppm)		Future with Project 1 Conc. (ppm)		Project 1 Increment (ppm)*		*De Minimis* Criteria (ppm)**	
		AM	PM	AM	PM	AM	PM	AM	PM
Analysis Year 2015									
Route 9W (N-S) & Fostertown Road	8-hour	3.1	3.3	3.2	3.3	0.1	0.0	6.1	6.1
Route 9W (N-S) & N. Plank Rd./I-84 WB Off Ramp	8-hour	4.3	4.4	4.4	4.4	0.1	0.0	6.7	6.7
Route 9W (N-S) & Site Driveway	8-hour	2.8	2.9	2.8	3.0	0.0	0.1	5.9	6.0

Notes:
* Project 1 increment is defined as the "future with Project 1" value minus the "future without Project 1" value.
** See 2.11-3.4 above for details on how this value is calculated.

PM

Table 2.11-20 shows the future (2015) maximum predicted 24-hour average PM_{10} concentrations with Project 1. As indicated in the table, predicted 24-hour concentrations of PM_{10}, including background would be below the corresponding ambient air quality standard, and, therefore, Project 1 would not result in predicted significant adverse PM_{10} impacts from mobile sources.

Table 2.11-20
Build Maximum Predicted 24-hour Average PM_{10} Concentrations ($\mu g/m^3$), West of Hudson Study Area

Intersection	Averaging Period	Ambient AQ Background ($\mu g/m^3$)	Model Results ($\mu g/m^3$)	Total Modeled Conc. ($\mu g/m^3$) *	NAAQS ($\mu g/m^3$)
Analysis Year 2015					
Route 9W (N-S) & N. Plank Rd./I-84 WB Off Ramp	24-hour	48	32	80	150
Route 9W (N-S) & Site Driveway	24-hour	48	12	60	150

Note: * Ambient AQ background + model results = total predicted concentration.

Future maximum predicted 24-hour and annual average $PM_{2.5}$ concentrations with Project 1 were also determined for 2015. The maximum predicted localized 24-hour and annual average $PM_{2.5}$ concentrations are presented in **Tables 2.11-21 and 2.11-22**, respectively. The results show that the daily (24-hour) and annual $PM_{2.5}$ concentrations would be below the ambient air quality standard, and, therefore, Project 1 would not result in predicted significant adverse $PM_{2.5}$ impacts from mobile sources.

As stated above, the concentrations of CO and PM would be below the applicable NAAQS and the *de minimis* criteria for incremental concentrations. Therefore, no significant adverse air quality impacts from construction-related traffic for CO or PM are predicted in the future with Project 1.

Table 2.11-21
Build Maximum Predicted 24-Hour Average $PM_{2.5}$ Concentrations (µg/m^3), West of Hudson Study Area

Intersection	Averaging Period	Ambient AQ Background (µg/m^3)	Model Results (µg/m^3)	Total Modeled Conc. (µg/m^3) *	NAAQS (µg/m^3)
Analysis Year 2015					
Route 9W (N-S) & N. Plank Rd./I-84 WB Off Ramp	24-hour	26	8.6	34.6	35
Route 9W (N-S) & Site Driveway	24-hour	26	3.1	29.1	35

Note: * Ambient AQ background + model results = total predicted concentration.

Table 2.11-22
Build Maximum Predicted Annual Average $PM_{2.5}$ Concentrations (µg/m^3), West of Hudson Study Area

Intersection	Averaging Period	Ambient AQ Background (µg/m^3)	Model Results (µg/m^3)	Total Modeled Conc. (µg/m^3) *	NAAQS (µg/m^3)
Analysis Year 2015					
Route 9W (N-S) & N. Plank Rd./I-84 WB Off Ramp	Annual	10.6	0.4	11.0	15
Route 9W (N-S) & Site Driveway	Annual	10.6	0.2	10.8	15

Notes: * Ambient AQ background + model results = total predicted concentration.

CUMULATIVE STATIONARY AND MOBILE SOURCE CONSTRUCTION IMPACTS

Table 2.11-23 presents the total cumulative concentrations of CO, PM_{10}, and $PM_{2.5}$ from the stationary and mobile source analyses.

Table 2.11-23
Maximum Predicted Total Cumulative Concentrations from the Stationary and Mobile Source Analyses, West of Hudson Study Area

Pollutant	Averaging Period	Ambient AQ Background (µg/m^3)	Maximum Stationary Source Model Results (µg/m^3)	Maximum Mobile Source Model Results (µg/m^3)	Total Modeled Conc. (µg/m^3)	NAAQS (µg/m^3)
PM_{10}	24-hour	48	32.7	12	92.7	150
CO	1-hour	3.5 ppm	16.2 ppm	1.0 ppm	20.7 ppm	35 ppm
	8-hour	2.2 ppm	2.2 ppm	0.7 ppm	5.1 ppm	9 ppm
$PM_{2.5}$	24-hour	26	5.2	3.1	34.3	35
	Annual	10.6	0.3	0.2	11.1	15

As indicated in Table 2.11-23, total cumulative concentrations of CO, PM_{10}, and $PM_{2.5}$ would not exceed any applicable standard even if the cumulative concentrations are conservatively estimated by adding the highest results from the mobile source analyses adjacent to the construction site to the stationary source analyses, which is extremely conservative considering that the maximum impacts of the two analyses occur at separate locations in different time periods. For $PM_{2.5}$, the maximum predicted mobile source (2015) concentration at the intersection of Route 9W (N-S) and Site Driveway was added to the maximum predicted concentrations located near the south-eastern fenceline for the short-term analysis and at the northern fenceline for the annual analysis from the stationary source construction analysis (2013). The cumulative concentrations plus background for the 24-hour and annual averaging periods would be 34.3 $\mu g/m^3$ and 11.1 $\mu g/m^3$, respectively. The 24-hour and annual average concentrations would be below the NAAQS.

Based on these results, construction of Project 1 at the west connection site would not result in any predicted concentrations above the NAAQS for NO_2, CO, PM_{10}, and $PM_{2.5}$ from stationary or mobile sources. In addition, maximum concentrations predicted locally at receptors near the west connection site would not result in cumulative concentrations above the NAAQS with the emissions from the east connection site; therefore, no significant adverse air quality impacts are predicted from the on-site construction and mobile sources during Project 1 construction.

2.11-6 EAST OF HUDSON

2.11-6.1 EXISTING CONDITIONS—EAST OF HUDSON

EXISTING SIMULATED POLLUTANT CONCENTRATIONS IN THE STUDY AREA

The monitored concentrations (presented above in Table 2.11-7) represent general air quality in the study area. However, this section presents the existing concentrations adjacent to the mobile-source analysis sites in the existing condition. These concentrations may be higher than at the monitoring stations due to the adjacent vehicular emissions. The highest simulated existing 8-hour average CO concentrations plus monitored background concentrations at the mobile-source analysis sites are presented in **Table 2.11-24**. (One-hour average values are not shown since predicted values are much lower than the 1-hour standard of 35 ppm.)

Table 2.11-24
Maximum Predicted Existing 8-Hour Average CO Concentrations for 2010, East of Hudson Study Area

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)
1	Route 9D (N-S) & I-84 WB Ramps	PM	4.2
2	Route 9D (N-S) & Chelsea Road/Baxtertown Road	PM	3.2
3	River Road North (E-W) & East Connection West Driveway	PM	2.3
Note: 8-hour standard is 9 ppm.			

2.11-6.2 FUTURE WITHOUT PROJECT 1, SHAFT AND BYPASS TUNNEL CONSTRUCTION—EAST OF HUDSON

STATIONARY SOURCE CONSTRUCTION IMPACTS

In the future without Project 1, air quality is anticipated to be similar to that described for existing conditions. No planned development projects have been identified within the study area. While there is a possibility for some limited redevelopment activity to occur within the study area, no significant changes in land use are anticipated in the area surrounding the east connection site. Since air quality regulations mandated by the Clean Air Act are expected to maintain or improve air quality in the region, it can be expected that air quality conditions in the future without Project 1 would similar or better than those that presently exist.

MOBILE SOURCE CONSTRUCTION IMPACTS

A mobile source air quality analysis was conducted for the future without Project 1 scenario for the peak construction traffic year, 2015. Localized pollutant impacts from the vehicles queuing at the selected intersection were analyzed for CO for the 1-hour and 8-hour averaging times. Impacts for PM were also considered in the analysis. PM_{10} was analyzed for the 24-hour averaging period and $PM_{2.5}$ for the 24-hour and annual averaging periods.

CO

As indicated in **Table 2.11-25**, the predicted total concentrations of CO (including background) for the future year without Project 1 (2015) would be below the corresponding ambient air quality standards at each of the three intersections analyzed. Both the 1-hour and 8-hour averaging periods for the modeled intersection would be in compliance with their respective standards.

Table 2.11-25
Future Without Project 1
Mobile Source CO Concentrations (ppm), East of Hudson Study Area

Analysis Site	Intersection	Averaging Period	Ambient AQ Background (ppm)	Model Results (ppm)		Total Modeled Conc. (ppm) *		NAAQS (ppm)
				AM	PM	AM	PM	
Analysis Year 2015								
4	Road Route 9D (N-S) & I-84 WB Ramps	1-hour	3.5	2.4	2.5	5.9	6.0	35
		8-hour	2.2	1.7	1.8	3.9	4.0	9
5	Route 9D (N-S) & Chelsea Road/Baxtertown Road	1-hour	3.5	1.2	1.2	4.7	4.7	35
		8-hour	2.2	0.8	0.8	3.0	3.0	9
6	River Road North (E-W) & East Connection West Driveway	1-hour	3.5	0.1	0.1	3.6	3.6	35
		8-hour	2.2	0.0	0.1	2.2	2.3	9

Notes: * Ambient AQ background + model results = total predicted concentration.

PM

Concentrations of PM_{10} and $PM_{2.5}$ from mobile sources without Project 1 were also determined for the 2015 analysis year. As indicated in **Tables 2.11-26 and 2.11-27**, the predicted 24-hour concentrations of PM_{10} and the predicted 24-hour and annual concentrations of $PM_{2.5}$, including background, would be below the corresponding ambient air quality standards at the two intersections analyzed.

Table 2.11-26
Future Without Project 1
Mobile Source PM_{10} 24-Hour Concentrations (μg/m^3),
East of Hudson Study Area

Analysis Site	Intersection	Averaging Period	Ambient AQ Background (μg/m^3)	Model Results (μg/m^3)	Total Modeled Conc. (μg/m^3) *	NAAQS (μg/m^3)
Analysis Year 2015						
4	Route 9D (N-S) & I-84 WB Ramps	24-hour	48	30	78	150
6	River Road North (E-W) & East Connection West Driveway	24-hour	48	3	51	150
Notes: * Ambient AQ background + model results = total predicted concentration.						

Table 2.11-27
Future Without Project 1
Mobile Source $PM_{2.5}$ 24-Hour and Annual Concentrations (μg/m^3),
East of Hudson Study Area

Analysis Site	Intersection	Averaging Period	Ambient AQ Background (μg/m^3)	Model Results (μg/m^3)	Total Modeled Conc. (μg/m^3) *	NAAQS (μg/m^3)
Analysis Year 2015						
4	Route 9D (N-S) & I-84 WB Ramps	24-hour	26	8.0	34.0	35
6	River Road North (E-W) & East Connection West Driveway	24-hour	26	0.7	26.7	35
4	Route 9D (N-S) & I-84 WB Ramps	Annual	10.6	0.3	10.9	15
6	River Road North (E-W) & East Connection West Driveway	Annual	10.6	0.01	10.61	15
Notes: * Ambient AQ background + model results = total predicted concentration.						

2.11-6.3 PROBABLE IMPACTS OF PROJECT 1, SHAFT AND BYPASS TUNNEL CONSTRUCTION—EAST OF HUDSON

This section summarizes the potential air quality impacts that could result from Project 1's construction activities at the east connection site. The most likely effects on local air quality during construction activities would result from:

- Engine emissions generated by on-site construction equipment and from trucks entering and leaving the connection site during construction;

- Fugitive dust emissions generated by soil excavation and other material processing activities; and
- Mobile source emissions generated by Project 1-related construction trucks and worker vehicles traveling to and from the connection site on local roads.

An analysis of the potential for air quality impacts from on-site construction sources was performed using the methodology described above under “Stationary Sources.” As discussed in the methodology, the peak phases of construction from the $PM_{2.5}$ emissions profile were used to analyze maximum short-term and annual impacts in the modeling analysis. For the east connection site, the peak construction phases are the site preparation phase overlapping with the shaft construction phase, and bypass tunnel excavation phase.

An analysis of the potential for air quality impacts from Project 1-induced traffic was also performed using the methodology described above under “Mobile Sources.” The peak period used in the modeling analysis for mobile sources is for the year 2015. Potential cumulative impacts from on-site and on-street sources were also determined. Maximum impacts from the mobile source analysis were added to the maximum impacts from the stationary source analysis for a conservative cumulative impact.

The results of both stationary and mobile source modeling analyses are summarized below. Since the predicted concentrations were modeled for periods that represent the highest expected site-wide air quality impacts by construction phase, the increments and total predicted concentrations during other phases of construction and at other locations are also not expected to result in any predicted significant adverse impacts. As indicated, the modeling analyses demonstrated that no significant adverse impacts from construction sources are expected during the peak emission periods and phases of construction.

STATIONARY SOURCE CONSTRUCTION IMPACTS

A dispersion modeling analysis was performed to estimate the maximum off-site pollutant concentrations associated with emissions produced by on-site construction activities at the east connection site. The modeling analysis was conducted using the AERMOD dispersion model and performed in accordance with EPA and DEP guidance regarding the use of dispersion models for regulatory purposes described above. The predicted ambient concentrations of criteria pollutants have been used to demonstrate compliance with applicable air quality standards and interim guidance values.

Site Preparation

Table 2.11-28 presents the maximum predicted concentrations of criteria pollutants due to the proposed construction activities at the East Site during the most conservative analysis period: the site preparation phase overlapping with the beginning of the shaft construction phase. The maximum concentrations from on-site construction sources were predicted at receptors near the site. This was true for all averaging periods, both short-term and annual, and for all pollutants modeled in the analysis. The maximum predicted total concentrations including background are also presented in the table.

Table 2.11-28
Maximum Predicted Total Concentrations for Construction Activities During Site Preparation, East of Hudson Study Area

Pollutant	Averaging Period	Background Conc. ($\mu g/m^3$)	Predicted Impact ($\mu g/m^3$)	Total Max Predicted Conc. ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2	Annual	54.6	16.5	71.1	100
PM_{10}	24-hour	48	8.1	56.1	150
CO	1-hour	3.5 ppm	16.7 ppm	20.2 ppm	35 ppm
	8-hour	2.2 ppm	1.4 pm	3.6 ppm	9 ppm
$PM_{2.5}$	24-hour	26	2.8	28.8	35
	Annual	10.6	0.1	10.7	15

As indicated in Table 2.11-28**,** the maximum predicted total concentrations of NO_2, PM_{10}, CO, and $PM_{2.5}$ would not exceed the NAAQS. Therefore, no significant adverse air quality impacts are predicted from the on-site construction sources.

Shaft Construction

Emissions from the shaft construction phase at the east connection site would be less than emissions during the site preparation or tunnel excavation phases; therefore, impacts from the shaft construction phase would be expected to be less than impacts during other phases of Project 1.

Bypass Tunnel Excavation

Table 2.11-29 presents the maximum predicted concentrations of criteria pollutants due to the proposed construction activities at the east connection site during bypass tunnel excavation. Similar to the site preparation phase, the maximum concentrations from on-site construction sources were predicted at receptors near the site and for all averaging periods, both short-term and annual, and for all pollutants modeled in the analysis. The maximum predicted total concentrations including background are also presented in the table.

Table 2.11-29
Maximum Predicted Total Concentrations for Construction Activities During Bypass Tunnel Excavation, East of Hudson Study Area

Pollutant	Averaging Period	Background Conc. ($\mu g/m^3$)	Predicted Impact ($\mu g/m^3$)	Total Max Predicted Conc. ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2	Annual	54.6	4.5	59.1	100
PM_{10}	24-hour	48	4.1	52.1	150
CO	1-hour	3.5 ppm	0.3 ppm	3.8 ppm	35 ppm
	8-hour	2.2 ppm	0.2 ppm	2.4 ppm	9 ppm
$PM_{2.5}$	24-hour	26	0.6	26.6	35
	Annual	10.6	0.1	10.7	15

As indicated in Table 2.11-29, the maximum predicted total concentrations of NO_2, PM_{10}, CO, and $PM_{2.5}$ would not exceed the NAAQS. Therefore, no significant adverse air quality impacts are predicted from the on-site construction sources.

Bypass Tunnel Lining/ Project 1Demobilization/Preparation for Project 2B (Bypass Tunnel Lining)

Emissions from construction activities during the bypass tunnel lining phase at the east connection site would be less than emissions during the site preparation and bypass tunnel excavation phases; therefore, impacts from the bypass tunnel lining phase would be expected to be less than impacts during other phases of Project 1.

Based on the multi-phase analyses described above and the relative emissions for other time periods of construction, construction of Project 1 at the east connection site would not result in predicted significant adverse air quality impacts from the on-site construction sources.

MOBILE SOURCE CONSTRUCTION IMPACTS

A mobile source air quality analysis was conducted for Project 1 during construction activities at the east connection site for the peak construction traffic year, 2015. Localized pollutant impacts from the vehicles queuing at the selected intersections were analyzed for CO for the 1-hour and 8-hour averaging times. Impacts for PM were also considered in the analysis. PM_{10} was analyzed for the 24-hour averaging period and $PM_{2.5}$ for the 24-hour and annual averaging periods.

CO

As indicated in **Table 2.11-30**, the predicted total concentrations of CO (including background) for the peak year for construction-related traffic (2015) would be below the corresponding ambient air quality standards. Both the 1-hour and 8-hour averaging periods for the modeled intersections would be in compliance with their respective standards.

In addition, the CEQR *de minimis* criteria were calculated for the 8-hour averaging period. As indicated in **Table 2.11-31** the predicted incremental CO concentrations at the modeled intersections would not exceed the CEQR *de minimis* criteria (incremental value) for the 8-hour period.

PM

Table 2.11-32 shows the future (2015) maximum predicted 24-hour average PM_{10} concentrations with Project 1. As indicated in the table, predicted 24-hour concentrations of PM_{10}, including background would be below the corresponding ambient air quality standard, and, therefore, Project 1 would not result in predicted significant adverse PM_{10} impacts from mobile sources.

Table 2.11-30
Future with Project 1
Mobile Source CO Concentrations (ppm) for Construction Activities, East of Hudson Study Area

Intersection	Averaging Period	Ambient AQ Background (ppm)	Model Results (ppm)		Total Modeled Conc. (ppm)*		NAAQS (ppm)
			AM	PM	AM	PM	
Analysis Year 2015							
Route 9D (N-S) & I-84 WB Ramps	1-hour	3.5	2.4	2.6	5.9	6.1	35
	8-hour	2.2	1.8	2.0	3.9	4.0	9
Route 9D (N-S) & Chelsea Road/Baxtertown Road	1-hour	3.5	1.2	1.4	4.7	4.9	35
	8-hour	2.2	0.8	1.0	3.0	3.2	9
River Road North (E-W) & East Connection West Driveway WB Ramps	1-hour	3.5	0.1	0.2	3.6	3.7	35
	8-hour	2.2	0.0	0.1	2.2	2.3	9

Notes: * Ambient AQ background + model results = total predicted concentration.

Table 2.11-31
Mobile Source 8-Hour CO Concentrations (ppm) and CEQR *De Minimis* Criteria, East of Hudson Study Area

Intersection	Averaging Period	Without Project 1 Conc. (ppm)		Future with Project 1 Conc. (ppm)		Project 1 Increment (ppm)*		*De Minimis* Criteria (ppm)**	
		AM	PM	AM	PM	AM	PM	AM	PM
Analysis Year 2015									
Route 9D (N-S) & I-84 WB Ramps	8-hour	3.9	4.0	3.9	4.0	0.0	0.0	6.4	6.4
Route 9D (N-S) & Chelsea Road/Baxtertown Road	8-hour	3.0	3.0	3.0	3.2	0.0	0.2	6.0	6.0
River Road North (E-W) & East Connection West Driveway	8-hour	2.2	2.3	2.2	2.3	0.0	0.0	5.6	5.6

Notes:
* Project 1 increment is defined as the “Future with Project 1” value minus the “Future without Project 1” value.
** See 2.11-3.4 above” for details on how this value is calculated.

Table 2.11-32
Build Maximum Predicted 24-hour Average PM_{10} Concentrations (μg/m^3), East of Hudson Study Area

Intersection	Averaging Period	Ambient AQ Background (μg/m^3)	Model Results (μg/m^3)	Total Modeled Conc. (μg/m^3) *	NAAQS (μg/m^3)
Analysis Year 2015					
Route 9D (N-S) & I-84 WB Ramps	24-hour	48	30	78	150
River Road North (E-W) & East Connection West Driveway	24-hour	48	3	51	150

Notes: * Ambient AQ background + model results = total predicted concentration.

Future maximum predicted 24-hour and annual average $PM_{2.5}$ concentrations with Project 1 were also determined for the 2015 year. The maximum predicted localized 24-hour and annual average $PM_{2.5}$ concentrations are presented in **Tables 2.11-33 and 2.11-34**, respectively. The results show that the daily (24-hour) and annual $PM_{2.5}$ concentrations would be below the ambient air quality standard, and, therefore, Project 1 would not result in predicted significant adverse $PM_{2.5}$ impacts from mobile sources.

Table 2.11-33
Build Maximum Predicted 24-Hour Average $PM_{2.5}$ Concentrations (µg/m^3), East of Hudson Study Area

Intersection	Averaging Period	Ambient AQ Background (µg/m^3)	Model Results (µg/m^3)	Total Modeled Conc. (µg/m^3) *	NAAQS (µg/m^3)
Analysis Year 2015					
Route 9D (N-S) & I-84 WB Ramps	24-hour	26	8.0	34.0	35
River Road North (E-W) & East Connection West Driveway	24-hour	26	0.8	26.8	35
Notes: * Ambient AQ background + model results = total predicted concentration.					

Table 2.11-34
Build Maximum Predicted Annual Average $PM_{2.5}$ Concentrations (µg/m^3), East of Hudson Study Area

Intersection	Averaging Period	Ambient AQ Background (µg/m^3)	Model Results (µg/m^3)	Total Modeled Conc. (µg/m^3) *	NAAQS (µg/m^3)
Analysis Year 2015					
Route 9D (N-S) & I-84 WB Ramps	Annual	10.6	0.3	10.9	35
River Road North (E-W) & East Connection West Driveway	Annual	10.6	0.1	10.7	35
Notes: * Ambient AQ background + model results = total predicted concentration.					

As stated above, the concentrations of CO and PM would be below the applicable NAAQS and the *de minimis* criteria for incremental concentrations. Therefore, no significant adverse air quality impacts from construction-related traffic for CO or PM are predicted in the future with Project 1.

CUMULATIVE STATIONARY AND MOBILE SOURCE CONSTRUCTION IMPACTS

Table 2.11-35 presents the total cumulative concentrations of CO, PM_{10}, and $PM_{2.5}$ from the stationary and mobile source analyses.

Table 2.11-35
Maximum Predicted Total Cumulative Concentrations from the Stationary and Mobile Source Analyses, East of Hudson Study Area

Pollutant	Averaging Period	Ambient AQ Background (µg/m^3)	Maximum Stationary Source Model Results (µg/m^3)	Maximum Mobile Source Model Results (µg/m^3)	Total Modeled Conc. (µg/m^3)	NAAQS (µg/m^3)
PM_{10}	24-hour	48	8.1	3	59.1	150
CO	1-hour	3.5 ppm	16.7 ppm	0.2 ppm	20.4 ppm	35 ppm
	8-hour	2.2 ppm	1.4 ppm	0.1 ppm	3.7 ppm	9 ppm
$PM_{2.5}$	24-hour	26	2.8	0.8	29.6	35
	Annual	10.6	0.1	0.1	10.8	15

As indicated in Table 2.11-35, total cumulative concentrations of CO, PM_{10}, and $PM_{2.5}$ would not exceed any applicable standard even if the cumulative concentrations are conservatively estimated by adding the highest results from the mobile source analyses adjacent to the construction site to the stationary source analyses, which is extremely conservative considering that the maximum impacts of the two analyses occur at separate locations in different time periods. For $PM_{2.5}$, the maximum predicted mobile source (2015) concentration at the intersection of River Road North (E-W) and East Connection West Driveway was added to the maximum predicted concentration from the stationary source construction analysis (2013) located near the eastern fenceline. The cumulative concentrations plus background for the 24-hour and annual averaging periods would be 29.6 $\mu g/m^3$ and 10.8 $\mu g/m^3$, respectively. The 24-hour and annual average concentrations would be below the NAAQS.

Based on these results, construction of Project 1 at the east connection site would not result in any predicted concentrations above the NAAQS for NO_2, CO, PM_{10}, and $PM_{2.5}$ from stationary or mobile sources. In addition, maximum concentrations predicted locally at receptors near the east connection site would not result in cumulative concentrations above the NAAQS with the emissions from the west connection site; therefore, no significant adverse air quality impacts are predicted from the on-site construction and mobile sources during Project 1 construction.

2.11-7 CONCLUSIONS

2.11-7.1 WEST OF HUDSON

Construction of Project 1 on the west of Hudson study area would not result in any predicted concentrations above the NAAQS for NO_2, CO, PM_{10}, and $PM_{2.5}$ from stationary or mobile sources. In addition, maximum concentrations predicted locally at receptors near the west connection site would not result in cumulative concentrations above the NAAQS with the emissions from the east connection site; therefore, no significant adverse air quality impacts are predicted from the on-site construction and mobile sources during Project 1 construction.

2.11-7.2 EAST OF HUDSON

Construction of Project 1 on the east of Hudson study area would not result in any predicted concentrations above the NAAQS for NO_2, CO, PM_{10}, and $PM_{2.5}$ from stationary or mobile sources. In addition, maximum concentrations predicted locally at receptors near the east connection site would not result in cumulative concentrations above the NAAQS with the emissions from the west connection site; therefore, no significant adverse air quality impacts are predicted from the on-site construction and mobile sources during Project 1 construction. ✷